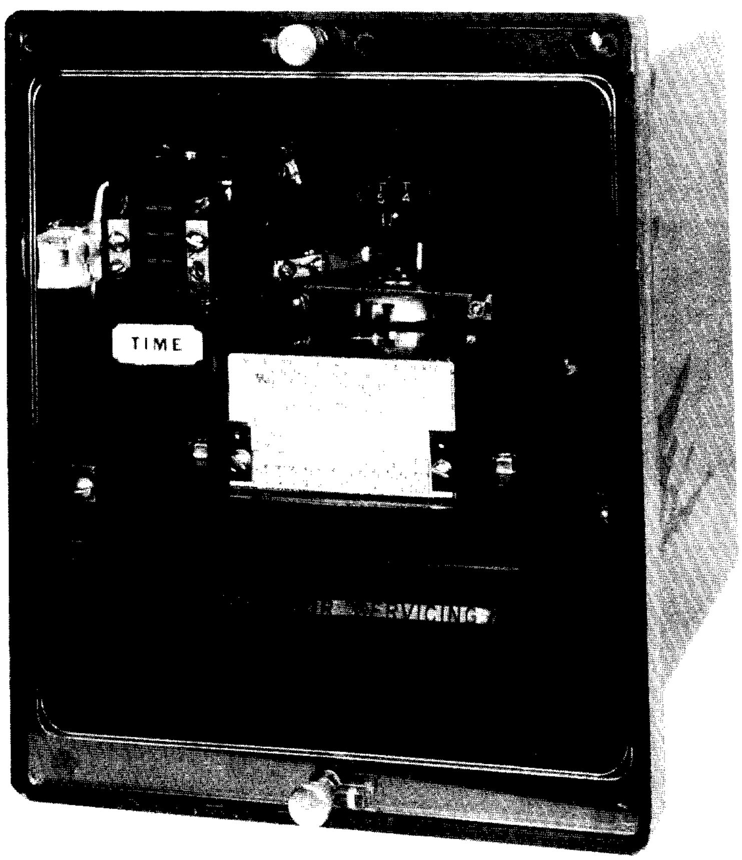
GEK-49931A
Supersedes GEK-49931

Instructions

TIME OVERCURRENT RELAYS WITH VOLTAGE CONTROL

TYPES

IFCS51AD
IFCS53AD



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TIME OVERCURRENT RELAYS WITH VOLTAGE CONTROL

TYPES

IFCS51AD
IFCS53AD

DESCRIPTION

The type IFCS relays covered by these instructions are extended-range, single-phase time overcurrent relays with voltage control. The available time-current characteristics are as follows:

IFCS51AD - Inverse Time

IFCS53AD - Very Inverse Time

The time overcurrent units are similar, respectively, to the IFC51A (inverse) or IFC53A (very inverse) relays, except that wound shading coils are included on the driving U-magnets instead of solid shading rings. Voltage control is provided by the normally-closed contact of an undervoltage unit, which completes the wound shading coil circuit when that unit drops out.

The undervoltage unit consists of a telephone-type relay with its coil connected in series with a zener regulator between the DC terminals of a full-wave bridge rectifier. A surge-limiting capacitor is connected across the AC terminals of the rectifier. Pickup adjustment is provided by a rheostat connected in series with the rectifier input.

The relays are equipped with a dual-rated target and seal-in unit haveing two electrically-separate contacts.

The relays are mounted in the size C1 drawout case of molded construction. Front and rear views of the IVCS53AD are shown in Figures 1 and 2 respectively.

The outline and panel-drilling dimensions are shown in Figure 18 for semi-flush mounting and Figure 19 for surface mounting. When semi-flush mounted on a suitable panel, these relays have a high seismic capability.

The internal connections for both the IFCS51AD and IFCS53AD are shown in Figure 3.

APPLICATION

A generator must be protected against prolonged contribution to a fault on the system. Such system fault backup protection is best made at the source of the fault current, the generator. The Type IFCS relay is one of several relays designed specifically for this application, or applied to provide such backup protection. Others are the Type IFCV voltage-restrained overcurrent relay on three single-phase distance relays plus a timer (for balanced-fault backup protection) and the Type INC or SGC relays for unbalanced-fault backup protection.

The choice between the IFCS or the distance relays is determined primarily by the protective relaying with which the generator backup relays must be selective. For example, if the lines leaving the station bus are protected by time overcurrent relays, then Type IFCS relays should be used. This would be typical of installations where the generator connects to the bus at generator voltage. The Type IFCS51AD would be chosen if the line relays have the inverse time characteristic, or the Type IFC53AD if the feeder relays have the very-inverse characteristic. On the other hand, unit generator - transformer installations generally connect to a high-voltage system on which distance- or pilot-relaying schemes are frequently used for the line protection. In such cases, distance relays such as the CEB13C plus a timer would be the usual choice for system backup to provide coordination with the line relaying.

For the situations noted above, the recommended practice is to use three IFCS relays, one per phase, or three single-phase distance units plus a timer. In many cases, especially on larger machines, negative-sequence time overcurrent relay, Type INC or SGC, is installed to provide backup protection against unbalanced system faults. In such cases, a single Type IFCS relay to protect against balanced system faults could be considered as a minimum requirement.

In some applications it may be more advantageous to use a voltage-restrained Type IFCV relay rather than an IFCS. The IFCV can provide faster backup protection than the IFCS, particularly in instances where the generator voltage does not drop significantly below rated voltage during fault conditions. On the other hand, if the generator voltage always drops below the setting of the undervoltage unit in the IFCS for all faults for which the generator backup is required to operate, better sensitivity can be obtained by using the IFCS rather than the IFCV.

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

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

The diagram in Figure 9 shows typical external connections for the Type IFCS relays when the generator connects to the bus at generator voltage. If Type IFCS relays are applied on a unit generator-transformer installation, the external connections shown in Figure 10 are typical.

CALCULATION OF SETTINGS

Current pickup of the Type IFCS relay should generally be set between 50% and 60% of full-load current on regulated generators. Unregulated generators, and generators with regulators having limited field-forcing capability, require settings on the order of 40% to 60% of synchronous current, I_{FC}/X_d, where I_{FC} is in amperes and X_d is per unit.

The undervoltage unit must be set to drop out at a voltage lower than the lowest voltage that can be maintained under normal load conditions. Typical voltage unit dropout settings range from 75% to 85% of rated voltage.

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

CONSTRUCTION

The IFCS induction disk voltage-controlled 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 and 2. 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 that 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 voltage unit consists of a telephone-type relay in series with a zener regulator connected across a full-wave bridge rectifier. An RC network is used to protect the rectifiers from severe voltage surge. A rheostat is connected in series with the rectifier to provide pickup adjustment.

The drawout connection/test system for the C1 case, shown in Figure 5, has provisions for 14 connection points, and 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 fingers on the case, and finally those on the relay support structure, to completely de-energize the drawout element.

There is a high-seismic target and seal-in unit mounted on the front, to the elft of the shaft of the time overcurrent unit (see 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 vutton located on the upper left side of the cover. The high-seismic target and seal-in unit has the letters "Hi-G" molded in the target block to distinguish it as a high-seismic unit. 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 Spectrum (RRS) in accordance with the IEEE Guide for Seismic Testing of Relays, STD501-1978.

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

RATINGS

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

TIME OVERCURRENT UNIT

Ranges for the time overcurrent unit are shown in Table I.

TABLE I

Relay	Frequency (Hertz)	Current Range (Amperes)
IFCS51 IFC53	50 and 60	1.0 - 12.0

Available taps for the type overcurrent unit are shown in Table II.

TABLE II

Range (Amperes)	Taps Available (Amperes)
1 - 12	1.0 1.2 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 10.0, 12.0

One-second thermal ratings are listed in Table III.

TABLE III

Model	Time Overcurrent Unit (Amperes)	One-Second Rating, Any Tap (Amperes)	K
IFCS51 IFCS53	1.0 - 12.0	260	67600

Ratings less than 1 second may be calculated according to the formula $I = (K/T)^{\frac{1}{2}}$, where T is the time in seconds that the current flows.

The continuous ratings for the 1-12 ampere range time overcurrent unit are shown in Table IV.

TABLE IV

Model	Tap												
	1.0	1.2	1.5	2.0	2.5	3.0	4.0	5.0	6.0	7.0	8.0	10.0	12.0
IFCS51	3.7	4.1	4.6	5.3	6.0	6.5	7.6	8.5	9.3	10.0	10.8	12.1	13.2
IFCS53	6.8	7.1	7.7	8.3	8.8	9.4	10.3	11.0	11.6	12.4	12.6	13.5	14.4

UNDERVOLTAGE UNIT

The voltage range of the undervoltage unit is 70 to 100 volts. Setting the dropout voltage is accomplished by means of a rheostat located in the back of the relay (see Figure 2). The unit is continuously rated for 120 volts.

