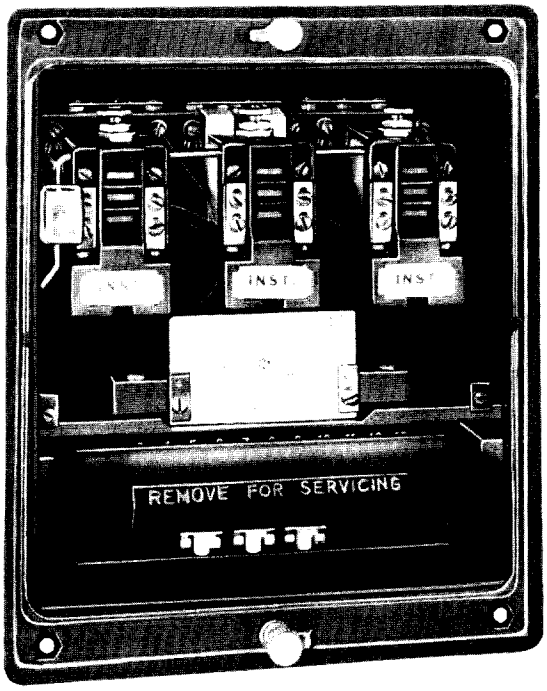
INSTRUCTIONS

INSTANTANEOUS OVERCURRENT RELAYS

TYPES:

HFC21B, HFC22B, HFC23C



GE Protection and Control
205 Great Valley Parkway
Malvern, PA 19355-1337

CONTENTS

(Cover Photo 8043211)

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DESCRIPTION

The Type HFC relays covered by this instruction book consist of one or more hinged armature instantaneous overcurrent units, each with two electrically separate contacts, assembled in a type C1 single end drawout case. The units have a hi-seismic rating and are identified by the letters "Hi-G" molded into the target block. Each unit includes a target button, which is raised into view and latched, when the unit picks up. The targets are manually reset by a button on the front of the relay cover.

The various relay types differ only in the number of units included in the case, as tabulated below:

RELAY TYPE	NUMBER OF UNITS
HFC21B	1
HFC22B	2
HFC23C	3

APPLICATION

The Type HFC relays are generally applied where a direct trip instantaneous overcurrent function is required. Typical applications are on transmission lines to supplement existing distance relays, or pilot schemes, with instantaneous overcurrent relays set to detect severe close-in faults; or in the distribution area, in combination with time overcurrent relays, and an automatic reclosing scheme, to provide coordination with branch fuses. When determining the pickup setting of the instantaneous units in these applications, their transient overreach characteristic (shown in Figure 7) must be considered. The percent transient overreach must be applied to proportionately increase the calculated pickup setting so that the instantaneous units will not overreach a downstream device, thereby causing loss of coordination in the system protection scheme.

The Type HFC21B can be applied with a doughnut-type current transformer encircling the three phase conductors (ground sensor scheme), to provide sensitive ground fault protection.

The Type HFC23C relay can be used to provide differential protection of a motor, usually by means of the self-balancd primary current scheme shown in Figure 6. With the current transformers mounted at the machine terminals, as indicated in this figure, the cables between the circuit breaker and the machine are not included in the differential zone. Therefore, the switchgear equipment should include some form of overcurrent relaying, operating from current transformers located at the circuit breakers, for protection of these cables.

CONSTRUCTION

The Type HFC relays consist of a molded case, cover, support structure assembly and a connection plug to make up the electrical connection. See cover figure, and Figures 1, 2 and 12.

The drawout connection/test system for the C1 case, shown in Figure 11, has provisions for 14 connection points, and a visible CT shorting bar located in the front. As the connection plug is withdrawn, it clears the shorter contact brushes in the output contact circuits first. Thus, the trip circuit is opened before any other circuits are disconnected. Next, the current circuit brushes on the case connection block engage the shorting bar (located at the lower front of the case) to short circit external current transformer secondary connections. The window provides visual confirmation of CT shorting. The connection plug then clears the current circuit contact brushes on the case, and finally those on the relay support structure, to completely de-energize the drawout element.

The instantaneous unit is a small hinged or armature type unit, with two electrically separate contacts mounted on the support structure. When the instantaneous unit picks up, it raises a target which latches up and remains exposed until it is released by pressing a button, located on the upper left side of the cover.

The instantaneous unit has the letters "Hi-G" molded into the target block to distinguish it as a hi-seismic unit. The seismic fragility level exceeds peak axial acceleration of 10 g's (4 g ZPA) when tested using a biaxial multi-frequency input motion to produce a required response spectra (RRS) in accordance with the Standard for Seismic Testing of Relays, ANSI 37.98-1978.

RATINGS

The relays are designed for operation in an ambient air temperatures from minus 20°C to plus 55°C. Ranges are shown in Table 1.

TABLE 1

Relay	Frequency (Hertz)	Current Range (Amperes)
HFC21B HFC22B HFC23C	50/60	0.5-4 and 2-50

The instantaneous units have a tapped coil for operation on either one or two ranges, HIGH (H) or LOW (L). Selection of the HIGH or LOW range is determined by the position of the link located on the top of the support structure (see Figure 1 and Table 2).

TABLE 2

Hi-Seismic Instantaneous Unit (Amps)	Link Position	**Range (Amps)	Continuous Rating (Amps)	***One Second Rating (Amps)	K
0.5 - 4	L H	0.5 - 2 2 - 4	0.75 1.5	94	8,836
2 - 50	L H	2 - 10 10 - 50	3.7 7.5	130	16,900

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

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

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

CONTACTS

The contacts will carry 30 amperes trip current.

BURDENS

The hi-seismic instantaneous unit burdens are listed in Table 3.

CHARACTERISTICS

The instantaneous units have either a 25 to 1 or an 8 to 1 range with a tapped coil. There are high and low ranges, selected by means of links located on the top of the support structure (see Figure 1). The time current curve for the instantaneous units is shown in Figure 8.

TABLE 3

Hi-Seismic Inst. Unit (Amps)	Hz	Link Position	Range (Amps)	Minimum Pickup (Amps)	Burden at Minimum Pickup (Ohms)			Burden in Ohms (Z) Times Pickup		
					R	JX	Z	3	10	20
0.5-4	60	L H	0.5 - 2 2 - 4	0.5 2	10.63 5.13	9.77 3.49	14.44 6.21	9.81 4.66	8.56 4.26	7.80 4.18
2-50	60	L H	2 - 10 10 - 50	2 10	0.750 0.070	0.650 0.024	0.992 0.074	0.634 0.072	0.480 0.071	0.457 0.070
0.5-4	50	L H	0.5 - 2 2 - 4	0.5 2	8.86 4.28	8.14 2.91	12.03 5.18	8.18 3.88	7.13 3.55	6.50 3.48
2-50	50	L H	2 - 10 10 - 50	2 10	0.625 0.058	0.542 0.020	0.827 0.062	0.528 0.060	0.400 0.059	0.380 0.058

RECEIVING, HANDLING AND STORAGE

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

Reasonable care should be exercised in unpacking the relay in order that none of the parts are damaged or the adjustments disturbed.

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

ACCEPTANCE TESTS

GENERAL

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

The following tests may be performed as part of the installation of the relay at the discretion of the user. Since most operating companies use different procedures for acceptance and installation tests, the following section includes all applicable tests that may be performed on the relays.

