INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE KP THREE PHASE VOLTAGE AND PHASE SEQUENCE RELAY

CAUTION: Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type KP relay is a three phase high speed voltage and phase sequence relay.

This relay can be used as either an undervoltage or overvoltage fault detector. In addition, it can also be used to check phase sequence of a three phase voltage.

CONSTRUCTION AND OPERATION

The type KP relay consists of a high speed cylinder unit with an adjustable spring and an indicating contactor switch when required.

Voltage Unit

The voltage unit is a product induction cylinder type unit.

Mechanically, the overcurrent unit is composed of three basic components: a die-cast aluminum frame and electromagnet, a moving element assembly, and a molded bridge.

The frame serves as the mounting structure for the magnetic core. The magnetic core which houses the lower pin bearing is secured to the frame by a spring and snap ring. The bearing can be replaced, if necessary, without having to remove the magnetic core from the frame.

The electromagnet has two pairs of coils. The coils of each pair are mounted diametrically opposite one another. In addition, there are two locating pins. The locating pins are used to accurately position the lower pin bearing, which is mounted on the frame, with respect to the upper pin bearing, which is threaded into the bridge. The electromagnet is permanently secured to the frame and cannot be separated from the frame.

The moving element assembly consists of a spiral spring, contact carrying member, and an aluminum cylinder assembled to a molded hub which holds the shaft. The shaft has removable top and bottom jewel bearings. The shaft rides between the bottom pin bearing and the upper pin bearing with the cylinder rotating in an air gap formed by the electromagnet and the magnetic core.

The bridge is secured to the electromagnet and frame by two mounting screws. In addition to holding the upper pin bearing, the bridge is used for mounting the adjustable stationary contact housing. The stationary contact housing is held in position by a spring type clamp. The spring adjuster is located on the underside of the bridge and is attached to the moving contact arm by a spiral spring. The spring adjuster is also held in place by a spring type clamp.

With the contacts closed, the electrical connection is made through the stationary contact housing clamp, to the moving contact, through the spiral spring out to the spring adjuster clamp.

The voltage at which the contacts either pickup or dropout can be varied by means of moving the spring adjuster.

Indicating Contactor Switch Unit (ICS)

The indicating contactor switch is a small d-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the cover.

SUPERSEDES I.L. 41-222.4
*Denotes change from superseded issue.

EFFECTIVE OCTOBER 1969

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

Contacts

The moving contact assembly in the KP voltage unit has been factory adjusted for low contact bounce performance and should not be disturbed.

The set screw in each stationary contact has been shop adjusted for optimum follow and this adadjustment should not be disturbed.

CHARACTERISTICS

The type KP relay can be adjusted by means of the spring adjuster on the cylinder unit for a range of pickup or dropout of 30 to 120 volts three phase. Factory calibration is 70 volts.

The KP Voltage Relay will also respond to phase to phase voltage conditions as well as three phase voltage. A conversion curve between both is shown in Fig. 4.

The relay has inverse timing; that is, the greater the decrease, or the greater the increase, in voltage, the faster the relay contacts will close. Typical time curves are shown in Figures 5 and 6.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal in contacts of the indicating contactor switch (when supplied) will safely carry this current long enough to trip a circuit breaker. The indicating contactor switch (when supplied) has a pickup of approximately 1 ampere. Its d-c resistance is 0.1 ohms.

Energy Requirements

Burden at rated 120 Volts AC

Phase A to B:
- watts — 1.44
- vars. — 2.40
- Volt-amperes — 2.80
- power factor angle — 59° Lag.

Phase C to B
- watts — 1.45
- vars. — 2.33
- volt-amperes — 2.75
- power factor angle — 58° Lag.

Continuous rating of the KP relay is 132 volts a-c.

SETTINGS

The KP Voltage Relay is factory calibrated and set for a dropout of 70 volts. However, if another voltage setting is required, then the following procedure should be used to recalibrate the relay:

If the relay is to be used as an undervoltage relay, apply the required three phase dropout voltage and make the following adjustment. Move the spring adjuster mounted just under the bridge of the cylinder unit until the mounting contact just touches the right hand stationary contact. For an overvoltage setting, use the same procedure except that the moving contact must just touch the left hand stationary contact.

The maximum range of adjustment is 30 to 120 volts, three phase. Looking at the front view and from the top of the KP relay, the 30 volt adjustment of the spring will be towards the full clockwise position of adjustment. The 120 volt calibration point will be towards the full counter-clockwise position of the spring adjuster.

Note: In order to adjust the spring, place a screwdriver or similar tool into one of the notches located on the periphery of the spring adjuster and rotate it.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminal by means of screws for steel panel mounting or the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed FT case information, refer to I.L. 41-076.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no customer adjustments,

other than those covered under "Settings," should be required.

Acceptance Check

The following check is recommended to insure that the KP Relay is in proper working order:

A. Voltage Unit

1. contact gap — the contact gap should be approximately .020".
2. voltage setting — a voltage setting of 70 volts was made at the factory This can be checked by applying 70 volts three phase to the relay and the moving contact should be just floating or touching the right-hand stationary contact within ±3% of this value. Greater accuracy can be obtained by pre-heating the relay at normal line voltage for approximately one hour.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be between 1 and 1.2 amperes. The indicator target should drop freely.

The contact gap should be approximately 5/64" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contacts should touch both stationary contacts simultaneously.

Routine Maintenance

All relays should be inspected periodically and the operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application.

All contacts should be periodically cleaned. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended because of the danger of embedding small particles in the face of the soft silver and thus imparing the contact.

Calibration

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or the adjustments have been disturbed. This procedure should not be used unless it is apparent that the relay is not in proper working order. (See "Acceptance Check").

A. Voltage Unit

1. The upper pin bearing should be screwed down until there is approximately .025 clearance between it and the top of the shaft bearing. The upper pin bearing should then be securely locked in position with the lock nut. The lower bearing position is fixed and cannot be adjusted.
2. The contact gap adjustment for the undervoltage unit is made with the moving contact in the reset position, i.e., against the right side of the molded bridge. Advance the right hand stationary contact until it just touches the moving contact. Then advance the stationary contact ¼ turn. Now screw in the left hand stationary contact until it just touches the moving contact. Then back off the left hand stationary contact one turn for a gap of approximately 1.020". The clamp holding the stationary contact housing need not be loosened for the adjustment since the clamp utilizes a spring-type action in holding the stationary contact in position.
3. For greater accuracy pre-heat the relay by applying rated voltage for approximately one hour prior to setting the sensitivity.

   The sensitivity adjustment is made by varying the tension of the spiral spring attached to the moving element assembly. The spring is adjusted by placing a screwdriver or similar tool into one of the notches located on the the periphery of the spring adjuster and rotating it. The spring adjuster is located on the underside of the bridge and is held in place by a spring type clamp that does not have to be loosened prior to making the necessary adjustments.

   Apply the desired dropout voltage to the relay and adjust the spiral spring as noted above until the moving contact just floats or makes with the right hand stationary contact.

B. Indicating Contactor Switch (ICS)

Adjust the contact gap for approximately 5/64" (−1/64", +0).

Close the main relay contacts and check to see that the relay picks up and the target drops between 1 and 1.2 amperes d-c.

To increase the pickup current remove the molded cover and bend the springs out or away from the cover. To decrease the pickup current bend the springs in toward the cover.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

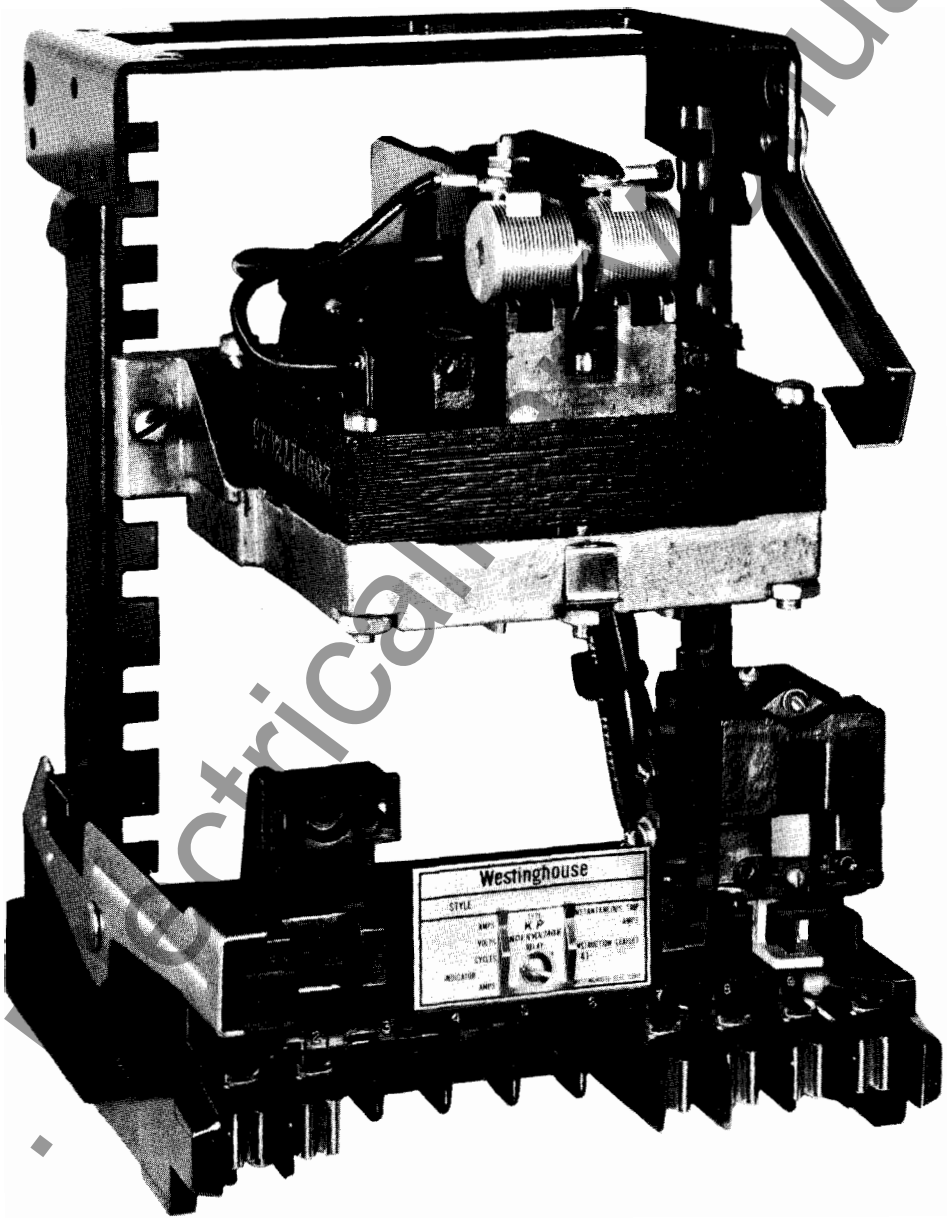


Fig. 1. Photograph — Type KP Relay without case.

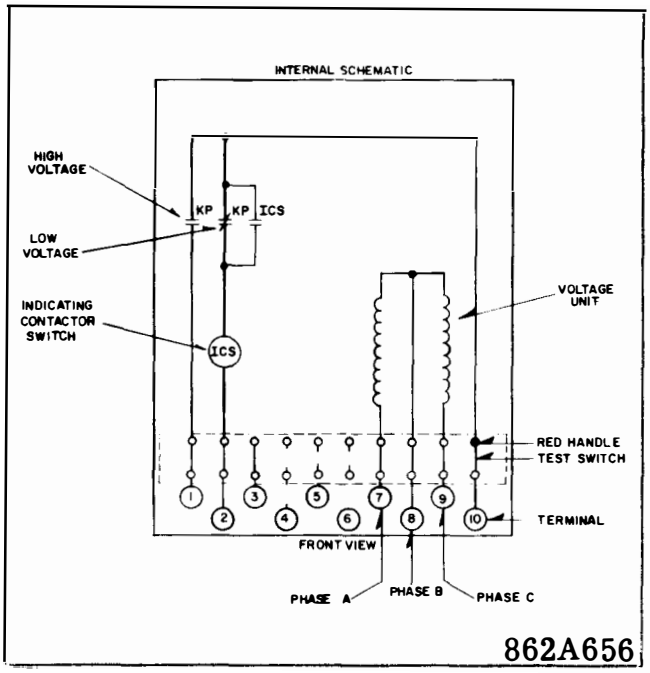


Fig. 2. Internal Schematic – Type KP Voltage Relay with an ICS in the Low Voltage circuit in the type FT21 case.

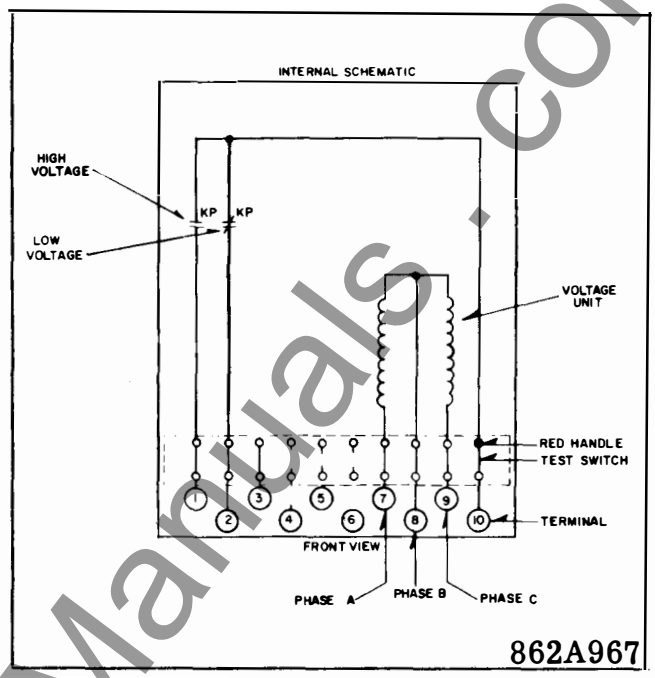


Fig. 3. Internal Schematic – Type KP Voltage Relay in the type FT21 case.

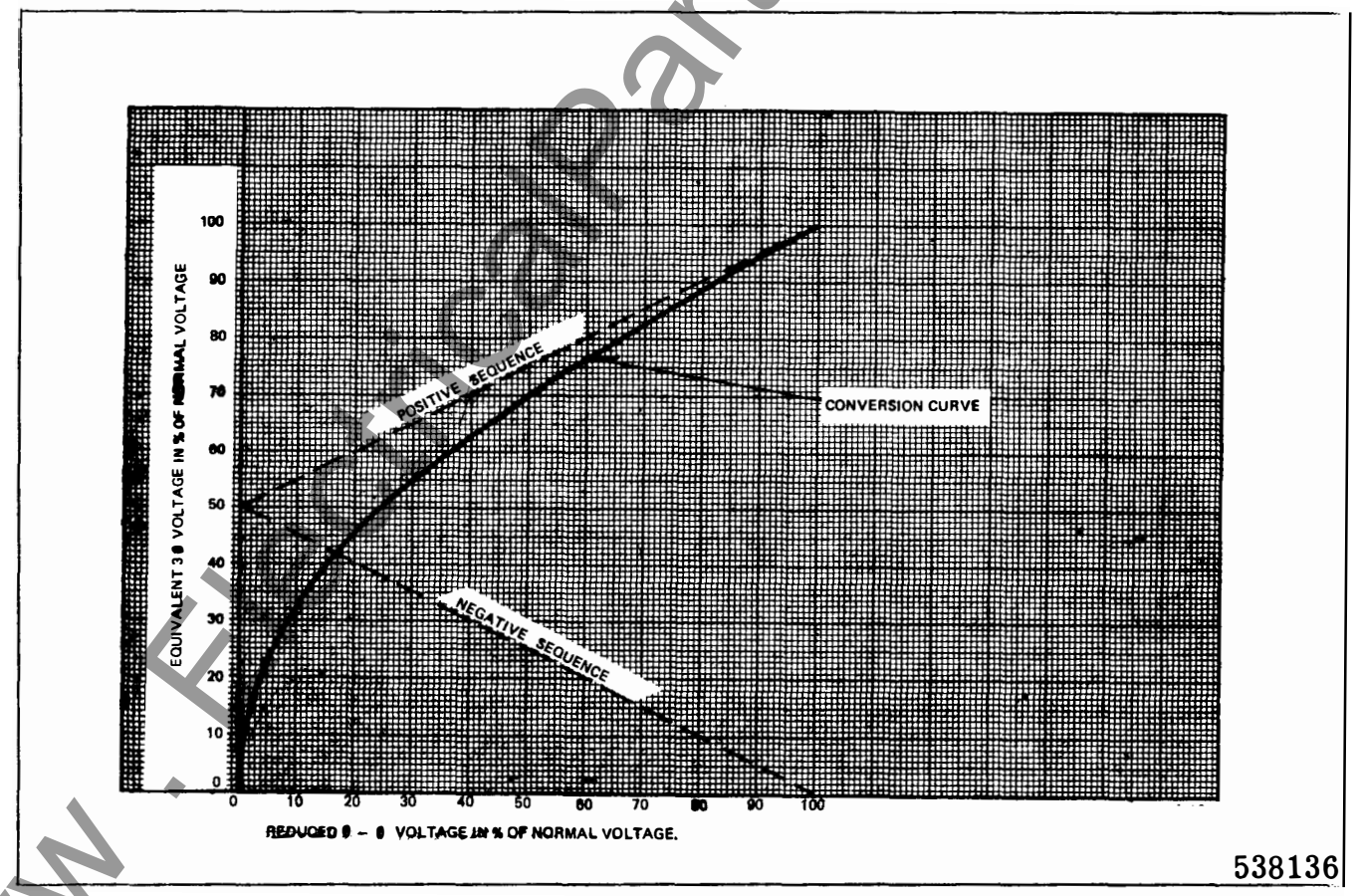


Fig. 4. Conversion curve for three phase vs. phase to phase voltages for the type KP Voltage Relay.