HIGH-SEISMIC TARGET AND SEAL-IN UNIT

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

TABLE V

	Tap	
	0.2	2.0
DC Resistance + 10% (ohms)	8.0	0.24
Minimum Operating (Amperes) +0 - 25%	0.2	2.0
Carry Continuously (Amperes)	0.3	3.0
Carry 30 Amperes for (Seconds)	0.03	4.0
Carry 10 Amperes for (Seconds)	0.25	30
60 Hertz Impedance (Ohms)	68.6	0.73

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

TABLE VI

				Burdens at Min.Pickup Min.Tap (ohms)			Burdens in Ohms (Z) Times Pickup		
Model	Hz	Range	Min. Tap	R	JX	Z	3	10	20
IFCS51	60	1 - 12	1.0	1.09	4.41	4.55	2.46	1.00	0.77
IFCS53	60			0.35	1.18	1.23	1.21	0.32	0.51
IFCS51	50			0.91	3.68	3.79	1.80	0.83	0.64
IFCS53	50			0.29	0.98	1.03	1.01	0.68	0.43

Note: The impedance values given are those for minimum tap; the impedance for other taps at pickup current (tap rating) varies inversely (approximately) as the square of the tap rating. For example: an IFCS 60 hertz relay has an impedance of 1.23 ohms on the 1.0 ampere tap; the impedance of the 4.0 amp tap is $(1.0/4.0)^2 \times 1.23 = 0.077$ ohms.

The maximum burden of the voltage unit at rated volts is 4.70 watts with a unity power factor.

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 that connect to the tap block at the top of the support structure (see Figure 1). The tap block is marked A through J or A tyhrough N. See the nameplate on the relay for tap settings.

Example: The 2.5 ampere tap for the IFCS53 relay requires one movable lead in position B and the other in position H.

Operating Time Accuracy

The IFCS relays should operate within ± 7 seconds or ± the time-dial setting times 0.010 seconds, whichever is greater. Figures 5 through 8 show the various time-current characteristics for the IFCS 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.

Reset

The unit resets at 90% 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 (0) is approximately 60 seconds for the IFC53 relays. The IFC51 relays will reset in approximately 12 seconds from the same number 10 time-dial setting.

UNDERVOLTAGE UNIT

The undervoltage unit is a hinged-armature unit which drops out when the magnetic pull created by the ampere turns in the operating coil is less than the force of the opening spring. The dropout voltage is changed by adjusting the rheostat located in the back of the relay. The pickup voltage is 110% or less of the dropout voltage. On any dropout operation, the voltage range from the beginning of the action to its completion is about 1% of rated voltage. The relay pickup time is approximately 20 cycles, and the dropout characteristic (voltage against time) is shown in Figure 13.

HIGH-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 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 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 of the case may find its way inside when the cover is removed, and cause trouble in the operation of the relay.

ACCEPTANCE TESTS

Immediately upon recept of the relay an inspection and acceptance test should be made to make sure 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 installtion or acceptance tests, at the discretion of the user. Since most operating companies use different procedures for acceptance tests and for installation tests, the following section includes all applicable tests that may be performed on these relays.

VISUAL INSPECTION

Check the nameplate to make sure 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 contrtol spring is not deformed, nor its comvolutions tangled or touching each other.

3. The telephone relay should operate smoothly and each normally-open contact should have a gap of 0.010 - 0.015 inch. The wipe of each normally-open or normally-closed contact should be approximately 0.005 inch. The wipe of a normally-open contact can be checked by inserting a 0.005 inch shim between the residual screw and the pole piece and operating the armature by hand. The normally-open contacts should make before the residual screw strikes the shim.

4. The armature and contacts of the seal-in unit should move freely when operated by hand; there should be at least 1/64 inch wipe.

5. The target in the seal-in unit must come into view and latch when the armature is operated by hand, and should unlatch when the target-release button is operated.

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

CAUTION

Should there be a need to tighten any screws, DO NOT OVERTIGHTEN, to prevent stripping.

DRAWOUT RELAY TESTING

The IFCS relays may be tested without removing them from the panel, by using either the 12XCA23A1 or 12XCA11A1 test probes. The test probes make connections to both the relay and external circuitry, providing maximum flexibility, but the test requires reasonable care since a CT shorting jumper is necessary when testing the relays. The CT circuit may also be tested by using an apmmeter in place of the jumper (see the test circuit in Figure 14). The test probes are different in the number of connections that can be made: The 12SCA28A1 has a full complement of 28 connections, and the 12XCA has four. Refer to instruction book GEK-49803 for additional information.

POWER REQUIREMENTS, GENERAL

All alternating-current-operated (AC) 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 AC devices (relays) will be affected by the applied waveform.

Therefore, in order to test AC relays properly 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, RL or RC networks, or saturating electromagnets (such as time-overcurrent relays), would be essentially affected by non-sinusoidal waveforms. Hence a resistance-limited current, as shown in Figure 15, 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 (0) 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. This screw should be held securely in its support.

With the contacts just closing at the No. 0 time setting, there should be sufficient gap between the stationary contact brush and its metal backing strip to provide 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. 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 makes it possible to obtain any desired setting intermediate between the various tap settings. If such an 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 5 through 8 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 to zero. 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 delay.

The primary adjustment for the time of operation of the unit is made by means of the rime 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 the 0.5 time-dial position and the lowest tap. Using the test connections in Figure 15, the main unit should close the contacts within ± 3% of tap-value current for 60 hertz relays and within ± 7.5% of tap-value current for 50 hertz relays.

Time Test

Set the relay at No. 5 time-dial setting and the lowest tap. Using the test connection in Figure 15, apply five times tap current to the relay. The relay operating times to close its contact are listed in Table VII.

TABLE VII

Relay	Hz	Time (seconds) Min.	Max.
IFCS51	50 and 60	1.75	1.81
IFCS53		1.28	1.34

Undervoltage Unit

Using the test connections in Figure 16, increase the voltage until the telephone relay picks up. Slowly decrease the voltage until the telephone relay drops out. Dropout must be 100 ± 2 volts. Pickup must be 110% or less of the dropout voltage.

HIGH-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.

Pickup and Dropout Test

1. Connect relay studs 1 and 2 (see the test circuit of Figure 17) 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 (0) time-dial position.**

3. Increase the current slowly until the seal-in unit picks up. See Table VIII.

4. Mover the time dial away from the zero (0) 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 VIII.

TABLE VIII

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 an testing.

The relay should be mounted on a vertical surface. The outline and panel drillings are shown in Figures 18 and 19. Figure 18 shows the semi-flush mounting and Figure 19 shows various methods of surface mounting.

The internal connection diagram for the relays is shown in Figure 3. Typical external connections are shown in Figures 9 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 3% of tap value for 60 hertz relays, and within 7.5% of tap value for 50 hertz relays.

Check the operating time at some multiple of tap value and the desired time-dial setting. This multiple of tap value may be 5 times tap rating, or the maximum fault current for which the relay must coordinate. This value is left to the discretion of the user.

Undervoltage Unit

Using the test circuit in Figure 16, set the undervoltage unit to the desired dropout setting, using the rheostat located in the back of the relay. Check that pickup is no greater than 110% of dropout.

High-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 TESTS** section.

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 ensure that the relays have not deviated from their original settings. If deviations are encountered, the relay must be retested and serviced as described in this instruction book.

TIME OVERCURRENT UNIT

1. Perform pickup test for the tap setting in service, as described in the **INSTALLATION** section.

2. Perform the time tests as described in the **INSTALLATION** section.

UNDERVOLTAGE UNIT

Perform the test described in the **INSTALLATION** section.

HIGH-SEISMIC TARGET AND SEAL-IN UNIT

1. Check that the unit picks up at the values shown in Table VIII.

2. Check that the unit drops out at 25% 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. 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.

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

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

* COVER CLEANING

The clear Lexan R cover should be clearned with a soft cloth and water only. No cleaning solutions should be used. Use of cleaning solutions may damate the clear cover.

SYSTEM TEST

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

SERVICING

TIME 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:

* Revised since last issue

Pickup Tests

Rotate time dial to the 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 provide 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 an 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 5 through 8 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.

Connext 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 connections, Figure 15).

With the tap block set for the lowest tap value and the time dial set where the contacts are just open, adjust the control spring to just close the contacts within $\pm$/1% of tap value.

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

Time Tests

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

Adjust the position of the drag magnet assembly to obtain an operating time as close as possible to 1.78 (IFCS51) or 1.31 (IFCS53) but at least as listed in Table IX.

TABLE IX

	Time (seconds)	
Relay	Min.	Max.
IFCS51	1.76	1.80
IFCS53	1.29	1.33

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 **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 which way the disk must be moved 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 uppoer pivot and turn the jewel bearing screw, from the underside of the support structure, to position the disk as determined in step 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 clar 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 withi 7-10 inch-pounds of torque, after securely seating the assembly and positioning it according to the Time Tests above.

UNDERVOLTAGE UNIT

Using the test circuit in Figure 16, set the undervoltage unit to the desired dropout setting with the rheostat located in the back of the relay. Check that the pickup of the telephone relay is no greater than 110% of dropout. The ratio of pickup to dropout can be changed by turning the residual screw. The minimum gap between the armature and the pole face must be 0.002 inch. The telephone relay should operate smoothly, and each normally-open contact should have a gap of 01010-0.015 inch. The wipe of each normally-closed contact should be approximately 0.00 inch. The wipe of each normally-open contact can be checked by inserting a 0.005 inch shim between the residual screw and the pole piece and operating the armature by hand. The normally-open contacts should make before the residual screw strikes the shim.

