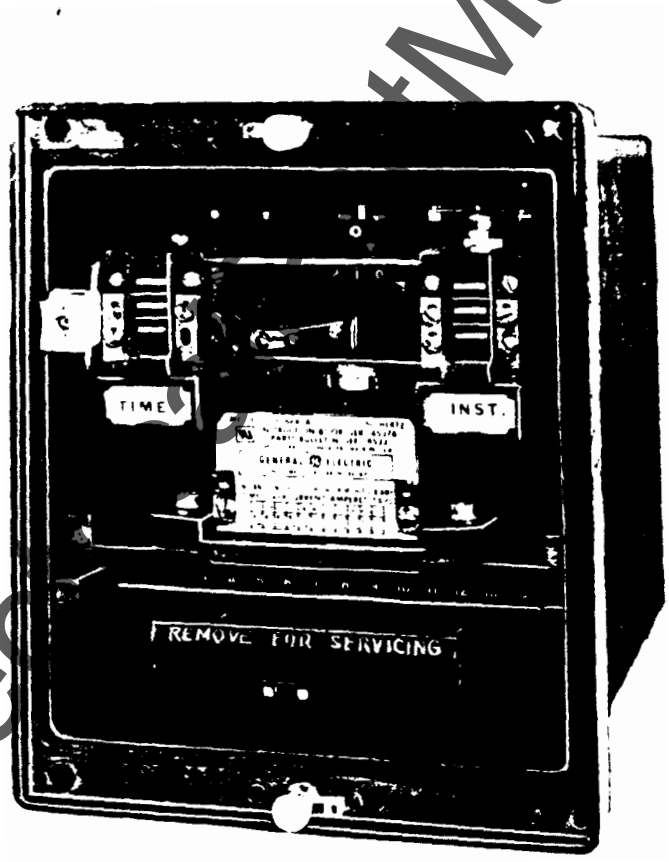
INSTRUCTIONS

GEK-49949A
Supersedes GEK-49949

TIME OVERCURRENT RELAYS

TYPES

IFC66AD
IFC66BD
IFC66KD



GENERAL ELECTRIC

CONTENTS

(Cover Photo 8043003)

TIME OVERCURRENT RELAYS

TYPES IFC66AD, IFC66BD, IFC66KD

DESCRIPTION

The Type IFC relays covered by these instructions are single-phase time overcurrent relays with long-time inverse 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 IFC66BD also includes a hi-seismic hinged-armature instantaneous overcurrent unit with target, mounted in the front of the relay. The IFC66KD 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 dropout 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 **CONSTRUCTION** section of this instruction book.

In addition to the contacts that are normally provided for tripping, each of the relays is provided with contacts that may be used for alarm, remote indication, or other purposes deemed suitable by the user. Note that the contacts associated with the target and seal-in unit will operate only after the time overcurrent unit contacts close to draw trip current, hence they are not reliable for use as tripping contacts. See the internal and external connections for the exact contact arrangement used in each of the relays.

When these relays are semi-flush mounted on a suitable panel, they 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 dimensions are shown in Figures 20 and 21. The internal connections diagrams for the IFC66AD, IFC66BD and IFC66KD relays are shown in Figure 3, 4 and 5, respectively.

APPLICATION

Time overcurrent relays are used extensively 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 backup protection on medium voltage industrial systems.

The principal application of the IFC66AD and IFC66BD relays is for motor protection. The long-time characteristic of the induction disk unit provides sufficient time to prevent relay 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. If used, the instantaneous unit in the IFC66BD 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 of Figure 11.

The IFC66AD and IFC66BD 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 IFC66BD is useful in this application only if 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 IFC66AD and IFC66BD are shown in Figure 8.

The IFC66KD is especially suited for motor protection. The relay is similar to the IFC66BD, 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 dropout 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

The user must determine the specific settings which will provide the required protection for the particular 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 IFC66KD relay will be as follows:

1. For motor overloads, the time overcurrent unit (51) will time out, picking up an external auxilary, 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 backup protection, the IFC66 time overcurrent unit 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:

1. Operating time of the downstream relay and breaker.

2. Overtravel in the induction disk unit.

3. 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 second; exact values can be read from Figure 11. Typical safety factors range from 0.1 to 0.2 second.

CONSTRUCTION

The IFC time overcurrent 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 carry a moving contact, which completes the alarm or trip circuit when it touches a stationary contact. 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 C1 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 current transformer 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, as shown in Figure 1. The seal-in unit has two electrically separate contacts, one of which is in series with its coil, and 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 "BD" and "KD" 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 with electrically separate contacts, and is mounted on the front of the relay and to the right of the shaft of the time overcurrent unit. When the instantaneous unit picks

up, it raises a target into view, 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 "KD" model relays, in addition to the above, contain a hi-seismic dropout instantaneous unit. The high dropout instantaneous unit is a small hinged type unit with electrically separate contacts mounted in the rear of the relay (see Figure 2). Unlike the hi-seismic instantaneous unit, this unit does not include a target: therefore, it does not have to be reset after it operates.

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

Both the hi-seismic target and seal-in unit, and the hi-seismic instantaneous unit have the letters "Hi-G" molded into their target blocks to distinguish them as hi-seismic units. Seismic fragility level exceeds peak axial acceleration of ten g's (4 g ZPA) when tested using a biaxial multi-frequency input motion to produce a required response spectra (RRS) in accordance with the IEEE Guide for Seismic Testing of Relays, STD 501-1978.

RATINGS

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

TIME OVERCURRENT UNIT

The range for the time overcurrent unit is shown in Table 1.

Table 1

Relay	Frequency (Hertz)	Current Range (Amperes)
IFC66AD, BD and KD	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
Tap Letters	A/M	A/L	B/L	B/K	C/K	C/J	D/J	D/H	E/H	E/G	F/G

The one second thermal ratings are listed in Table 3.

Table 3

Model	Time Overcurrent Unit (Amperes)	One Second Rating, Any Tap (Amperes)	K
IFC66AD, BD and KD	2.5 - 7.5	260	67,600

Ratings less than one second may be calculated according to the formula, $I = \sqrt{K/T}$, where T is the time in seconds that 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, HIGH (H) or LOW (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.

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.

Table 5

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

(Notes for Table 5)

** The range is approximate, which means that the 2-10 amp range may be 2-8 amps, and the 10-50 amp range may be 8-50 amps. However, 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, HIGH (H) or LOW (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 (Amps)	Continuous Rating (Amps)	***One Second Rating (Amps)	K
2-8	L H	2 - 4 4 - 8	3.7 4.8	130	16,900

** The range is approximate, which means that the 2-4 amp range may be 2-5 amps, and the 4-8 amp range may be 5-8 amps. However, 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 TARGET AND SEAL-IN UNIT

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

Table 7

		TAP	
		0.2	2
DC resistance ± 10%	(ohms)	8.0	0.24
Minimum Operating (plus 0%, minus 60%)	(amperes)	0.2	2.0
Carry continuous	(amperes)	0.3	3.0
Carry 30 amps	(seconds)	0.03	4.0
Carry 10 amps	(seconds)	0.25	30.0
60 hertz impedance	(ohms)	68.6	0.73

If the tripping current exceeds 30 amperes, an auxiliary relay should be used, and the connection should be 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	Hertz	Range	Minimum Tap Amps	Burdens at Minimum Pickup Minimum Tap (Ohms)			Burdens in Ohms (Z) Times Pickup		
				R	JX	Z	3	10	20
IFC66	50 60	2.5-7.5	2.5	.085 .102	.307 .368	.318 .382	.153 .183	.081 .097	.063 .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 hertz relay, with 2.5-7.5 ampere range, has an impedance of 0.382 ohms on the 2.5 ampere tap. The impedance of the 5.0 ampere tap is:

$(2.5/5.0)^2 \times 0.382 = 0.096$ ohms.

The hi-seismic instantaneous unit burdens are listed in Table 9.

TABLE 9

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

The hi-seismic dropout instantaneous unit burdens are listed in Table 10.

Table 10

Hi-Seismic Hi-Dropout Inst. Unit (Amps)	Hz	Movable Lead Position	Range (Amps)	Minimum Pickup (Amps)	Burden at Minimum Pickup (Ohms)			Burden in Ohms (Z) Times Pickup		
					R	jX	Z	3	10	20
2-8	60	L H	2-4 4-8	2 4	0.69 0.30	0.62 0.22	0.93 0.37	0.55 0.25	0.41 0.21	0.38 0.20
2-8	50	L H	2-4 4-8	2 4	0.58 0.25	0.52 0.18	0.78 0.31	0.46 0.21	0.34 0.18	0.32 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. The tap setting markings are shown in Table 2 of this instruction book. They also appear on the relay nameplate.

Example:

The five ampere tap for a 2.5 to 7.5 IFC66 time overcurrent relay requires one movable lead in position D, and the other in position J.

Operating Time Accuracy

The IFC relays should operate within plus or minus seven 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 ten and the disk has to travel its maximum distance to close the contacts.

Reset

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

HI-SEISMIC INSTANTANEOUS UNIT

The instantaneous unit has a 25 to one 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 four to one 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 for the instantaneous unit is shown in Figure 13.

HI-SEISMIC TARGET AND SEAL-IN UNIT

The target and seal-in unit has two taps located on the front of the unit (see Figure 1).

RECEIVING, HANDLING AND STORAGE

These relays, when not included as 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 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 when unpacking the relay in order that none o the parts are damaged 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 the operation of the relay.

ACCEPTANCE TESTS

GENERAL

The relay should be examined and tested upon delivery to ensure that no damage has been sustained in shipment and that the relay calibrations have not been disturbed. If examination or test indicates that a readjustment is necessary, refer to the section on **SERVICING.**

The following tests may be performed as part of the installation of the relay 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 the relays.

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 the screws are tight.

MECHANICAL INSPECTION

1. There should be no noticable friction when the disk is slowly rotated in a clockwise direction. The disk should return by itself to its reset position.

2. Make sure the control spring is not deformed, and that its convolutions are not 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 instantaneous contacts (see **SERVICING** section for seal-in unit).

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.

5. Make sure that the brushes and shorting bars agree with the internal connections diagram.

CAUTION: If there is a need to tighten any screws, DO NOT OVERTIGHTEN. Overtightening may cause stripping.

DRAWOUT RELAYS, GENERAL

The IFC relays may be tested without removing them from the panel by using either the 12XCA28A1 or 12XCA11A1 test probes. The test probes make connections to both the relay and the external circuitry, which provides maximum flexibility, but requires reasonable care in use, since a CT shorting jumper is necessary when testing. The test probes are different in the number of connections that can be made. The 12XCA28A1 has a full complement of 28 connections, and the 12XCA11A has four. Refer to instruction book GEK-49803 for additional information.

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 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 saturating electromagnets (such as time overcurrent relays), would be essentially affected by non-sinusoidal waveforms.

TIME OVERCURRENT UNIT

Rotate the time dial slowly. Use a lamp to check 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 way of its adjusting screw.

With the contacts just closing at the zero time dial setting, there should be a 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 **CHARACTERISTICS** 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. If this adjustment has been distrubed, the operating current of the unit may be brought into agreement with the tap setting by turning the ring. This adjustment also permits any desired setting between the various tap settings to be obtained. If this adjustment is required, the

higher tap setting is recommended. It should be noted that the relay will not necessarily agree with the time current characteristics of Figure 6 and 7 if the relay has been adjusted to pick up at a value other than at the tap value. This is 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 its contacts when the current reaches a predetermined value. The contacts are just closed when the time dial is set on zero. When the time dial is set on ten, the disk must travel the maximum distance to close the contacts, and therefore will give the maximum setting time.

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

Pickup Test

Set the relay at 0.5 time dial position and the lowest tap. Using the test connections of Figure 15, the main unit should close the contacts within plus or minus three percent of tap value current.

Time Test

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

Table 11

Relay	Hertz	Time (seconds)	
		Minimum	Maximum
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 internal connections diagram, Figure 4. Connect as indicated in the test circuit of Figure 16. Whenever possible, use the higher range, since the higher range has a 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 it 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 one-eighth of a turn fully clockwise, and 20 turns counterclockwise from the fully clockwise position. Do not leave the core in the fully 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 it 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 one-eighth of a turn fully clockwise, and 20 turns counterclockwise from the fully 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 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.

