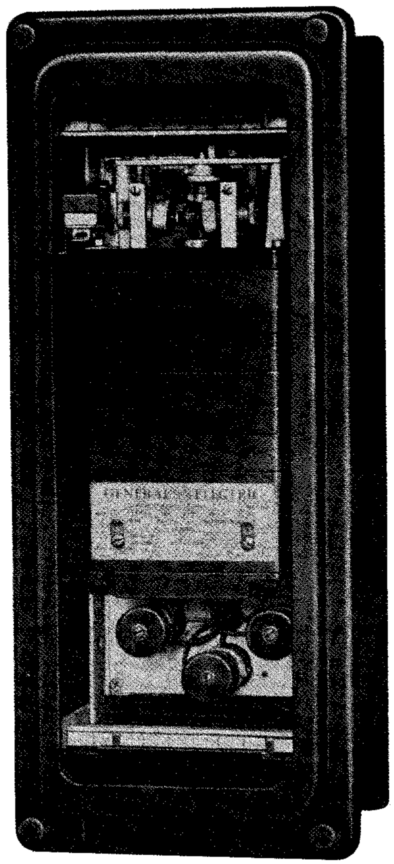
INSTRUCTIONS

GEI-23980 G
Supersedes GEI-23980 F

THREE-PHASE POWER DIRECTIONAL RELAY

TYPE CCP13D



GENERAL ELECTRIC

CONTENTS

THREE-PHASE POWER DIRECTIONAL RELAY
TYPE CCP13D

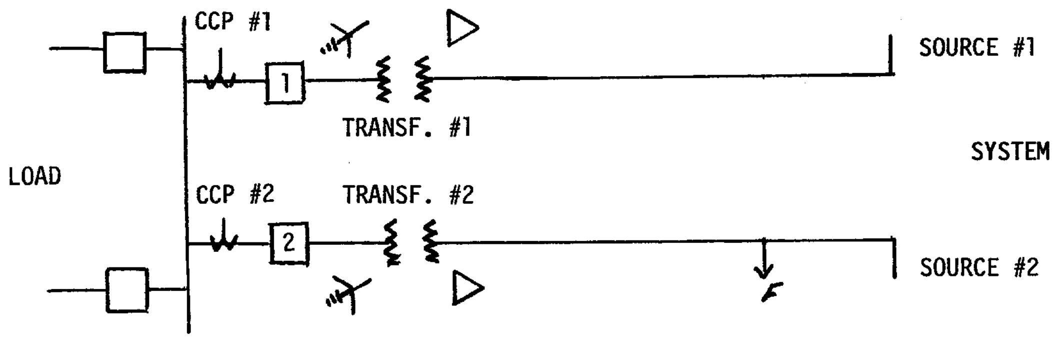
INTRODUCTION

The Type CCP13D relay is a very sensitive induction cylinder power directional relay for three phase alternating current circuits.

The relay consists of three single-phase directional units with the three rotors mounted on a single shaft. The contact assembly consists of two electrically separate contacts, one normally open and one normally closed. The normally closed contacts are held closed by two spiral springs which also complete the control circuits to the moving contacts. There is a target that is brought out to separate studs so that the target may be connected in any circuit. The relay can be supplied with no-holding coils, or with a holding coil in the normally open contact circuit, or with a holding coil in the normally closed contact circuit.

APPLICATION

Because of its sensitivity and its real power directional characteristics, the CCP13D relay finds application where it is required to detect extremely small reverse power flow. This application is restricted to cases where the normal direction of power flow is always in the same direction. The classical example of such an application is illustrated below.



Consider the section of a system shown above with normal load flow from the system to the load. If a single-phase-to-ground fault were to occur at F, it would be cleared at source #2, but not necessarily at breaker #2 because of delta-wye transformer #2. However, it is desirable to open circuit breaker #2 in order to clear the ground fault completely. This can be accomplished by the CCP13D relay associated with circuit breaker #2. The CCP13D is generally sensitive enough to operate on the real component of the exciting current (this is the core loss component) taken by the transformer through circuit breaker #2 when source #2 is removed.

Since the CCP13D is very fast and very sensitive, it could operate for system disturbances that result in momentary reversals of power through one or the other of the two banks. For this reason, the CCP13D should be used in conjunction with some time delay when applied as discussed above. Fig. 7 shows how this can be done.

Before the CCP13D is applied, certain calculations should be made to check the sensitivity of the particular relay model being used against the available core loss component of the associated transformer in order to insure proper operation. A sample calculation is illustrated in the section titled SAMPLE CALCULATIONS. In general, the CT's that supply the CCP13D relay should be selected with the lowest possible ratio without exceeding the 5.0 ampere continuous rating of the relay.

Another way to handle the situation where the core loss current is less than the relay minimum pickup setting is to reverse the current circuit connections to the relay and to use the relay as an undercurrent relay. With this arrangement, the relay is in the operated position for normal load flow, and it resets when the load current drops below the relay setting (such as 0.004 amperes). The normally closed contact makes when the relay resets, and this can be used to trip the breaker after a time delay as mentioned above.

SAMPLE CALCULATIONS

Consider the system illustrated in the section on APPLICATION having the following transformer ratings

10,000 KVA

13,800 Volts wye/138,000 Volts delta
Core losses = 15.0 KW at Rated Voltage

The full load current at 13,800 volts is

$$\frac{10,000}{13.8\sqrt{3}} = 418 \text{ Primary Amperes}$$

At rated voltage, the core loss component produces an in-phase current of

$$\frac{15}{13.8\sqrt{3}} = 0.628 \text{ Primary Amperes}$$

Since the relay may be called on to operate at lower than normal voltages, the core losses at these lower voltages should be obtained. If this information is not readily available, consider that 95 percent of rated voltage is a good figure and, since the transformer core losses are roughly proportional to the square of the applied voltage, the minimum core loss current will be

$$(0.95)\ (0.628) = 0.597 \text{ Primary Amperes}$$

At reduced voltage, the CCP minimum operating current goes up. Actually, it is inversely proportional to the applied voltage. Thus, the minimum pickup in this case will be the nameplate value divided by 0.95, and the 0.004 ampere relay will have a minimum pickup, at 95 percent voltage, of

$$\frac{0.004}{0.95} = 0.0042 \text{ Secondary Amperes}$$

Based on the maximum full load current, the smallest CT ratio that could be used is 500/5. With this ratio, the core loss component of current would be

$$\frac{0.597}{100} = 0.00597 \text{ Secondary Amperes.}$$

Since the CCP will pick up at 0.0042 secondary amperes, this application is satisfactory.

If the main CT's were selected as 800/5, then the core loss component would have been 0.00354 amperes and the relay would not operate. If this were the case, suitable auxiliary CT's could be used to step up the current to the CCP. However, caution should be used in the selection of these auxiliary CT's to insure that no more than 5.0 amperes is supplied to the relay under full load conditions.

Note that the above calculations are based on a balanced three-phase condition, with equal magnitudes of core loss current flowing in all three phases.

RATINGS

Relays are available with potential coils rated 115, 208, 216, or 480 volts, 60 hertz. The 50 hertz relays are available with potential coils rated 115 or 208 volts.

The current coils of all models are rated five amperes continuously or 200 amperes for one second.

The relay has maximum torque when the three-phase system is at unity power factor if the relay is connected as shown in Fig. 7. The minimum balanced three-phase current to operate the relay at maximum torque angle and with rated voltage on the potential circuits will be 0.004, 0.008, or 0.025 amperes depending on the relay model.

The available ratings for both the target and the holding coil are 0.2 amperes or 1.0 amperes. The characteristics of these ratings are given in Table I.

