Instructions

GEK-49886A
Supersedes GEK-49886

TIME OVERVOLTAGE RELAYS

TYPES

IFV51DD
IFV51KD

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TIME OVERVOLTAGE RELAYS

TYPES IFV51DD AND IFV51KD

DESCRIPTION

The IFV51DD and IFV51KD relays are single-phase overvoltage relays of induction disk construction that may be used to provide very sensitive protection for overvoltage conditions. Each relay is mounted in a standard C1 size case, the outline and panel drilling dimensions for which are given in Figs. 12 and 13. The internal connections for the relays are given in Figs. 3 and 4. Each of the relays is provided with a target and seal-in unit. One set of contacts from the seal-in unit is used for protection of the main contacts and control spring. A second electrically-separate set of seal-in contacts is made available for alarm or indication. Note that this second set of contacts is not suitable for tripping because they will close only after the seal-in function has operated. The characteristics for each of the relays are given in the Table I below.

* TABLE I

Characteristics			
Relay Type	Continuous Rating (Volts)	Pickup Range (Volts)	Internal Connections
IFV51DD	120** 208** 360	9.5 - 42 14.5 - 65 26 - 115	Fig. 3
IFV51KD	69**	5 - 22	Fig. 4

**Each relay will withstand 360 volts for 10 seconds.

APPLICATION

The IFV51DD and IFV51KD relays are sensitive, single-phase overvoltage relays with time-delay operating characteristics. They are applied mainly in ground-fault detection schemes used with resistance-grounded generators or on an ungrounded system.

The operate circuit for these relays is tuned to the fundamental frequency of the system (50 or 60 Hz). A capacitor is connected in series in the operate circuit to implement the tuning. This capacitor is mounted inside the case of the IFV51DD; it is supplied separately with each IFV51KD, for it must be mounted external to the case because of its large size. Because the

* Indicates revision

operate circuit is tuned, the pickup voltage at frequencies other than the fundamental will be higher than the pickup with voltage of fundamental frequency applied. The frequency-response curves for the IFV51 relays are shown in Fig. 7.

In applying these relays in schemes used for the detection of ground faults in generators grounded through high resistance, there may be a significant component of third harmonic voltage present at the relay. Because the response to the third harmonic voltage will be much higher than the response to voltage of fundamental frequency (see Fig. 7), the relay can be safely applied in generator ground-fault-detection schemes.

The external-connection diagram for the IFV51KD relay when used for sensitive generator-ground-fault detection is shown in Fig. 15. This is a typical protection scheme for a unit generator transformer using a distribution transformer connected in the neutral with a resistor across the transformer secondary. The IFV51KD relay is usually used for this application because it provides the very sensitive 5.0 volt pickup rating. This enables the relay to detect a ground fault within a few percent of the winding from the neutral. Since the power transformer and the station service transformer in a unit generator transformer scheme are both connected in delta on the generator side, coordination with other protection is easily implemented and the ground relay used can be very sensitive. Some time delay in relay operation is usually used to coordinate with fuses protecting against faults on the secondary side of potential transformers (PT's) that are normally connected to the generator terminals. The usual practice is to use these relays to trip the generator breaker and shut down the machine. If the relay is used only to sound an alarm when a ground fault is detected, the application should be reviewed to determine if the continuous voltage rating might be exceeded. If it is, steps should be taken to disconnect the relay before damage occurs.

The external-connection diagram for the IFV51DD relay for ground-fault detection on an ungrounded power system is shown in Fig. 14. The relay operates to detect the first ground fault that occurs on the system so that it can be removed before a second ground occurs, causing a double phase-to-ground fault, which requires a service interruption. Since the relay may be applied merely to sound an alarm in this application, it is necessary that it be continuously rated for the full broken delta voltage expected for a single phase-to-ground fault located right at the potential transformers, or some automatic means must be employed to disconnect the relay from the voltage supply.

When this fault occurs, it is equivalent to shorting out one phase of the primary of the potential transformer. The other two unfaulted phases of the PT primaries now have full phase-to-phase voltage applied, and their corresponding delta secondaries will be supplying $\sqrt{3}$ times their normal rated voltage. The broken delta equivalent voltage will be the sum of these two voltages, and for a ground fault right at the potential location, it will be equal to three times the normal delta phase-to-phase voltage.

The resistor shown in Fig. 14 connected across the broken delta secondary of the PT's, or alternatively connected in series in the primary neutral connection, is usually required to prevent the occurrence of ferro-resonance.

* Indicates revision

This phenomenon could occur due to the interaction of the PT inductance with the distributed capacitance-to-ground of the primary power system.

CONSTRUCTION

The IFV induction disk relays consist of a molded case, cover, support structure assembly, and a connection plug to make up the electrical connection. See Cover Figure and Figs. 1, 2, and 10. Figs. 1 and 2 show the induction unit mounted to the molded support structure. This disk is activated by a voltage-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 voltage. Its rotation is retarded by a permanent magnet mounted in a molded housing on the support structure.

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

The drawout connection/test system for the C1 case, shown in Fig. 10, has provisions for 14 connection points. 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. The connection plug then clears the voltage-circuit contact fingers on the case, and finally those on the relay support structure, to de-energize the drawout element completely.

There is a High-Seismic target and seal-in unit mounted on the front to the left of the shaft of the time overvolatge unit, see Fig. 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 overvoltage 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 that latches up and remains exposed until released by pressing a button located on the upper left side of the cover.

The High-Seismic target and seal-in unit has the letters "Hi-G" molded in its target block to distinguish it as a High-Seismic unit. The Seismic Fragility Level exceeds peak axial acceleration of 10g's (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, STD 501-1978.

RATINGS

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

TIME OVERVOLTAGE UNIT

The operating-circuit ratings and ranges available are shown in Table II. The relays will stand rated voltage continuously for all pickup settings.

TABLE II

Relay	Voltage Rating		Pickup Range	
	50 Hz	60 Hz	Min.	Max.
IFV51DD	120 208 360	120 208 360	10 15 27	40 65 112
IFV51KD	69	69	5.4	20

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

CONTACTS

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

BURDENS

Burdens for the IFV51DD and KD relays at rated voltage are given in Table IV.

TABLE IV

Relay	Voltage Rating	Frequency	Pickup Setting	Volt-Amps	Power Factor	Watts
IFV51DD	120	60	9.5	23.81	0.002	0.05
			20.0	22.40	0.43	9.63
			30.0	17.86	0.78	13.93
			40.0	14.39	0.94	13.53
	208	60	14.5	27.66	0.16	4.43
			31.0	25.75	0.63	16.22
			48.0	20.82	0.85	17.70
			65.0	16.52	0.94	15.53
	360	60	26.0	25.52	0.21	5.36
			55.0	23.83	0.64	15.25
			83.0	19.87	0.85	16.89
			115.0	15.50	0.95	14.73
IFV51KD	69	60	5.0	25.32	0.08	2.03
			10.0	23.18	0.59	13.68
			15.0	19.80	0.81	16.04
			20.0	16.35	0.92	15.04
* IFV51DD	120	50	9.5	19.9	0.002	0.04
			20.0	18.7	0.45	8.4
			30.0	14.9	0.81	12.1
			40.0	12.0	0.97	11.6
	208	50	14.5	23.05	0.15	3.46
			31.0	21.60	0.58	12.53
			48.0	17.78	0.84	14.94
			65.0	14.30	0.94	13.44
	360	50	26.0	19.8	0.23	4.55
			55.0	18.72	0.68	12.73
			83.0	15.85	0.87	13.79
			115.0	13.10	0.97	12.71
IFV51KD	69	50	5.0	21.39	0.04	0.86
			10.0	19.35	0.18	3.48
			15.0	16.40	0.46	7.54
			20.0	11.80	0.70	8.26

* Burdens for the IFV51DD and KD relays, with pickup voltage applied, are given in Table V for various pickup levels.

* Indicates revision

TABLE V

Relay	Voltage Rating	Frequency	Pickup Setting	Volt-Amps	Power Factor	Watts
IFV51DD	120	60	9.5	0.38	1.0	0.38
			20.0	0.79	1.0	0.79
			30.0	1.19	1.0	1.19
			40.0	1.58	1.0	1.58
	208	60	14.5	0.36	1.0	0.36
			31.0	0.76	1.0	0.76
			48.0	1.18	1.0	1.18
			65.0	1.60	1.0	1.60
	360	60	26.0	0.37	1.0	0.37
			55.0	0.78	1.0	0.78
			83.0	1.17	1.0	1.17
			115.0	1.62	1.0	1.62
IFV51KD	69	60	5.0	0.36	1.0	0.36
			10.0	0.72	1.0	0.72
			15.0	1.07	1.0	1.07
			20.0	1.42	1.0	1.42
* IFV51DD	120	50	9.5	0.34	1.0	0.34
			20.0	0.75	1.0	0.75
			30.0	1.09	1.0	1.09
			40.0	1.50	1.0	1.50
	208	50	14.5	0.33	1.0	0.33
			31.0	0.65	1.0	0.65
			48.0	1.03	1.0	1.03
			65.0	1.38	1.0	1.38
	360	50	26.0	0.31	1.0	0.31
			55.0	0.55	1.0	0.55
			83.0	0.82	1.0	0.82
			116.0	1.31	1.0	1.31
IFV51KD	69	50	5.0	0.28	1.0	0.28
			10.0	0.56	1.0	0.56
			15.0	0.85	1.0	0.85
			20.0	1.14	1.0	1.14

* Indicates revision

CHARACTERISTICS

TIME OVERVOLTAGE UNIT

Pickup is defined as the voltage required to close the contacts from the 0.5 time-dial position. Pickup-voltage settings are made by means of a potentiometer mounted to the front right of the relay. Pickup settings are continuously adjustable over the ranges stated in the RATINGS section.

