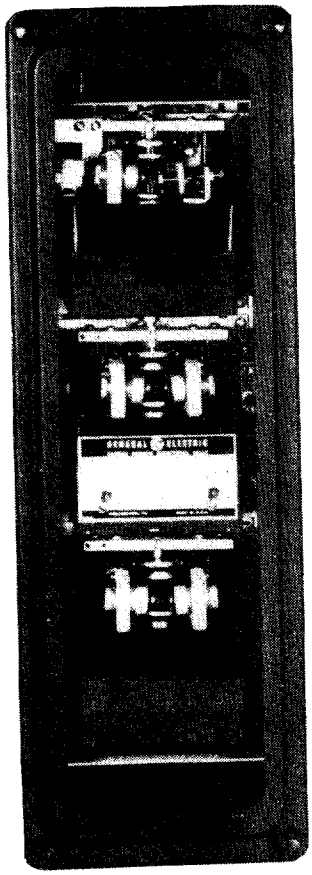
INSTRUCTIONS

GEI-83910G

CARRIER CURRENT GROUND RELAY

CLPG12C



GENERAL ELECTRIC

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CLPG12C

INTRODUCTION

The CLPG12C is a high-speed, zero-sequence ground relay designed specifically for use as a ground-fault relay in directional-comparison relaying schemes. This relay contains one high-speed zero-sequence directional unit, which may be polarized from voltage and/or current. It also contains two high-speed zero-sequence non-directional overcurrent units and one direct-current-operated (DC) auxiliary unit. The CLPG12C is packaged in a size-L2 case and includes a target and a separate seal-in unit. One CLPG12C is required per terminal.

APPLICATION

The CLPG12C finds application on grounded neutral systems as the directional-comparison ground relay in directional-comparison schemes, regardless of the type of channel that is used. This relay, operating in conjunction with the pilot channel and the CLPG12C relays at the other ends of the protected line section, provides high-speed tripping for all single-phase-to-ground faults in the protected line section.

The two non-directional overcurrent units and the operating circuit of the directional unit may be all supplied in series from the neutral connection of the three line-current transformers. The polarizing circuit of the directional unit may be supplied from a current transformer in the neutral of a grounded neutral power transformer or from the broken-delta secondary connection of three potential transformers whose primary windings are connected in wye, or it may be simultaneously supplied from both sources of polarization.

The sensitivity of each of the overcurrent units, as well as that of the directional unit, is adjustable over the ranges specified under **RATINGS.** The operating times of the three units are given in the **CHARACTERISTICS** section. A complete elementary diagram for a directional-comparison scheme over a carrier channel including the CLPG12C may be obtained from the local district office. Figure 2 shows typical external connections.

RATINGS

COILS

The potential coils of the CLPG12C relay are rated 120 volts intermittent and 360 volts for 10 seconds, both values being at rated frequency.

The CLPG12C relay is available in either of the following ratings at either 50 or 60 Hz.

G1 Unit Range in Amperes	G2 Unit Range in Amperes	GD Unit Range V × I Potential Polarization	GD Unit Range I × I Current Polarization
0.4 - 1.6	0.5 - 2/1 - 4	3.6 - 57.6	0.25 - 4.0
0.8 - 3.2	1 - 4/2 - 8	3.6 - 57.6	0.25 - 4.0

The angle of maximum torque is 80° ± 2° (I lags V) when the unit is potential-polarized. If it is current-polarized, the angle of maximum torque is 10° ± 10° (I pol lead Iop).

If the unit is set for 0.25 (IxI), then the unit will pick up when VxI = 4.5 ± 15%. If a 3.6 VA pickup is required, then the control spring should be adjusted so that the contact will just close when 3.6 VA is applied at the angle of maximum torque.

The auxiliary-telephone-relay unit (GD1X) is available in continuous ratings of 48 or 110 or 125 or 250 volts DC. The current circuits are rated 3 amperes continuous and 140 amperes for one second. The 140 ampere rating is also the maximum permissible current. The target-and-seal-in coils with a one (1) ampere rating will carry 30 amperes for tripping duty and 2.5 amperes continuously. The target-and-seal-in units with ratings of 0.6 ampere DC will carry 30 amperes for tripping duty and 0.9 amperes continuously.

CONTACTS

The tripping contacts of this relay are the normally-open contacts of the G2 and GD units. They will carry 2.5 amperes continuously and will close and carry 30 amperes DC for tripping duty at control voltages of 250 VDC or less. The breaker-trip-coil circuit should, however, always be opened by a circuit-breaker auxiliary switch or other suitable means. If the tripping current exceeds 30 amperes, an auxiliary tripping relay should be used.

CHARACTERISTICS

OPERATING PRINCIPLES

The three main units of the CLPG12C relay are of the high-speed efficient eight-pole cup structure. They most closely resemble an induction motor, except that the rotor iron is stationary while the rotor conductor portion (the cup) is free to rotate.

PICKUP

The relays can be set to pick up, i.e. close the N.O. Contacts, at the values of current shown in the **RATINGS** section. The method of adjusting pickup is described in the **INSTALLATION PROCEDURE** section.

OPERATING TIME

Figure 3 shows the operating time of the two overcurrent units (G1 and G2) as a function of operating current. Figure 4 shows the operating time of the directional unit (GD) as a function of multiples of product pickup.

TABLE I

60 C.P.S. CURRENT BURDENS AT MINIMUM G1 PICKUP							MEASURED BURDENS IN OHMS IMPEDANCE AT:			
Circuit	G1 Transformer Connection	G1 Rating Amps	G2 Tap Range Amps	R Ohms	X Ohms	Z Ohms	5 Amps	10 Amps	20 Amps	60 Amps
Operating (Studs 3-4)	Shunt	0.4-1.6	0.5-2	0.80	1.84	2.00	2.00	1.80	1.50	0.95
	Shunt	0.4-1.6	1 - 4	0.60	1.36	1.50	1.50	1.20	1.00	0.70
	Stepup	0.4-1.6	0.5-2	2.44	3.42	4.20	4.20	3.10	2.20	1.20
	Stepup	0.4-1.6	1 - 4	2.12	3.12	3.80	3.80	2.60	2.00	1.10
	Shunt	0.8-3.2	1 - 4	0.30	0.70	0.76	0.76	0.70	0.57	0.40
	Shunt	0.8-3.2	2 - 8	0.23	0.52	0.58	0.58	0.50	0.42	0.31
	Stepup	0.8-3.2	1 - 4	0.73	1.04	1.26	1.26	1.20	1.05	0.75
	Stepup	0.8-3.2	2 - 8	0.64	0.94	1.14	1.14	1.00	0.80	0.50
Polarizing (Studs 5-6)	All	All	All	0.25	0.04	0.26	0.26	0.23	0.21	0.20

BURDEN

The burdens imposed on the current transformers are shown in Table I. The capacitive potential circuit burden, calculated at 120 volts, 60 Hz, is shown in the following table:

Potential Circuit Burdens

WATTS	VARS	VOLT AMPERES
18	3.18	18.35

The burdens imposed by the 50 Hz relays are approximately 90% of those shown for the comparable 60 Hz relays. The resistance of the target and seal-in units is given in the following table:

DEVICE UNIT	RATING	RES. 25°C
Target	1 A	0.34 Ohms
Seal-In	1 A	0.28 Ohms
Target	0.6A	0.73 Ohms
Seal-In	0.6A	0.72 Ohms

CALCULATIONS OF SETTINGS

It is not possible to give specific settings for the CLPG12C relay for all conditions. However, a general guide for setting the three units of this relay follows:

TWO-TERMINAL LINE

GD UNIT: Set for minimum pickup (maximum sensitivity). Check to ensure pickup for all single-phase-to-ground faults on the protected line with line breakers closed at both terminals. Use dual polarization where facilities permit.

G1 UNIT: The preferred pickup setting is the minimum rated pickup value of this unit. Do not set higher than 80% of the G2 pickup setting at the remote end of the line.

G2 UNIT: Set pickup no higher than 67% of minimum single-phase-to-ground fault current in the relay with the remote breaker closed. Lower pickup settings are permissible, and in most cases desirable for increased speed of operation. However, do not set pickup lower than 125% of the G1 pickup setting at the remote end of the line.

THREE-TERMINAL LINE

GD UNIT: Set for minimum pickup (maximum sensitivity). Check to ensure pickup for all single-phase-to-ground faults on the protected line with the line breakers closed at all three terminals. Use dual polarization where facilities permit.

G1 UNIT: The preferred pickup setting is the minimum rated pickup value of this unit. However, when current outfeed can exist for internal faults, an attempt should be made to set the pickup above the value of outfeeding current at that terminal. In any event this unit should not be set higher than 40% of the G2 pickup settings at the two remote terminals.

G2 UNIT: Set pickup no higher than 67% of the minimum single-phase-to-ground fault current in the relay with both remote line breakers closed. Lower pickup settings are permissible, and in most cases desirable for increased speed of operation. However, do not set pickup lower than 250% of the G1 pickup settings at the two remote terminals.