VISUAL INSPECTION

Check the nameplate stamping to ensure that the model number and rating of the relay agree with the requisition.

Remove the relay from its case and check that there are no broken or cracked molded parts or other signs of physical damage, and that all the screws are tight.

MECHANICAL INSPECTION

1. 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 instantaneous contacts.

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

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

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

DRAWOUT RELAYS, GENERAL

The HFC relays may be tested without removing them from the panel by using the 12XCA11A1 four-point test probes. These test probes make connections to both the relay and the external circuitry, which provides maximum flexibility, but requires reasonable care in use, since a CT shorting jumper is necessary when testing. The CT circuit may also be tested by using an ammeter with the 12XCA11A2. See the test circuit of Figure 9.

NOTE: Figure 9 shows test connections for the HFC21B current transformer, and the left unit current transformer of the HFC22B and HFC23C. To test the CTs of the HFC22B and HFC23C, refer to internal connections shown in Figures 4 and 5, respectively.

POWER REQUIREMENTS, GENERAL

All alternating current operated devices are affected by frequency. Since non-sinusoidal waveforms can be analyzed as a fundamental frequency plus harmonics of the fundamental frequency, it follows that alternating current devices (relays) will be affected by the applied waveform.

Therefore, in order to properly test alternating current relays it is essential to use a sine wave current and/or voltage. The purity of the sine wave (i.e., its freedom from harmonics) cannot be expressed as a finite number for any particular relay; however, any relay using tuned circuits, R-L or RC networks or saturating electromagnets (such as time overcurrent relays), would be essentially affected by non-sinusoidal waveforms. Hence a resistance-limited circuit, as shown in Figure 10, is recommended.

HI-SEISMIC INSTANTANEOUS UNIT

Make sure that the instantaneous unit link is in the correct position for the range in which it is to operate. Use the higher range whenever possible, since the higher range has a higher continuous rating. Test connections for testing pickup and operating times are shown in Figure 10.

NOTE: Figure 10 shows test connections for the HFC21B and the left unit of the HFC22B and HFC23C. To test the other units of the HFC22B and HFC23C, refer to internal connections shown in Figures 4 and 5, respectively.

Setting the Hi-Seismic Instantaneous Unit

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

CAUTION: REFER TO TABLE 2 FOR THE CONTINUOUS AND ONE SECOND RATINGS OF THE INSTANTANEOUS UNIT. DO NOT EXCEED THESE RATINGS WHEN APPLYING CURRENT TO THE INSTANTANEOUS UNIT.

The range of the instantaneous unit (see Table 2) must be obtained between a core position of one-eighth of a turn fully clockwise, and 20 turns counterclockwise from the fully clockwise position. Do not leave the core in the fully clockwise position.

INSTALLATION

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

The relay should be mounted on a vertical surface. The outline and panel drilling dimensions are shown in Figures 12 and 13. Figure 12 shows semi-flush mounting, and Figure 13 shows various methods of surface mounting.

The internal connections diagrams for the relays are shown in Figures 3, 4 and 5.

INSTALLATION TESTS

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

Hi-Seismic Instantaneous Unit

1. Select the desired range by setting the link in the proper position (see Figure 1 and the internal connections diagram). Always select the higher range whenever possible, since it has a higher continuous rating.

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

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

PERIODIC CHECKS AND ROUTINE MAINTENANCE

In view of the vital role of protective relays in the operation of a power system, it is important that a periodic test program be followed. The interval between periodic checks will vary depending upon environment, type of relay and the user's experience with periodic testing. Until the user has accumulated enough experience to select the test interval best suited to his individual requirements, it is suggested that the points listed below be checked at an interval of from one to two years.

CONTACT CLEANING

A flexible burnishing tool should be used for cleaning relay contacts. This is a flexible strip of metal with an etched-roughened surface, which in effect resembles a superfine file. The polishing action of this file is so delicate that no scratches are left on the contacts, yet it cleans off any corrosion thoroughly and rapidly. The flexibility of the tool insures the cleaning of the actual points of contact. Do not use knives, files, abrasive paper or cloth of any kind to clean relay contacts.

COVER CLEANING

The clear Lexan® cover should be cleaned with a soft cloth and water only. No cleaning solutions should be used. Use of cleaning solutions other than water may damage the clear cover.

SYSTEM TEST

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

SERVICING

HI-SEISMIC INSTANTANEOUS UNIT

1. Both contacts should close at the same time.

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2. With the armature against the pole piece, there should be at least 1/64-inch wipe on the contacts. Check this by inserting a 0.010 inch feeler gage between the front half of the shaded pole with the armature held closed. Contacts should close with the feeler gage in place. Since mechanical 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.

Since the last edition, Figures 12 and 13 have been changed.