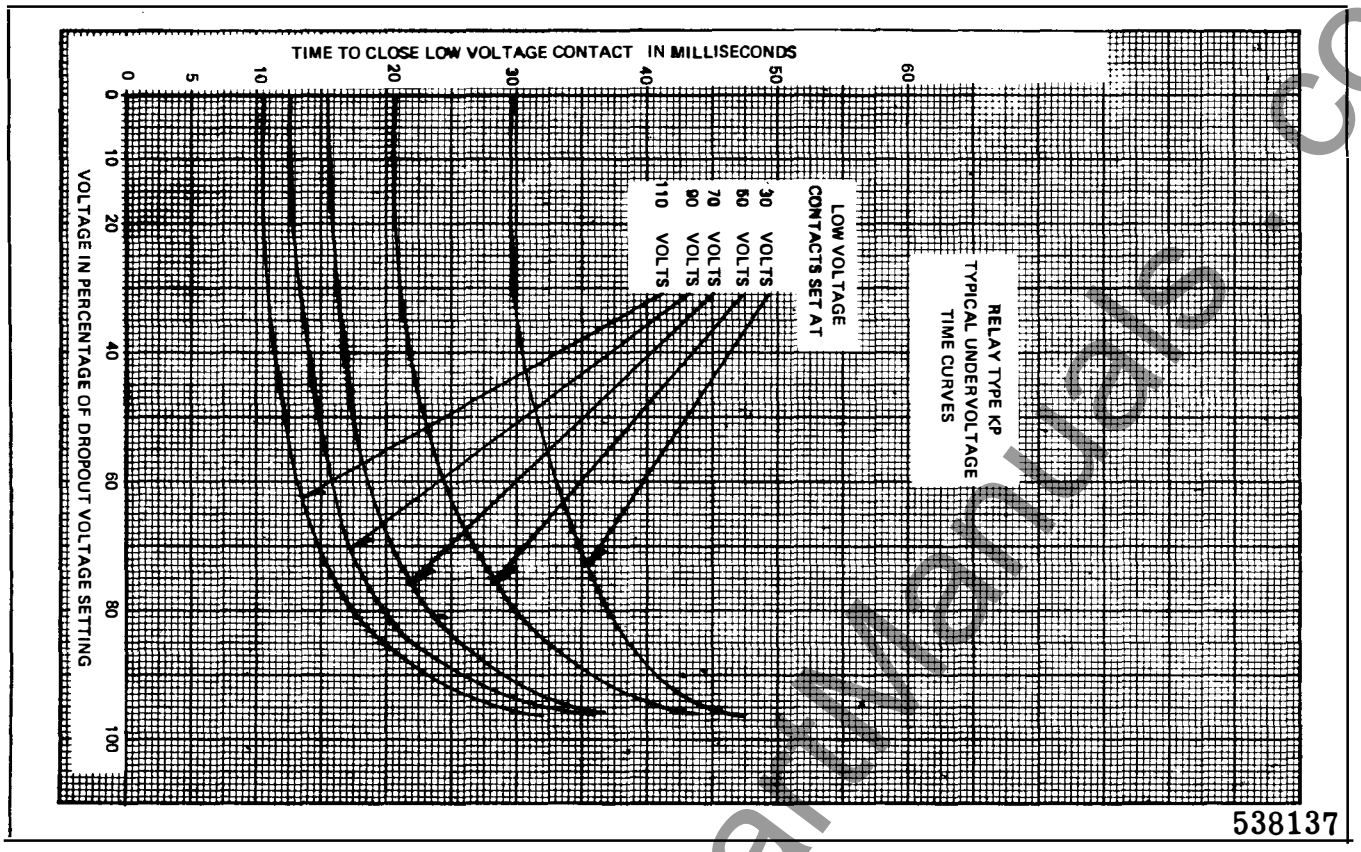


Fig. 5. Typical undervoltage time curves for the type KP Voltage Relay.

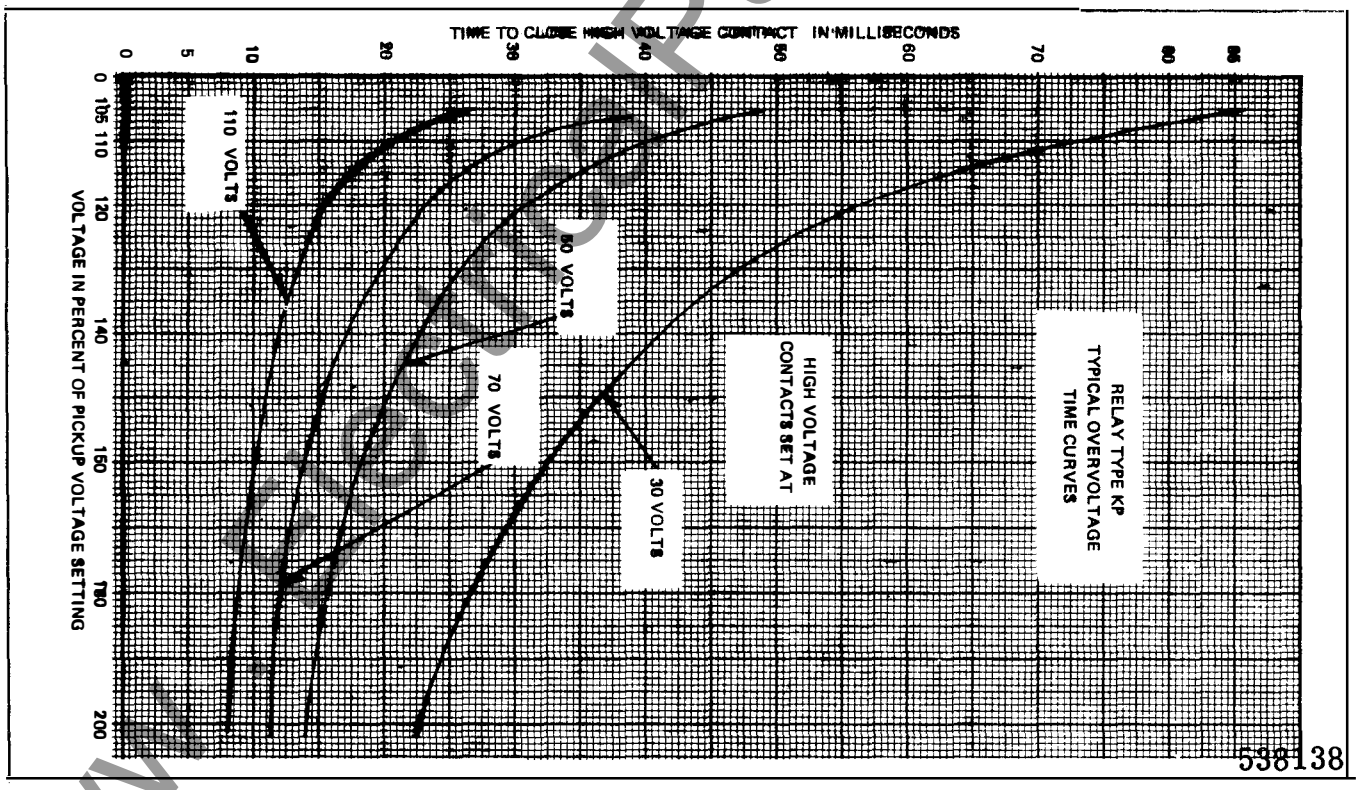
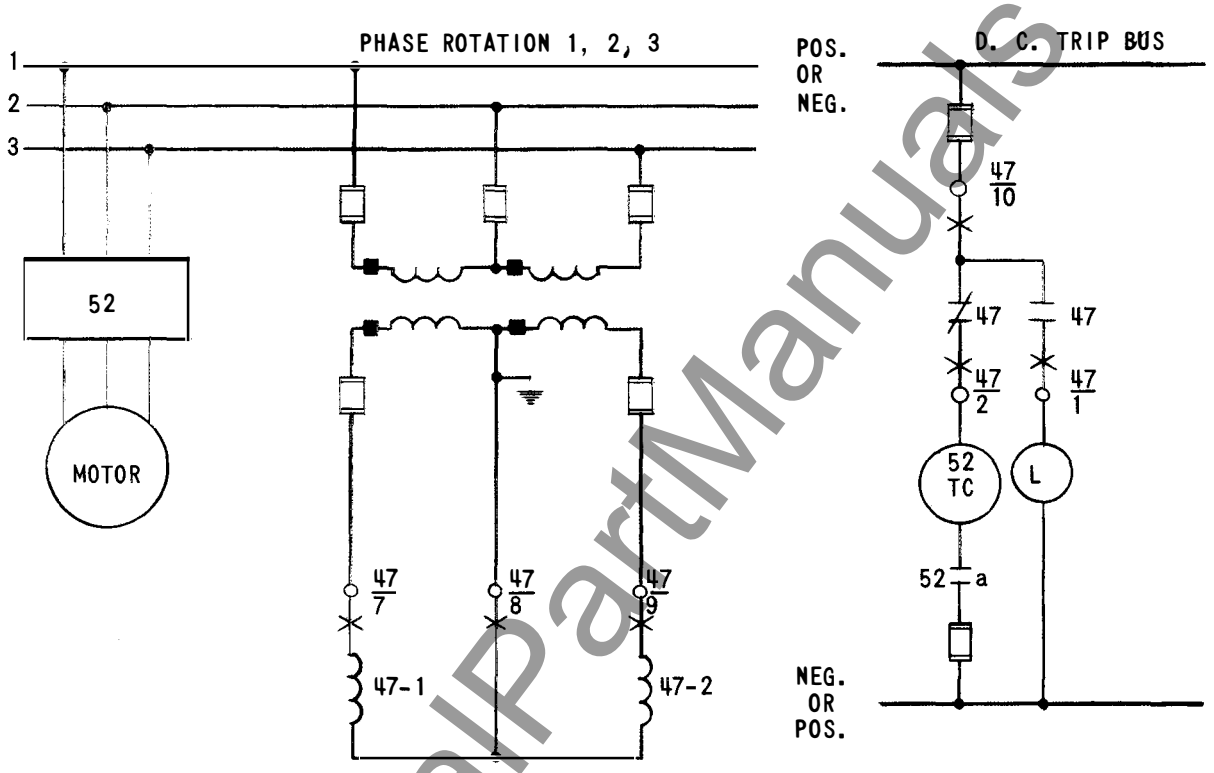


Fig. 6. Typical overvoltage time curves for the type KP Voltage Relay.



DEVICE NUMBER CHART

47 - REVERSE PHASE RELAY, TYPE KP
47-1) -
47-2) - PHASE 1, 2 & 3 COILS RESPECTIVELY
47-3) -
52 - POWER CIRCUIT BREAKER
TC - BREAKER TRIP COIL
a - BREAKER AUXILIARY CONTACT
L - INDICATING LAMP

878A250

* *Fig. 7. External schematic diagram for the type KP Voltage Relay in the type FT21 case.*

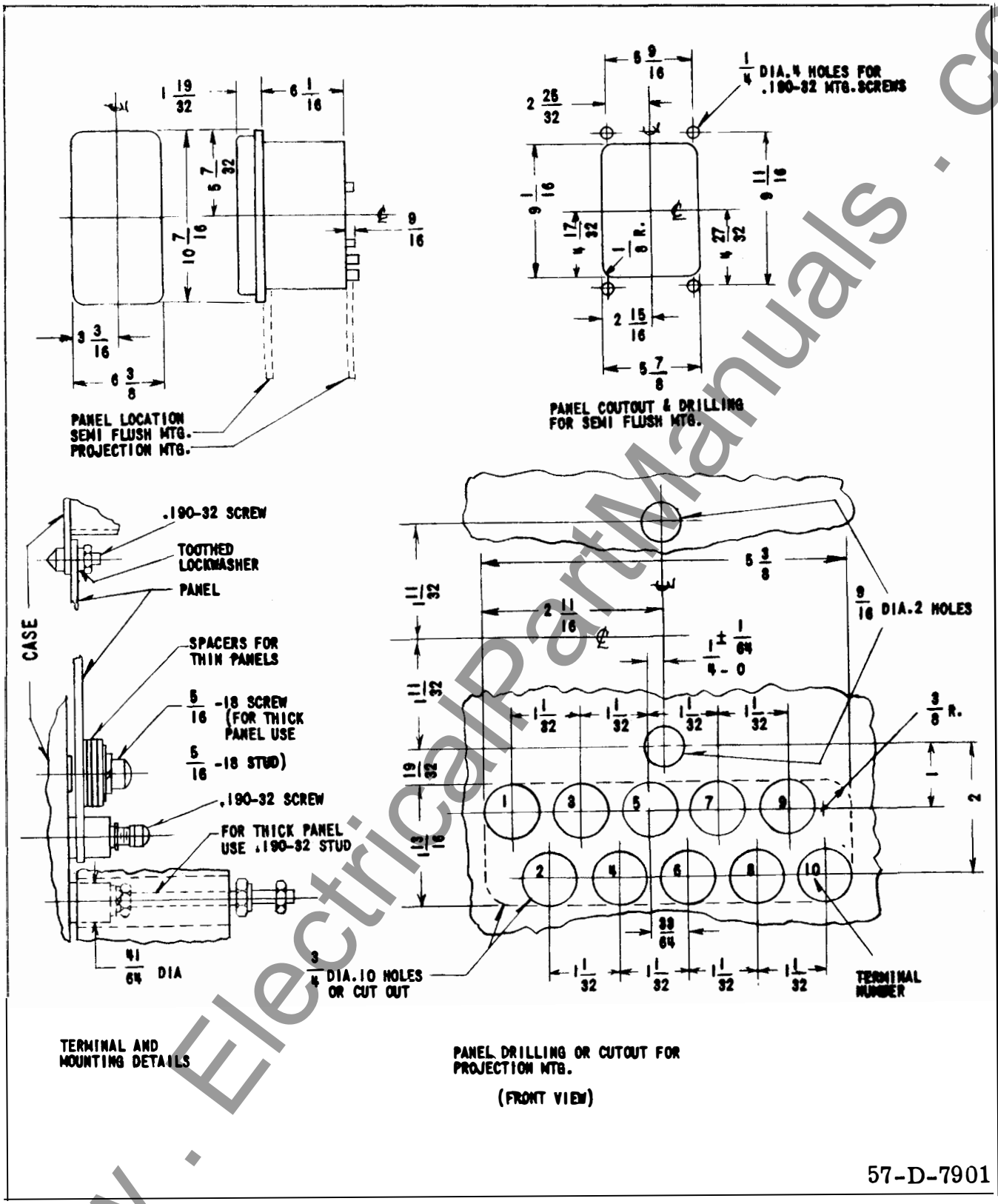


Fig. 8. Outline and drilling plan for the Type KP Voltage Relay in the type FT21 case.

WESTINGHOUSE ELECTRIC CORPORATION
RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**
Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE KP THREE PHASE VOLTAGE AND PHASE SEQUENCE RELAY

CAUTION: Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type KP relay is a three phase high speed voltage and phase sequence relay.

This relay can be used as either an undervoltage or overvoltage fault detector. In addition, it can also be used to check phase sequence of a three phase voltage.

CONSTRUCTION AND OPERATION

The type KP relay consists of a high speed cylinder unit with an adjustable spring and an indicating contactor switch when required.

Voltage Unit

The voltage unit is a product induction cylinder type unit.

Mechanically, the overcurrent unit is composed of three basic components: a die-cast aluminum frame and electromagnet, a moving element assembly, and a molded bridge.

The frame serves as the mounting structure for the magnetic core. The magnetic core which houses the lower pin bearing is secured to the frame by a spring and snap ring. The bearing can be replaced, if necessary, without having to remove the magnetic core from the frame.

The electromagnet has two pairs of coils. The coils of each pair are mounted diametrically opposite one another. In addition, there are two locating pins. The locating pins are used to accurately position the lower pin bearing, which is mounted on the frame, with respect to the upper pin bearing, which is threaded into the bridge. The electromagnet is permanently secured to the frame and cannot be separated from the frame.

The moving element assembly consists of a spiral spring, contact carrying member, and an aluminum cylinder assembled to a molded hub which holds the shaft. The shaft has removable top and bottom jewel bearings. The shaft rides between the bottom pin bearing and the upper pin bearing with the cylinder rotating in an air gap formed by the electromagnet and the magnetic core.

The bridge is secured to the electromagnet and frame by two mounting screws. In addition to holding the upper pin bearing, the bridge is used for mounting the adjustable stationary contact housing. The stationary contact housing is held in position by a spring type clamp. The spring adjuster is located on the underside of the bridge and is attached to the moving contact arm by a spiral spring. The spring adjuster is also held in place by a spring type clamp.

With the contacts closed, the electrical connection is made through the stationary contact housing clamp, to the moving contact, through the spiral spring out to the spring adjuster clamp.

The voltage at which the contacts either pickup or dropout can be varied by means of moving the spring adjuster.

Indicating Contoctor Switch Unit (ICS)

The indicating contactor switch is a small d-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the cover.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

Contacts

The moving contact assembly in the KP voltage unit has been factory adjusted for low contact bounce performance and should not be disturbed.

The set screw in each stationary contact has been shop adjusted for optimum follow and this adadjustment should not be disturbed.

CHARACTERISTICS

The type KP relay can be adjusted by means of the spring adjuster on the cylinder unit for a range of pickup or dropout of 30 to 120 volts three phase. Factory calibration is 70 volts.

The KP Voltage Relay will also respond to phase to phase voltage conditions as well as three phase voltage. A conversion curve between both is shown in Fig. 4.

The relay has inverse timing; that is, the greater the decrease, or the greater the increase, in voltage, the faster the relay contacts will close. Typical time curves are shown in Figures 5 and 6.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal in contacts of the indicating contactor switch (when supplied) will safely carry this current long enough to trip a circuit breaker. The indicating contactor switch (when supplied) has a pickup of approximately 1 ampere. Its d-c resistance is 0.1 ohms.

