INSTRUCTIONS

DIRECTIONAL OVERCURRENT RELAYS

CJCG16K

POWER SYSTEMS MANAGEMENT DEPARTMENT

GENERAL ELECTRIC

PHILADELPHIA, PA.

NOT AVAILABLE

FIG. 1 (TYPE CJCG16K(-)A RELAY FRONT VIEW OUT OF THE CASE

NOT AVAILABLE

FIG. 2 (TYPE CJCG16K RELAY REAR VIEW OUT OF THE CASE

CONTENTS

DIRECTIONAL OVERCURRENT RELAY

TYPE

12CJCG16K(-)A

DESCRIPTION

The CJCG16K is a directional overcurrent relay used for ground fault protection of transmission lines. The relay consists of an instantaneous overcurrent unit, and a dual polarized directional which can be internally connected to torque control the overcurrent unit or to operate independently. A Target and Seal-in unit for operation of two circuits is also included.

The relay is mounted in an M2 size drawout case. The outline and mounting dimensions are shown in Figure 10. The internal connections are shown in Figure 3.

APPLICATION

The CJCG16K relay is designed for directional overcurrent ground fault protection in transferred tripping schemes for transmission lines. Typical external connections for a Permissive Overreaching Scheme utilizing a Frequency shift pilot channel are shown in Figure 14.

The directional unit of the CJCG16K relay is dual-polarized and may be polarized by current alone, voltage alone, or by both simulaneously. The simultaneous use of both sets of polarizing coils is advantageous on applications where current and potential polarizing sources are available and there is a possibility that one or the other source may be temporarily lost.

When potential polarized, the potential coils of the relay are connected to a set of potential transformers which is connected wye-broken delta. (Broken delta means a complete delta with one corner left open, and should not be confused with the open-delta of V- connection of two PT windings). If the PT's are connected wye-wye, auxiliary wye-broken delta PT's should be used as shown in Figure 1 to obtain the zero sequence polarizing voltage. Current polarization is obtained by connecting the CJCG16K current polarizing circuits to a current transformer in the neutral of a suitable power transformer, as shown in Figure 14.

The instantaneous overcurrent unit torque control circuit is provided with a movable red lead, as shown in Figure 3. When shipped from the factory this red lead is connected to point A providing torque control of the overcurrent unit by the directional unit contacts. The red lead can be reconnected to point B to permit independent operation of the overcurrent unit.

RATINGS

The CJCG16K(-)A relays consist of two cup type units contained in an M2, medimum size, drawout case. The upper unit (IOC) is an instantaneous overcurrent unit available in the following ranges:

0.5 - 2.0 amperes 60 hertz
1.0 - 4.0 amperes 60 hertz
2.0 - 8.0 amperes 60 hertz
4.0 -16.0 amperes 50 or 60 hertz
10.0 -40.0 amperes 60 hertz
20.0 -80.0 amperes 60 hertz

The lower unit (D) is a dual-polarized directional unit with the following rating available.

Voltage 120 volts continously rated
360 volts for 60 seconds
Pickup V x I = 3.6 - 14.4
Pickup I x I = 0.25- 1.0

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

To the extent required the products described herein meet applicable ANSI, IEEE and NEMA standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.

SHORT TIME RATINGS

The short time ratings of the current operating circuit is shown in table I.

TABLE I

IOC RANGE	ONE SECOND RATING IN AMPERES	K FACTOR
0.5 - 2.0	80	6400
1.0 - 4.0	150	22500
2.0 - 8.0	150	22500
4.0 -16.0	150	22500
10.0 -80.0	150	22500

Current can be applied for shorter or for longer periods of time by solving for I in the following:

$$I^2t = K$$

K = Factor listed in table I for the unit range under consideration

t = Time in seconds

I = Current applied to the relay

CONTACTS

The CJCG16K (-)A relays have a trip-contact current-closing rating of 30 amperes, Momentarily, for voltages not exceeding 250 volts. The continuous current carring rating is limited by the tap rating of the target/seal-in unit. The trip contacts do not have an interrupting rating and therefore must be dis connected from the trip coil of the breaker by some other suitable means.

TARGET SEAL-IN UNIT

The target/seal-in units are available in 0.2/2.0 D.C. amperes and 0.6/2.0 D.C. amperes. Table II lists the ratings of these units.

TABLE II

Target / Seal-in Characteristics	0.2	0.6	2.0
D.C. Resistance + 10% Ohms	7	0.6	0.13
Mimimum Operating (Amperes)	0.2	0.6	2.0
Carry Cont. (Amperes)	0.3	0.9	3.0
Carry 30 Amperes (Seconds)	0.03	0.5	4.0
Carry 10 Amperes (Seconds)	0.25	4.0	30.0
60 HZ Impedence (Ohms)	52	6.0	0.53
Mimimum Dropout (Amperes)	0.05	0.15	0.5

The 0.2 ampere tap is for use with trip coils which operate on currents from 0.2 to 2.0 amperes at the minimum control voltage. If this tap is used with trip coils requiring more than 2 amperes there is a possibility that the resistance of 7.5 ohms will reduce the current to such a low value that the breaker may not trip.

The 2.0 ampere tap should be used with trip coils that take 2 amperes or more at minimum control voltage, provided the current does not exceed 30 amperes at the maximum control voltage. If the tripping current exceeds 30 amperes, the connections should be arranged so that the instantanous overcurrent unit contacts will operate an auxiliary relay which in turn energizes the trip coil or coils. With this application, it may be necessary to connect a loading resisor in parallel with the auxiliary relay coil to allow enough current to flow in order to operate the target/seal-in unit. The internal connections diagram for the CJCG16K (-) A relay is shown in Figure 3.

CHARACTERISTICS

The directional unit of the CJCG16K (-)A relay, when potential polarized, has an angle of maximum torque of 60 degrees lag (I lags E) with a V x I product pickup range of 3.6 - 14.4 volt amperes.

When current polarized, the angle of maximum torque occurs when the operating and the polarizing currents are in phase. The Io times I_p product pickup range is 0.25 to 1.0 amperes.

When dual polarized, the directional unit pickup can be calculated with the following equation.

$$3.6 = Io\ Vp\ \cos(\theta - 60^{0}) + 14.4\ IoIp\ \cos\phi$$

where: Io = Operating current (amperes)
Ip = Polarizing current (amperes)
Vp = Polarizing voltage
θ = Angle by which Io lags Vp
ϕ = Angle between Io and Ip

The operating time characteristics of the CJCG16K (-) A relay is shown in Figure 4 for current, potential or for dual polarization.

The operating time of the instantaneous overcurrent unit is shown in Figure 5 for various spring settings within the units range of pickup. Note: This operating time is only the operating time of the I.O.C. unit and does not include the operating time of the directional unit.

The I.O.C. unit when shipped from the factory will be connected to have its torque controlled by the contacts of the directional unit. In the event that this application is not necessary then the I.O.C. unit torque control can be made independent of the directional unit by connecting the red lead on the directional unit contact from point A to point B as shown on the relay internal connections diagram of Figure 3. With this connection change the I.O.C. unit will function as an instantaneous overcurrent relay independently of the directional unit.

BURDENS

POTENTIAL CIRCUIT

The potential circuit of the directional unit has a capacitive burden of 10 volt amperes at 0.87 power factor with 120 volts applied at 60 hertz.

CURRENT OPERATING CIRCUIT

Table III lists the total operating circuit current burden of the instantaneous and the directional units.

