



## INSTRUCTIONS

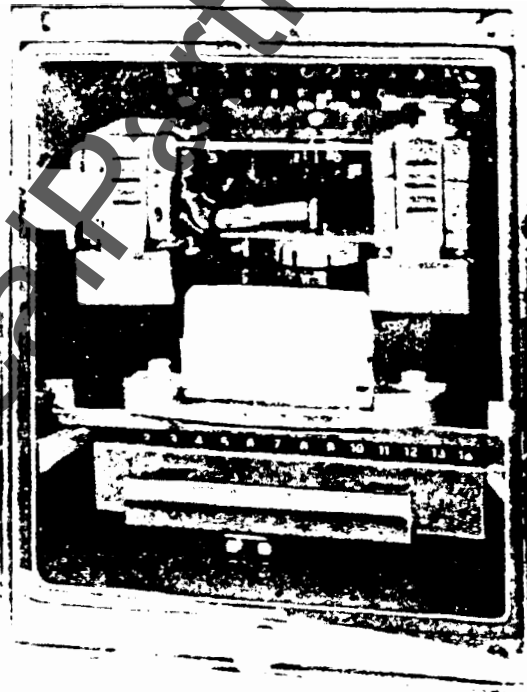
GEK-45376B

Supersedes GEK-45376A

### TIME OVERCURRENT RELAYS

#### TYPES

IFC66A  
IFC66B  
IFC66K



GENERAL  ELECTRIC

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# TIME OVERCURRENT RELAYS TYPES IFC66A, IFC66B, IFC66K

## DESCRIPTION

The type IFC relays covered by these instructions are single-phase time overcurrent relays with long-time characteristics, used primarily for motor protection. All three relay types include an induction disk time overcurrent unit and a dual-rated target and seal-in unit. The IFC66B also includes a Hi-Seismic hinged-armature instantaneous overcurrent unit with target, mounted in the front of the relay. The IFC66K includes the Hi-Seismic instantaneous unit in the front, and also a high dropout unit also with Hi-Seismic capability mounted in the rear. The high drop-out unit is designed to drop out at 80 percent or more of its pickup setting and does not include a target. All units are described in detail in the section on CONSTRUCTION.

When semiflush mounted on a suitable panel these relays have a high seismic capability. Also, these relays are recognized under the Components Program of Underwriters Laboratories, Inc.

The relays are mounted in a C1 drawout case of molded construction. The outline and panel drilling are shown in Figures 20 and 21. The relay internal connections are for the IFC66A, IFC66B and IFC66K are shown in Figures 3, 4 and 5 respectively.

## APPLICATION

Time overcurrent relays are extensively used for protection on utility and industrial systems. The long-time inverse characteristic of the IFC66 family is useful for overload protection on larger medium voltage motors and as long-time back-up protection on medium-voltage industrial systems.

The principal application of the IFC66A and IFC66B relays is for motor protection. The long-time characteristic of the induction disk unit provides sufficient time to prevent operation on motor starting current. In this application the relay settings are frequently determined by National Electric Code requirements as well as by consideration of the motor thermal heating and starting characteristics. The instantaneous unit in the IFC66B if used must be set above locked rotor current. To account for the transient overreach of the instantaneous unit a setting of twice-locked rotor current is usually recommended. More precise settings can be made by using the transient overreach curves in Figure 11.

The IFC66A and IFC66B relays are also useful for application on the primary of a small low voltage load center transformer when the secondary main protective device is an insulated case circuit breaker. In such cases the long time capability permits the relay to be set selectively with the non-adjustable long-time thermal element of the low voltage breaker. The instantaneous attachment in the IFC66B is useful in this application only when it can be set above the magnitude of current at the relay location for a fault at the low-voltage terminals of the transformer. Typical external connections for the IFC66A and IFC66B are shown in Figure 8.

The IFC66K is especially suited for motor protection. The relay is similar to the IFC66B except that a second instantaneous overcurrent unit, with a high dropout characteristic, is included. The purpose of this high dropout instantaneous unit is to provide discrimination between motor running overload and locked rotor current. This is accomplished by setting pickup of the high drop-out unit (50/B) between motor full-load current and locked rotor current, as illustrated in Figure 9, with the normal dropout instantaneous unit (50/A) set above locked rotor current. The time overcurrent unit must coordinate with the motor thermal limit. Typical settings to accomplish this are listed in the following table:

	Unit	Pickup Setting Multiples of Full Load Current
Time Overcurrent Unit	51	1.15 to 1.4
Normal Dropout Instantaneous Overcurrent Unit	50/A	8 to 15
High Dropout Instantaneous Overcurrent Unit	50/B	2 to 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.

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.

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The user must determine the specific settings which will provide the required protection for his machine, and select a relay model having the operating ranges needed to obtain these settings.

With settings as illustrated in Figure 9 and external connections shown in Figure 10, the operation of the IFC66K relay will be as follows:

1. For motor overloads the time overcurrent unit (51) will time out, picking up an external auxiliary 51X, which sounds an alarm.
- \*2. For the locked rotor condition the high-dropout unit (50/B) will pick up instantaneously and the TOC unit (51) will pick up with a time delay consistent with the motor thermal limit. When both units have operated the breaker will be tripped.
- \*3. For a fault the normal dropout instantaneous unit (50/A) will pick up instantaneously and trip the breaker.

When used as back-up protection, the time overcurrent unit IFC66 should be set to coordinate with downstream protective devices. A minimum coordinating time margin of 0.2 to 0.4 seconds will normally be required. The following factors must be considered in determining a setting:

- Operating time of the downstream relay and breaker
- Overtravel in the induction disk unit
- A safety factor to allow for variations in system parameters from the values used to determine the relay setting.

Relay overtravel is often considered to be less than 0.1 seconds; exact values can be read from Figure 11. Typical safety factors range from 0.1 to 0.2 seconds.

#### CONSTRUCTION

The IFC induction disk relays consist of a molded case, cover, support structure assembly, and a connection plug to make up the electrical connection. See Cover Figure and Figures 1, 2 and 19. Figure 2 shows the induction unit mounted to the molded support structure. The disk is activated by a current operating coil mounted on a laminated U-Magnet. The disk and shaft assembly carries a moving contact which completes the alarm or trip circuit when it touches a stationary contact. The disk assembly is restrained by a spiral spring to give the proper contact closing current. The disk's rotation is retarded by a permanent magnet mounted in a molded housing on the support structure.

The drawout connection/test system for the CI case, shown in Figure 19, has provisions for 14 connection points, and a visible CT shorting bar located up front. As the connection plug is withdrawn, it clears the shorter contact fingers in the output contact circuits first. Thus, the trip circuit is opened before any other circuits are disconnected. Next, current circuit fingers on the case connection block engage the shorting bar (located at the lower front of the case) to short-circuit external current transformer secondary connections. The window provides visual confirmation of CT shorting. The connection plug then clears the current circuit contact fingers on the case and finally those on the relay support structure to completely de-energize the drawout element.

There is a Hi-Seismic target and seal-in unit mounted on the front to the left of the shaft of the time overcurrent unit, see Figure 1. The seal-in unit has its coil in series and its contacts in parallel with the contacts of the time overcurrent unit such that when the induction unit 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 reset button located on the upper side of the cover.

The IFC "B" and "K" model relays in addition to the above contain a Hi-Seismic instantaneous unit, see Figure 1. The instantaneous unit is a small hinged type unit which is mounted on the front to the right of the shaft of the time overcurrent unit. Its contacts are normally connected in parallel with the contacts of the time overcurrent unit and its coil is connected in series with the time overcurrent unit. When the instantaneous unit picks up it raises a target which latches up and remains exposed until it is released. The same reset button that releases the target seal-in unit also releases the target of the instantaneous unit.

The IFC "K" model relays in addition to the above contain a Hi-Seismic dropout instantaneous unit. The high dropout instantaneous unit is a small hinged type mounted in the rear of the relay, see Figure 2. Unlike the Hi-Seismic instantaneous unit, this unit does not include a target and therefore does not have to be re-set after it operates.

A magnetic shield, depicted in Figure 1, is mounted to the support structure, to eliminate the proximity affect of external magnetic materials.

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Both the Hi-Seismic target and seal-in unit and the Hi-Seismic instantaneous unit have the letters "Hi-G" molded into their target block to distinguish them as Hi-Seismic units. Seismic fragility level exceeds peak axial acceleration of 10g's (4g ZPA) when tested using a biaxial multi-frequency input motion to produce a Required Response Spectra (RRS) in accordance with the IEEE Proposed Guide for Seismic Testing of Relays, P501, May, 1977.

### RATINGS

The relays are designed for operation in an ambient air temperature from -20°C to +55°C.

#### TIME OVERCURRENT UNIT

Range for the time overcurrent unit is shown in Table 1.

TABLE 1

Relay	Frequency (Hertz)	Current Range (Amperes)
IFC66A,B&K	50 and 60	2.5 - 7.5

Available taps for the time overcurrent unit are shown in Table 2.

TABLE 2

Range (Amperes)	Taps Available (Amperes)
2.5 - 7.5	2.5, 2.8, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.5

The one second thermal ratings are listed in Table 3.

TABLE 3

Model	Time Overcurrent Unit (Amperes)	One Second Rating Any Tap (Amperes)	K
IFC66A,B&K	2.5 - 7.5	350	122500

Ratings less than one second may be calculated according to the formula  $I = \sqrt{K/T}$ , where T is the time in seconds that the current flows.

The continuous ratings for the time overcurrent unit are shown in Table 4.

TABLE 4

#### 2.5 - 7.5 Ampere Range Ratings

Model	IFC66										
Tap	2.5	2.8	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.5
Continuous Current	5.0	5.3	5.5	5.8	6.1	6.4	6.8	7.0	7.3	7.5	8.0

#### HI-SEISMIC INSTANTANEOUS UNIT

The instantaneous coil is tapped for operation on either one of two ranges (H or L). Selection of the high or low range is determined by the position of the link located on the top of the support structure. See Figure 2 and Table 5.

Since the instantaneous unit coil is in series with the time overcurrent unit coil, see Tables 3,4,5 and 6 to determine the current limiting element for both continuous and short time ratings.

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TABLE 5

Hi-Seismic Instantaneous Unit (Amps)	Link Position	* Range (Amps)	Continuous Rating (Amps)	**One Second Rating (Amps)	K
2 - 50	L	2 - 10	3.7	130	16,900
	H	10 - 50	7.5		
6 - 150	L	6 - 30	10.2	260	67,600
	H	30 - 180	19.6		

\*The range is approximate, which means that the 2-10, 10-50 may be 2-8, 8-50. There will always be at least one ampere overlap between the maximum L setting and the minimum H setting. Whenever possible, always select the higher range, since it has the higher continuous rating.

\*\*Higher currents may be applied for shorter lengths of time in accordance with the formula:

$$I = \sqrt{K/T}$$

#### HI-SEISMIC HIGH DROPOUT INSTANTANEOUS UNIT

The high dropout instantaneous unit is tapped for operation on either of two ranges (H or L). Selection of the high or low range is accomplished by means of a movable lead located in the rear of the relay.

TABLE 6

Unit	Tap Position	*Range	Continuous Rating (Amps)	**One Second Rating (Amps)	K
2 - 8	L	2 - 4	3.7	130	16900
	H	4 - 8	4.8		

\*The range is approximate which means that the 2-4, 4-8 may be 2-5, 4-8. There will always be at least one ampere overlap between the maximum L setting and the minimum H setting. Whenever possible select the higher range, since it has the higher continuous rating.

\*\*Higher currents may be applied for shorter lengths of time in accordance with the formula:

$$I = \sqrt{K/T}$$

Since the high dropout unit coil is in series with the time overcurrent unit coil and the Hi-Seismic instantaneous unit coil, see Tables 3, 4, 5 and 6 to determine the current limiting element for both continuous and short time ratings.

#### HI-SEISMIC TARGET AND SEAL-IN UNIT

Ratings for the target and seal-in unit are shown in Table 7.

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TABLE 7

	Tap	
	0.2	2
D.C. Resistance $\pm 10\%$ (ohms)	8.0	0.24
Min. Operating (Amp.) $+0 -60\%$	0.2	2.0
Carry Continuous (Amperes)	0.3	3
Carry 30 Amps for (Sec.)	0.03	4
Carry 10 Amps for (Sec.)	0.25	30
60 Hz Impedance (Ohms)	68.6	0.73

If the tripping current exceeds 30 amperes an auxiliary relay should be used, and the connection being such that the tripping current does not pass through the contacts or the target and seal-in coils of the protective relay.

#### CONTACTS

The current-closing rating of the contacts is 30 amperes for voltages not exceeding 250 volts. The current-carrying rating is limited by the ratings of the seal-in unit.

#### BURDENS

Burdens for the time overcurrent unit are given in Table 8.

TABLE 8

Model	Hz	Range	Min. Tap Amps	Burdens at Min. Pickup Min. Tap (Ohms)			Burdens in Ohms (Z) Times Pickup		
				R	$J_X$	Z	3	10	20
IFC66	50	2.5 - 7.5	2.5	.085	.307	.318	.153	.081	.063
	60			.102	.368	.382	.183	.097	.076

Note: The impedance values given are those for minimum tap of each range, the impedance for other taps at pickup current (tap rating) varies inversely (approximately) as the square of the tap rating. For example, an IFC66 60 Hz relay with 2.5 - 7.5 amp range has an impedance of 0.382 ohms on the 2.5 amp tap. The impedance of the 5.0 amp tap is  $(2.5/5.0)^2 \times 0.382 = 0.096$  ohms.

The Hi-Seismic instantaneous unit burdens are listed in Table 9.