LIST OF FIGURES

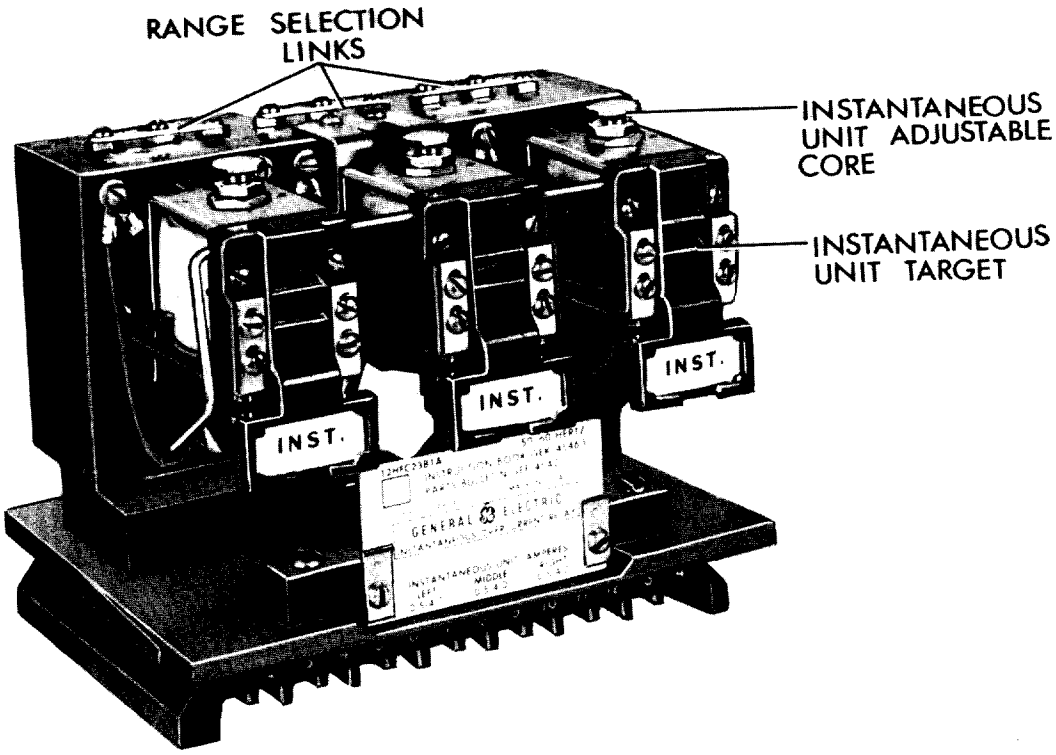


Figure 1 (8043212) Type HFC23B Relay, Removed From Case, Front View

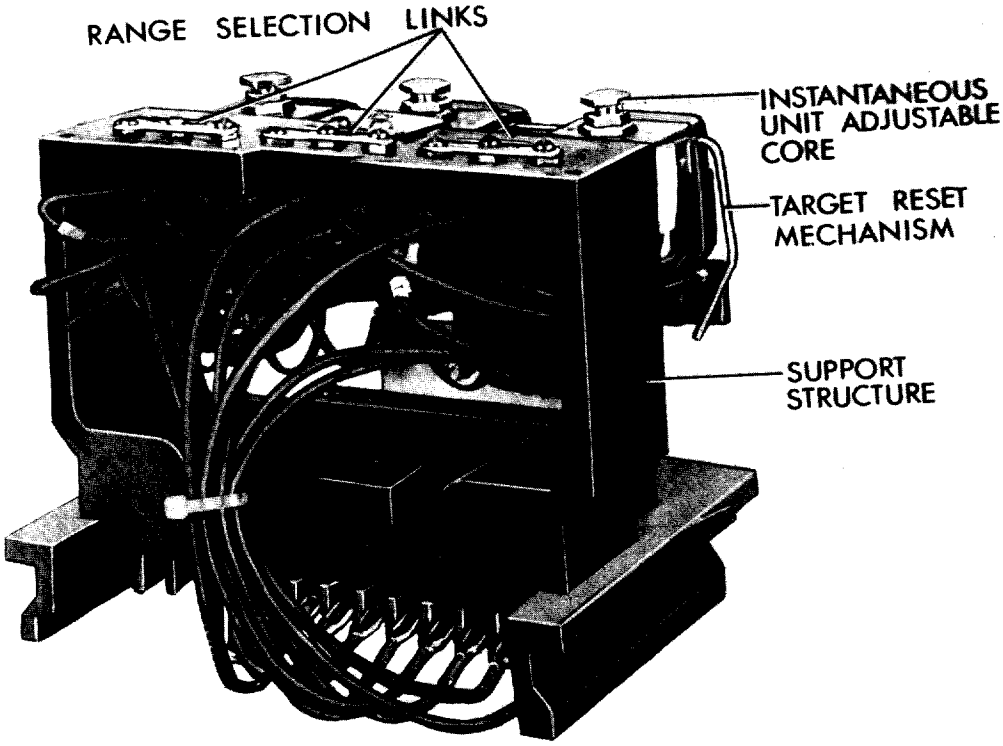
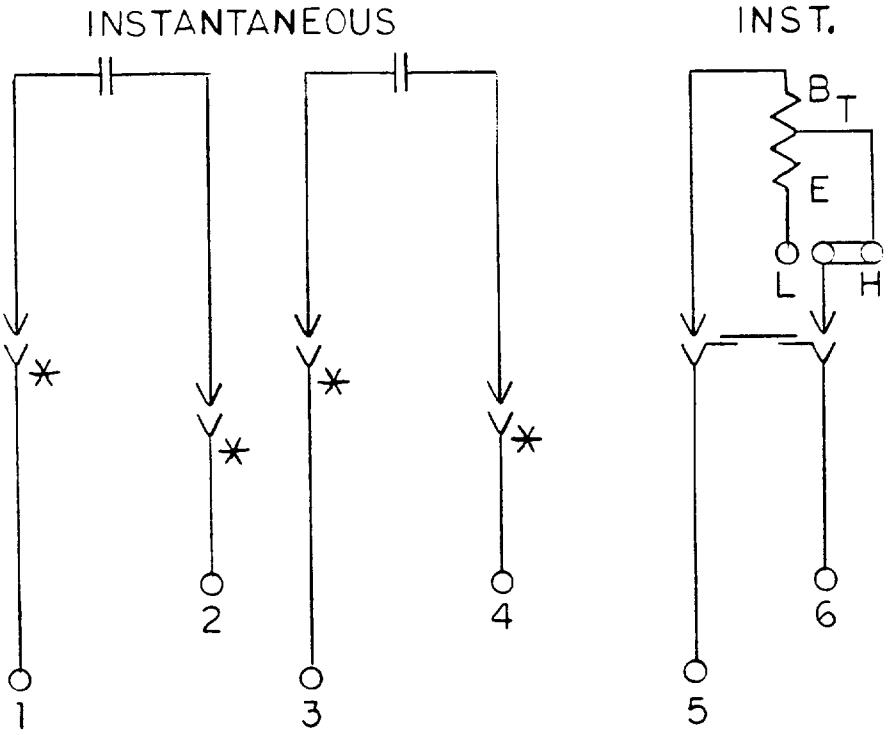