TABLE 111

CURRENT CIRCUIT BURDEN AT 5 AMPERES, 60 HERTZ, FOR THE CJCG16K (-)A RELAY

IOC UNIT RATING AMPERES	IMPEDENCE IN OHMS	VOLT AMPERES	POWER FACTOR
0.5 - 2	1.40	35.0	0.39
1 - 4	0.60	16.5	0.39
2 - 8	0.53	13.2	0.39
4 -16	0.50	12.5	0.39
10 -40	0.48	12.0	0.58
20 -80	0.48	12.0	0.58

CURRENT POLARIZING CIRCUIT

The burden for all relay ratings of the current polarized circuit with 5 amperes, 60 hertz applied is 8.6 volt amperes at 0.95 power factor with an impedence of 0.35 ohms.

TARGET/SEAL-IN UNIT

The target/seal-in units burden and characteristics is shown in Table II. The text following Table II explains the method and reason for selecting the target tap in respect to the breaker trip coil current.

CONSTRUCTION

DIRECTIONAL UNIT (D)

The directional unit is constructed of the induction-cylinder principle with a laminated stator having eight poles projecting inward and arranged symmetrically around a stationary central core. The cup-like aluminum induction rotor is free to operate within the annulars air gap between the poles and the core. The poles are fitted with current operating, potential or current polarizing coils.

The principle by which torque is produced is the same as that of an induction disk relay with a watt-metric element, although, in arrangement of parts, the unit is more like a split-phase induction motor. The induction-cylinder construction produces a higher torque and lower rotor inertia than the induction-disk construction, resulting in a faster and more sensitive relay.

INSTANTANEOUS OVERCURRENT UNIT

This unit is similar in construction to the directional unit described above, differing only in coil turns and connections. The four corner coils consist of two winding, an inner winding consisting of a large number of turns of fine wire, and an outer winding having a few turns of heavy wire. The outer winding of the corner coils are connected in series with two side coils. The inner windings of the corner coils are all connected in series, and in turn are connected in series with a capacitor and the contacts of the directional unit. This circuit thus controls the torque of the instantaneous overcurrent unit. When the directinal unit contacts are closed, the instantaneous unit will develop torque in proportion to the square of the current.

SEAL-IN UNIT

A seal-in unit is mounted on the left side of the instantaneous-overcurrent unit. This unit has its coil in series and its contacts in parallel with the main contacts of the instantaneous-overcurrent unit, arranged in such a manner that when the main contacts close, the seal-in unit picks up and seals in around the main contacts. When the seal-in unit operates, it raises a target into view which latches up and remains exposed until manually released by pressing the button located at the lower left corner of the cover.

CONTACTS

The contacts of both units 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 then 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. To change the stationary contact mounting spring, remove the contact barrel and sleeve as a complete unit after loosening the screw at the front of the contact block. Unscrew the cap (E). The contact and its flat spiral mounting spring may then be removed.

The above units are all contained in an M2, medium size drawout case. The relay can be removed from the case by removing the cover and connection plugs (top and botton), unlatch the top and bottom of the cradle from the case and remove the relay.

A cross sectional view of the case, cradle and connection plug is shown in Figure 7. The outline and panel drilling dimensions are shown in Figure 10.

WARNING: Every circuit in the drawout case has an auxiliary brush. It is especially important on current circuits and other circuits with shorting bars that the auxiliary brush be bent high enough to engage the connecting plug or test plug before the main brushes do. This will prevent CT secondary circuits from being opened.

RECEIVING, HANDLING AND STORAGE

These relays, when not included as a part of the 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 APPARATUS SALES OFFICE.

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

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

ACCEPTANCE TESTS

VISUAL INSPECTION

Upon receiving the relay, check the nameplate on the relay and the case label to insure that the relay model number is correct as ordered.

Check the fingers (long and short) in the relay and the fingers and C.T. shorting bars of the case against the internal connections diagram of Figure 3.

Check that there are no broken or damaged parts in the relay and that the control springs are reasonably concentric on all units.

DRAWOUT RELAYS GENERAL

Since all drawout relays in service operate in their case, it is recommended that they be tested in their case or an equivalent steel case. In this way any magnetic effects of the enclosure will be accurately duplicated during testing. A relay may be tested without removing it from the panel by using a XLA13A test plug. This plug makes connections only with the relay and does not disturb any shorting bars in the case. Of course, the XLA12A test plug may also be used. Although this test plug allows greater testing flexibility, it also requires C.T. shorting jumpers and the exercise of greater care since connections are made to both the relay and the external circuitry.

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 of current and/or voltage. The purity of the sine wave (i.e. its freedom from harmonics) cannot be expressed as a finite number for any particular relay, however, any relay using tuned circuits, R-L or RC networks, or saturating electromagnets (such as time-overcurrent relays) would be essentially affected by non-sinusoidal wave forms.

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

MECHANICAL ADJUSTMENTS

Contact gaps - 0.016 to 0.020 inches

Cup end play - 0.015 to 0.032 inches

CONTACT CLEANING

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

POLARITY TESTS

To determine that the relay is operational, a polarity test can be performed by connecting the relay as shown in Figure 8. With the connections shown the relay unit will produce operating torque to close the normally open contacts of the directional unit (D). The I.O.C. will also close its normally open contact provided that the current in the test circuit is equal to or higher than the pickup setting of the I.O.C. unit. If the I.O.C. unit pickup setting is higher than the test current a change in the series resistor to a lower value so the test current is high enough to provide an operating current to the I.O.C. unit. Do not allow this higher current to remain for any length of time because it may tend to overheat the units.

The CJCG16K(-)A relays have been completely tested at the factory for each unit's full range of adjustment and finally set at the minimum pickup rating prior to shipment. The target/seal-in unit is tested and set in the highest tap prior to shipment.

In order to verify the minimum pickup settings on the units, connect the relay according to the test circuit shown in Figure 11.

<u>I.O.C.UNIT</u> - Apply current and check that the I.O.C. unit will pick up at the minimum current listed on the nameplate ± 5 percent.

<u>D. DIRECTIONAL UNIT</u> - IxI product - Apply current and check that the directional unit will pickup with an I x I product current of).25 amperes. This is equivalent to 0.5 amperes in the operating and current polarizing coils connected in series ± 3 percent.

<u>D. DIRECTION UNIT</u> - VxI product - Apply V = 5 volts, increase current until the unit picks up. This should occur between 0.85 - 1.7 amperes.

<u>TARGET/SEAL-IN</u> Apply D.C. current to studs 1 and 11. Block the D and I.O.C. normally opened contacts closed. Increase the current and the unit should pickup between 75 - 95 % of tap rating.

If any additional settings are necessary on these units refer to the section on SERVICING.

INSTALLATION PROCEDURE

1. Check the nameplate to determine that the correct relay is being installed.

2. Check that the fingers and shorting bars are correct according to the internal connection diagram of Figures 3 and 7.

3. Check that the moving contacts are free of binds and that the control spring turns are not touching each other.

4. The relay should be tested in its case or in an equivalent case.

5. Check that the contact gaps on both units are between 0.016 to 0.020 inches.

6. Check that the cup shaft end play is between 0.015 - 0.032 inches.

7. Relay settings other than those set by the factory can be performed by referring to the section on SERVICING.

8. Tests can be performed on the relay in its case on the panel with the use of XLA plugs shown in Figures 12 and 13. The instructions for the XLA plugs are covered in instruction book GEI-25327.