The relay has contacts that close when the voltage increases to the pickup setting. The time delay in closing the contacts is determined by the setting of the time dial at the top of the shaft. The relay has a capacitor and potentiometer connected in series with the operating coil. The capacitor is added to tune the circuit, providing a low pickup voltage at rated frequency. At rated voltage the U-magnet is highly saturated, increasing the impedance of the circuit, thus limiting the current to a safe value.

The difference between the IFV51DD and IFV51KD is that the latter has an external capacitor. Figs. 5 and 6 show the various time-voltage characteristics for the IFV relays.

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 Fig. 1.

RECEIVING, HANDLING AND STORAGE

These relays, when not included as a part of a control panel, will be shipped in cartons designed to protect them against damage. Immediately upon receipt of a relay, examine it for any damage sustained in transit. If injury or damage resulting from rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Sales Office.

Reasonable care should be exercised in unpacking the relay in order that none of the parts are injured nor the adjustments disturbed.

If the relays are not to be installed immediately, they should be stored in their original cartons in a place that is free from moisture, dust, and metallic chips. Foreign matter collected on the outside may find its way inside when the cover is removed and cause trouble in the operation of the relay.

ACCEPTANCE TESTS

Immediately upon receipt of the relay an INSPECTION AND ACCEPTANCE TEST should be made to 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.

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.

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

VISUAL INSPECTION

Check the nameplate to make sure that the model number and rating of the relay agree with the requistion.

Remove the relay from its case and check that there are no broken or cracked parts or any other signs of physical damage.

MECHANICAL INSPECTION

1. There should be no noticeable friction when the disk is rotated slowly clockwise. The disk should return by itself to its rest position.

2. Make sure the control spring is not deformed nor its convolutions tangled or touching.

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

5. Make sure that the brushes agree with the internal connection diagram, Figs. 3 and 4.

6. **CAUTION: Should there be a need to tighten any screws, DO NOT OVER TIGHTEN, 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-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 relays properly it is essential to use a sine wave of current and/or voltage. The purity of the sine wave (ie., 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 especially affected by non-sinusoidal waveforms.

Similarly, relays requiring DC control power should be tested using direct current 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 No.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 pickup of the time overvoltage unit is adjusted by means of a spring-adjusting ring, see Fig 1. The potentiometer must be in the full counterclockwise position for minimum pickup. The spring-adjusting 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 minimum pickup setting as stated in the RATINGS section. Turning the potentiometer clockwise provides a continuous pickup selection over the ranges stated in the RATINGS section.

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. 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 to the 0.5 time-dial position and the potentiometer to the maximum counterclockwise position (minimum pickup). Using the test connections in Fig. 8, slowly increase the voltage. The contacts should close within ± 4% of the minimum pickup as stated in the RATINGS section.

Set the potentiometer to the maximum clockwise position (maximum pickup). Pickup should be equal to or greater than the maximum pickup as stated in the RATINGS section.

Time Test

Set the relay to the No.5 time-dial position and pickup for minimum (potentiomater full counterclockwise). Apply six (6) times minimum pickup voltage to the relay. The relay operating time for the time overvoltage unit to close its contact should be between 2.3 and 2.5 seconds.

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 undersired tap and place it on the left-hand stationary contact where the first screw was removed. See Fig. 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 Fig. 9) to a DC source, ammeter and load box so that the current can be controlled over a range of 0.1 to 2.0 amperes.

2. Turn the time dial to the ZERO time-dial position.

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

4. Move the time dial away from the ZERO time-dial position; the seal-in unit should remain in the picked up position.

5. Decrease the current slowly until the seal-in drops out. See Table VI.

TABLE VI

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 drillings are shown in Figs. 12 and 13. Fig. 12 shows the semi-flush mounting and Fig. 13 shows various methods of surface mounting.

The internal connection diagrams for the relays are shown in Figs. 3 and 4. Typical external connections are shown in Figs. 14 and 15.

INSTALLATION TESTS

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

Time Overvoltage Unit

Set the time dial to the 0.5 position. If other than minimum pickup is desired, adjust the potentiometer to the desired pickup, using the test circuit in Fig. 8.

Check the operating time at some multiple of pickup setting. This multiple is 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 the pickup and dropout tests as outlined in the ACCEPTANCE TEST 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 this manual.

TIME OVERVOLTAGE UNIT

1. Perform pickup test as described in the INSTALLATION section.
2. Perform the time test 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 VI.

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 delicated that no scratches are left, yet it will clean off any corrosion thoroughly and rapidly. Its flexibility ensures the cleaning of the actual points of contact. Do not use knives, files, abrasive paper or cloth of any kind to clean relay contacts.

SYSTEM TEST

Although this instruction book is primarily written to check and set the 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 maybe 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 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 pickup of the time overvoltage unit is adjusted by means of a spring-adjusting ring, see Fig. 1. The potentiometer must be in the full counterclockwise position for minimum pickup. The spring-adjusting 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 minimum pickup setting as stated in the RATINGS section. Turning the potentiometer clockwise provides a continuous pickup selection over the ranges stated in the RATINGS 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 pickup for minimum (potentiometer fully counterclockwise). Apply six (6) times minimum pickup voltage to the relay.

Adjust the position of the drag magnet assembly to adjust the time delay as near as possible to 2.40 seconds, but at least between 2.35 to 2.45 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 Fig. 1. Moving the drag magnet towards the disk and shaft decreases the operating time and moving the drag magnet away from the disk and shaft increases the operating time. The screws securing the drag magnet assembly to the support structure must be tight before proceeding with other time checks.

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 way the disk must be aligned to clear all gap surfaces by 0.010 inch.

2. Remove the drag magnet assembly by loosening the two screws securing it to the support structure. The screws need not be removed.

3. Loosen the upper-pivot bearing **set** screw (1/16 inch hex wrench) slightly, so the upper pivot can move freely. Do not remove the set screw from the support structure.

4. Loosen the jewel bearing **set** screw on the bottom of the support structure, as in 3 above.

5. Apply a slight downward finger pressure on the upper pivot and turn the jewel-bearing screw, from the underside of the support structure, to position the disk as determined in 1 above.

6. Turn the jewel-bearing screw 1/8 turn clockwise and tighten the upper-pivot **set** screw to 2.5-3.5 inch pounds of torque.

7. Turn the jewel-bearing screw 1/8 turn counterclockwise. This will lower the disk and shaft assembly approximately 0.005 inch and permit proper end-play. The shaft must have 0.005-0.010 inch of end-play.

8. Tighten the jewel-bearing **set** screw to 2.5-3.5 inch pounds of torque.

9. Rotate the disk through the electromagnet gap. The disk should clear the gap surfaces by 0.010 inch and be within 0.005 inch flatness. If the disk is not within 0.005 inch flatness the disk should be replaced.

10. Reinstall the drag magnet assembly and check that the disk has at least 0.010 inch clearance from the drag magnet assembly surfaces.

11. After securely seating the assembly and positioning it according to the time test above, tighten the drag-magnet-assembly mounting screws with 7-10 inch pounds of torque,

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 ± 0.002 feeler gage and the right contact with a 0.010 ± 0.002 feeler gage.

CAUTION

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

RENEWAL PARTS

It is recommended that sufficient quantities of renewal parts be carried in stock to enable the prompt replacement of any that are worn, broken or damaged.

When ordering renewal parts, address the nearest Sales Office of the General Electric Company, and specify quantity required, name of the part wanted, and the complete model number of the relay for which the part is required.