CONSTRUCTION

The three main units (G1, G2, and GD) of the CLPG12C relay covered by these instructions are of the induction-cup construction.

A. CARRIER-START UNIT (G-1)

This is the top unit of the CLPG12C relay. It has two electrically separate contacts. The right-hand (front view) contact is closed when the unit is de-energized. When energized, the unit operates to open its right-hand contact and then closes its left-hand contact.

The four corner coils of the unit consist of two windings each. The inner windings consist of a large number of turns of fine wire, and the outer windings have a few turns of heavy wire. The inner windings are connected in series with a capacitor to form a phase-shifting circuit. The outer windings are connected in series internally, and into the operating-current circuit externally. The four side coils are similarly connected into the operating-current circuit.

To increase the torque output for sensitive settings of the G1 unit (1-2 times minimum pickup), there is provided in the CLPG12C relay a 2:1 autotransformer. The transformer, when connected as a step-up transformer, effectively doubles the current in the G1 unit.

The increased torque thus requires additional control-spring windup, thereby increasing the force on the normally-closed (carrier-start) contact. The net result is to reduce or eliminate the possibility of spurious carrier signals due to shock or vibration when sensitive settings are employed on this unit.

As a further aid in reducing the possibility of spurious carrier signals, the carrier-start contact is of the low-gradient construction.

The low-gradient contacts of the G1 unit are shown in Figure 5. Both the stationary and the moving contact brushes are made from low-gradient material. When subjected to vibration they tend to follow one another, thus resisting contact separation.

The contact dial (A) supports the stationary contact brush (B) on which is mounted a conical contact tip (C). The moving-contact arm (D) supports the moving-contact brush (E) on which is mounted a button contact tip (F). The end of the moving-contact brush bears against the inner face of the moving-contact-brush retainer (G). Similarly, the end of the stationary-contact brush bears against the inner face of the stationary-contact-brush retainer (H). The stop (J), mounted on the contact dial, functions to stop the motion of the contact arm by striking the moving-contact-brush retainer after the moving- and stationary-contact members have made contact. The stationary-contact support (K) and the contact dial are assembled together by means of a mounting screw (L) and two locknuts (M).

The normally-open contact is of the standard barrel type of construction.

The barrel-type contacts shown in Figure 6 are especially constructed to suppress bouncing. The stationary contact (G) is mounted on a flat spiral spring (F) backed up by a thin diaphragm (C). These are both mounted in a slightly inclined tube (A). A stainless steel ball (B) is placed in the tube before the diaphragm is assembled. When the moving contact hits the stationary contact, the energy of the former is imparted to the latter and thence to the ball, which is

free to roll up the inclined tube. Thus, the moving contact comes to rest with substantially no rebound or vibration.

The moving contacts are supported on a molded plastic arm that is attached to the rotor shaft. The arm is held from rotating freely by a control spring. This spring maintains a torque in the direction to hold the normally-open contacts open by a magnitude that determines the pickup of the unit.

B. TRIP UNIT (G-2)

This is the middle unit of the CLPG relay and is similar in construction to the G1 unit previously described. This unit has two electrically separate contacts. The left-hand contact is closed when the unit is de-energized. When energized, the unit operates to open its left-hand contact and then closes its right-hand contact. It further differs from the G1 unit as follows: -

The G1 unit has its corner coils and side coils connected in series internally. However, the G2 unit side- and corner-coil connections are brought out to a tap block located at the side of the G2 unit. This tap block arrangement permits the G2 unit coils to be connected in series or parallel, depending on the tap chosen. This allows the unit to have two ranges of pickup.

Both the normally-open and normally-closed contacts of the G2 unit are of the barrel-type construction previously described. Furthermore the G2 unit does not use an auxiliary current transformer.

C. DIRECTIONAL UNIT (GD)

This is the bottom unit of the CLPG relay. It has 2 electrically separate contacts of the barrel-type construction previously described. When de-energized, the right-hand contact is closed. When energized in the tripping direction, the unit operates to open the right-hand contact and then closes the left-hand contact.

The stator has eight laminated magnetic poles projecting inward and arranged symmetrically around a central magnetic core. The poles are fitted with current and potential coils. Three of the corner coils are connected internally to form a single circuit for current polarization. Each of these coils has two windings, one of which carries the polarizing current. The other winding is connected in series with the corresponding winding of each of the other two coils, with a capacitor. The resultant flux from these coils is shifted in phase with respect to the operating-circuit flux. The fourth corner coil is a potential coil for potential polarization. The four side coils are connected together to form the operating-current circuit.

In the annular air gap between the poles and central core is the cylindrical cup-like part of the aluminum rotor, which turns freely in the gap. The rotor shaft is supported at the bottom by a steel pivot that projects downward through a bronze guide bearing mounted in the end of the shaft. The shaft carries the movable contact arm through which the contact circuits are completed.

D. AUXILIARY UNIT (GD1X)

This unit is located in the rear of the CLPG12C relay, just below the upper unit.

It is a telephone-type relay unit with adjustable time-delay pickup. The unit is preset at the factory for 16-18 milliseconds time-delay pickup. A copper slug on the armature end of the core delays the flux buildup, and consequently the relay pickup. Dropout time is approximately 88 milliseconds. One normally-closed contact and one normally-open contact of the unit are brought out to separate studs for external circuit control. The resistor, R_2, is connected across the GD1X coil when it is used on 220 or 250 VDC.

E. SEAL-IN UNIT (SI)

This unit is located in the upper right-hand corner (rear view) of the relay. It is of the familiar hinged-armature construction and operates to lift and close its contacts, whenever sufficient trip current flows in its operating coil.

The above units and associated components are mounted on a steel cradle assembly that can be easily removed from the relay case.

The cradle is locked in the case by means of latches at the top and bottom. The electrical connections between the case block and cradle block are completed through a removable connection plug. A separate testing plug can be inserted in place of the connection plug to permit testing the relay in its case. The cover attaches to the case from the front and includes the target reset mechanism and an interlock arm to prevent the cover from being replaced until the connection plug has been inserted.

The case is suitable for either semiflush or surface mounting on panels up to two inches (2") thick. Hardware is available for any panel thickness up to two inches, but panel thickness must be specified on the order to ensure that the proper hardware will be provided. Outline and panel-drilling dimensions are shown in Figure 14.

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 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 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 examination and tests 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 tests indicate that readjustment is necessary, refer to the section on **SERVICING**.

VISUAL INSPECTION

Check the nameplate to make sure that the model number, rating and calibration range of the relay received agree with the requisition. Remove the relay from its case and check that there are no broken or cracked molded or compound parts, and that all screws are tight.

MECHANICAL INSPECTION

It is recommended that the following mechanical adjustments be checked:

1. There should be no noticeable friction in the rotating structure of each unit. The normally-closed contacts should be closed when the relay is in an upright position.

2. There should be an end play of from .005 to .015 inch on the shafts of the rotating structures. The lower jewel-screw bearing of each unit should be screwed firmly in place, and the pivot at the top of the shaft should be locked by its set screw.

3. The contact gap on each unit should be approximately 0.020 inches.

4. The target shield should drop freely when the armature is pushed against the pole piece. With the cover fastened securely in place, check that the target resets positively when the reset button at the bottom of the cover is operated.

5. The armature and contacts of the seal-in unit should move freely when operated by hand. There should be at least 1/32" wipe on the seal-in contacts.

6. Check the location of the contact brushes on the cradle and case blocks against the internal-connection diagram for the relay (See Figure 13). Be sure that the shorting bars are in the proper locations on the case blocks, and that the long and short brushes on the cradle block agree with the internal-connection diagram. Figure 8 shows a sectional view of the case and cradle blocks with the connection plug in place. Note that there is an auxiliary brush in each position on the case block. This brush should be formed high enough so that when the connecting plug is inserted, it engages the auxiliary brush before striking the main brush. This is especially important in current circuits and other circuits with shorting bars, since an improper adjustment of the auxiliary brush could result in a CT secondary circuit being momentarily open-circuited.

ELECTRICAL TESTS

Upper-Unit Pickup (G1)

Check that the green lead is connected to terminal #3 and that the black lead is connected to terminal #3A. See internal diagram Figure 13.

Using the test connections shown in Figure 9, the unit should pick up and close the normally-open (left) contacts at a value of current ± 5% of the minimum shown on the nameplate for this unit. A neon light is recommended to indicate contact closure, and the GD unit must be held in the normally-closed position to obtain indication of G1 contact closure (see Figures 9 and 13).

Middle-Unit Pickup (G2)

With the tap plugs in the lower tap range, and using the connections shown in Figure 9, the unit should pick up (close the right-hand contacts) at a value ± 5% of the minimum value shown on the nameplate for this unit.

Bottom-Unit Pickup (GD)

Using the test connections shown in Figure 9, the unit should pick up (close the left-hand contacts) at 0.5 ampere ±5%.

Bottom-Unit-Core Check (GD)

a. Check the position of the notch that indicates the position of the flat on the core. This notch should be pointing to the front right-hand corner of the unit, front view.

b. Short circuit terminals 7 and 8; connect the relay as shown in part A of Figure 11.

c. Adjust I_O for 0.25 amp and I_P for 100 amps and check that the unit does not operate. If the unit operates, adjust the core until the unit does **not** operate.