HIGH-SEISMIC TARGET AND SEAL-IN UNIT

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

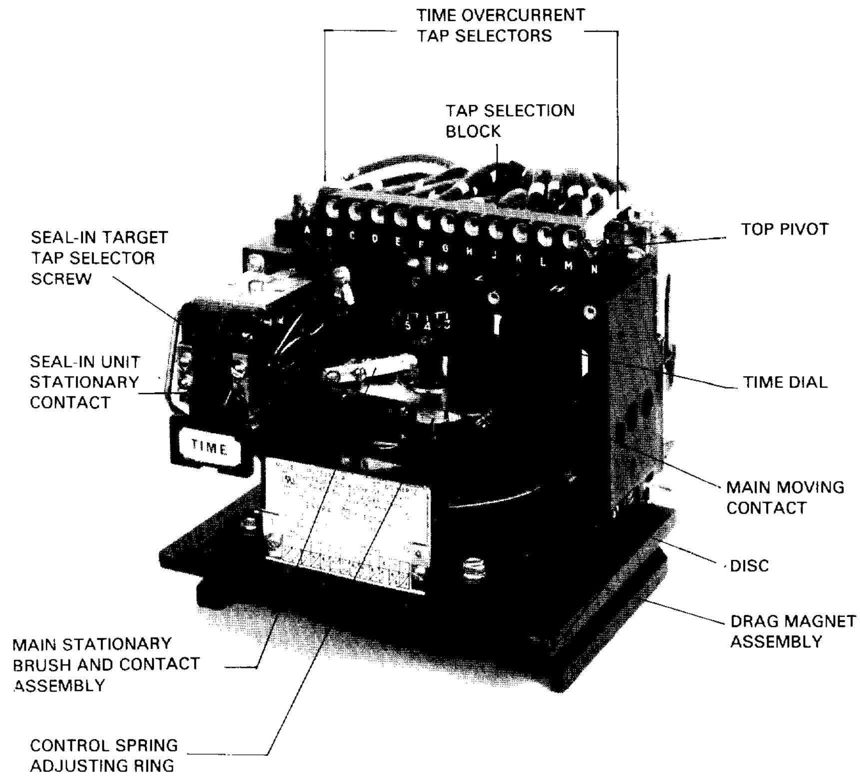


Figure 1 (8043487) Type IFC53AD Relay, Removed from Case, Front View

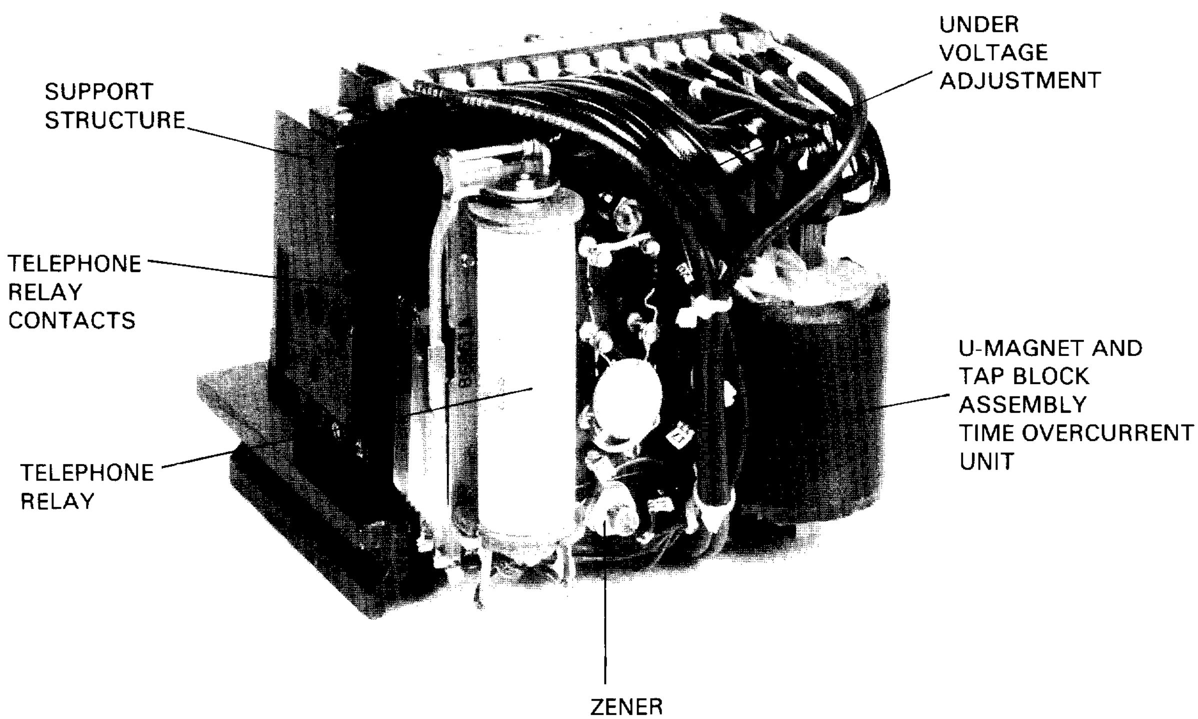


Figure 2 (8043488) Type IFC53AD Relay, Removed from Case, Rear View

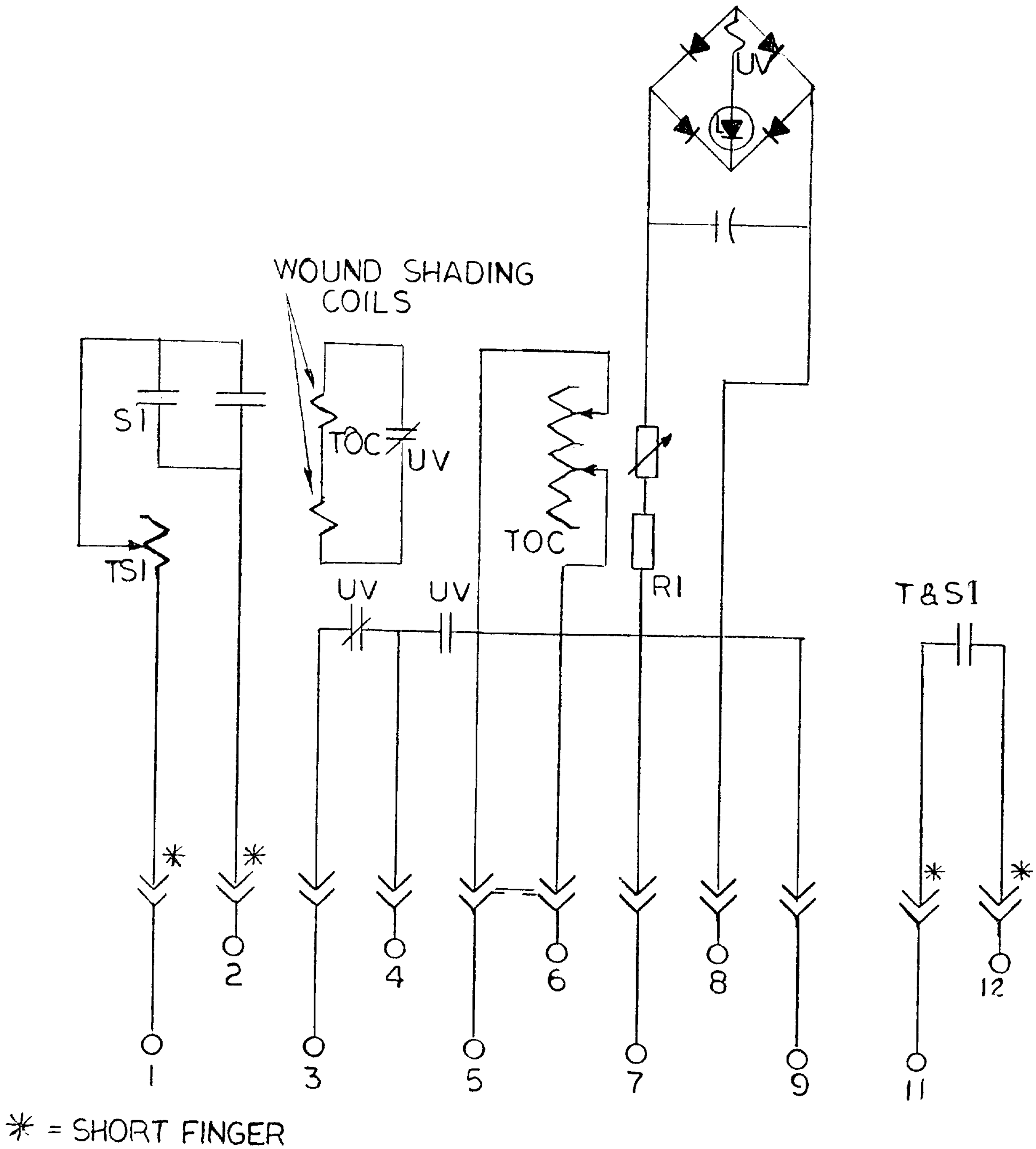


Figure 3 (0269A3197-1) Internal Connections for Relay Types IFCS51AD and IFCS53AD, Front View