9. The taps on the target/seal-in can be changed in the following manner so as not to disturb the mechanical adjustments. Remove one screw from the left plate. Place it in the desired right tap. Remove the unwanted tap screw and put it in the left plate.

10. Apply a D.C. Current to studs 1 and 11, close the D and I.O.C. contact. Increase the D.C. current and note that the target will pick up between 75 and 95 percent of its tap rating.

    To check the dropout, add an external jumper to studs 11 and 12. With the unit picked up, open either or both of the contacts and the target should remain picked up. Gradually reduce the current until the target/seal-in drops out. This should occur at 25 percent of the tap rating or higher.

11. For additional tests and adjustment procedures refer to the section on SERVICING.

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 under INSTALLATION PROCEDURE be checked at an interval of from one to two years.

SERVICING

The relay can be readjusted for any setting within the range of the unit by following the procedure listed below.

Connect the relay according to the test circuit of Figure 11 for the unit under test.

TOOLS:
1. Locknut wrench 378A518 P-4
2. Spanner wrench 178A9478 G-1
3. Open end wrench 1/4 inch
4. Open end wrench 7/16 inch
5. Screw driver standard

Tools #1 and #2 are special tools which can be purchased through the GENERAL ELECTRIC CO.

Tools #3,#4 and #5 are standard tools which are available at any hardware store.

A. Instantaneous Overcurrent Unit (I.O.C.)

1. Core adjustment (I.O.C.)
   The core (inner stator) of the I.O.C. unit is not adjusted for any bias torque but should be checked for tightness.

   The core protrudes through the center of the bottom plate of the unit and is secured to the plate by a locknut.

   The center of the core has a 7/16 inch hex jewel screw secured to it. The jewel screw provides the cup with a pivot point and is used also as a means of securing the core to the bottom plate.

To tighten the core, put the core locknut wrench and the 7/16 inch wrench to the locknut and hex jewel screw then apply a slight opening torque pressure to the jewel screw and tighten the locknut with the special wrench.

2. PICKUP (I.O.C.)

With the 1/4 inch wrench, loosen the hex stud located on the top rear center of the unit. Block the "D" N.O. contact closed.

Apply minimum pickup as listed on the nameplate and with the spanner wrench, which fits the holes in the control spring adjusting ring, adjust the unit for its minimum pickup. Then wind up the control spring until the maximum pickup can be obtained. The final setting can be made at this time by adjusting the control spring to the desired setting. Lock the spring adjusting ring into position.

When locking the spring adjusting ring put some pressure on the ring from the front to back of the unit to insure that the ring is fully into the slot of the bakelite collar before tightening the 1/4 inch hex stud. Failure to do this will result in a broken bakelite collar. Tighten the hex stud with only enough force to keep the adjusting ring from turning when a slight turning pressure is applied by hand.

3. LACK OF TORQUE TEST

The lack of torque test is a check on the directional control that the "D" unit has on the I.O.C. unit. This test is accomplished by keeping the "D" unit contact open. Apply up to 20 times pickup and note that the I.O.C. unit does not close its contact.

4. CLUTCH.

The clutch is adjusted with the screw and locking nut located in the bakelite of the moving contact assembly on the right hand side, front view.

Loosen the locknut and turning the screw clockwise will set the clutch for a higher setting.

Close the "D" unit contact. Apply current and note at what level of current that the clutch begins to slip. The current can be applied instantaneously and the clutch slip can be observed by watching the retainer U - shaped pin located just above the bakelite moving contact and secured around the cup shaft. One revolution of this pin can be considered clutch slip.

The setting of the clutch depends on the range of the unit under test and these are listed below.

RELAY RATING AMPERES	I.O.C. PICKUP AMPERES	CLUTCH NO SLIP	CLUTCH SLIP AT
2.5	Below 1.0	3.0A	6.0A
5.0	Below 1.0	7.0A	11.0A
5.0	1-4	7.0A	11.0A
5.0	2-8	11.0A	17.0A
5.0	4-16	22.0A	34.0A
5.0	10-40	Tighten to full extent of adjustment	
5.0	20-80	Tighten to full extent of adjustment	
5.0	40-60	Tighten to full extent of adjustment	

On the ranges where the clutch is tightened to the full extent of adjustment, be careful not to overtighten or the bakelite moving assembly may be broken. This also holds true when tightening the locknut for any clutch setting.

B. DIRECTIONAL UNIT (D).

1. CORE ADJUSTMENT

The core of the directional unit is adjusted to remove the effects of current bias which might tend to close the N.O. contact.

Short circuit studs 9 and 10.
Leave terminals 7 and 8 open (unshorted).

In order to check the core adjustment, the pickup (IxI) or (VxI) setting must be disturbed. This can be done by loosening the hex stud at the top rear of the unit and with the spanner wrench, adjust the control spring so that the moving contact floats between the stop and the stationary contact.

Apply 30 amperes and note the direction of rotation of the moving contact. A correctly, adjusted unit will develop a slight opening torque. If this does not occur then the core must be adjusted.

With the locknut wrench and the 7/16 inch open end wrench, unlock the locknut slightly and then turn both wrenches together in order to rotate the core. Adjust the Core until the unit develops a slight opening bias. Do not keep this current on for any length of time because it will tend to overheat the unit. Lock the assembly when the core position has been set.

2. PICKUP (IXI)

Connect the relay per Figure 11, directional unit, IxI test.

Loosen the hex stud located at the top rear of the unit. With the spanner wrench the pickup range can be checked which is 0.25 to 1.0 amperes. On an IxI product this is equivalent to 0.5 to 1.0 amperes through the operating and current polarizing coils connected in series. Use the spanner wrench to set the desired IxI product and lock the assembly as mentioned in the I.O.C. pickup test.

3. PICKUP (VXI)

The VxI product pickup can be checked by connecting the relay per Figure 11, directional units, VxI pickup.

Although the VxI product pickup can be adjusted with the control spring, it may be only necessary to check this value without disturbing the control spring setting which was set for IxI product pickup.

The VxI product pickup is directly proportional to the IxI product pickup. That is, the IxI pickup of 0.25 amperes corresponds to a VxI product pickup of 3.6 V.A. at 60 degrees lag while the IxI pickup of 1.0 amperes corresponds to the VxI product pickup of 14.4 V.A. at 60 degrees lag. Therefore, the V.A. pickup can be calculated for any IxI product pickup setting that was previously set by using the following equation.

$$\text{Relay (VxI)} = \frac{(\text{VxI})\text{min}}{(\text{IxI})\text{min}} \times \text{(IxI) setting (at } 60^{\circ} \text{ lag)}$$

$$\text{Relay (VxI)} = \frac{3.6}{0.25} \times \text{(IxI) setting (at } 60^{\circ} \text{ lag)}$$

In order to check the VxI, apply 5 volts and increase the operating current until the directional unit closes its N.O. contact, which should occur between 1.3 - 1.6 amperes for an IxI setting of 0.25 amperes.

The test circuit for checking the VxI product is at 0 degrees and is therefore off the angle of maximum torque of the relay by 60 degrees. This must be taken into account when calculating the actual VxI at 60 degrees lag. The following equation will assist in accomplishing this difference.

$$(\text{VxI})\ 60^{\circ} = \text{(VxI) 0 degrees x cos 60 degrees}$$

Example: $(\text{VxI})\ 60^{\circ} = \text{5VX 1.44 A (nom) x 0.5}$

$(\text{VxI})\ 60^{\circ} = \text{3.6 V.A.}$

4. CLUTCH ADJUSTMENT

Connect the relay per Figure 11, directional unit, IxI test.
Short studs 9 and 10.
Set the clutch on the directional unit so that it slips between 10-20 amperes for an IxI setting of 0.25 amperes. Set the clutch proportionally higher for higher IxI product setting.
The procedure for adjusting the clutch is explained in the I.O.C. unit clutch settings.