NOTE: DO NOT KEEP THE 100 AMPS ON THE CIRCUIT FOR MORE TIME THAN NECESSARY, TO AVOID OVERHEATING THE COILS.

d. Open the polarizing circuit, adjust I_O for 7 amps, and check that the unit does not operate. If the unit operates, adjust the core for no operation and repeat the test, starting at b.

e. Unshort terminals 7 and 8 and connect as shown in part B of Figure 11.

f. Set I_O for 0.25 amperes and V_P for 120 volts, and check that the unit does **not** operate. If the unit operates, adjust the core for no operation and repeat the tests, starting at b.

GD1X Unit Pickup

Using the test connections shown in Figure 10, the unit should pick up at a value of 80% or less of the voltage shown on the nameplate. The G1 normally-open contact must be held closed during this test (see Figures 10 and 13).

INSTALLATION PROCEDURE

If after the **ACCEPTANCE TESTS** the relay is held in storage before shipment to the job site, it is recommended that the visual and mechanical inspection described under the section on **ACCEPTANCE TESTS** be repeated before installation.

Before any of the following electrical adjustments are made, the relay should be in its case, preferably mounted in its permanent location.

RELAY SETTINGS

Refer to the section on **CALCULATIONS OF SETTINGS** for a discussion of suggested procedures for determining the settings of the three main units.

CARRIER-PICKUP-START UNIT (G1)

If the required setting is less than two times the minimum value shown on the nameplate, the G1 auxiliary current transformer should be connected in such a way as to step up (The green lead connected to terminal #3 and the black lead connected to terminal #3A). Should the required setting be greater than two times the minimum value shown on the nameplate, interchange the green and black leads. Using the test connections shown in Figure 9, apply the desired current to the relay. Loosen the hexagonal locking screw located at the rear of the spiral-spring assembly. Then slip the adjusting ring (to which the control spring is attached) in the ring guide in a direction that will cause the normally-open contacts barely to close at the pickup level chosen. Retighten the locking screw and recheck the settings.

CLUTCH ADJUSTMENT

Using the test connections shown in Figure 9, and referring to Table II, check that the clutch slips (i.e. the induction cup begins to rotate after the normally-open contact has closed) within the prescribed limits. To prevent overheating the relay, a suggested method for determining that the clutch slips within the prescribed limits is to apply current 5% below the minimum shown in the table and note that the clutch does **not** slip. Next apply current 5% above the maximum shown in the table and note that the clutch **does** slip.

TABLE II

CLUTCH ADJUSTMENTS		
Unit	Current Rating, Amps	Clutch Slips, Amps
G1 †	0.4 - 1.6	3.5 - 5.0
	0.8 - 3.2	7.0 - 10.0
G2	0.5 - 2.0	7.5 - 10.0
	1.0 - 4.0	15.0 - 20.0
GD	0.25 - 4.0 Product Pickup	10.0 - 15.0

† Values of clutch slip are primary amperes with the auxiliary current transformer not connected for step up.

TRIP UNIT (G2)

Pickup: Connect the taps in the G2 tap block so that the desired setting will be within the selected tap range. Should the desired setting be such that either tap range would be adequate, it is recommended that the lower tap range be used on two-terminal lines and the higher tap range be used on three-terminal lines. Using the test connections shown in Figure 9, apply the desired level of current to the relay and set pickup by means of the control-spring adjustment, as previously described for the G1 unit.

G2 Unit Rebound Test:

Connect the relay as shown in Figure 7, and check that the G2-unit contact will not rebound on the removal of an external fault. The test connections show the TB unit of the NAA22A being used for this test but if an instantaneous dropout relay is available it may be substituted. The use of the TB unit will result in loss of instantaneous reclosure in the carrier-current scheme, and the TB unit contact in circuit 15-16 must be shorted so that protection is still provided.

The following test procedure should be followed.

1. Close the G2 unit manually to check that the lamp will light.
2. Manually close the TB unit and apply maximum expected through-fault current to the G2 unit.
3. Remove the current and check that the lamp does not light.

CAUTION:	It is advisable to practice this sequence, so that the tester will be able to operate it correctly with a high-current impulse **short** enough to avoid overheating the unit.

If the G2 unit fails this test, check the wipe and gap of the G2 barrel contacts, and also the clutch slip adjustment.

CLUTCH ADJUSTMENT

Using the test connections shown in Figure 9 and the appropriate value shown in Table II, check the clutch adjustment as previously described for the G1 unit.

DIRECTIONAL UNIT (GD)

Current-Polarized Pickup: Using the test connections shown in Figure 9, apply the desired level of current to the relay and set pickup by means of the control-spring adjustment, as previously described for the G1 unit. The product pickup thus obtained will be the square of the current applied to the relay. Thus, if a product pickup of 0.25 ampere is desired, 0.5 ampere should be applied to the relay.

Potential-Polarized Pickup: Using the test connections shown in Figure 12, the GD unit can be set for potential polarization. When setting pickup for potential polarization, it is recommended that a voltage (Vp) of 5 to 30 volts be used. Five volts is the minimum value encountered in ground relaying, while above 30 volts the current is small and difficult to measure.

Clutch Adjustment: Using the test connections shown in Figure 9 and the appropriate value from Table II, the clutch may now be set as previously described for the G1 unit.

GD1X Unit Pickup: Using the test connections shown in Figure 10, the unit should pick up at 80% or less of the DC voltage shown on the nameplate. With rated voltage suddenly applied, the unit should pick up in 16-18 milliseconds.

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 following points be checked once a year.

MECHANICAL CHECKS

Operate the contacts by hand and check that the contacts are making with proper wipe. The barrel-type contacts are marked with a letter on the rear of the barrel that designates the amount of wipe.

Unit	Contact	Stamping	Wipe
Top	Left	H	.013-.018
Middle	Left	L	.002-.004
Middle	Right	L	.002-.004
Bottom	Right	L	.002-.004
Bottom	Left	S	.004-.009

The wipe is the distance the spiral contact can move into the barrel before it hits the diaphragm, as shown in Figure 6. This can be changed by adjusting the flat spiral spring until the proper spacing is obtained.

Examine the contact surfaces for signs of tarnishing or corrosion. Fine silver contacts should be cleaned with a burnishing tool that consists of a flexible strip of metal with an etch-roughened surface. Burnishing tools designed especially for cleaning relay contacts can be obtained from the factory. Do not use knives, files, abrasive paper or cloth of any kind to clean relay contacts.

When burnishing the low-gradient G1 unit contacts, exercise additional caution to avoid damaging the delicate leaf springs to which the contacts are fastened.

ELECTRICAL TESTS

Connect the relay as shown in Figure 9 and check that the pickup of the G1 unit is within ±5% of the original setting. Next check that the clutch setting is within ±5% of the original setting. Repeat the tests for the G2 and GD units, using the test diagrams as shown in Figure 9.

Connect the relay as shown in Figure 10 and check that the pickup of the GD1X unit is within ±5% of the original pickup voltage.

SERVICING

If any of the mechanical or electrical check points described in the previous sections are found to be out of limits, the following points should be observed in restoring them.

MECHANICAL ADJUSTMENTS

1. **G1-unit low-gradient (right-hand) contact adjustment:**

   a. With the relay setting upright, and the moving contact held away from the stationary contact, both the stationary-contact brush and the moving-contact brush should touch their respective retainers (See Figure 5).

   b. With the relay lying on its right side and the moving contact held clear, the stationary-contact brush should just part from its retainer under its own weight.

   c. With the relay lying on its left side and the moving contact held clear, the moving-contact brush should just part from its retainer under its own weight.

   d. With the relay vertical and de-energized, the contacts should make with (0.003-0.005 inch) deflection on each brush from its own retainer. To adjust the contact wipe proceed as follows:

      Adjust the stop screw in the face of the stationary contact so that the contact tips just separate, and then back it off 1/2 turn.

   e. The gap on the normally-open contact should be between 15 and 20 mils, which can be achieved as follows:

      Adjust the left contact barrel until the contacts just part, and then back the barrel off 1/2 to 2/3 of a turn.

2. **G2-unit contact adjustment.**

   a. With the unit completely de-energized, adjust the control spring so that the center line of the moving contact arm is parallel to the sides of the relay.

   b. Using a neon light as an indication of contact closure, turn both contact barrels into the moving contact until they just touch.

   c. Lock the left barrel in place by means of the clamping screw.

   d. Rotate the right barrel approximately 210° to obtain the 0.015-0.020 gap.

   e. Lock the right barrel in place.

3. **GD-unit contact adjustment.**

   a. The GD unit adjustment is similar to the G2 unit previously described, except the **right** barrel is locked in place and the **left** barrel is rotated to obtain the 0.015-0.020 inch contact gap.

4. **Shaft End Play:** The end play of the shafts of the three main units should be 1/64". This can be adjusted by the position of the upper pivot. **Be sure** to tighten the set screw that holds the upper pivot in position after the adjustment is completed.