TABLE I

	TARGET		HOLDING COIL	
Coil Rating (AMPS)	0.2	1.0	0.2	1.0
Resistance (OHMS)	8.0	0.3	8.0	0.3
Carry for Tripping Duty (AMPS)	5	30	5	30
Carry Continuously (AMPS)	0.5	2.0*	0.5	2.0*

*The two ampere rating is determined by the control spring rating not the target of holding coil rating.

OPERATING CHARACTERISTICS

This relay consists of three single-phase directional units with the three rotors on a common shaft. Each unit develops maximum torque when the current thru the current coils leads the voltage applied to the potential coils by 30 degrees. When the delta voltaqes are applied to the potential coils as shown in Fig. 7. The currents in the current coils will lead these voltages by 30 degrees when the three-phase system is at unity power factor. For example, the top unit is connected to have Phase 1 current in its current coils (stud 3-4) and Phase 1-3 on its potential coils (studs 13-14). The relay will therefore respond to the watt component of the power (Fig. 11).

BURDENS

CURRENT COILS

The burden imposed on the current transformers at five amperes is given in Table II.

TABLE II

MIN PICKUP	FREQ	R	X	Z	WATTS	VARS	VA
0.004 AMP	60	0.27	0.62	0.68	6.8	15.6	17.0
0.004 AMP	50	0.23	0.52	0.57	5.9	13.0	14.3
0.008 AMP	60	0.22	0.44	0.49	5.4	11.1	12.4
0.025 AMP	60	0.22	0.44	0.49	5.4	11.1	12.4

POTENTIAL COILS

The burden imposed on the potential transformer at rated voltage is given in Table III.

TABLE III

FREQ	VOLTS	R	X	Z	WATTS	VARS	VA
60	115	408	710	815	8.1	14.1	16.2
60	208	1350	2300	2640	8.4	14.3	16.4
60	216	1350	2300	2640	9.0	15.4	17.7
60	480	7080	12320	14210	8.1	14.0	16.2
50	115	413	720	830	8.0	13.9	16.0
50	208	1370	2370	2730	7.9	13.7	15.8

CONSTRUCTION

DIRECTIONAL UNIT

These relays are induction cylinder devices for alternating current circuits. The principle by which torque is developed is the same as that employed in an induction-disk relay with a watthour meter element, though in arrangement of parts they are more like split-phase induction motors.

The stator of each unit has eight laminated magnetic poles projecting inward and arranged symmetrically around a central magnetic core. The poles are fitted with current and potential coils; four potential coils which are internally connected forming a single circuit as well as four current coils similarly connected. In the annular air gap between the poles and central core is the cylindrical part of the cup-like aluminum rotor, which turns freely in the air gap. The central core is fixed to the stator frame; the rotor alone turns. The three units are mounted one on top of the other. The three rotors are mounted on a single shaft.

This construction provides higher torque and lower rotor inertia than the induction-disk construction, thus making these relays faster and more sensitive.

CONTACTS

The contacts (see Fig. 2) 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 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.

DRAWOUT CASE

The Type CCP13D relay is mounted in a M-2 size case. The case has studs at both ends in the rear for external connections. The outline and panel drilling for this case is shown in Fig. 8.

The electrical connections between the relay units and the case studs are made through stationary molded inner and outer blocks between which nests a removable connection plug which completes the circuits. The outer blocks attached to the case have the studs for the external connections and the inner blocks have the terminals for the internal connections.

Every circuit in the drawout case has the auxiliary brush, as shown in Fig. 10, to provide adequate overlap when the connecting plug is withdrawn or inserted. Some circuits are equipped with shorting bars (see internal connections in Fig. 5) and on those circuits, it is especially important that the auxiliary brush make contact as indicated in Fig. 10 with adequate pressure to prevent the opening of important interlocking circuits.

The relay mechanism is mounted in a steel framework called the cradle and is a complete unit with all leads terminated at the inner block. This cradle is held firmly in the case with a latch at both top and bottom and by a guide pin at the back of the case. The connecting plug, besides making the electrical connections between the respective blocks of the cradle and case, also locks the latch in place. The cover, which is drawn to the case by thumbscrews, holds the connecting plugs in place. The target reset mechanism is a part of the cover assembly.

The relay case is suitable for either a semi-flush or surface mounting on all panels up to two inches thick and appropriate hardware is available. However, panel thickness must be indicated on the relay order to insure that proper hardware will be included.

A separate testing plug can be inserted in place of the connecting plug to test the relay in place on the panel either from its own source of current and voltage, or from other sources. Or the relay can be drawn out and replaced by another which has been tested in the laboratory.

RECEIVING, HANDLING AND STORAGE

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

Immediately upon receipt of the relay, an INSPECTION AND ACCEPTANCE TEST should be made to insure that no damage has been sustained in shipment and that the relay calibrations have not been disturbed. If the examination or test indicates that readjustment is necessary, refer to the section on LABORATORY TESTS.

VISUAL INSPECTION

Check the nameplate stamping to insure 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 screws are tight.

MECHANICAL INSPECTION

1. There should be no noticeable friction in the rotating structure of the relay unit.
2. Make sure the control springs are not deformed.
3. With the relay leveled in its upright position the left-hand contact should be open and the right-hand contact should be closed.
4. Check the location of the contact brushes and shorting bars in case and cradle blocks against the internal connection diagram for the relay (Fig. 5).
5. Check the vertical end play of the moving contact and shaft assembly. It should be between 1/64 inch and 1/32 inch.
6. The contact gap should be approximately 3/64 inch.
7. The contact wipe should be 0.004 inch to 0.009 inch.

If there is reason to believe that the jewel is cracked or dirty the screw assembly can be removed from the bottom of the unit and examined under a microscope, or the surface of the jewel explored with the point of a fine needle. When replacing a jewel, have the top pivot engaged in the shaft while screwing the jewel screw.

All nuts and screws should be tight.

The felt gasket on the cover should be securely cemented in place in order to keep out dust.

All contact surfaces should be clean.

CAUTION: EVERY CIRCUIT IN THE DRAWOUT CASE HAS AN AUXILIARY BRUSH; THIS IS THE SHORT ONE IN THE CASE (NOT ON THE CRADLE) WHICH THE CONNECTION PLUG OR TEST PLUG SHOULD ENGAGE FIRST. ON EVERY CURRENT CIRCUIT OR OTHER CIRCUIT WITH A SHORTING BAR, MAKE SURE THESE AUXILIARY BRUSHES ARE BENT HIGH ENOUGH TO ENGAGE THE CONNECTION PLUG OR TEST PLUG BEFORE THE MAIN BRUSHES IN THE CASE DO, AS OTHERWISE THE CT SECONDARY CIRCUIT MAY BE OPENED (WHERE ONE BRUSH TOUCHES THE SHORTING BAR) BEFORE THE CIRCUIT IS COMPLETED FROM THE PLUG TO THE OTHER MAIN BRUSH.

A cutaway view of the case, cradle blocks, and connection plug is shown in Fig. 10.

ELECTRICAL TESTS

Polarity

Complete polarity tests are made at the factory but these may be checked by using the connections shown in Fig. 3. Each unit should be checked separately. The cup should rotate in the direction to close the left-hand contact (front view).

Pickup

The pickup of the CCP13D relay may be checked by applying rated voltage and frequency to the relay as in Fig. 4. The relay should close its left contact at the current specified on the nameplate, multiplied by 1.15. The 1.15 multiplier is used to compensate for the test being made 30 degrees off the angle of maximum torque ($1/\cos 30^{o} = 1/.866 = 1.15$). A phase shifter and phase angle meter could be used to give a test circuit that would test the units at the angle of maximum torque. However most phase angle meters will not operate correctly with only 0.004 amperes in their current coils. For this reason the three-phase test circuit, with phase shifter and phase angle meter, is not recommended.

Clutch

The clutch should not slip at rated voltage and 10 amperes when the relay is connected as in Fig. 4. (See section on CLUTCH under MAINTENANCE.)