Figure 2 (8043213) Type HFC23B Relay, Removed from Case, Rear View

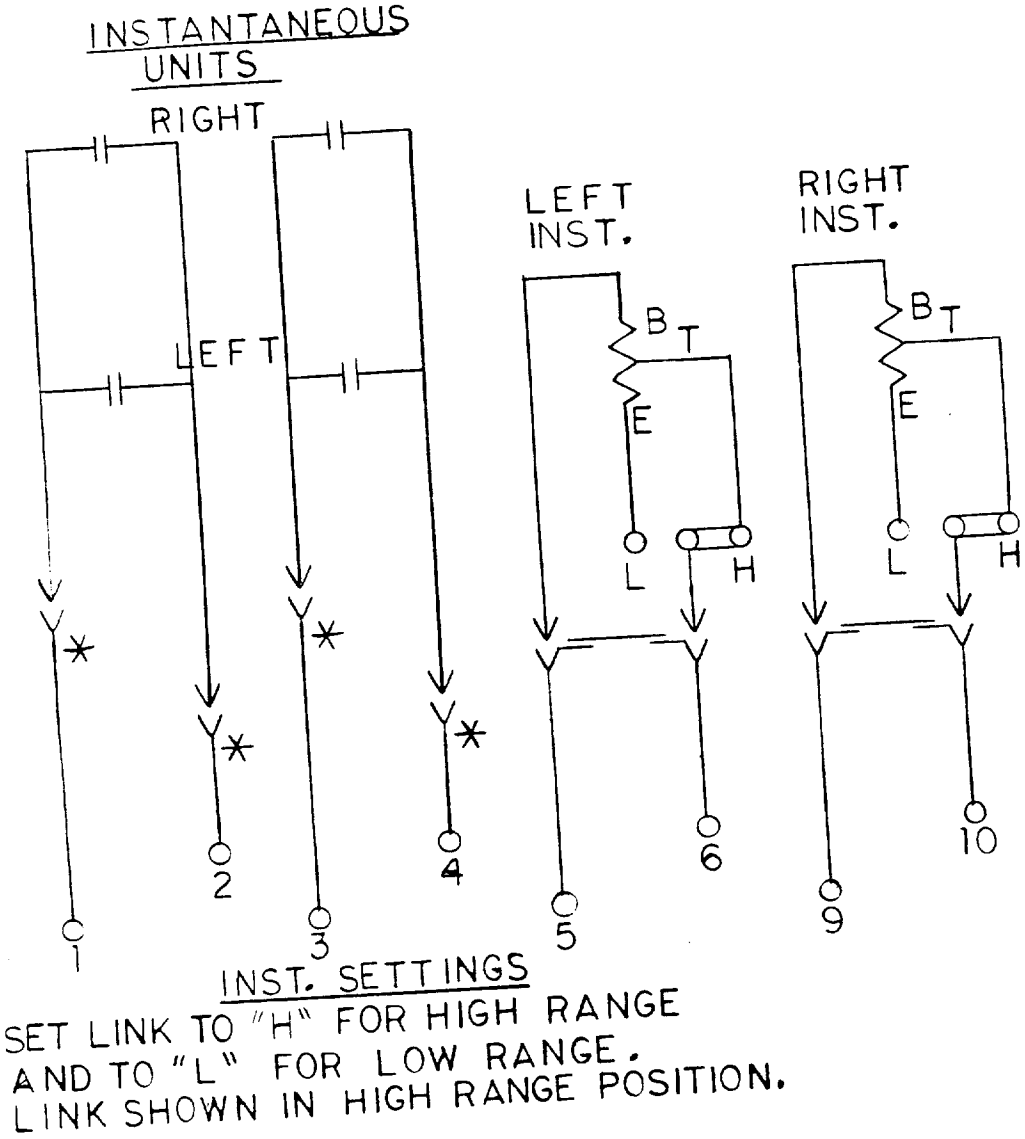


INST. SETTING

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

* = SHORT FINGERS

Figure 3 (0269A3074-0) Type HFC21B Internal Connections Diagram, Front View



* = SHORT FINGERS

Figure 4 (0275A1900-0) Type HFC22B Internal Connections Diagram, Front View

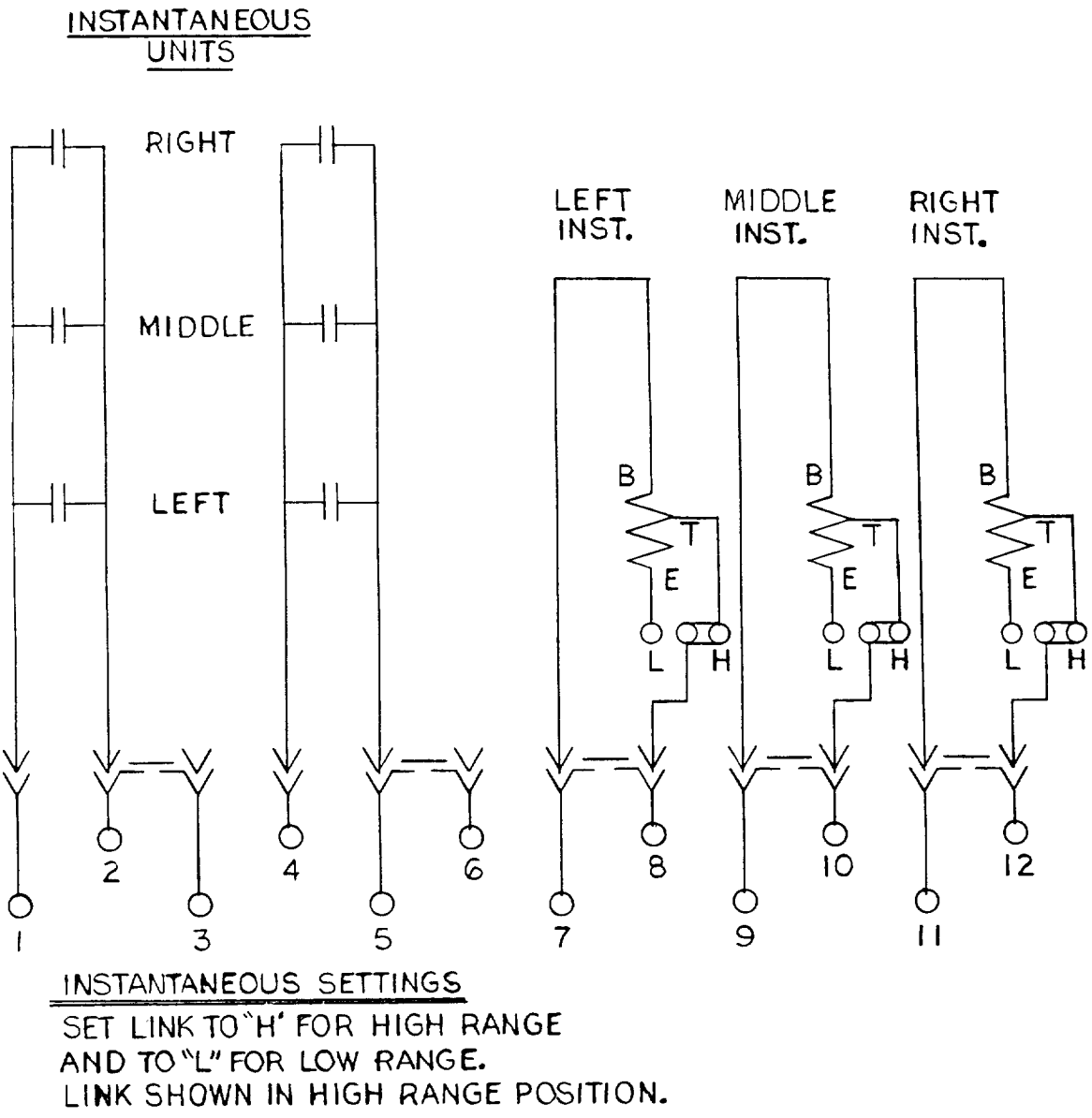