5. **Barrel Contact Wipe Check and Adjustment:** To check for the proper amount of contact wipe, first loosen the screw that locks the barrel contact in its mounting block so that the barrel contact can be threaded in and out. Next hold the moving contact still. In the top unit, do this by using the stop screw of the low-gradient contact. In the middle and bottom units, do this by pushing the moving contact against the other barrel. Now thread the barrel contact until its silver contact tip just touches the moving contact. Use a neon light as an indication of contact closure. Continue to thread the contact barrel until the back of the contact touches the diaphragm behind it (See Figure 6) The point at which this occurs can only be determined by feel.

CAUTION: Do not thread the barrel past the point where the contact first touches the diaphragm; further threading of the barrel could damage the diaphragm.

The number of degrees of contact barrel rotation between when the silver contact tip just touches the moving contact and when the back of the contact touches the diaphragm behind it determines the contact wipe. Rotating the barrel 45° corresponds to a 0.004 wipe, while 105° corresponds to a 0.009 wipe.

If the proper wipe is not noted, then the spiral spring upon which the contact tip is fastened must be re-formed. Remove the contact barrel from the mounting block and remove the threaded cap. Lift off the spiral contact assembly. Holding the outer edge of the spiral with your fingers, place a tweezer on the inside of the spiral next to the contact cone. If more wipe is required, then lift the inside spiral so that the contact tip is stretched away from the diaphragm. If less wipe is required, then the spiral should be stretched so as to move the contact tip toward the diaphragm. Make sure that the spiral is not distorted or bent during this process. Replace the spiral contact assembly on the barrel and screw the cap onto the barrel. The wipe should now be re-checked by following the above procedure. It may be necessary to repeat the wipe adjustment until the proper wipe is obtained.

To finish the procedure, set the proper contact gap.

ELECTRICAL ADJUSTMENTS

Clutch Adjustment: The clutch is adjusted by means of the screw located on the right-hand side of the moving support. See Figure 1 for location of this screw. To readjust the clutch, first loosen the hexagonal locking nut on the adjusting screw. Turning the screw into the shaft (clockwise rotation of the screw) increases the value of current necessary to cause the clutch to slip. On the G2 unit it is recommended that the clutch adjustment be made with the taps in the **lower** tap range.

GD1X Pickup: To change the pickup time or voltage of the GD1X unit, resistor R_1 is adjusted (see Figure 1B). Increasing R_1 will increase the pickup voltage and pickup time. Be certain the slide band on R_1 is retightened after this adjustment, but do not overtighten, to avoid damaging the resistance wire.

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 the quantity required, the name of the part, and complete relay nameplate data. If possible, give the General Electric Company requisition number on which the relay was furnished.

LIST OF FIGURES

Since the last edition, changes have been made in the INSTALLATION PROCEDURE G2 Unit Rebound Test, the SERVICING Barrel Contact Wipe Check and Adjustment, and Figure 14.