Pickup and Dropout Test

1. Connect relay studs 1 and 2 (see test circuit of Figure 18) 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. This closes the normally open induction unit contact.

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	DROPOUT 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 drilling dimensions are shown in Figure 20 and 21. Figure 20 shows semi-flush mounting, and Figure 21 shows various methods of surface mounting.

The internal connections diagrams for the relays are shown in Figure 3, 4 and 5. Typical external connections are shown in Figure 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 of 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. The 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 described in the **ACCEPTANCE TESTS** 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). Always select the higher range whenever possible, since it has a higher continuous rating.

2. Set the instantaneous unit to pick up at the desired current level. See "Setting the Instantaneous Unit" in the **ACCEPTANCE TESTS** section.

All the tests described under **INSTALLATION** must be performed at the time of installation. In addition, if those test described under the **ACCEPTANCE TESTS** section were not performed prior to installation, it is recommended that 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). Always select the higher range whenever possible, since it has a 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 TESTS** section.

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

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

HIGH DROPOUT INSTANTANEOUS UNIT

Check that the high dropout instantaneous unit picks up and drops out at the desired current levels, as outlined in the **ACCEPTANCE TESTS** 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

A flexible burnishing tool should be used for cleaning relay contacts. This is a flexible strip of metal with an etched-roughened surface, which in effect resembles a superfine file. The polishing action of this file is so delicate that no scratches are left on the contacts, yet it cleans off any corrosion thoroughly and rapidly. The flexibility of the tool 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 clear Lexan® cover should be cleaned with a soft cloth and water only. No cleaning solutions should be used. Use of cleaning solutions may damage the clear cover.

SYSTEM TEST

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

SERVICING

TIME OVERCURRENT UNIT

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

Pickup Tests

Rotate time dial to the zero time dial setting. Use a lamp to check 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 its adjusting screw. This screw should be held securely in its support.

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*Indicates Revision

With the contacts just closing at the zero time dial 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 time overcurrent unit for any current tap setting is adjusted by means of a spring adjusting ring. If this adjustment has been disturbed, the operating current of the unit may be brought into agreement with the tap setting by turning the ring. This adjustment also permits any desired setting between the various tap settings to be obtained. If this adjustment is required, the higher tap setting is recommended. It should be noted that the relay will not necessarily agree with the time current characteristics of Figure 6 and 7 if the relay has been adjusted to pick up at a value other than at the tap value. This is because the torque level of the relay has been changed.

Connect the operating coil terminals to a source of the proper frequency and good wave form having a voltage of 110 volts or more, with resistance load boxes for setting the current (see the test circuit of Figure 15).

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

Table 13

Tap Range	Tap	Minimum Amps	Maximum 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 the 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)	
	Minimum	Maximum
IFC66	18.2	19.0

The operating time should be adjusted as nearly as possible to 18.6 seconds. The drag magnet assembly should be approximately in the middle of its travel and may be 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. 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 tightened before proceeding with other time checks.

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 the direction that the disk must be moved in order 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. Using a 1/16 inch hex wrench, loosen the upper pivot bearing set screw so that the upper pivot can move freely. Do not remove the set screw from the support structure.

4. Using a 1/16 inch hex wrench, loosen the jewel bearing set screw.

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 reposition the disk.

6. Turn the jewel bearing screw one-eighth of a turn clockwise and tighten the upper pivot set screw to 2.5 to 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. After securely seating the assembly and positioning it according to "Time Tests" above, tighten the drag magnet assembly mounting screws with seven to ten inch-pounds of torque.

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 end (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 the front half of the shaded pole with the armature held closed. Contacts should close with the feeler gage in place.

4. Since mechanical adjustments may affect the seismic fragility level, no mechanical adjustments are advised if seismic capability is of concern.

HI-SEISMIC TARGET AND SEAL-IN UNIT

1. The left contact must make before the right contact.

2. To check the wipe of the seal-in unit, insert a feeler gage between the residual button of the armature and the front end of the pole piece. The left contact should close with a 0.015 inch, plus or minus 0.002 inch, feeler gage; the right contact with a 0.010 inch, plus or minus 0.002 inch, feeler gage.

3. Since mechanical adjustments may affect the seismic fragility level, no mechanical adjustments are advised if seismic capability is of concern.

RENEWAL PARTS

Sufficient quantities of renewal parts should be kept in stock for 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 the name of the part wanted, quantity required, and complete nameplate data, including the serial number, of the relay.