INSTALLATION PROCEDURE

LOCATION

The location of the relay should be clean and dry, free from dust, excessive heat and vibration, and should be well lighted to facilitate inspection and testing.

MOUNTING

The relay should be mounted on a vertical surface. The outline and panel drilling dimensions are shown in Fig. 8.

CONNECTIONS

The internal connections of the CCP13D relay are shown in Fig. 5. An elementary diagram of typical external connections is shown in Fig. 7.

One of the mounting studs or screws should be permanently grounded by a conductor, not less than No. 12B & S gage copper wire or its equivalent.

VISUAL INSPECTION

Remove the relay from its case and check that there are no broken or cracked component parts and that all screws are tight. Check the contacts for tarnish. If any trouble is found, it should be corrected in the manner described under LABORATORY TESTS.

EXTERNAL CONNECTION TEST

The external connections to the relay can be checked at the relay by referring to Fig. 6. This test is not a test on the relay but a test of the proper external connections to the relay.

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 relay be checked at an interval of from one to two years.

The pickup test, checked using the connections of Fig. 4, will show if the relay is operating correctly If any of the coils should become open circuited then the pickup will be higher since all three units will no longer be producing torque.

The contacts should be checked to see that they are clean and are not pitted. If the contacts need cleaning see section on CONTACT CLEANING under SERVICING.

LABORATORY TESTS

If the relay is out of calibration it can be recalibrated as follows:

RELAY CONTACTS

1. The clearance between (a) the back of the silver contact mounted on the flat spiral, and (b) the diaphragm behind it, should be 0.004 inch to 0.009 inch. This wipe should be measured by moving the contact arm over until it just touches the stationary contact to be measured. Then, holding the contact arm in this position rotate barrel until back of contact touches diaphragm. Rotating barrel 45 degrees corresponds to 0.004 inch wipe while 105 degrees is the equivalent of 0.009 inch.

2. Contact gap should be 3/64 inch. This should be adjusted in the following manner: with the contact arm parallel to the sides of the relay, turn the contact barrels until both contacts are just made (use neon lamps). Tighten the clamping screw, locking the right-hand contact barrel. Back off the left-hand contact barrel 1-1/2 revolutions (540 degrees) and tighten its clamping screw.

VOLTAGE BIAS

1. Unwind the upper control spring until the moving contact assembly is floating approximately half way between the right contact and the left contact. This should be done with the relay mounted in a level position and no voltage or current applied to the relay.

2. Apply rated three-phase voltage to the potential circuit using same connections as shown on the external connection diagram (Fig. 7). With no current in the current coils, the moving contact should stay in the float position set in Step 1 above. Should the moving contact arm move enough to close the right or left contact it will be necessary to readjust the core. The core is adjusted by loosening the core locknut and rotating the core slightly to the right or left depending on the relay. The core locknut is located in the center of the lower iron casting. The core is turned by putting an offset screwdriver into the jewel screw slot. The locknut should only be loosened enough to allow the core to be turned. When the contact assembly is set for the float position by turning the core, the locknut should be tightened. Recheck that the moving contact assembly is still flloating when the locknut is tight.

POLARITY

The polarity of the coils can be checked using connections of Fig. 3. Each unit is checked separately and each should produce a torque in the direction to close the left contact.

If in any of the three tests the torque is in the direction to close the right contact, the polarity is reversed. To correct the polarity, the connections of that potential circuit should be reversed at the cradle terminals. For example, if the polarity was reversed when the top unit was tested, then the potential coil lead to terminal 13 should be moved to terminal 14 and the lead going to terminal 14 should be connected to terminal 13.

ANGLE OF MAXIMUM TORQUE

If the maximum angle of torque (30 degrees lead) of the relay has been disturbed, it may be restored by referring to Fig. 9. With rated voltage and frequency applied to the potential circuit and five amperes flowing in the current circuit, the potential circuit resistor is adjusted so that the contact will not move at a phase angle meter reading of 120 degrees or 300 degrees (angles of zero torque). The relay should close its left contact at all angles between 120 degrees and 300 degrees. This test is performed by energizing one unit at a time.

PICKUP ADJUSTMENT

The control spring adjustment is made by using the connections of Fig. 4. This single-phase test connects the three potential coils in parallel and the three current coils in series. With these connections each unit is 30 degrees off the angle of maximum torque. It is therefore necessary to apply 1.15 times the current that would have to be used if the three units were at the angle of maximum torque. For example, if the minimum pickup setting required at maximum torque angle is 0.004 amperes, then 1.15 x 0.004 amperes or 0.0046 amperes should be applied to the current circuit and the control spring should be moved in the counterclockwise direction until the left contact is just closed.

CLUTCH ADJUSTMENT

Using the connections of Fig. 4, increase the current to ten amperes and see that the clutch does not slip. This test should be made with rated voltage on the potential circuits. It can be determined if the clutch is slipping by watching the "hairpin" clip at the top of the moving contact shaft. If the "hairpin" clip is not turning then the clutch is not slipping. If the clutch slips at ten amperes, then the clutch should be tightened. This is done by loosening the locknut on the right side of the moving contact assembly, and then turning the adjusting screw in until the clutch stops slipping. The lock nut should then be retightened.

SERVICING

CONTACT CLEANING

For cleaning fine silver 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 corroded material will be removed rapidly and thoroughly. The flexibility of the tool insures the cleaning of the actual points of contact.

Fine silver contacts should not be cleaned with knives, files, or abrasive paper or cloth. Knives or files may leave scratches which increase arcing and deterioration of the contacts. Abrasive paper or cloth may leave minute particles of insulating abrasive material in the contacts and thus prevent closing.

The burnishing tool described is included in the standard relay tool kit obtainable from the factory.

CONTACT ADJUSTMENT

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 be then removed. (See Fig. 2.)

The contact gap may be adjusted by loosening slightly the same screw at the front of the contact block. The screw should be loose enough only to allow the contact barrel to rotate in its sleeve.

The normally closed or right contact should hold the moving contact arm in neutral position, i.e., with the moving contact arm pointing directly forward. Then bring the stationary contact up until it just touches the moving contact by rotating the contact barrel. Next, back the contact barrel away 1-1/2 turns to obtain approximately 0.047 inch contact gap. Last, tighten the screw which secures the barrel.

The moving contact may be removed by loosening the screw which secures the moving contact to the contact arm and sliding the contact from under the screw head.

BEARINGS

The lower jewel screw can be removed from the unit by means of an offset screwdriver or an end wrench. The jewel may be tested for cracks by exploring its surface with the point of a fine needle. If it is necessary to replace the jewel a new pivot should be screwed into the bottom of the shaft at the same time.

The lower jewel bearing should be screwed all the way in until its head engages the end of the threaded core. The upper bearing should be adjusted to allow about 1/32 inch end play of the shaft.

Press down on the contact arm near the shaft to check the clearance between the iron core and the inside of the rotor cup and thus depress the spring-mounted jewel until the cup strikes the iron; the shaft should move about 1/16 inch.

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 the part wanted, and give complete nameplate data. If possible, give the General Electric Company requisition number on which the relay was furnished. The renewal parts publication for Type CCP13D relay is GEF-3916.