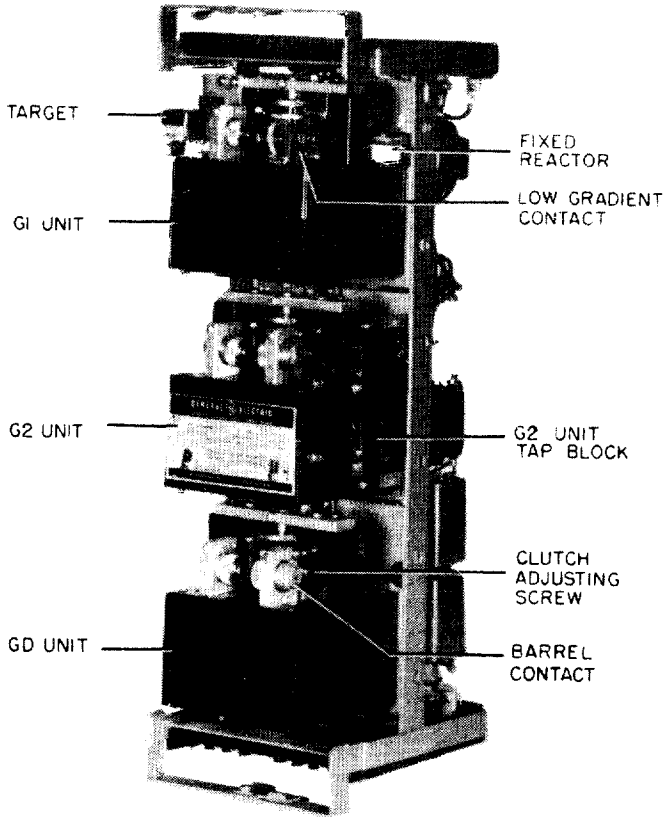


Figure 1A (8029723) CLPG12C Relay Front View

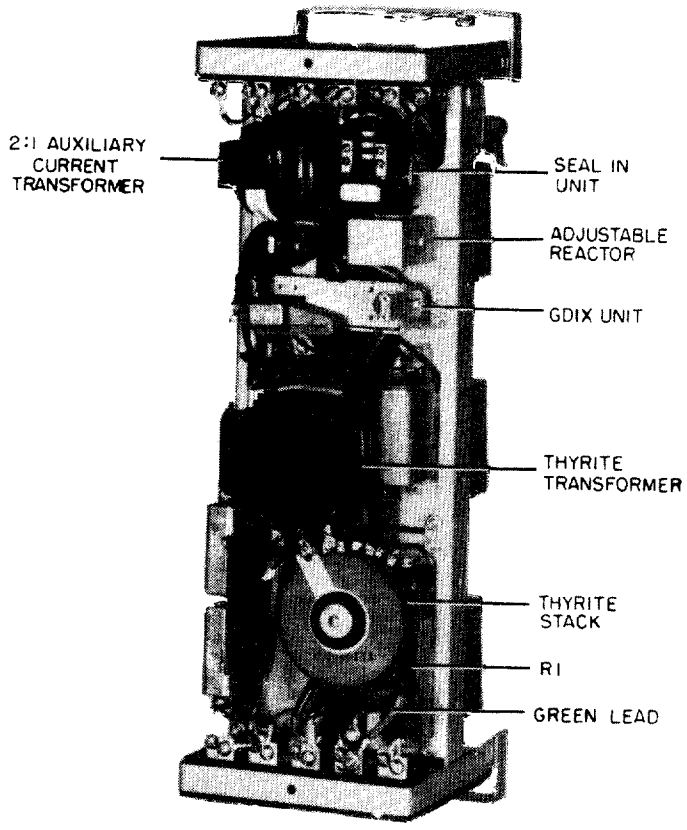


Figure 1B (8029724) CLPG12C Relay Rear View

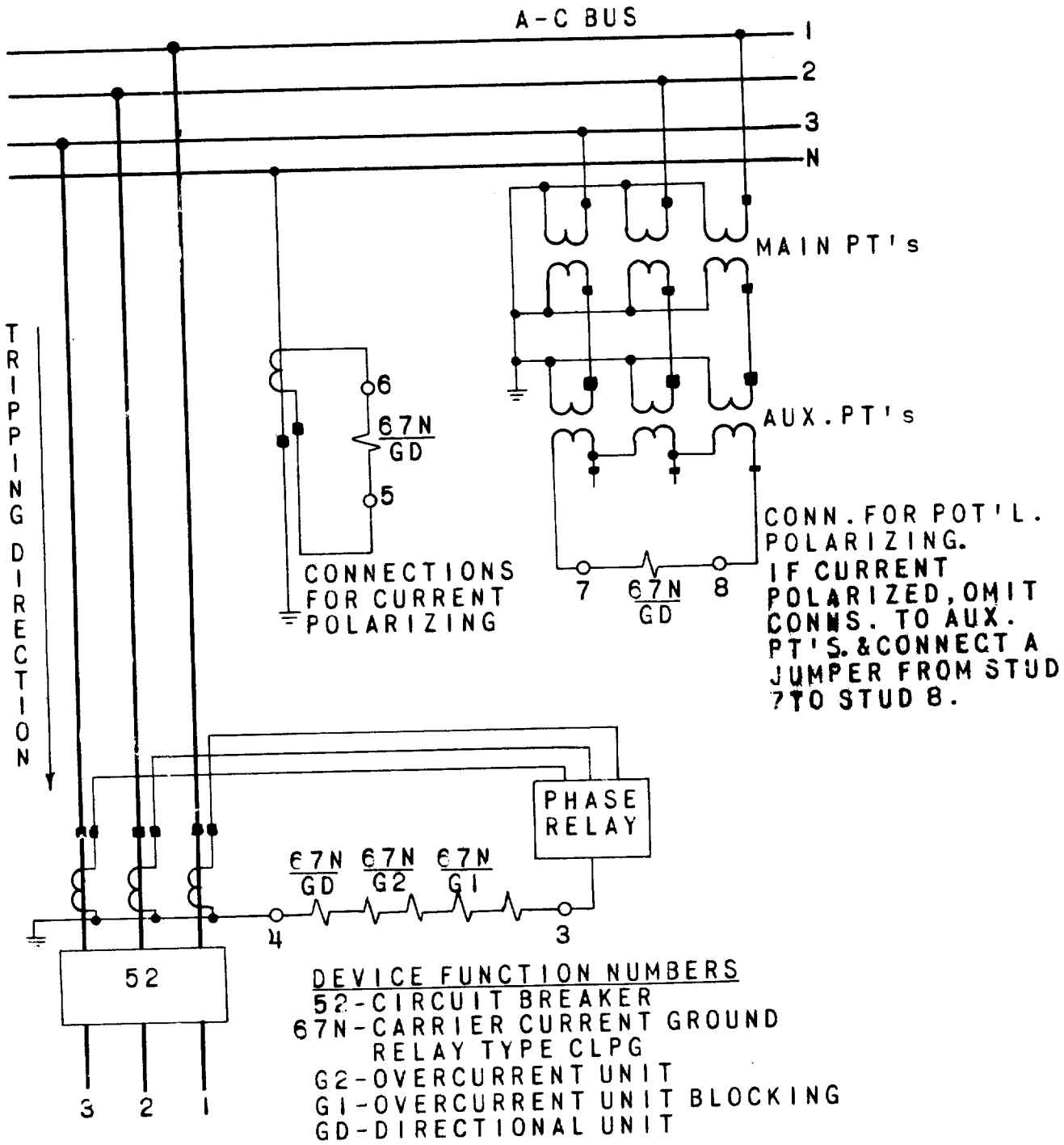


Figure 2 (362A544 [4]) External Connections for the CLPG12C Relay

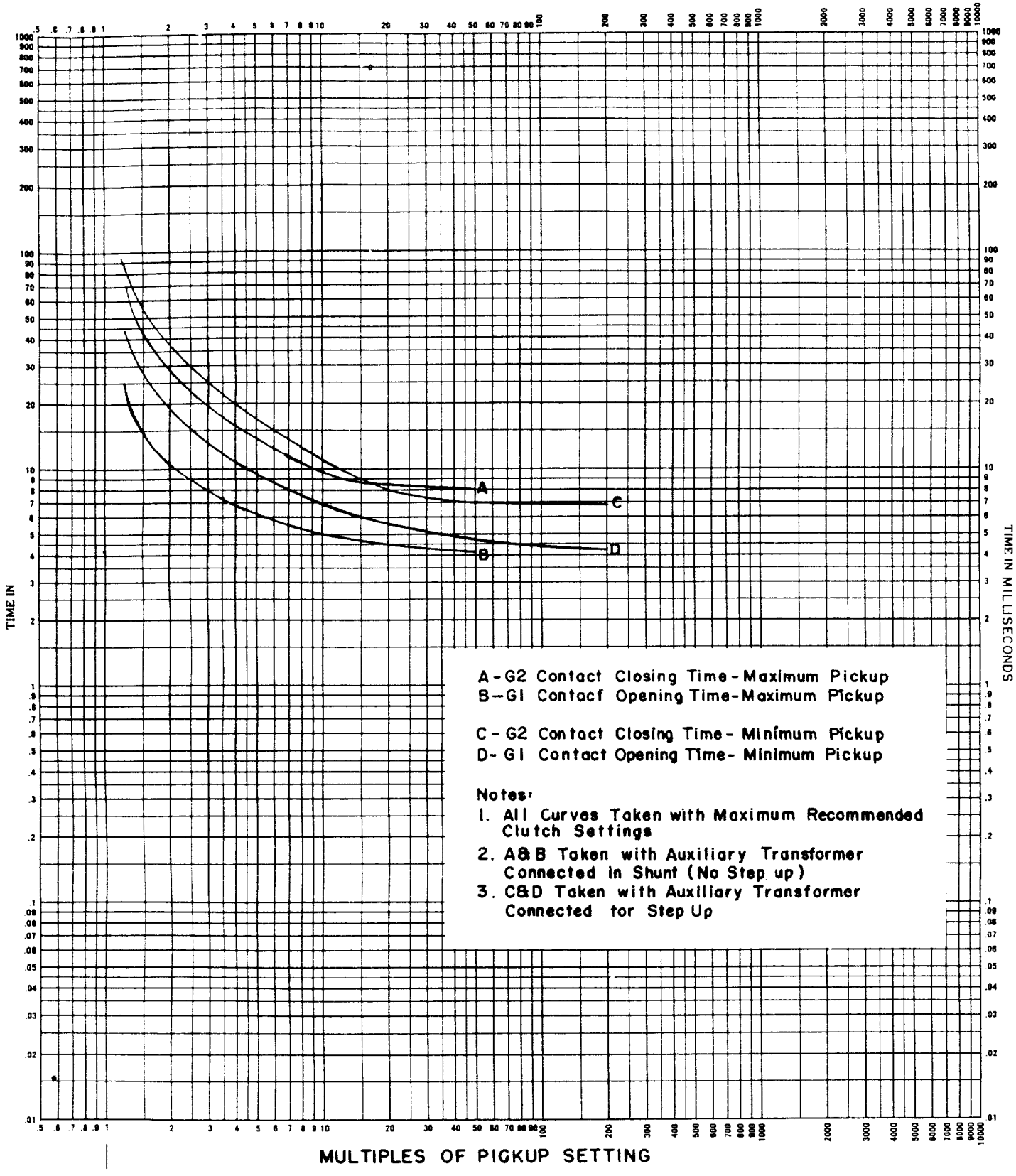


Figure 3 (0891B0495) Time-Current Curves for the Overcurrent Units of the CLPG12C Relay

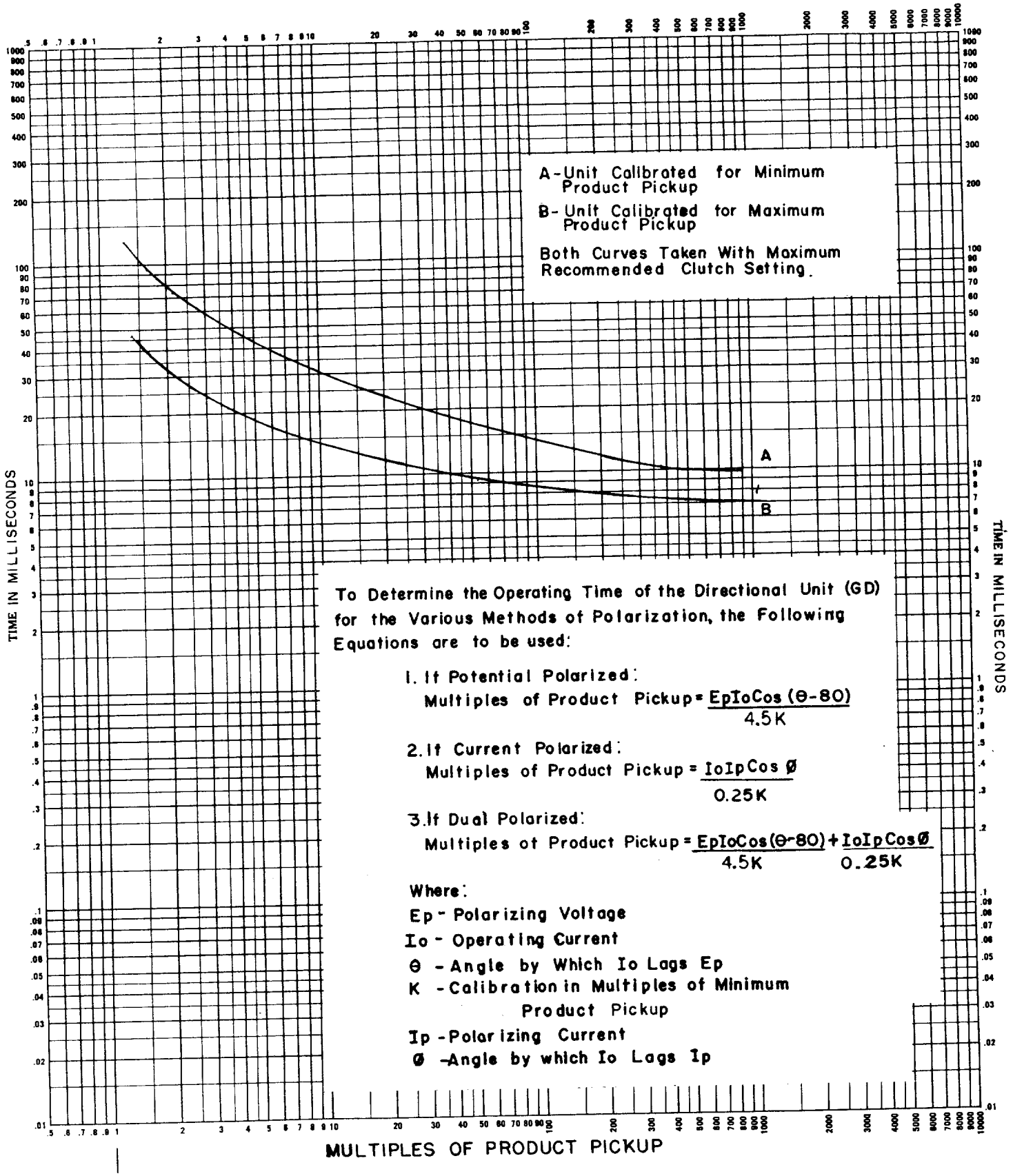


Figure 4 (0891B0496-1) Contact-Closing Time-Curves for the Directional Unit of the CLPG12C Relay