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TABLE 9

Hi-Seismic Inst. Unit (Amps)	Hz	Link Position	Range (Amps)	Min. Pickup (Amps)	Burdens at Min. Pickup (Ohms)			Burdens In Ohms (Z) Times Pickup		
					R	J <sub>X</sub>	Z	3	10	20
2-50	60	L	2-10	2	0.750	0.650	0.992	0.634	0.480	0.457
		H	10-50	10	0.070	0.024	0.074	0.072	0.071	0.070
6-150	60	L	6-30	6	0.110	0.078	0.135	0.095	0.081	0.079
		H	30-150	30	0.022	0.005	0.023	0.022	0.022	0.022
2-50	50	L	2-10	2	0.625	0.542	0.827	0.528	0.400	0.380
		H	10-50	10	0.058	0.020	0.062	0.060	0.059	0.058
6-150	50	L	6-30	6	0.092	0.065	0.112	0.079	0.068	0.066
		H	30-150	30	0.018	0.004	0.019	0.018	0.018	0.018

The Hi-Seismic high drop-out instantaneous unit burdens are listed in Table 10.

TABLE 10

Hi-Seismic High Dropout Inst. Unit (Amps)	Hz	Movable Lead Position	Range (Amps)	Min. Pickup Amps	Burdens at Min. Pickup (Ohms)			Burdens In Ohms (Z) Times Pickup		
					R	J <sub>X</sub>	Z	3	10	20
2-8	60	L	2-4	2	0.69	0.62	0.93	0.55	0.41	0.38
		H	4-8	4	0.30	0.22	0.37	0.25	0.21	0.20
2-8	50	L	2-4	2	0.58	0.52	0.78	0.46	0.34	0.32
		H	4-8	4	0.25	0.18	0.31	0.21	0.18	0.17

### CHARACTERISTICS

#### TIME OVERCURRENT UNIT

##### Pickup

Pickup in these relays is defined as the current required to close the contacts from the 0.5 time-dial position. Current settings are made by means of two movable leads which connect to the tap block at the top of the support structure, see Figure 1. The tap block is marked A through M. See the nameplate on the relay for tap settings.

Example:

The 5 amp tap for a 2.5 to 7.5 IFC66 time overcurrent relay requires one movable lead in position O and the other in position J.

##### Operating Time Accuracy

The IFC relays should operate within +7 percent of the published time curve. Figures 6 and 7 show the various time-current characteristics for the IFC relays. The setting of the time dial determines the length of time required to close the contacts for a given current. The higher the time-dial setting the longer the operating time.

The contacts are just closed when the time dial is set to zero. The maximum time setting occurs when the time dial is set to 10 and the disk has to travel its maximum distance to close the contacts.

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Reset

The unit resets at 90 percent of the minimum closing current. Reset times are proportionate to the time-dial settings. The time to reset to the number 10 time-dial position when the current is reduced to zero is approximately 75 seconds for the IFC66 relays.

HI-SEISMIC INSTANTANEOUS UNIT

The instantaneous unit has a 25-to-1 range with a tapped coil. There are high and low ranges, selected by means of a link located on the top of the support structure. See Figure 1. The time-current curve for the instantaneous unit is shown in Figure 13.

HIGH DROPOUT INSTANTANEOUS UNIT

The high dropout instantaneous unit has a 4-to-1 range with a tapped coil. There are high and low ranges selected by means of a movable lead in the rear of the relay. See Figure 2. The time-current curve is shown in Figure 13.

HI-SEISMIC TARGET AND SEAL-IN UNIT

The target and seal-in unit has two tap selections located on the front of the unit. See Figure 1.

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 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 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. 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.

Since most operating companies use different procedures for acceptance and installation tests, the following section includes all applicable tests that may be performed on these relays.

VISUAL INSPECTION

Check the nameplate to insure 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 parts or any other signs of physical damage.

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 1/64 inch wipe on the seal-in and the instantaneous contacts.
4. The targets in the seal-in unit and in the instantaneous unit must come into view and latch when the armatures are operated by hand and should unlatch when the target release button is operated.

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5. Make sure that the brushes and shorting bars agree with the internal connections diagram.
6. CAUTION: Should there be a need to tighten any screws, DO NOT OVER TIGHTEN to prevent stripping.

#### DRAWOUT RELAY TESTING

The IFC relays may be tested without removing them from the panel by using the 12XCA11A1 four point test probes. The 12XCA11A1 four point test probe makes connections to both the relay and the external circuitry, which provides maximum flexibility, but requires reasonable care since a CT shorting jumper is necessary when testing the relay. The CT circuit may also be tested by using an ammeter instead of the jumper. See the test circuit in Figure 14.

#### 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 waveforms. Hence a resistance limited circuit, as shown in Figures 17-19, is recommended.

#### TIME OVERCURRENT UNIT

Rotate the time dial slowly and check by means of a lamp that the contacts just close at the zero time dial setting.

The point at which the contacts just close can be adjusted by running the stationary contact brush in or out by means of its adjusting screw.

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 insure approximately  $1/32$  inch wipe.

The minimum current at which the contacts will just close is determined by the tap setting in the tap block at the top of the support structure. See CHARACTERISTIC section.

The pickup of the time overcurrent unit for any current tap setting is adjusted by means of a spring-adjusting ring. See Figure 1. The spring-adjusting ring either winds or unwinds the spiral control spring. By turning the ring, the operating current of the unit may be brought into agreement with the tap setting employed, if this adjustment has been disturbed. This adjustment also permits any desired setting intermediate between the various tap settings to be obtained. If such adjustment is required, it is recommended that the higher tap be used. It should be noted that the relay will not necessarily agree with the time current characteristics of Figures 6 and 7, if the relay has been adjusted to pick up at a value other than tap value, because the torque level of the relay has been changed.

#### Time Setting

The setting of the time dial determines the length of time the unit requires to close the contacts when the current reaches a predetermined value. The contacts are just closed when the time dial is set on 0. When the time 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 and shaft decreases the time, while moving it away increases the time.

#### Pickup Test

Set the relay at 0.5 time-dial position and the lowest tap. Using the test connections in Figure 15 the main unit should close the contacts within  $\pm 3$  percent of tap value current.

#### Tap Test

Set the relay at No. 5 time-dial setting and the lowest tap. Using the test connection in Figure 14 apply five times tap current to the relay. The relay operating times to close its contact are listed in Table 11.

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TABLE 11

Relay	Hz	Time (seconds)	
		Min.	Max.
IFC66	50 and 60	18.0	19.2

### HI-SEISMIC INSTANTANEOUS UNIT

Make sure that the instantaneous unit link is in the correct position for the range in which it is to operate. See the internal connections diagram Figure 4 and connect as indicated in the test circuit of Figure 16. Whenever possible use the higher range since the higher range has higher continuous rating.

#### Setting The Hi-Seismic Instantaneous Unit

The instantaneous unit has an adjustable core located at the top of the unit as shown in Figure 1. To set the instantaneous unit to a desired pickup loosen the locknut and adjust the core. Turning the core clockwise decreases the pickup, turning the core counterclockwise increases the pickup. Bring up the current slowly until the unit picks up. It may be necessary to repeat this operation, until the desired pickup value is obtained. Once the desired pickup value is reached, tighten the locknut.

#### CAUTION:

REFER TO TABLE 5 FOR THE CONTINUOUS AND ONE SECOND RATINGS OF THE INSTANTANEOUS UNIT. DO NOT EXCEED THESE RATINGS WHEN APPLYING CURRENT TO THE INSTANTANEOUS UNIT.

The range of the instantaneous unit (see Table 5) must be obtained between a core position of 1/8 of a turn of full clockwise and 20 turns counterclockwise from the full clockwise position. Do not leave the core in the full clockwise position.

### HIGH DROPOUT INSTANTANEOUS UNIT

Make sure that the movable lead (see Figure 2) is in the correct position for the range in which it is to operate. Whenever possible use the higher range since the higher range has higher continuous rating. See the internal connections diagram Figure 5 and connect as indicated in the test circuit of Figure 16.

#### Setting The High Dropout Instantaneous Unit

The high dropout instantaneous unit has an adjustable core located at the top of the unit as shown in Figure 2. To set the instantaneous unit to a desired pickup loosen the locknut and adjust the core. Turning the core clockwise decreases the pickup, turning the core counterclockwise increases the pickup. Bring up the current slowly until the unit picks up. It may be necessary to repeat this operation, until the desired pickup value is obtained. Once the desired pickup value is reached, tighten the locknut. With the unit picked up, slowly reduce the current until the unit drops out. Dropout current must be 80 percent or greater than the pickup value.

#### CAUTION:

REFER TO TABLE 6 FOR THE CONTINUOUS AND ONE SECOND RATINGS OF THE INSTANTANEOUS UNIT. DO NOT EXCEED THESE RATINGS WHEN APPLYING CURRENT TO THE INSTANTANEOUS UNIT.

The range of the instantaneous unit (See Table 6) must be obtained between a core position of 1/8 of a turn of full clockwise and 20 turns counterclockwise from the full clockwise position.

### HI-SEISMIC TARGET AND SEAL-IN UNIT

The target and seal-in unit has an operating coil tapped at 0.2 and 2.0 amperes. The relay is shipped from the factory with the tap screw in the higher ampere position. The tap screw is the screw holding the right hand stationary contact. To change the tap setting, first remove one screw from the left hand stationary contact and place it in the desired tap. Next remove the screw from the undesired tap and place it on the left hand stationary contact where the first screw was removed. See Figure 1. This procedure is necessary to prevent the right hand stationary contact from getting out of adjustment. Screws should never be left in both taps at the same time.

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Pickup And Dropout Test

1. Connect relay studs 1 and 2 (See the test circuit of Figure 18) to a d-c 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 12.
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 12.

TABLE 12

TAP	PICKUP CURRENT	DROP-OUT CURRENT
0.2	0.12 - 0.20	0.05 or more
2.0	1.2 - 2.0	0.50 or more

INSTALLATION

The relay should be installed in a clean, dry location, free from dust, and well lighted to facilitate inspection and testing.

The relay should be mounted on a vertical surface. The outline and panel drillings are shown in Figures 20 and 21. Figure 20 shows the semi-flush mounting and Figure 21 shows various methods of surface mounting.

The internal connection diagrams for the relays are shown in Figures 3, 4 and 5. Typical external connections are shown in Figures 8 and 10.

INSTALLATION TESTS

The following tests are to be performed at the time of installation:

Time Overcurrent Unit

Set the tap block to the desired tap setting and the time dial to the 0.5 position. Using the test circuit in Figure 15 gradually apply current until the contacts just close. This value of current is defined as pickup and should be within three percent of tap value.

Check the operating time at some multiple of tap value and the desired time dial setting. This multiple of tap value may be five times tap rating or the maximum fault current for which the relay must coordinate. This value used is left to the discretion of the user.

Hi-Seismic Target and Seal-in Unit

1. Make sure that the tap screw is in the desired tap.
2. Perform pickup and dropout tests as outlined in the ACCEPTANCE TEST section.

Hi-Seismic Instantaneous Unit

1. Select the desired range by setting the link in the proper position. (See Figure 1 and the Internal Connections Diagram). Whenever possible always select the higher range since it has higher continuous rating.
2. Set the instantaneous unit to pick up at the desired current level. See SETTING THE INSTANTANEOUS UNIT in the ACCEPTANCE TEST section.

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All the tests described above under INSTALLATION TESTS must be performed at the time of installation. In addition, if those tests described under the ACCEPTANCE TESTS section were not performed prior to installation, it is recommended they be performed at this time.

#### High Dropout Instantaneous Unit

1. Select the desired range by setting the movable lead in the proper position. (See Figure 2 and the internal connections diagram). Whenever possible always select the higher range since it has higher continuous rating.
2. Set the high dropout instantaneous unit to pick up at the desired current level. See SETTING THE HIGH DROPOUT INSTANTANEOUS UNIT in the ACCEPTANCE TEST section.

All the tests described above under INSTALLATION TESTS must be performed at the time of installation. In addition, if those tests described under the ACCEPTANCE TESTS section were not performed prior to installation, it is recommended they be performed at this time.

#### 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 from one to two years.

These tests are intended to insure 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

1. Perform pickup test as described in the INSTALLATION section for the tap setting in service.
2. Perform the time tests as described in the INSTALLATION section.

#### HI-SEISMIC INSTANTANEOUS UNIT

1. Check that the instantaneous unit picks up at the desired current level, as outlined in the ACCEPTANCE TEST section.

#### HIGH DROPOUT INSTANTANEOUS UNIT

1. Check that the high drop-out instantaneous unit picks up and drops out at the desired current levels, as outlined in the ACCEPTANCE TEST section.

#### HI-SEISMIC TARGET AND SEAL-IN UNIT

1. Check that the unit picks up at the values shown in Table 11.
2. Check that the unit drops out at 25 percent or more of tap value.

#### 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 insures the cleaning of the actual points of contact. Do not use knives, files, abrasive paper or cloth of any kind to clean relay contacts.

#### \* COVER CLEANING

The lexan\*\* cover should only be cleaned with soap and water. If solvents are used that contain hydrocarbons, then the cover may become cloudy.

#### SYSTEM TEST

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

\* indicates revision

\*\* registered trademark of General Electric Company

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SERVICINGTIME 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:

Pickup Tests

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

The point at which 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 insure approximately 1/32 inch wipe.

The pickup of the unit for any current tap setting is adjusted by means of a spring-adjusting ring. 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. If such adjustment is required, it is recommended that the higher tap setting be used. It should be noted that the relay will not necessarily agree with the time current characteristics of Figures 6 and 7, if the relay has been adjusted to pickup at a value other than tap value, because the torque level of the relay has been changed.

Connect the operating coil terminals to a source of the proper frequency and good waveform having a voltage of 110 or more, with resistance load boxes for setting the current. See TEST CIRCUIT Figure 15.