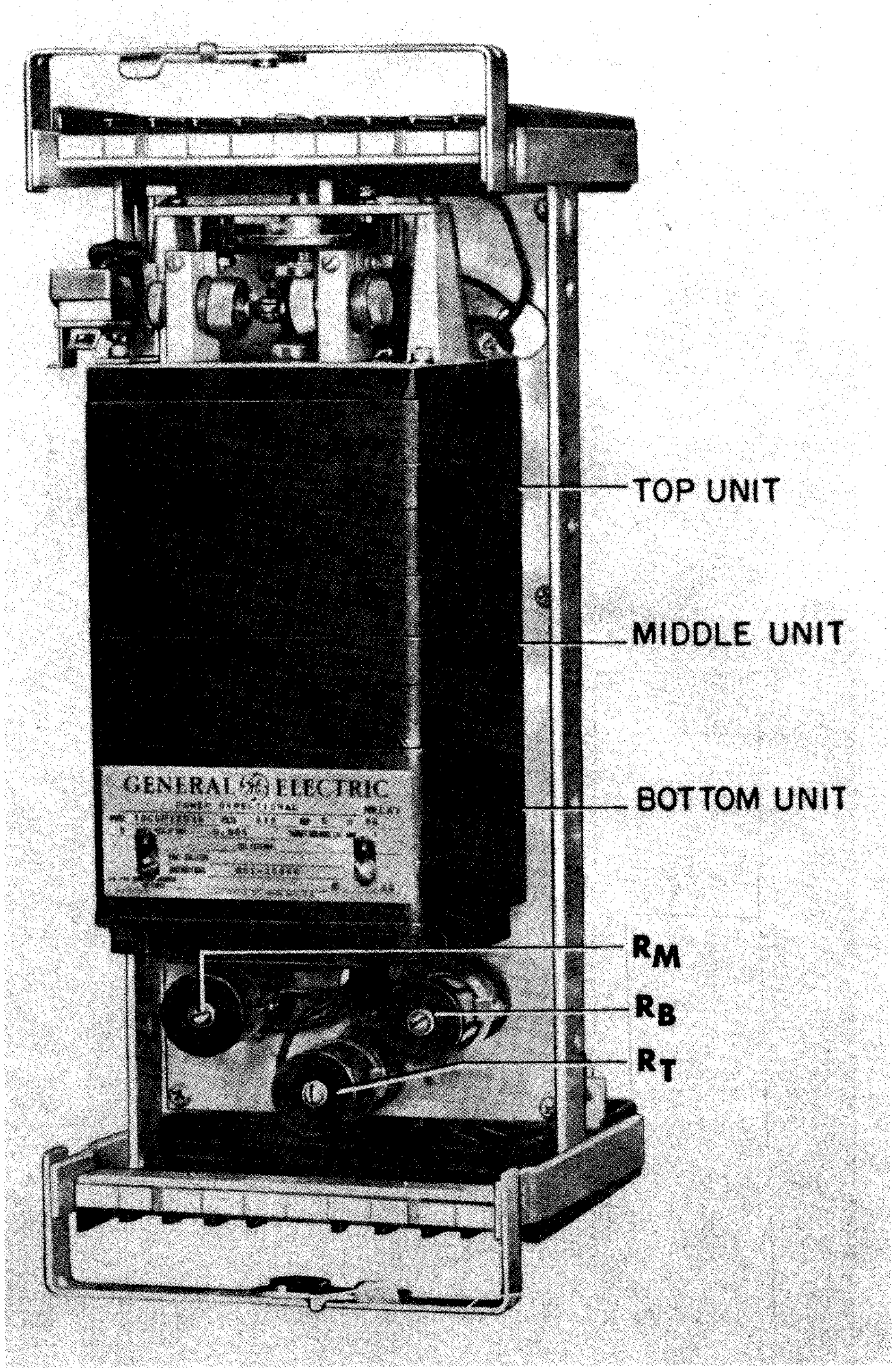


FIG. 1 (8010272-1) Type CCP13D Relay Removed from Case (Front View)