* Revised since last issue

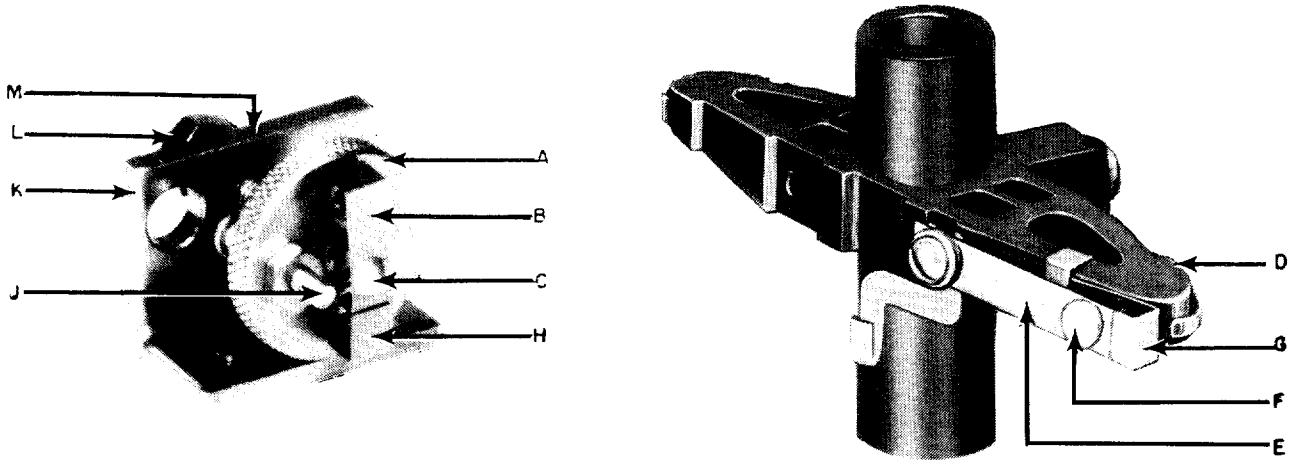
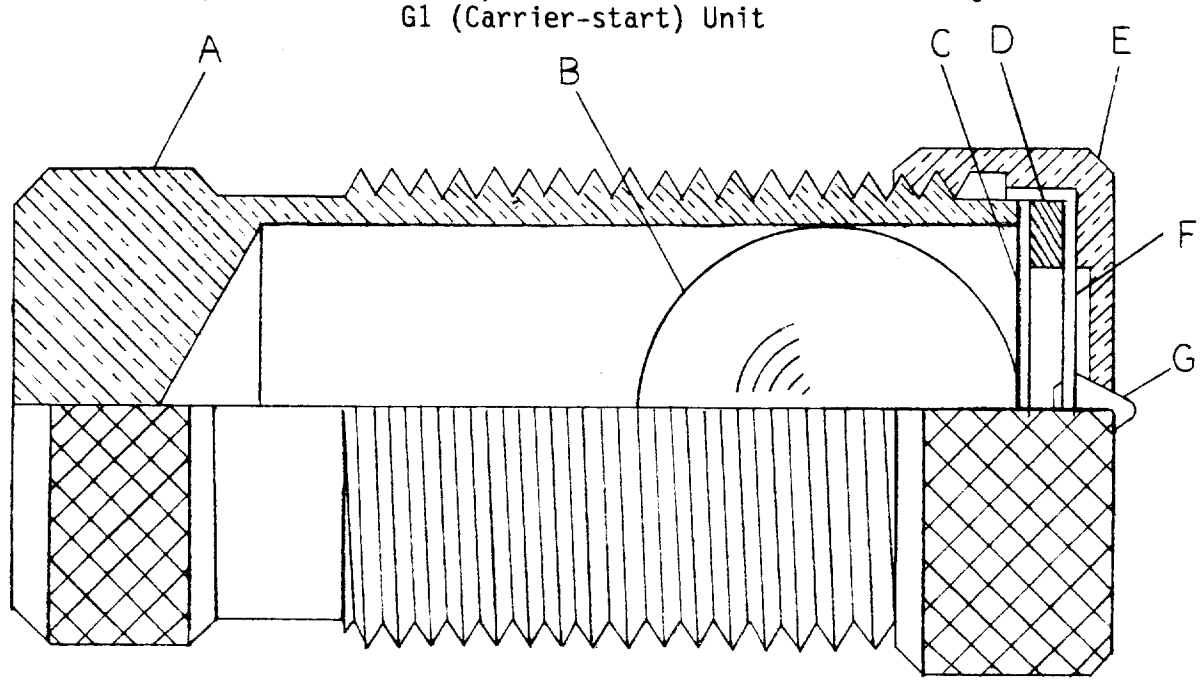


Figure 5 (8027688 & 8023399) Low-Gradient Contact Assembly for the G1 (Carrier-start) Unit



A - INCLINED TUBE
B - STAINLESS STEEL BALL
C - DIAPHRAM
D - SPACER
E - CAP
F - FLAT SPIRAL SPRING
G - CONTACT

Figure 6 (6077069-4) Barrel-Type Contact Assembly for CLPG12C Relay

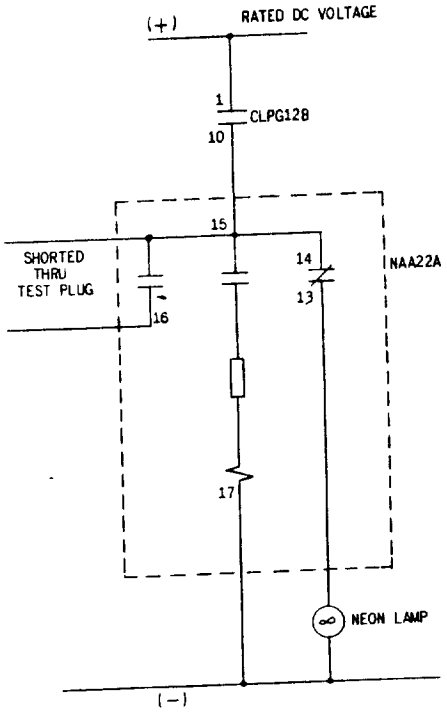
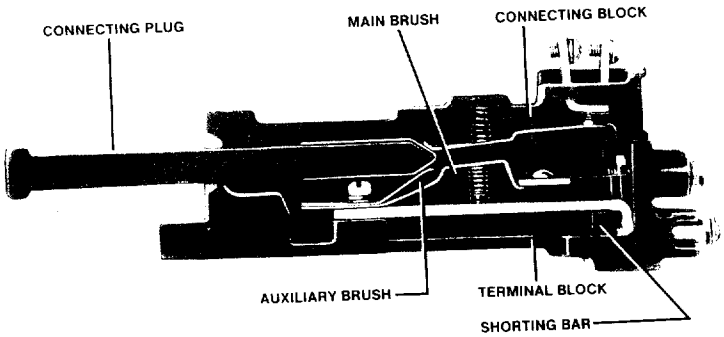


Figure 7 (459A215) Test Connections to Check for G2 Rebound Using the Carrier-Current Auxiliary



NOTE: AFTER ENGAGING AUXILIARY BRUSH CONNECTING PLUG TRAVELS ¼ INCH BEFORE ENGAGING THE MAIN BRUSH ON THE TERMINAL BLOCK.

Figure 8 (8025039) Cross Section of Drawout Case Showing Position of Auxiliary Brush and Shorting Bar

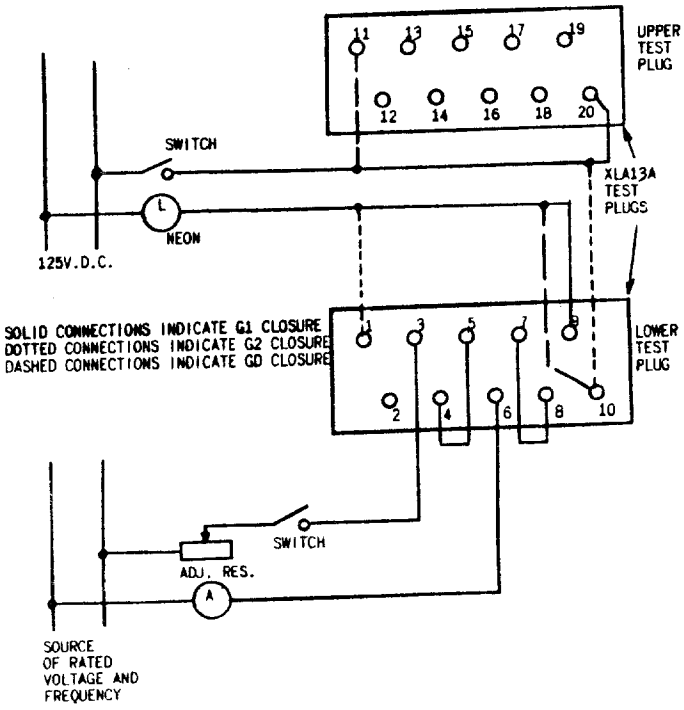


Figure 9 (0148A4066) Test Connections for Checking G1, G2 and GD Unit (Current-Polarized) Pickup and Clutch Settings

