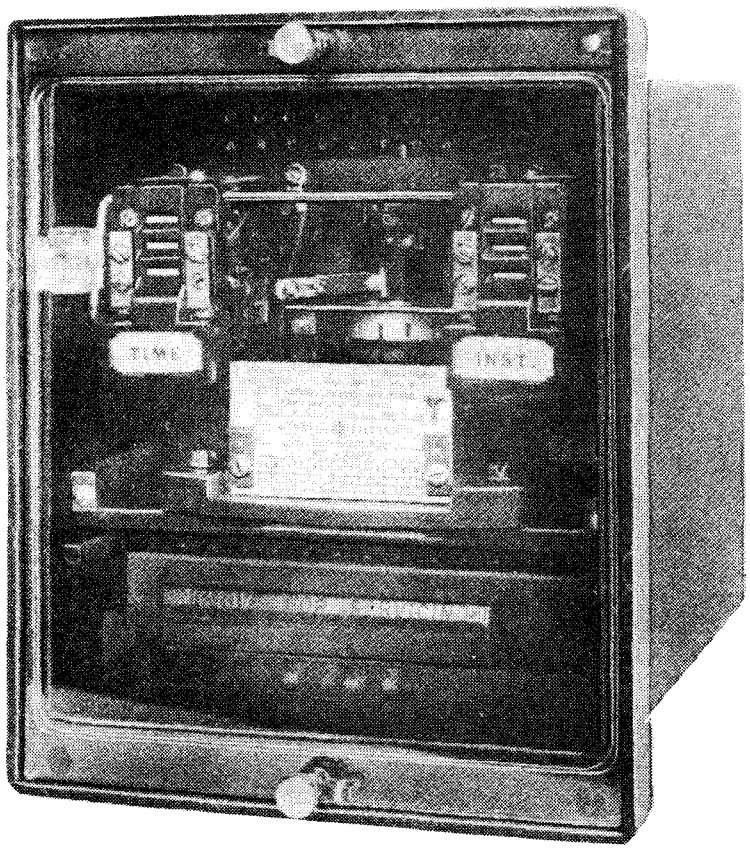
INSTRUCTIONS

GEK-49865A
Supersedes GEK-49865

TIME OVERVOLTAGE RELAYS



TYPES

IFV51AD
IFV71AD
IFV71BD

GENERAL ELECTRIC

CONTENTS

TIME OVERVOLTAGE RELAYS

TYPES

IFV51AD
IFV71AD
IFV71BD

DESCRIPTION

The IFV51AD, IFV71AD and IFV71BD relays are single-phase, voltage-operated, induction disk relays with adjustable time delay. The IFV71BD relay contains an instantaneous voltage-operated unit in addition to the induction disk unit.

The induction disk unit in the IFV71AD and IFV71BD relays, and the instantaneous unit in the IFV71BD relay are frequency compensated. The pickup of these units will remain within 7.5% of the pickup setting at the rated system frequency over the range of 50% to 150% of system frequency.

Each relay contains a target seal-in unit that operates in conjunction with the associated disk unit. The target seal-in unit has two electrically-separate sets of normally-open contacts. One set of contacts is connected in parallel with the contacts of the disk unit, to protect them and their associated control spring. The second set of contacts is brought out of the relay through a separate pair of studs. This set of contacts may be used for monitoring or to sound an alarm, but they are not suitable for use as the initiating contact in any circuit because they will operate only after the contacts of the disk unit have closed.

The instantaneous unit in the IFV71BD relay has two electrically-separate sets of normally-open contacts. These contacts will close when the instantaneous unit operates, and they may be used to initiate tripping, to sound an alarm, or to monitor operation of the unit. The instantaneous unit has a self-contained target that will show after the unit has operated.

Each relay is mounted in a standard C1-size drawout case, the outline and panel drilling dimensions for which are shown in Figures 15 and 16. Internal connections for the relays are shown in Figures 3, 4 and 5. Typical external connections are shown in Figures 6 and 7.

APPLICATION

The IFV51AD, IFV71AD and IFV71BD relays are single-phase, voltage-operated relays that may be used for the protection, or time control, of circuits where overvoltage, or the sudden presence of voltage, is the controlling factor.

TABLE II

Relay	Continuous Rating	Tap
IFV71AD and 71BD	120	55 64 70 82 93
	240	110 128 140 164 186 210 240
	280	280

HIGH-SEISMIC TARGET AND SEAL-IN UNIT

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

TABLE III

	Tap	
	0.2	2.0
DC Resistance + 10% (Ohms)	8.0	0.24
Min. Operating (Amp.) +0 -60%	0.2	2.0
Carry Continuously (Amperes)	0.3	3
Carry 30 Amperes for (Seconds)	0.03	4
Carry 10 Amperes for (Seconds)	0.25	30
60 Hz Impedance (Ohms)	68.6	0.73

HIGH-SEISMIC INSTANTANEOUS UNIT

The instantaneous unit is frequency-compensated over the range of 50% to 150% of system frequency. There are two ranges available (120-200 and 180-300) that are continuously adjustable by means of a potentiometer located in the rear of the 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 IFV relays at tap voltage are given in Table IV. Those at rated voltage are given in Table V.

TABLE IV

Relay	Frequency	Tap Setting	Volt Amps	Power Factor	Watts
IFV51AD	60	55	2.99	0.54	1.61
		64	2.86	0.49	1.40
		70	2.79	0.46	1.28
		82	2.71	0.42	1.14
		93	2.65	0.40	1.06
		110	2.60	0.37	0.962
		128	2.56	0.35	0.90
		140	2.53	0.35	0.89
		164	2.46	0.35	0.86
		186	2.40	0.36	0.86
		210	2.37	0.37	0.88
		240	2.38	0.40	0.95
		280	2.38	0.44	1.05
	50	50	2.82	0.59	1.66
		56	2.50	0.54	1.35
		60	2.36	0.51	1.20
		72	2.41	0.46	1.11
		82	2.39	0.43	1.03
		100	2.50	0.40	1.00
		113	2.36	0.37	0.86
		125	2.32	0.36	0.85
		144	2.20	0.36	0.79
		164	2.18	0.36	0.78
		185	2.15	0.37	0.80
		211	2.13	0.39	0.83
		250	2.20	0.43	0.95
IFV71AD & BD	60	55	4.75	0.53	2.52
		64	4.60	0.48	2.21
		70	4.55	0.46	2.09
		82	4.40	0.42	1.85
		93	4.34	0.39	1.69
		110	4.29	0.36	1.54
		128	4.21	0.34	1.43
		140	4.20	0.33	1.39
		164	4.03	0.33	1.33
		186	3.96	0.33	1.31
		210	3.89	0.34	1.33
		240	3.91	0.35	1.36
		280	3.92	0.37	1.45
	50	55	5.45	0.57	3.11
		64	5.31	0.52	2.76
		70	5.26	0.49	2.58
		82	5.13	0.44	2.26
		93	5.08	0.41	2.08
		110	5.03	0.37	1.86
		128	4.94	0.35	1.73
		140	5.00	0.33	1.65
		164	4.72	0.32	1.51
		186	4.67	0.32	1.49
		210	4.60	0.32	1.47
		240	4.61	0.33	1.52
		280	4.62	0.35	1.62

TABLE V

Relay	Frequency	Rated Volts	Tap Setting	Volt Amps	Power Factor	Watts
IFV51AD	60	120	55	14.52	0.55	7.99
			64	10.20	0.50	5.10
			70	8.30	0.47	3.90
			82	5.84	0.43	2.51
			93	4.46	0.41	1.83
		240	110	12.72	0.36	4.58
			128	9.17	0.35	3.21
			140	7.58	0.34	2.58
			164	5.30	0.35	1.86
			186	4.03	0.36	1.45
			210	3.12	0.37	1.15
			240	2.38	0.40	0.95
		280	280	2.38	0.44	1.05
	50	120	50	16.61	0.76	12.62
			56	11.59	0.54	6.26
			60	9.46	0.51	4.82
			72	6.68	0.46	3.07
			82	5.11	0.43	2.20
		240	100	15.00	0.39	5.85
			113	10.75	0.37	3.98
			125	8.86	0.36	3.19
			144	6.19	0.36	2.23
			164	4.70	0.36	1.69
			185	3.65	0.37	1.35
			211	2.76	0.39	1.08
		250	250	2.20	0.43	0.95
IFV71AD & BD	60	120	55	23.40	0.80	18.72
			64	16.08	0.56	9.00
			70	13.08	0.47	6.15
			82	9.49	0.42	3.99
			93	8.00	0.49	3.92
		240	110	21.79	0.35	7.63
			128	15.36	0.33	5.07
			140	12.65	0.32	4.05
			164	8.76	0.32	2.80
			186	6.67	0.33	2.20
			210	5.14	0.33	1.70
			240	3.89	0.35	1.36
		280	280	3.92	0.37	1.45
	50	120	55	26.52	0.92	24.40
			64	19.08	0.79	15.07
			70	15.98	0.69	11.03
			82	11.04	0.46	5.08
			93	8.46	0.42	3.55
		240	110	27.22	0.42	11.43
			128	18.84	0.33	6.22
			140	15.38	0.32	4.92
			164	10.42	0.30	3.13
			186	7.97	0.30	2.39
			210	6.10	0.31	1.89
			240	4.61	0.33	1.52
		280	280	4.62	0.35	1.62

CHARACTERISTICS

The IFV51AD relay is an overvoltage relay that closes its contacts when the voltage increases to the pickup value as set on the tap block.