Figure 5 (0285A6295-0) Internal Connections for Relay Type HFC23C, Front View

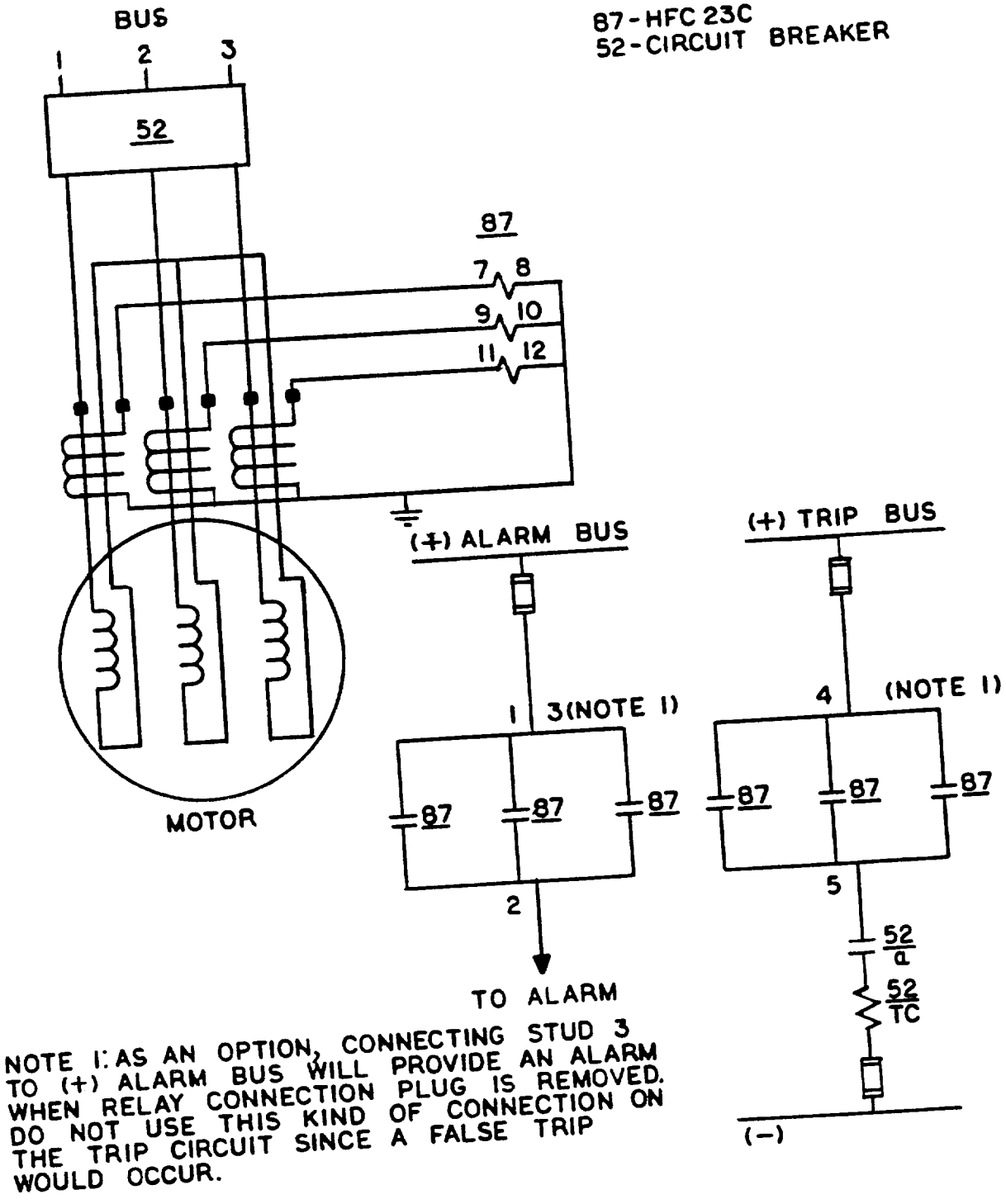


Figure 6 (0285A7123-0) External Connections for Type HFC23C, Self Balancing Primary Current Differential Scheme for Motor Protection

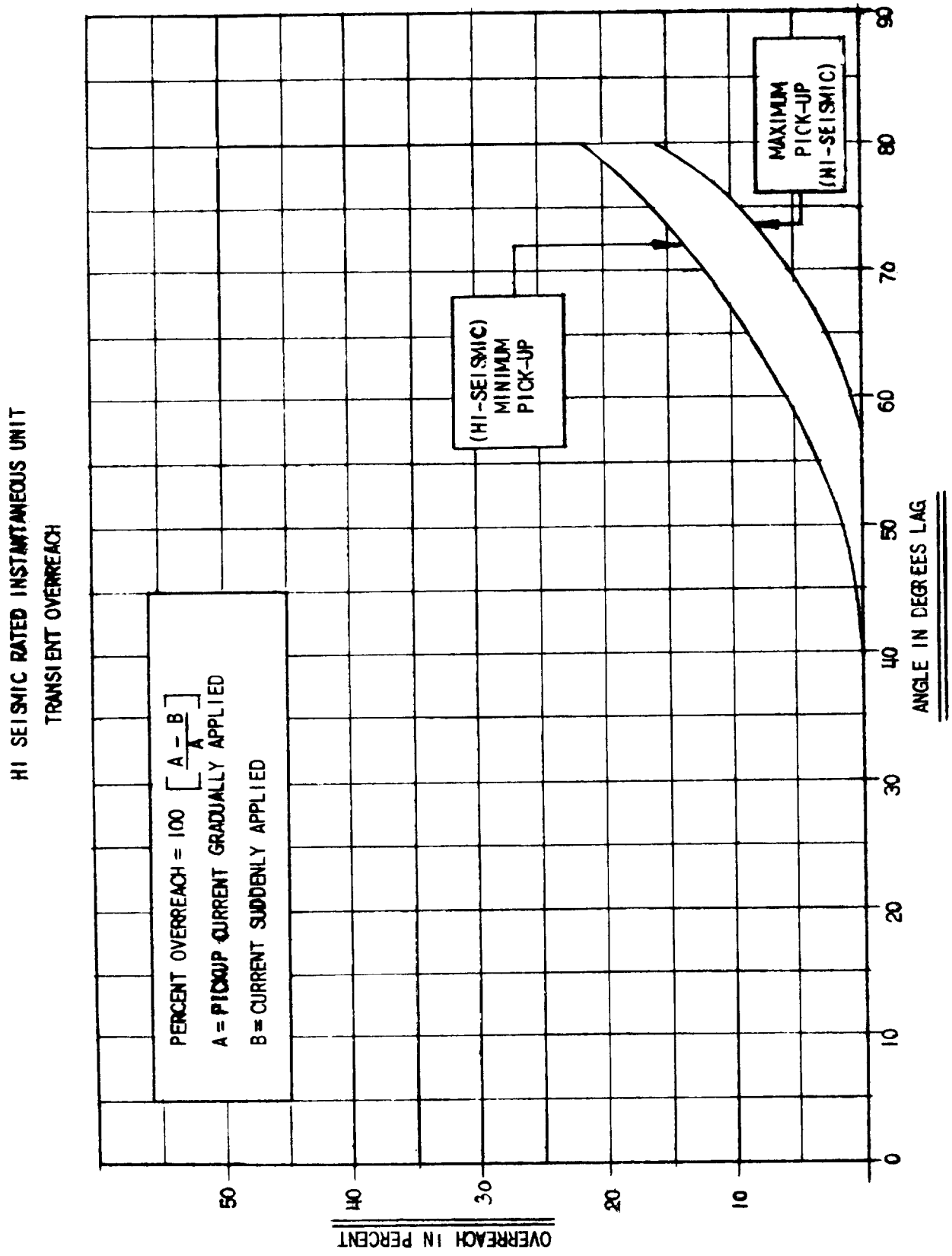


Figure 7 (0208A8694-2) Transient Overreach Characteristics
Of the Hi-Seismic Instantaneous Unit