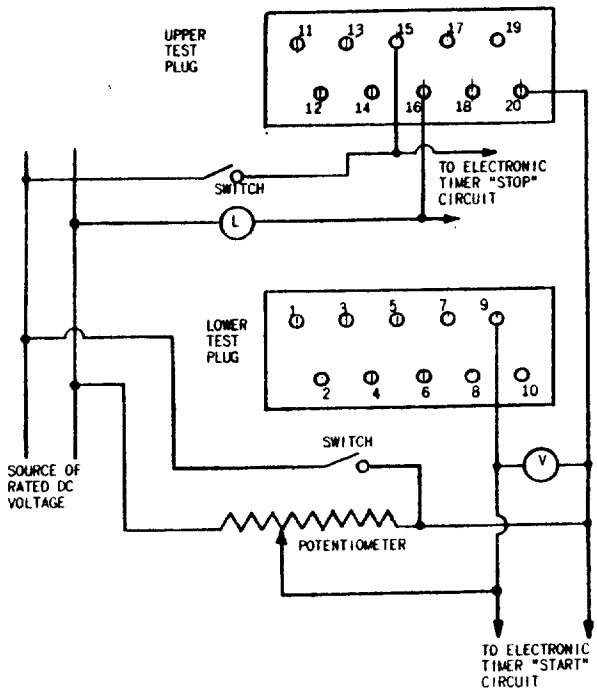


Figure 10 (0148A4065) Test Connections for Checking GDIX Time and Pickup Voltage

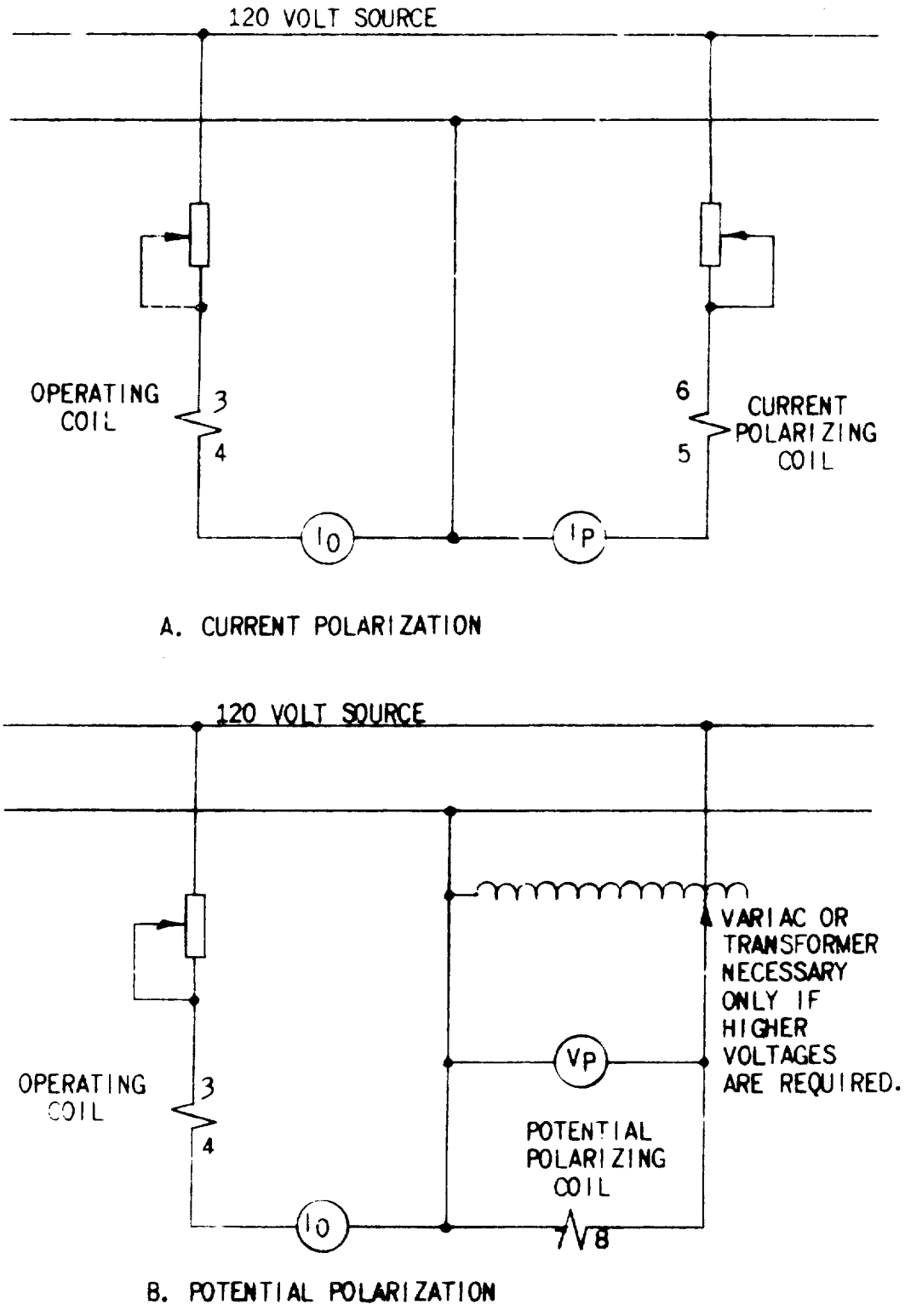


Figure 11 (0459A0204) Test Connections for Checking Proper Directional-Unit Core Position