The IFV71AD relay is similar to the IFV51AD relay, except that it is frequency-compensated to hold its calibration within 7.5% from 50% to 150% of system frequency.

The IFV71BD relay is similar to the IFV71AD relay except for the addition of an instantaneous unit, which is also frequency-compensated. See Figure 10 for a typical pickup-versus-frequency characteristic. Pickup of this instantaneous unit is determined by the setting of a potentiometer located in the rear of the relay.

TIME OVERVOLTAGE UNIT

Pickup of these relays is defined as the voltage required to close the contacts with the relay set at the 0.5 time-dial position. Tap settings are made by means of a movable lead that connects to the tap block at the top of the support structure (See Figure 1). The tap block is marked A through N. The nameplate on the relay contains a table that shows the tap voltage for each tap setting.

The IFV relays should operate within $\pm$ 10% of the time-voltage characteristic or $\pm$ the time-dial setting times 0.010 second, whichever is greater. Figures 8 and 9 show the various time-voltage characteristics for the IFV relays. The setting of the time dial determines the length of the time required to close the contacts for a given voltage. 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.

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.

HIGH-SEISMIC INSTANTANEOUS UNIT

The instantaneous unit setting is determined by a potentiometer located in the rear of the relay. See the **RATINGS** section for the various voltage ranges.

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 receipt 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 installation or acceptance tests, at the discretion of the user.

Since most operating companies use different procedures for acceptance 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 control spring is not deformed, nor its convolutions tangled or touching each other.

3. The armature and contacts of the seal-in unit, as well as the armature and contacts of the instantaneous unit, 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.

5. Make sure that the brushes agree with the appropriate internal connection diagram (see Figures 3, 4, or 5).

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

7. **CAUTION: Do not use hydrocarbons to clean the cover.**

DRAWOUT RELAY TESTING

IFV 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 external circuitry, providing maximum flexibility. 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 12XCA11A1 has four. Refer to instruction book GEK-49803 for additional information.

POWER REQUIREMENTS, GENERAL

All alternating-current (AC) 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 test alternating-current (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.

Similarly, relays requiring DC control power should be tested using direct current (DC) and not full-wave rectified power. Unless the rectified supply is well filtered, many relays will not operate properly due to the dips in the rectified power. Zener diodes, for example, can turn off during these dips. As a general rule, the DC source should not contain more than 5% ripple.

TIME OVERVOLTAGE 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.

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

The minimum voltage 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 overvoltage unit for any voltage tap setting is adjusted by means of a spring-adjustment ring. See Figure 1. The spring-adjustment ring either winds or unwinds the spiral control spring. By turning the ring, the operating voltage of the unit may be brought into agreement with the tap setting employed, if this adjustment has been disturbed.

This adjustment also permits obtaining 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/voltage characteristics of Figures 8 and 9 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 voltage reaches a predetermined value. The contacts are just closed when the time dial is set on zero (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 the 0.5 time-dial position and the lowest tap. Using the test connections in Figure 11, the main unit should close the contacts within ± 4% of tap value at rated frequency.

For frequency-compensated relays, pickup must be within 7.5% from 50% to 150% of system frequency.

Time Test

Set the relay to the No. 5 time-dial setting and the tap as shown in Table VI. Using the test connection in Figure 11, apply 130% of tap voltage to the relay. The relay operating times to close its contact are listed in Table VI.

TABLE VI

Relay	Tap	Volts Applied	Frequency	Time(Seconds) Min.	Max.
IFV51AD	128	166.4	60	9.3	9.6
	113	146.9	50		
IFV71AD & BD	128	166.4	50 or 60		

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 12) 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 VII.

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 VII.

TABLE VII

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

HIGH-SEISMIC INSTANTANEOUS UNIT

The instantaneous unit range is 120 to 200 volts, or 180 to 300 volts, and is continuously adjustable by means of a potentiometer located in the rear of the relay. The relay is shipped with the instantaneous unit setting at minimum pickup.

1. Connect relay terminals 7 and 8 (see test circuit of Figure 13) to a variable voltage source of rated frequency.

2. Increase the voltage slowly until the instantaneous unit picks up. The unit must pick up within ± 2% of minimum pickup.

3. Check pickup at 50% to 150% of system frequency. The unit must pick up within ± 5% of the pickup found in 2 above.

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 15 and 16. Figure 15 shows the semi-flush mounting, and Figure 16 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 6 and 7.

INSTALLATION TESTS

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

Time Overvoltage 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 11, gradually apply voltage until the contacts close. This value of voltage is defined as pickup, and should be within ± 4% of the tap value.

Check the operating time at some multiple of tap value, and the desired time-dial setting. These settings are left to the discretion of the user.

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.

High-Seismic Instantaneous Unit

Perform a pickup test at system frequency, 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 make sure that the relays have not deviated from their original settings. If deviations are encountered, the relay must be retested and serviced as described in the **SERVICING** section of this manual.

TIME OVERVOLTAGE UNIT

1. Perform pickup test as described in the **INSTALLATION** section.

2. Perform the time tests as 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 VII in the **ACCEPTANCE TESTS** section).

2. Check that the unit drops out at 25% or more of tap value.

HIGH-SEISMIC INSTANTANEOUS UNIT

Perform a pickup test at system frequency, as outlined in the **ACCEPTANCE TESTS** section.

CONTACT CLEANING

For cleaning relay contacts, a flexible burnishing tool should be used. This consists of a flexible strip of metal with an etched-roughened surface, resembling in effect a superfine file. The polishing action is so delicate that no scratches are left, yet it will clean off any corrosion thoroughly and rapidly. The flexibility of the tool ensures the cleaning of the actual points of contact.

Do not use knives, files, abrasive paper or cloth of any kind to clean relay contacts. 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 ® 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 primarily written to check and set the IFV relay, overall functional tests to check the system operation are recommended at intervals based on the customer's experience.

SERVICING

TIME OVERVOLTAGE UNIT

If it is found during installation or periodic testing that the time overvoltage 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.

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

The pickup of the time overvoltage unit is adjusted by means of a spring-adjustment ring (see Figure 1). The spring-adjustment ring either winds or unwinds the spiral control spring. By turning the ring, the operating voltage of the unit may be brought into agreement with the tap setting employed, as stated in the **ACCEPTANCE TESTS** section.

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

Time Tests

Set the relay to the No. 5 time-dial position and the tap setting per Table VIII.

TABLE VIII

Relay	Frequency	Tap
IFV51AD	60	128
	50	113
IFV71AD or BD	50 or 60	128

* Revised since last issue

Apply 1.3 times tap-setting voltage to the relay. Adjust the position of the drag magnet assembly to obtain an operating time as close as possible to 9.5 seconds, at least between 9.4 and 9.6 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 screw securing the drag magnet assembly to the support structure must be tight 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, however, the following adjustment can be made.

1. Determine which direction the disk must be moved to clear all gap surfaces by 0.010 inches.

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 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 electromagnetic 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 setting the assembly and positioning it according to the time test above.

CAUTION

Since mechanical adjustments may affect the seismic fragility level, it is advised that no mechanical adjustments be made if seismic capability is of concern.

HIGH-SEISMIC TARGET AND SEAL-IN UNIT

The left contact must make before the right contact.