5. THYRITE* DISK TESTS

Apply five amperes of current to the current polarizing coils only (studs 7-8) and measure the voltage across the terminals of the Thyrite* disk using a high input impedance A.C. voltmeter. The voltage should be between 35-45 volts.

C. TARGET/SEAL-IN

1. Apply D.C. current with a good wave form to studs 1 and 11 with a variable current range of 0.1 to 3.0 amperes.
2. Jumper studs 11 and 12.
3. Block the D and I.O.C. contacts closed.
4. Gradually increase the current and the target should pickup in one motion between the current values listed in table IV.

TABLE IV

TAP	PICKUP RANGE	DROPOUT
0.2	0.15 - 0.19	0.06 or more
0.6	0.45 - 0.57	0.18 or more
2.0	1.50 - 1.90	0.60 or more

When the unit is picked up, open either the D or I.O.C. unit contact and the target/seal-in unit should remain picked up.

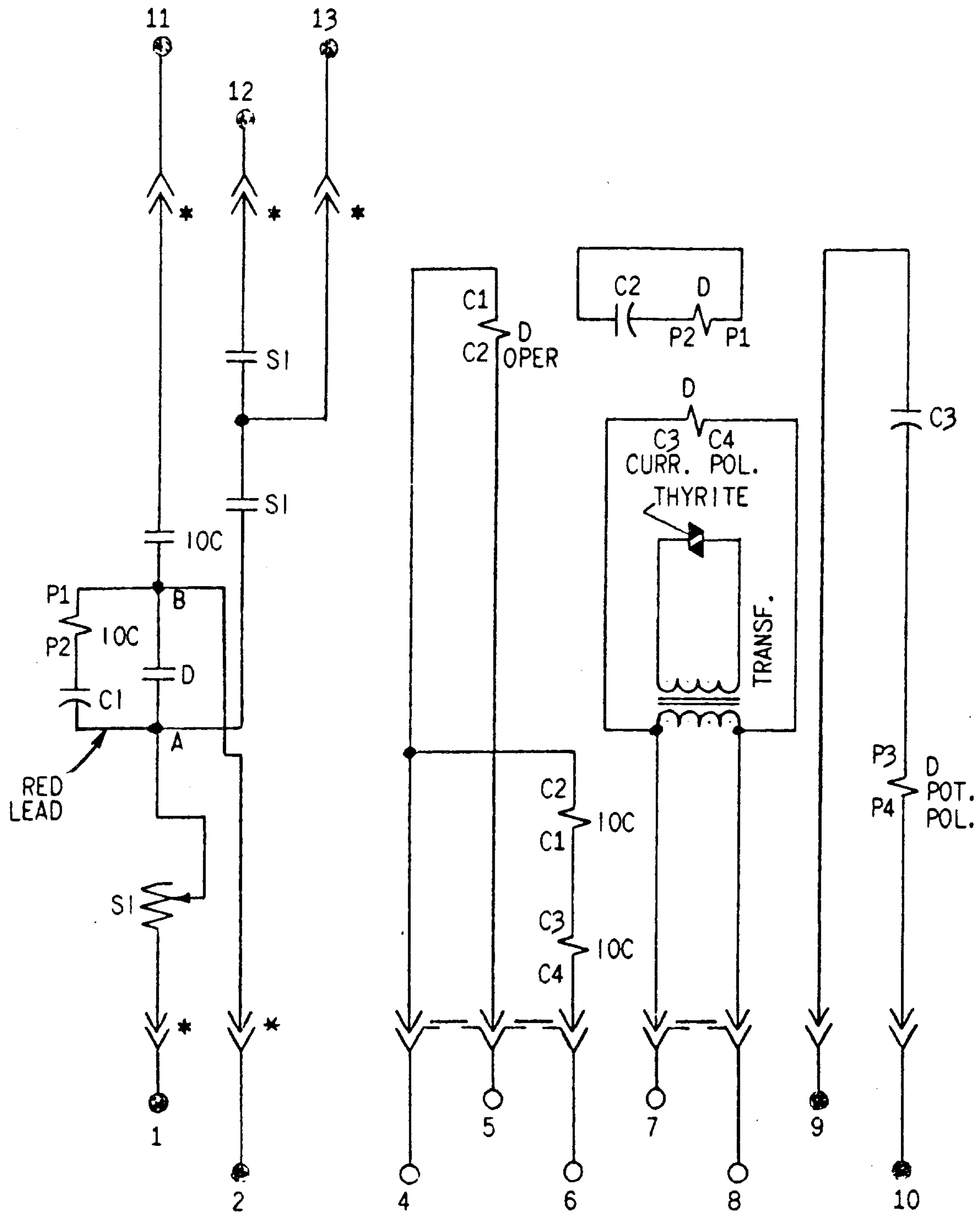
Dropout can be checked by reducing the current slowly unitl the unit drops out. This should occur at the limits specified in table IV.

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, specify quantity required, name of the part wanted, and the complete model number of the relay for which the part is required.

* Registered trademark of General Electric Company



IOC-INSTANTANT OVERCURRENT UNIT (TOP)
D-DIRECTIONAL UNIT (BOTTOM)
SI-SEAL-IN UNIT

* = SHORT FINGERS

FIG. 3 (0127A9471-2) INTERNAL CONNECTIONS DIAGRAM FOR THE 12CJCG16K(-)A RELAY

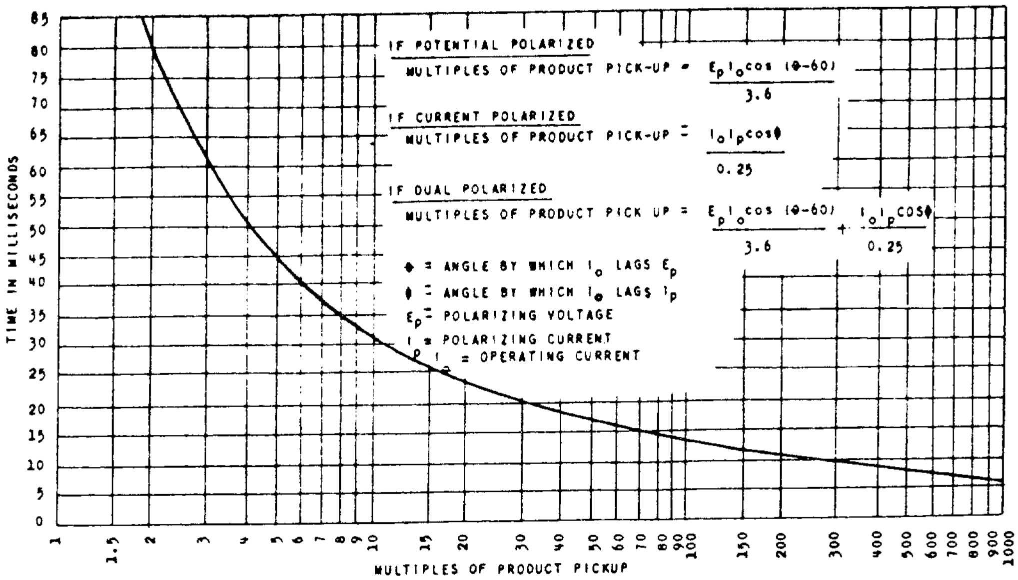


FIG. 4 (0376A0934-0) DIRECTIONAL UNIT TIME CURVE FOR CURRENT, POTENTIAL OR DUAL POLARIZED CONNECTIONS OF THE 12CJCG16K(-)A RELAY