With the tap block set for the lowest tap and the time dial set where contacts are just open, adjust the control spring to just close the contacts within the limits given below which are plus and minus 1 percent of the tap amps. See Table 13.

TABLE 13

Tap Range	Tap	Min. Amps	Max. Amps.
0.5-4	0.5	0.495	0.505
1.0-12.0	1.0	0.99	1.01

It should never be necessary to wind up the control spring adjuster more than 30 degrees (one notch) or unwind it more than 120 degrees (three notches) from the factory setting to obtain the above pickup setting.

Time Tests

With the tap block set for the lowest tap and the time dial at No. 5 setting, apply five times tap current to the relay.

Adjust the position of the drag magnet assembly to obtain an operating time as listed in Table 14.

TABLE 14

Relay	Time (Seconds)	
	Min.	Max.
IFC66	18.2	19.0

However, it would be preferable to adjust the operating time as near as possible to 18.6 seconds. The drag magnet assembly should be approximately in the middle of its travel. The drag magnet assembly is adjusted by loosening the two screws securing it to the support structure. See Figure 1. Moving the drag magnet towards the disk and shaft decreases the operating time and moving the drag magnet away from the disk and shaft increases the operating time. The screws securing the drag magnet assembly to the support structure must be tight before proceeding with other time checks.

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Mechanical Adjustment

The disk does not have to be in the exact center of either air gap for the relay to perform correctly. Should the disk not clear all gaps, the following adjustment can be made.

1. Determine which way the disk must be aligned to clear all gap surfaces by 0.010 inch.
2. Remove the drag magnet assembly by loosening the two screws securing it to the support structure. The screws need not be removed.
3. Loosen the upper pivot bearing set screw (1/16 inch hex wrench) slightly, so the upper pivot can move freely. Do not remove the set screw from the support structure.
4. Loosen the jewel bearing set screw as in 3 above.
5. Apply a slight downward finger pressure on the upper pivot and turn the jewel bearing screw, from the underside of the support structure, to position the disk as determined in 1 above.
6. Turn the jewel bearing screw 1/8 turn clockwise and tighten the upper pivot set screw to 2.5-3.5 inch pounds of torque.
7. Turn the jewel bearing screw 1/8 turn counterclockwise. This will lower the disk and shaft assembly approximately 0.005 inch and permit proper end-play. The shaft must have 0.005-0.010 inch of end-play.
8. Tighten the jewel bearing set screw to 2.5 - 3.5 inch pounds of torque.
9. Rotate the disk through the electromagnet gap. The disk should clear the gap surfaces by 0.010 inch and be within 0.005 inch flatness. If the disk is not within 0.005 inch flatness the disk should be replaced.
10. Reinstall the drag magnet assembly and check that the disk has at least 0.010 inch clearance from the drag magnet assembly surfaces.
11. Tighten the drag magnet assembly mounting screws with 7-10 inch pounds of torque, after securely seating the assembly and positioning it according to the TIME TEST above.

HI-SEISMIC INSTANTANEOUS UNIT AND HIGH DROPOUT INSTANTANEOUS UNIT

1. Both contacts should close at the same time.
2. The backing strip should be so formed that the forked and (front) bears against the molded strip under the armature.
3. With the armature against the pole piece, the cross member of the "T" spring should be in a horizontal plane and there should be at least 1/64" inch wipe on the contacts. Check this by inserting a 0.010 inch feeler gage between front half of the shaded pole with the armature held closed. Contacts should close with feeler gage in place.
4. Since mechanical adjustments may affect the Seismic Fragility Level, it is advised that no mechanical adjustments be made if seismic capability is of concern.

HI-SEISMIC TARGET AND SEAL-IN UNIT

Check 1 and 2 as described under INSTANTANEOUS UNIT.

To check the wipe of the seal-in unit, insert a 0.010 inch feeler gage between the plastic residual of armature and the pole piece with the armature held closed. Contacts should close with feeler gage in place. Since mechanical adjustments may affect the Seismic Fragility Level, it is advised that no mechanical adjustments be made if seismic capability is of concern.

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RENEWAL PARTS

It is recommended that sufficient quantities of renewal parts be carried in stock to enable the prompt placement 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.

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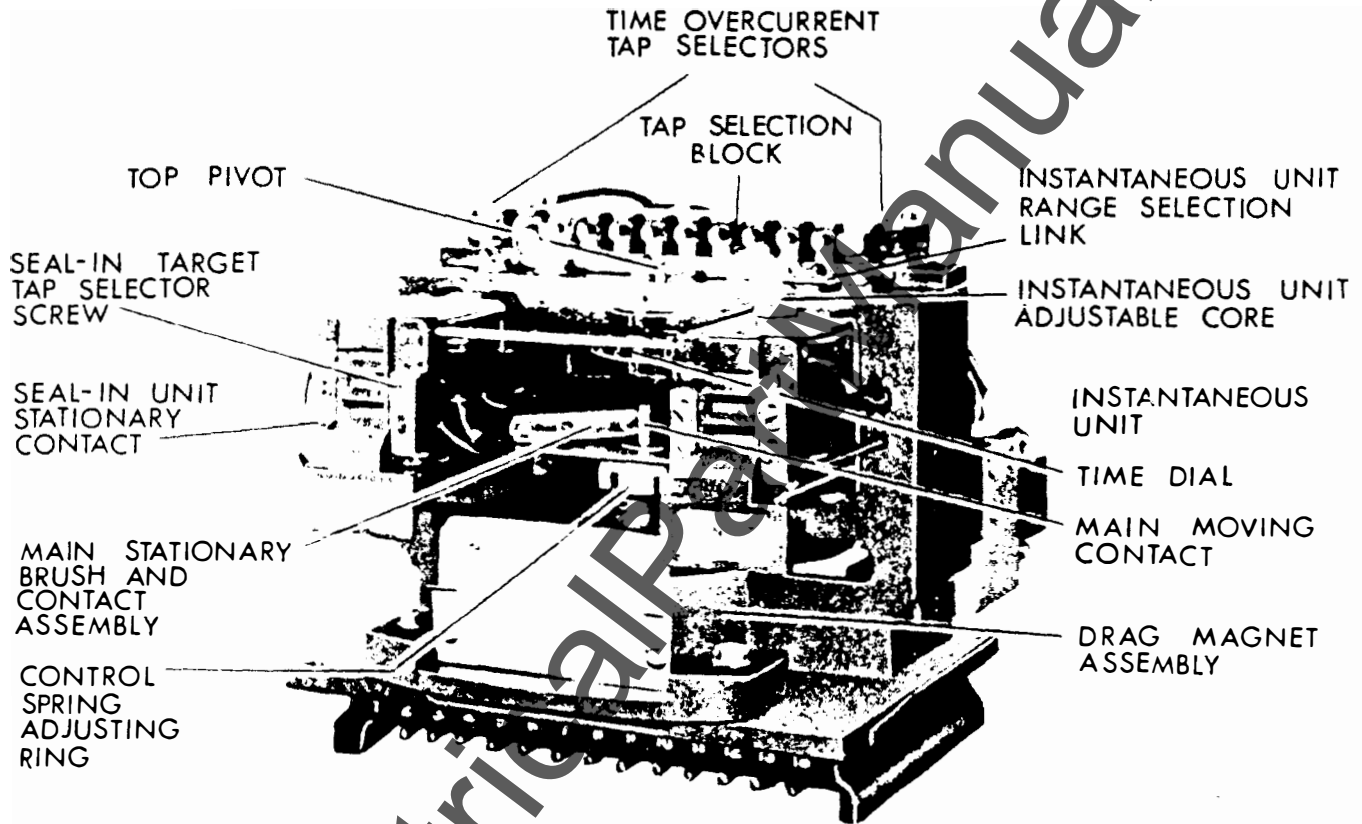


FIG. 1 (8043007) TYPE IFC66K RELAY, REMOVED FROM CASE, FRONT VIEW

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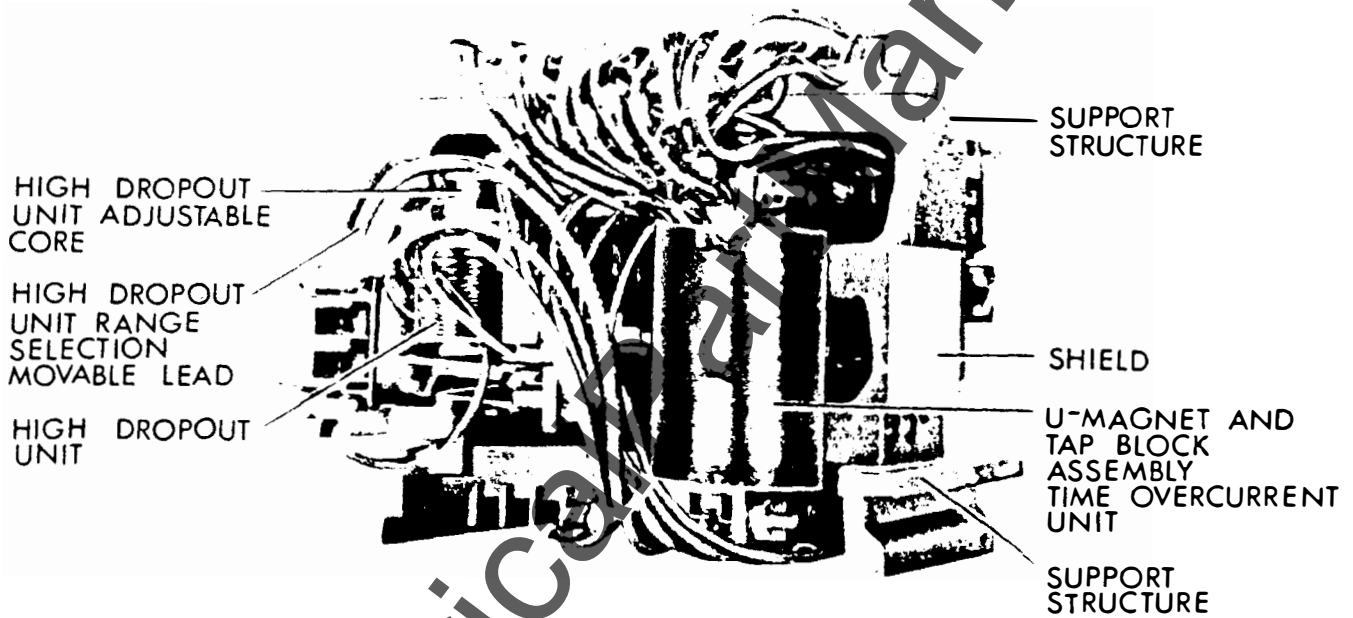


FIG. 2 (8043011) TYPE IFC66K RELAY, REMOVED FROM CASE, REAR VIEW

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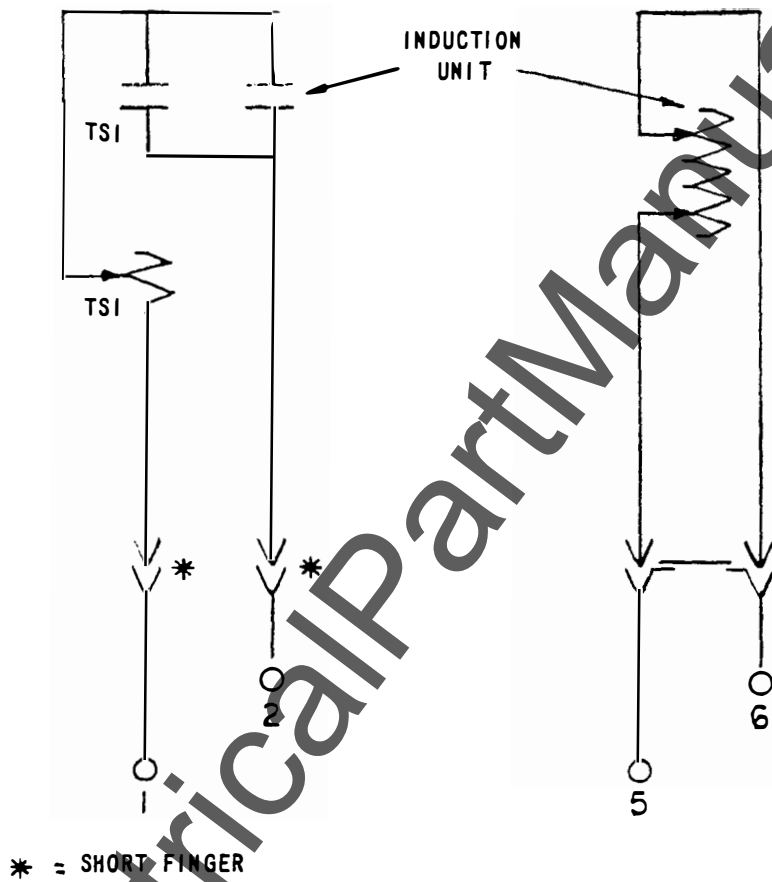