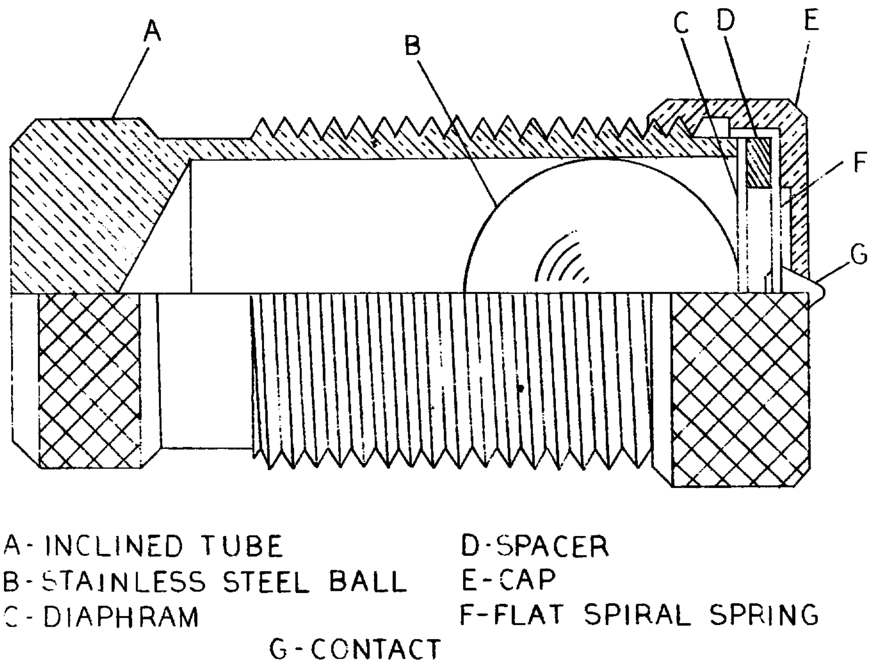


FIG. 2 (6077069-0) Barrel Type Contact Assembly

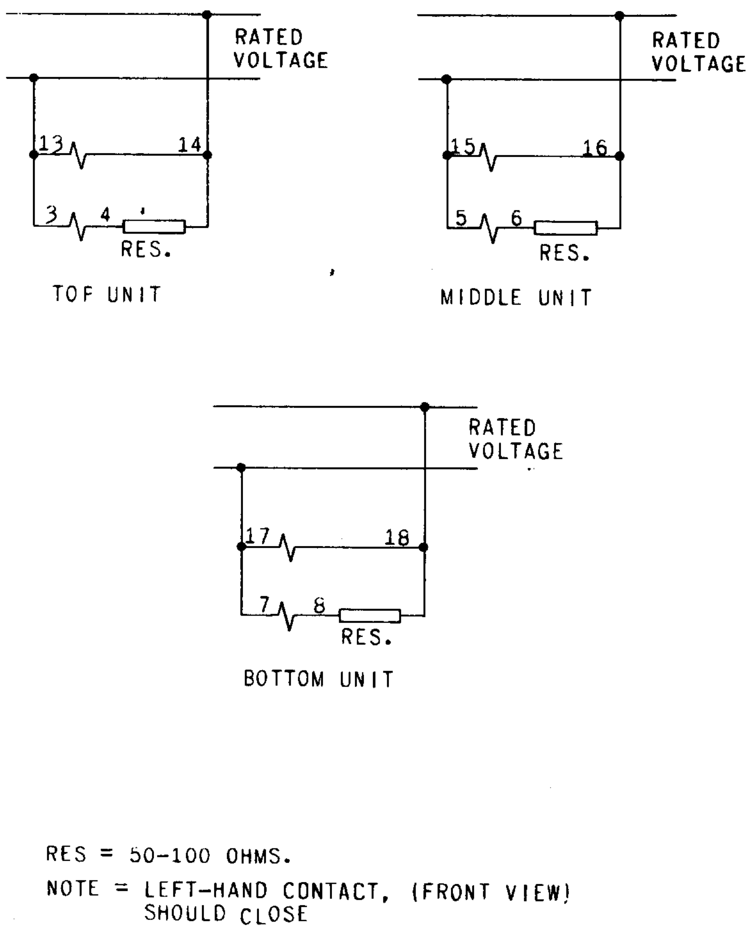


FIG. 3 (6507918-0) Connections for Checking the Polarity of Type CCP13D Relay

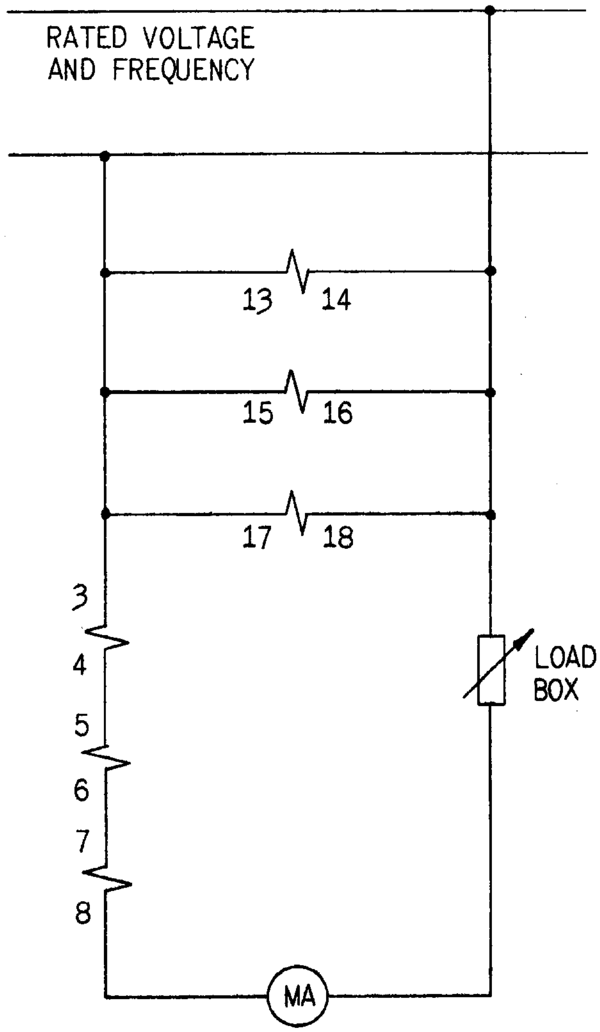


FIG. 4 (104A8511-0) Test Connections for Checking Pickup and Clutch Adjustments of Type CCP13D Relay

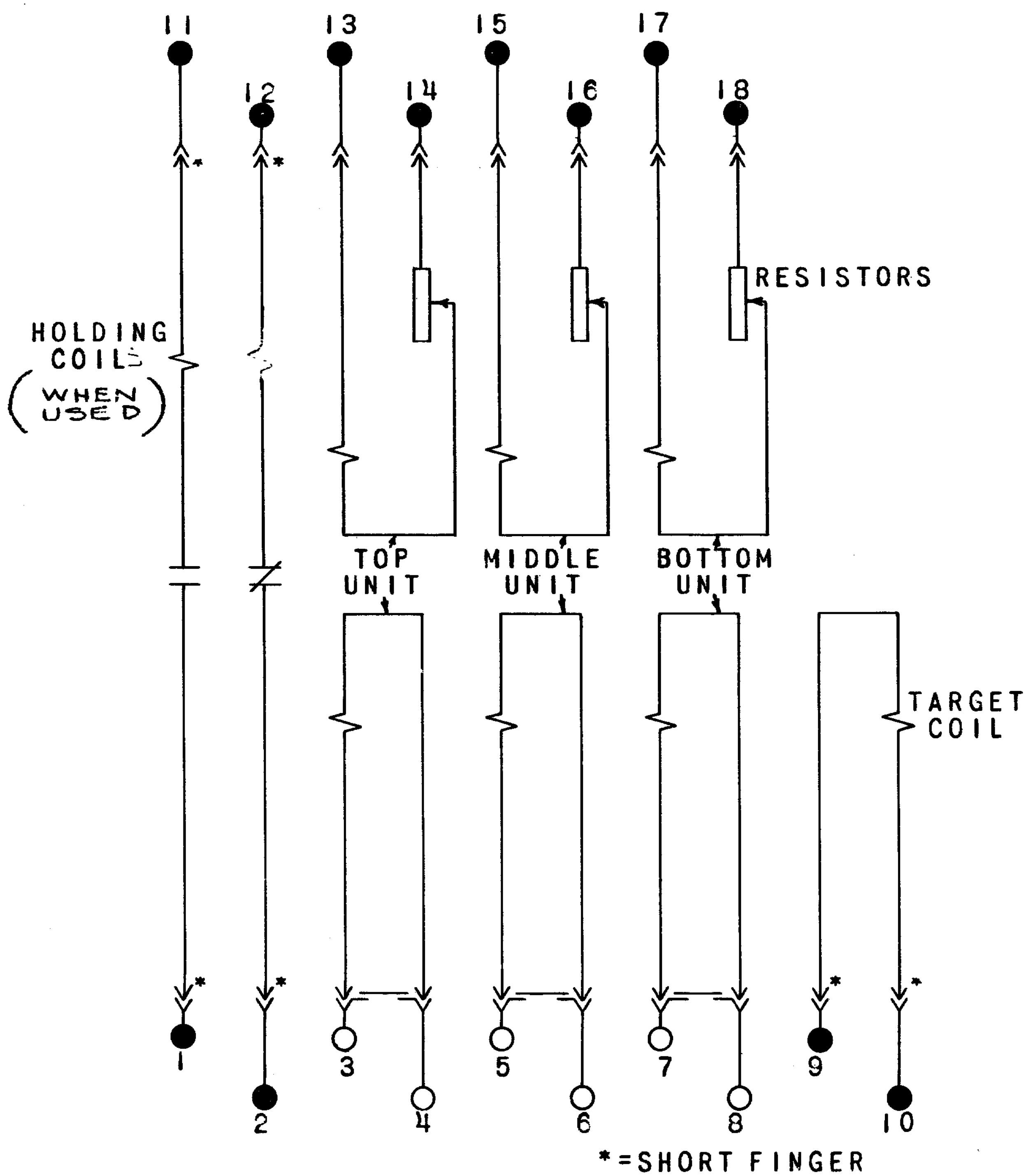
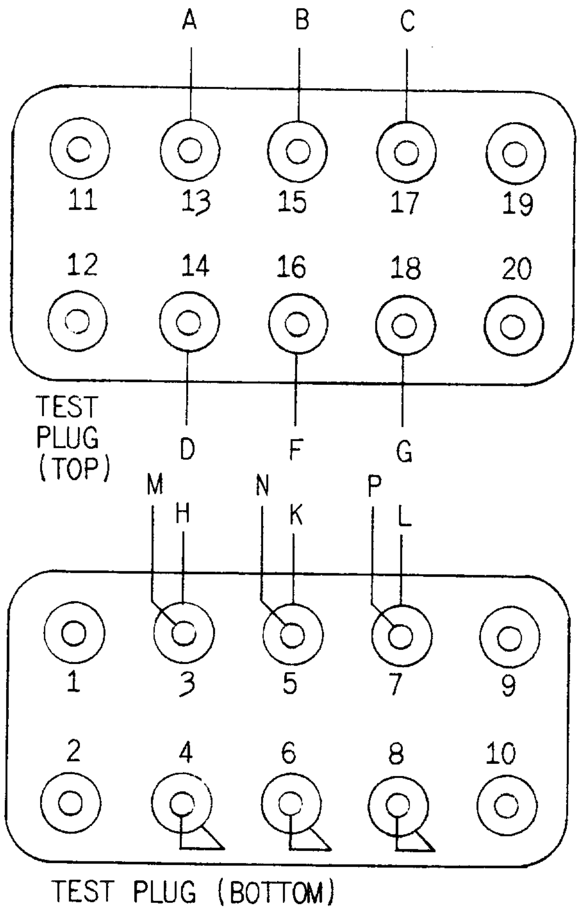
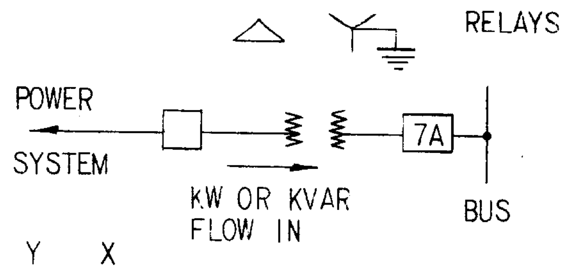
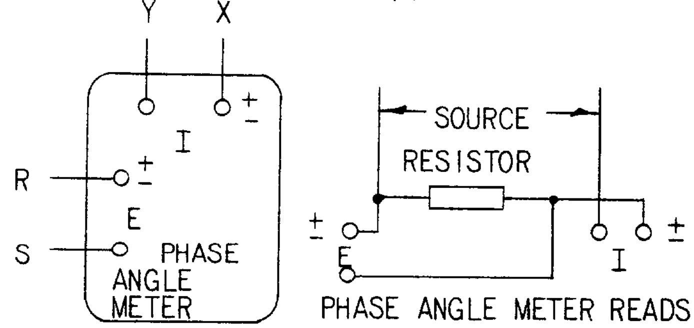