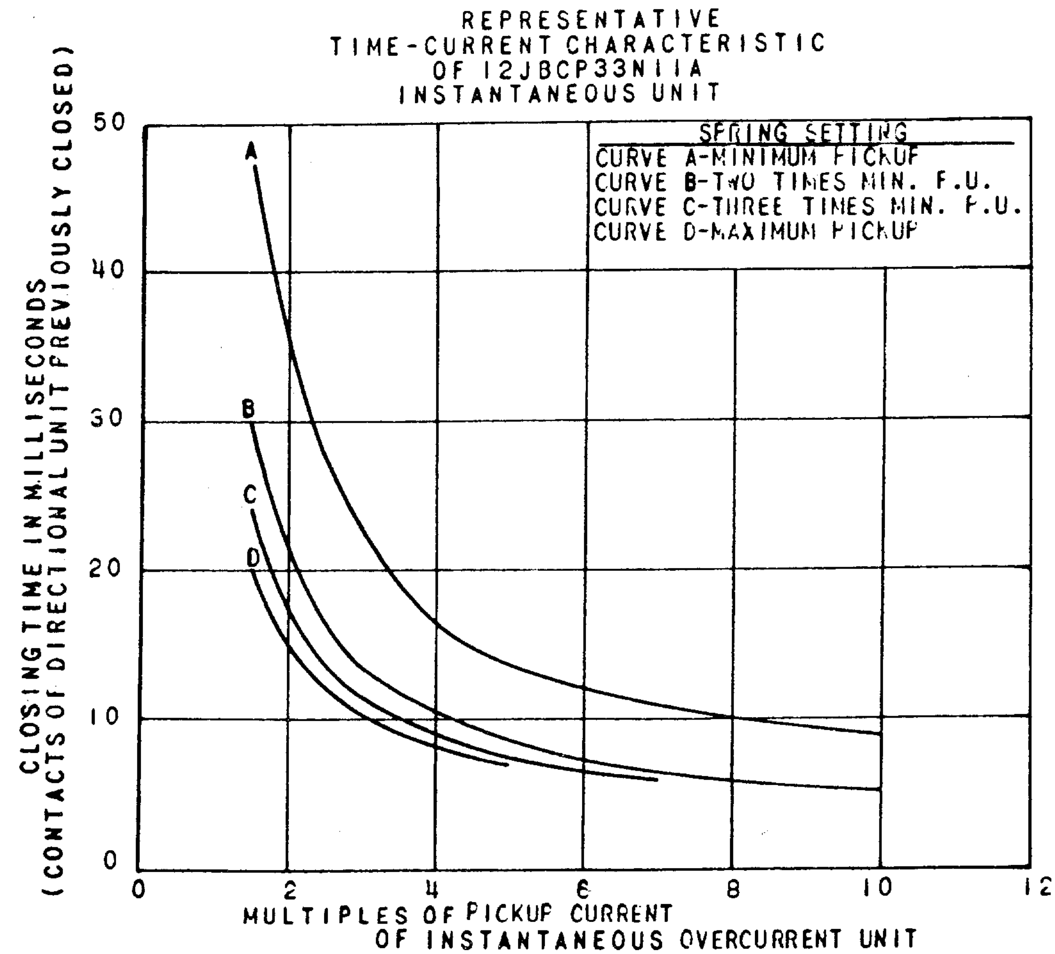
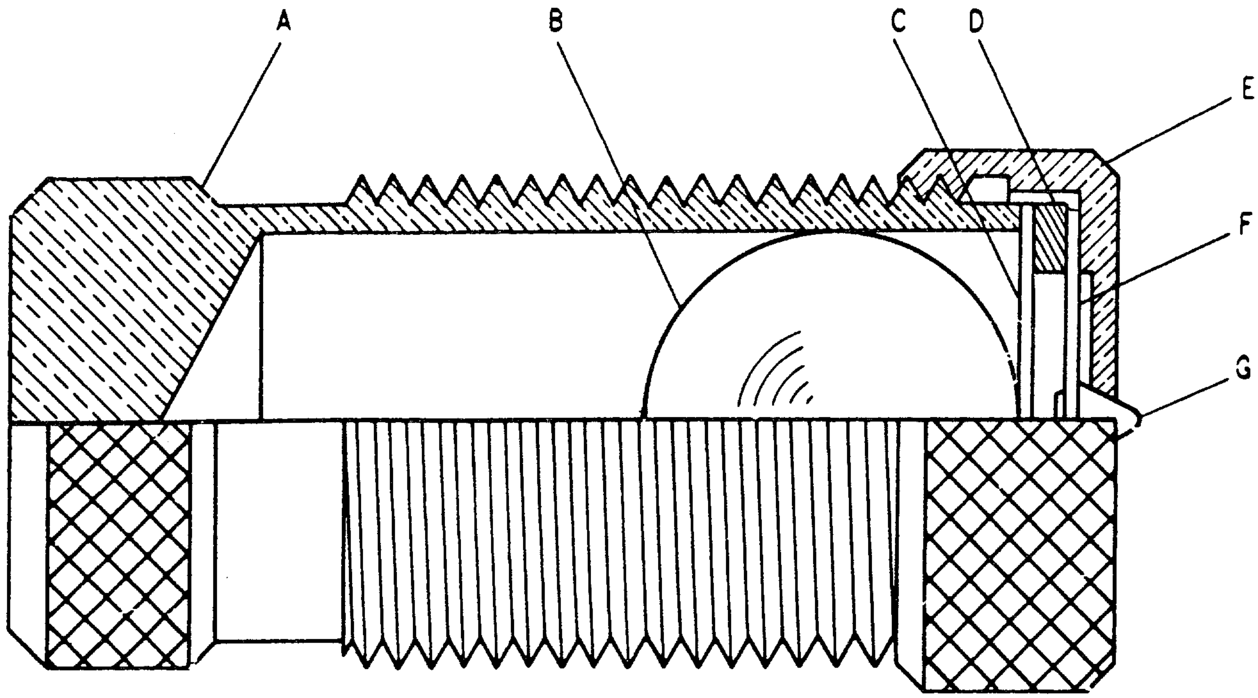