LIST OF FIGURES

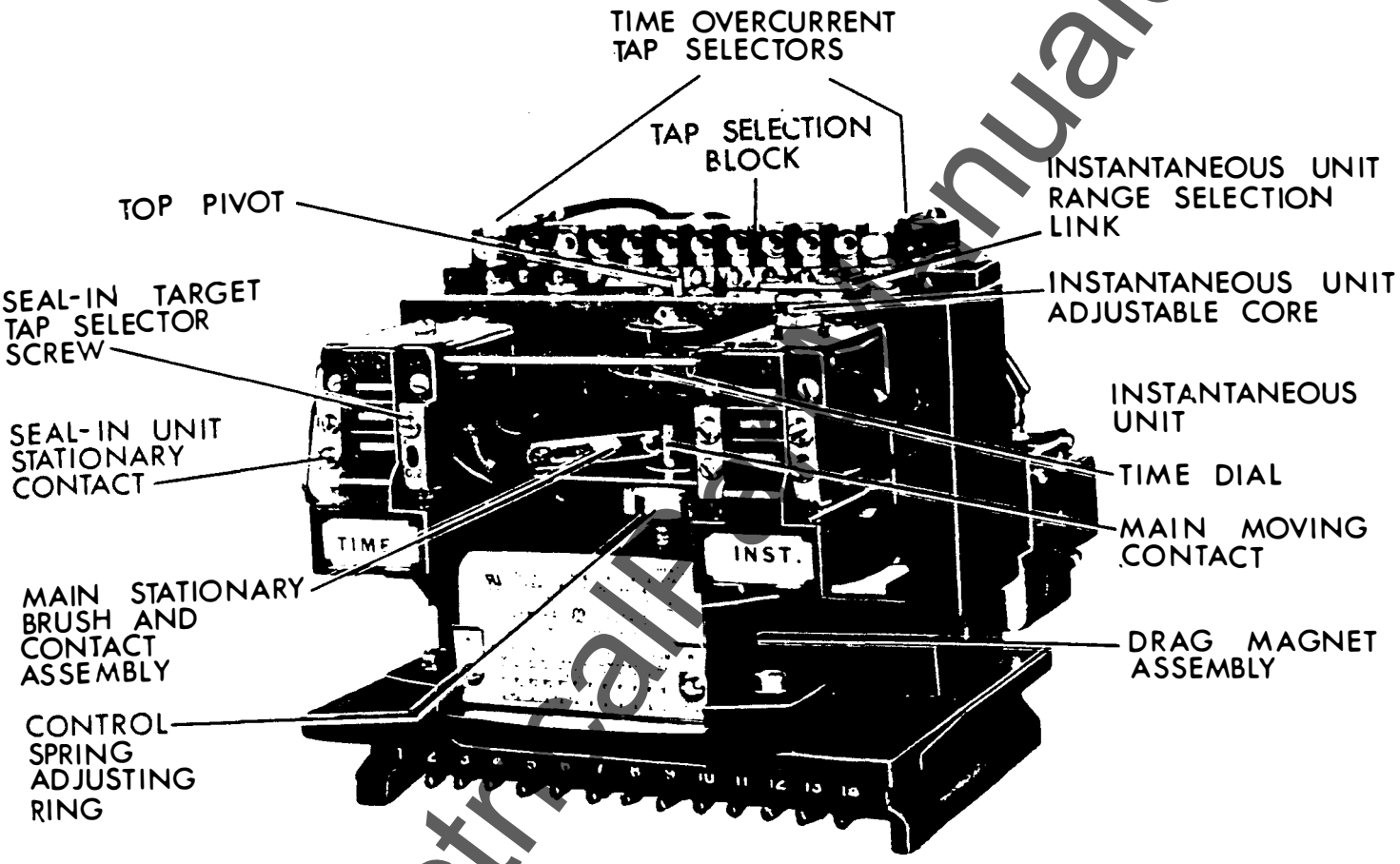


Figure 1 (8043007) Type IFC66KD Relay Removed from Case, Front View

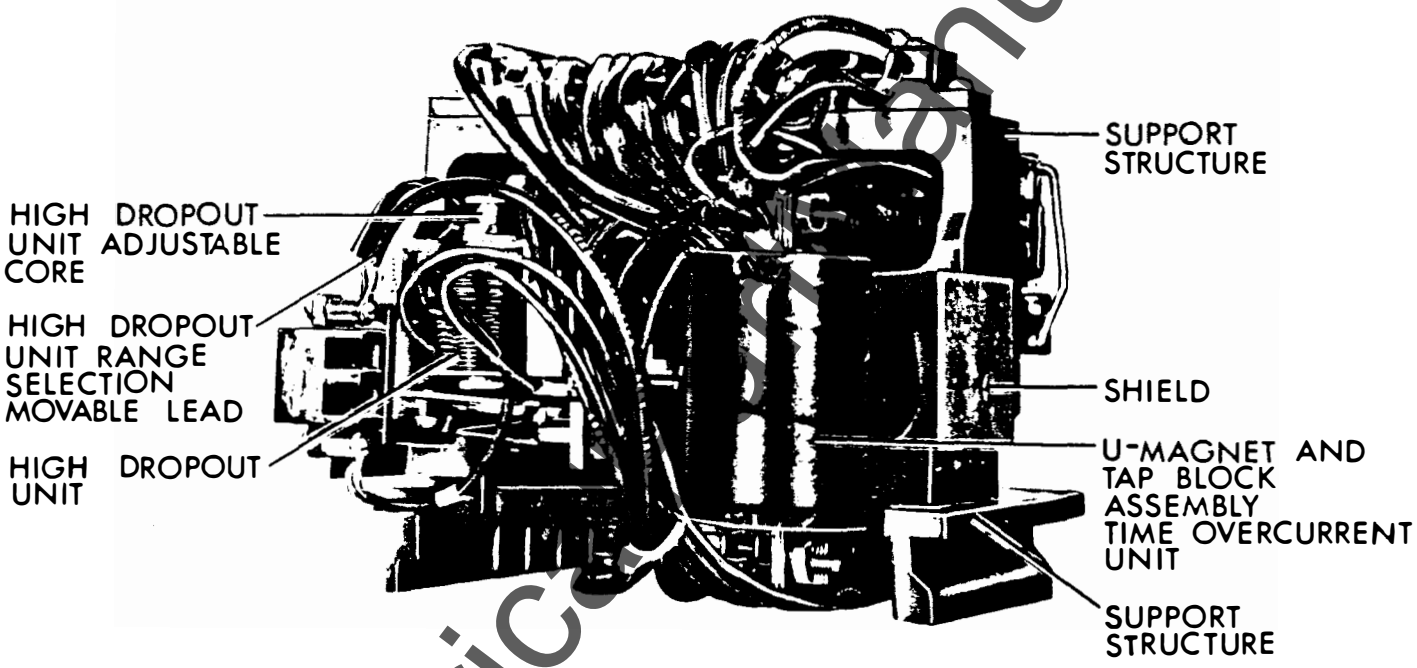


Figure 2 (8043011) Type IFC66KD Relay Removed from Case, Rear View

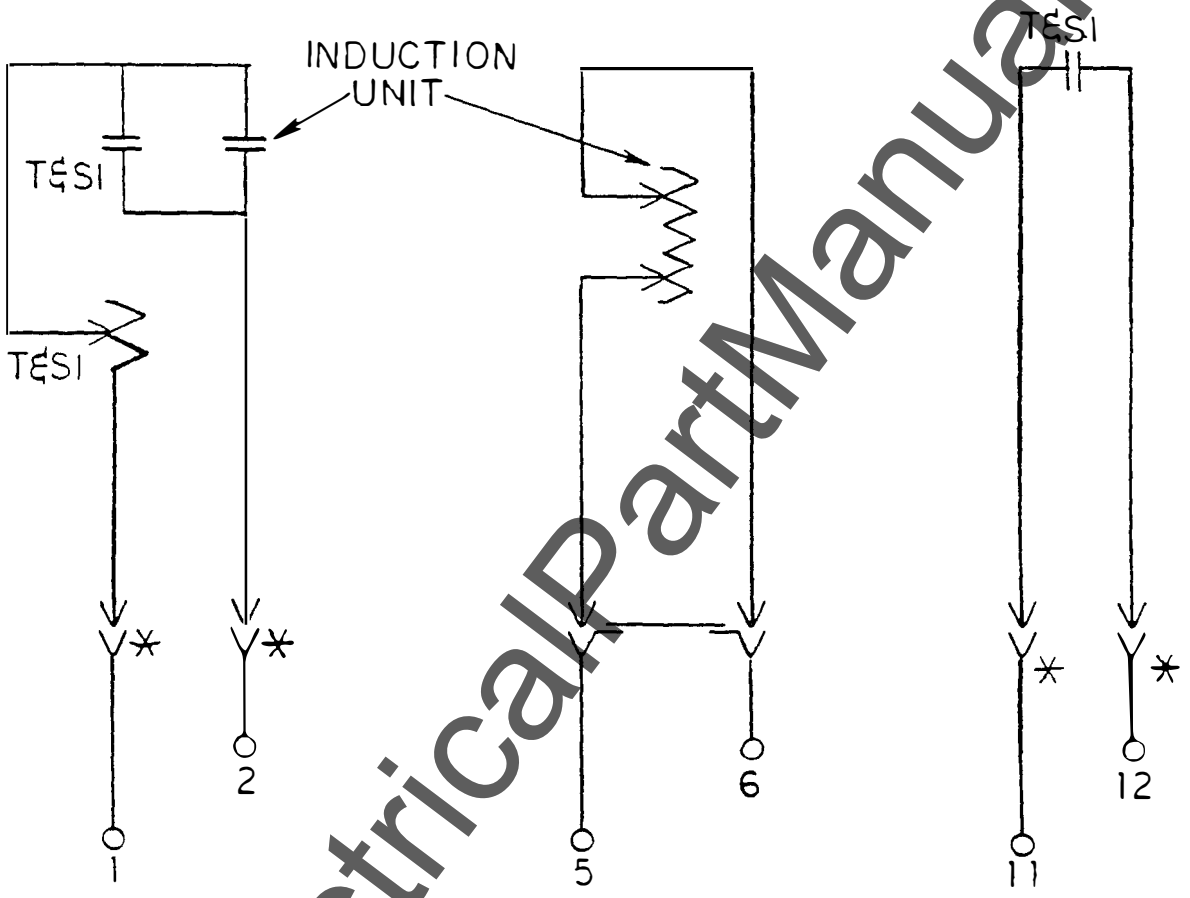
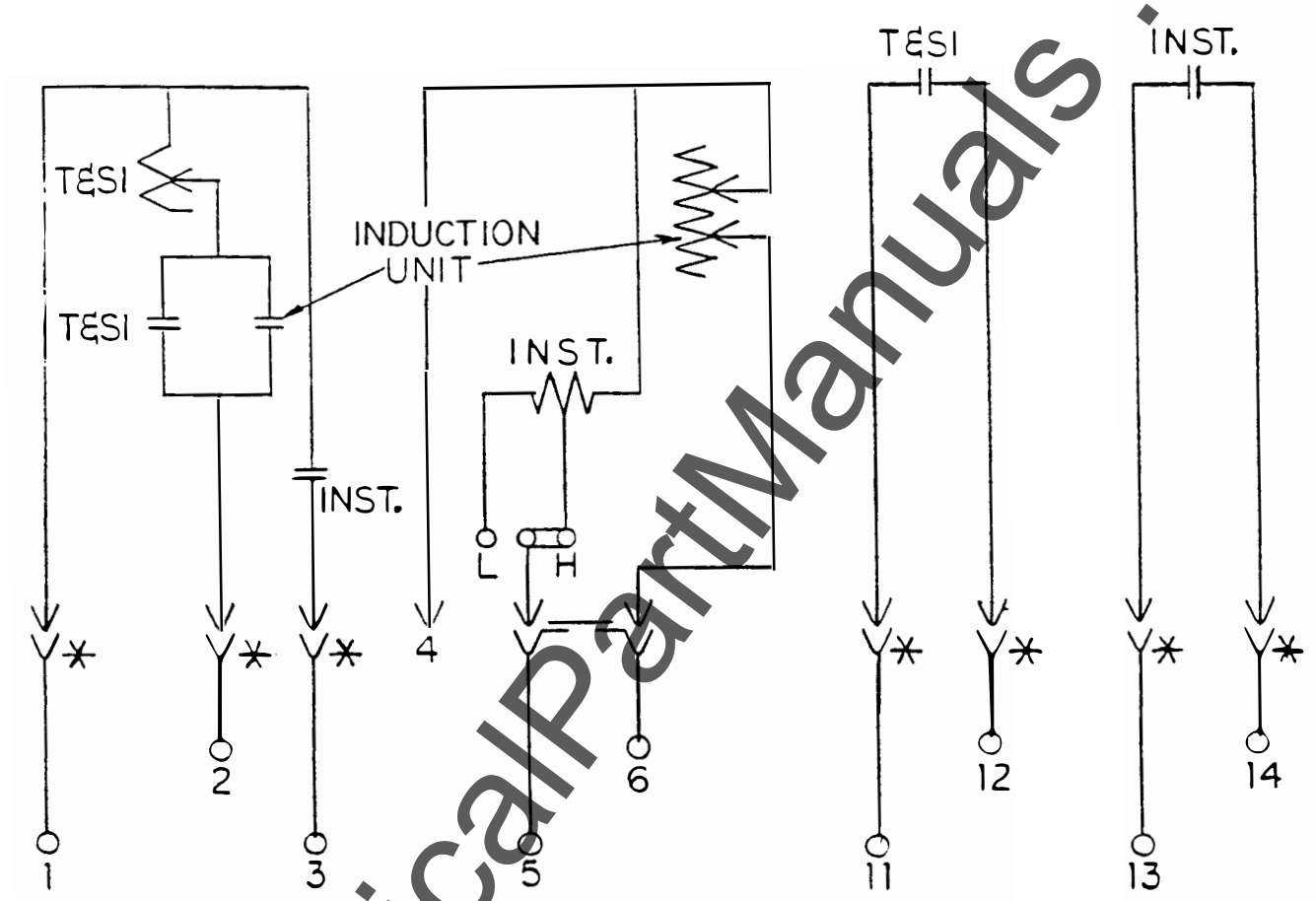


Figure 3 (0208A8514-1) Internal Connections for Type IFC66AD Relay - Front View



INSTANTANEOUS SETTINGS:

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

✳=SHORT FINGER

Figure 4 (0208A8515-1) Internal Connections for Type IFC66BD Relay - Front View

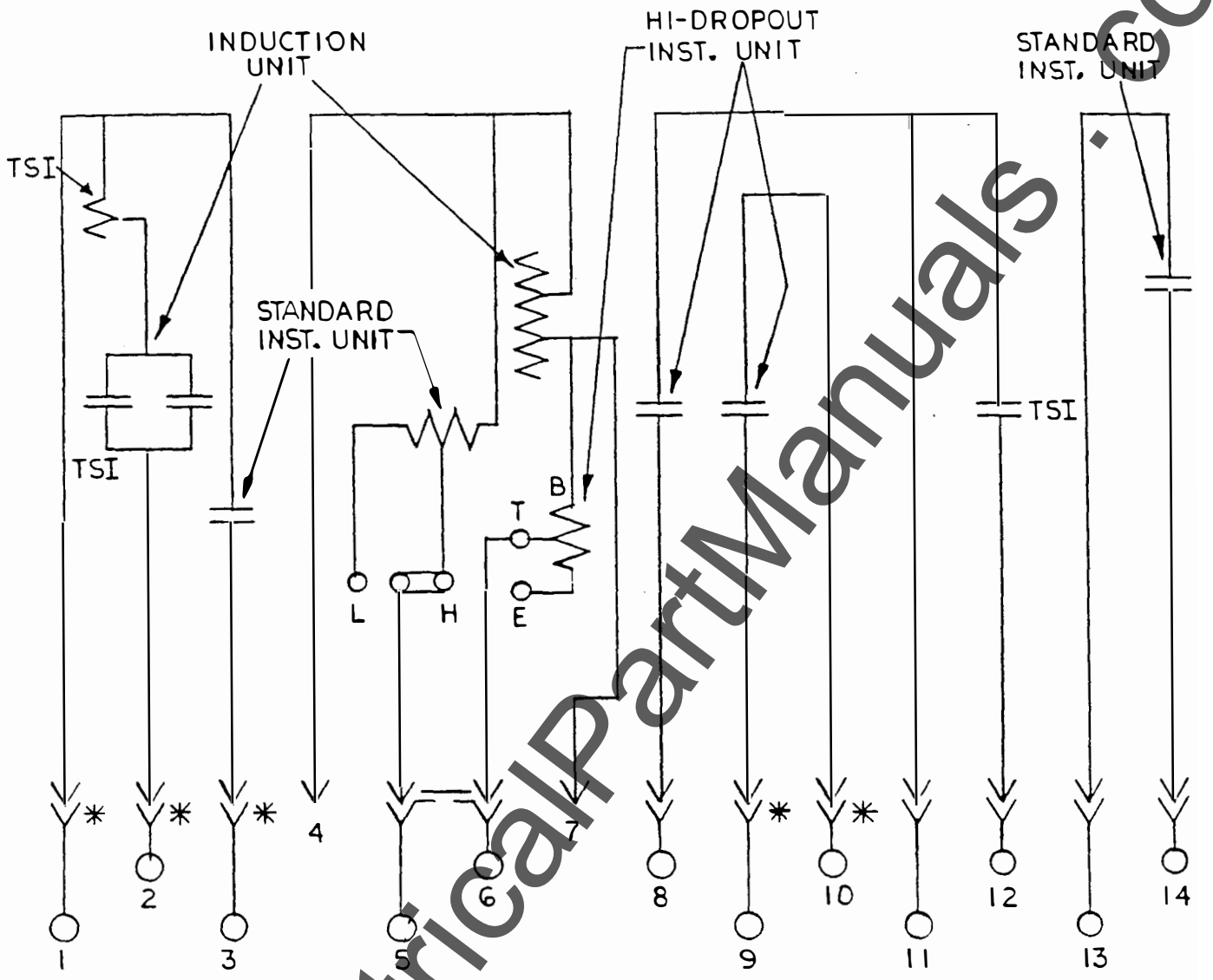


Figure 5 (0275A3237-0) Internal Connections for Type IFC66KD Relay - Front View

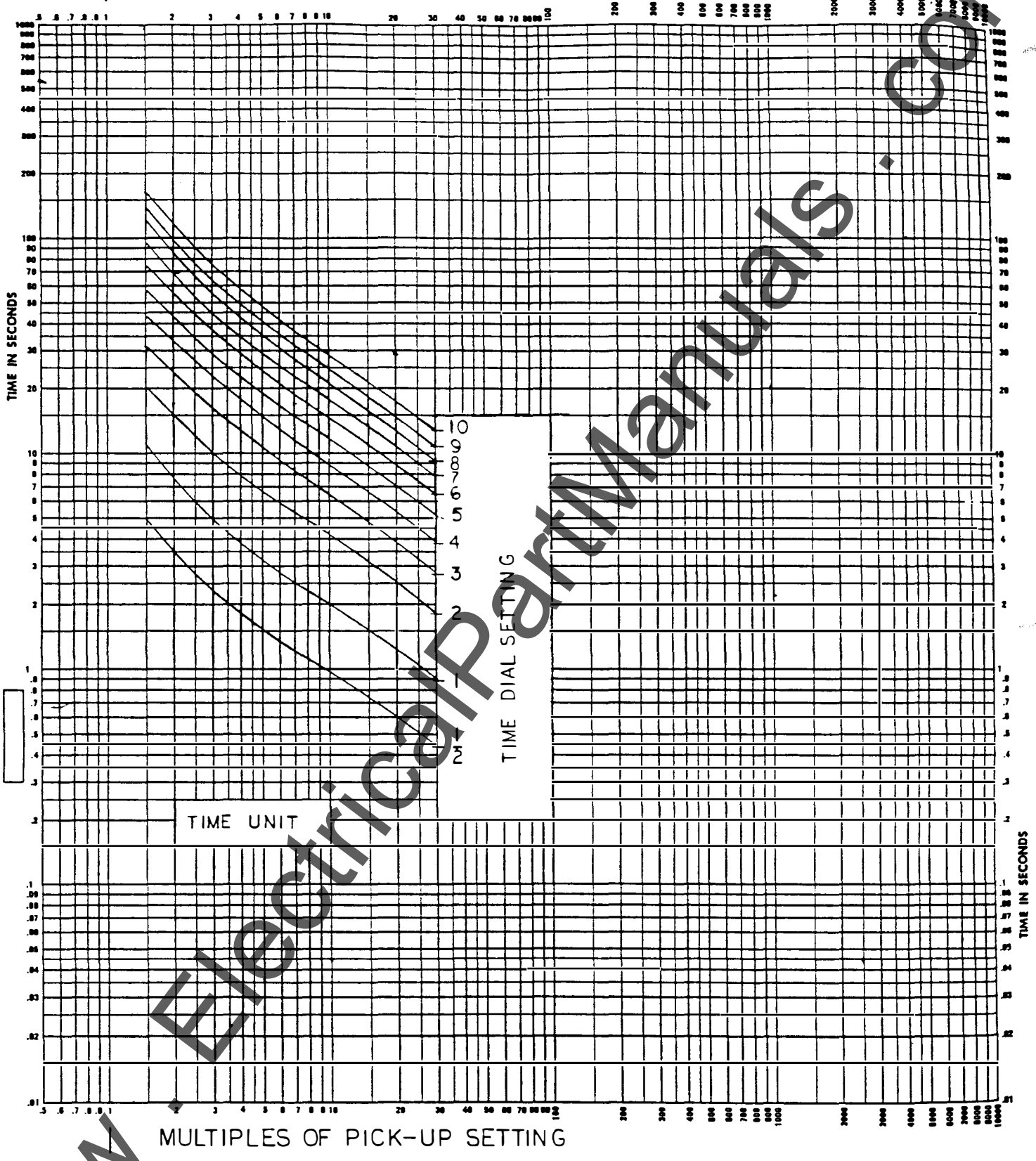


Figure 6 (0108B8969-1) 60 Hertz Time-Current Characteristics for Type IFC66 Relay

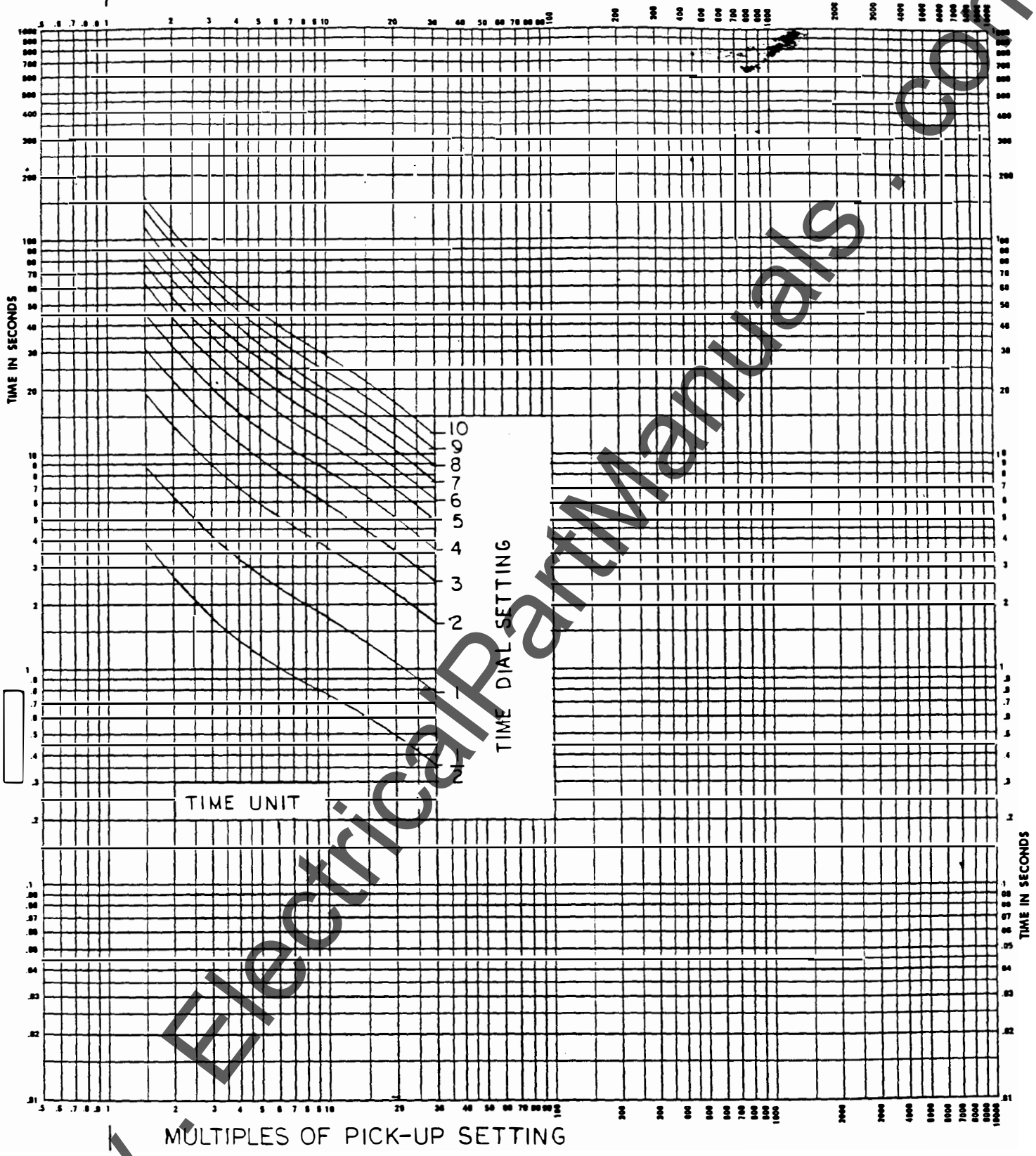


Figure 7 (0108B8970-1) 50 Hertz Time-Current Characteristics for Type IFC66 Relay

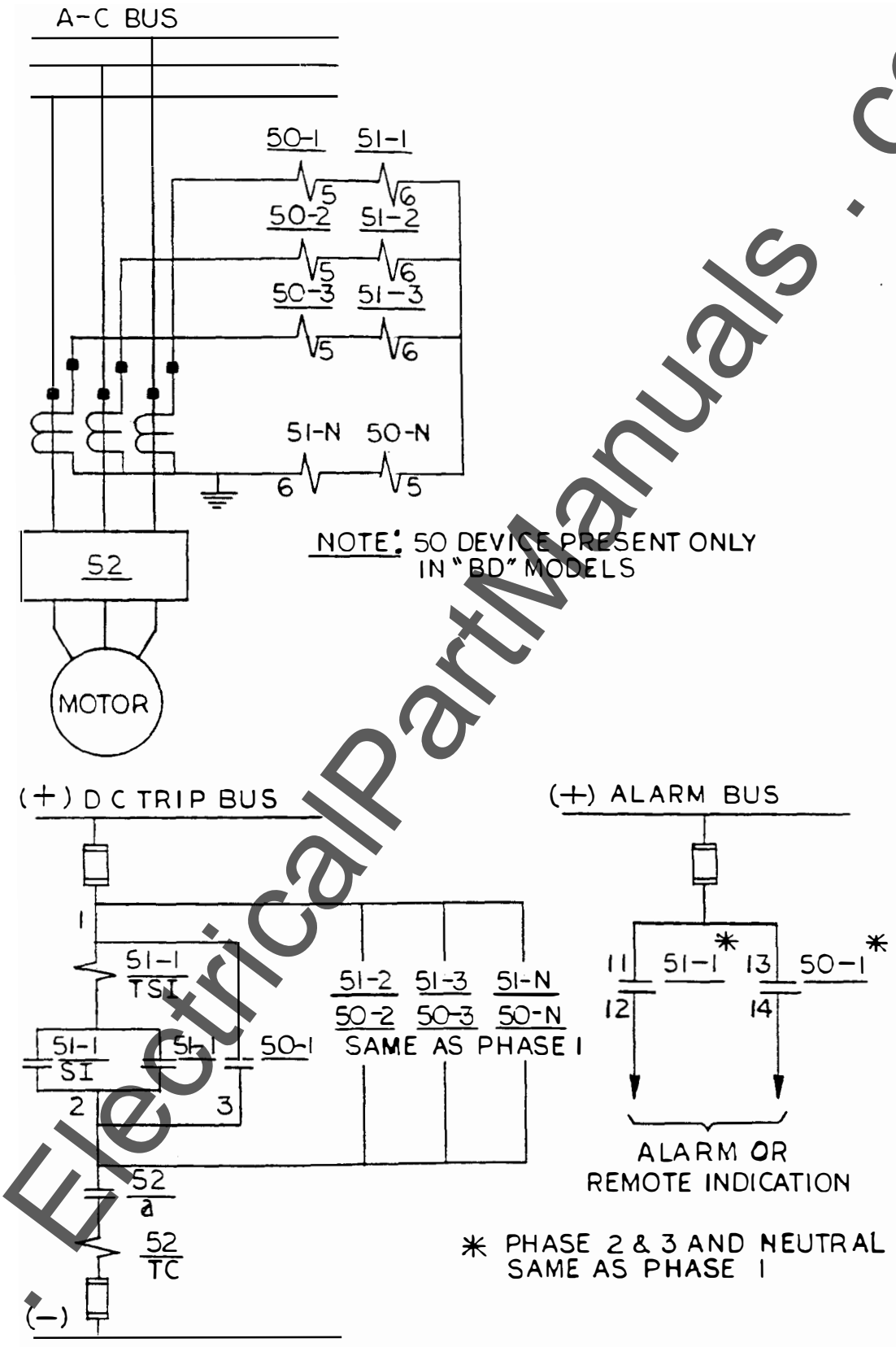


Figure 8 (0275A3834-0) Typical External Connections for Types IFC66AD and IFC66BD Relays