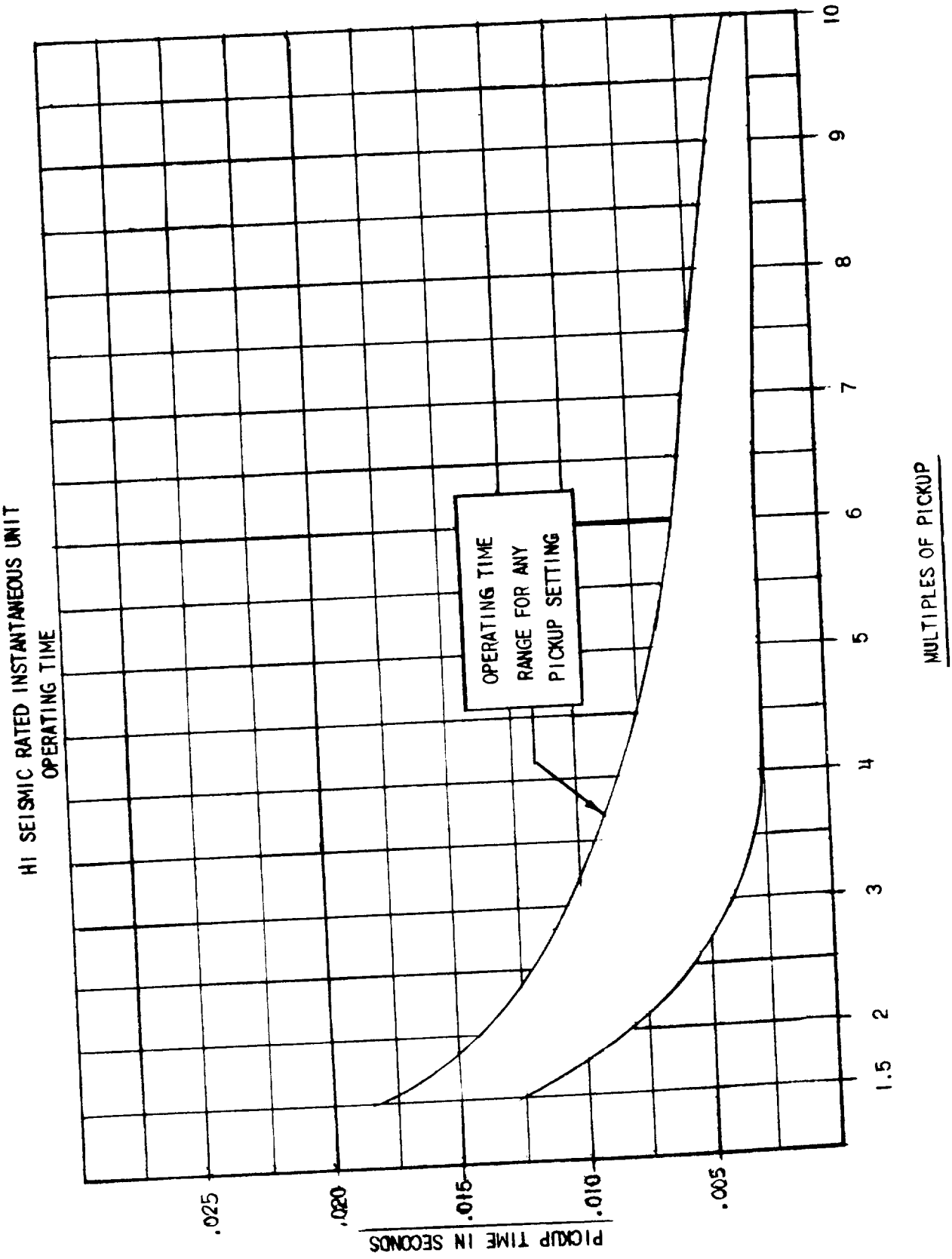
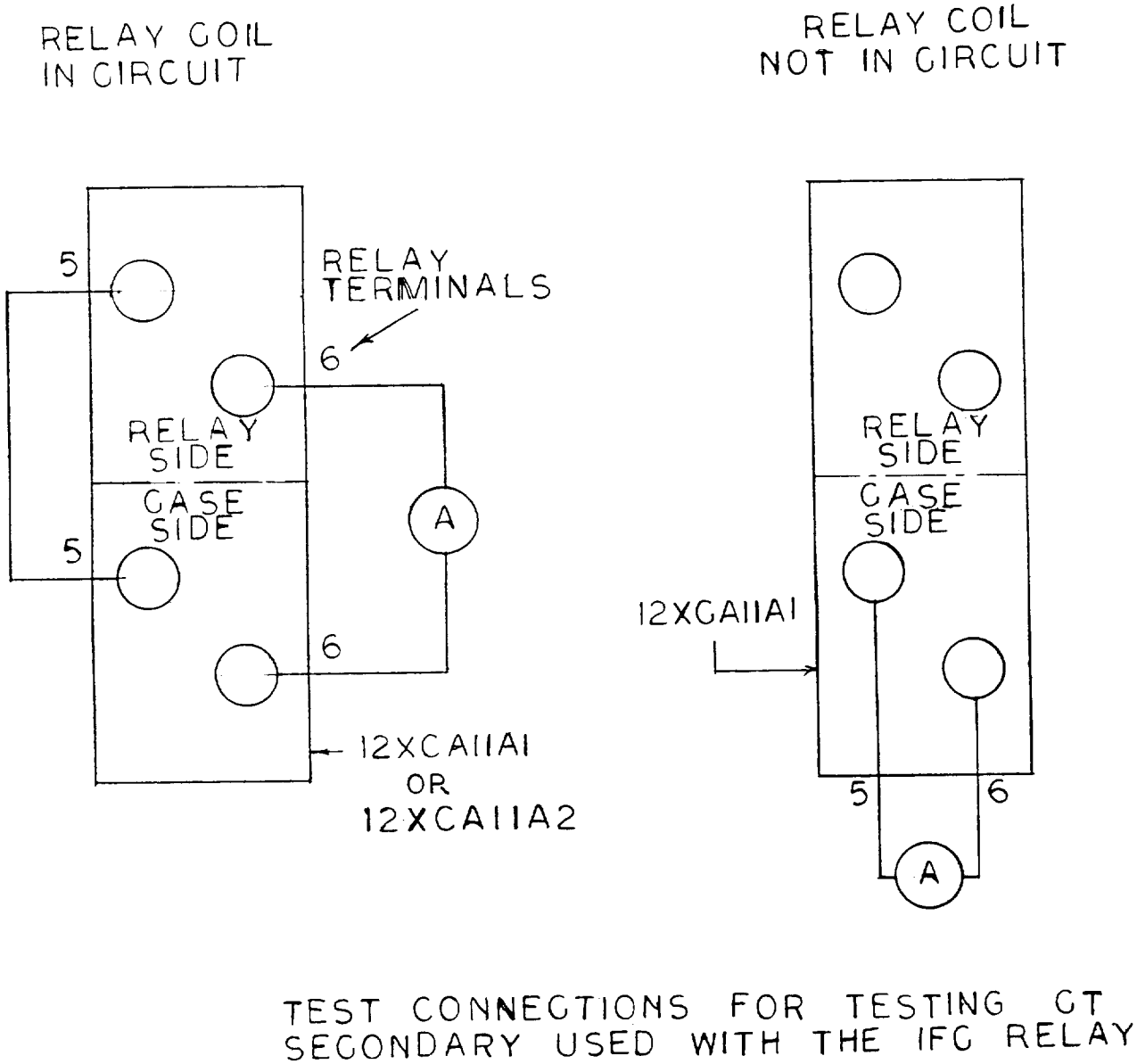
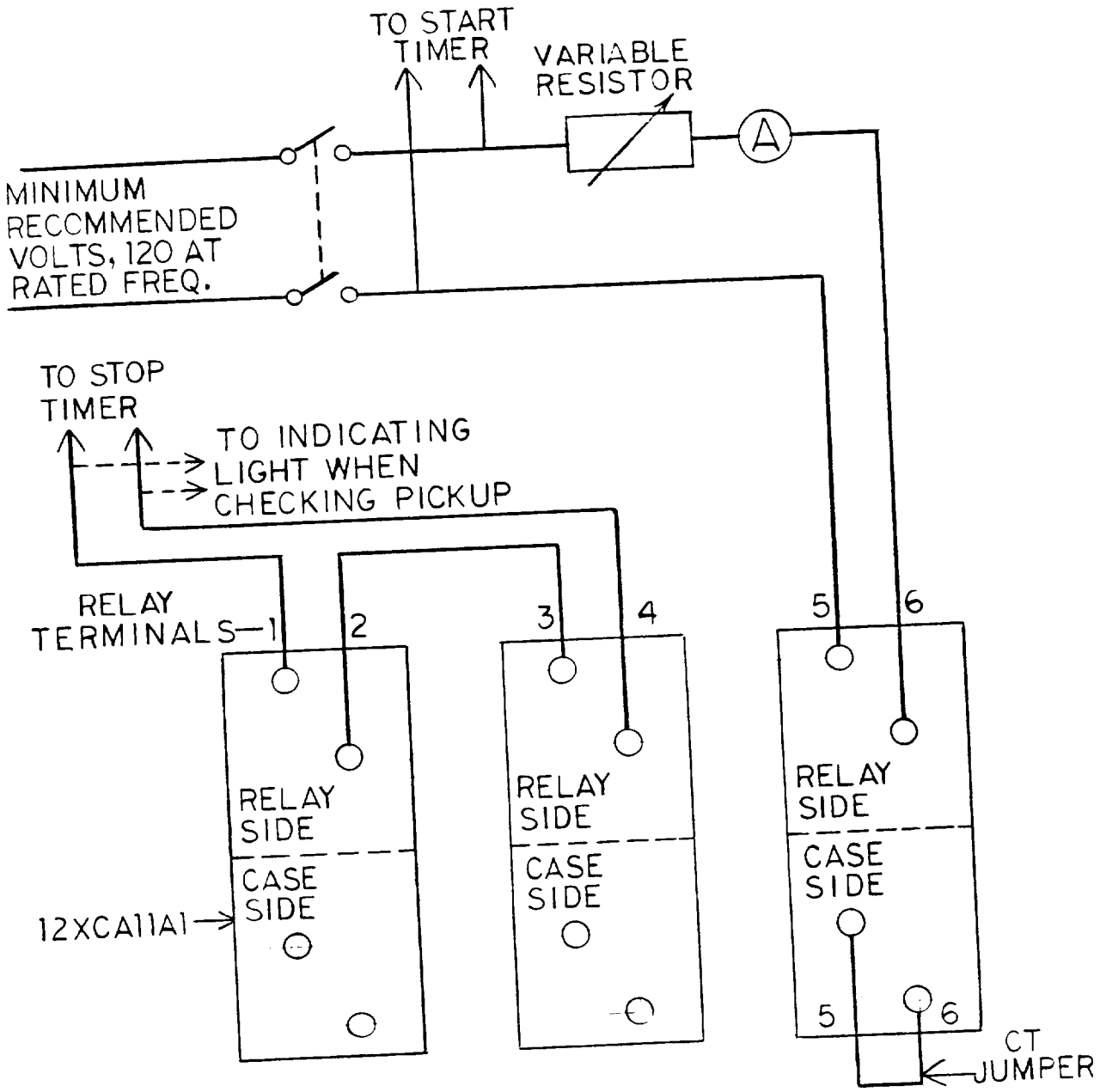