Energy Requirements

Burden at rated 120 Volts AC

Phase A to B;
watts — 1.44
vars. — 2.40
Volt-amperes — 2.80
power factor angle — 59° Lag.

Phase C to B
watts — 1.45
vars. — 2.33
volt-amperes — 2.75
power factor angle — 58° Lag.

Continuous rating of the KP relay is 132 volts a-c.

SETTINGS

The KP Voltage Relay is factory calibrated and set for a dropout of 70 volts. However, if another voltage setting is required, then the following procedure should be used to recalibrate the relay:

If the relay is to be used as an undervoltage relay, apply the required three phase dropout voltage and make the following adjustment. Move the spring adjuster mounted just under the bridge of the cylinder unit until the mounting contact just touches the right hand stationary contact. For an overvoltage setting, use the same procedure except that the moving contact must just touch the left hand stationary contact.

The maximum range of adjustment is 30 to 120 volts, three phase. Looking at the front view and from the top of the KP relay, the 30 volt adjustment of the spring will be towards the full clockwise position of adjustment. The 120 volt calibration point will be towards the full counter-clockwise position of the spring adjuster.

Note: In order to adjust the spring, place a screwdriver or similar tool into one of the notches located on the periphery of the spring adjuster and rotate it.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminal by means of screws for steel panel mounting or the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed FT case information, refer to I.L. 41-076.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no customer adjustments,

other than those covered under "Settings," should be required.

Acceptance Check

The following check is recommended to insure that the KP Relay is in proper working order:

A. Voltage Unit

1. contact gap — the contact gap should be approximately .020".

2. voltage setting — a voltage setting of 70 volts was made at the factory This can be checked by applying 70 volts three phase to the relay and the moving contact should be just floating or touching the right-hand stationary contact within ±3% of this value. Greater accuracy can be obtained by pre-heating the relay at normal line voltage for approximately one hour.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be between 1 and 1.2 amperes. The indicator target should drop freely.

The contact gap should be approximately 5/64" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contacts should touch both stationary contacts simultaneously.

Routine Maintenance

All relays should be inspected periodically and the operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application.

All contacts should be periodically cleaned. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended because of the danger of embedding small particles in the face of the soft silver and thus imparing the contact.

Calibration

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or the adjustments have been disturbed. This procedure should not be used unless it is apparent that the relay is not in proper working order. (See "Acceptance Check").

A. Voltage Unit

1. The upper pin bearing should be screwed down until there is approximately .025 clearance between it and the top of the shaft bearing. The upper pin bearing should then be securely locked in position with the lock nut. The lower bearing position is fixed and cannot be adjusted.

2. The contact gap adjustment for the undervoltage unit is made with the moving contact in the reset position, i.e., against the right side of the molded bridge. Advance the right hand stationary contact until it just touches the moving contact. Then advance the stationary contact ¼ turn. Now screw in the left hand stationary contact until it just touches the moving contact. Then back off the left hand stationary contact one turn for a gap of approximately 1.020". The clamp holding the stationary contact housing need not be loosened for the adjustment since the clamp utilizes a spring-type action in holding the stationary contact in position.

3. For greater accuracy pre-heat the relay by applying rated voltage for approximately one hour prior to setting the sensitivity.

   The sensitivity adjustment is made by varying the tension of the spiral spring attached to the moving element assembly. The spring is adjusted by placing a screwdriver or similar tool into one of the notches located on the the periphery of the spring adjuster and rotating it. The spring adjuster is located on the underside of the bridge and is held in place by a spring type clamp that does not have to be loosened prior to making the necessary adjustments.

   Apply the desired dropout voltage to the relay and adjust the spiral spring as noted above until the moving contact just floats or makes with the right hand stationary contact.

B. Indicating Contactor Switch (ICS)

Adjust the contact gap for approximately 5/64" (−1/64", +0).

Close the main relay contacts and check to see that the relay picks up and the target drops between 1 and 1.2 amperes d-c.

To increase the pickup current remove the molded cover and bend the springs out or away from the cover. To decrease the pickup current bend the springs in toward the cover.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

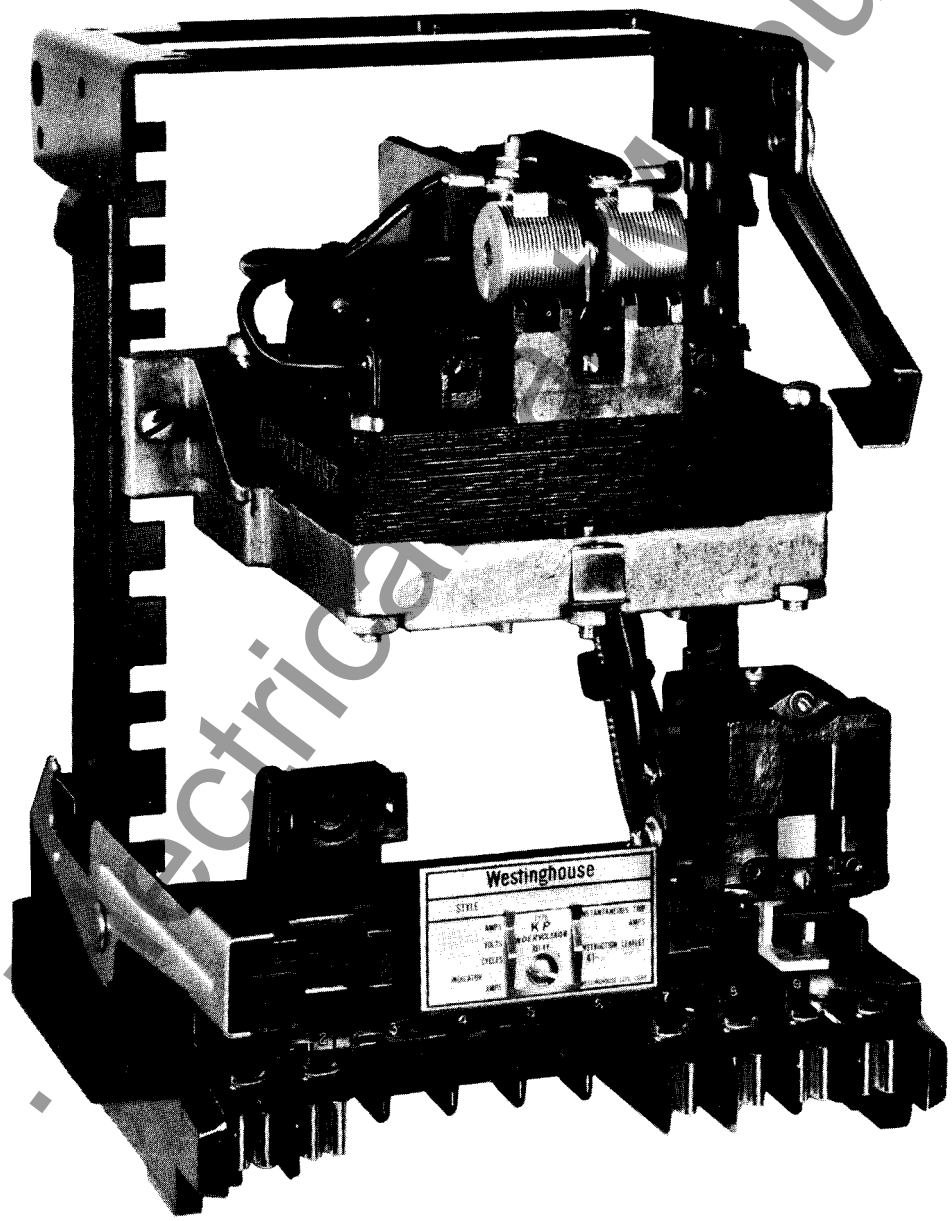


Fig. 1. Photograph — Type KP Relay without case.

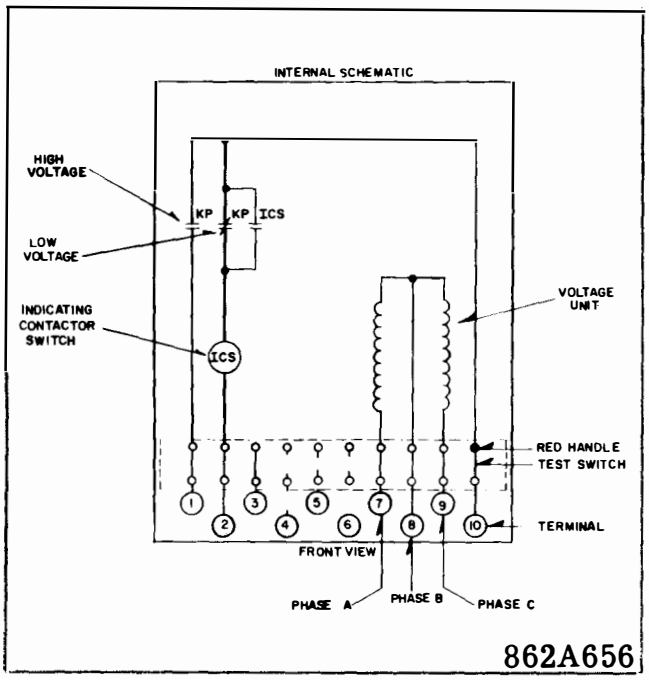


Fig. 2. Internal Schematic – Type KP Voltage Relay with an ICS in the Low Voltage circuit in the type FT21 case.

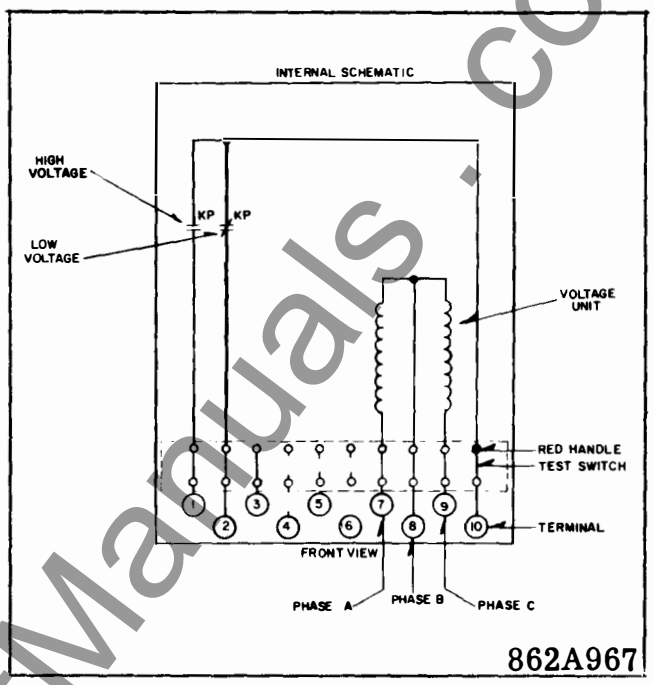


Fig. 3. Internal Schematic – Type KP Voltage Relay in the type FT21 case.

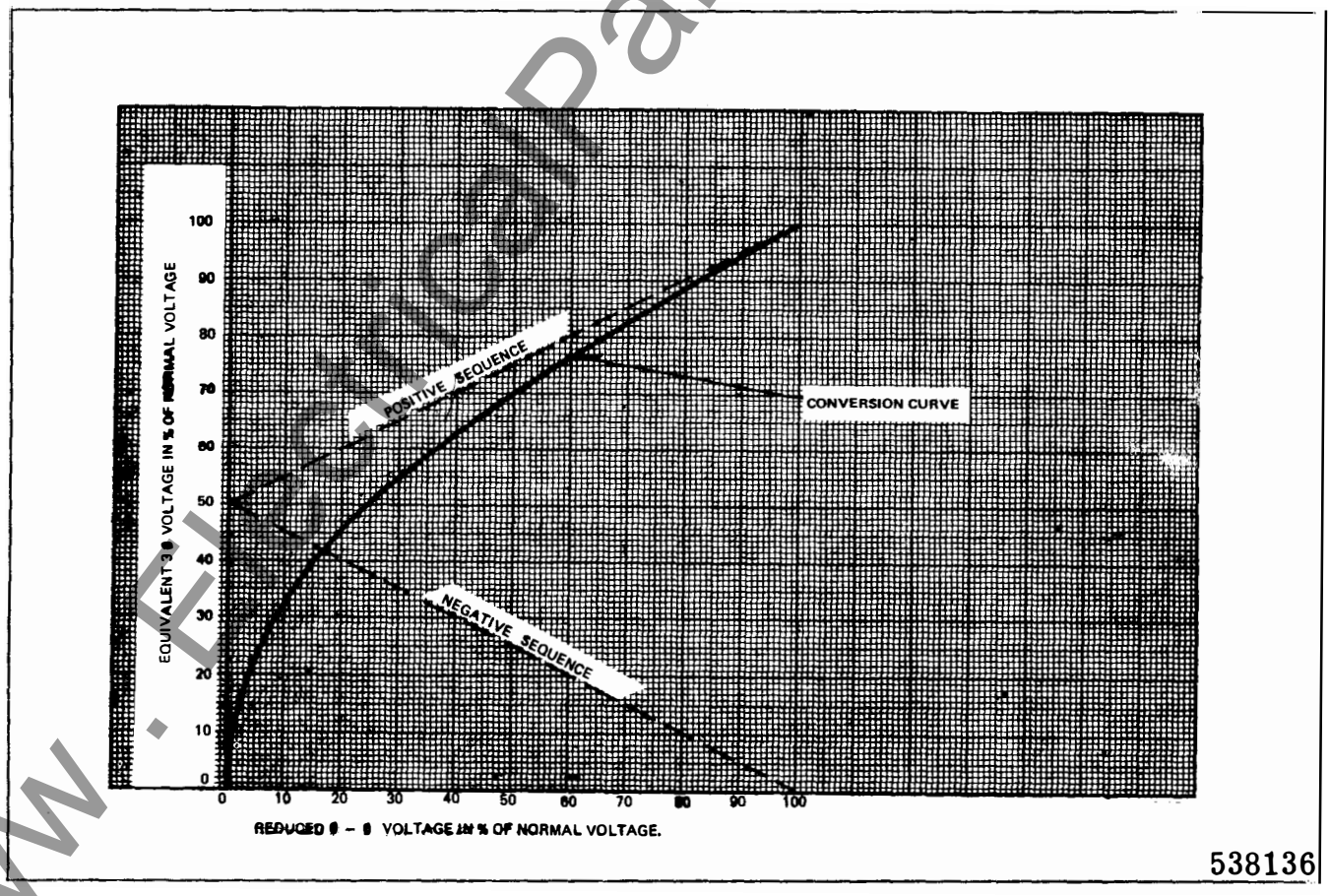


Fig. 4. Conversion curve for three phase vs. phase to phase voltages for the type KP Voltage Relay.

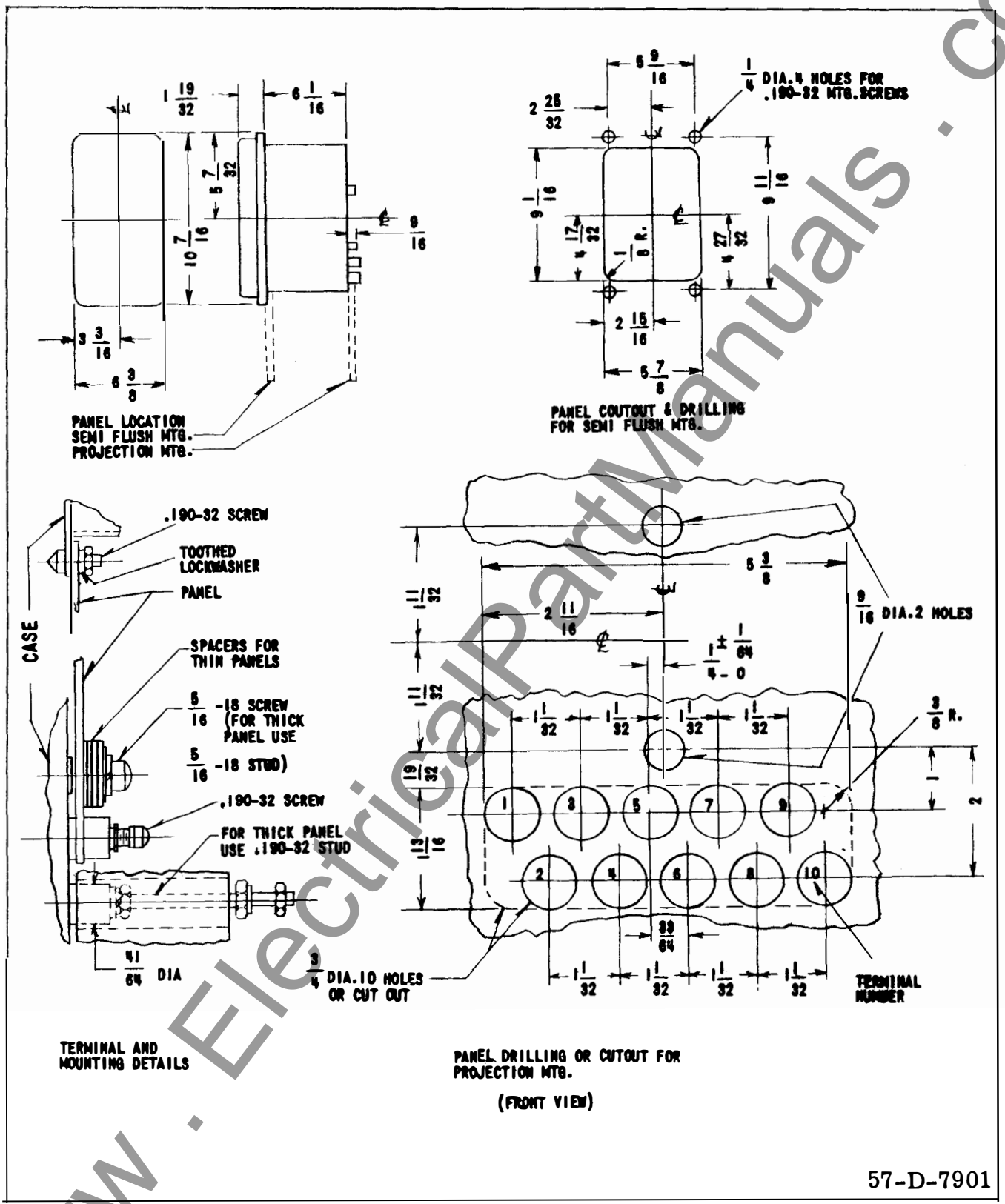


Fig. 8. Outline and drilling plan for the Type KP Voltage Relay in the type FT21 case.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CP REVERSE PHASE RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type CP relay is a three phase induction disc type relay that operates upon phase reversal to disconnect a motor from a circuit. The relay may not operate for an open phase on the motor unless the motor is so heavily loaded that normal voltage cannot be maintained on all phases. Normally, the relay will operate as soon as the machine is stopped and prevent it from being started again if one phase wire is open.