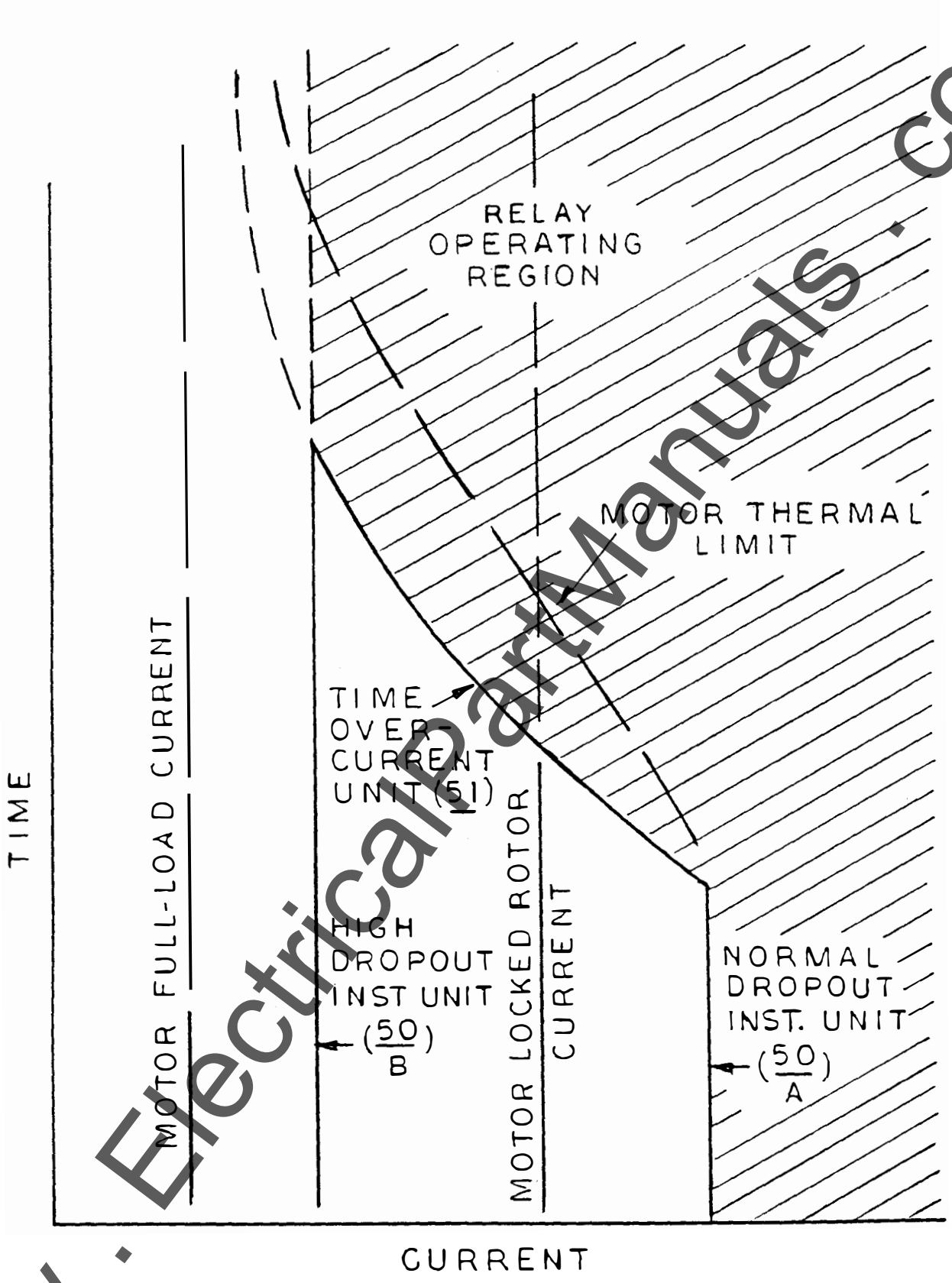
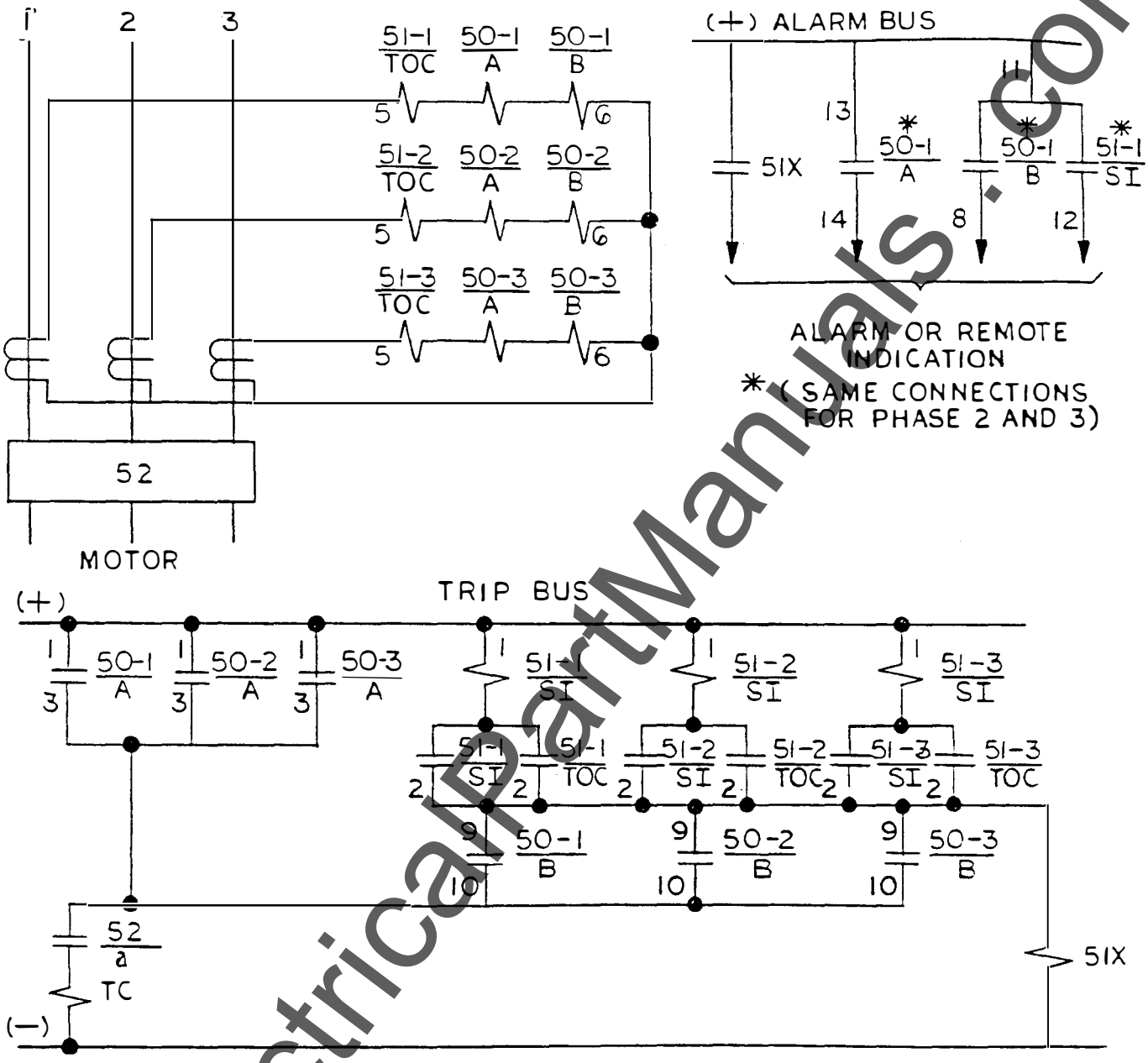


Figure 9 (0269A3055-0) Motor Protection Characteristic Curve



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

Figure 10 (0275A383) Typical External Connections for Type IFC66KD Relay

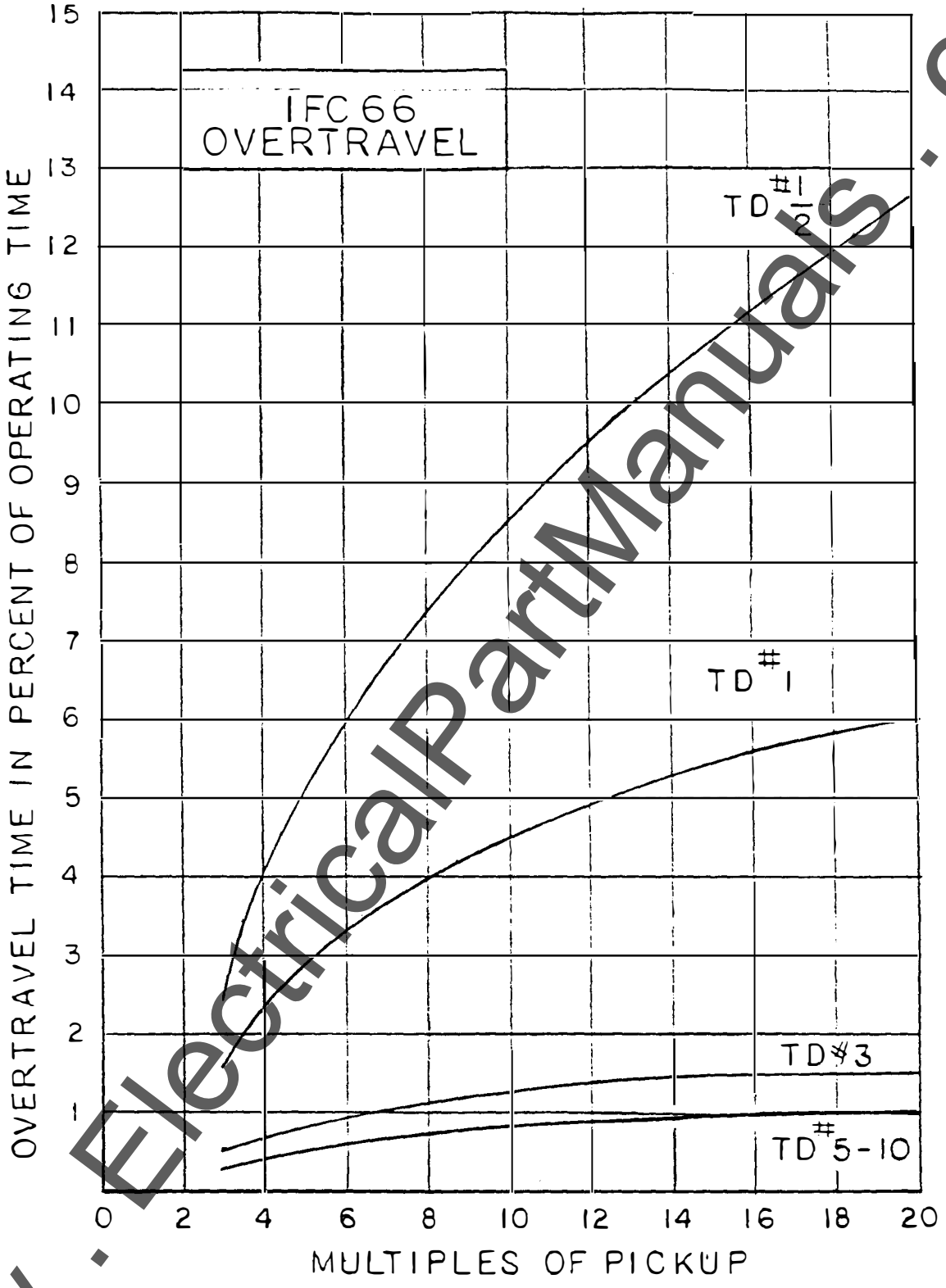


Figure 11 (0269A1869-0) Overtravel Curves for Type IFC66 Relay

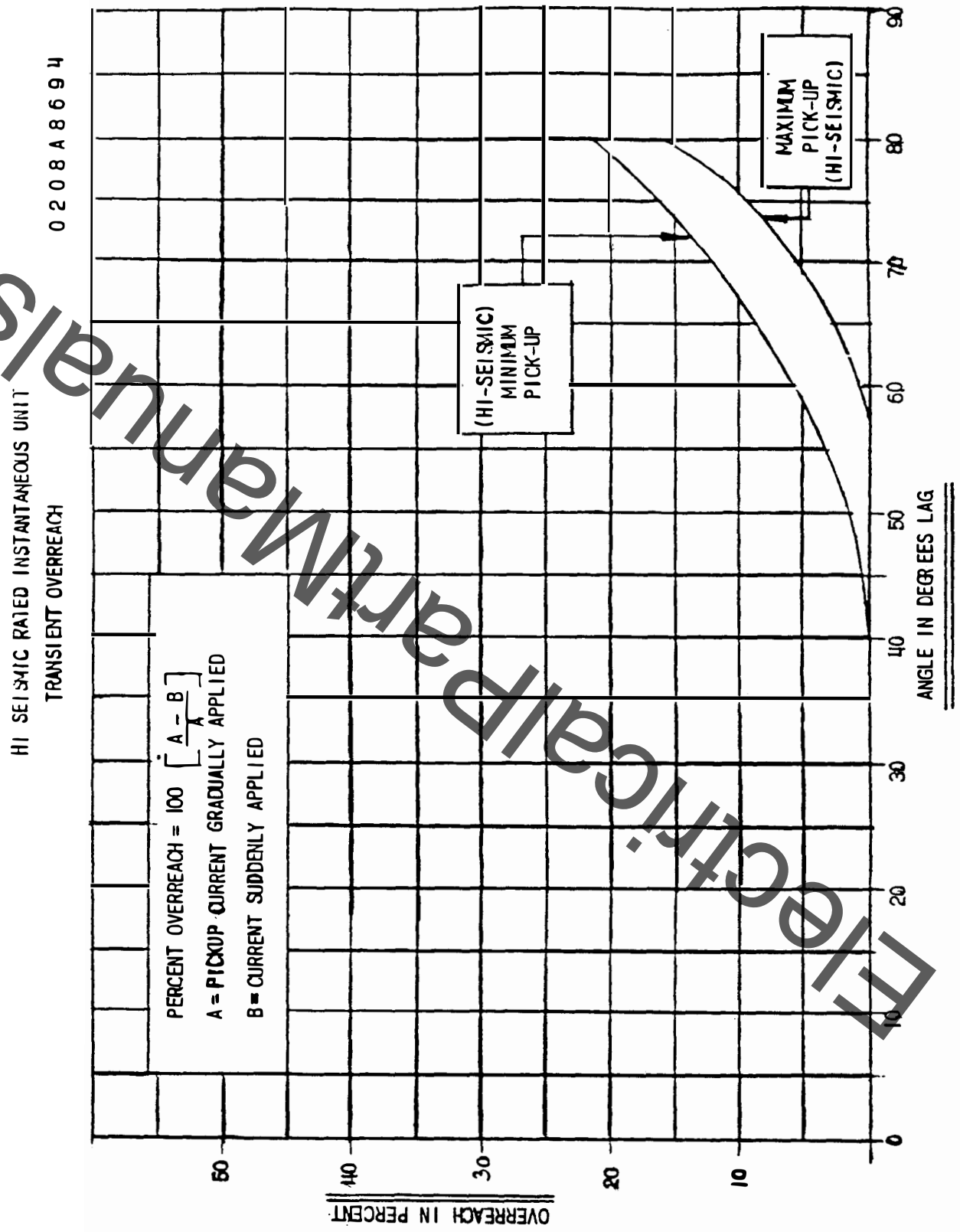


Figure 12 (0208A8694-2) Transient Overreach Characteristics of the Hi-Seismic Instantaneous Unit