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14	External Connections - IFV51DD	31
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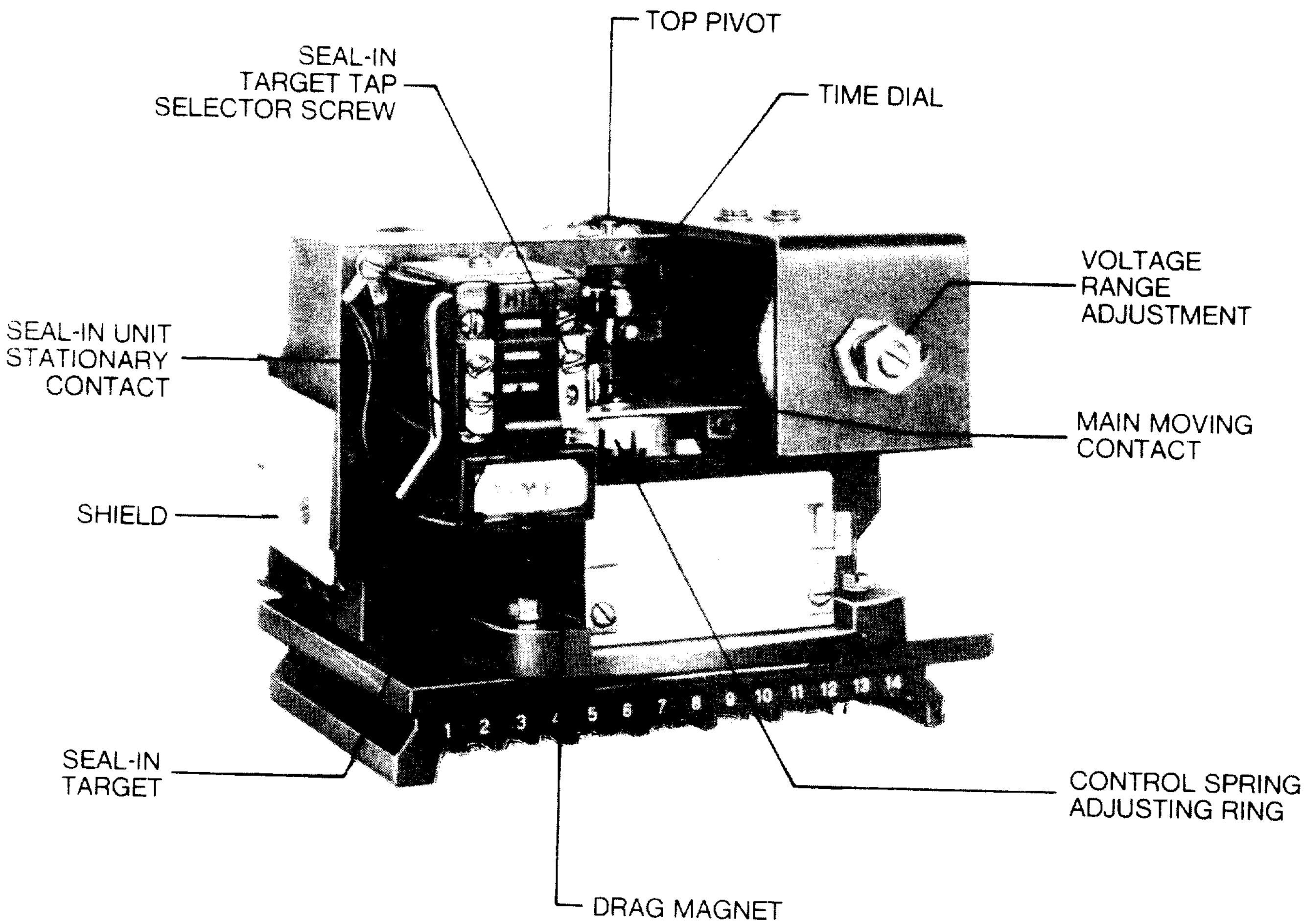