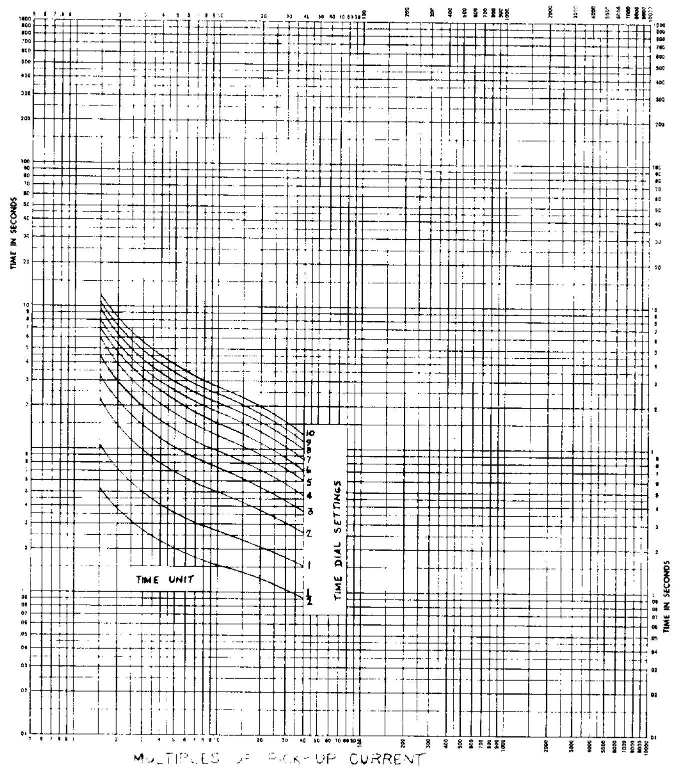


Figure 4 (0108A8943-1) 60 Hertz Time-Current Characteristics for Relay Type IFCS51AD

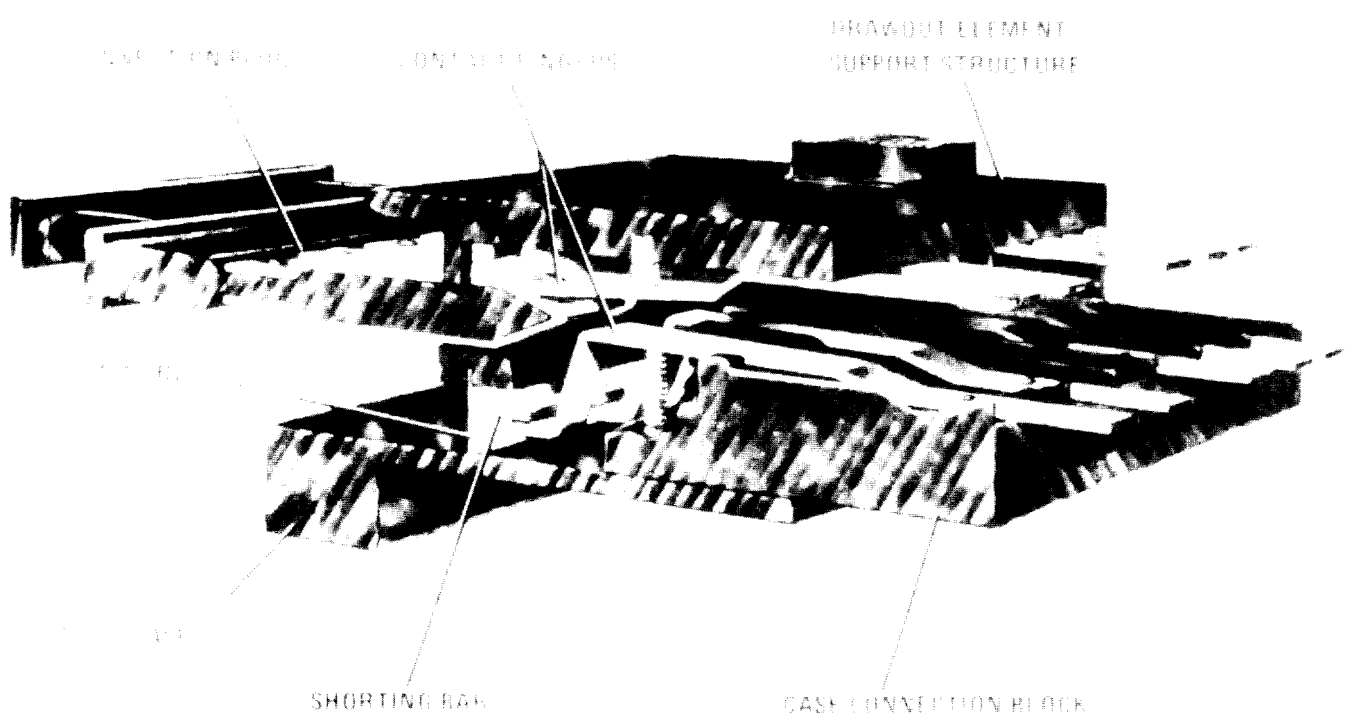


Figure 5 (8042715) Cross Section of IFCS Drawout Case Showing Shorting Bar

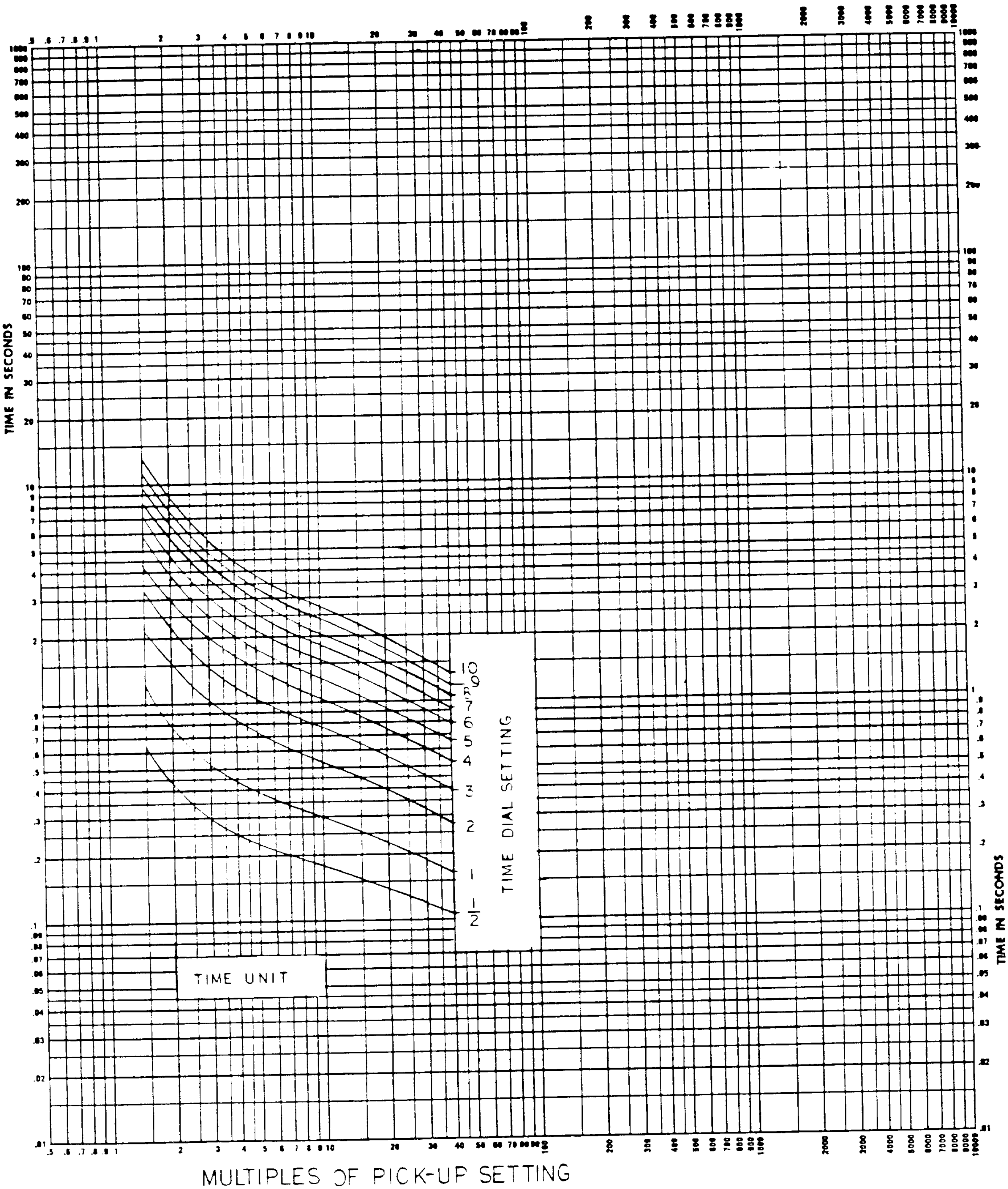


Figure 6 (0108A8973-1) 50 Hertz Time-Current Characteristics for Relay Type IFCS51AD