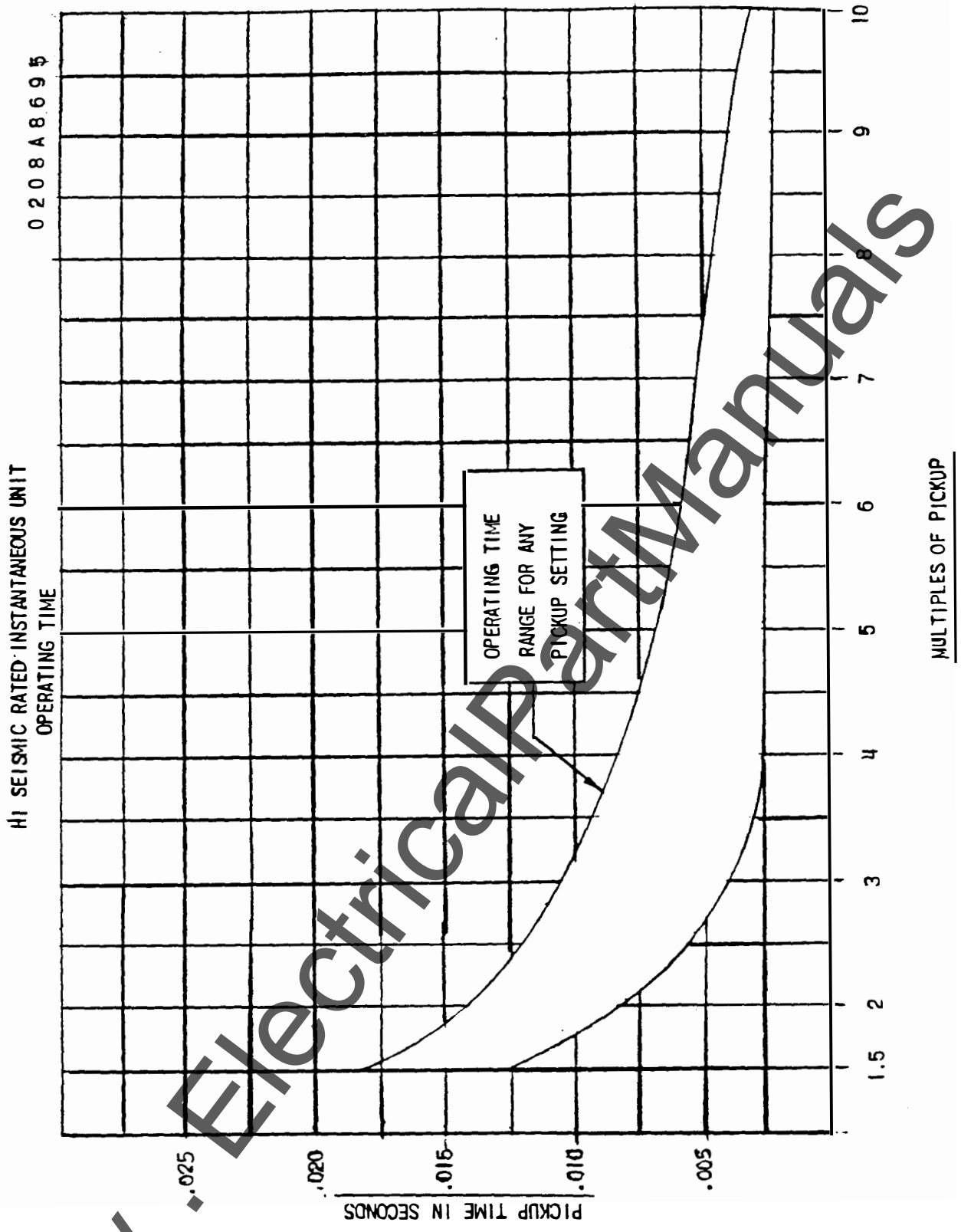
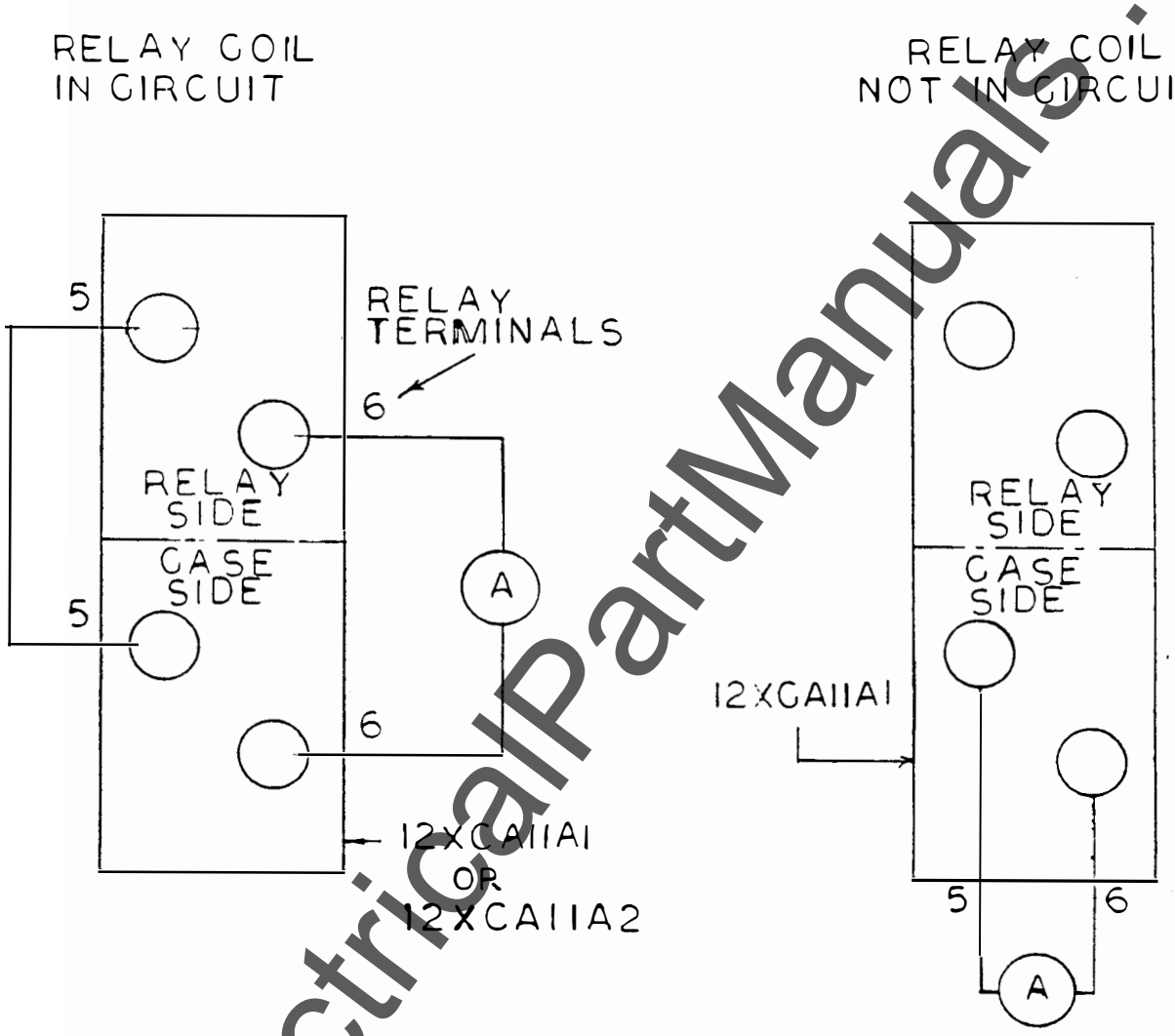


Figure 13 (0208A8695-1) Time Current Characteristics
the Hi-Seismic Instantaneous Unit



TEST CONNECTIONS FOR TESTING CT SECONDARY USED WITH THE IFC RELAY

Figure 14 (0269A1787-1) Test Connections for Testing CT Secondary Used with the IFC Relay