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 $\pm$ 0.002 feeler gage and the right contact with a 0.010 $\pm$ 0.002 feeler gage.

HIGH-SEISMIC INSTANTANEOUS UNIT

The instantaneous unit may be checked the same as the target and seal-in unit for contact wipe.

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 model and serial numbers, of the relay for which the part is required.

LIST OF FIGURES

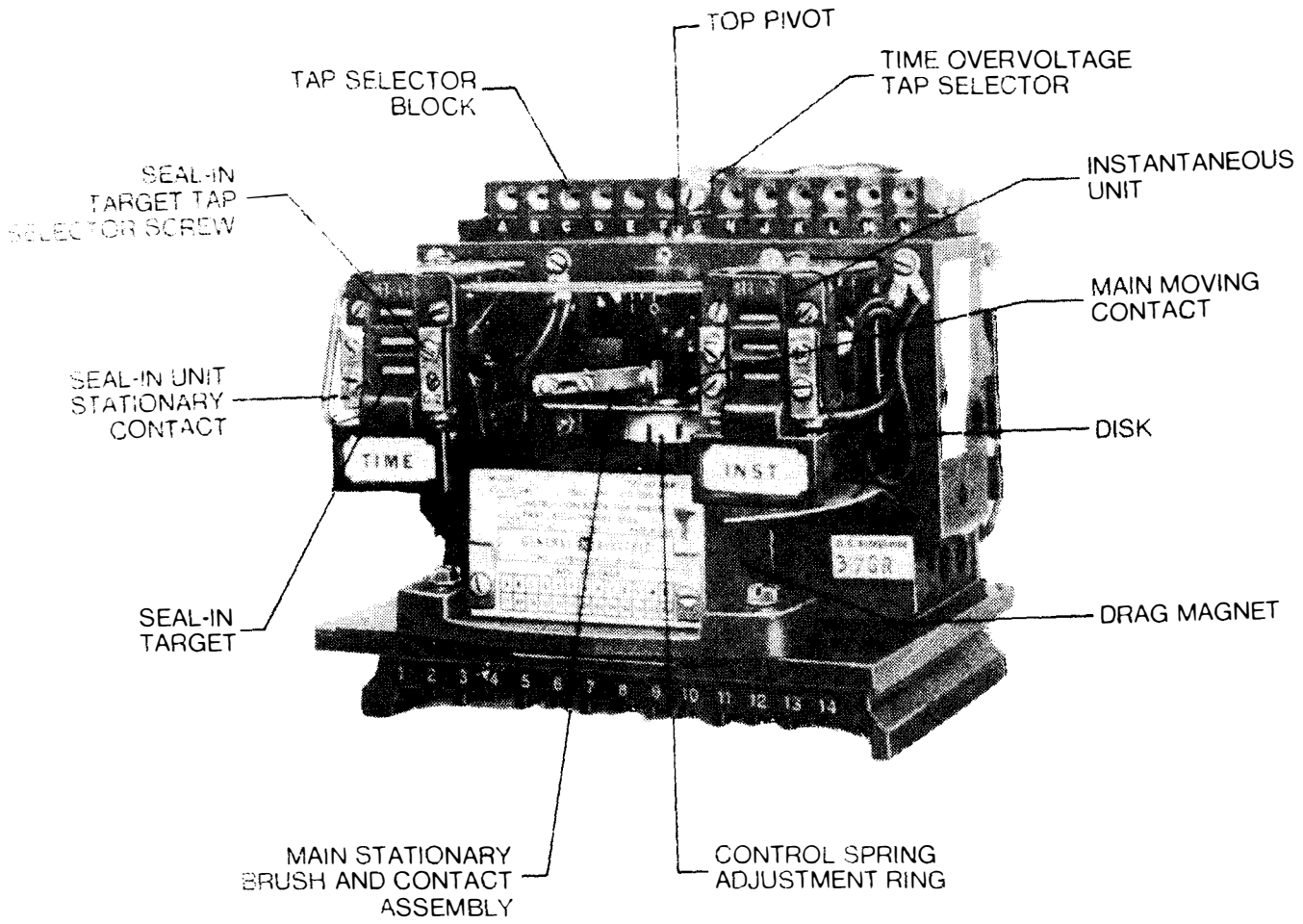


Figure 1 (8043453) Type IFV71BD Relay, Removed from Case, Front View

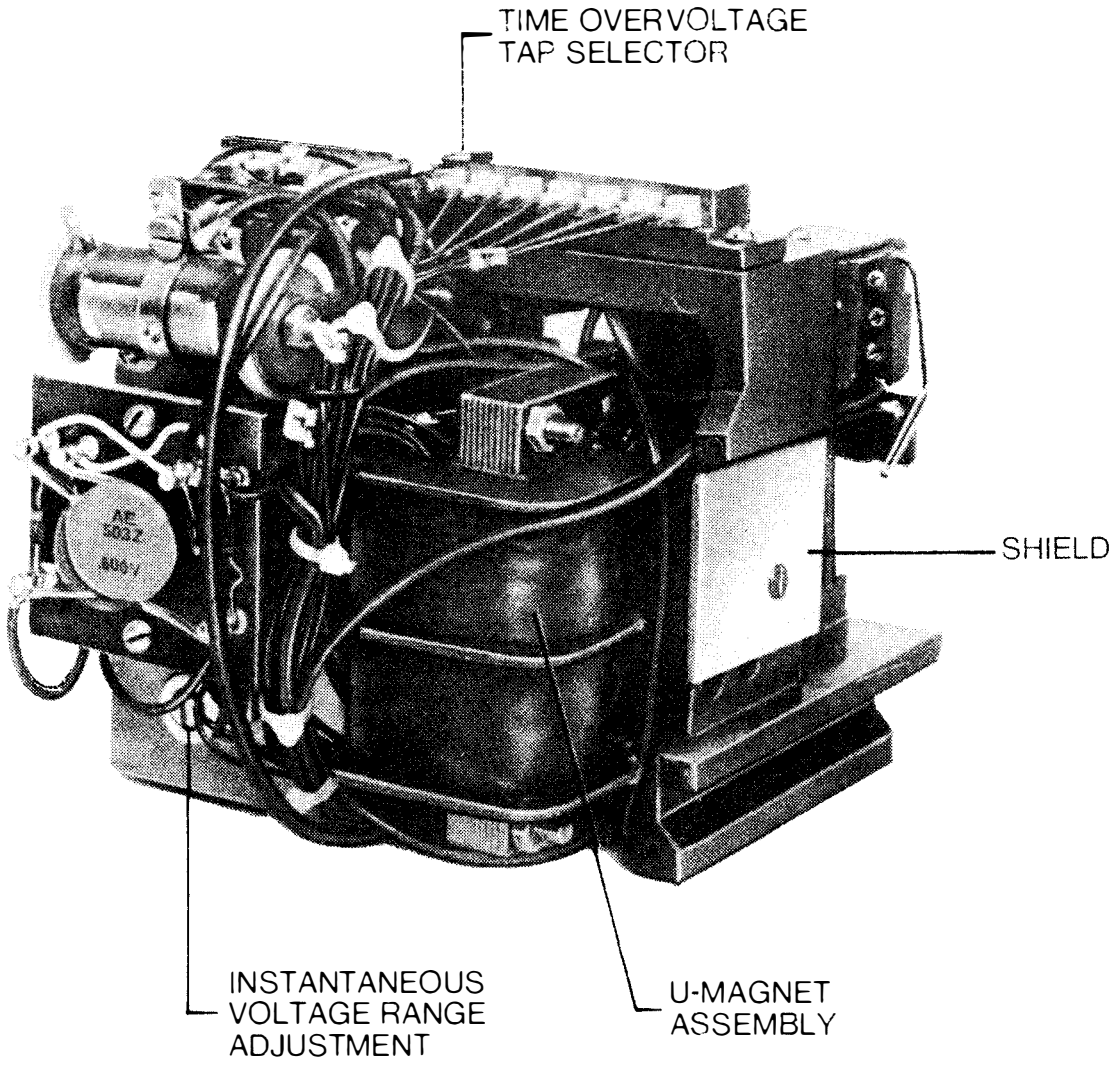


Figure 2 (8043454) Type IFV71BD Relay, Removed from Case, Rear View

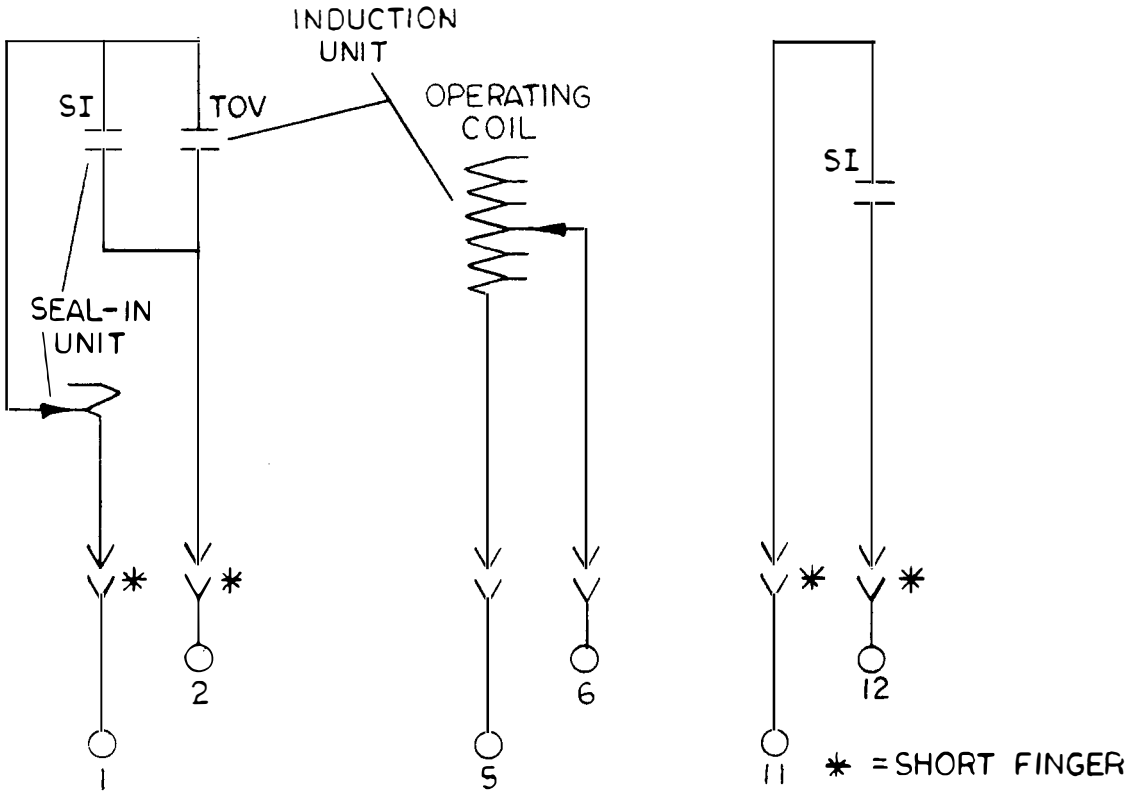


Figure 3 (0275A2026-0) Internal Connections for Relay Types IFV51AD - Front View