Figure 8 (0208A8695-1) Time-Current Characteristics of the Hi-Seismic Instantaneous Unit



TEST CONNECTIONS FOR TESTING CT SECONDARY USED WITH THE IFC RELAY

Figure 9 (0269A1787-1) Test Connections for Testing Current Transformer Secondary Used with the Type HFC Relay



TEST CONNECTIONS FOR TESTING PICKUP AND OPERATING TIMES OF THE HFC RELAY INSTANTANEOUS UNIT WITH ELECTRICALLY SEPARATE CONTACTS.

Figure 10 (0275A1904-0) Test Connections for Testing Pickup and Operating Times of Type HFC Relay Hi-Seismic Instantaneous Unit

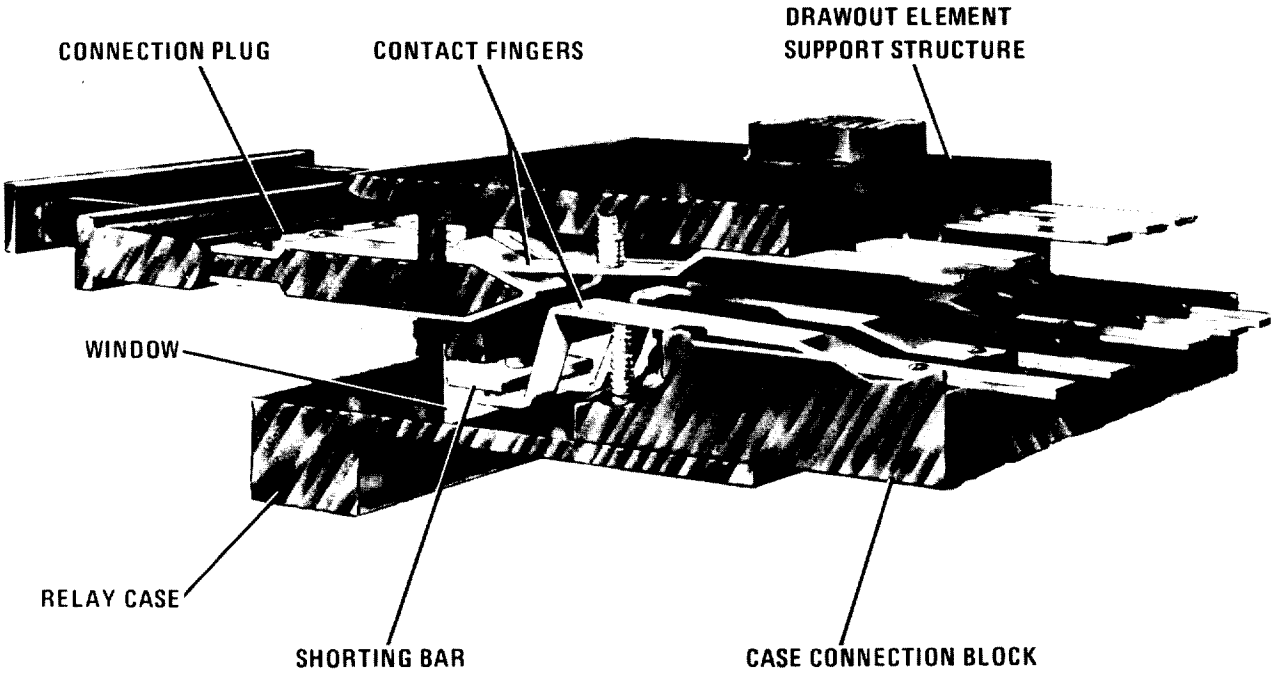


Figure 11 (8042715) Cross-Section of Type HFC Relay Drawout Case Showing Shorting Bar