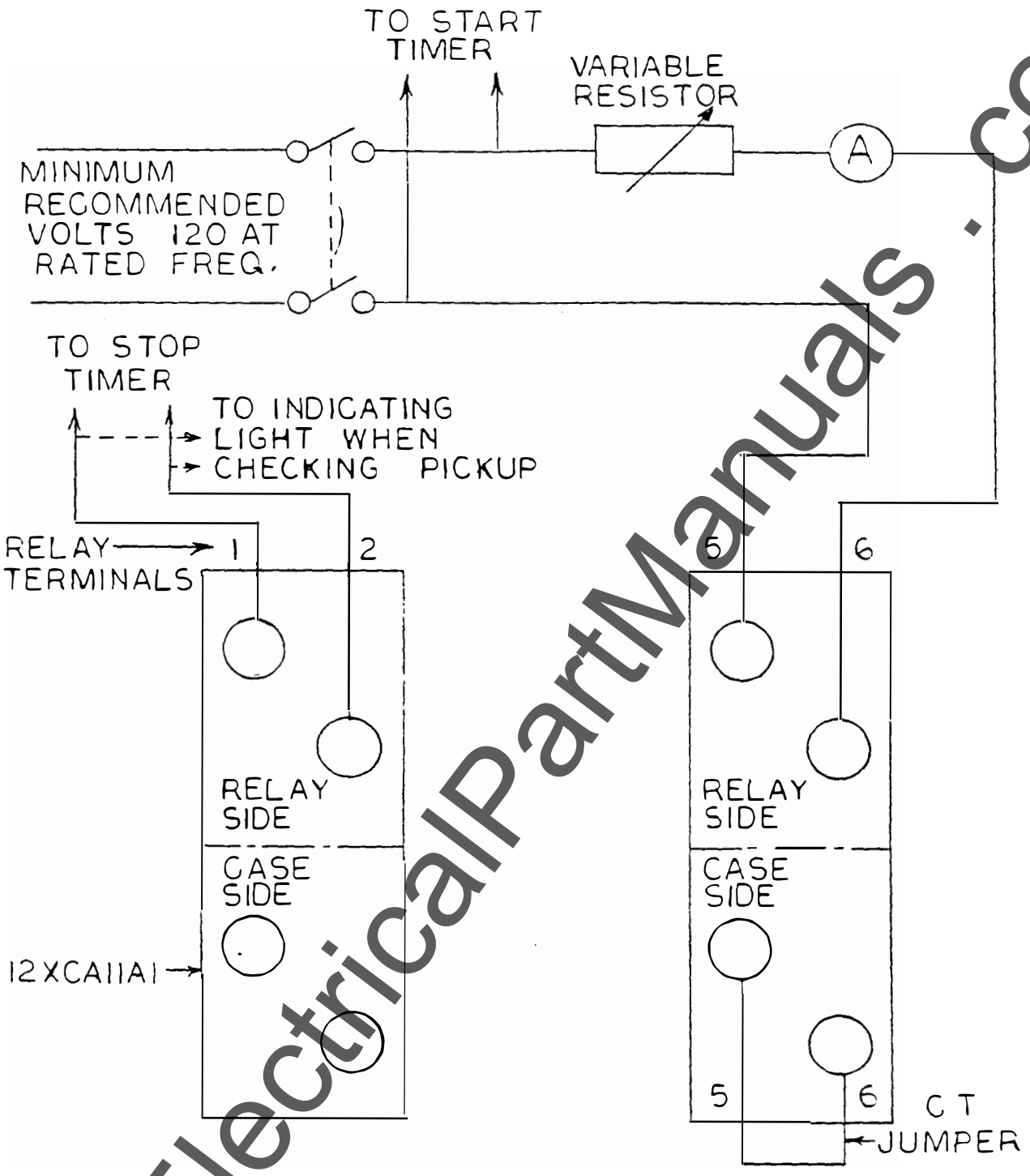
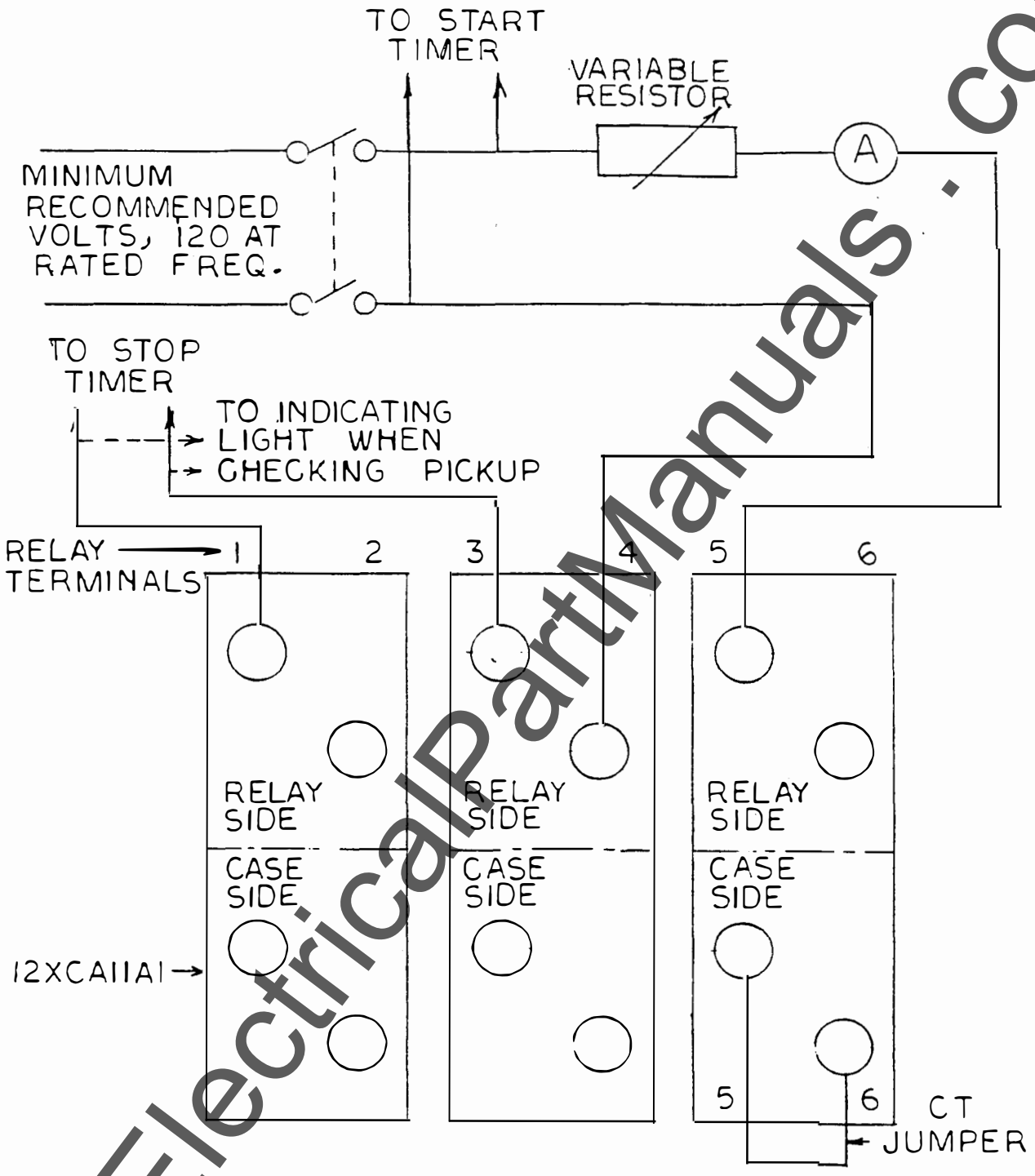
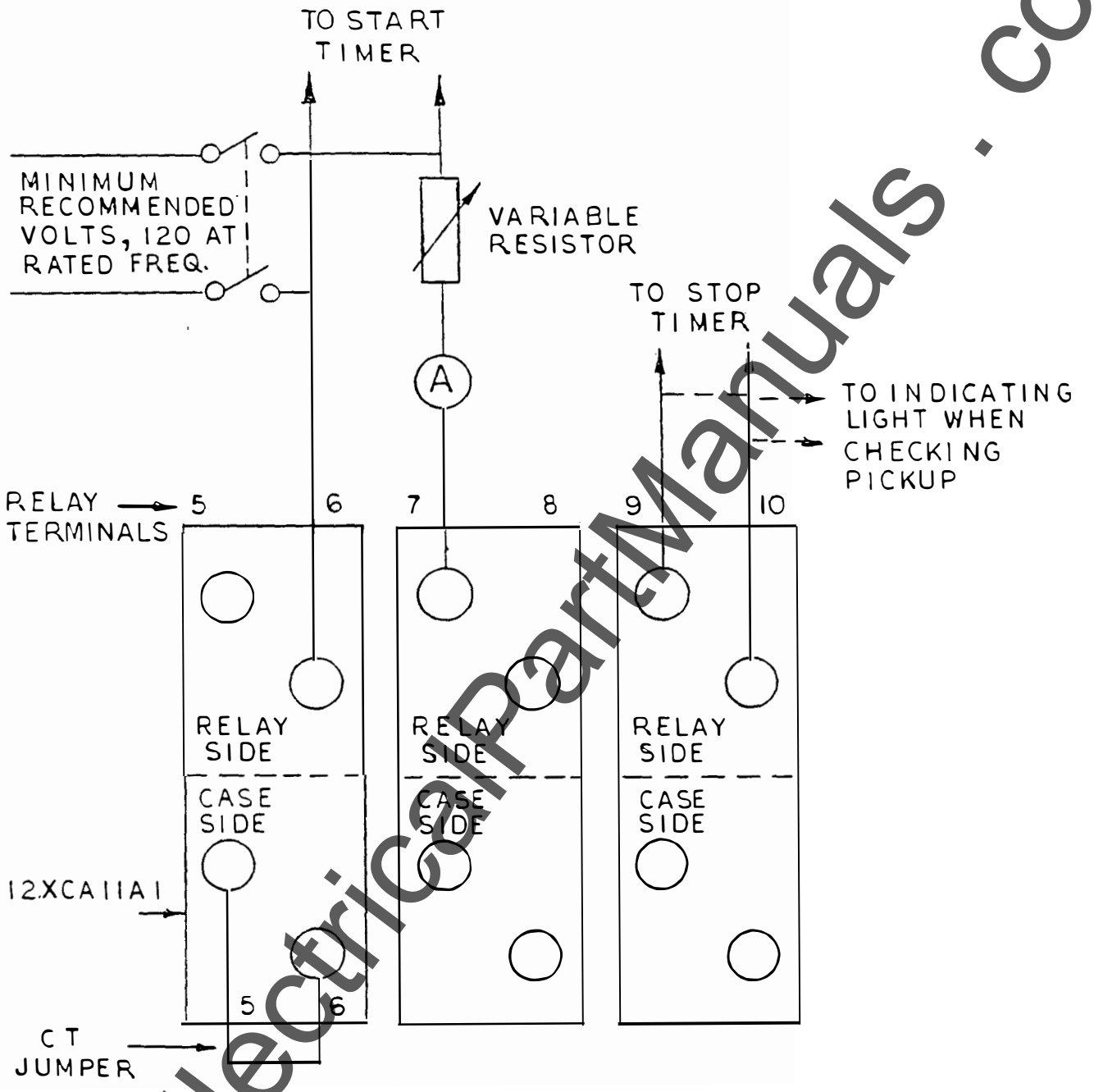


Figure 15 (0269A1789-0) Test Connections for Testing Pickup and Operating Times of the IFC Relay Time Overcurrent Unit



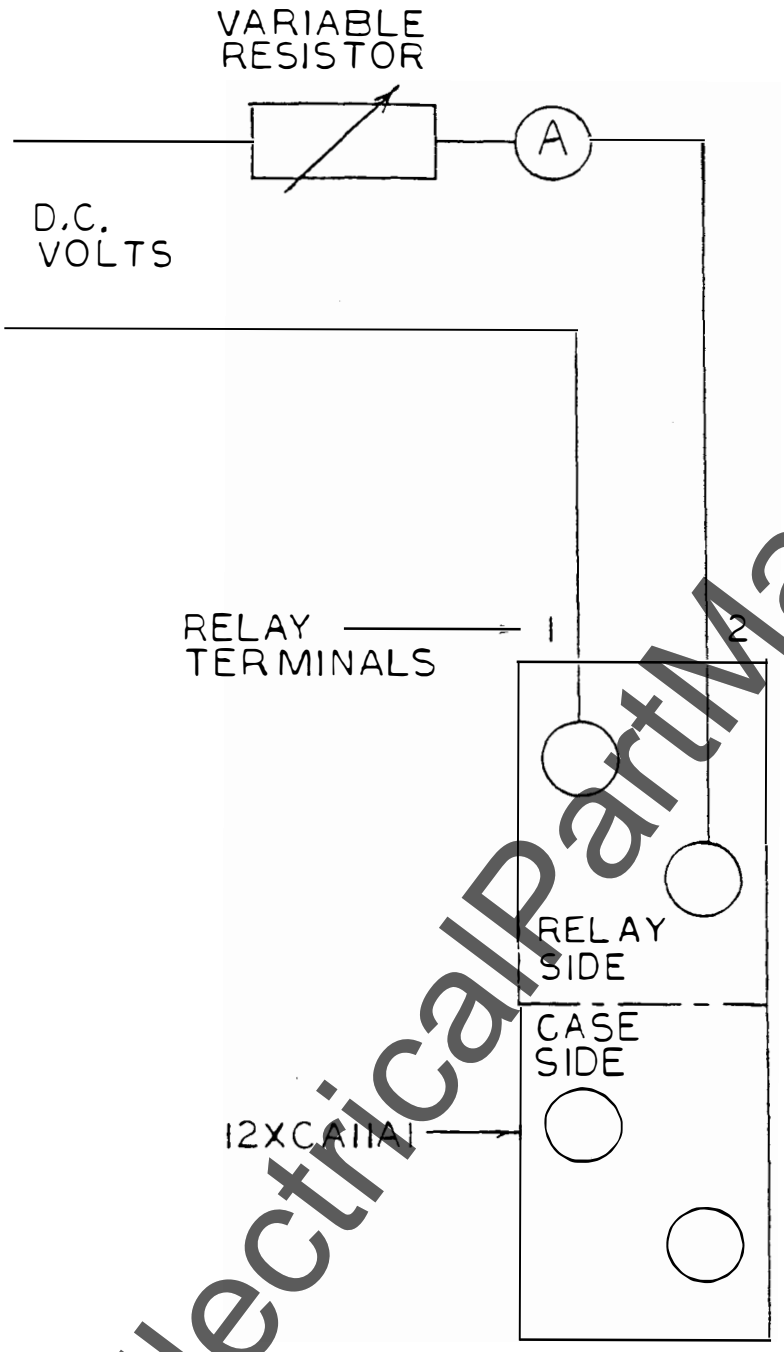
TEST CONNECTIONS FOR TESTING PICKUP AND OPERATING TIMES OF THE IFC RELAY INSTANTANEOUS UNIT