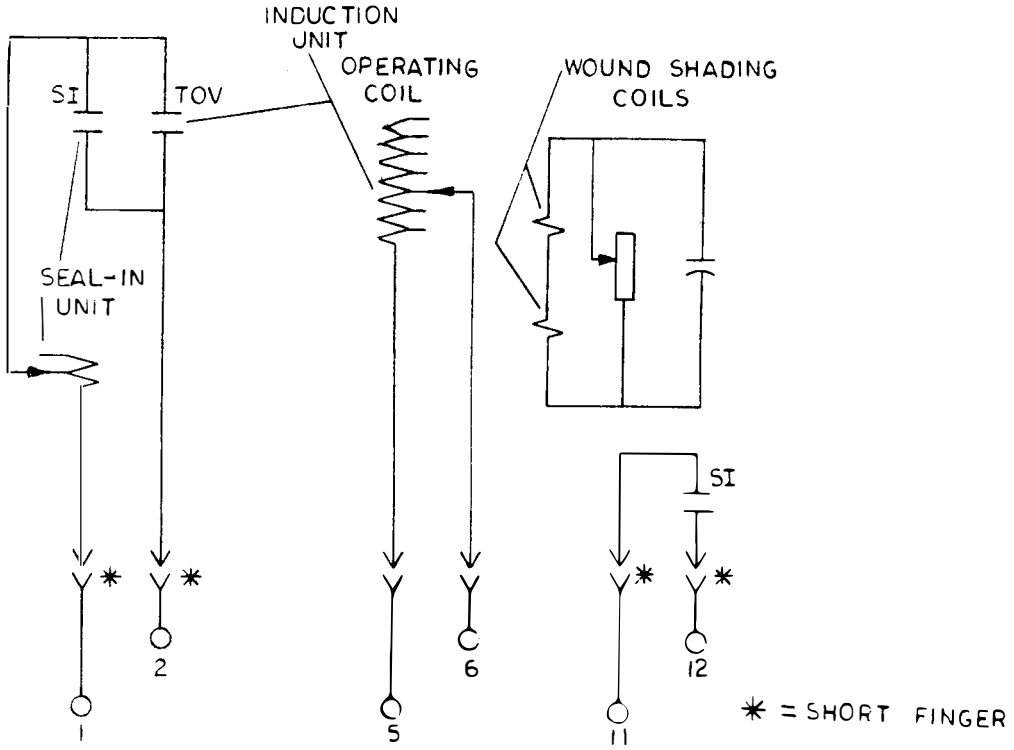


Figure 4 (0275A2029-0) Internal Connections for Relay Types IFV71AD - Front View

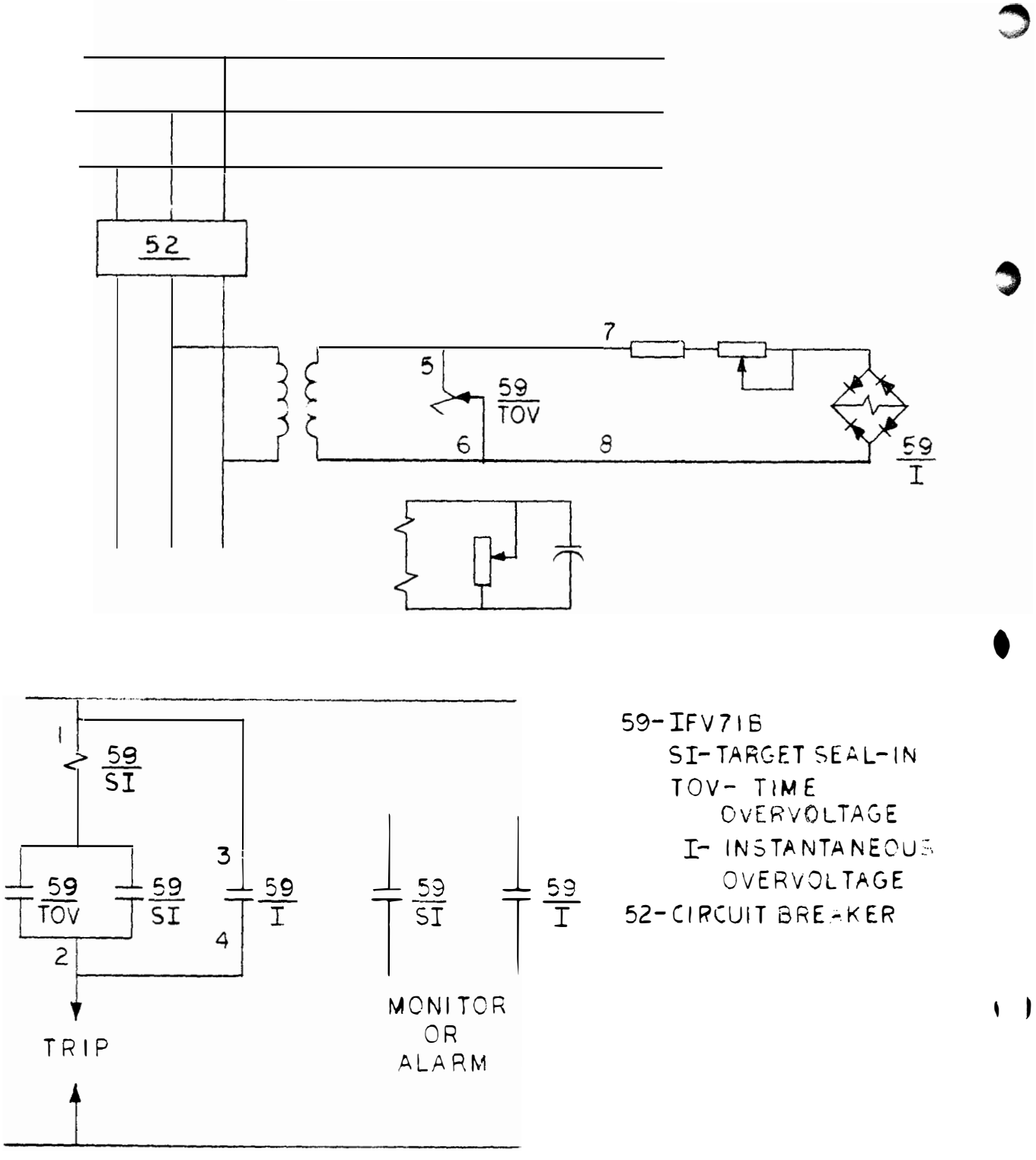


Figure 7 (0273A9039-0) Typical External Connections for IFV71BD Relay

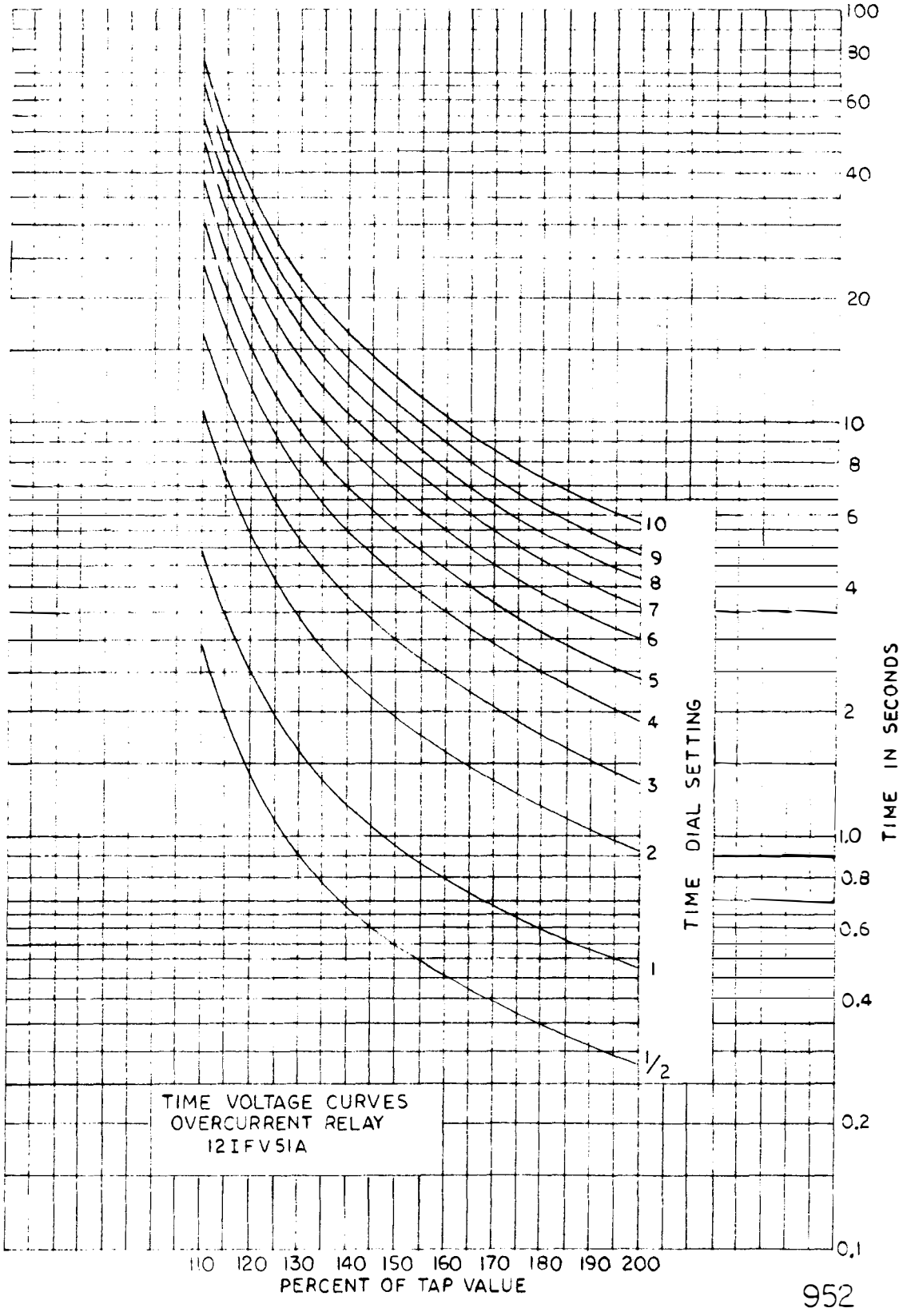


Figure 8 (0275A2075-1) Time-Voltage Characteristics for Relay Types IFV51AD

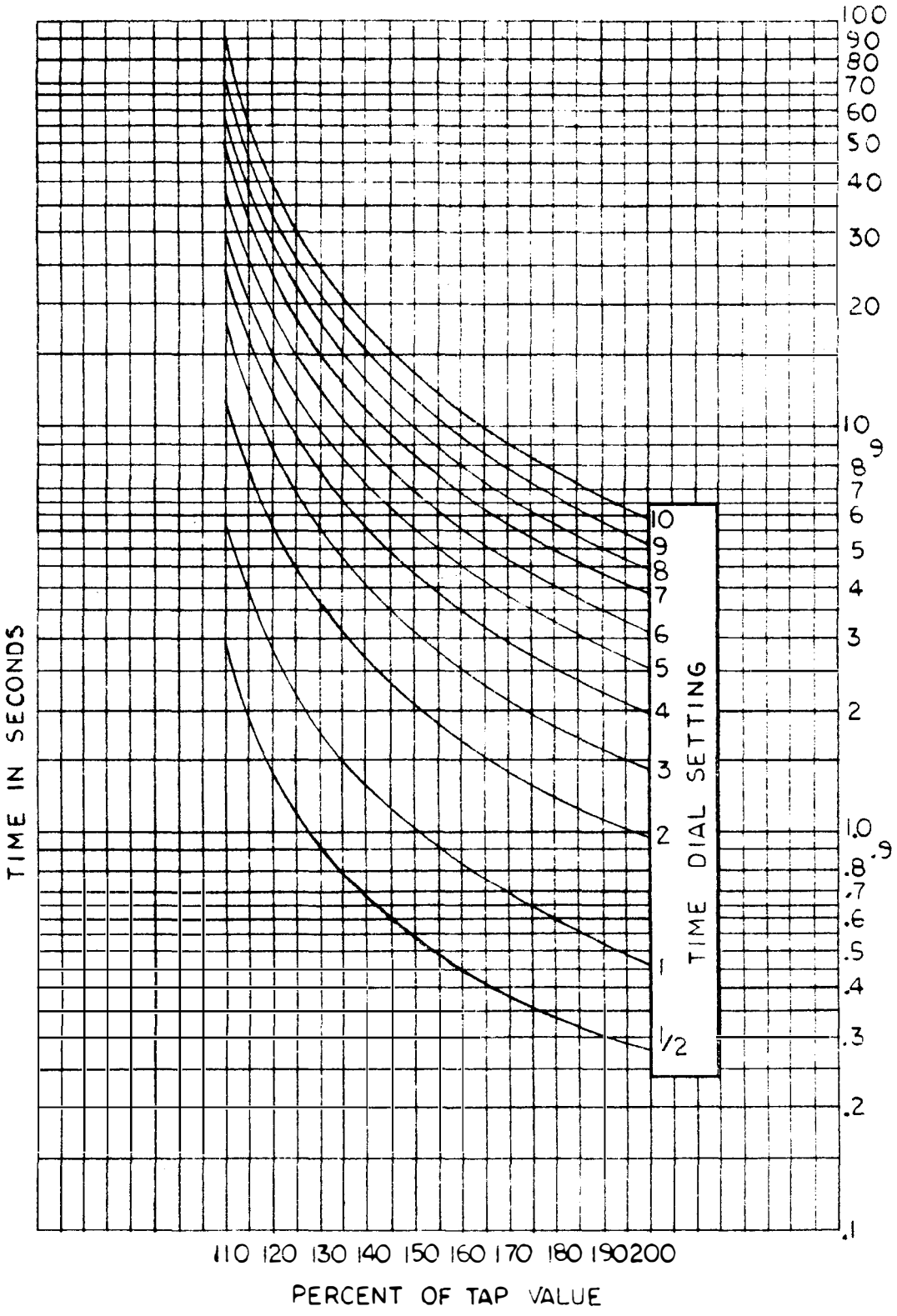