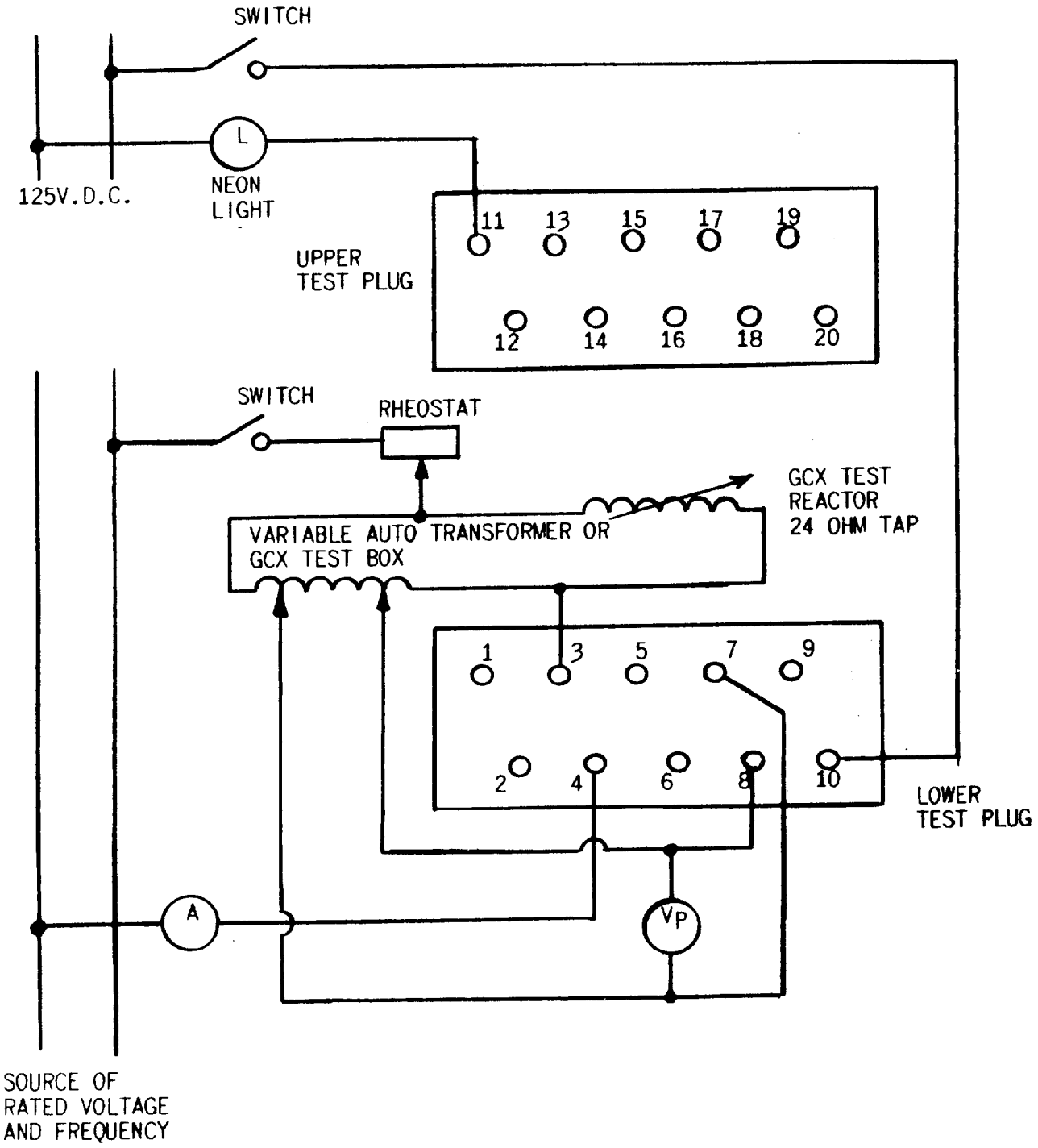
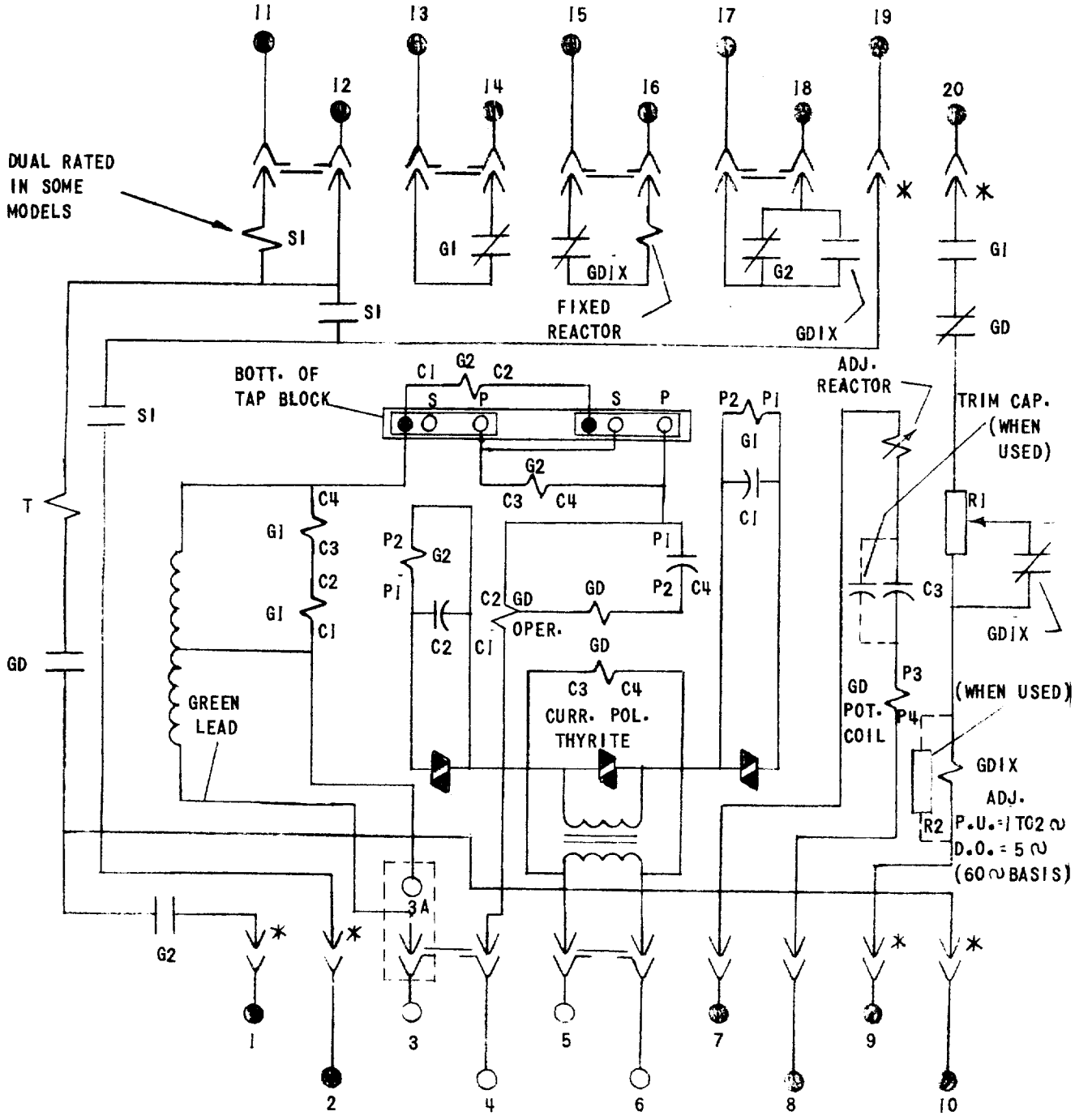


Figure 12 (0148A4064) Test Connections for Setting GD Unit Pickup Using Potential Polarization



GI = INSTANT OVERCURRENT UNIT (TOP)
G2 = INSTANT OVERCURRENT UNIT (MIDDLE)
GD = GROUND DIRECTIONAL UNIT
FOR LOWER PICK-UP RANGE, CONNECT TAPS IN "S"
FOR HIGHER PICK-UP RANGE, CONNECT TAPS IN "P"

* = SHORT FINGER
SI = SEAL-IN UNIT
T = TARGET

Figure 13 (0148A3975-3) Internal Connections (Front View) for CLPG12C Relay

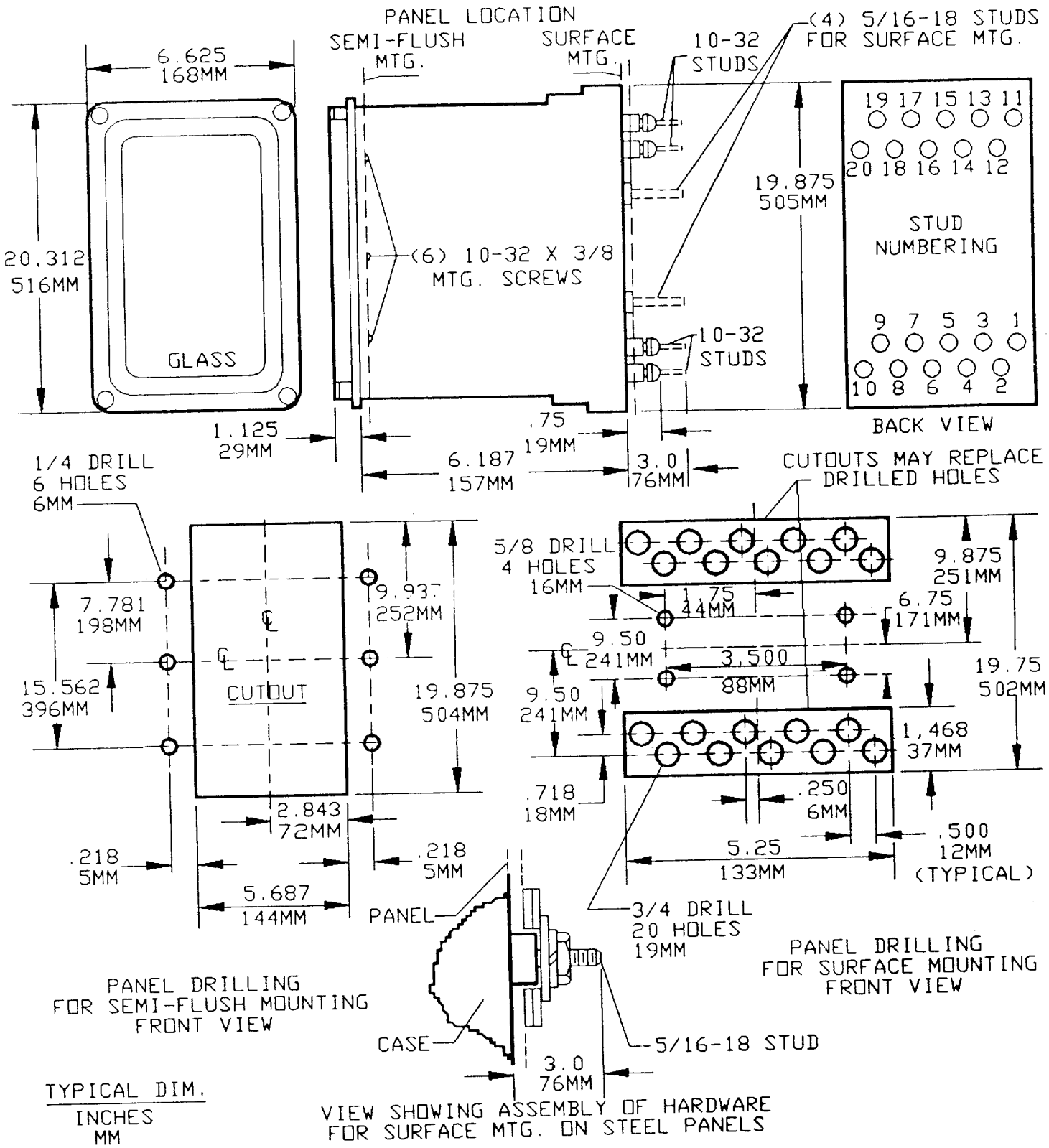


Figure 14 (6209276 [5]) Outline and Panel-Drilling Dimensions for CLPG12C Relay

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