Fig. 1 (8043450) Type IFV51DD Relay, Removed from Case, Front View

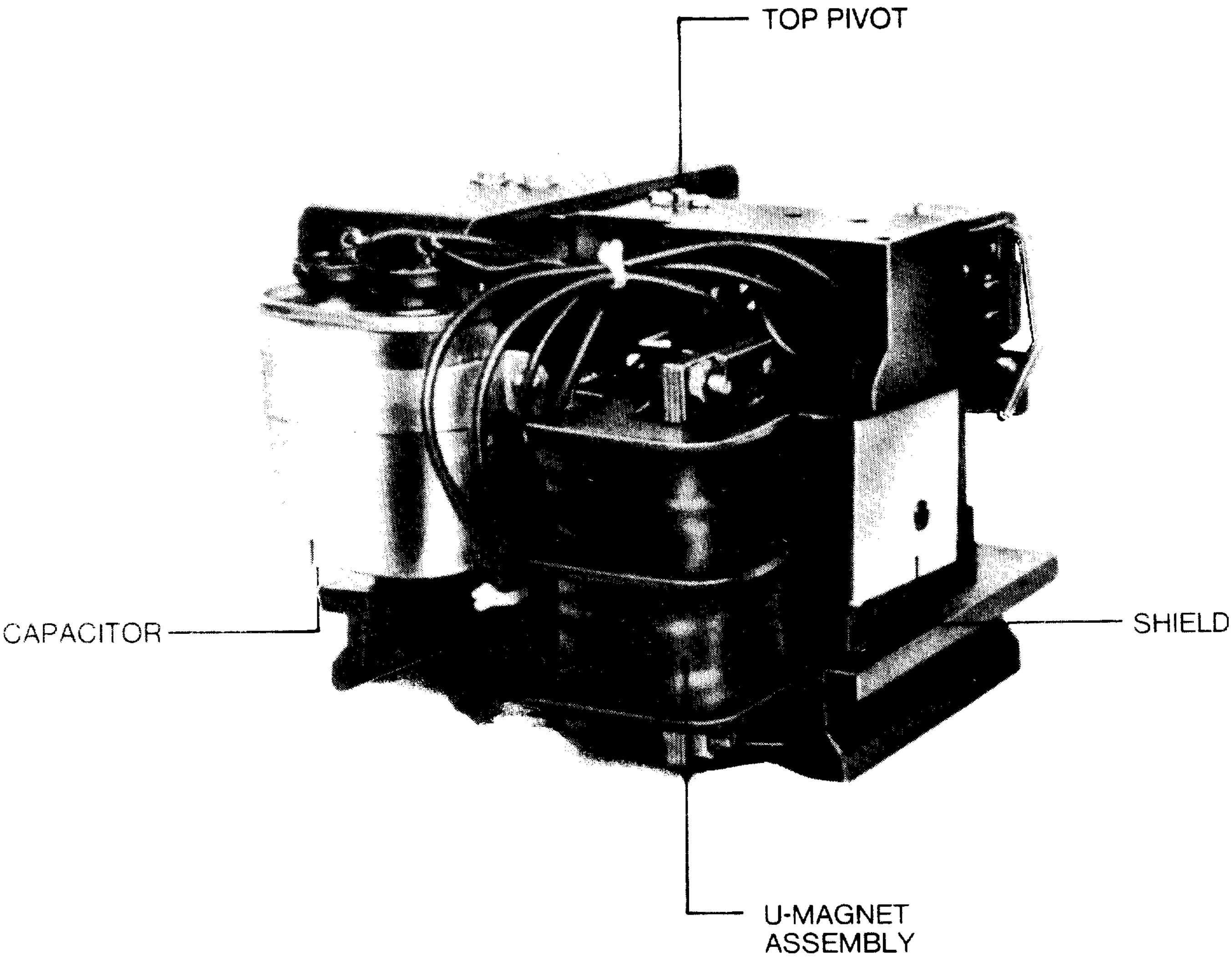

Fig. 2 (8043451) Type IFV51DD Relay, Removed from Case, Rear View

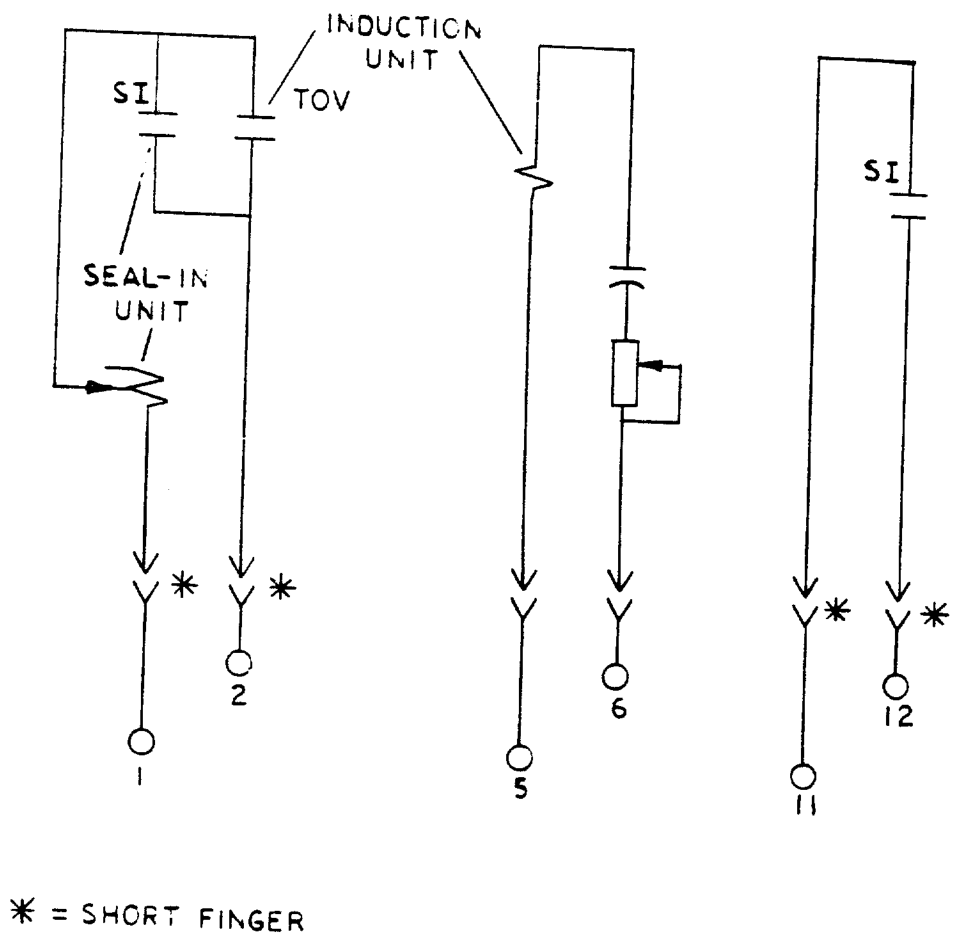

Fig. 3 (0275A2027-0) Internal Connections for Relay Type IFV51DD - Front View

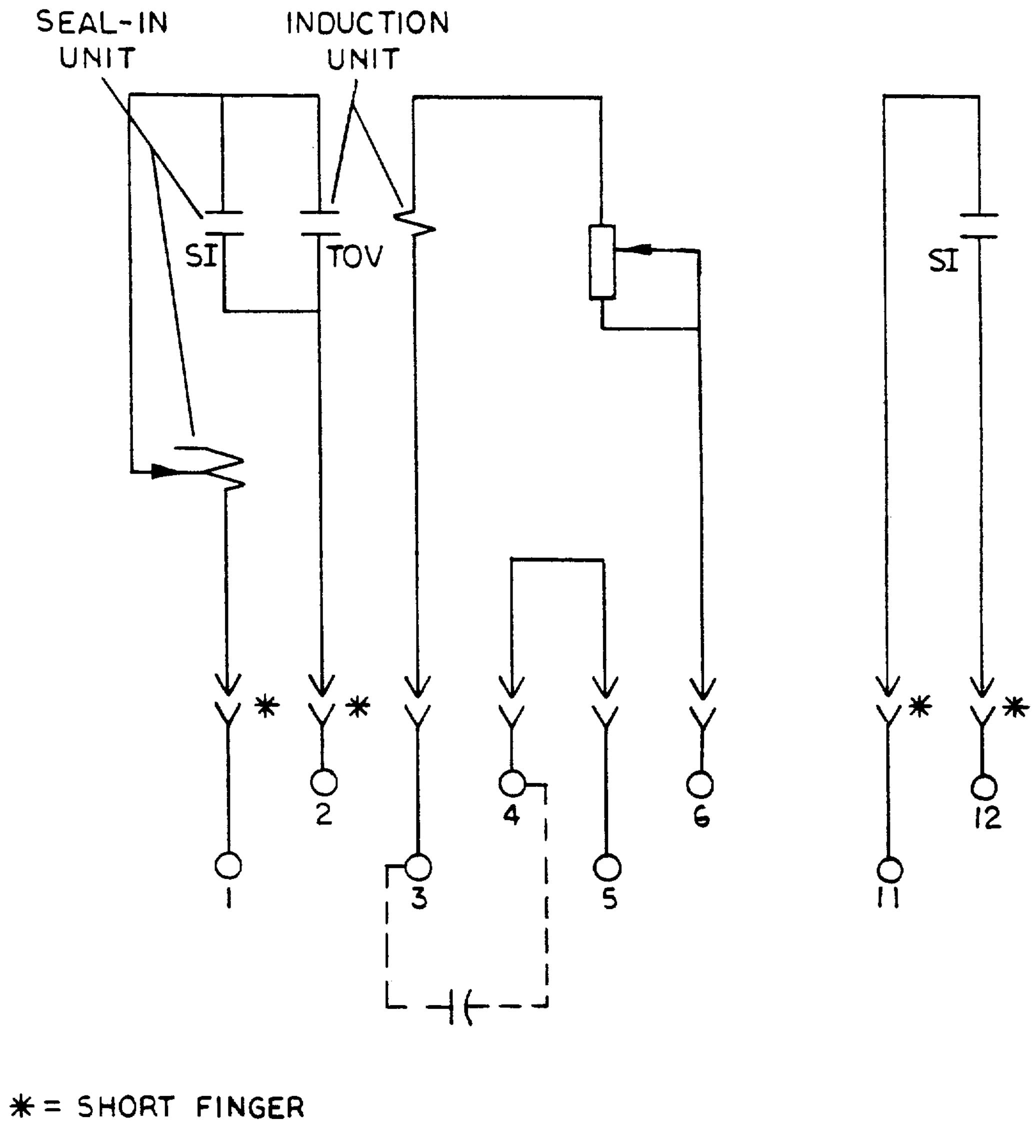

Fig. 4 (0275A2028-0) Internal Connections for Relay Type IFV51KD - Front View

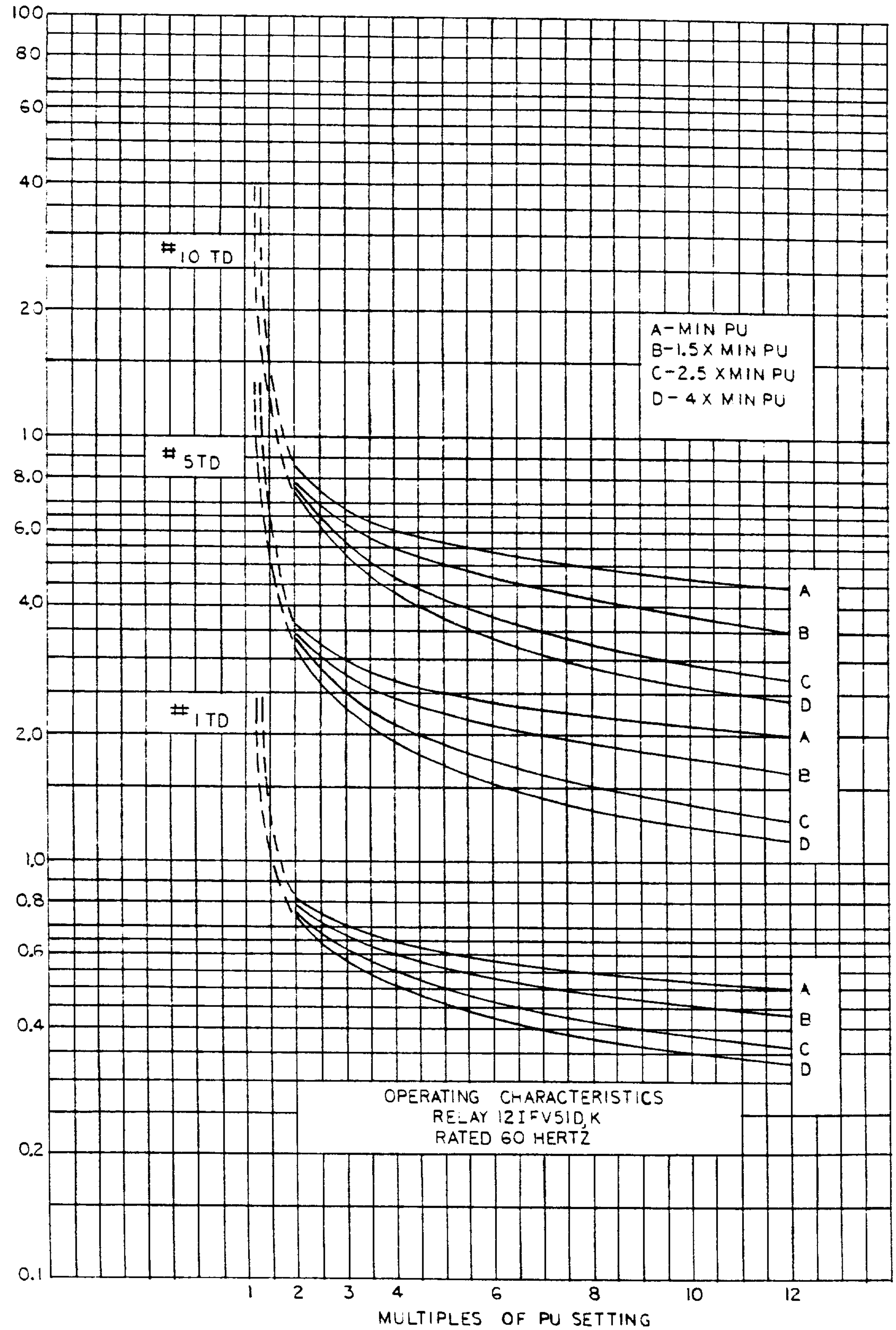

Fig. 5 (0273A9519-0) 60 Hertz Time-voltage Characteristics for Relay Types IFV51DD and IFV51KD