Figure 9 (0275A2074-0) Time-Voltage Characteristics for Relay Types IFV71

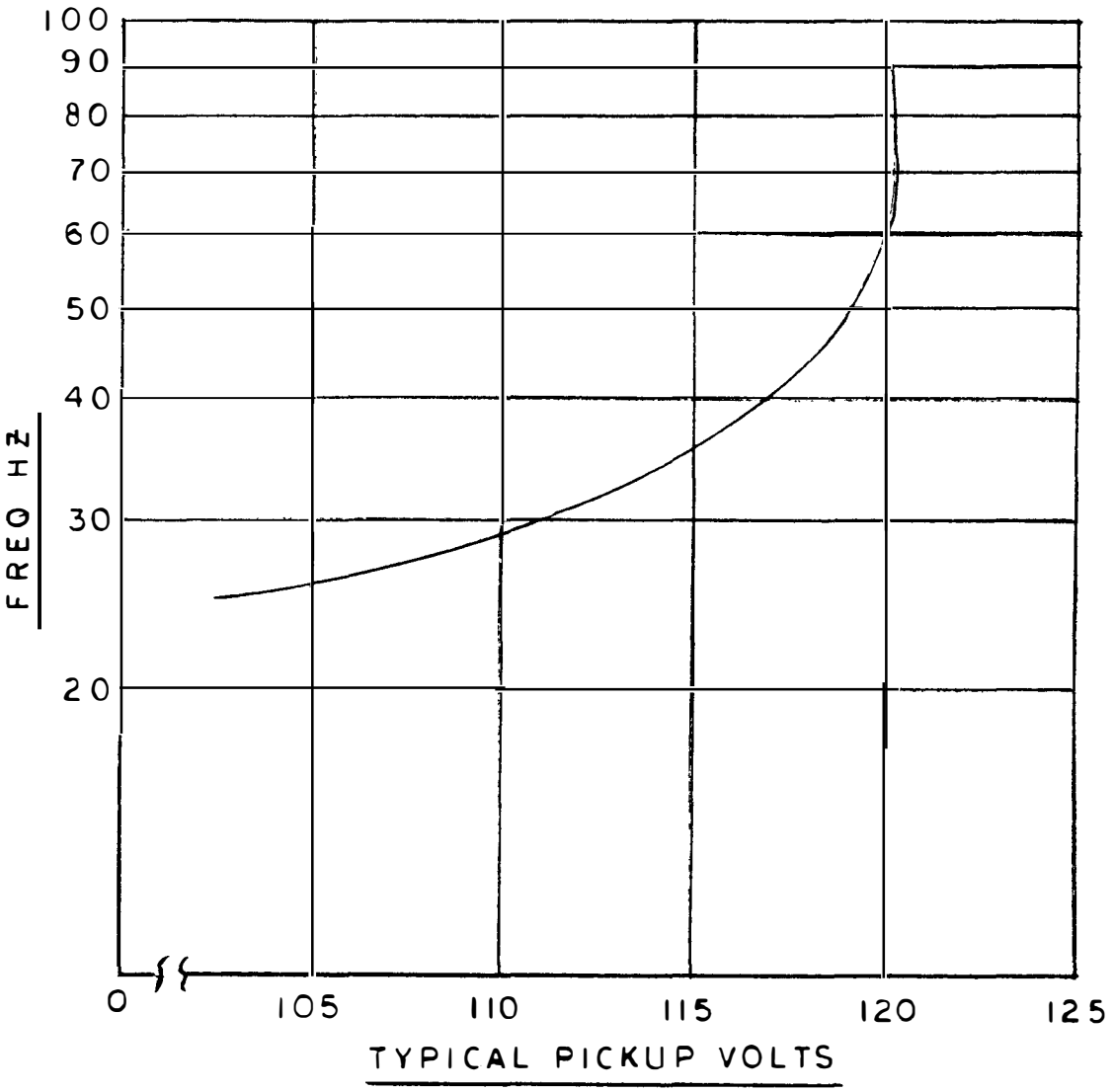


Figure 10 (0273A9588-0) Typical Pickup-Versus-Frequency Characteristic for the IFV71BD Instantaneous Unit

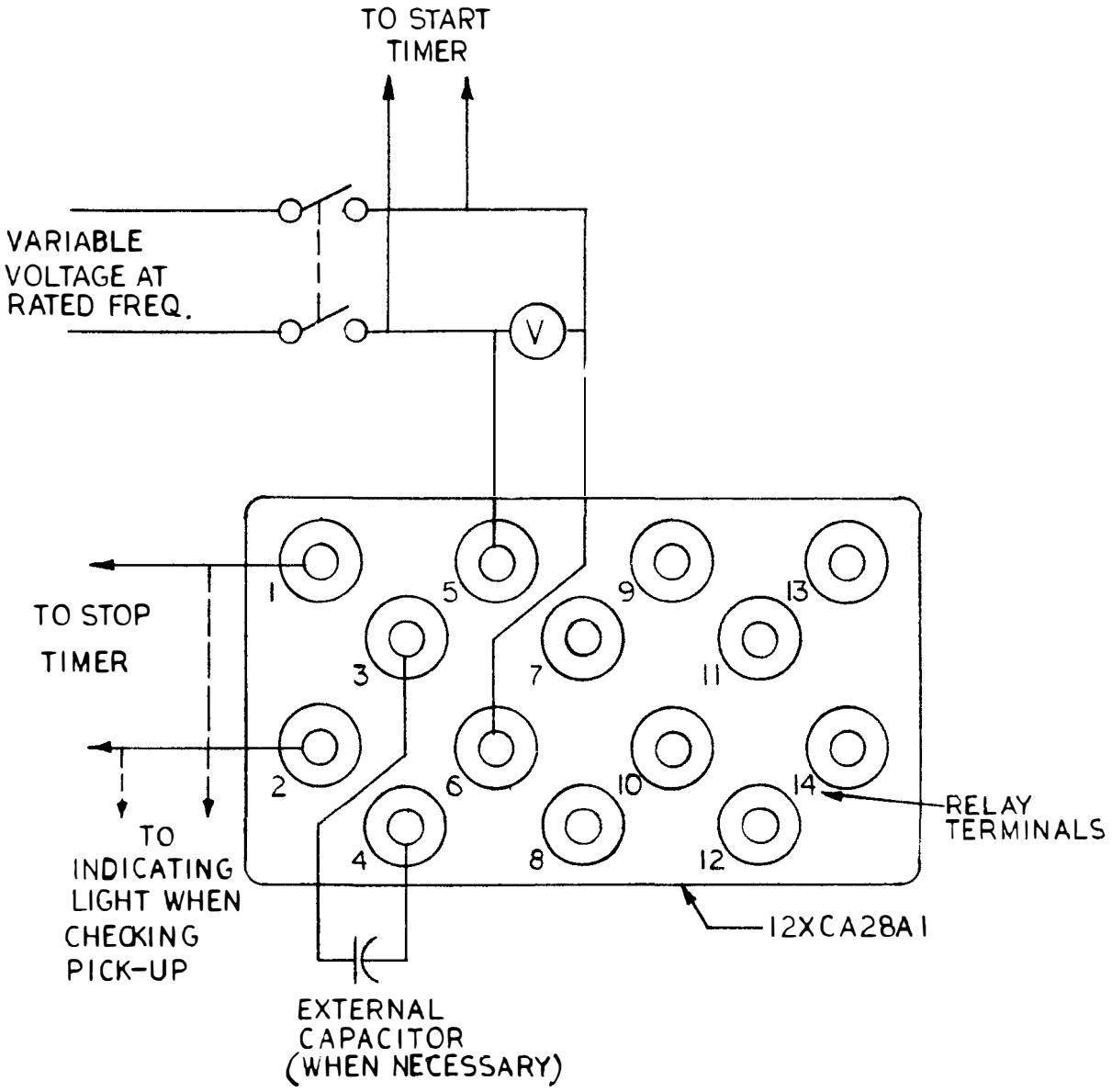


Figure 11 (0273A9078-1) Test Connections for Testing Pickup and Operating Times of the IFV Relay Time Overvoltage Unit