This relay may also be applied to close its contacts on either three phase overvoltage or three phase undervoltage conditions on a system. For example, one relay is used to initiate source breaker trip and another relay is used to supervise alternate source breaker closing on automatic bus transfer schemes.

The CVQ relay performs a similar function for motor protection – supervision of supply breaker closing, low-voltage, and single-phasing protection. The CVQ is a more sophisticated relay, providing more sensitive single-phasing protection than does the CP relay; that is, the CVQ will detect single-phasing of a predominately motor load, where the motors are lightly loaded.

CONSTRUCTION AND OPERATION

The type CP relay consists of a three phase voltage unit, an indicating contactor switch when supplied, and an indicating voltage switch when supplied. The principal component parts of the relay and their location are shown in figure 1.

A. Voltage Unit (CP)

The electromagnet is an "E" type laminated structure with a coil mounted on each leg. A wye connection is formed by connecting one lead of each coil together. The other lead of the coils are connected to separate phases of a three phase system.

When the coils are energized with a three phase voltage, a flux is induced in each leg of the electromagnet. These fluxes are out-of-phase with respect to each other since they are induced by out-of-phase voltages. The path of the three fluxes is across an air gap in which a disc is located. The out-of-phase fluxes cause a torque to be produced on the disc which moves to a position in its travel that corresponds to the three phase voltage applied to the electromagnet. The disc will remain in this position until the applied three phase voltage is changed, at which time, the disc will move to a new position that corresponds to the new voltage.

The out-of-phase fluxes are such that a positive sequence voltage tends to close the high voltage contact while a negative sequence voltage tends to close the low voltage contact. A reversed phase (which means negative sequence phase rotation) will cause the relay's low voltage contact to close. This contact will also close on unbalance voltages that contain a negative sequence component sufficient to reduce the relay torque to its low voltage trip point.

B. Indicating Contactor Switch (ICS)

The indicating contactor switch is a small d-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also, during this operation two fingers on the armature deflect a spring located on

All possible contingencies which may arise during installation, operation, or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding his particular installation, operation or maintenance of his equipment, the local Westinghouse Electric Corporation representative should be contacted.

SUPERSEDES I.L. 41-222.2F, dated Jan. 1975
✪Denotes change from superseded issue.

EFFECTIVE SEPTEMBER 1977

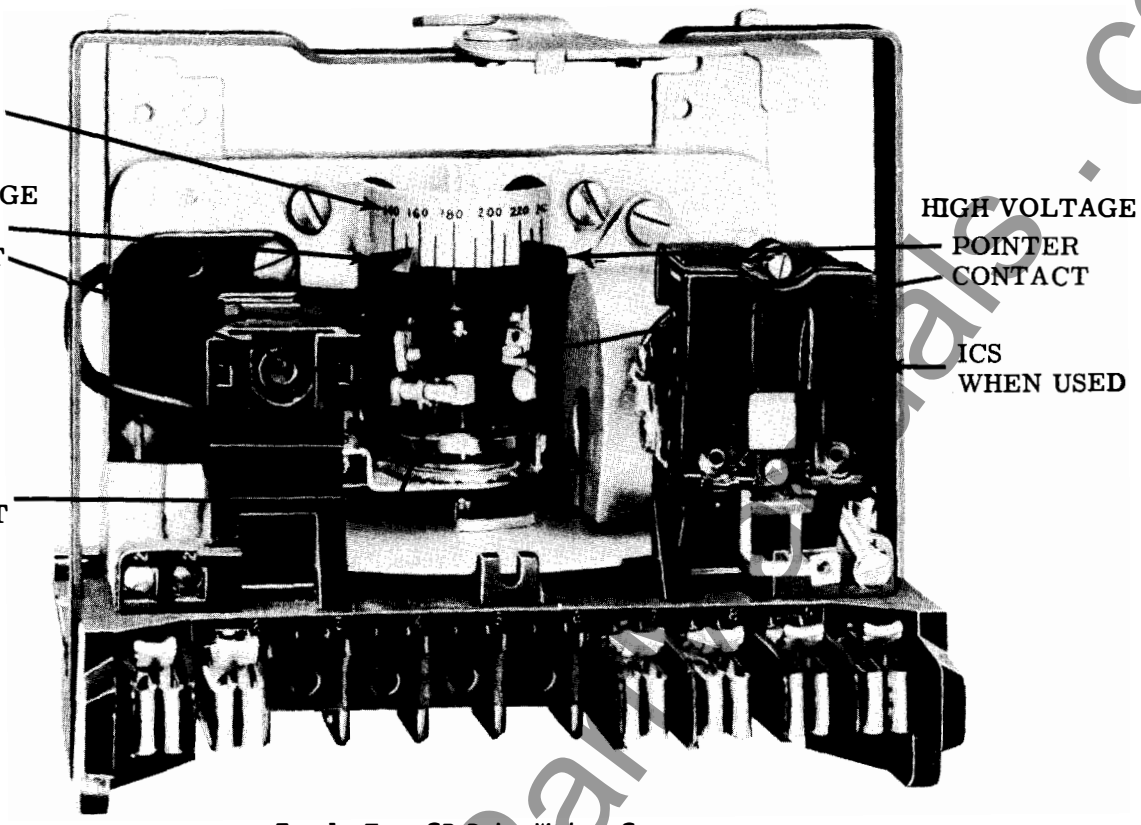


Fig. 1. Type CP Relay Without Case.

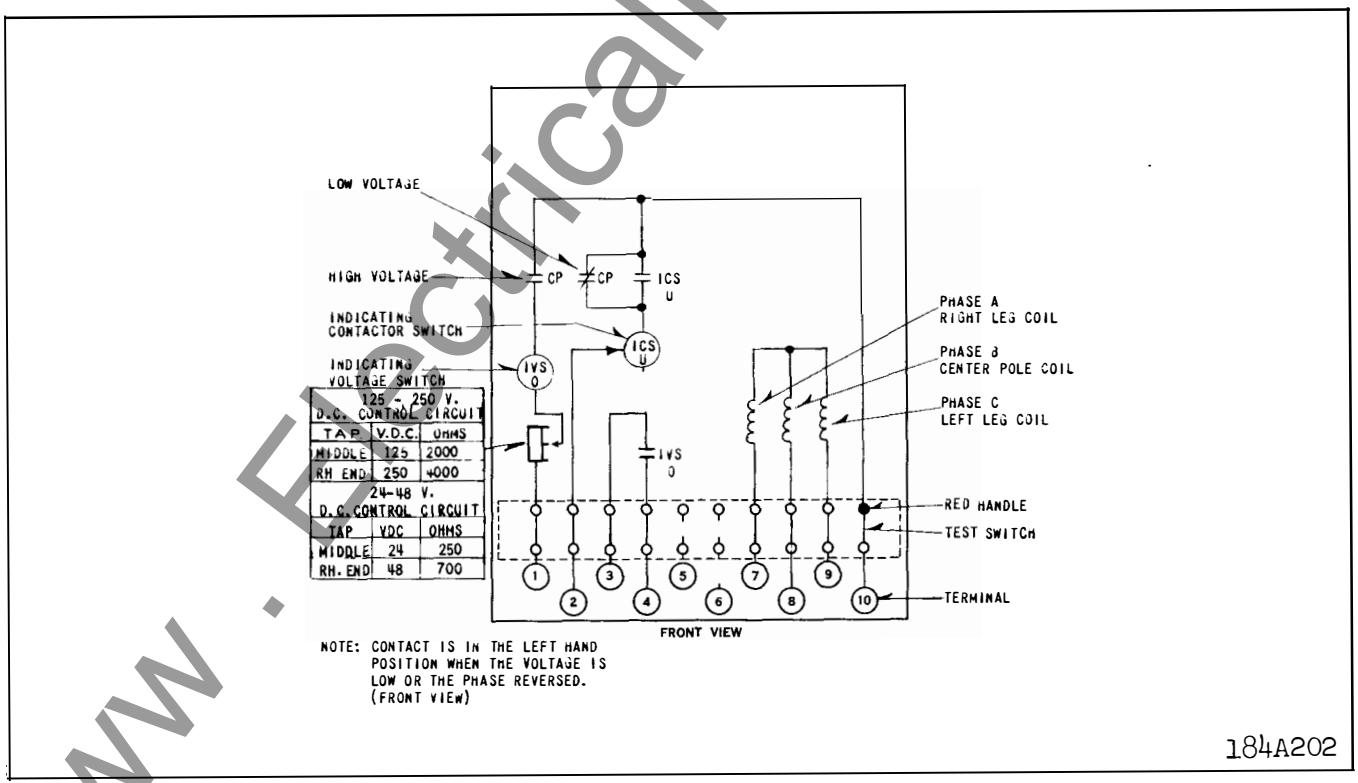


Fig. 2. Internal Schematic of the Type CP Relay with independent contacts in the Type FT11 case.

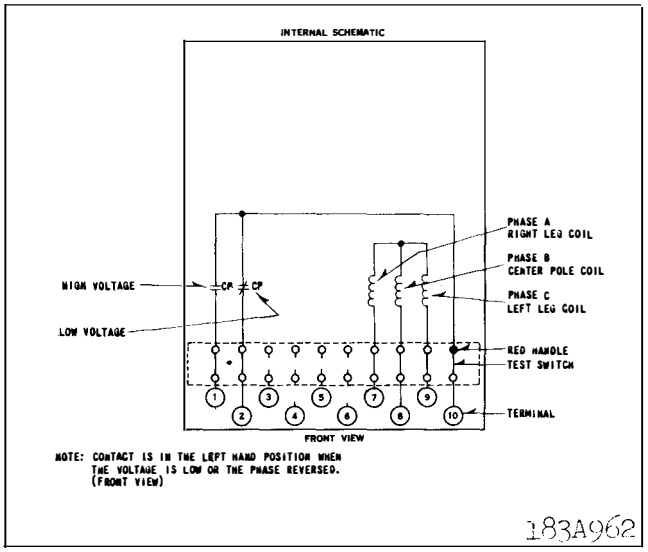


Fig. 3. Internal Schematic of the Type CP Relay in the Type FT11 Case.

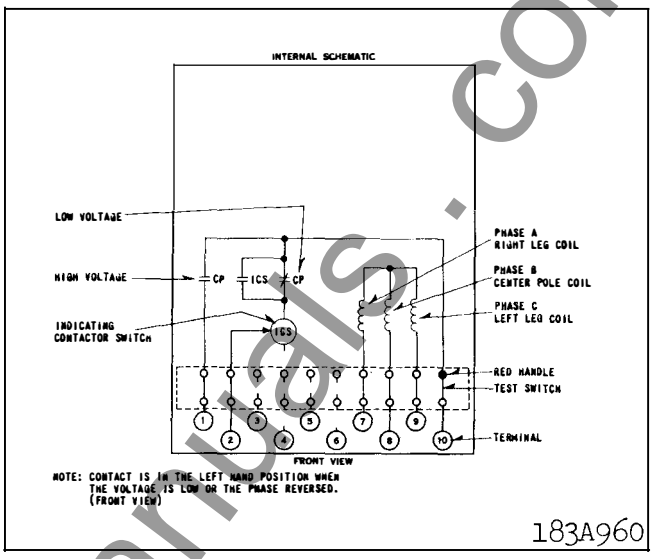


Fig. 4. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the Low Voltage Circuit in the Type FT11 Case.

the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the case.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

An AC indicating contact switch (ACS) is used where the relay contacts connect to an AC trip or control circuit.

C. Indicating Voltage Switch (IVS)

The indicating voltage switch has the same construction as the indicating contactor switch.

CHARACTERISTICS

The type CP relay has adjustable high and low voltage contacts which can be set around the periphery of a scale. The range of adjustment of the contacts are as follows:

120 volt relay	70 to 120 volts
240 volt relay	140 to 240 volts
480 volt relay	280 to 480 volts
208 volt relay	120 to 220 volts

If either of the adjustable contacts are set for a value of voltage within these ranges, the relay will just close its contacts when the balanced three phase line to line voltages equal this value. For such a condition, the relay is operating at its minimum trip point, and the operating times on repeated operations are not repetitive within close tolerances. However, voltages greater than the overvoltage setting or less than the undervoltage setting, result in relay timing operations which are consistent for repeated trials.

The relay has inverse timing; that is, the greater the increase in voltage the faster the relay contacts will close. Typical time curves for various contact settings are shown in figures 6 and 7.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch (when supplied) will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch (when supplied) has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constant

Indicating contactor switch (ICS) (When Supplied).

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

Indicating Voltage Switch (IVS) (When Supplied)

The indicating voltage switch (IVS) has a series resistor. The IVS will operate when 80% d.c. rated voltage is applied to the IVS circuitry.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration and heat. Mount the relay vertically by means of the rear mounting stud or studs for the type FT projection case or by means of the four mounting holes on the flange for the semi-flush type FT case. Either the stud or the mounting screws may be utilized for grounding the relay. Ex-

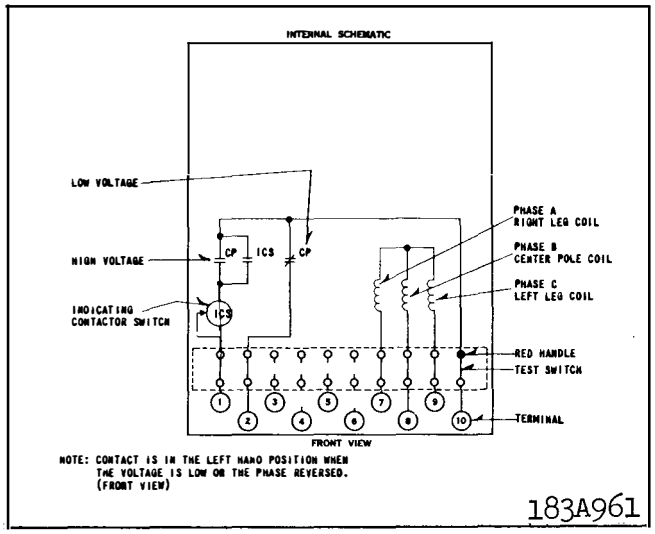


Fig. 5. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the High Voltage Circuit in the Type FT11 Case.

ternal toothed washers are provided for use in the locations shown on the outline and drilling plan to facilitate making a good electrical connection between the relay case, its mounting screws or studs, and the relay panel. Ground wires are affixed to the mounting screws or studs as required for poorly grounded or insulating panels. Other electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal stud furnished with the relay for thick panel mounting. The terminal stud may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detail information on the FT case refer to I.L. 41-076.

SETTINGS

There are two independent relay adjustments. These are the high and low voltage contact settings as described under "Characteristics". These settings determine the balanced three phase line-to-line voltage at which the relay contacts trip. The relay timing is not an independent adjustment, since it is fixed by the contact settings chosen. Typical time curves for various contact settings are given in Figs. 6 and 7.

For motor protection set the low-voltage contact at the minimum permissible operating voltage. (This contact may also close when the motor is operated single-phased, provided the open phase voltage is not held too close to normal by the motor. A motor operating near full load or a motor connected in parallel with substantial static load will not be able to maintain near normal open-phase voltage.) Where the high voltage contact supervises supply breaker closing, it must be set lower than normal voltage. For example, set the high-voltage contact at 90% and the low-voltage contact at 80% of rated voltage. The high and low voltage contacts must be sufficiently separated to allow for a minimum contact gap of about 0.020 inches. This corresponds to a voltage setting separation of about 7%.

Indicating Contactor Switch (ICS) (When Supplied)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energizes a 125 volt or 250 volt d.c. type WL relay switch, or equivalent, use the 0.2 ampere tap. For 48 volt d.c. applications set ICS in 2 ampere tap and use S#304C209G01 type WL relay or equivalent.

Indicating Voltage Switch (IVS) (When Supplied)

No setting is required on the IVS unit except for the selection of the required voltage tap on the tapped resistor.

ADJUSTMENT AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no adjustments, other than those covered under "Settings", should be required.

Acceptance Check

The following check is recommended to insure that the relay is in proper working order:

A. CP Unit

1. Contacts — Set the left-hand adjustable contact in the center of the scale and adjust the voltage until the moving contact just makes. Set the left-hand contact back out of the way and bring the right-hand contact up until the contacts just make. The pointer should be within ± 1/32" of where the left-hand pointer was.

2. Minimum Trip Voltages — Check the scale markings by setting either of the two contacts at a value marked on the scale, then alternately apply this voltage plus 3% and minus 3%. Contacts should make and break.

   Check all of the scale markings in a similar manner.