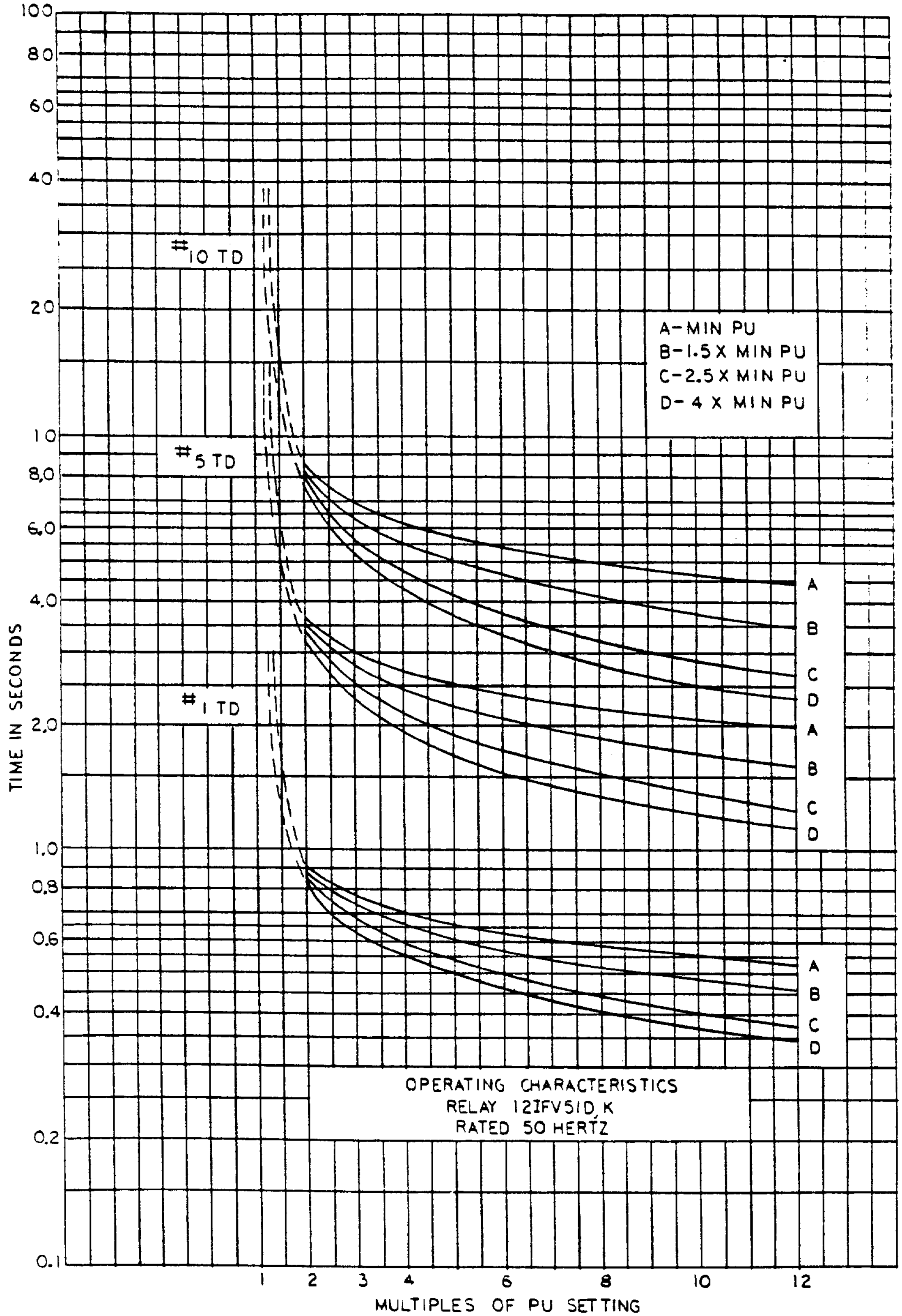

Fig. 6 (0273A9520-0) 50 Hertz Time-voltage Characteristics for Relay Types IFV51DD and IFV51KD

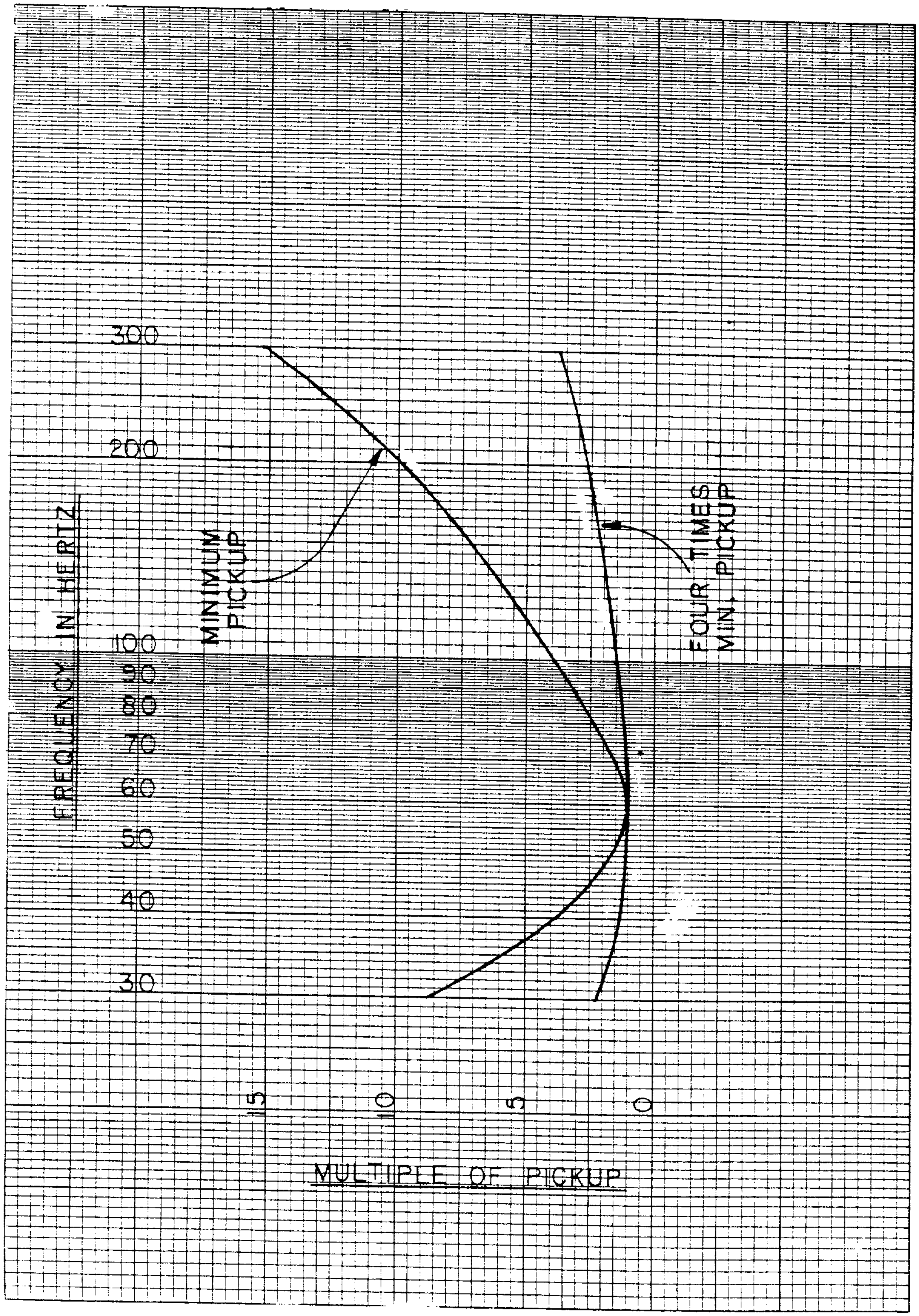

Fig. 7 (0273A9500-0) Pickup-Versus-Frequency Characteristics for IFV51DD and IFV51KD Relays