FIG. 5 (K-6556439-2) INSTANTANEOUS OVERCURRENT UNIT (IOC) OPERATING TIME CURVE FOR THE 12CJCG16K(-) RELAY



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

FIG. 6 (K-6077069-4) BARREL CONTACT FOR THE I.O.C. AND THE DIRECTIONAL UNITS

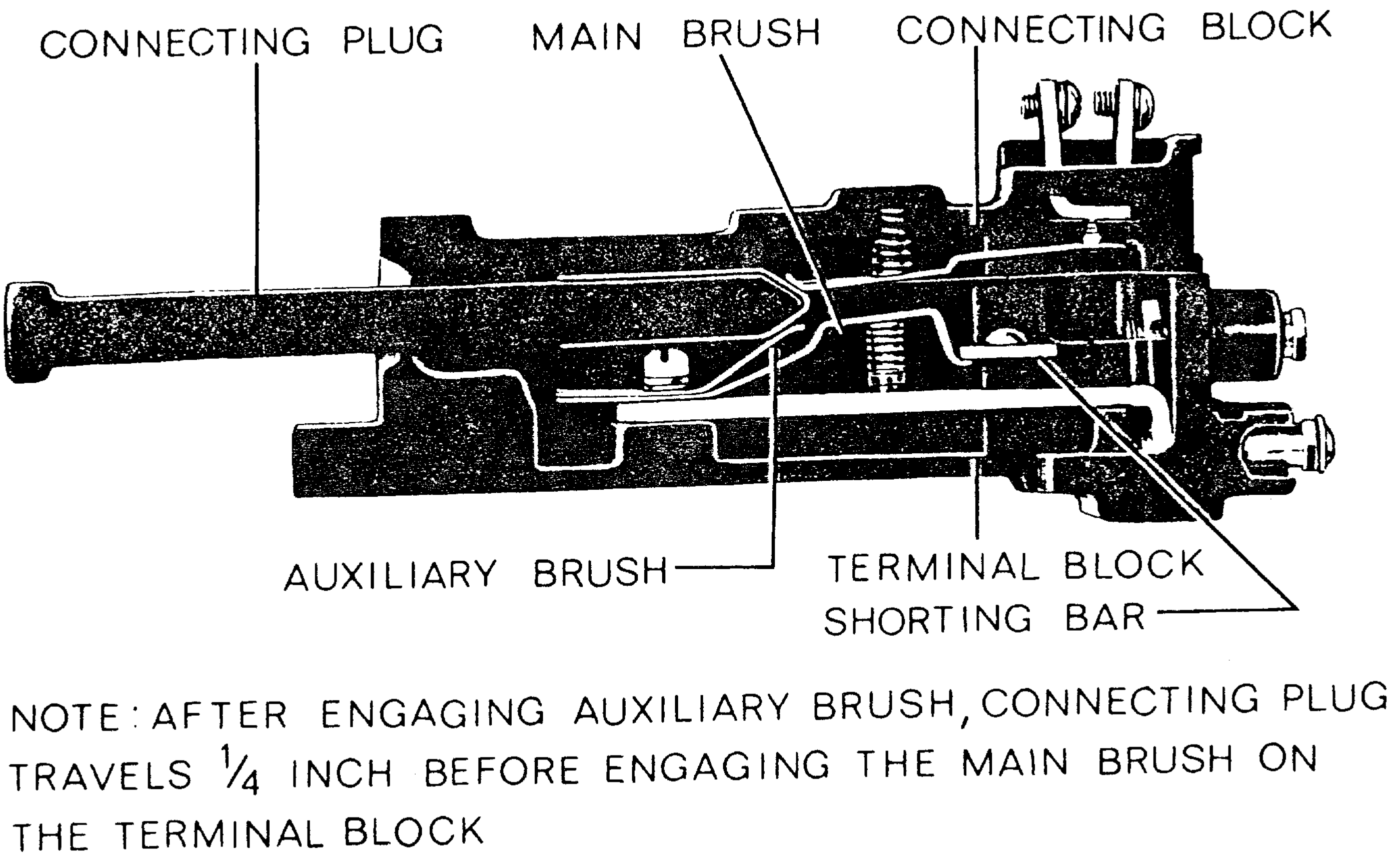
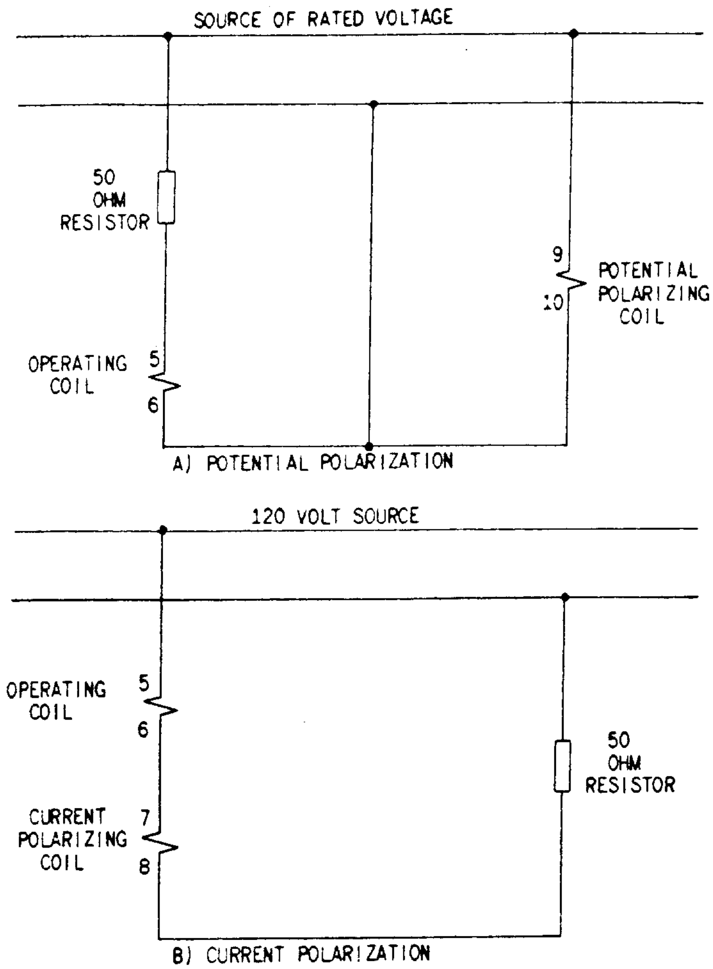


FIG. 7 (8025039) CROSS SECTION VIEW OF THE CASE, CRADLE AND CONNECTING PLUG SHOWING THE AUXILIARY BRUSH



NOTE: THE DIRECTIONAL UNIT CONTACTS SHOULD CLOSE WHEN THE RELAY IS ENERGIZED WITH EITHER OF THE ABOVE CONNECTIONS.