3. Time Curve — The time curve can be checked by the use of the circuits of Figs. 8 and 9.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient

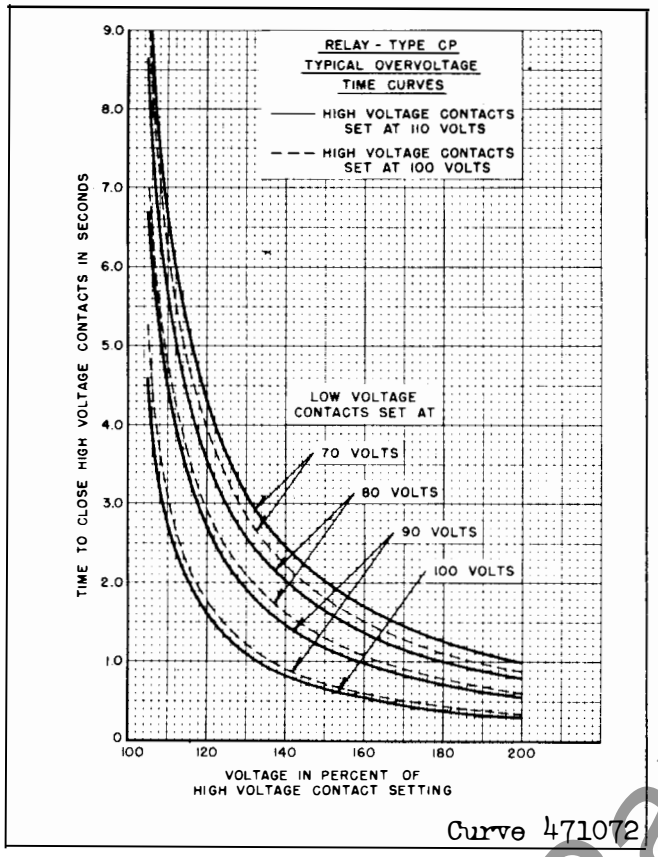


Fig. 6. Typical Overvoltage Time Curves for the Type CP Relay.

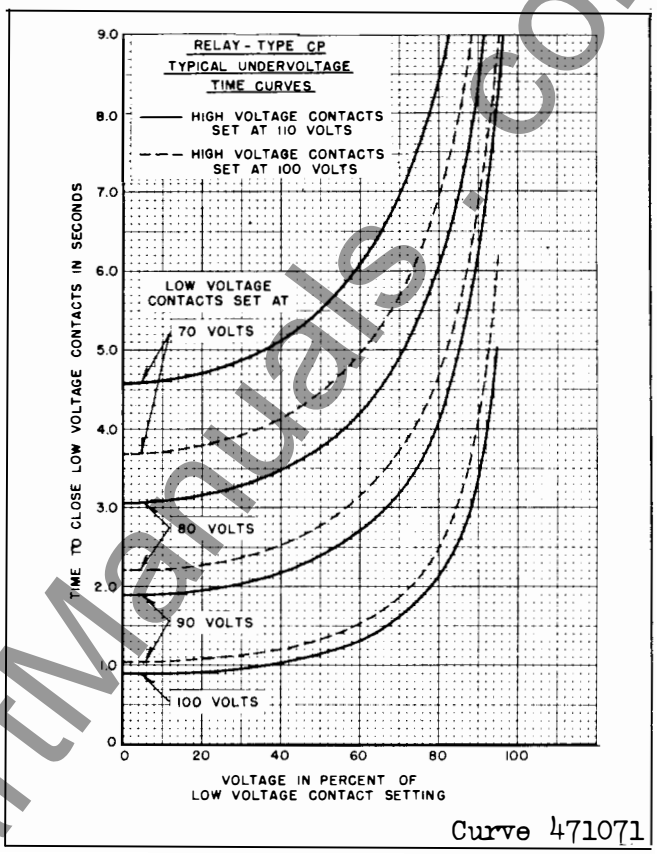


Fig. 7. Typical Undervoltage Time Curves for the Type CP Relay.

d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

C. Indicating Voltage Switch (IVS)

Close the main relay contacts and apply rated d-c voltage across terminals 1 and 10. The contacts of the IVS unit should close and the indicator target should drop freely.

Routine Maintenance

All relays should be inspected periodically and the time of operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application.

All contacts should be periodically cleaned. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver contact and thus impairing the contact.

Calibration

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs, or the adjustments have been disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order (See "Acceptance Check").

A. CP Unit

1. Contacts — Apply sufficient voltage to the relay, to make the disc float in the center of its travel. Move either of the adjustable contacts until it just makes with the moving contact. If the two contacts pointers do not meet at the same point on the scale, adjust the follow on both adjustable contacts. The contacts should just make with the moving contacts when the pointers meet on the scale. Approximately the same follow should be in each of the adjustable stationary contacts.

2. Minimum Trip Voltage — The adjustment of the spring tension in setting the minimum trip voltage is most conveniently made with the damping magnet removed.

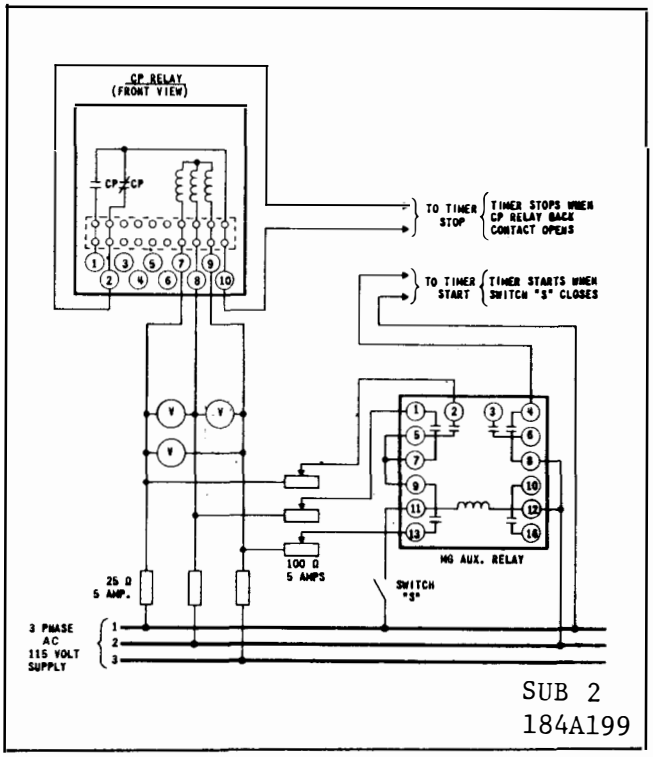


Fig. 8. Diagram of Test Connection for checking the Undervoltage Time Curves of the Type CP Relay.

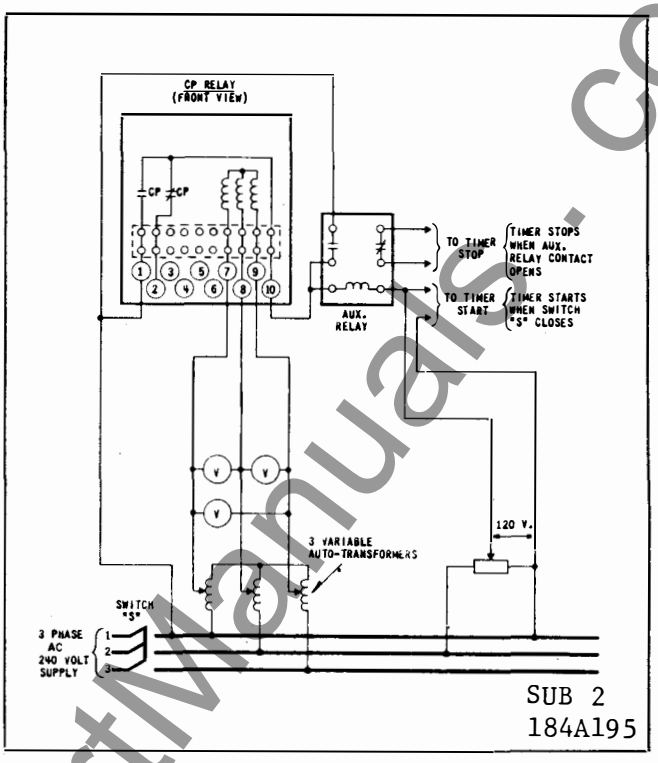


Fig. 9. Diagram of Test Connection for checking the Overvoltage Time Curves of the Type CP Relay.

Set either of the adjustable stationary contacts in the center of its travel. (For example, on the 120 volt relay, set the contact on the 95 volt setting.) Apply this voltage to the relay. Wind up the spiral spring by means of the spring adjuster until the stationary contact and moving contact just make.

Check the other scale markings by setting the adjustable contact on these markings and applying the corresponding voltage. The moving contact should make and break within plus or minus 3% of the value marked on the scale.

3. Time Curve Calibration — Install the permanent magnet and connect the relay as per the circuit of Fig. 8.

Set the high voltage contact on 100 volts and the low voltage contact on 70 volts. (For the 240 volt relay, multiply these values by two. Similarly for the 480 volt relay, multiply these values by four.) For the 208 volt relay set the high voltage contact on 170 volts and the low voltage contact on 120 volts. Apply rated voltage to the relay to allow the high voltage contact to make. Suddenly drop the voltage to zero and adjust the permanent magnet gap until the relay operates in 3.7 ± .15 sec.

Check the closing time of the high voltage contact by use of Fig. 9. With the voltage originally zero, suddenly apply rated voltage to the relay. The high voltage contact should close in 3.9 seconds ± 0.2 sec.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

The type CP relay when energized at rated voltage balanced 3 phase has the following VA burden for each phase.

	Watts	Vars	VA	Lagging Power Factor Angle
Phase A	.25	2.82	2.83	85
Phase B	.37	1.92	1.96	79
Phase C	1.11	2.50	2.73	66

The continuous voltage rating of the relays is 110% of rated voltage.

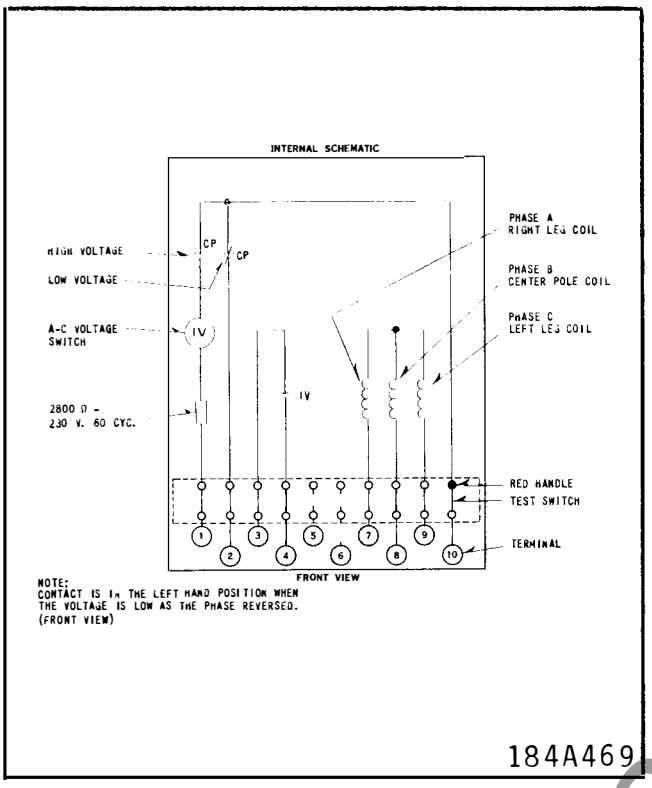


Fig. 10. Relay-Type CP Reserve Phase - 3 Phase, 3 or 4 Wire, S.P.D.T. - with A.C. independent, voltage switch in Type FT 11 Case.

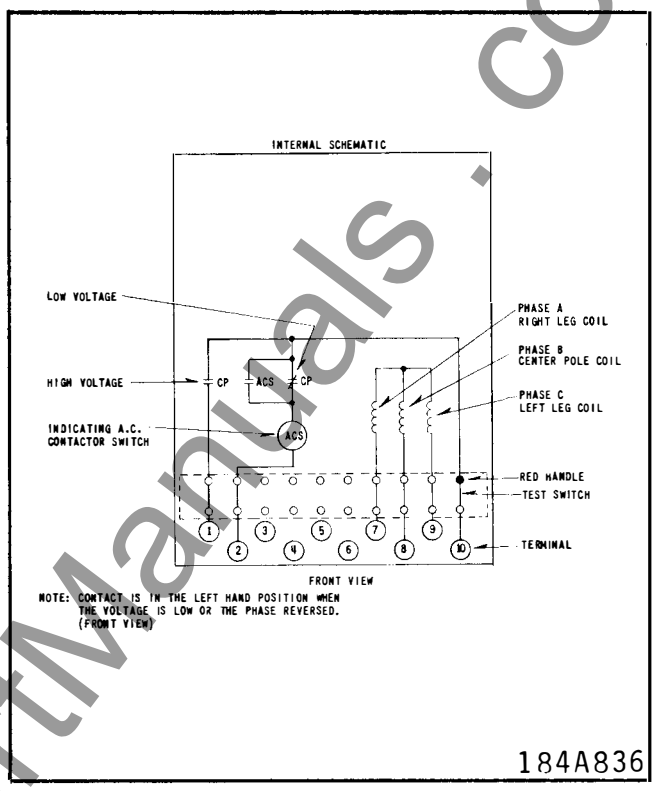


Fig. 11. Relay-Type CP Reverse Phase, 3 Phase, 3 or 4 Wire - S.P.D.T. Contacts with indicating A.C. contactor switch in low voltage circuit - in Type FT-11 Case.

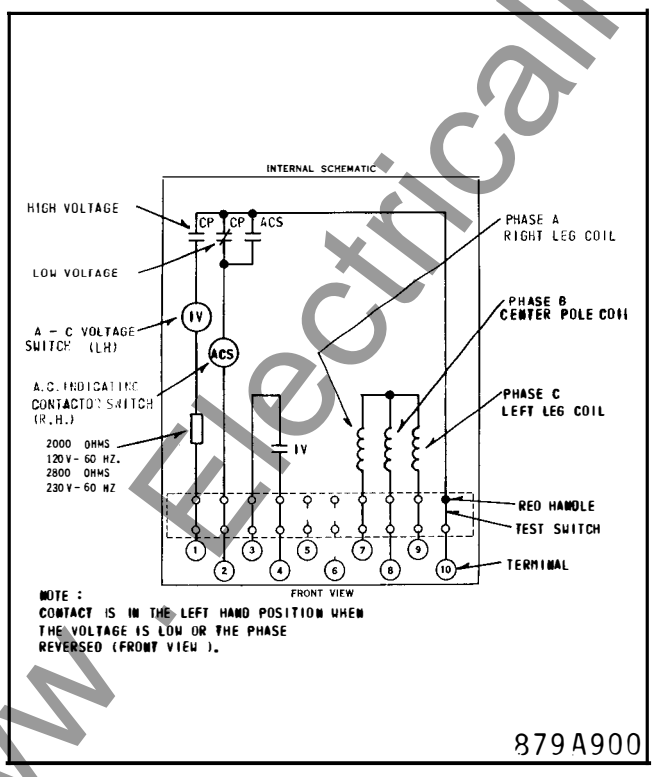


Fig. 12. Relay - Type CP Reverse Phase - 3 Phase 3 or 4, S.P.D.T. - with A.C.S. in low voltage circuit and with A.C. independent voltage switch in Type FT-11 Case.

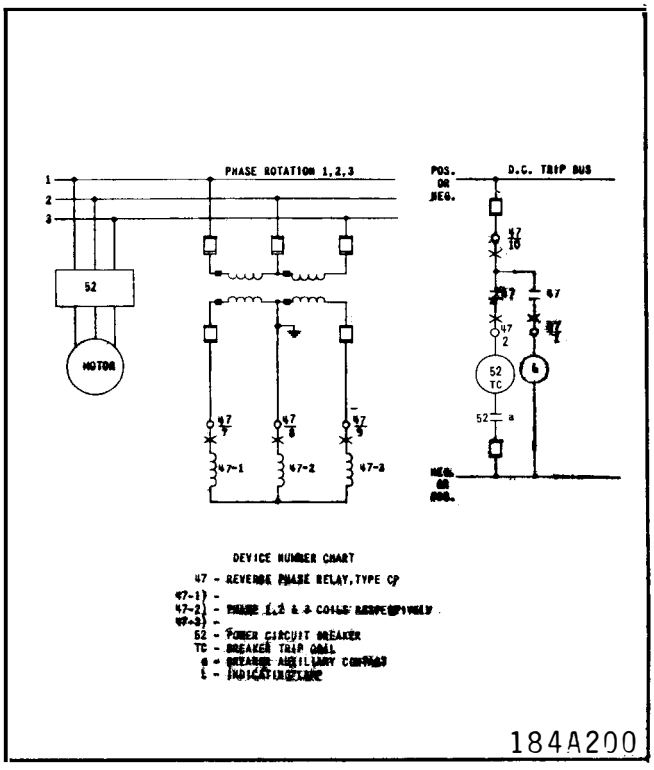
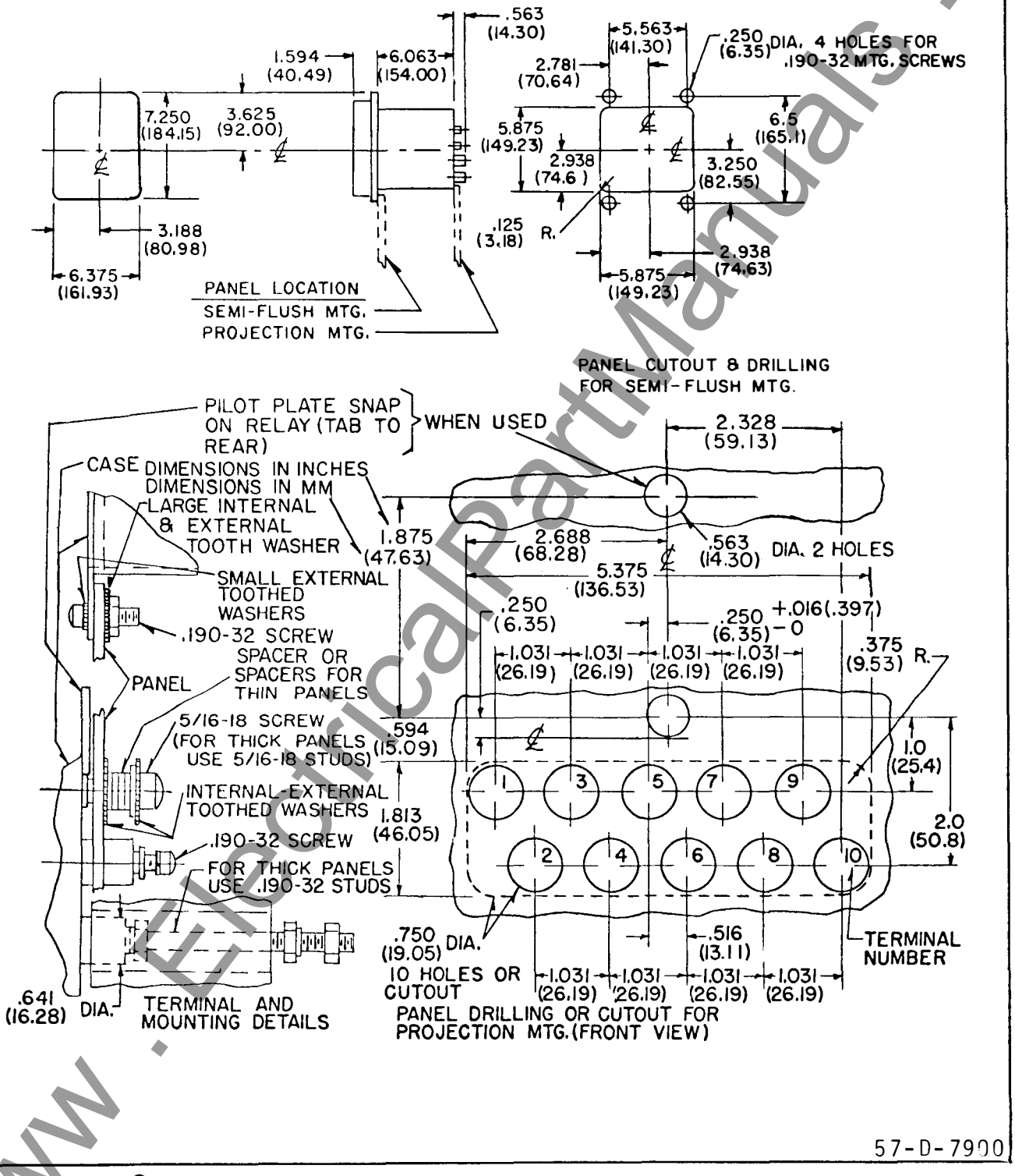


Fig. 13. External Schematic Diagram of the Type CP Relay in the Type FT11 Case.