Figure 16 (0269A1788-1) Test Connections for Testing Pickup and Operating Times of the IFC Relay Hi-Seismic Instantaneous Unit



TEST CONNECTIONS FOR TESTING PICKUP & DROP-OUT OPERATING TIMES OF THE IFC RELAY HIGH DROP-OUT INSTANTANEOUS UNIT

Figure 17 (0269A1865-0) Test Connections, Pickup and Dropout of the High Dropout Instantaneous Unit



TEST CONNECTIONS FOR TESTING THE TARGET AND SEAL IN UNIT USED WITH THE IFC RELAY

Figure 18 (0269A1790-0) Test Connections for Testing the Hi-Seismic Target and Seal-in Unit Used with the IFC Relay

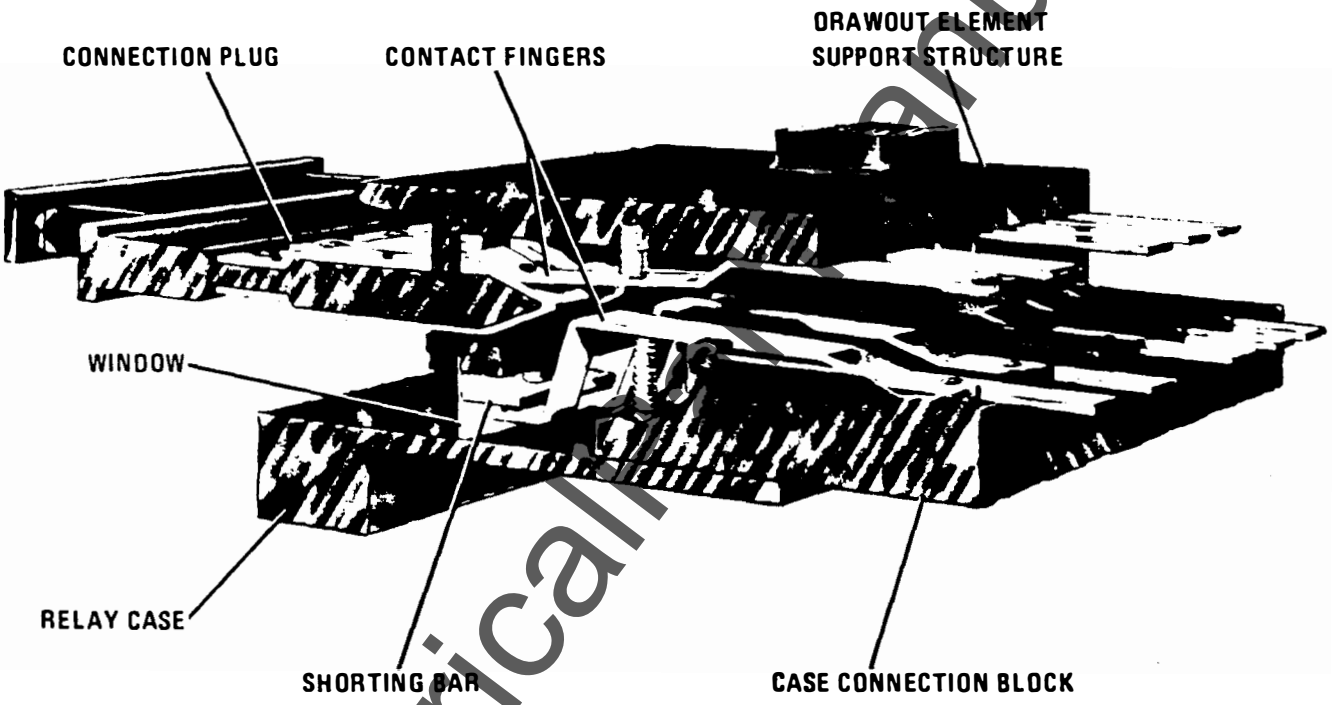


Figure 19 (8042715) Cross Section of IFC Drawout Case Showing Shorting Bar

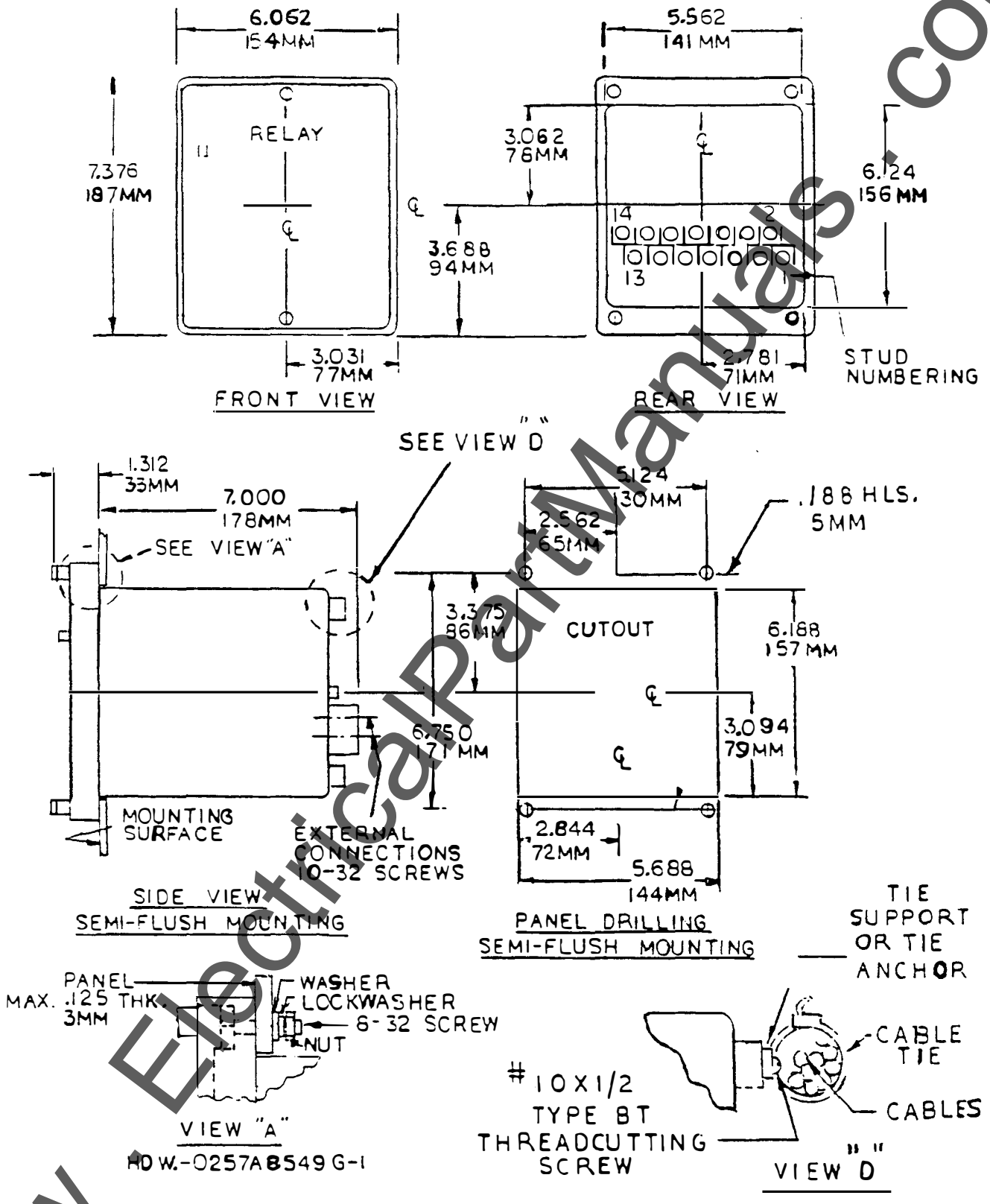


Figure 20 (0257A8452-2, Sh. 1) Outline and Panel Drilling for Type IFC66 Relay

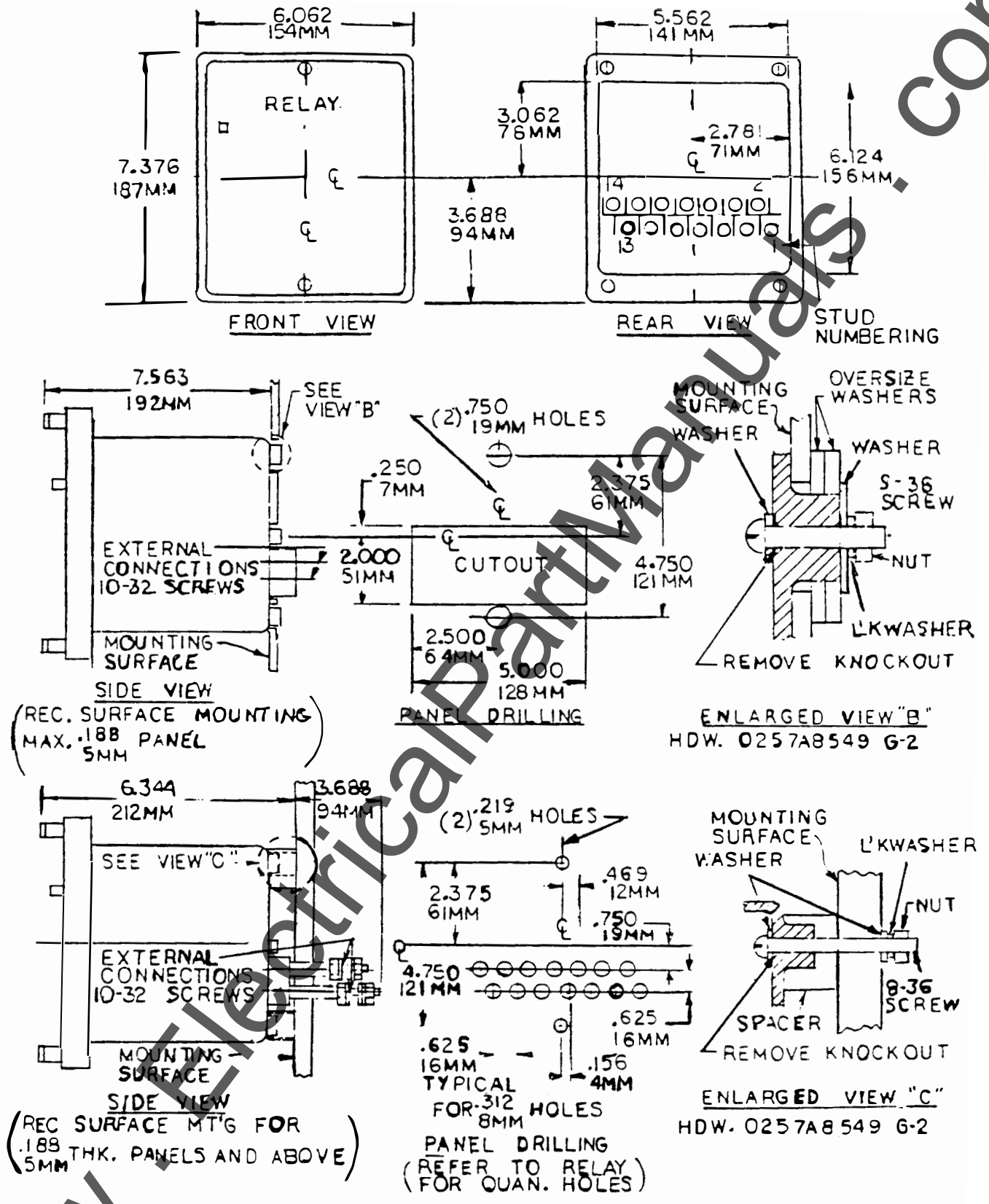


Figure 21 (0257A8452-2, Sh. 2) Outline and Panel Drilling for Type IFC66 Relay