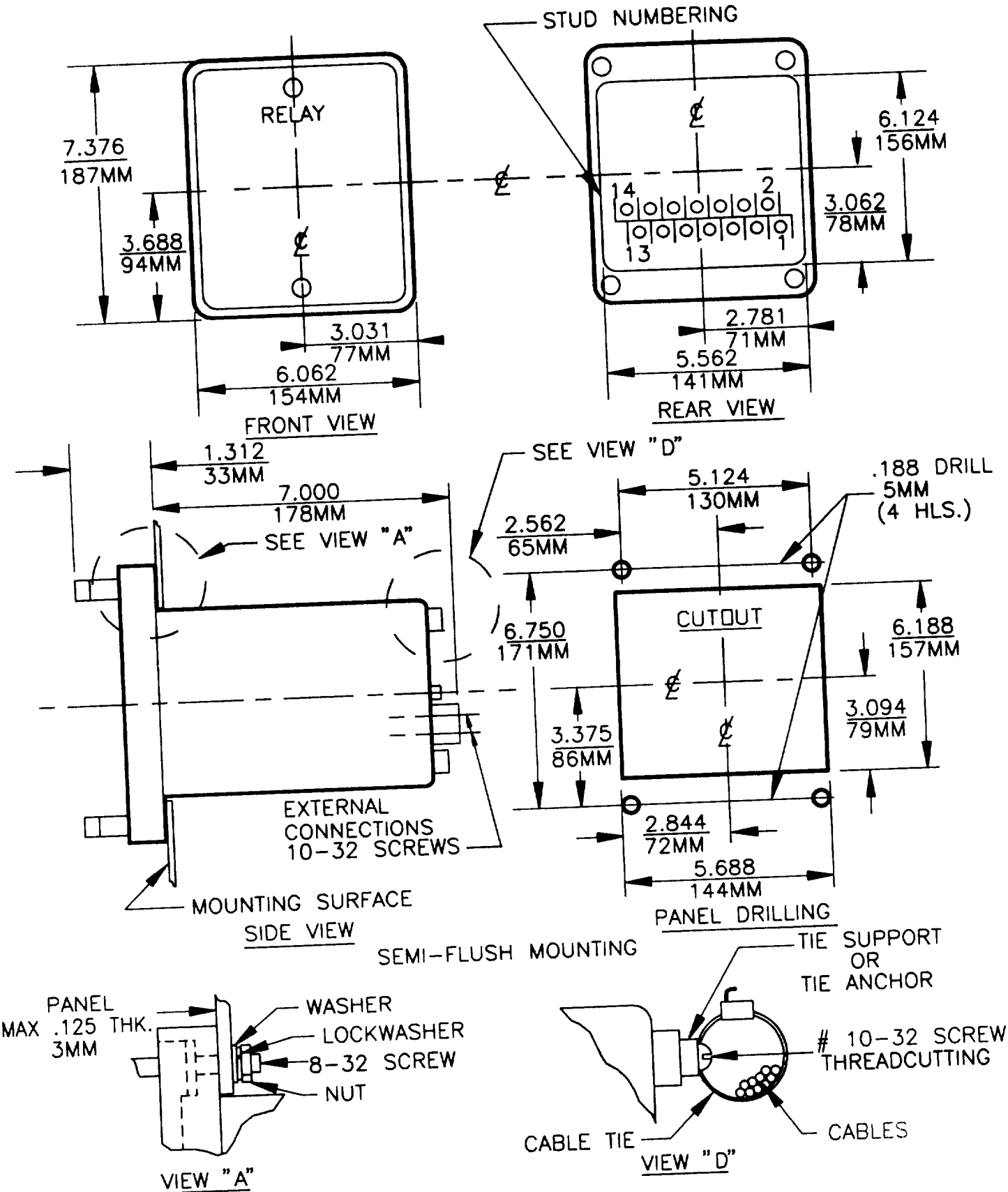


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Figure 12 (0257A8452-1, Sh. 1 [6]) Outline and Panel Drilling for Type HFC Relay

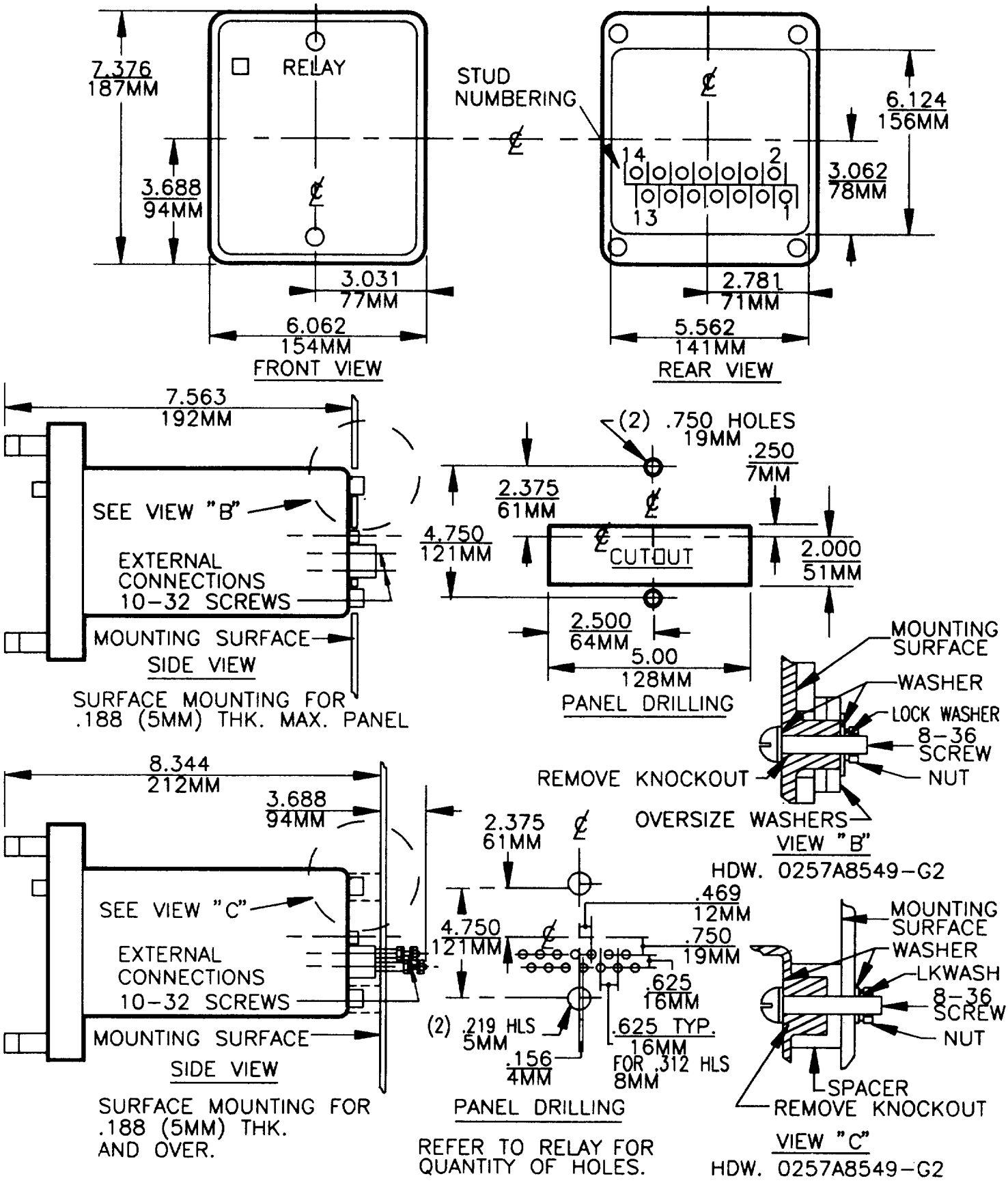

Figure 13 (0257A8452-1, Sh. 2 [6]) Outline and Panel Drilling for Type HFC Relay

GE Power Management

215 Anderson Avenue
Markham, Ontario
Canada L6E 1B3
Tel: (905) 294-6222
Fax: (905) 201-2098
www.ge.com/indsys/pm