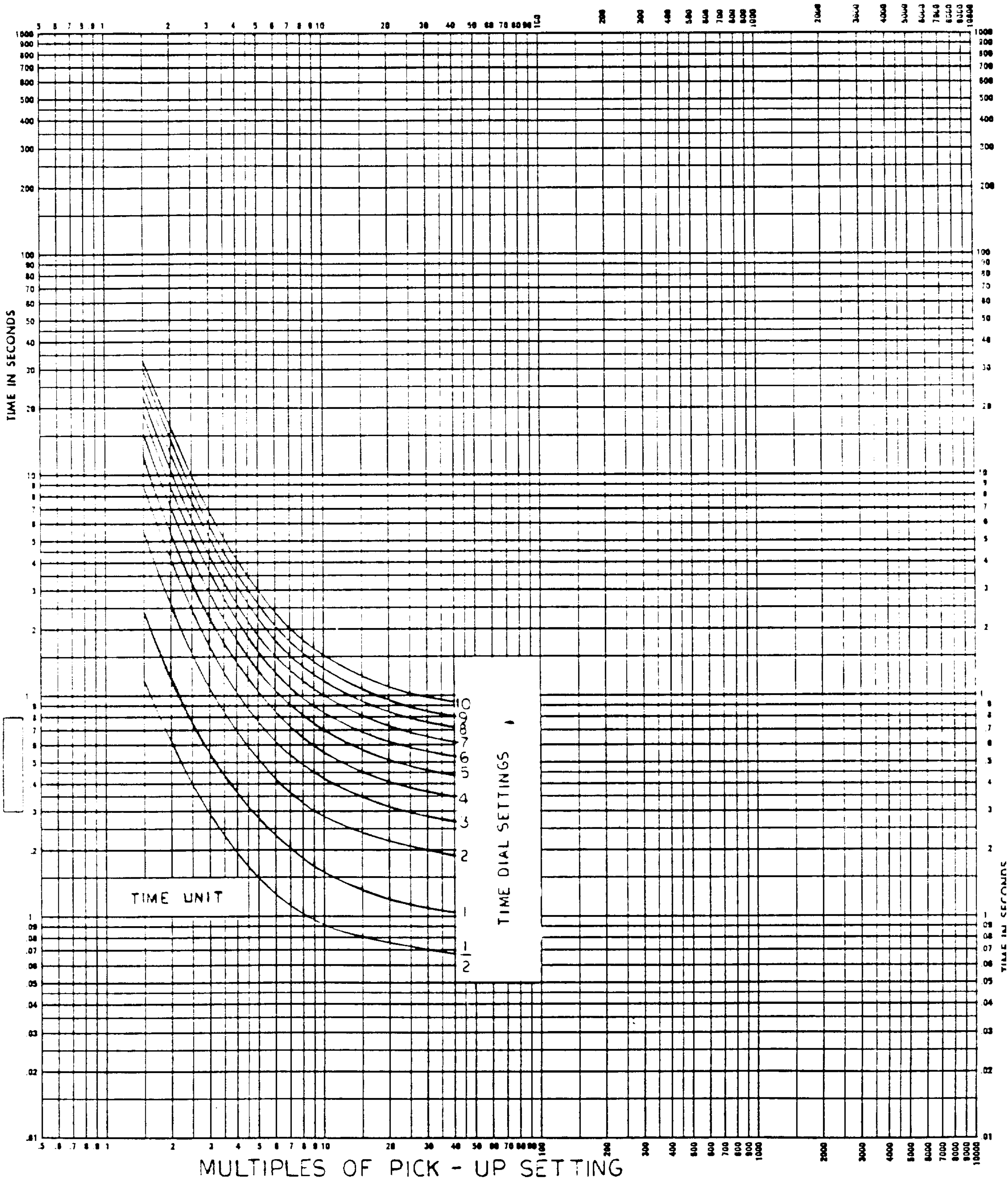


Figure 7 (0108G8944-1) 60 Hertz Time-Current Characteristics for Relay Type IFC53AD

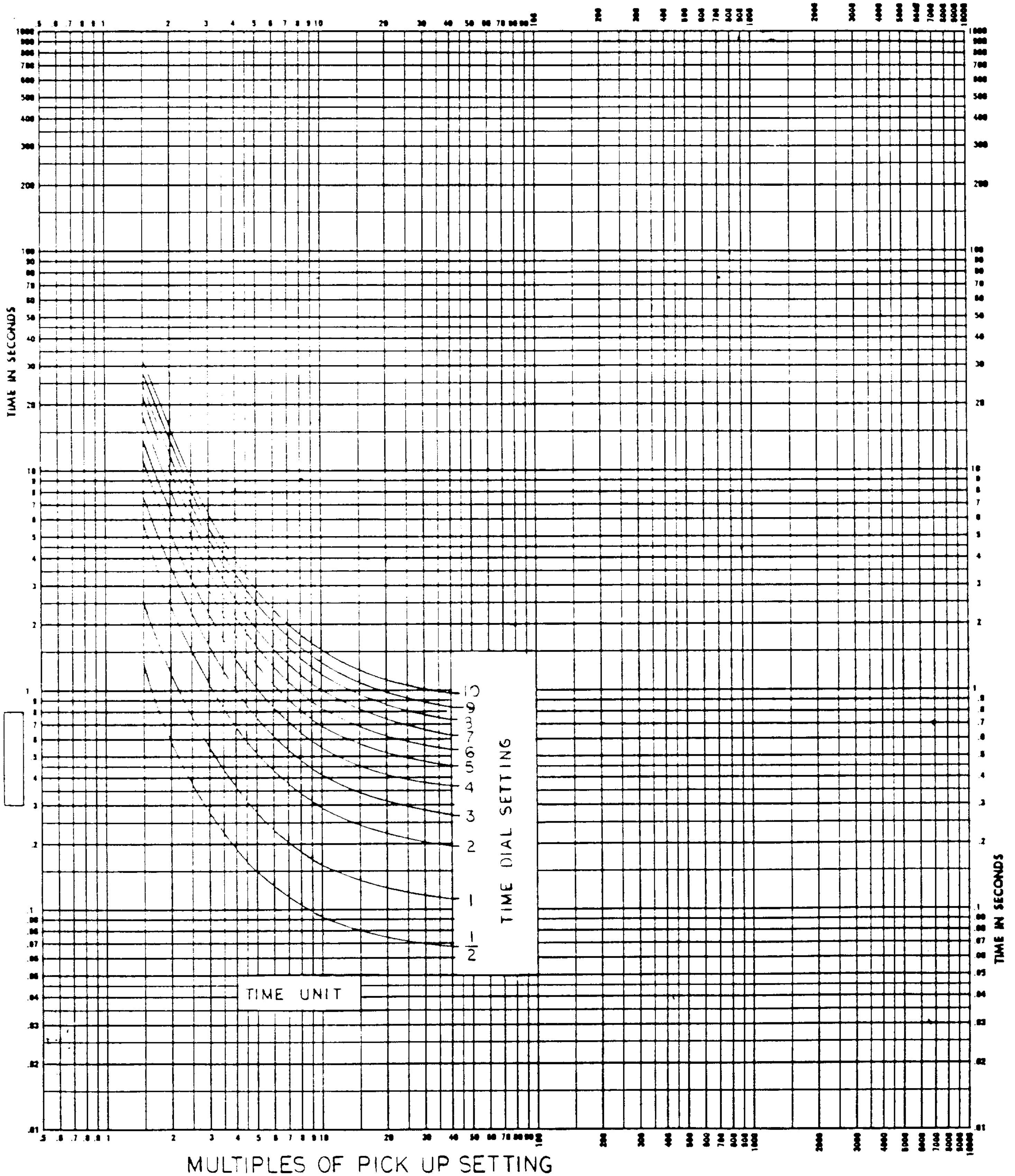
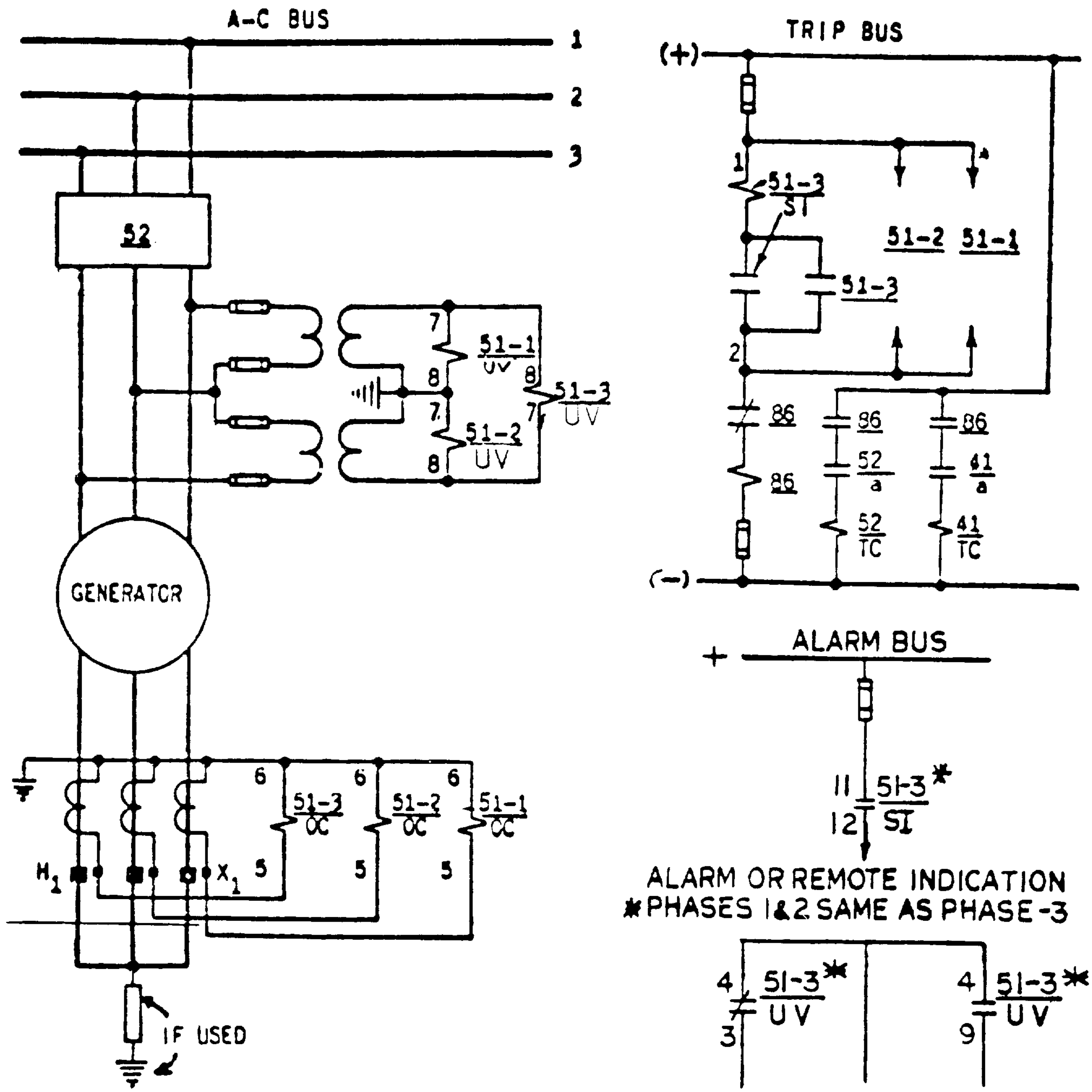