FIG. 5 (6400664-) Internal Connection Diagram for Type CCP13D Relay (Front View)







PHASE ANGLE METER READS ZERO DEGREES FOR ABOVE CONNECTIONS.

NOTE: ADD JUMPER FROM K TO N & FROM L TO P WHEN PHASE ANGLE METER IS CONNECTED TO H & M TO AVOID OPEN CT SECONDARY CIRCUITS. USE SIMILAR JUMPERS FOR OTHER CONNECTIONS.

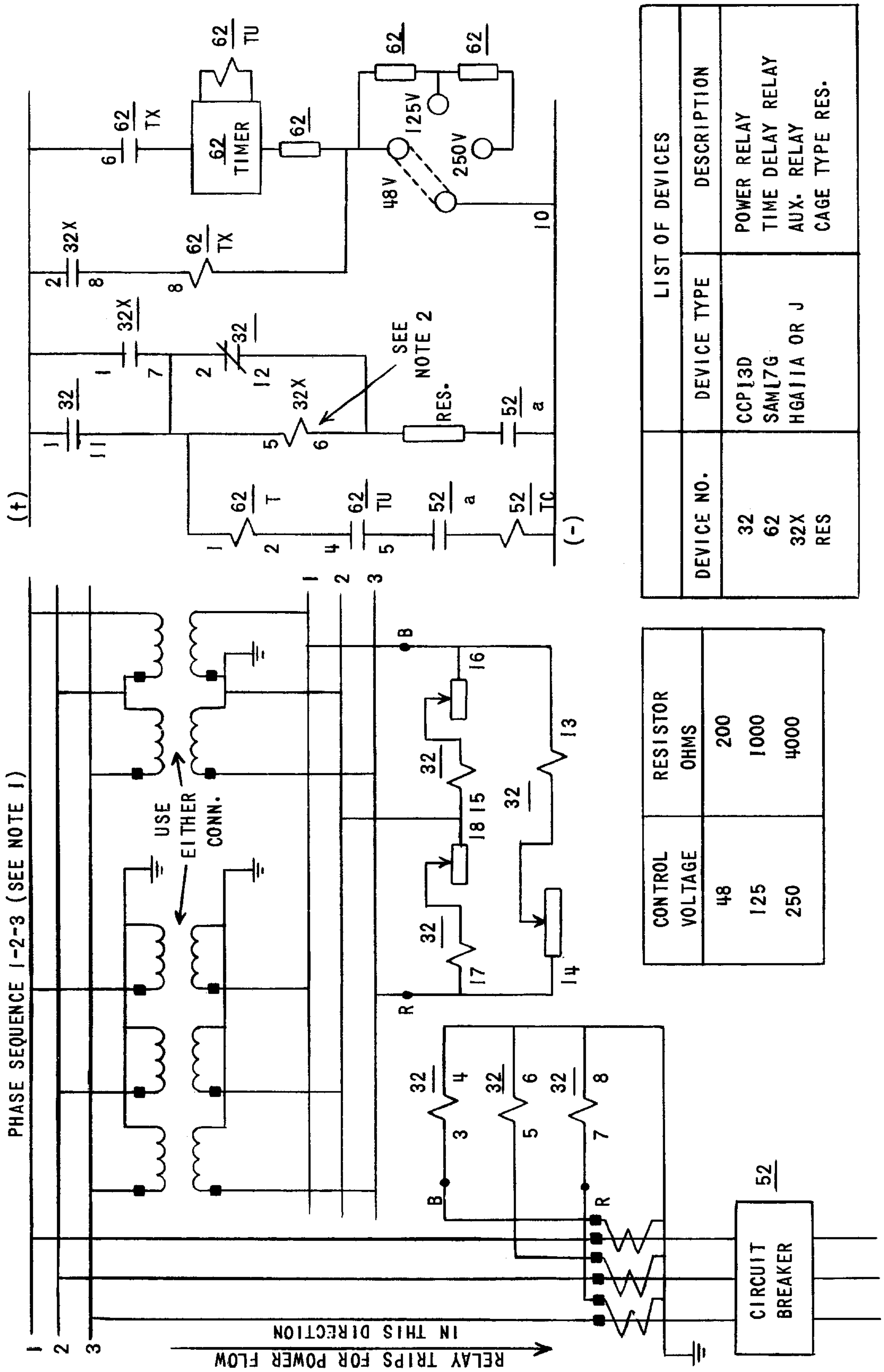
	PHASE ANGLE METER READING WITH PROPER EXT. CONNS.			
POWER FACTOR ANGLE* DEGREES LEAD OR LAG AS NOTED	90° TO 45°	45° TO 0°	0° TO -45°	-45° TO -90°
RELAY CONNECTIONS: R TO F , S TO B X TO K , Y TO N M TO H , P TO L	120° † TO 75°	75° † TO 30°	30° † TO 345°	345° † TO 300°
RELAY CONNECTIONS: R TO G , S TO C X TO L , Y TO P M TO H , N TO K	120° † TO 75°	75° † TO 30°	30° † TO 345°	345° † TO 300°
RELAY CONNECTIONS: R TO D , S TO A X TO H , Y TO M N TO K , P TO L	120° † TO 75°	75° † TO 30°	30° † TO 345°	345° † TO 300°

† THESE RANGES OF PHASE ANGLE METER READINGS ARE THE ANGLES BY WHICH THE CURRENT LEADS THE VOLTAGE WITH THE DESCRIBED CONDITIONS OF LOAD POWER FACTOR ANGLE.

CAUTION: MAKE CONNECTIONS FOR METER ERRORS ON LOW CURRENTS, INHERENT IN SOME PHASE ANGLE METERS.

*AS DETERMINED FROM INSTRUMENTS READING POWER INTO BUS FROM THE POWER SYSTEM. NEGATIVE SIGN FOR LAG. POSITIVE SIGN FOR LEAD.

FIG. 6 (104A8513-0) Test Connections for Checking Polarity of Windings to the Type CCP13D Relay



LIST OF DEVICES		
DEVICE NO.	DEVICE TYPE	DESCRIPTION
32	CCP13D	POWER RELAY
62	SAM17G	TIME DELAY RELAY
32X	HGA11A OR J	AUX. RELAY
RES		CAGE TYPE RES.

CONTROL VOLTAGE	RESISTOR OHMS
48	200
125	1000
250	4000

NOTE 1 - FOR PHASE SEQUENCE OPPOSITE TO THAT INDICATED, INTERCHANGE CONNECTIONS BETWEEN B & R IN BOTH THE POTENTIAL & CURRENT CIRCUITS.

NOTE 2 - SELECT HGA RELAY WITH CONTINUOUS RATING EQUAL TO 1/2 THE CONTROL VOLTAGE SUPPLY & SELECT A RESISTOR FROM THE TABLE.