✪ *Fig. 14. Outline and Drilling Plan for the Type CP Relay in the Type FT11 Case.*

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CP REVERSE PHASE RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type CP relay is a three phase induction disc type relay that operates upon phase reversal to disconnect a motor from a circuit. The relay may not operate for an open phase on the motor unless the motor is so heavily loaded that normal voltage cannot be maintained on all phases. Normally, the relay will operate as soon as the machine is stopped and prevent it from being started again if one phase wire is open.

This relay may also be applied to close its contacts on either three phase overvoltage or three phase undervoltage conditions on a system. For example, one relay is used to initiate source breaker trip and another relay is used to supervise alternate source breaker closing on automatic bus transfer schemes.

CONSTRUCTION AND OPERATION

The type CP relay consists of a three phase voltage unit, an indicating contactor switch when supplied, and an indicating voltage switch when supplied. The principal component parts of the relay and their location are shown in figure 1.

A. Voltage Unit (CP)

The electromagnet is an "E" type laminated structure with a coil mounted on each leg. A wye connection is formed by connecting one lead of each coil together. The other lead of the coils are connected to separate phases of a three phase system.

When the coils are energized with a three phase voltage, a flux is induced in each leg of the electromagnet. These fluxes are out-of-phase with respect to each other since they are induced by out-of-phase voltages. The path of the three fluxes is across an air gap in which a disc is located. The out-of-phase fluxes cause a torque to be produced on the disc which moves to a position in its travel that corresponds to the three phase voltage applied to the electromagnet. The disc will remain in this position until the applied three phase voltage is changed, at which time, the disc will move to a new position that corresponds to the new voltage.

The out-of-phase fluxes are such that a positive sequence voltage tends to close the high voltage contact while a negative sequence voltage tends to close the low voltage contact. A reversed phase (which means negative sequence phase rotation) will cause the relay's low voltage contact to close. This contact will also close on unbalance voltages that contain a negative sequence component sufficient to reduce the relay torque to its low voltage trip point.

B. Indicating Contactor Switch (ICS)

The indicating contactor switch is a small d-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also, during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the case.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

* C. Indicating Voltage Switch (IVS)

The indicating voltage switch has the same construction as the indicating contactor switch.

CHARACTERISTICS

The type CP really has adjustable high and low voltage contacts which can be set around the peri-

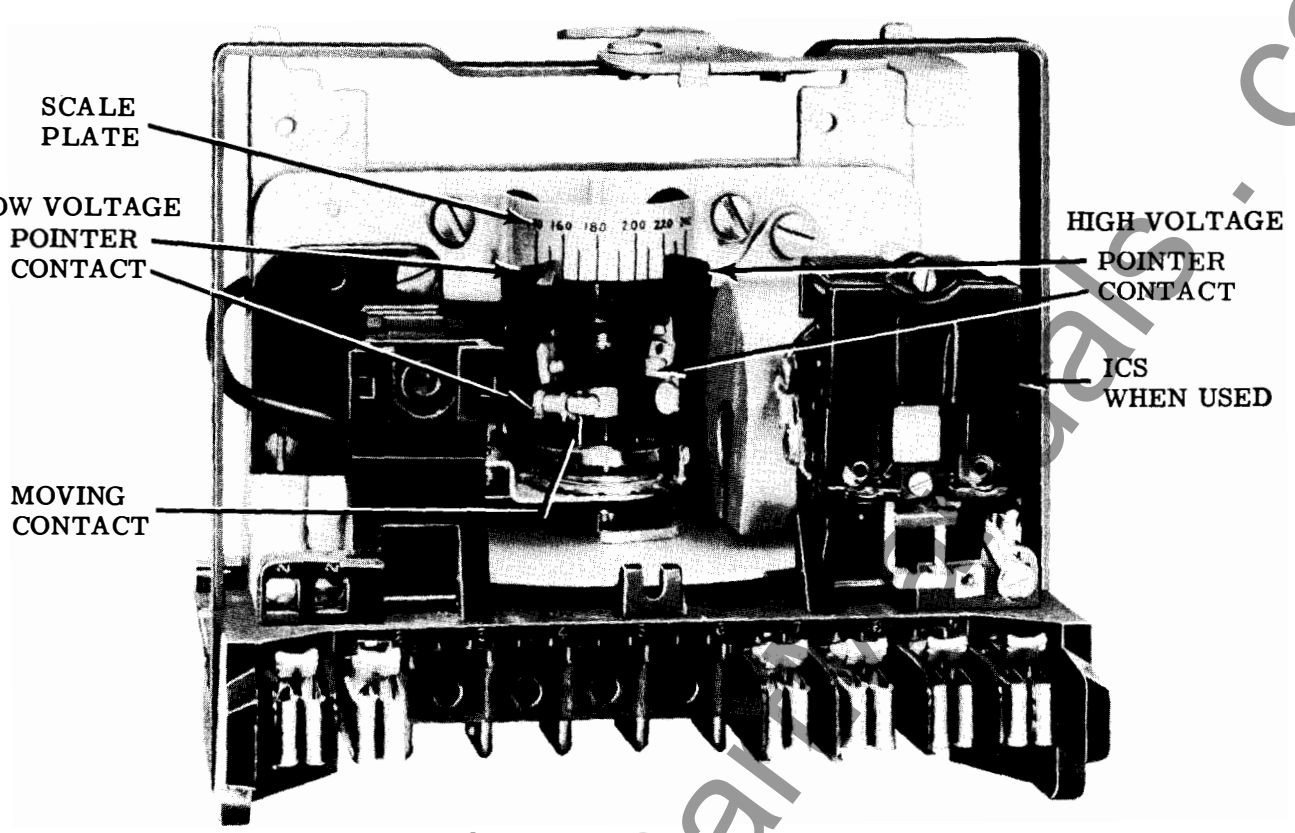
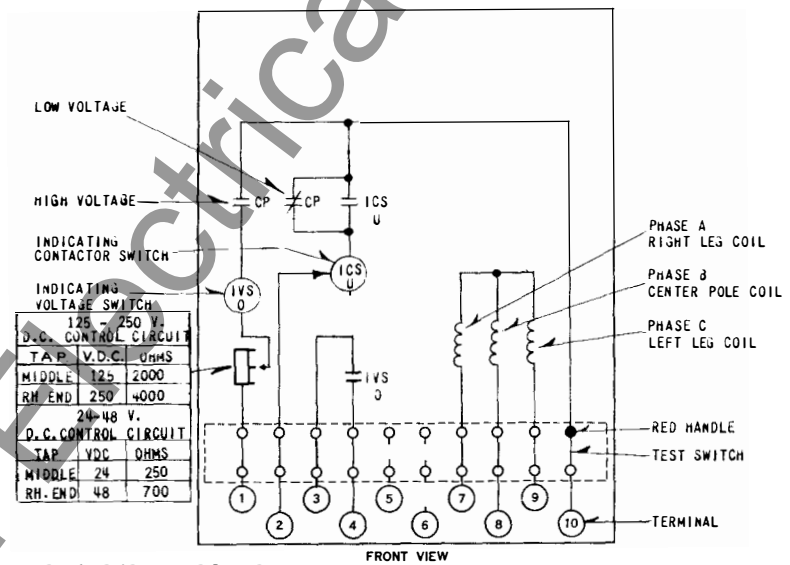


Fig. 1. Type CP Relay Without Case.



* *Fig. 2. Internal Schematic of the Type CP Relay with independent contacts in the Type FT11 case.*

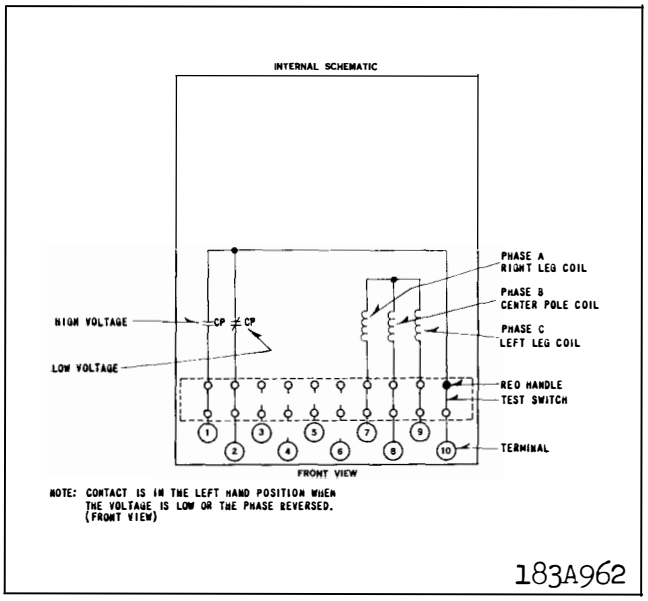


Fig. 3. Internal Schematic of the Type CP Relay in the Type FT11 Case.

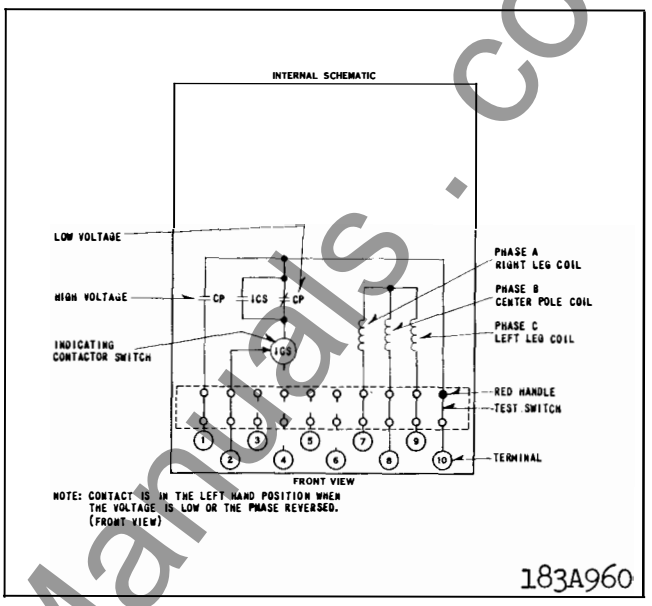


Fig. 4. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the Low Voltage Circuit in the Type FT11 Case.

phery of a scale. The range of adjustment of the contacts are as follows:

120 volt relay	70 to 120 volts
240 volt relay	140 to 240 volts
* 480 volt relay	240 to 480 volts

If either of the adjustable contacts are set for a value of voltage within these ranges, the relay will just close its contacts when the balanced three phase line to line voltages equal this value. For such a condition, the relay is operating at its minimum trip point, and the operating times on repeated operations are not repetitive within close tolerances. However, voltages greater than the overvoltage setting or less than the undervoltage setting, result in relay timing operations which are consistent for repeated trials.

The relay has inverse timing; that is, the greater the increase in voltage the faster the relay contacts will close. Typical time curves for various contact settings are shown in figures 6 and 7.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch (when supplied) will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch (when supplied) has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constant

Indicating contactor switch (ICS) (When Supplied).

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

* Indicating Voltage Switch (IVS) (When Supplied)

The indicating voltage switch (IVS) has a series resistor. The IVS will operate when 80% d.c. rated voltage is applied to the IVS circuitry.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed FT case information refer to I.L. 41-076.

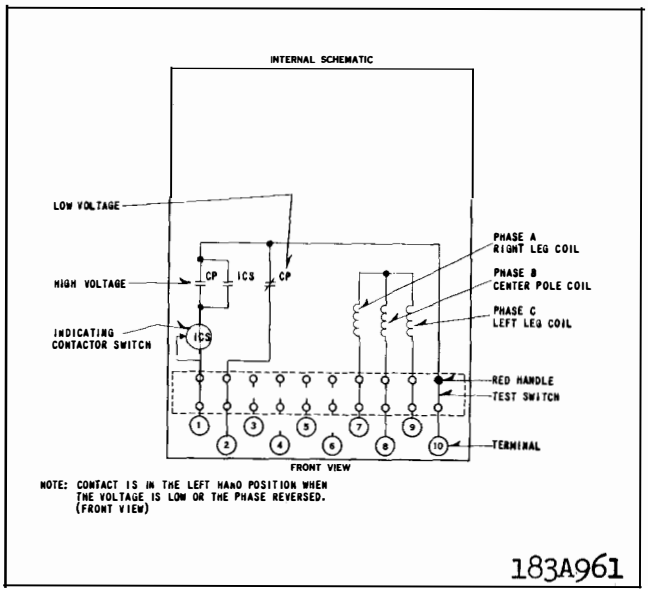


Fig. 5. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the High Voltage Circuit in the Type FT11 Case.

SETTINGS

There are two independent relay adjustments. These are the high and low voltage contact settings as described under "Characteristics". These settings determine the balanced three phase line-to-line voltage at which the relay contacts trip. The relay timing is not an independent adjustment, since it is fixed by the contact settings chosen. Typical time curves for various contact settings are given in Figs. 6 and 7.

Indicating Contactor Switch (ICS) (When Supplied)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energizes a 125 volt or 250 volt d.c. type WL relay switch, or equivalent, use the 0.2 ampere tap. For 48 volt d.c. applications set ICS in 2 ampere tap and use S#304C209G01 type WL relay or equivalent.

Indicating Voltage Switch (IVS) (When Supplied)

* No setting is required on the IVS unit except for the selection of the required voltage tap on the tapped resistor.

ADJUSTMENT AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no adjustments, other than those covered under "Settings", should be required.

Acceptance Check

The following check is recommended to insure that the relay is in proper working order:

A. CP Unit

1. Contacts — Set the left-hand adjustable contact in the center of the scale and adjust the voltage until the moving contact just makes. Set the left-hand contact back out of the way and bring the right-hand contact up until the contacts just make. The pointer should be within ± 1/32" of where the left-hand pointer was.
2. Minimum Trip Voltages — Check the scale markings by setting either of the two contacts at a value marked on the scale, then alternately apply this voltage plus 3% and minus 3%. Contacts should make and break.

   Check all of the scale markings in a similar manner.
3. Time Curve — The time curve can be checked by the use of the circuits of Figs. 8 and 9.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

* C. Indicating Voltage Switch (IVS)

Close the main relay contacts and apply rated d-c voltage across terminals 1 and 10. The contacts of the IVS unit should close and the indicator target should drop freely.

Routine Maintenance

All relays should be inspected periodically and the time of operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application.

All contacts should be periodically cleaned. A

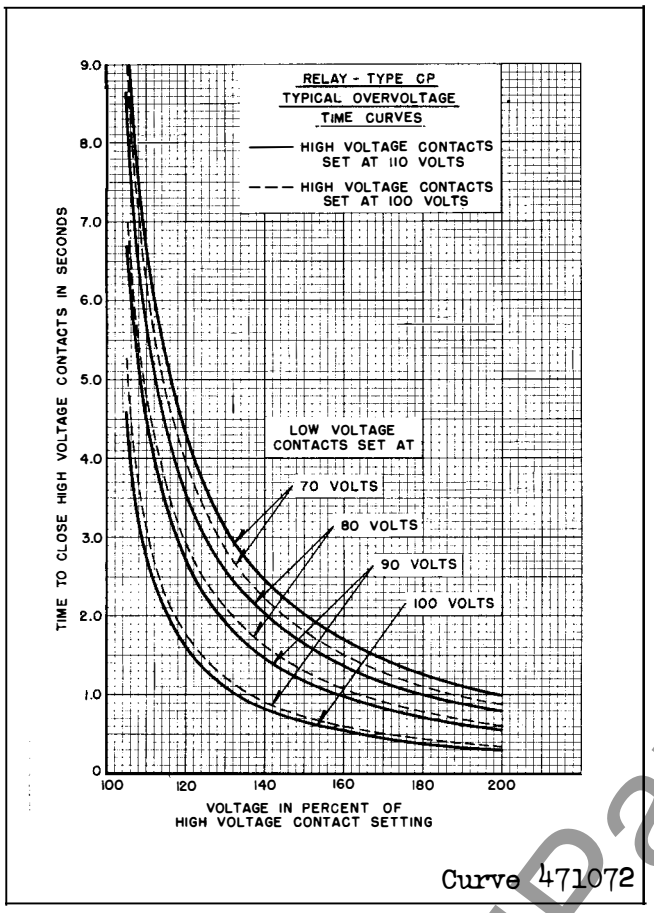


Fig. 6. Typical Overvoltage Time Curves for the Type CP Relay.