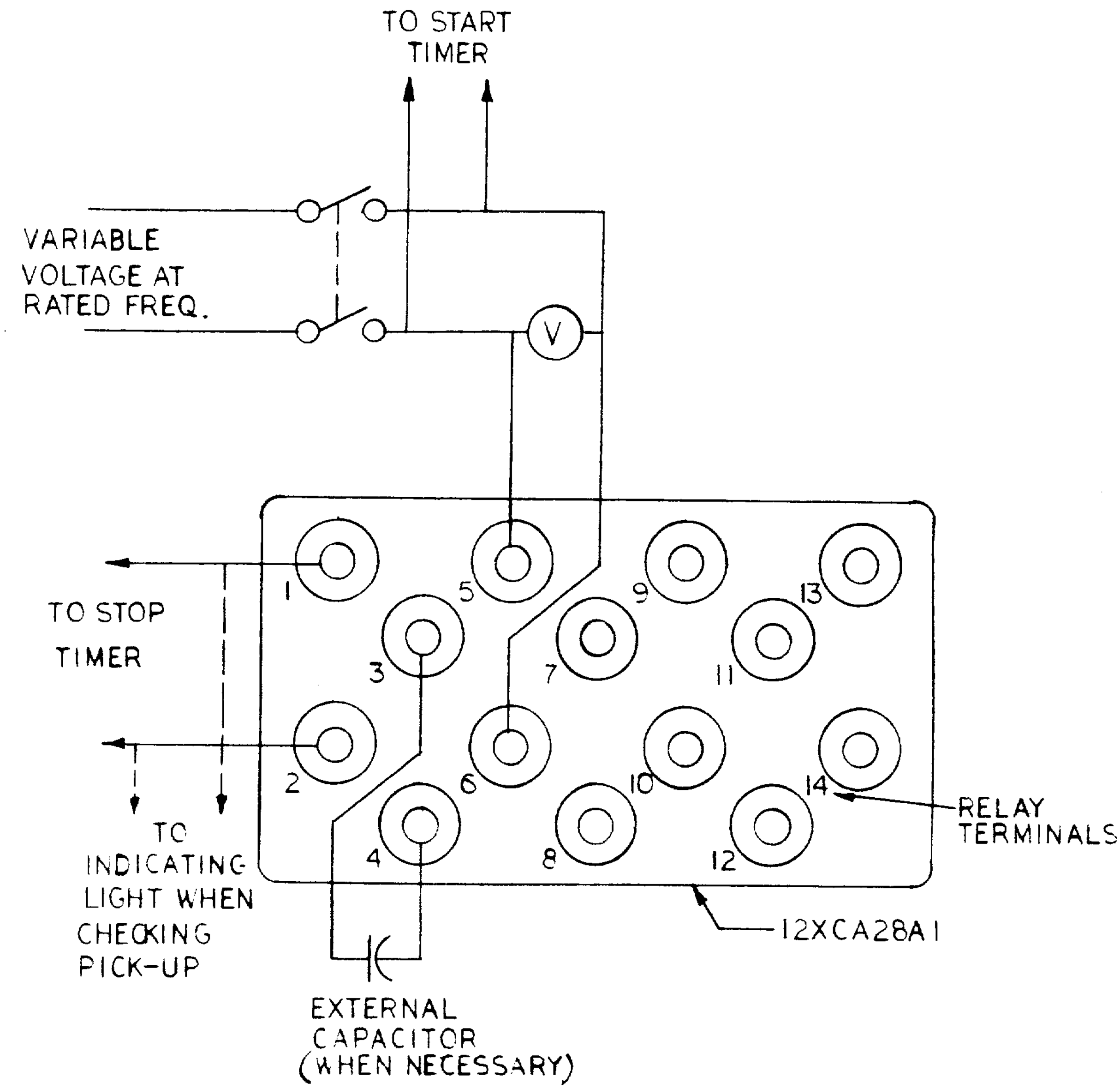

Fig. 8 (0273A9078-1) Test Connections for Testing Pickup and Operating Times of the IFV Relay Time Overvoltage Unit

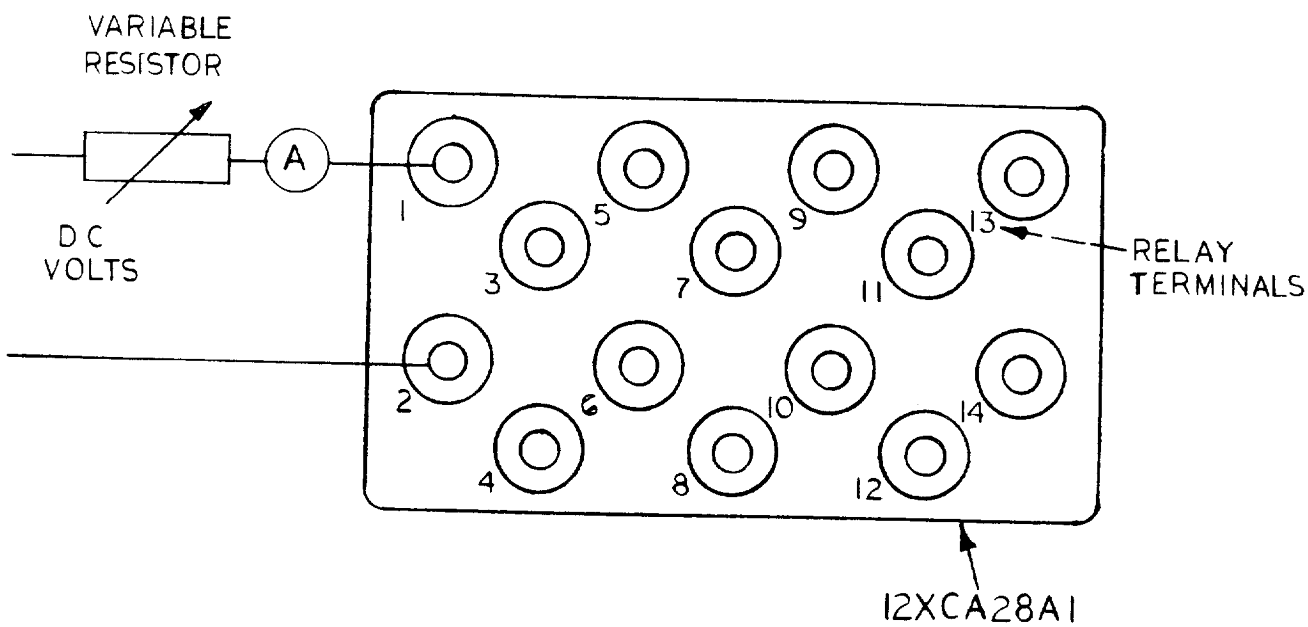

Fig. 9 (0273A9079-0) Test Connections for Testing the High-Seismic Target and Seal-in Unit Used with the IFV Relay