FIG. 8 (0418A0969-0) POLARITY TEST CONNECTION FOR THE CJCG16K(-)A RELAY

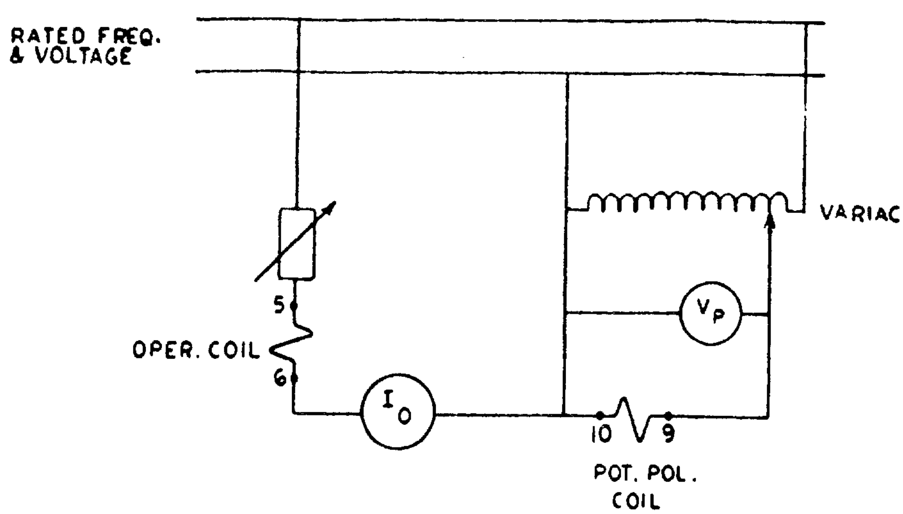


FIG. 9 (0257A8362-0) TEST CONNECTIONS FOR THE CJCG16K(-)A RELAY

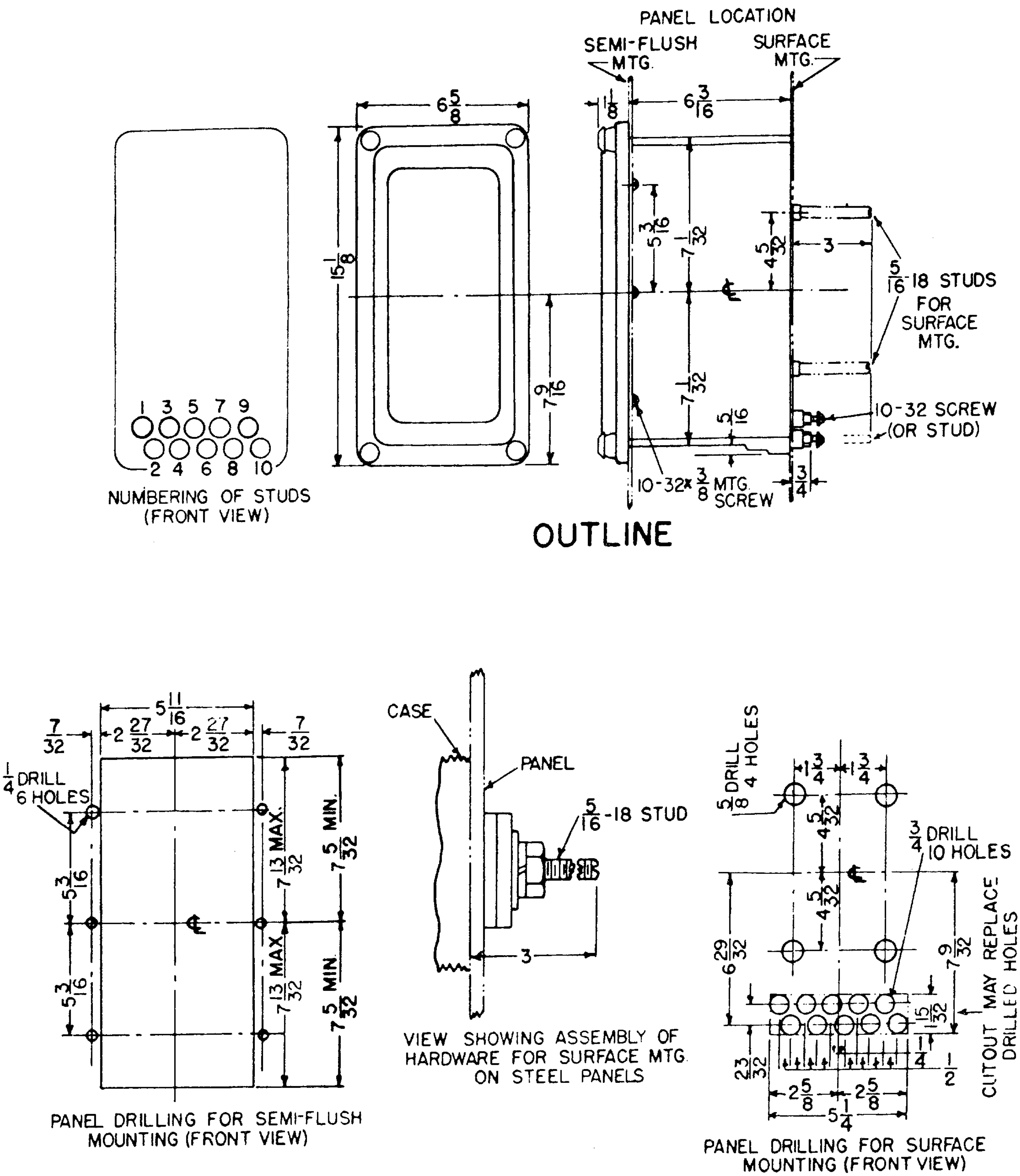
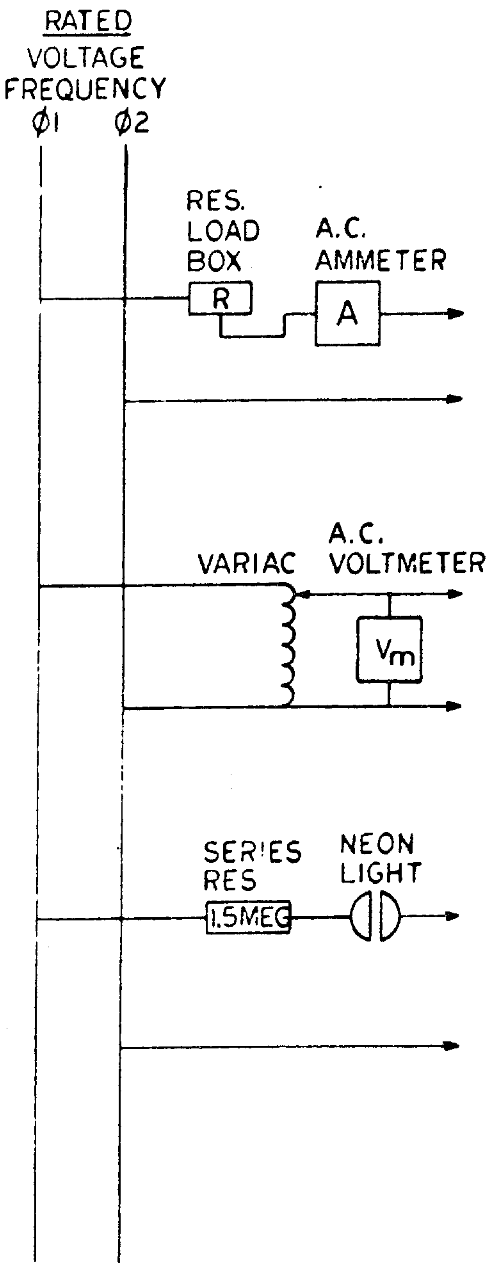


FIG. 10 (K-6209273-2) OUTLINE AND PANEL DIMENSION FOR THE 12CJCG16K(-)A RELAY



12CJCG16K(-)A UNIT TEST CONNECTIONS		
I.O.C. STUDS	I x I DIR. UNIT STUDS	V x I DIR. UNIT STUDS
4	5	5
5	8	6
BLOCK DIR. UNIT N.O. CONT. CLOSED	JUMPER STUDS 6-7	
—	—	9
—	—	10
2	1	1
11	2	2