* FIG. 7 (246A6954-2) Typical External Connections of Type CCP13D Relay

* Indicates revision

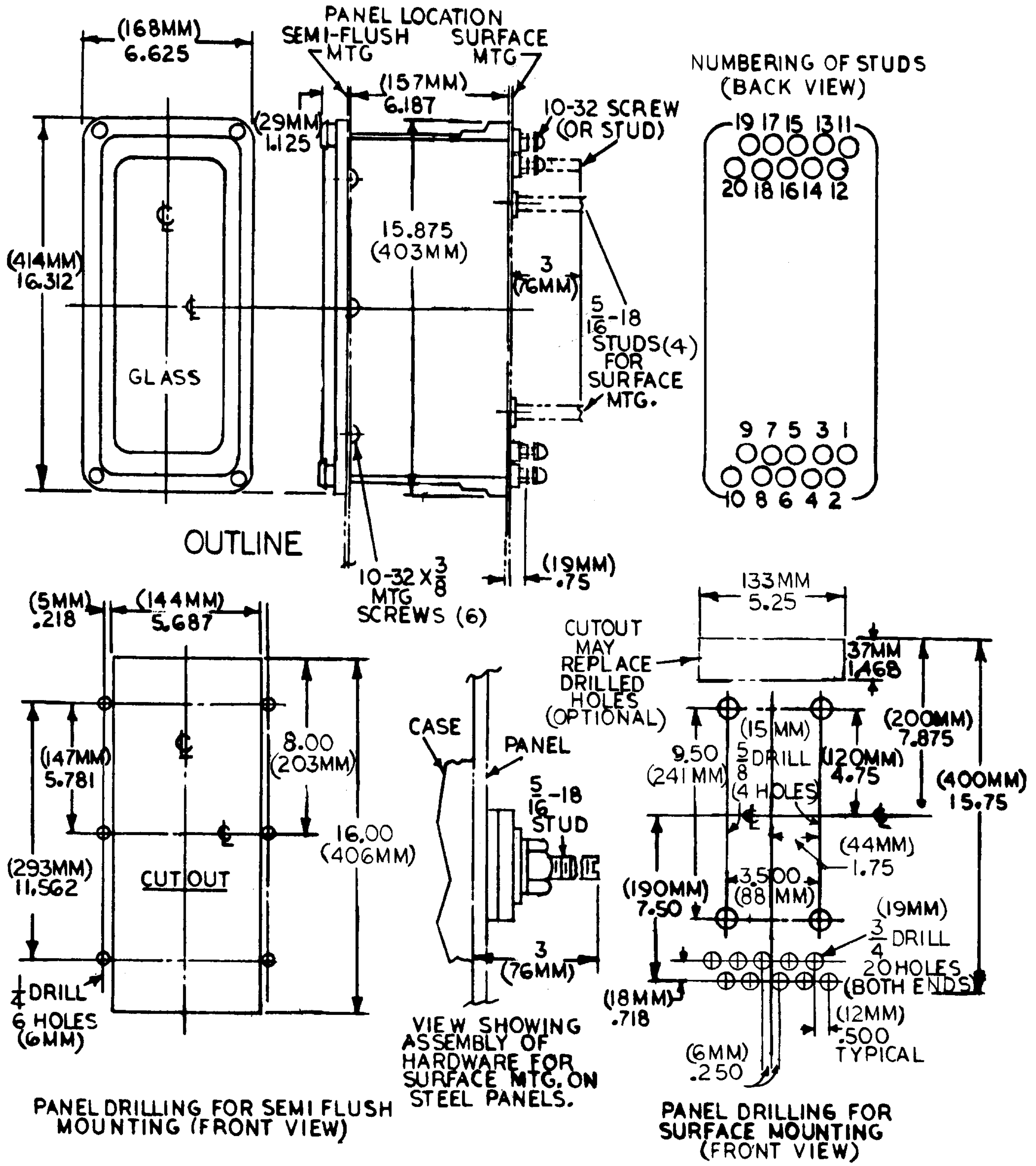
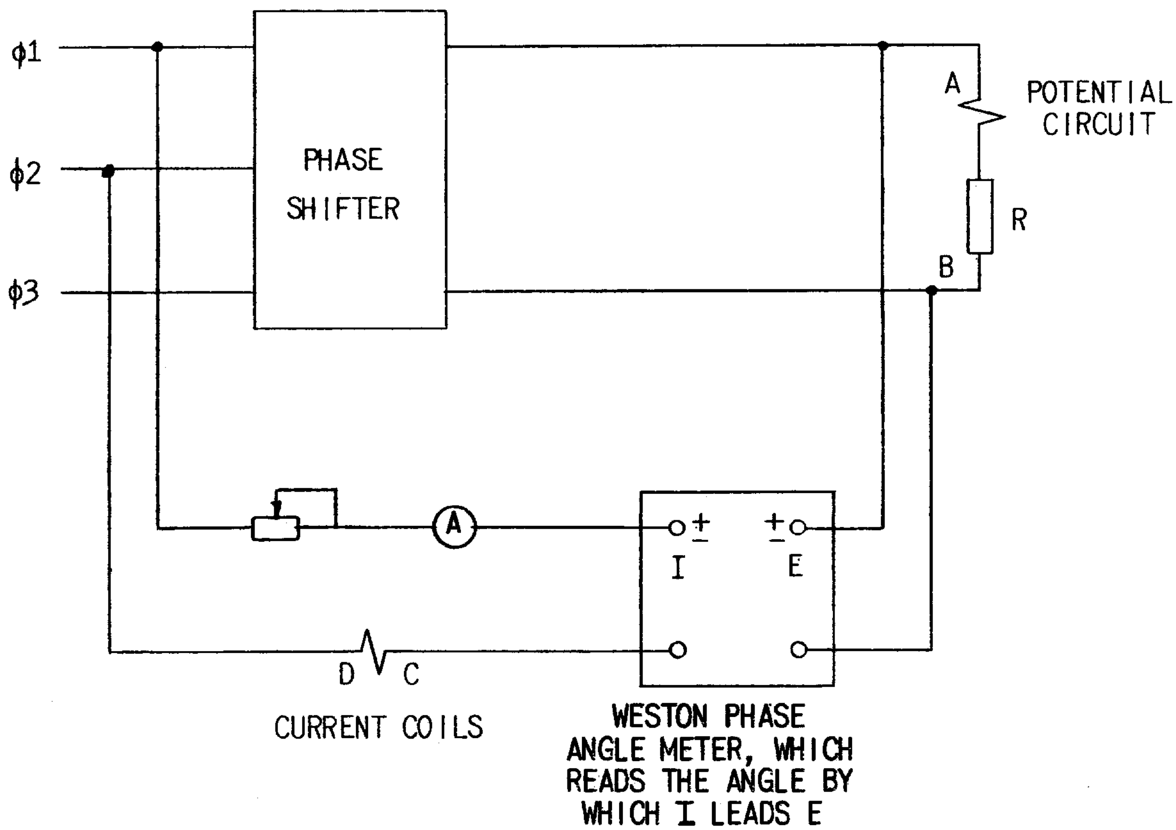


FIG. 8 (K-6209274-4) Outline and Panel Drilling Dimensions Diagram for Type CCP13D Relay



RELAY UNIT	ADJUST. RESISTOR	POWER CONNECTIONS	
		POTENTIAL STUDS A-B	CURRENT STUDS C-D
TOP	R_T	13-14	3-4
MIDDLE	R_M	15-16	5-6
BOTTOM	R_B	17-18	7-8

FIG. 9 (104A8512-1) Test Connections for Making the Torque Adjustments of the Type CCP13D Relay