Figure 8 (0108G8944-1) 50 Hertz Time-Current Characteristics for Relay Type IFC53AD



DEVICE FUNCTION NUMBERS

51-OVERCURRENT RELAY.
TYPE IFCS51AD OR IFCS53AD
OC-OVERCURRENT UNIT
UV-UNDERVOLTAGE UNIT
TSI-TARGET SEAL-IN UNIT

52-POWER CIRCUIT BREAKER
a-AUXILIARY CONTACT. CLOSED WHEN BREAKER IS CLOSED
TC-TRIP COIL
86-LOCKOUT RELAY HAND RESET
41-FIELD BREAKER

Figure 9 (0275A3812-0) Typical External Connections for IFCS Relays When Generator Conneects to the Bus at Generator Voltage

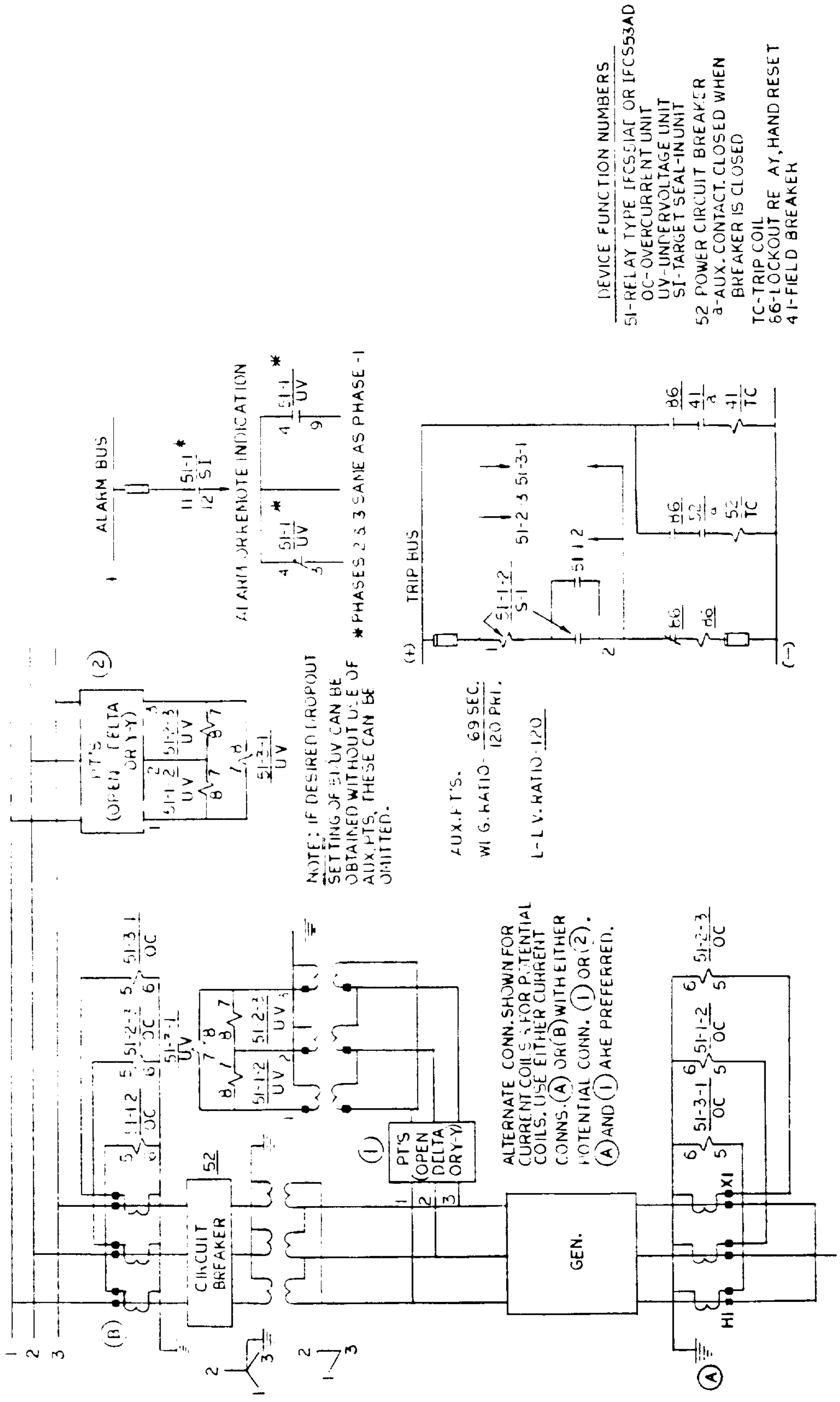


Figure 10 (00108B9186-0) Typical External Connections for IFCS Relays for Unit Generator-Transformer Installations