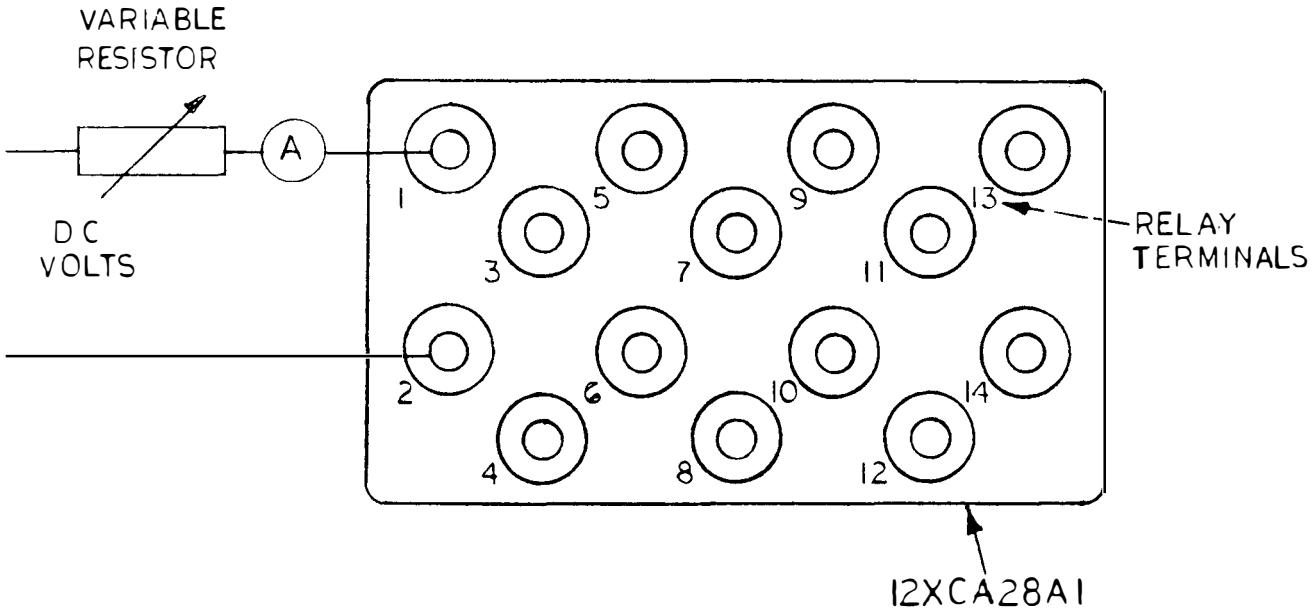


Figure 12 (0273A9079-0) Test Connections for Testing the High-Seismic Target and Seal-in Unit Used with the IFV Relay

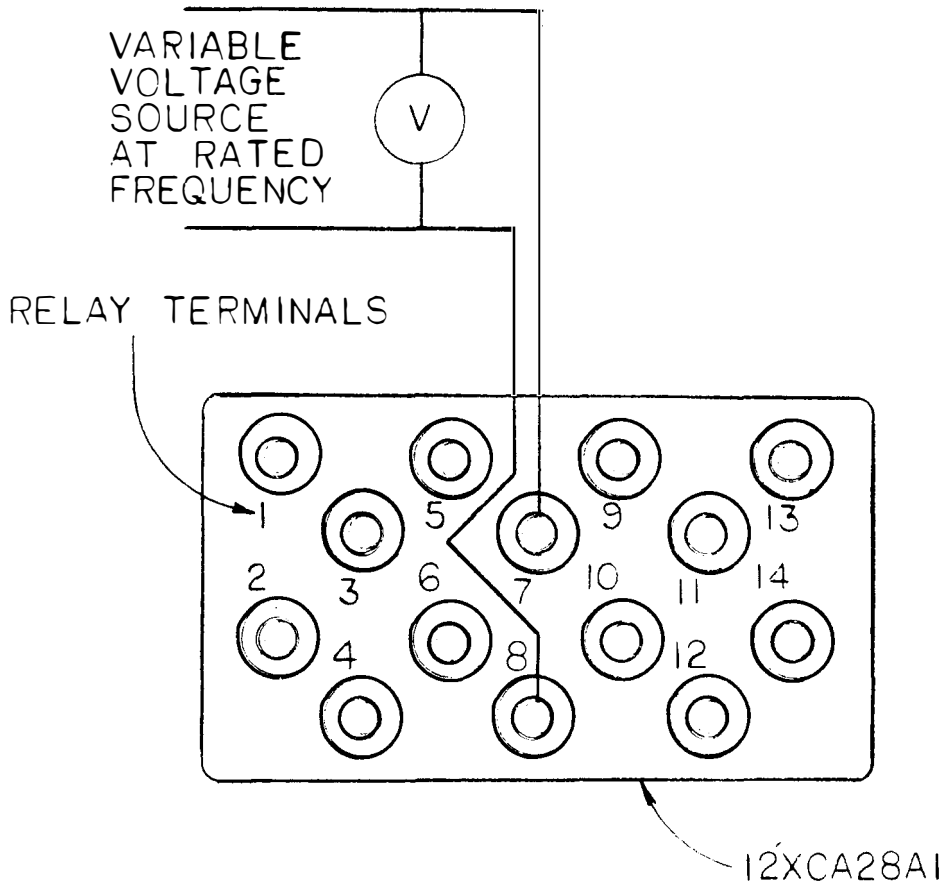


Figure 13 (0273A9193-0) Test Connections for Testing the High-Seismic Instantaneous Unit Used with the IFV Relay