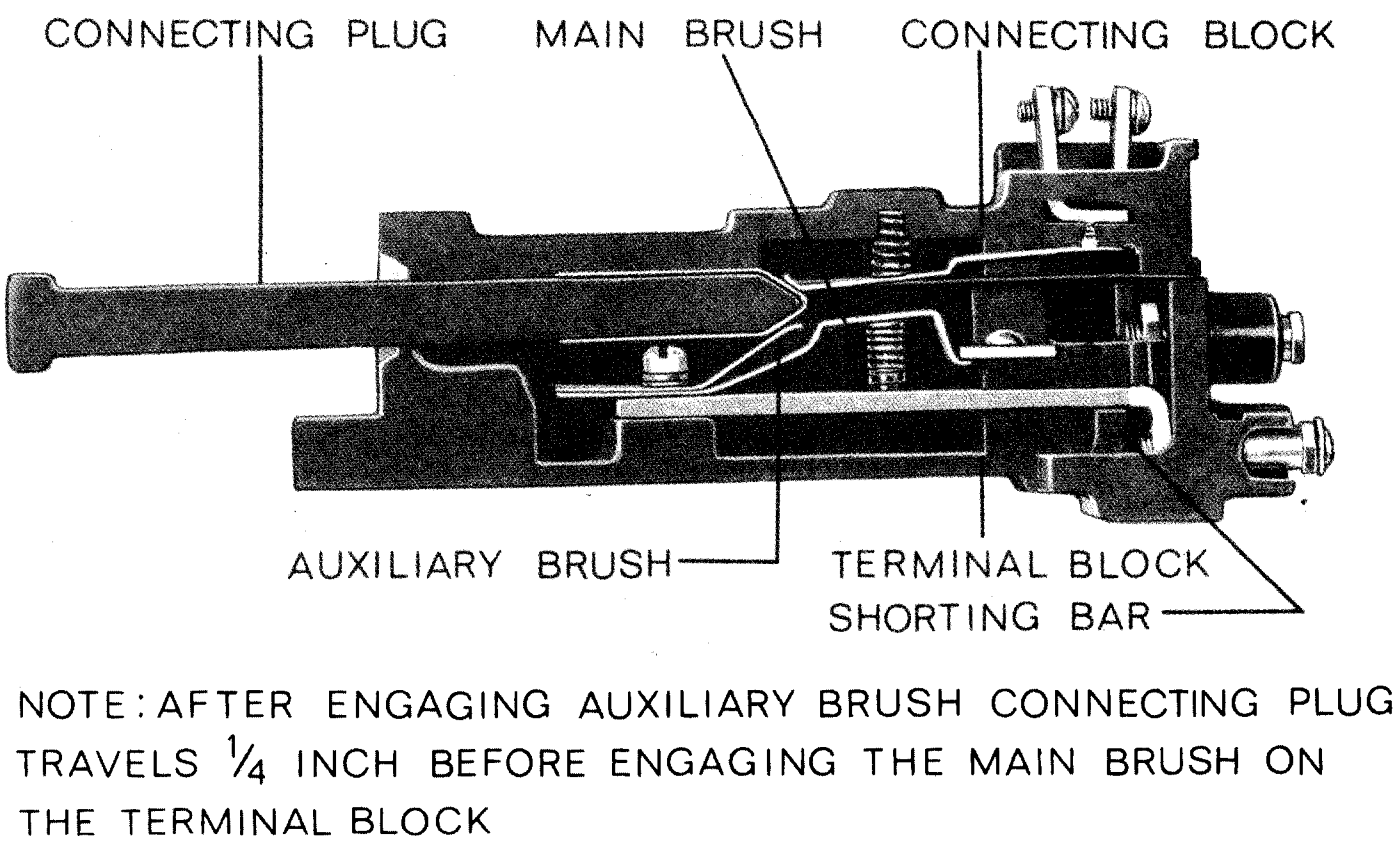


FIG. 10 (8025039) Cross Section of Case and Cradle Blocks

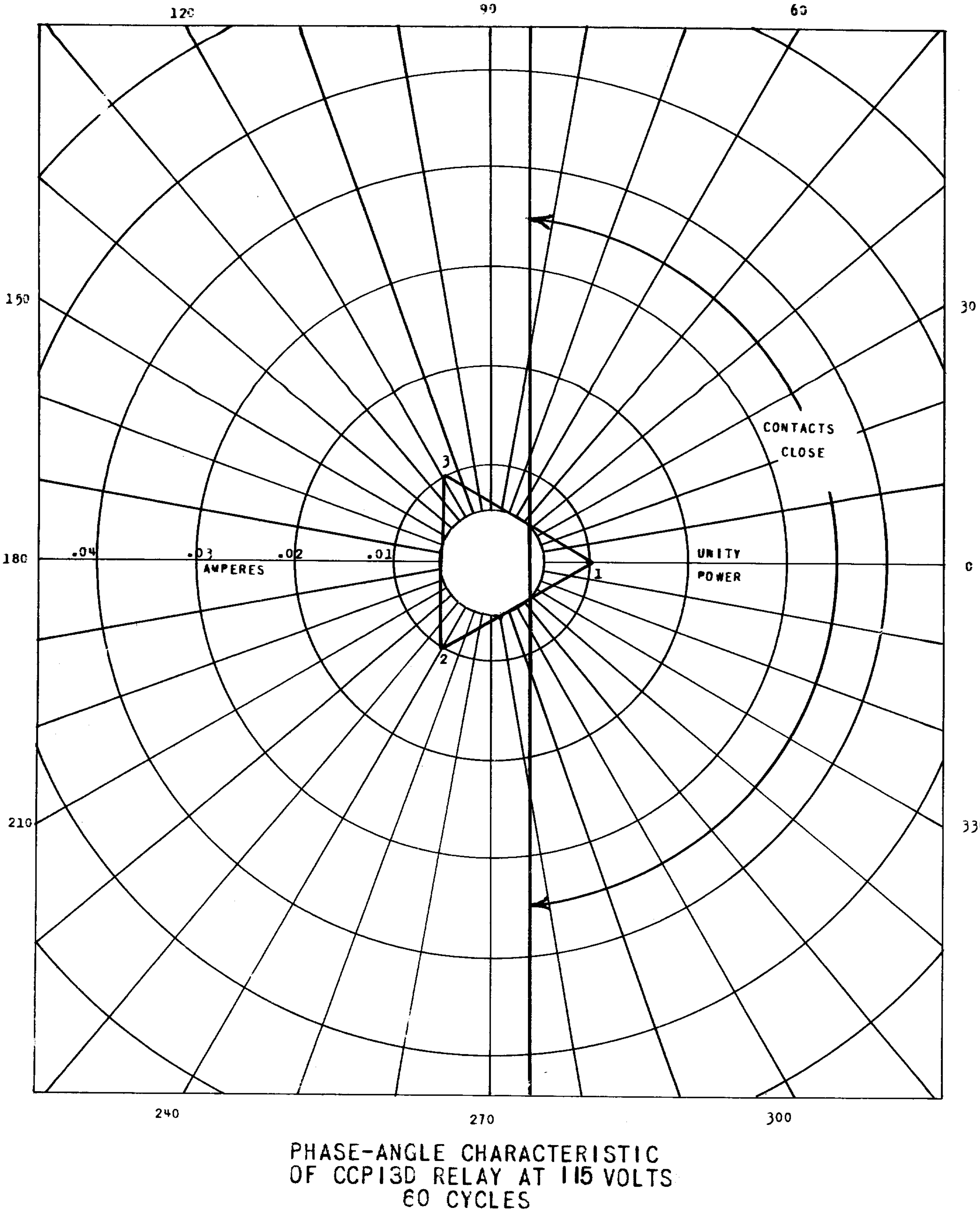


FIG. 11 (K-6556481-1) Phase Angle Characteristics of Type CCP13D Relay when Set for 0.004 Amps Pickup at Rated Voltage and Maximum Torque Angle