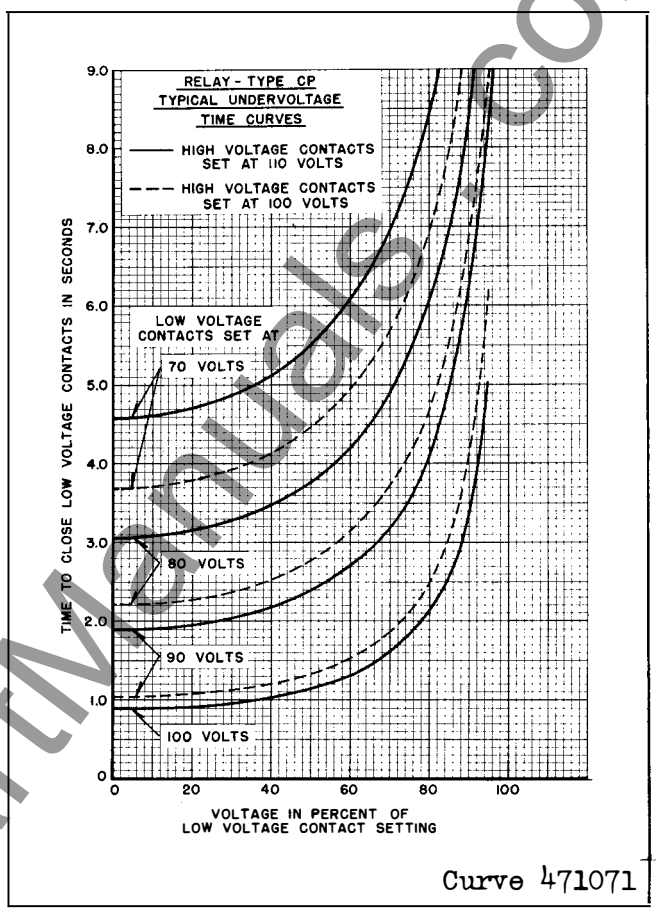


Fig. 7. Typical Undervoltage Time Curves for the Type CP Relay.

contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver contact and thus impairing the contact.

Calibration

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs, or the adjustments have been distrubed. This procedure should not be used until it is apparent that the relay is not in proper working order (See "Acceptance Check").

A. CP Unit

1. Contacts – Apply sufficient voltage to the relay, to make the disc float in the center of its travel. Move either of the adjustable contacts until it just makes with the moving contact. If the two contacts pointers do not meet at the same point on the scale, adjust the follow on both adjustable contacts. The contacts should just make with the moving contacts when the pointers meet on the scale. Approximately the same follow should be in each of the adjustable stationary contacts.

2. Minimum Trip Voltage – The adjustment of the spring tension in setting the minimum trip voltage is most conveniently made with the damping magnet removed.

Set either of the adjustable stationary contacts in the center of its travel. (For example, on the 120 volt relay, set the contact on the 95 volt setting.) Apply this voltage to the relay. Wind up the spiral spring by means of the spring adjuster until the stationary contact and moving contact just make.

Check the other scale markings by setting the adjustable contact on these markings and applying the corresponding voltage. The moving contact should make and break within plus or minus 3% of the value marked on the scale.

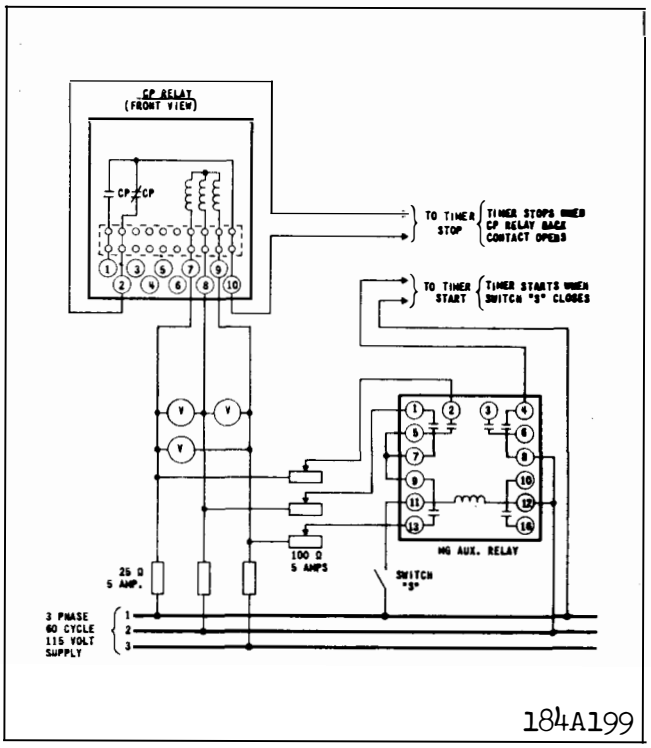


Fig. 8. Diagram of Test Connection for checking the Undervoltage Time Curves of the Type CP Relay.

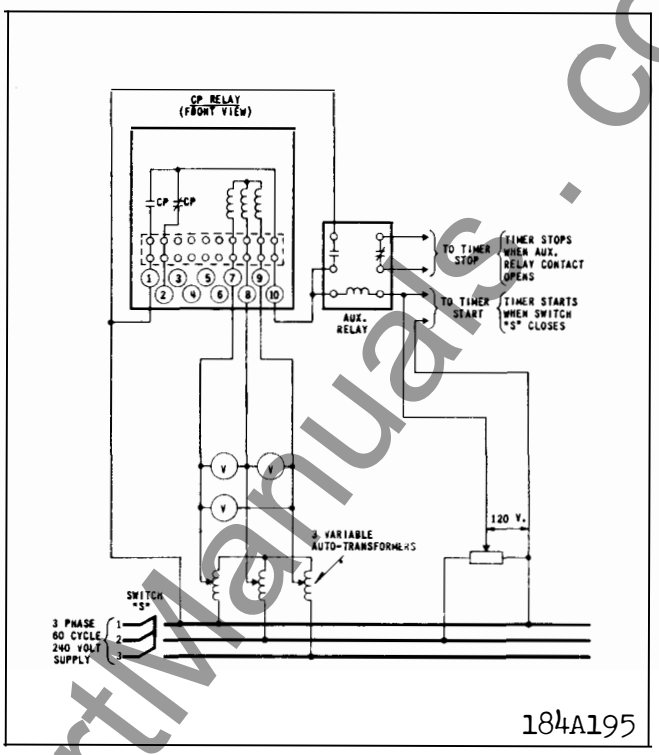


Fig. 9. Diagram of Test Connection for checking the Overvoltage Time Curves of the Type CP Relay.

3. Time Curve Calibration – Install the permanent magnet and connect the relay as per the circuit of Fig. 8.

* Set the high voltage contact on 100 volts and the low voltage contact on 70 volts. (For the 240 volt relay, multiply these values by two. Similarly for the 480 volt relay, multiply these values by four.) Apply rated voltage to the relay to allow the high voltage contact to make. Suddenly drop the voltage to zero and adjust the permanent magnet gap until the relay operates in 3.7 ± .15 sec.

Check the closing time of the high voltage contact by use of Fig. 9. With the voltage originally zero, suddenly apply rated voltage to the relay. The high voltage contact should close in 3.9 seconds ± 0.2 sec.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

* The type CP relay when energized at rated voltage balanced 3 phase has the following VA burden for each phase.

	Watts	Vars	VA	Lagging Power Factor Angle
Phase A	.25	2.82	2.83	85
Phase B	.37	1.92	1.96	79
Phase C	1.11	2.50	2.73	66

The continuous voltage rating of the relays is 110% of rated voltage.

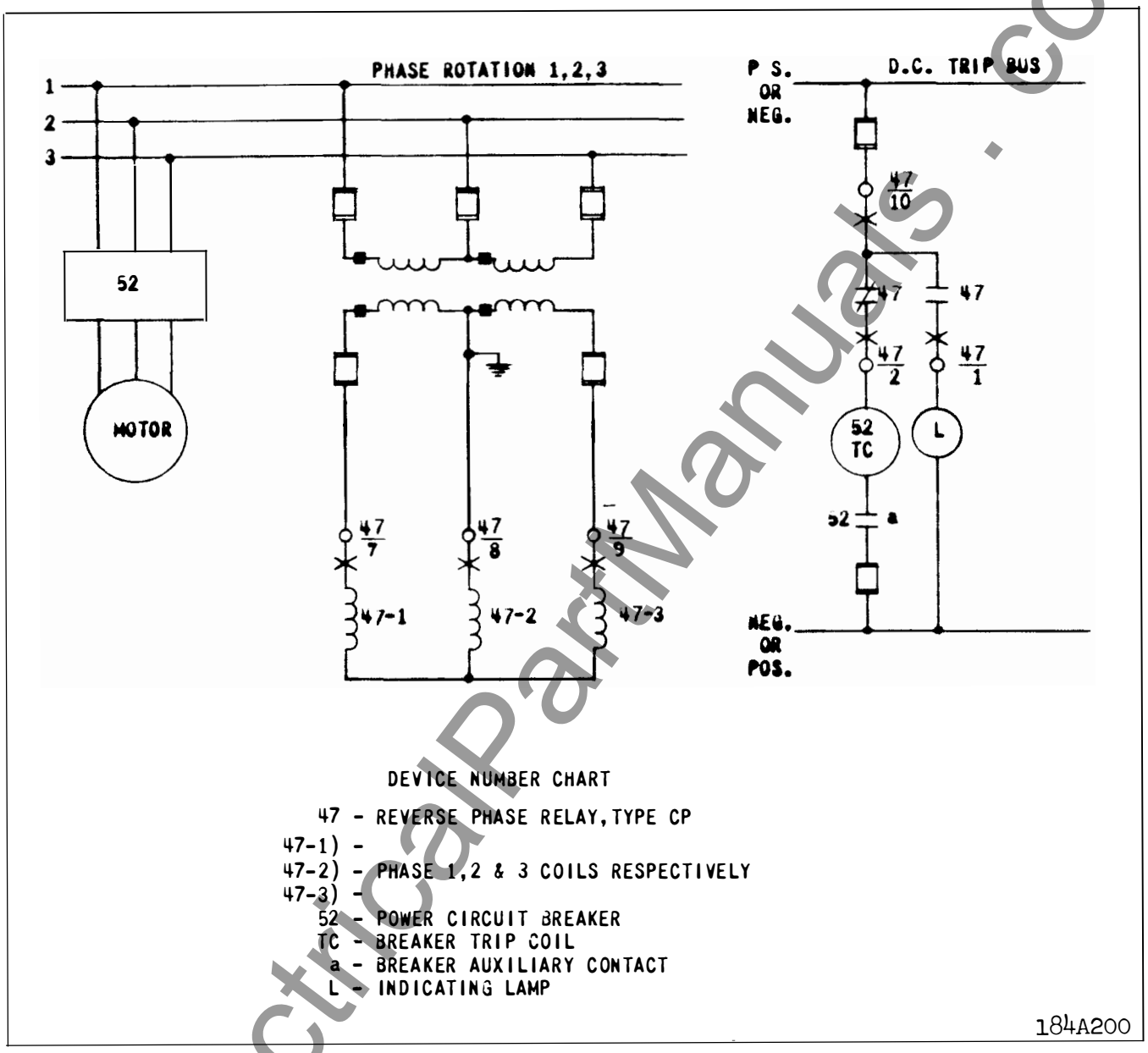
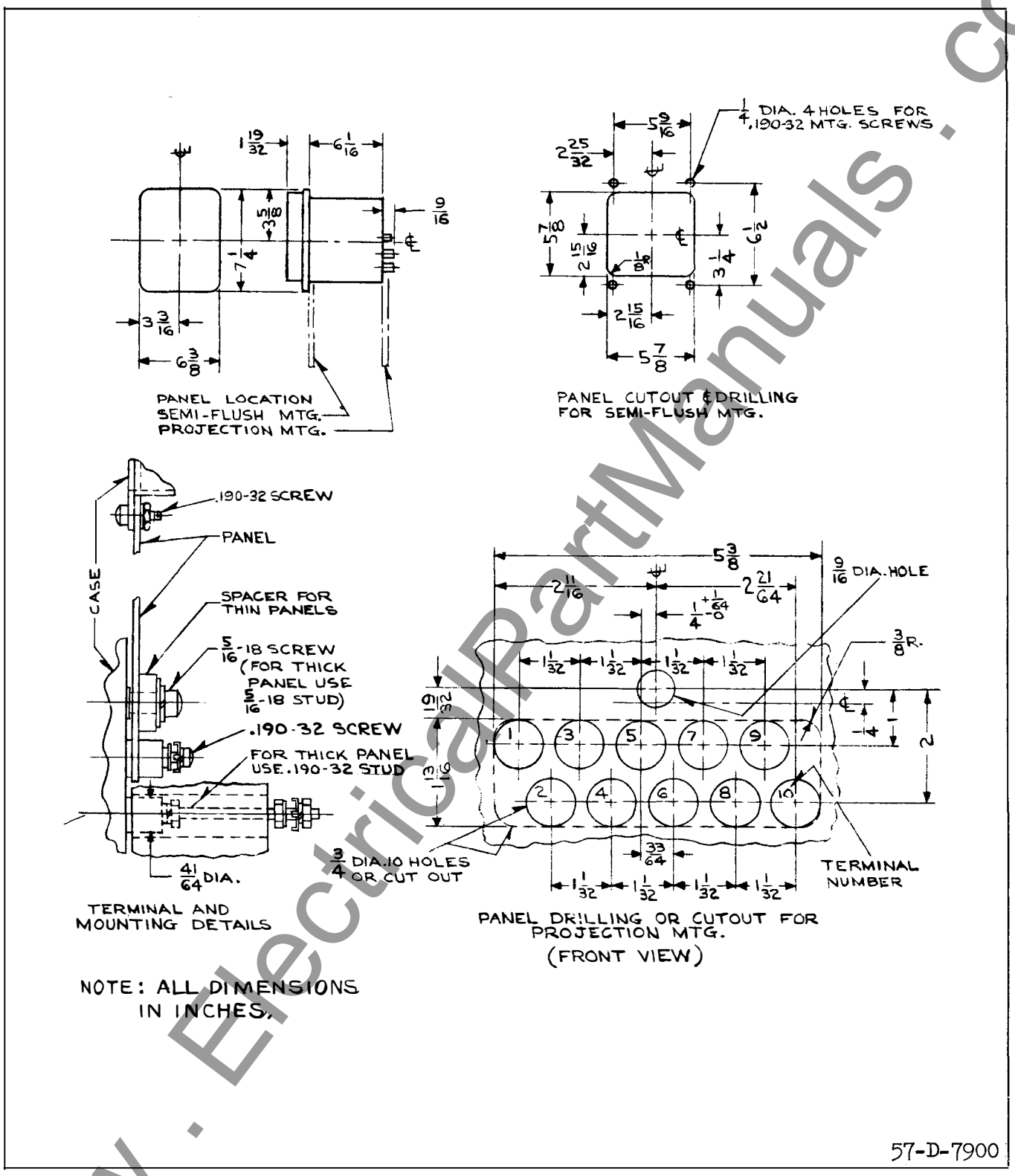


Fig. 10. External Schematic Diagram of the Type CP Relay in the Type FT11 Case.



* *Fig. 11. Outline and Drilling Plan for the Type CP Relay in the Type FT11 Case.*

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CP REVERSE PHASE RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type CP relay is a three phase induction disc type relay that operates upon phase reversal to disconnect a motor from a circuit. The relay may not operate for an open phase on the motor unless the motor is so heavily loaded that normal voltage cannot be maintained on all phases. Normally, the relay will operate as soon as the machine is stopped and prevent it from being started again if one phase wire is open.

This relay may also be applied to close its contacts on either three phase overvoltage or three phase undervoltage conditions on a system. For example, one relay is used to initiate source breaker trip and another relay is used to supervise alternate source breaker closing on automatic bus transfer schemes.

CONSTRUCTION AND OPERATION

The type CP relay consists of a three phase voltage unit and an indicating contactor switch when supplied. The principal component parts of the relay and their location are shown in figures 1 and 2.

A. Voltage Unit (CP)

The electromagnet is an "E" type laminated structure with a coil mounted on each leg. A wye connection is formed by connecting one lead of each coil together. The other lead of the coils are connected to separate phases of a three phase system.

When the coils are energized with a three phase voltage, a flux is induced in each leg of the electromagnet. These fluxes are out-of-phase with respect to each other since they are induced by out-of-phase voltages. The path of the three fluxes is across an air gap in which a disc is located. The out-of-phase fluxes cause a torque to be produced on the disc which moves to a position in its travel that corresponds to the three phase voltage applied to the electromagnet. The disc will remain in this position until the applied three phase voltage is changed, at which time, the disc will move to a new position that corresponds to the new voltage.

The out-of-phase fluxes are such that a positive sequence voltage tends to close the high voltage contact while a negative sequence voltage tends to close the low voltage contact. A reversed phase (which means negative sequence phase rotation) will cause the relay's low voltage contact to close. This contact will also close on unbalance voltages that contain a negative sequence component sufficient to reduce the relay torque to its low voltage trip point.

B. Indicating Contactor Switch (ICS)

The indicating contactor switch is a small d-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also, during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the case.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The type CP really has adjustable high and low voltage contacts which can be set around the peri-

Fig. 1. Type CP Relay Without Case.