FIG. 3 (0257A8339-2) INTERNAL CONNECTIONS FOR RELAY TYPE IFC66A - FRONT VIEW

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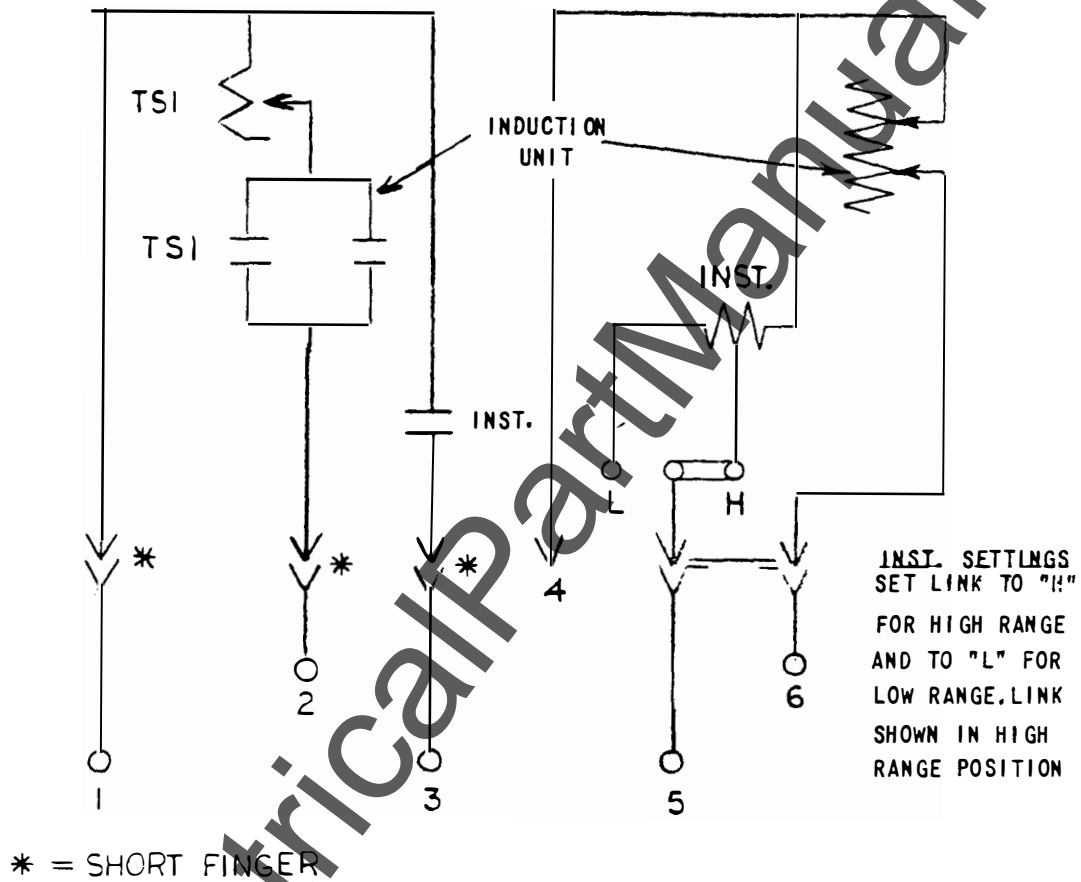
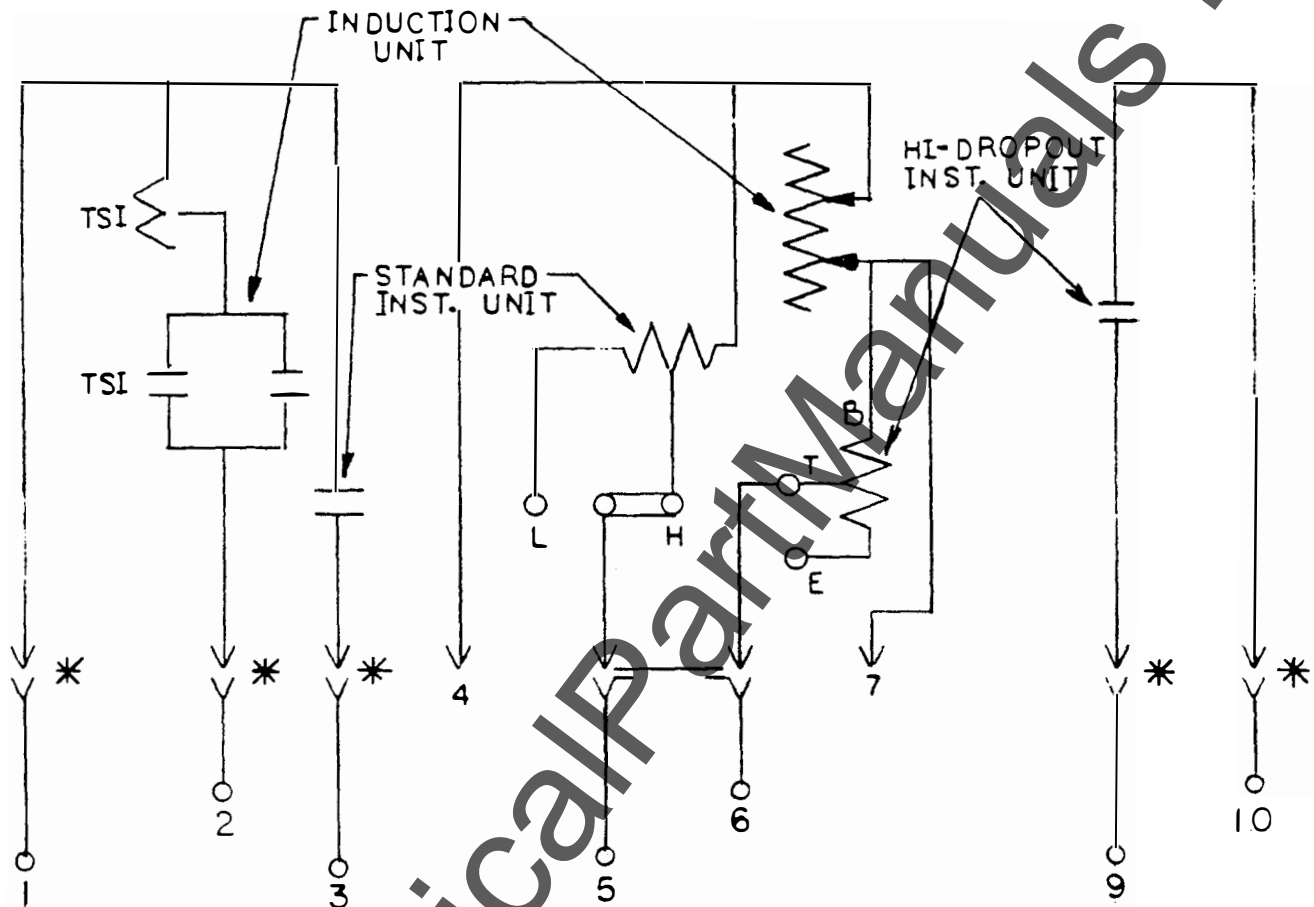


FIG 4. (0257A8340-4) INTERNAL CONNECTIONS FOR RELAY TYPE IFC66B - FRONT VIEW

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#### STANDARD INST. SETTINGS

SET LINK TO "H"  
FOR HIGH RANGE  
AND TO "L" FOR  
LOW RANGE.  
LINK SHOWN IN  
HIGH RANGE  
POS..

#### HI DROPOUT INST SETTINGS

SHOWN IN THE  
HIGH RANGE.  
CONNECT  
TERMINAL 6 TO  
"E" FOR LOW  
RANGE.

FIG. 5 (0257A9644-1) INTERNAL CONNECTIONS FOR RELAY TYPE IFC66K - FRONT VIEW

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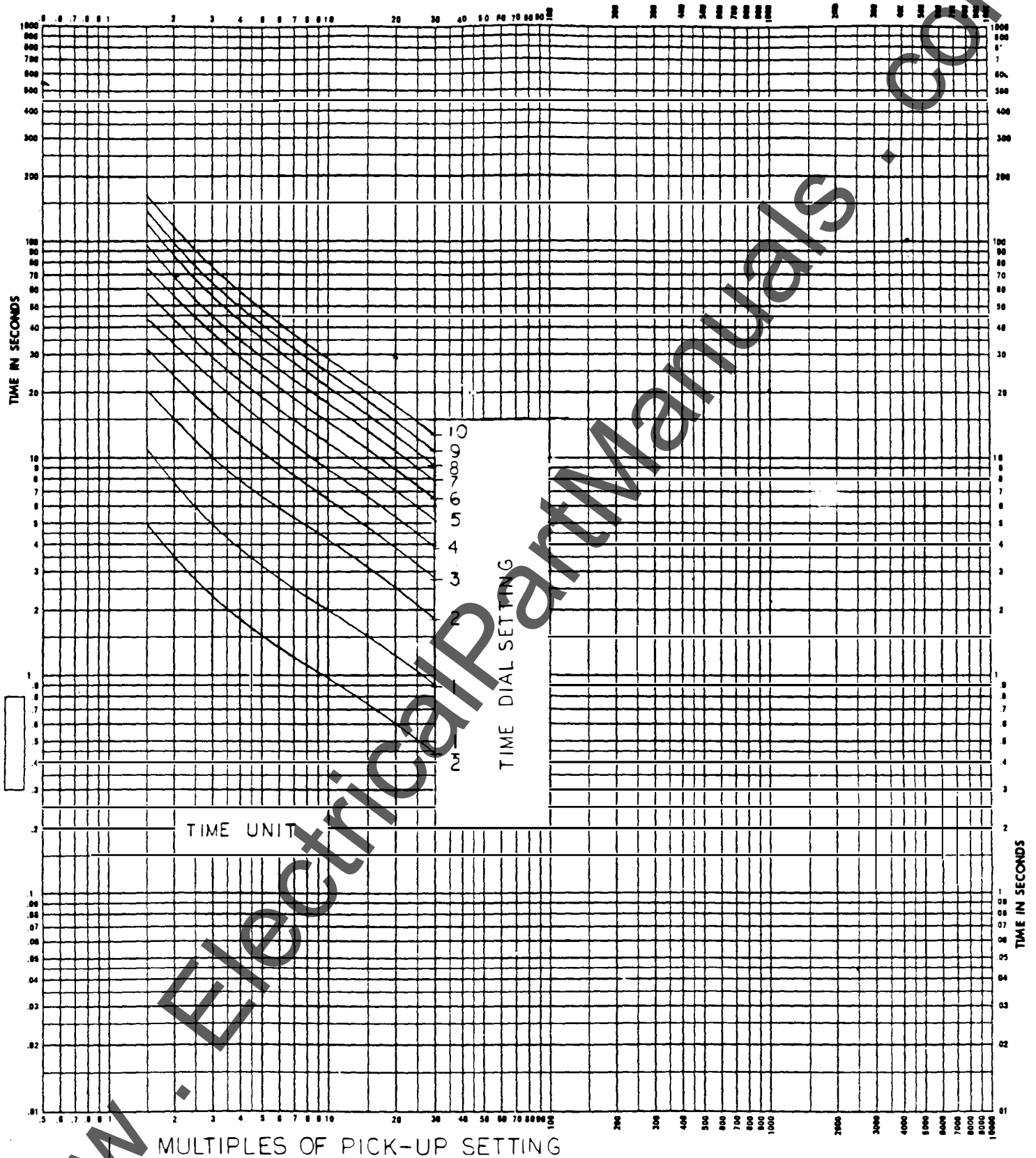
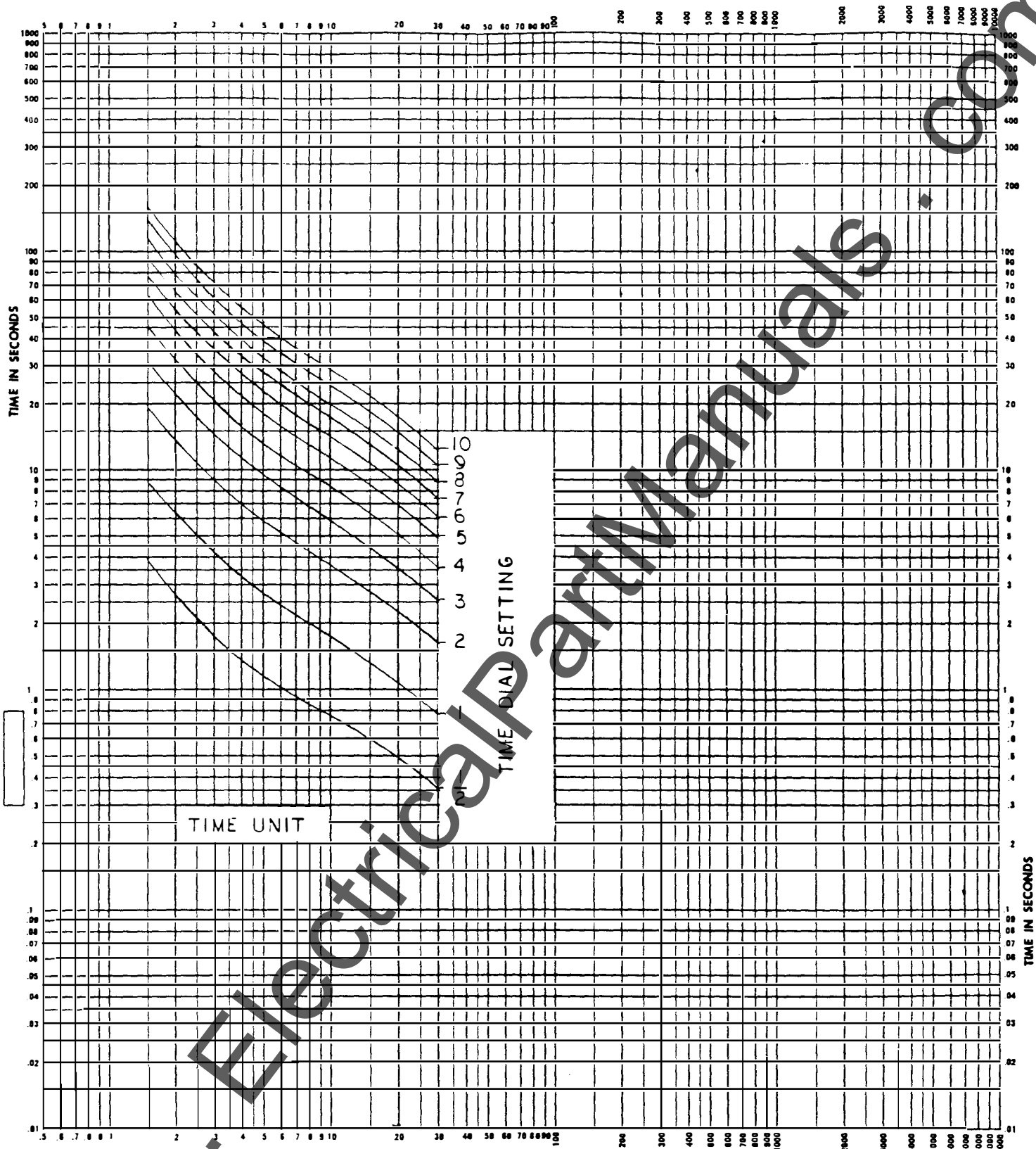