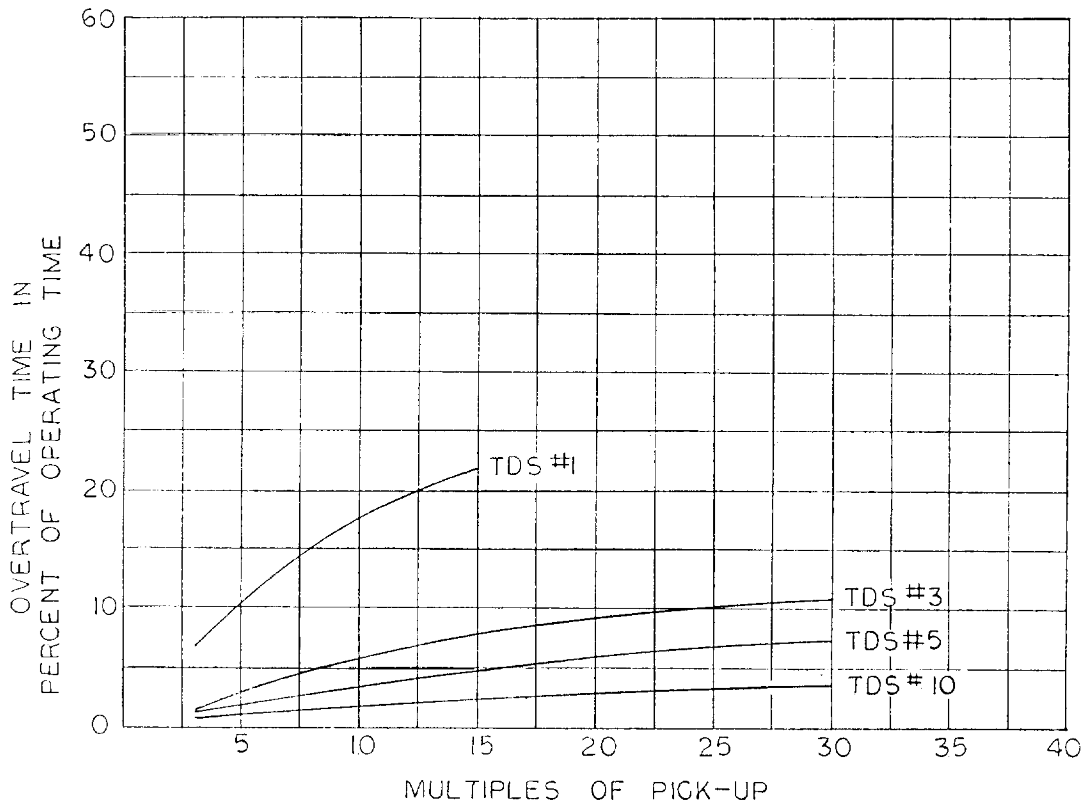


Figure 11 (0257A8594-2) Overtravel Curves for Relay Type IVCS51AD

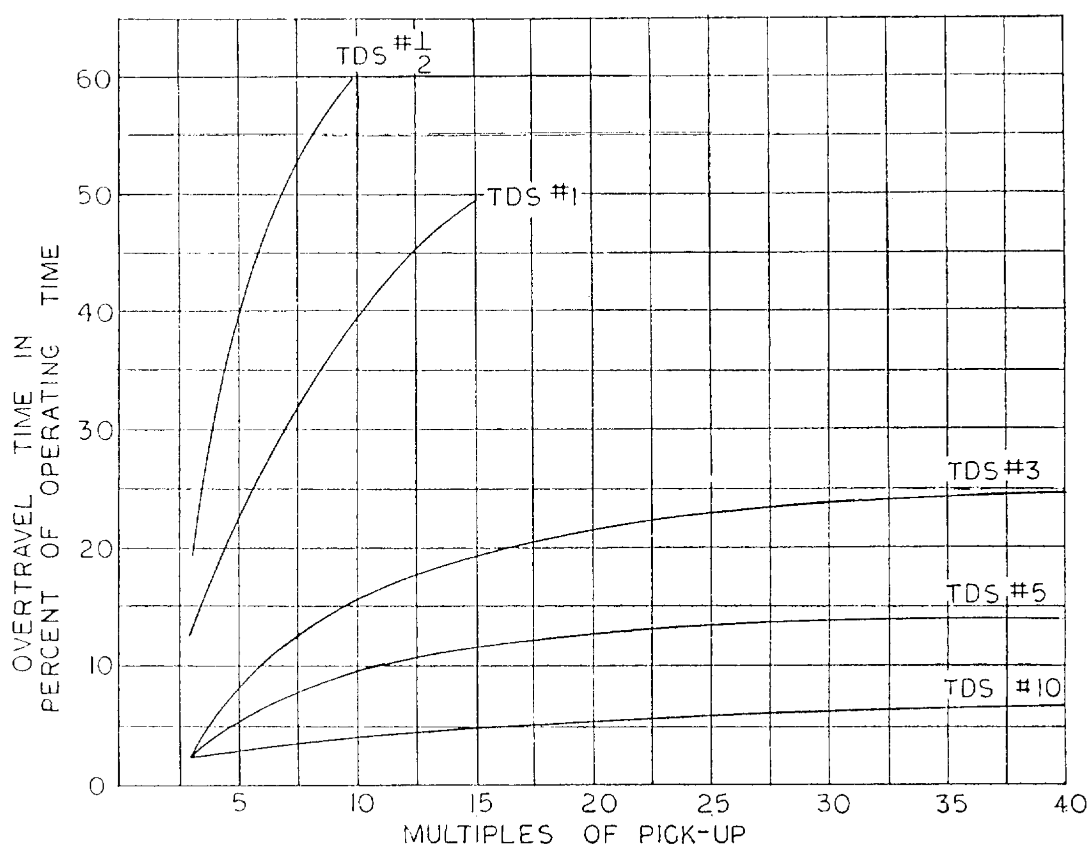


Figure 12 (0257A8595-2) Overtravel Curves for Relay Type IVCS53AD

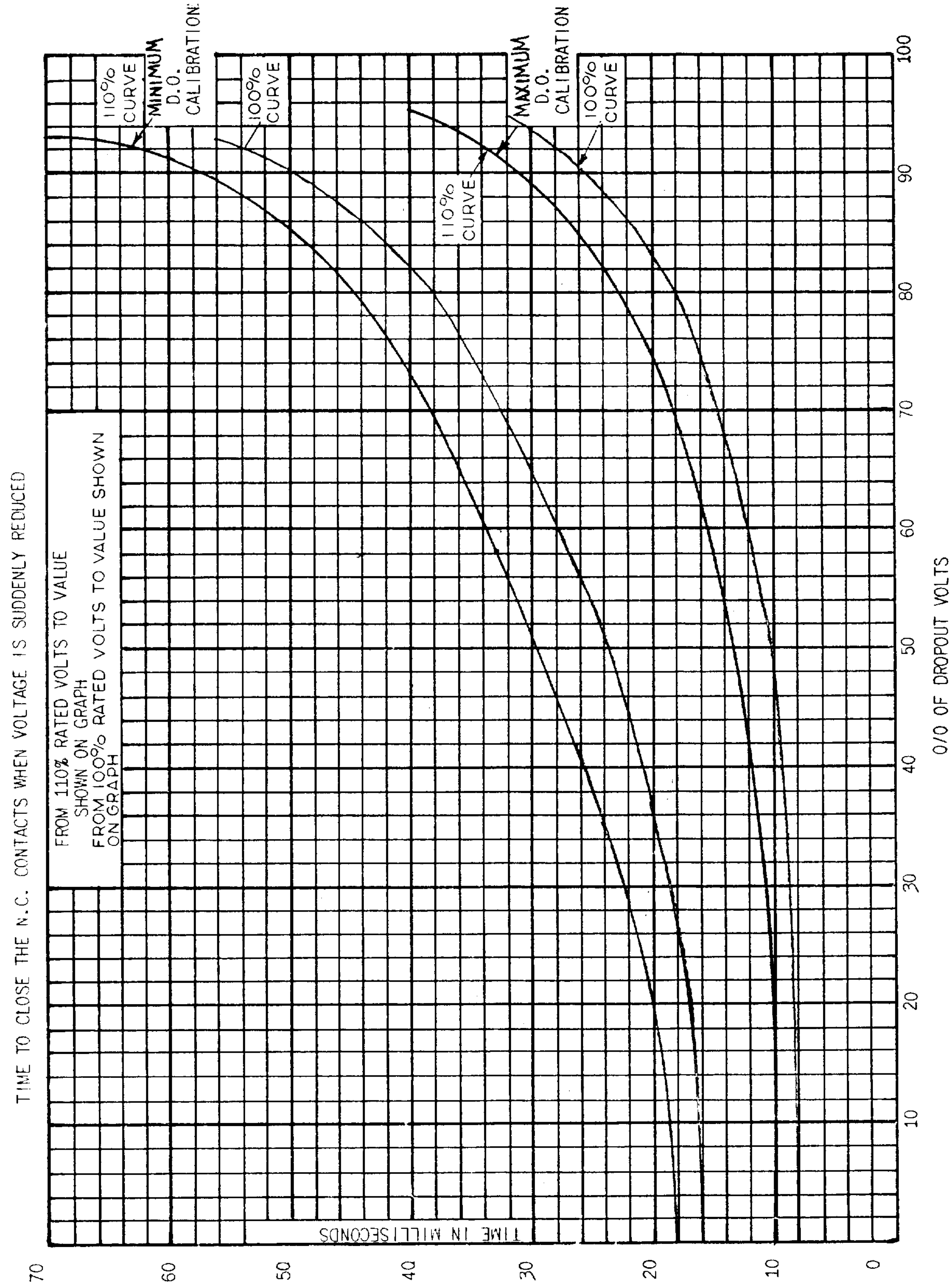


Figure 13 (0165A7560-2) Operating Time Curves
for Undervoltage Unit in IFCS51 and IFCS53 Type Relays

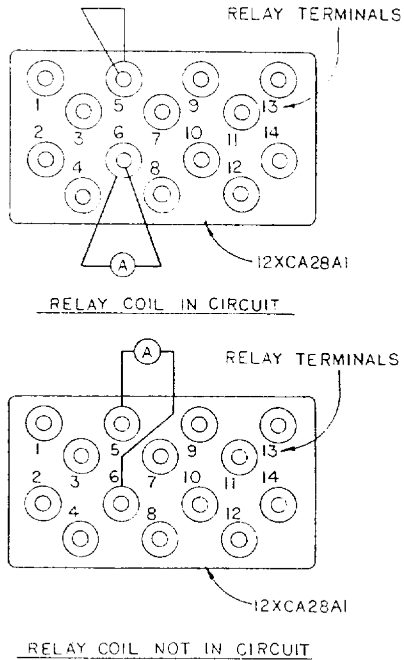


Figure 14 (0273A9501-0) Test Connections
for Testing CT Secondary Used with the IFCS Relay

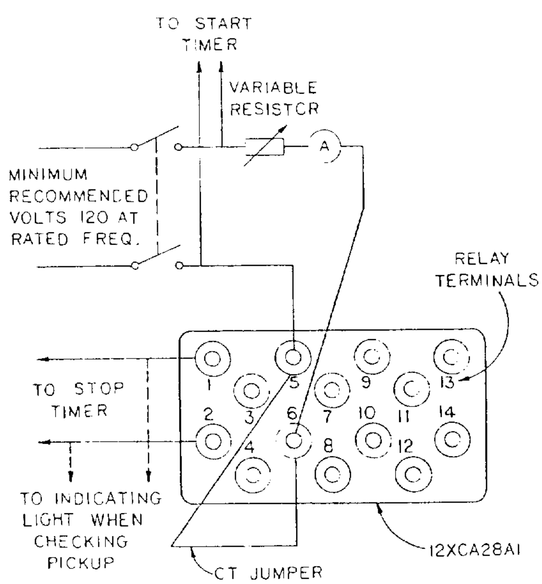


Figure 15(0273A9508-0) Test Connections for Testing
Pickup and Operating Times of the IFCS Relay Time Overcurrent Unit

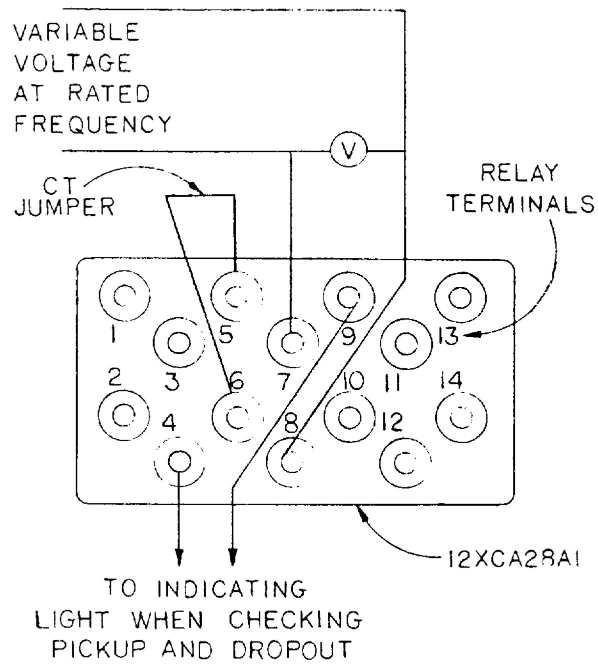


Figure 16 (0273A9502-0) Test Connections for Testing Pickup and Dropout of the Undervoltage Unit in the IFCS Relay