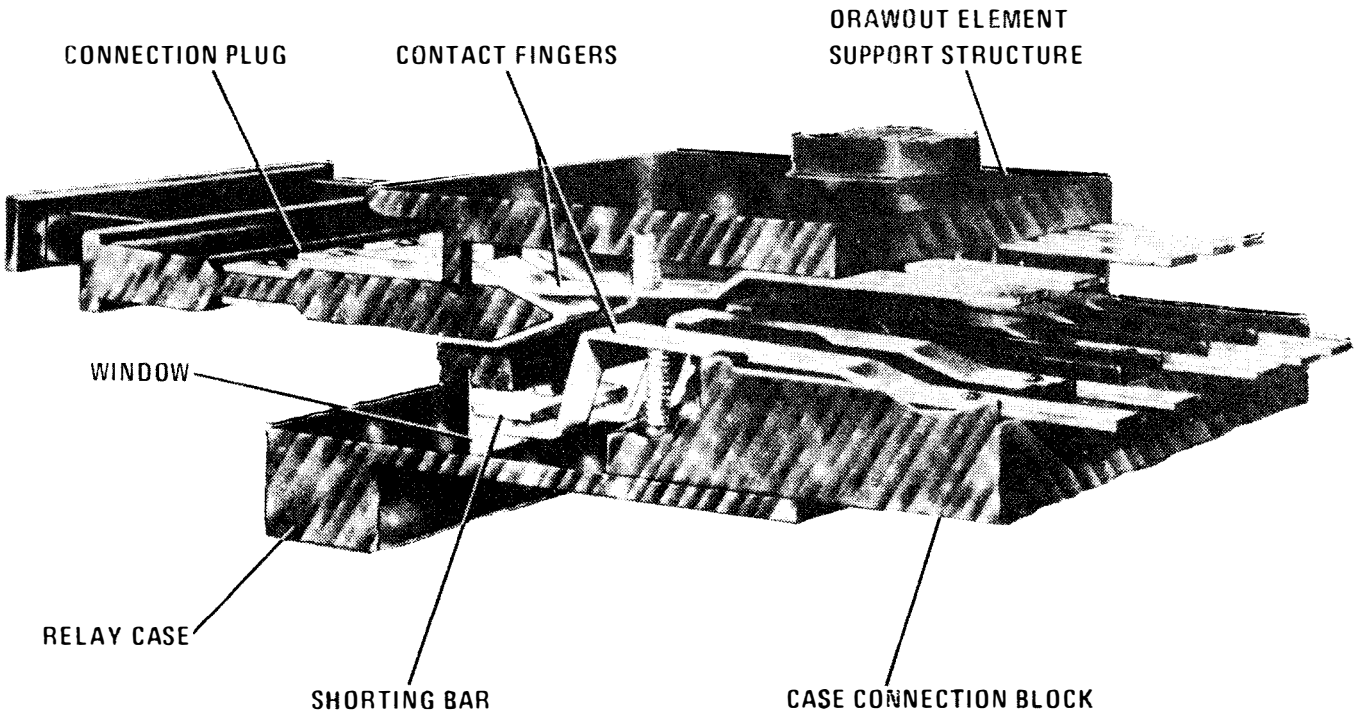


Figure 14 (8C42715) Cross Section of Drawout Case Connections

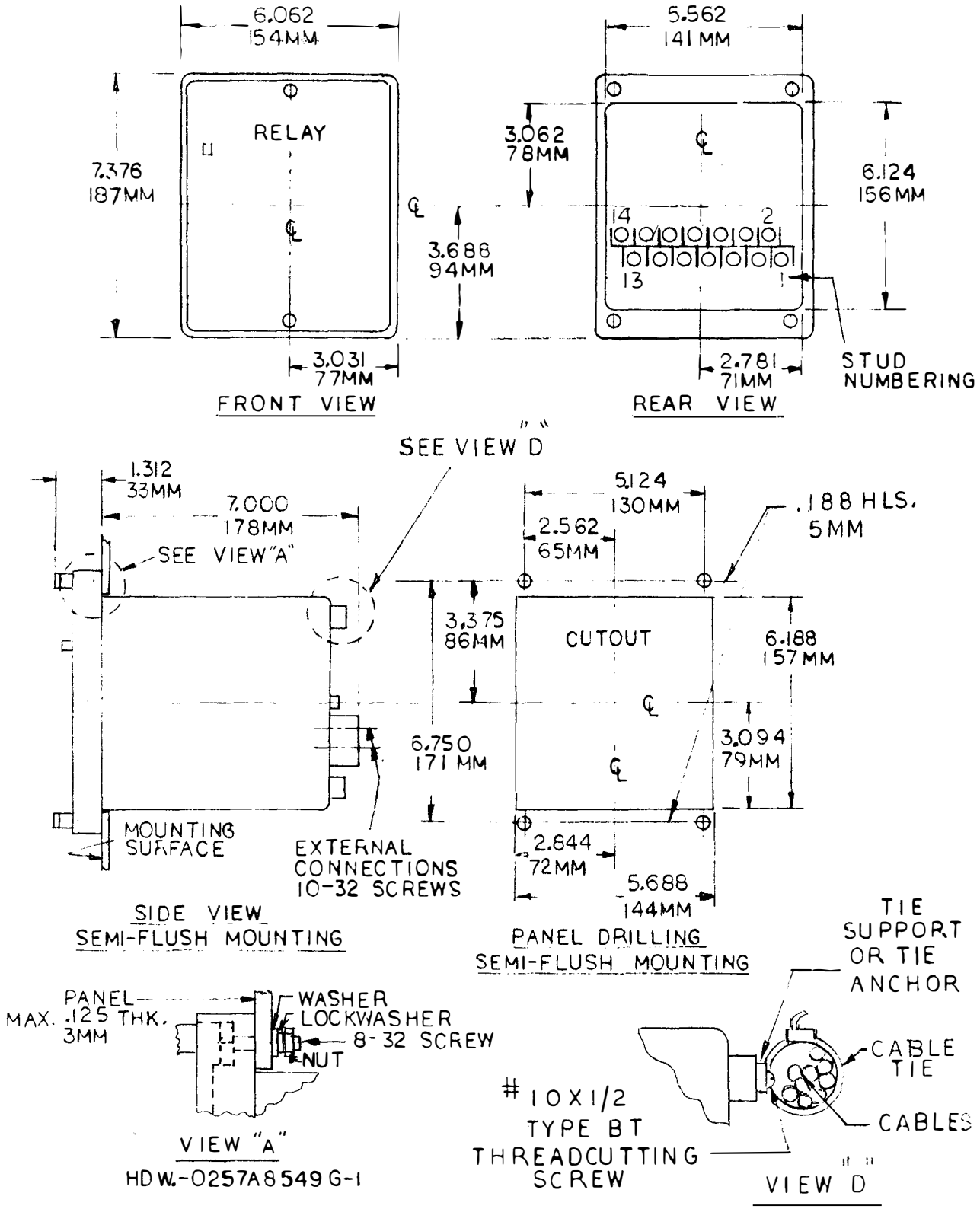


Figure 15 (0257A8452 Sh.1 -3) Outline and Panel Drilling for Relay Types IFV51AD, 71AD and 71BD

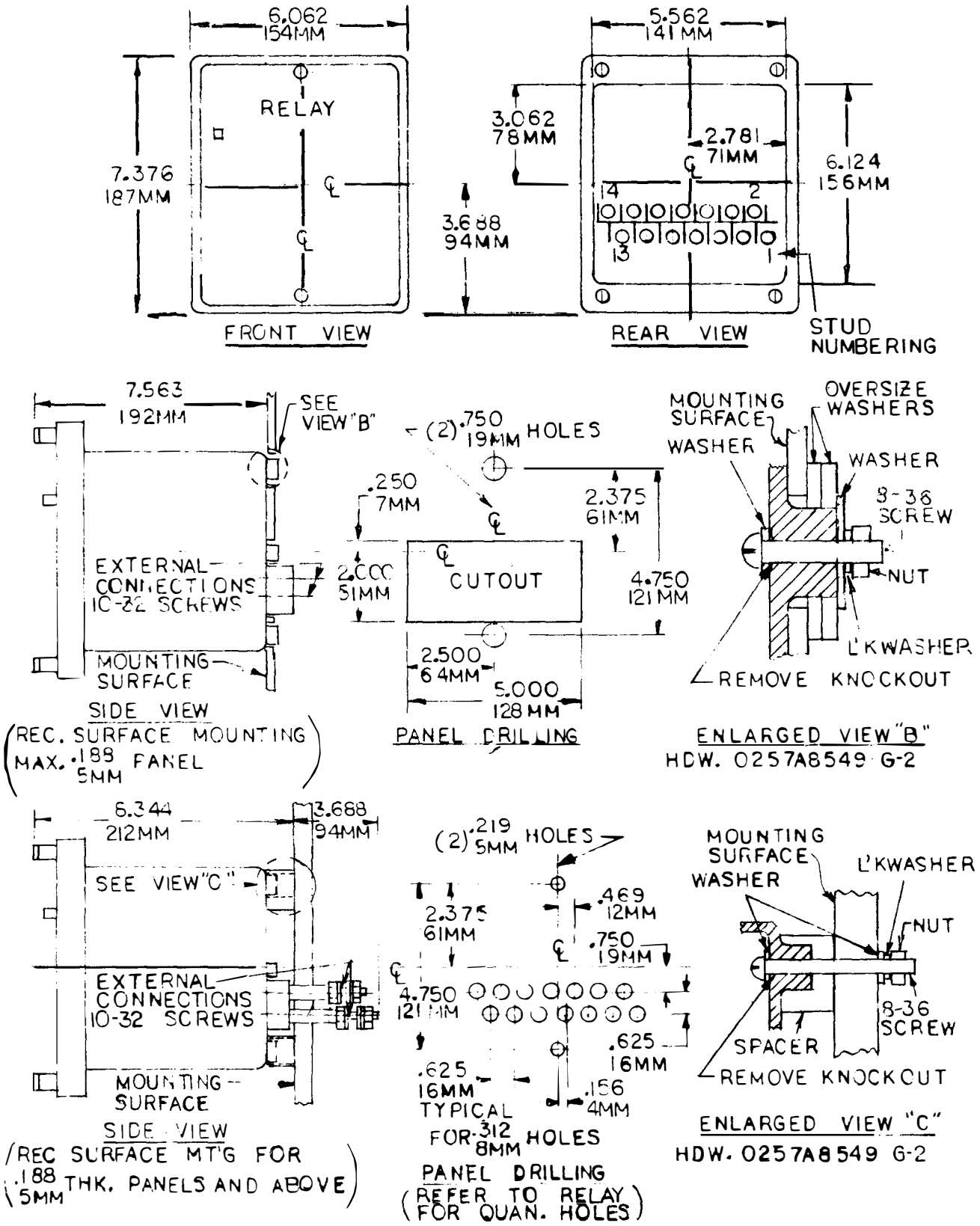


Figure 16 (0257A8452 Sh.2 -3) Outline and Panel Drilling
for Relay Types IFV51AD, 71AD and 71BD