FIG. 6 (0108B8969-1) 60 HERTZ TIME-CURRENT CHARACTERISTICS FOR RELAY TYPE IFC66

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MULTIPLES OF PICK-UP SETTING

FIG. 7 (0108B8970-1) 50 HERTZ TIME-CURRENT CHARACTERISTICS FOR RELAY TYPE TFC66

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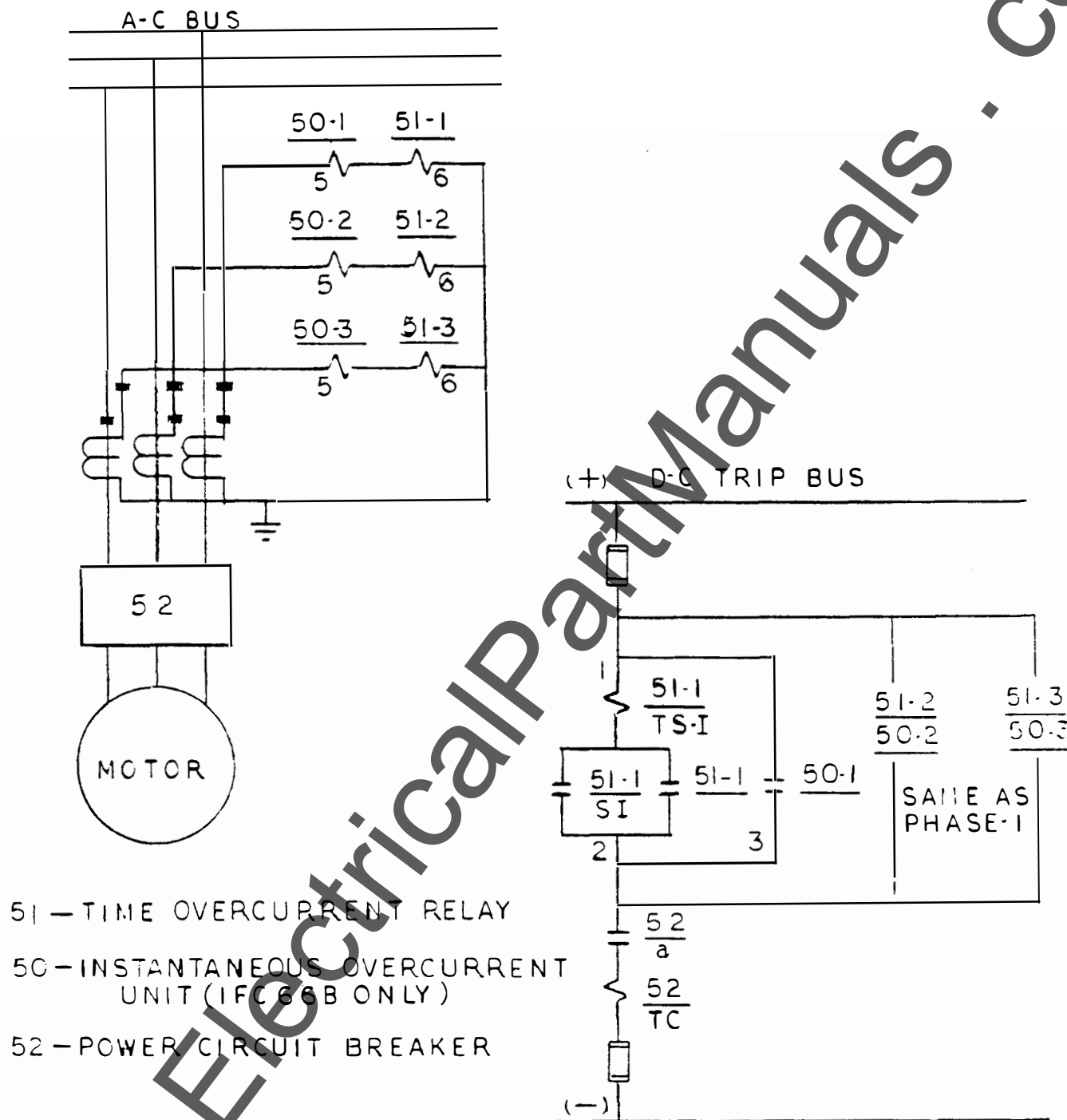


FIG. 8 (0269A3014-0) TYPICAL EXTERNAL CONNECTIONS FOR RELAY TYPES IFC66A AND IFC66B

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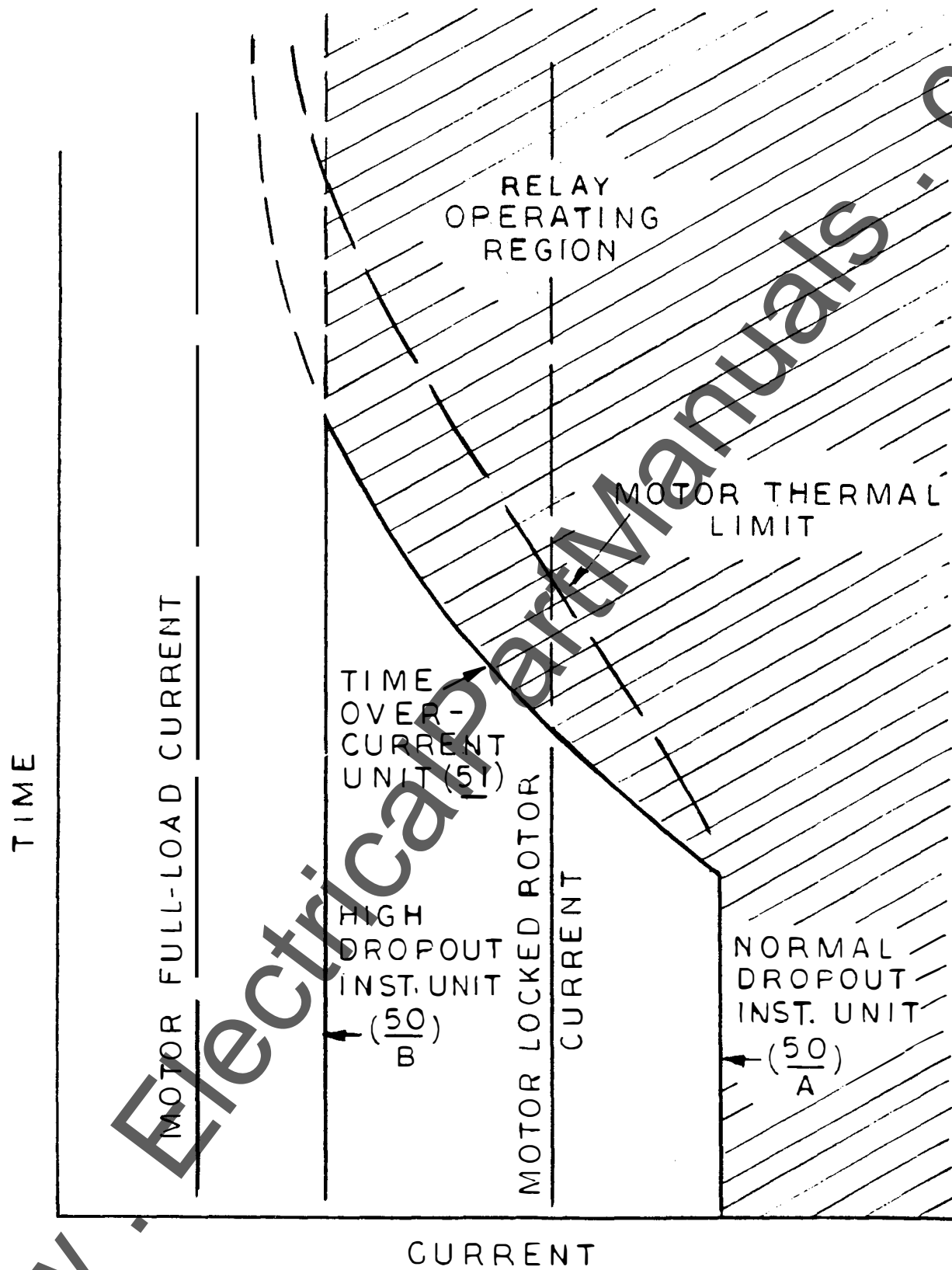
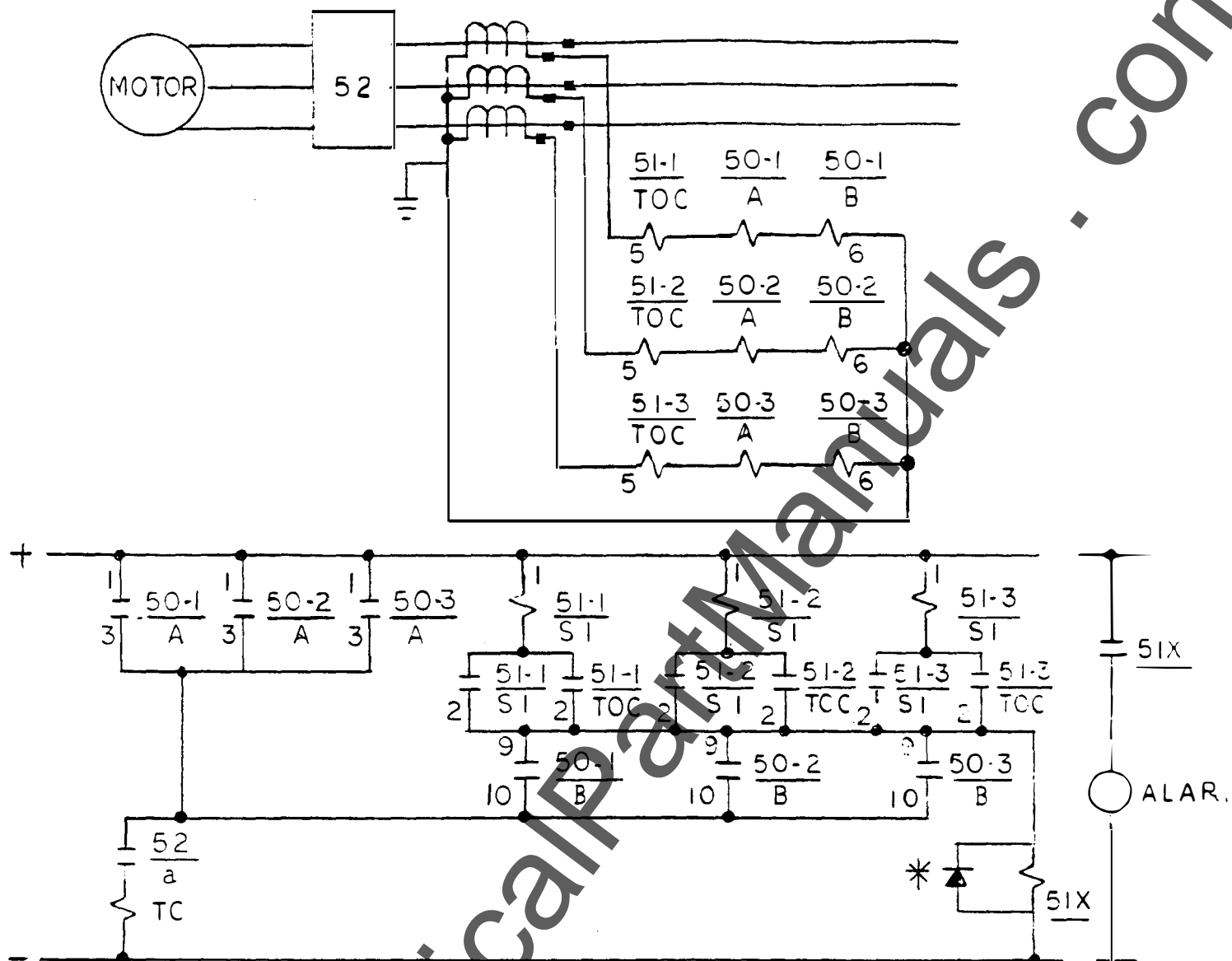