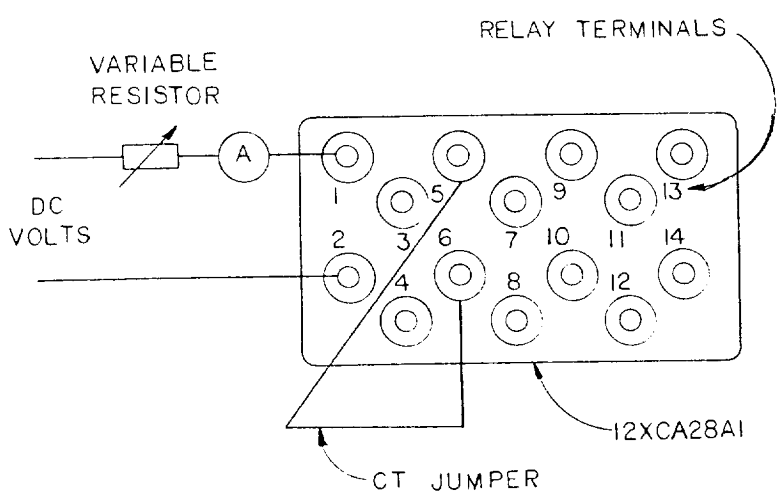


Figure 17 (0273A9503-0) Test Connections for Testing the High-Seismic Target and Seal-In Unit Used with the IFCS Relay

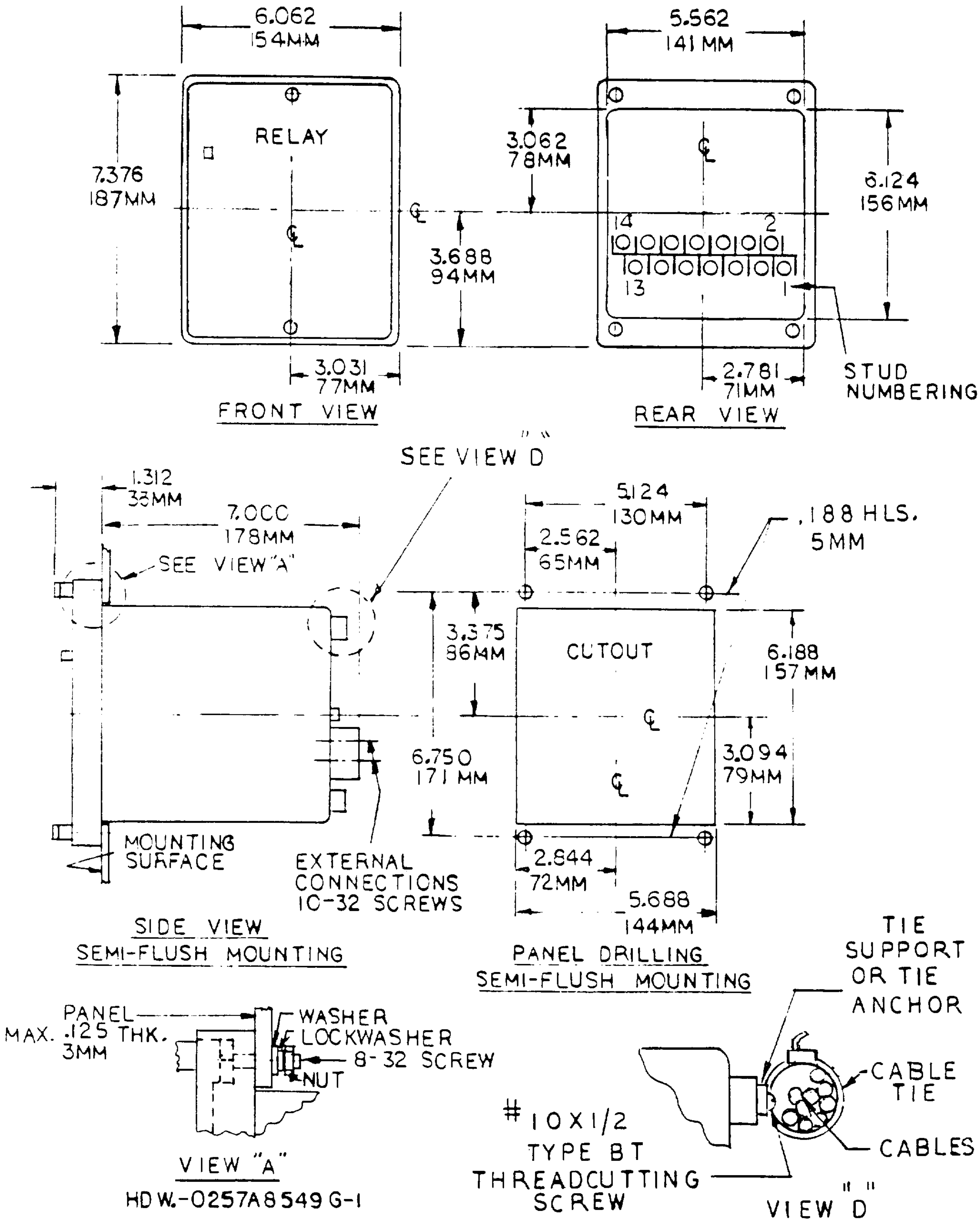


Figure 18 (0237A8452 Sh.1 -3) Outline and Panel Drilling for Relay Type IFCS for Semi-Flush Mounting

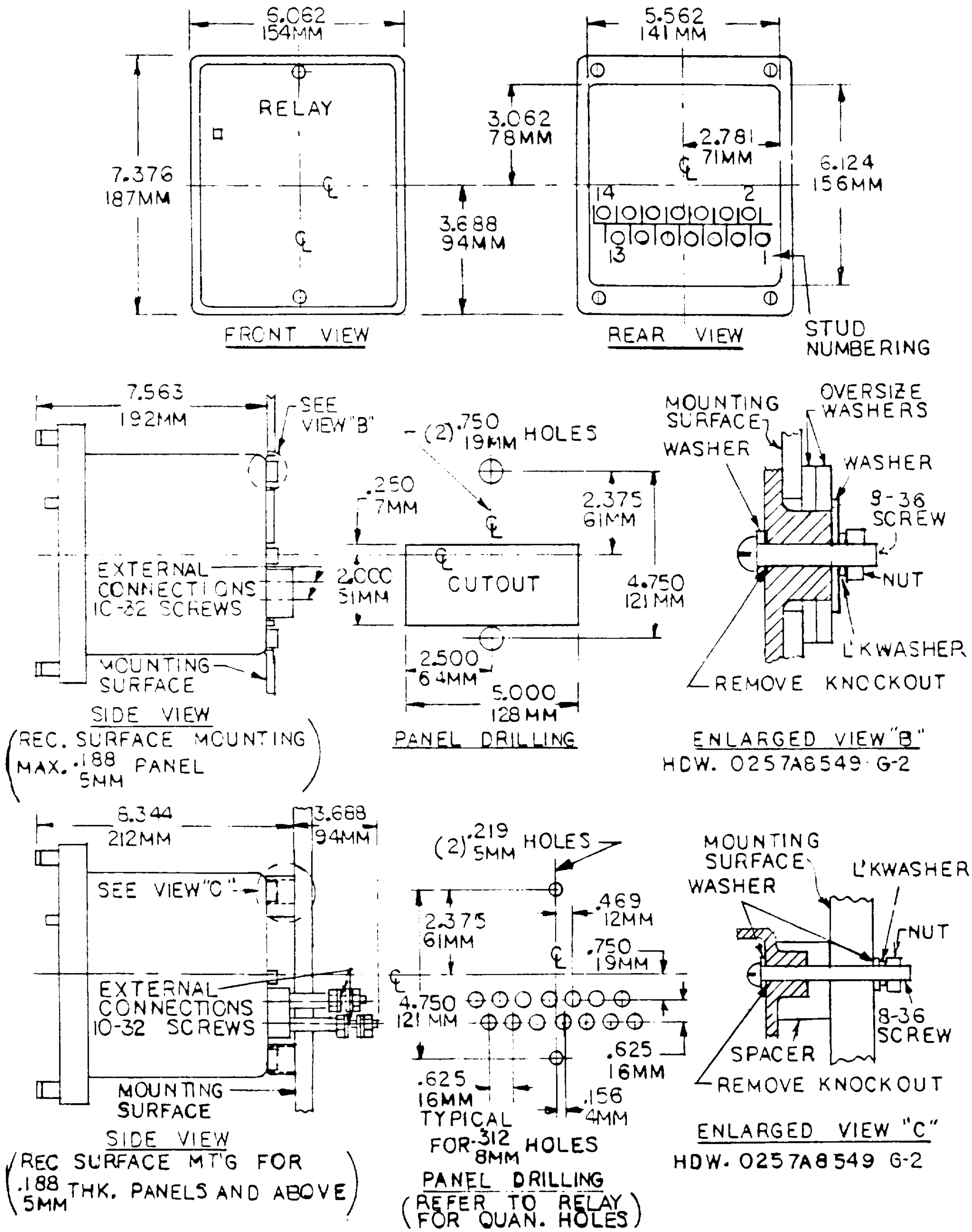


Figure 19 (0257A8452 Sh.2 -3) Outline and Panel Drilling
for Relay Type IFCS for Surface Mounting

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