FIG. 11 (0257A8483-0) TEST CONNECTIONS FOR THE 12CJCG16K(-)A RELAY

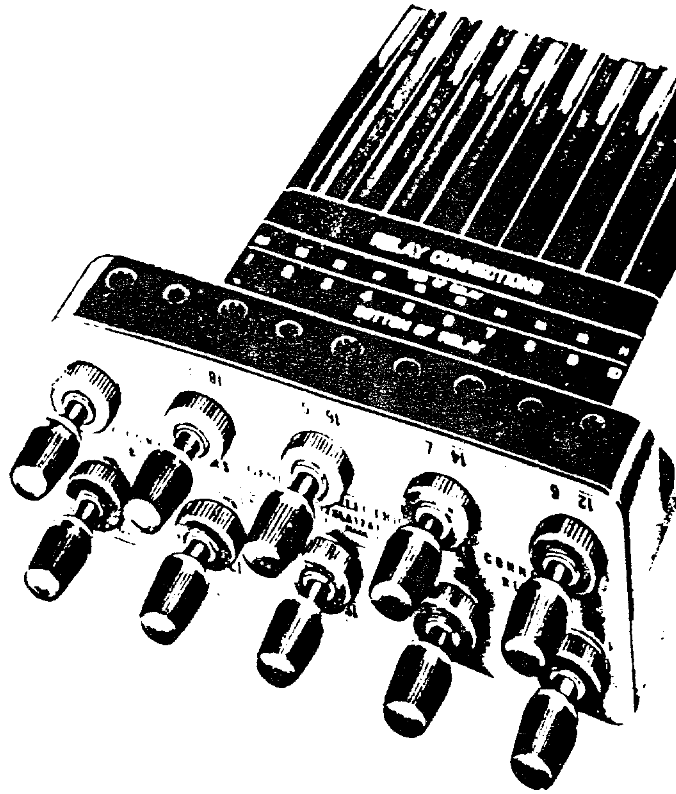


FIG. 12 (8005524) 12XLA12A TEST PLUG

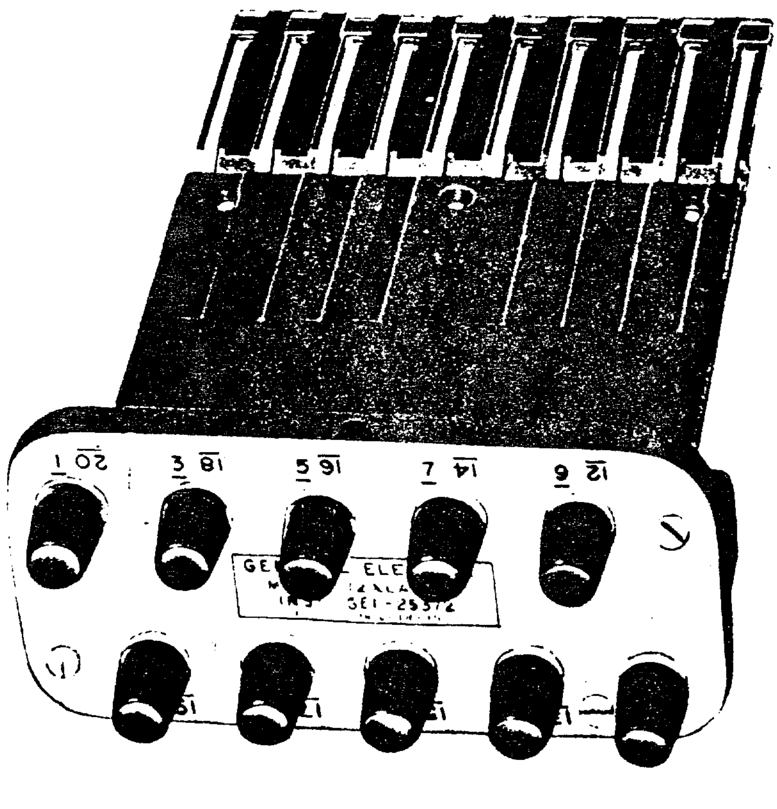
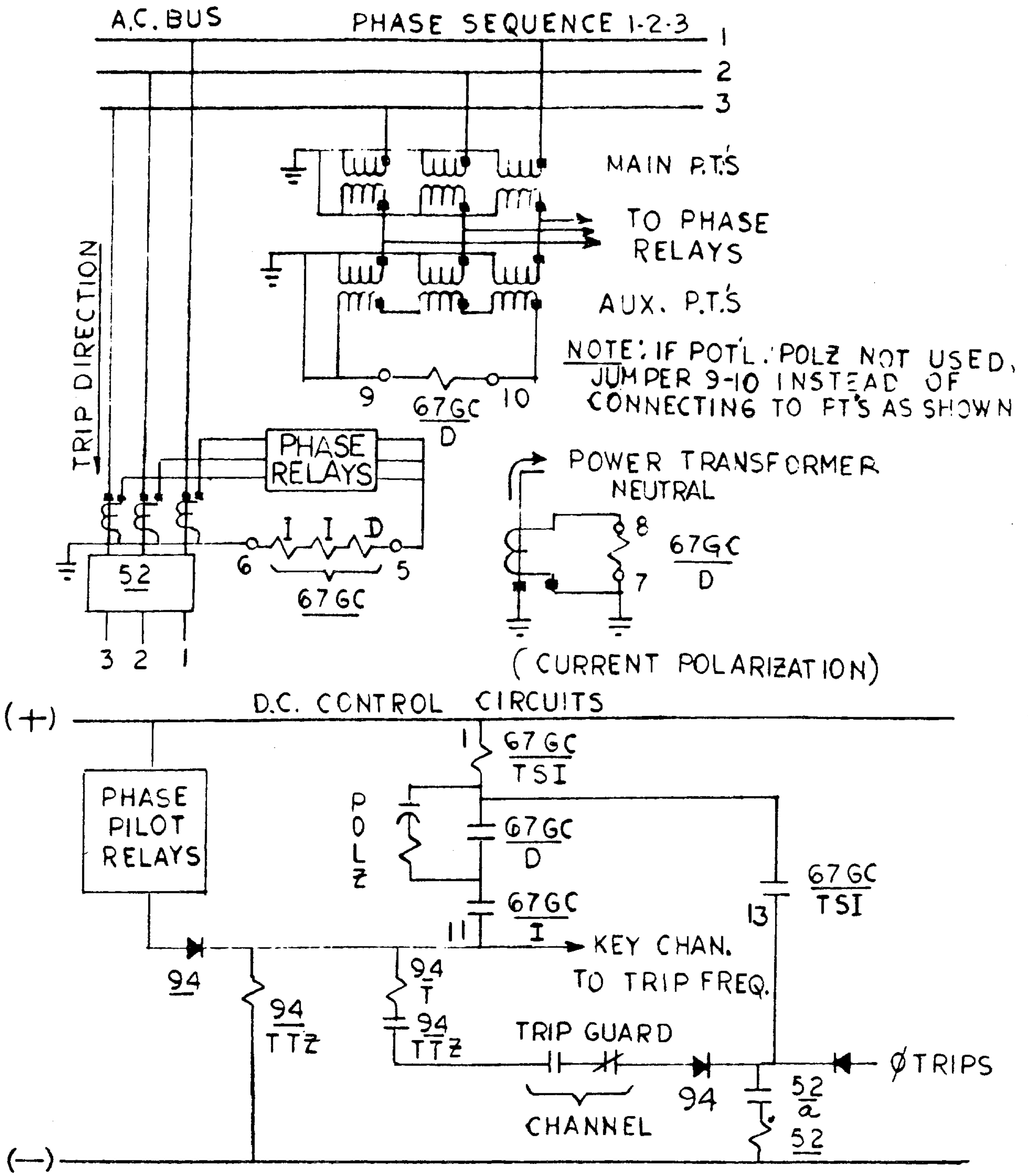


FIG. 13 (8024186) 12XLA13A TEST PLUG



LEGEND

SYMBOL	DEVICE TYPE
67GC	CJCG16K GROUND RELAY
94	NAA27AC CHAN. AUX.
52	POWER CIRCUIT BREAKER
CHAN.	PILOT COMM. CHANNEL

FIG. 14 (0257A8393-0) TYPICAL EXTERNAL CONNECTIONS FOR A PERMISSIVE OVERREACHING SCHEME UTILIZING A FREQUENCY SHIFT PILOT CHANNEL