FIG. 9 (0269A3055-0) MOTOR PROTECTION CHARACTERISTIC CURVE

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\* USE WHEN NECESSARY FOR CONTACT ARC SUPPRESSION

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

FIG. 10. (0269A3013-1) TYPICAL EXTERNAL CONNECTIONS FOR RELAY TYPE IFC66K

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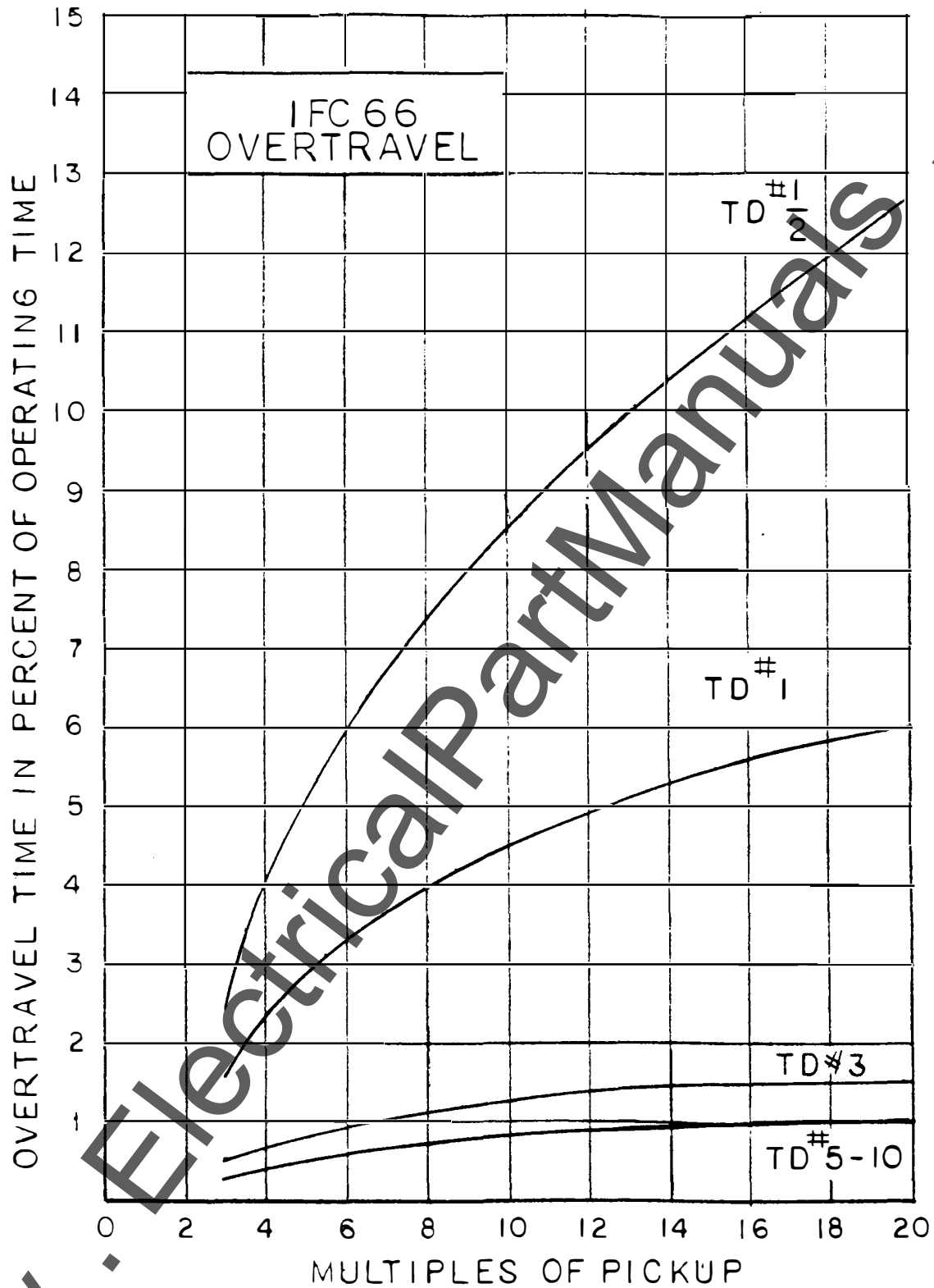


FIG. 11 (0269A1869-0) OVERTRAVEL CURVES FOR RELAY TYPE IFC66

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# HI SEISMIC RATED INSTANTANEOUS UNIT TRANSIENT OVERREACH

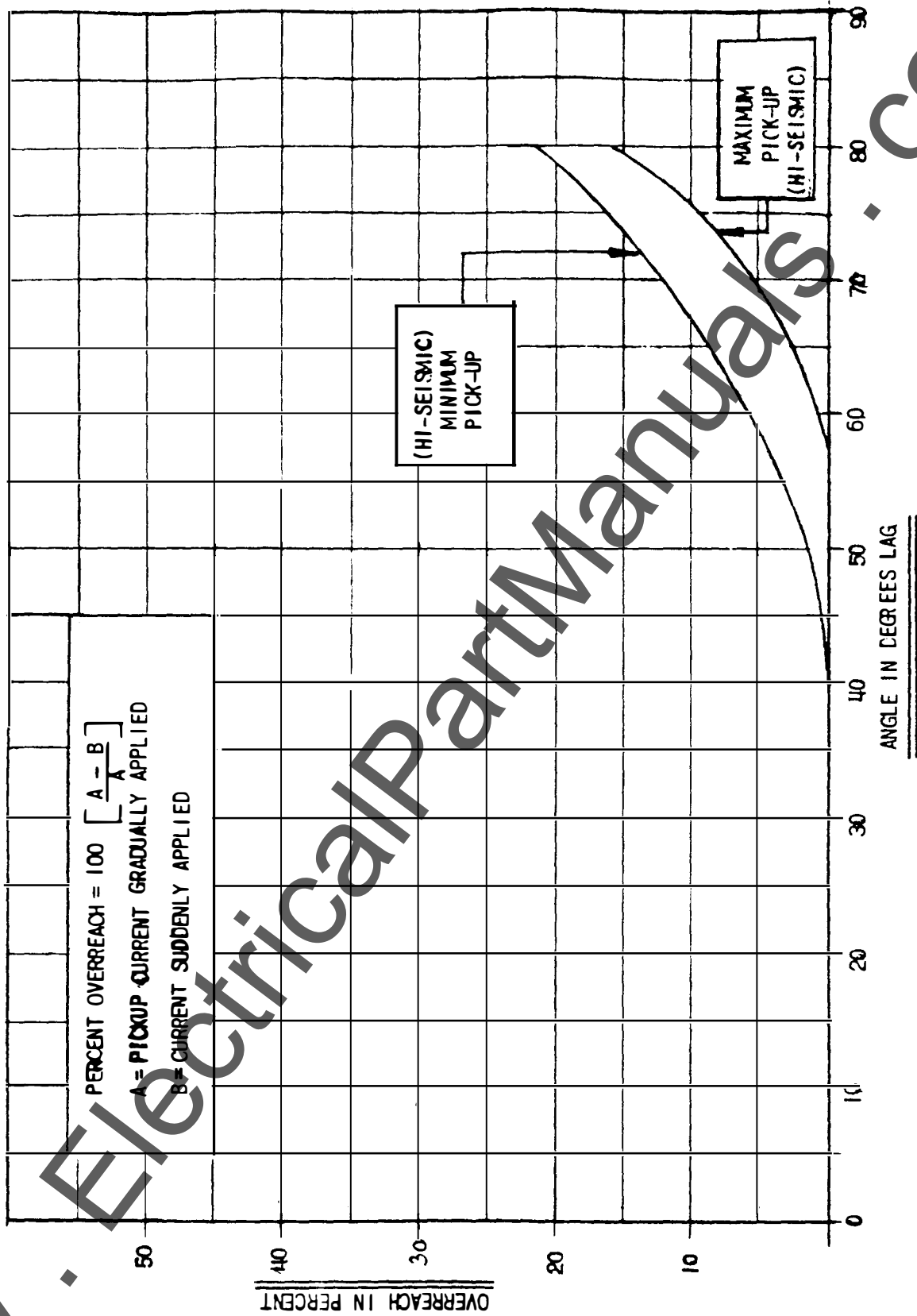


FIG. 12 (0208A8694-1) TRANSIENT OVERREACH CHARACTERISTICS OF THE HI-SEISMIC INSTANTANEOUS UNIT

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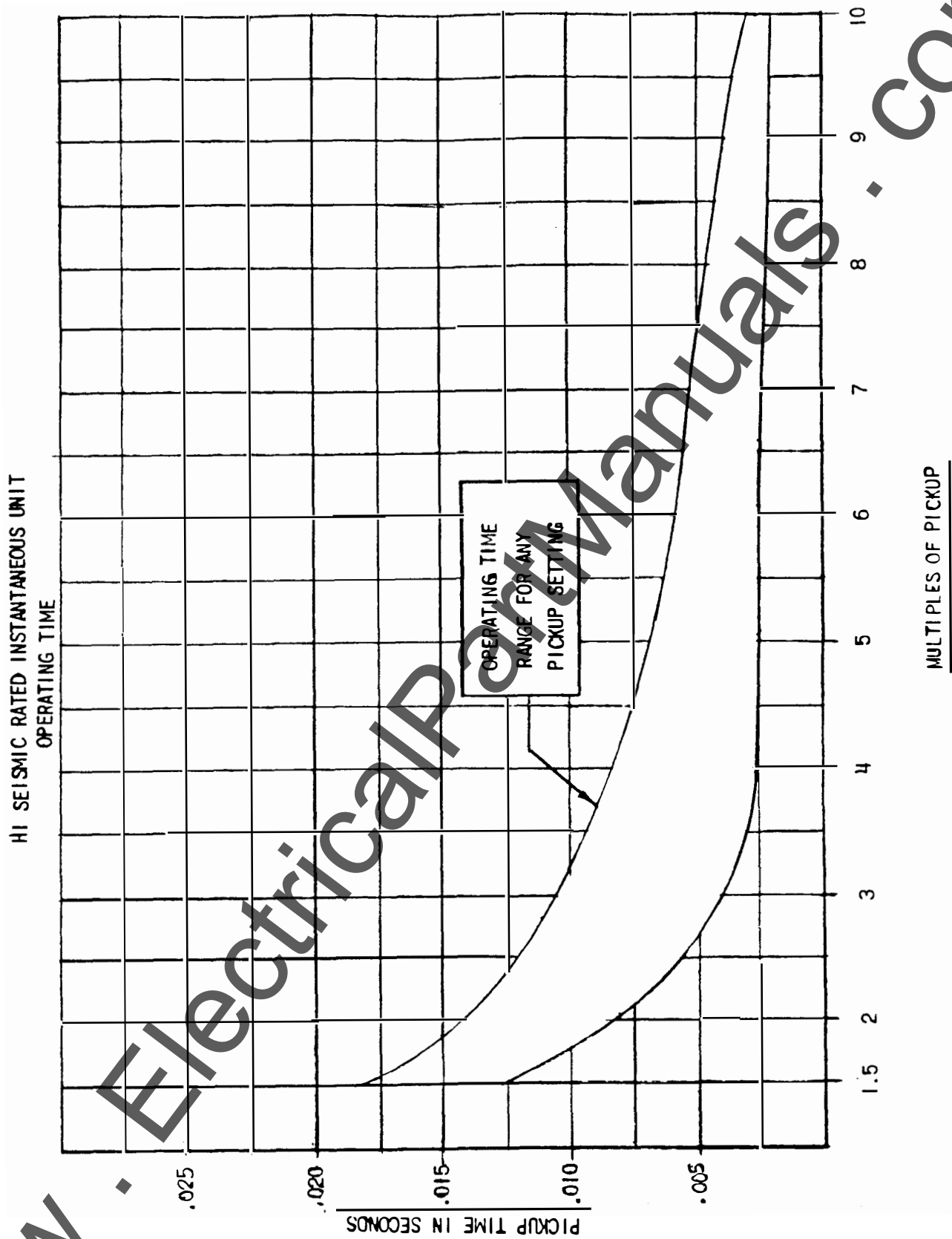
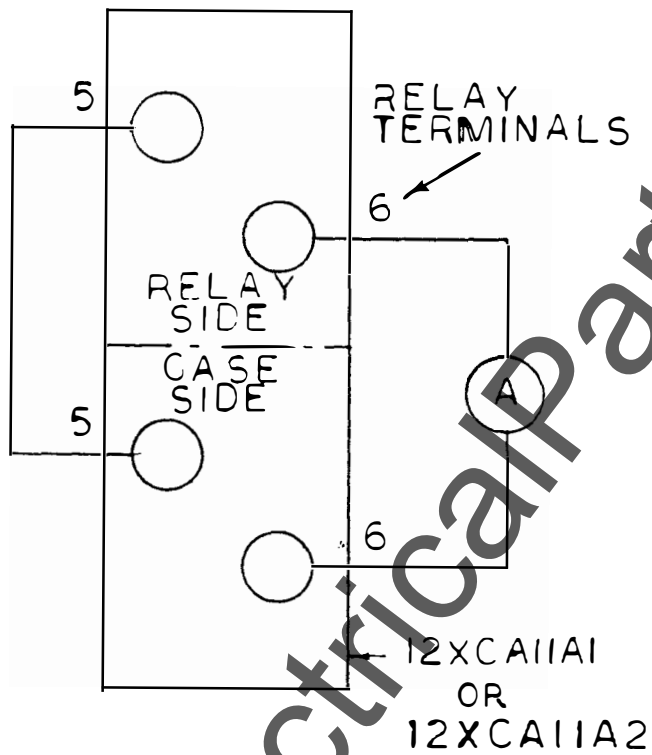