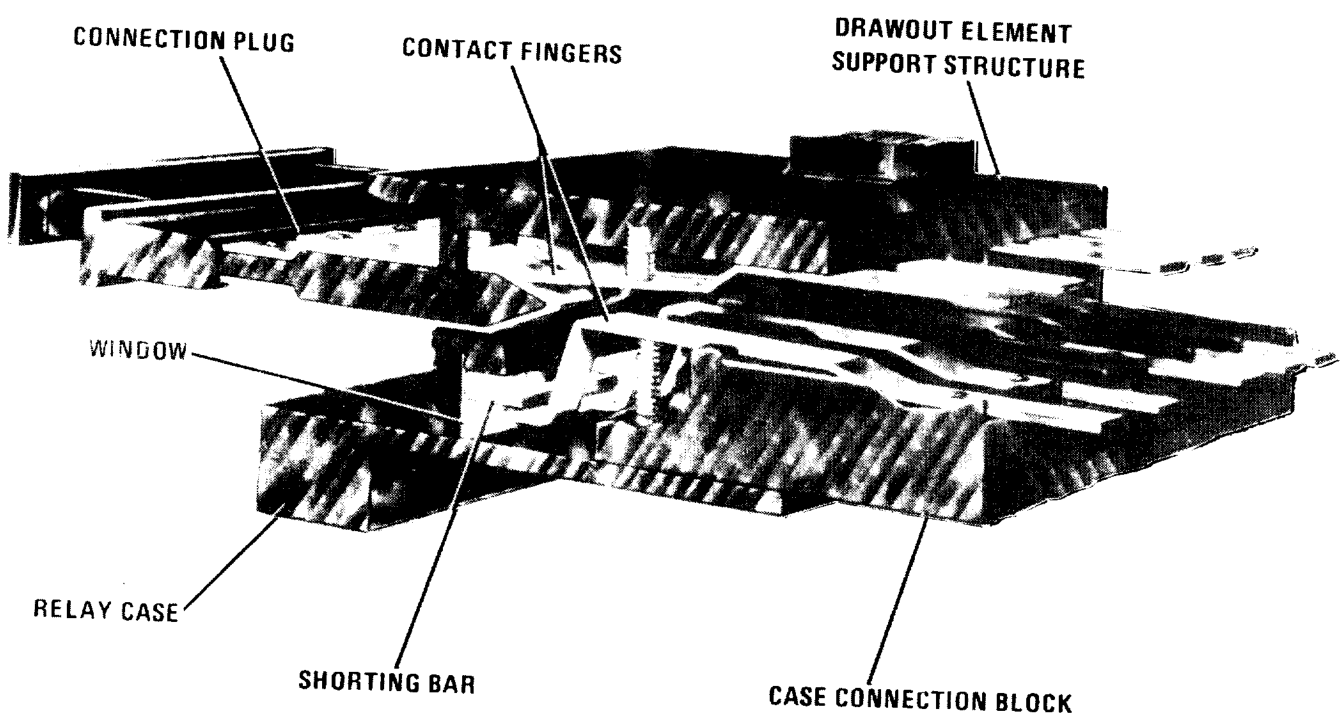

Fig. 10 (8042715) Cross Section of Drawout-Case Connections

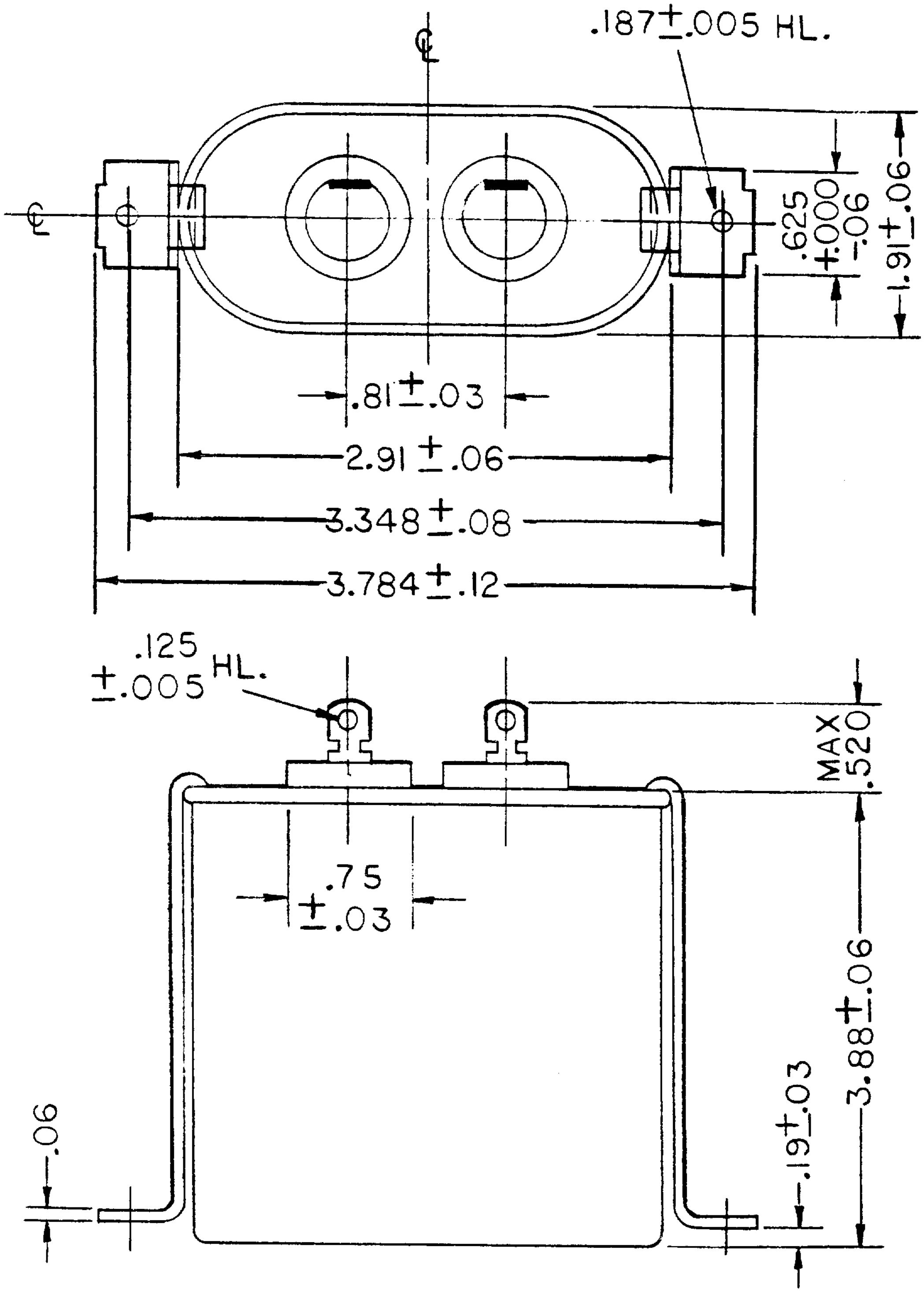

Fig. 11 (0273A9192-0) Outline of IFV51KD External Capacitor

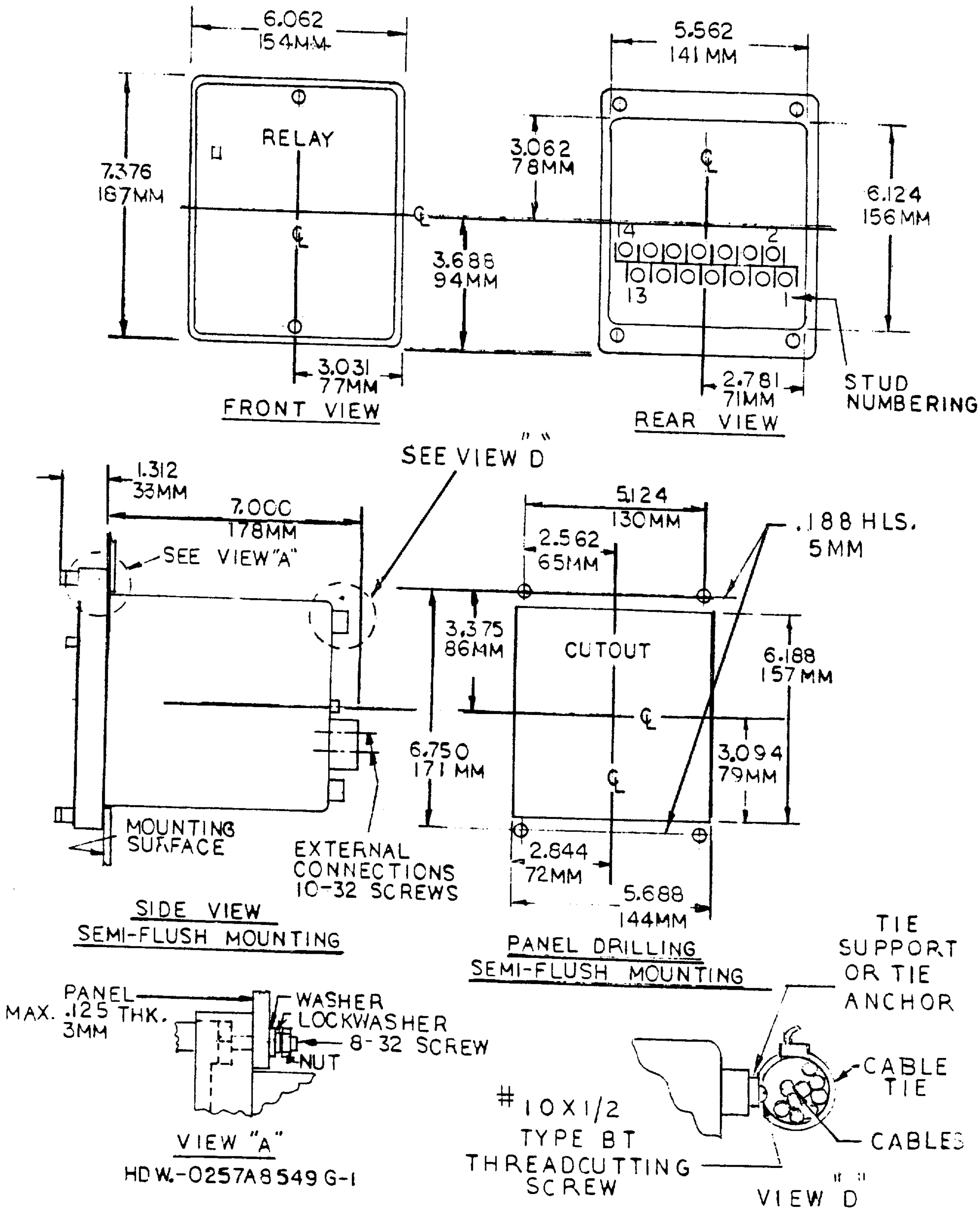

Fig. 12 (0257A8452, Sheet 1, 3) Outline and Panel Drilling for Relay Types IFV51DD and IFV51KD

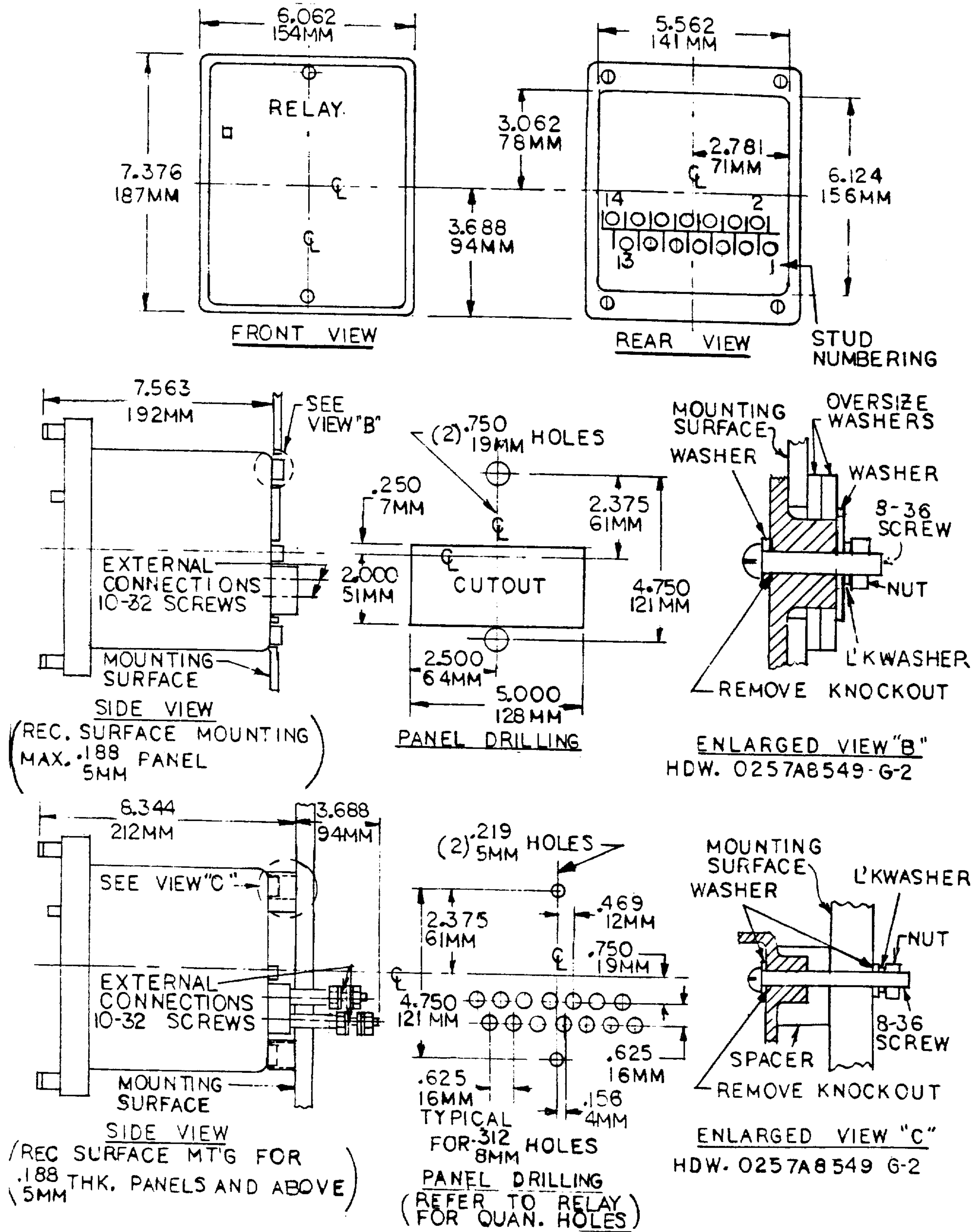

Fig. 13 (0257A8452, Sheet 2 3) Outline and Panel Drilling for Relay Types IFV51DD and IFV51KD