FIG. 13 (0208A8695-0) TIME-CURRENT CHARACTERISTICS OF THE HI-SEISMIC INSTANTANEOUS UNIT

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RELAY COIL  
IN CIRCUIT



RELAY COIL  
NOT IN CIRCUIT

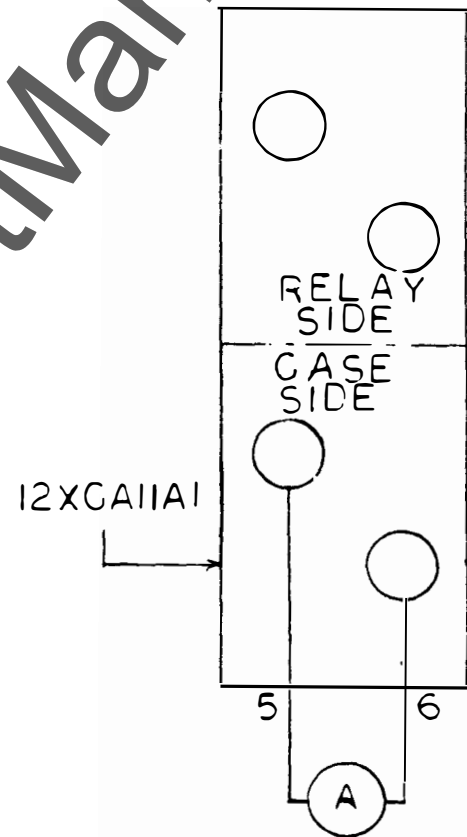


FIG. 14 (0269A1787-0) TEST CONNECTIONS FOR TESTING CT SECONDARY USED WITH THE IFC RELAY

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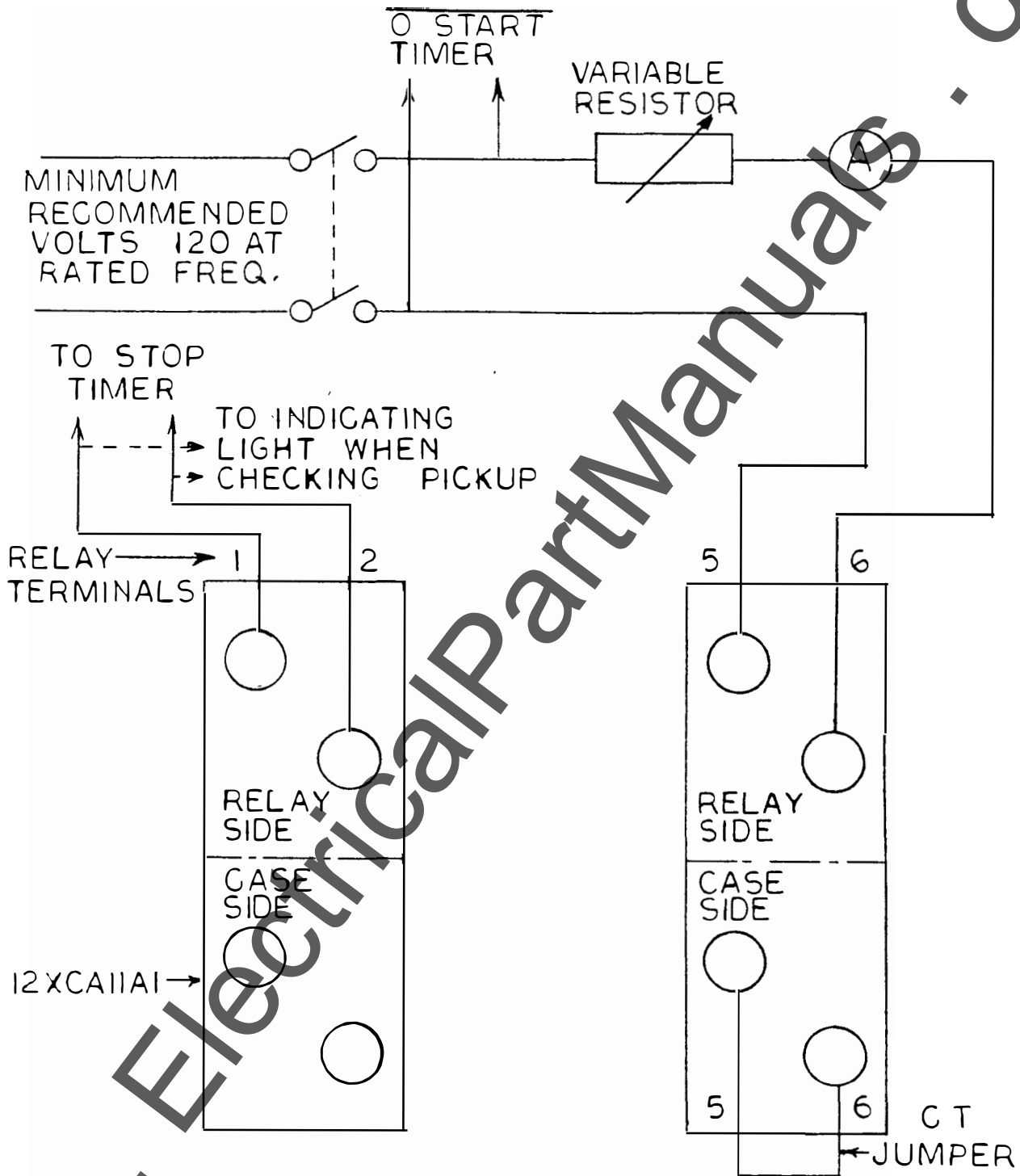


FIG. 15 (0269A1789-0) TEST CONNECTIONS FOR TESTING PICKUP AND OPERATING TIMES OF THE IFC RELAY TIME OVERCURRENT UNIT

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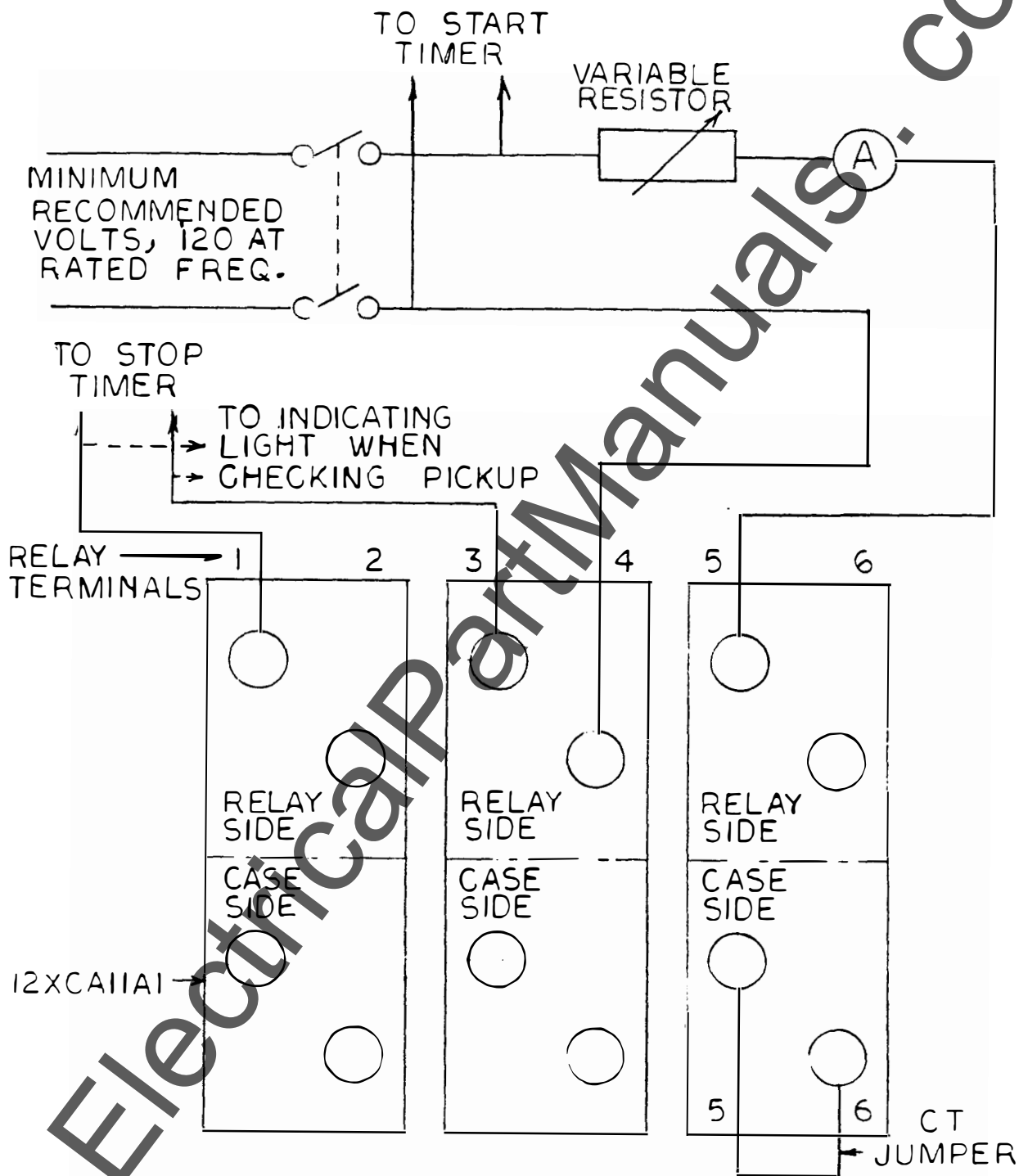


FIG. 16 (0269A1788-1) TEST CONNECTIONS FOR TESTING PICKUP AND OPERATING TIMES OF THE IFC RELAY HI-SEISMIC INSTANTANEOUS UNIT

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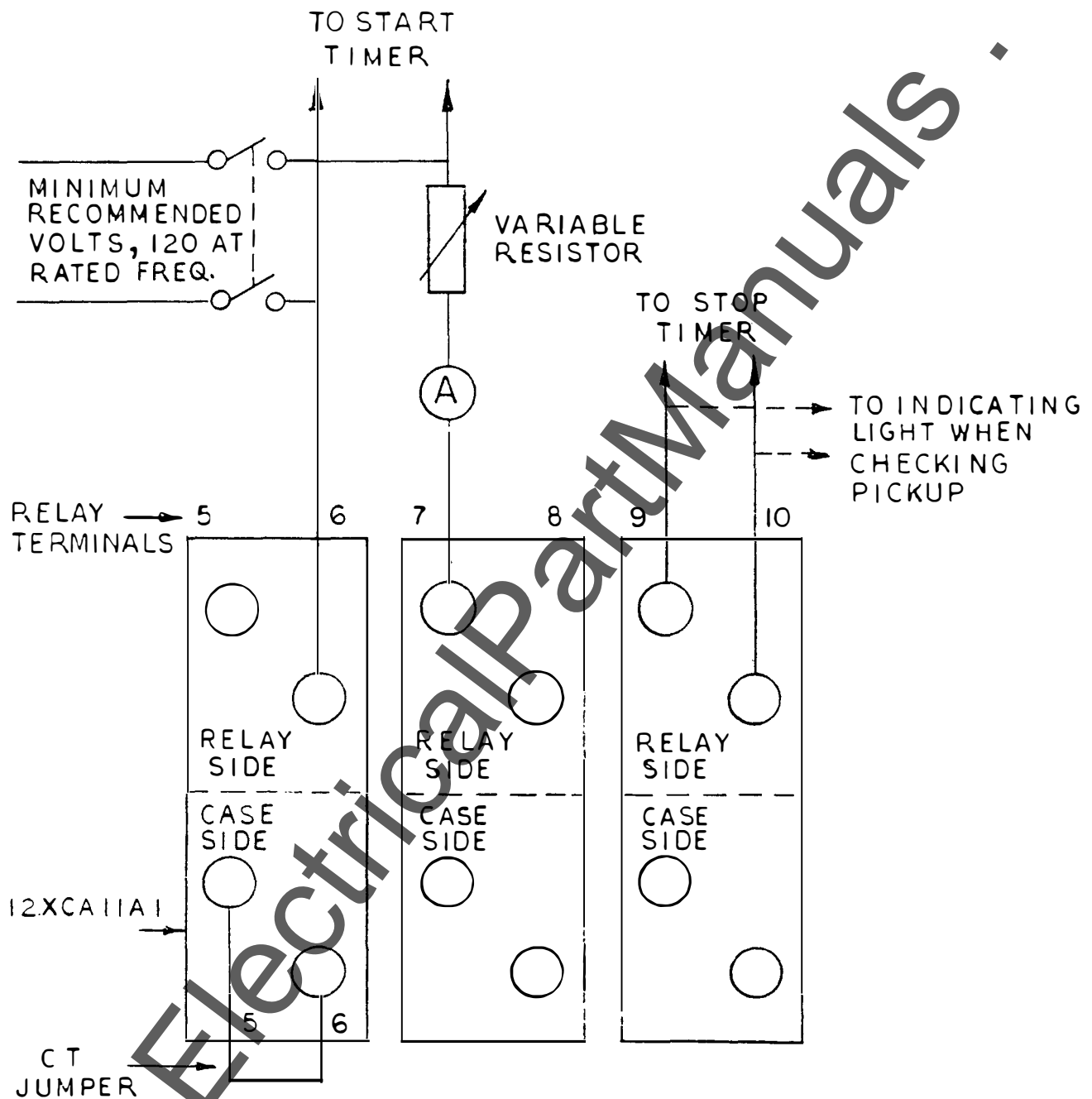


FIG. 17 (0269A1865-0) TEST CONNECTIONS PICKUP AND DROPOUT OF THE HIGH DROPOUT INSTANTANEOUS UNIT

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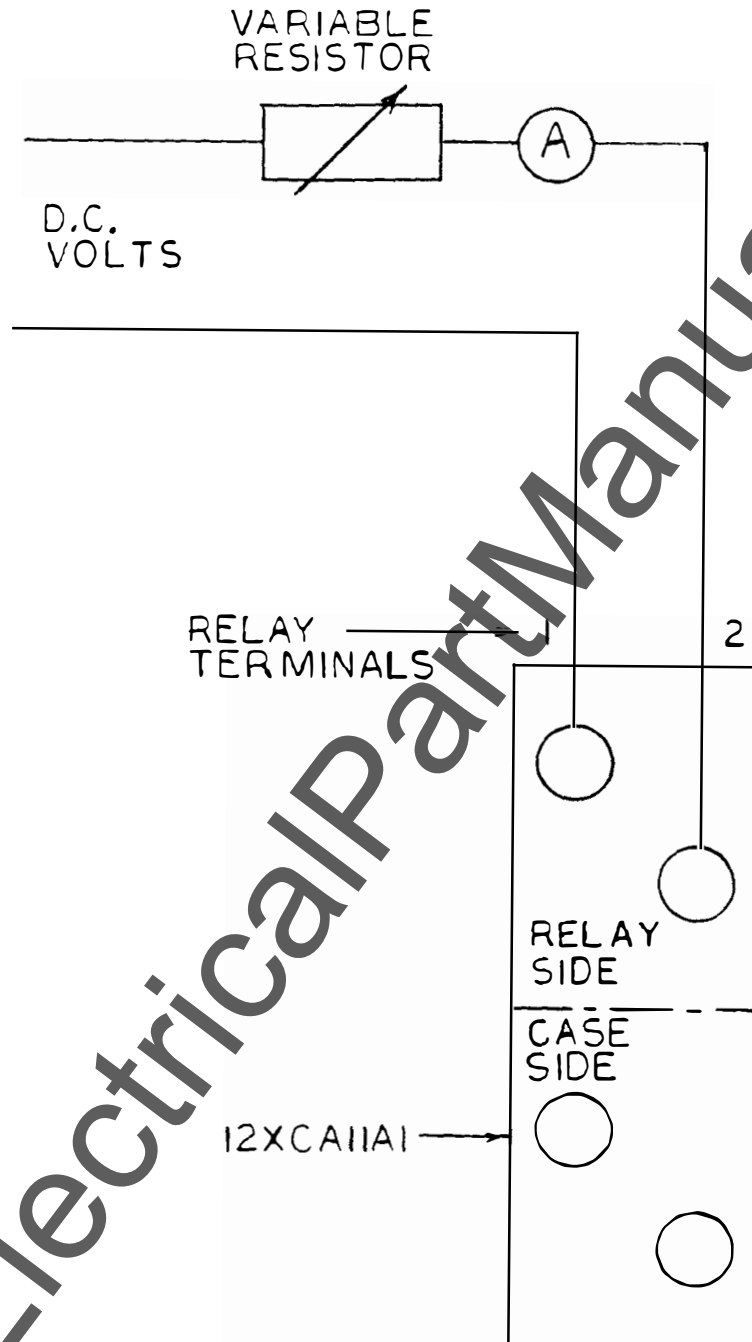


FIG. 18 (0269A1790-0) TEST CONNECTIONS FOR TESTING THE HI-SEISMIC TARGET AND SEAL-IN UNIT USED WITH THE IFC RELAY

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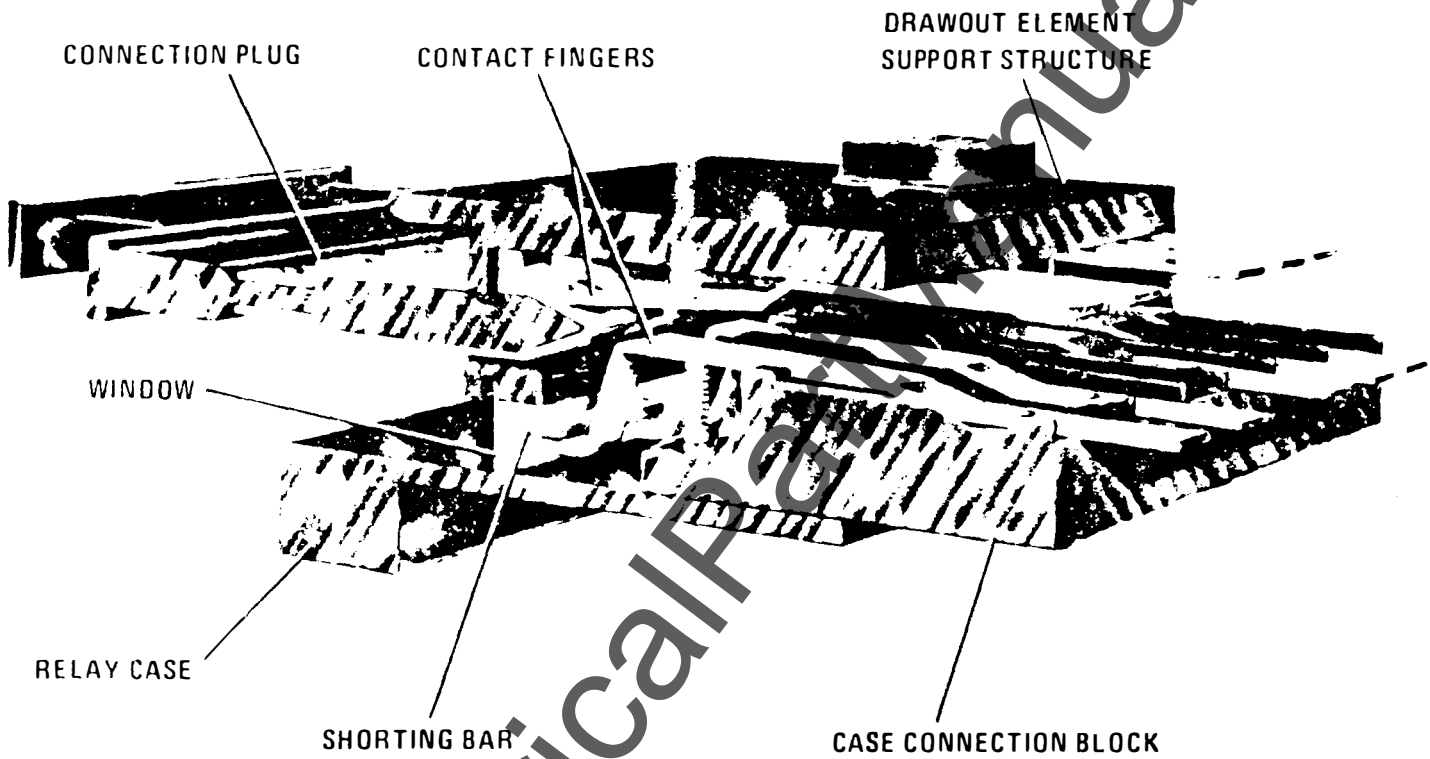


FIG. 19 (8042715) CROSS SECTION OF IFC DRAWOUT CASE SHOWING SHORTING BAR

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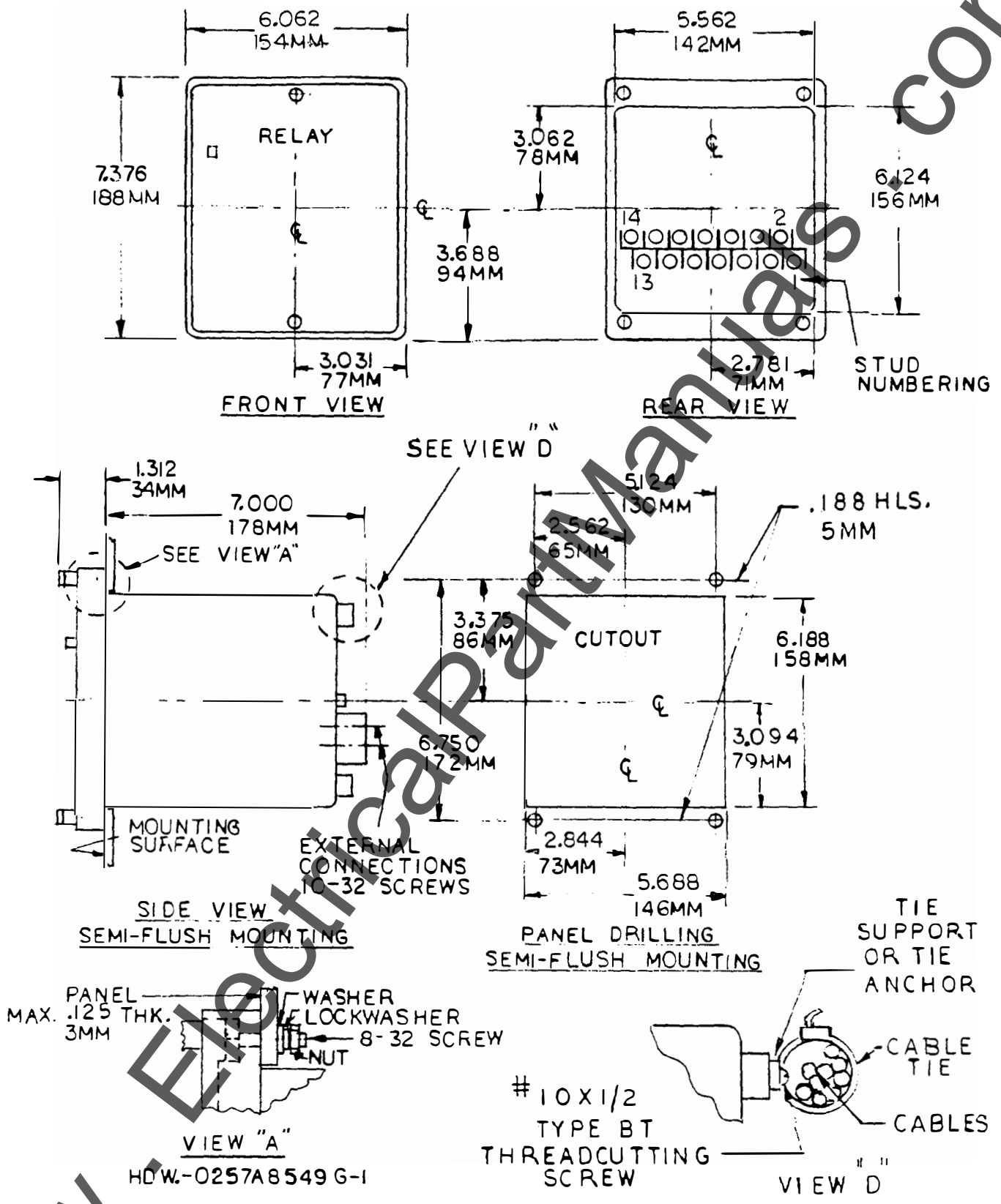


FIG. 20 (0257A8452-2 SH. 1) OUTLINE AND PANEL DRILLING FOR RELAY TYPE IFC66

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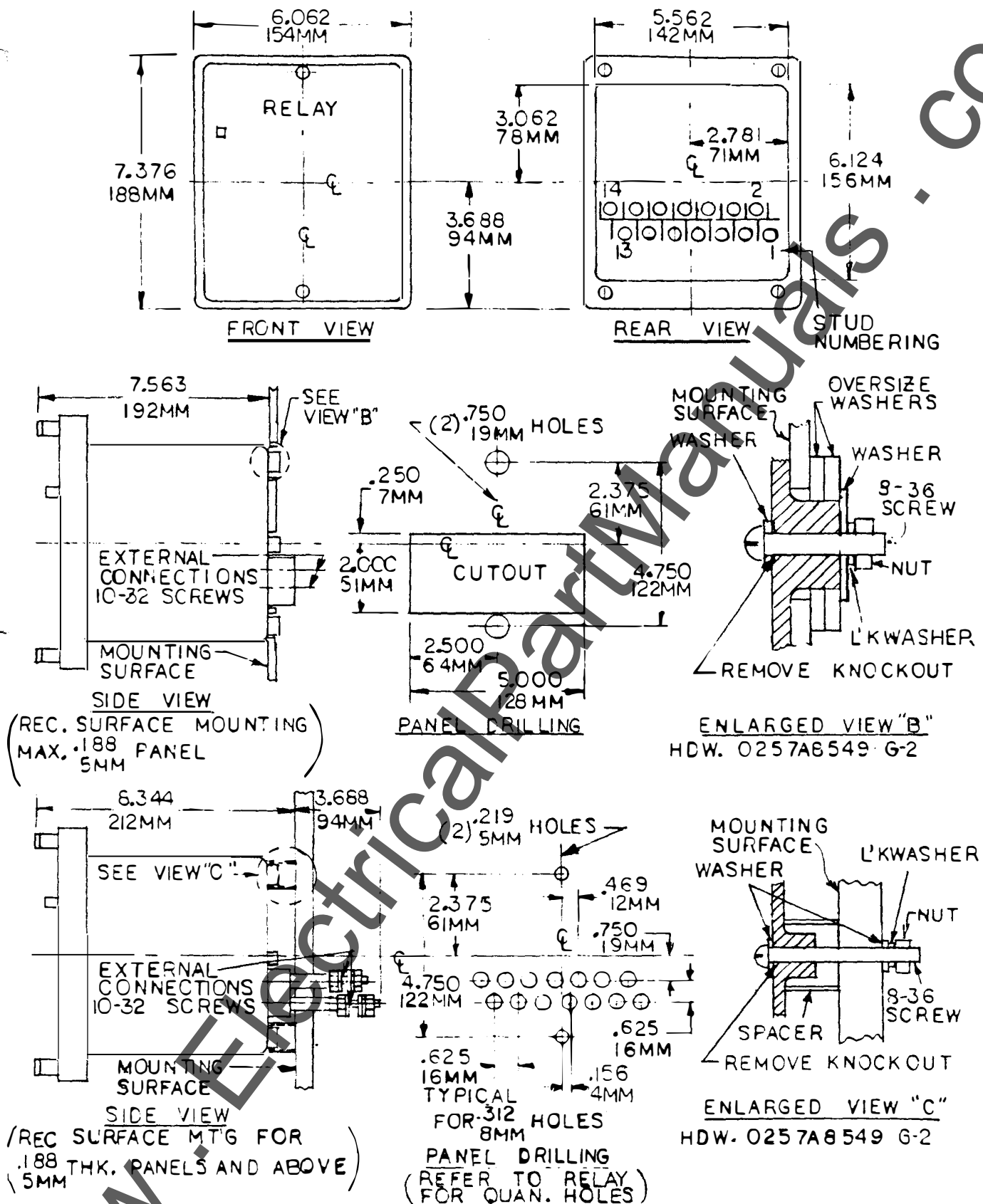


FIG. 21 (0257A8452-1 SH. 2) OUTLINE AND PANEL DRILLING FOR RELAY TYPE IFC66

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