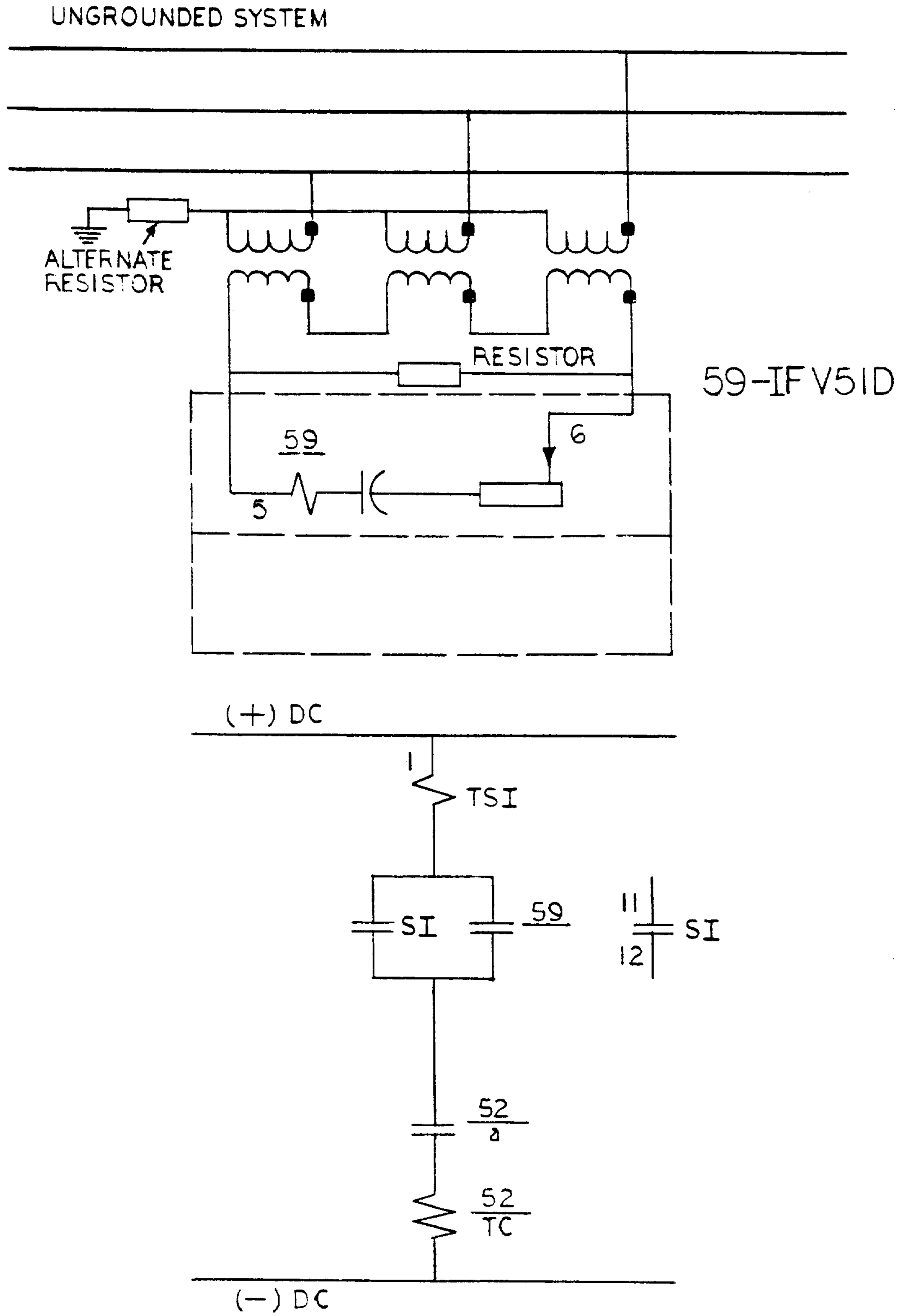

Fig. 14 (0275A2089-0) Typical External Connections for IFV51DD Relay

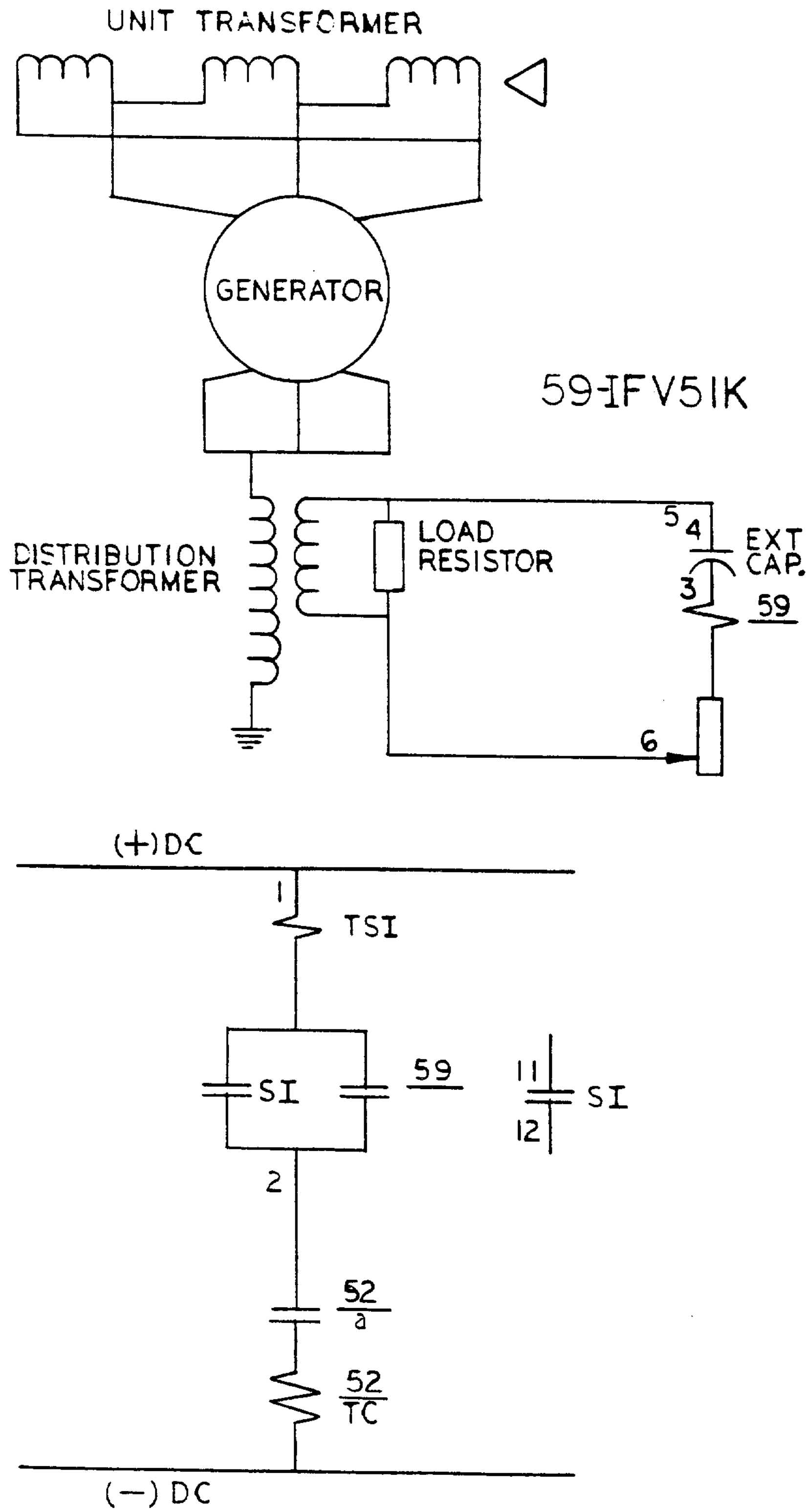

Fig. 15 (0275A2090-0) Typical External Connections for IFV51KD Relay

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