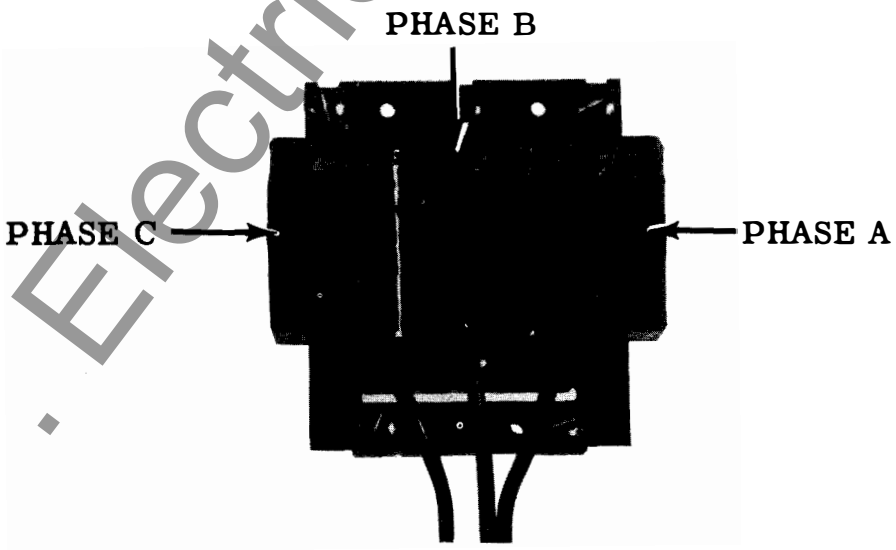


Fig. 2. CP Electromagnet, rear view.

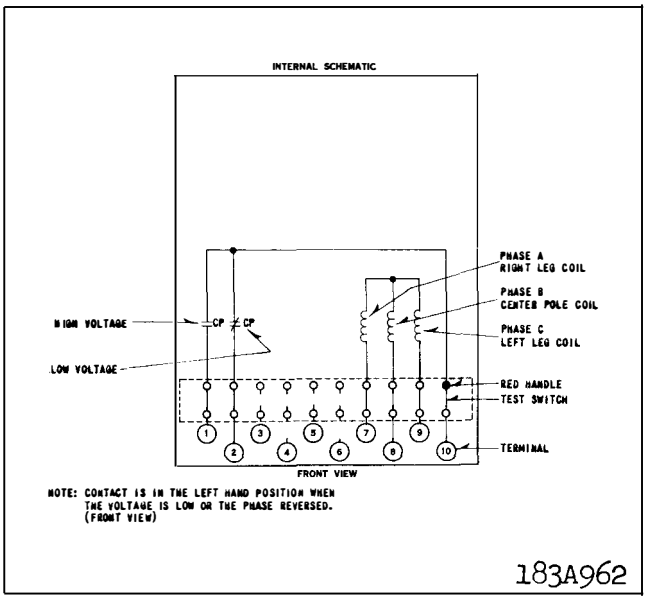


Fig. 3. Internal Schematic of the Type CP Relay in the Type FT11 Case.

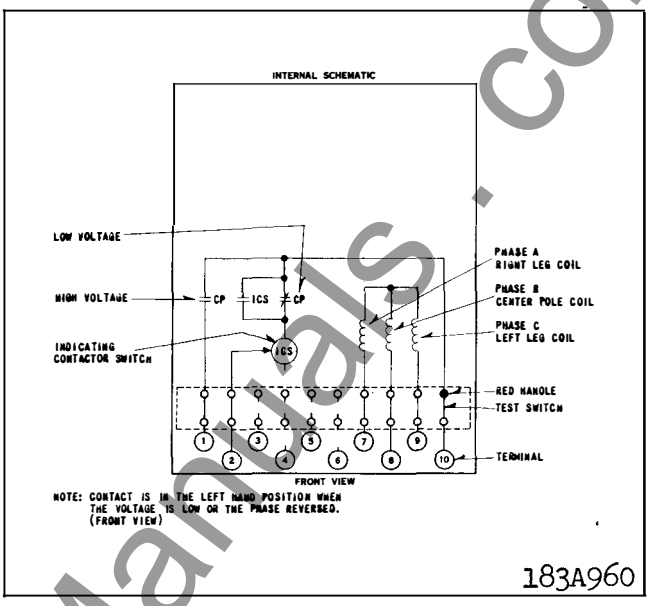


Fig. 4. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the Low Voltage Circuit in the Type FT11 Case.

phery of a scale. The range of adjustment of the contacts are as follows:

120 volt relay	70 to 120 volts
240 volt relay	140 to 240 volts

If either of the adjustable contacts are set for a value of voltage within these ranges, the relay will just close its contacts when the balanced three phase line to line voltages equal this value. For such a condition, the relay is operating at its minimum trip point, and the operating times on repeated operations are not repetitive within close tolerances. However, voltages greater than the overvoltage setting or less than the undervoltage setting, result in relay timing operations which are consistent for repeated trials.

The relay has inverse timing; that is, the greater the increase in voltage the faster the relay contacts will close. Typical time curves for various contact settings are shown in figures 6 and 7.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch (when supplied) will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch (when supplied) has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constant

Indicating contactor switch (ICS) (When Supplied).

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed FT case information refer to I.L. 41-076.

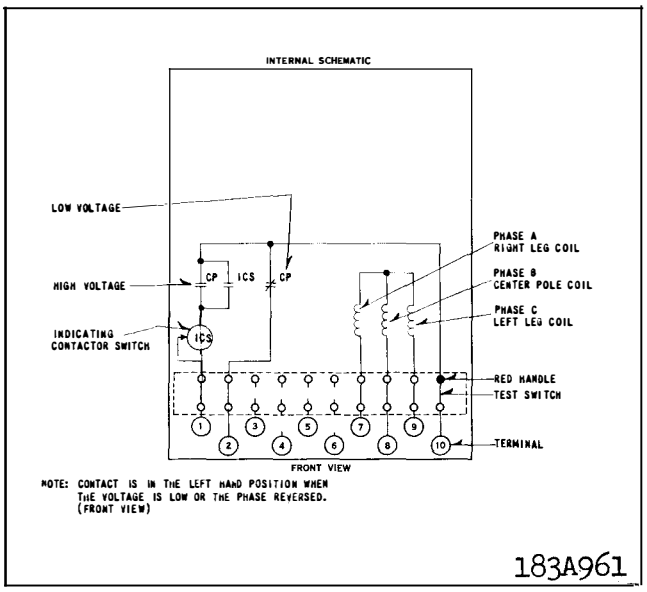


Fig. 5. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the High Voltage Circuit in the Type FT11 Case.

SETTINGS

There are two independent relay adjustments. These are the high and low voltage contact settings as described under "Characteristics". These settings determine the balanced three phase line-to-line voltage at which the relay contacts trip. The relay timing is not an independent adjustment, since it is fixed by the contact settings chosen. Typical time curves for various contact settings are given in Figs. 6 and 7.

Indicating Contactor Switch (ICS) (When Supplied)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energizes a 125 volt or 250 volt d.c. type WL relay switch, or equivalent, use the 0.2 ampere tap. For 48 volt d.c. applications set ICS in 2 ampere tap and use S#304C209G01 type WL relay or equivalent.

ADJUSTMENT AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no adjustments, other than those covered under "Settings", should be required.

Acceptance Check

The following check is recommended to insure that the relay is in proper working order:

A. CP Unit

1. Contacts – Set the left-hand adjustable contact in the center of the scale and adjust the voltage until the moving contact just makes. Set the left-hand contact back out of the way and bring the right-hand contact up until the contacts just make. The pointer should be within ± 1/32" of where the left-hand pointer was.
2. Minimum Trip Voltages – Check the scale markings by setting either of the two contacts at a value marked on the scale, then alternately apply this voltage plus 3% and minus 3%. Contacts should make and break.

   Check all of the scale markings in a similar manner.

* 3. Time Curve – The time curve can be checked by the use of the circuits of Figs. 8 and 9.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

Routine Maintenance

* All relays should be inspected periodically and the time of operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application.

All contacts should be periodically cleaned. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver contact and thus impairing the contact.

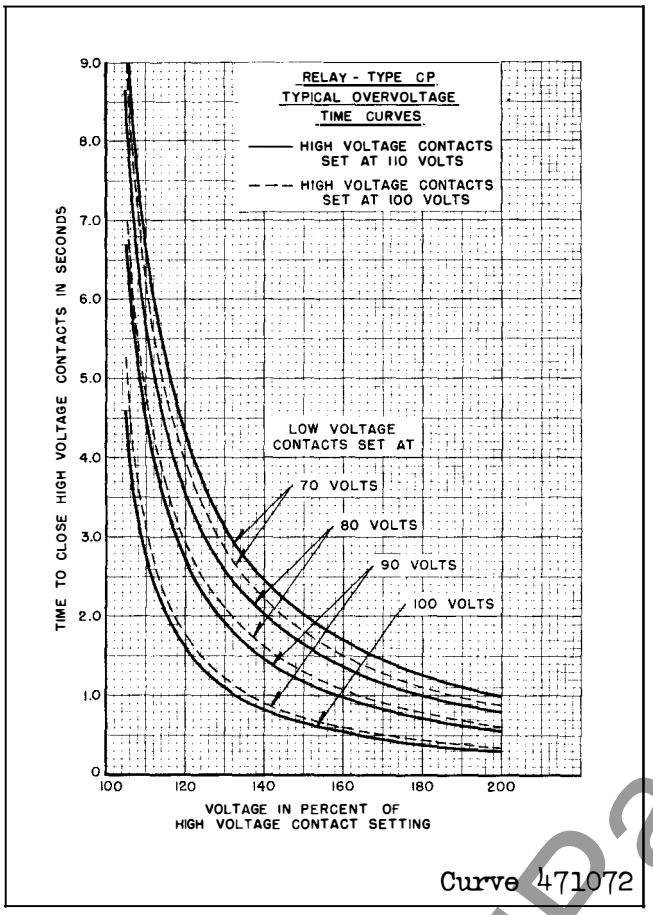


Fig. 6. Typical Overvoltage Time Curves for the Type CP Relay.

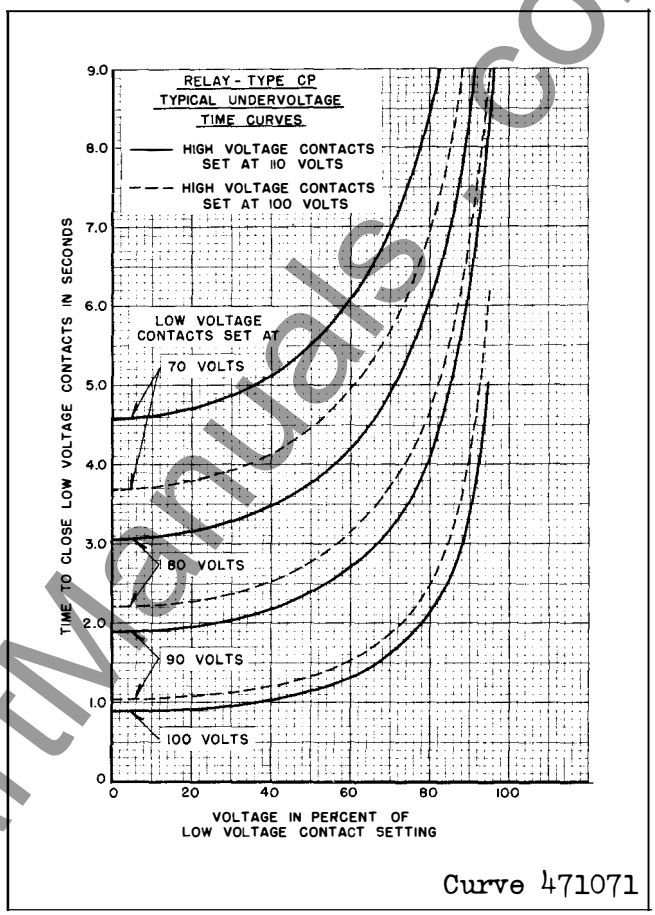


Fig. 7. Typical Undervoltage Time Curves for the Type CP Relay.

Calibration

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs, or the adjustments have been distrubed. This procedure should not be used until it is apparent that the relay is not in proper working order (See "Acceptance Check").

A. CP Unit

1. Contacts — Apply sufficient voltage to the relay, to make the disc float in the center of its travel. Move either of the adjustable contacts until it just makes with the moving contact. If the two contacts pointers do not meet at the same point on the scale, adjust the follow on both adjustable contacts. The contacts should just make with the moving contacts when the pointers meet on the scale. Approximately the same follow should be in each of the adjustable stationary contacts.

2. Minimum Trip Voltage — The adjustment of the spring tension in setting the minimum trip voltage is most conveniently made with the damping magnet removed.

   Set either of the adjustable stationary contacts in the center of its travel. (For example, on the 120 volt relay, set the contact on the 95 volt setting.) Apply this voltage to the relay. Wind up the spiral spring by means of the spring adjuster until the stationary contact and moving contact just make.

   Check the other scale markings by setting the adjustable contact on these markings and applying the corresponding voltage. The moving contact should make and break within plus or minus 3% of the value marked on the scale.

3. Time Curve Calibration — Install the permanent magnet and connect the relay as per the circuit of Fig. 8.

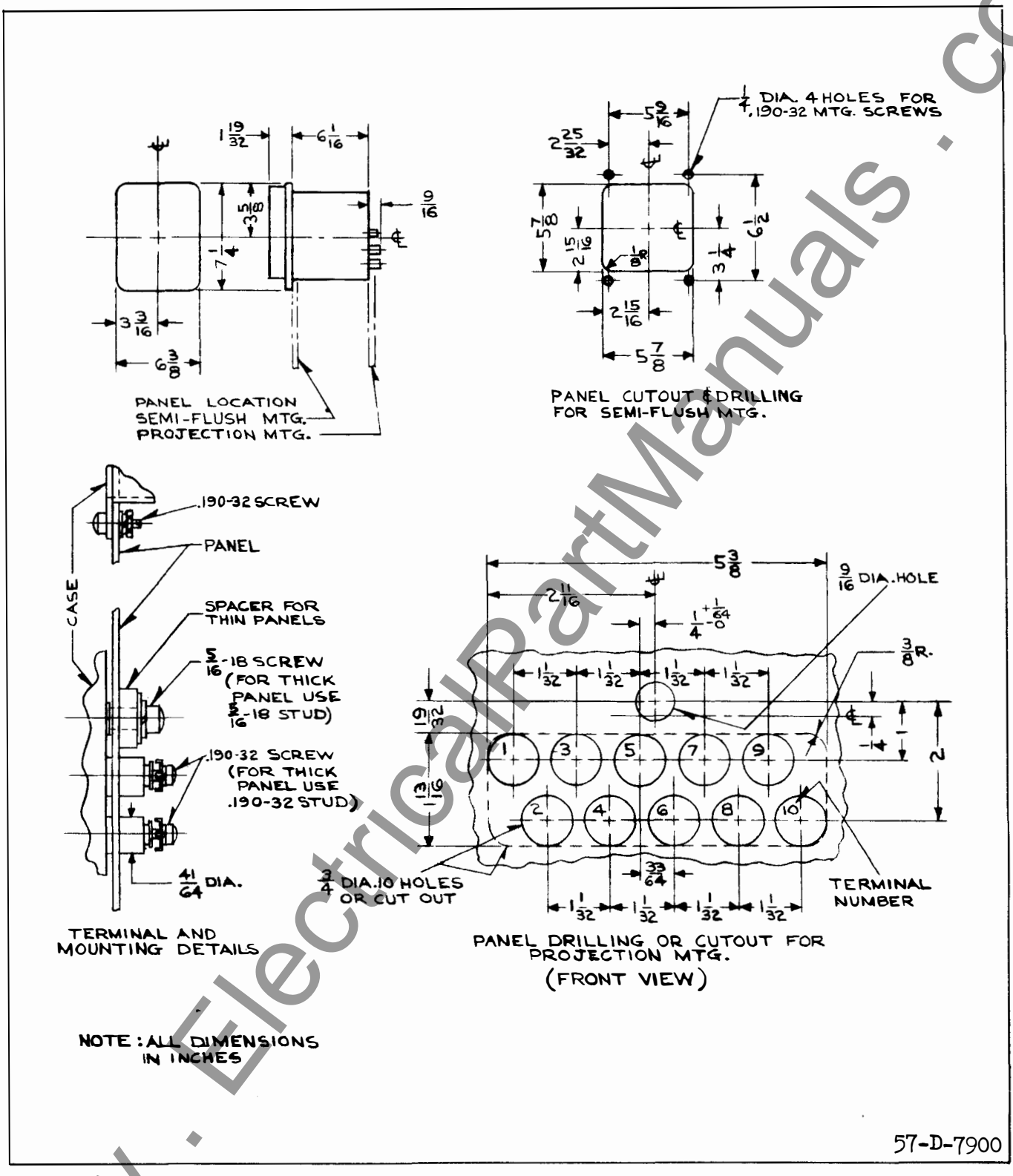


Fig. 11. Outline and Drilling Plan for the Type CP Relay in the Type FT11 Case.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CP REVERSE PHASE RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type CP relay is a three phase induction disc type relay that operates upon phase reversal to disconnect a motor from a circuit. The relay may not operate for an open phase on the motor unless the motor is so heavily loaded that normal voltage cannot be maintained on all phases. Normally, the relay will operate as soon as the machine is stopped and prevent it from being started again if one phase wire is open.

This relay may also be applied to close its contacts on either three phase overvoltage or three phase undervoltage conditions on a system. For example, one relay is used to initiate source breaker trip and another relay is used to supervise alternate source breaker closing on automatic bus transfer schemes.

CONSTRUCTION AND OPERATION

The type CP relay consists of a three phase voltage unit, an indicating contactor switch when supplied, and an indicating voltage switch when supplied. The principal component parts of the relay and their location are shown in figure 1.

A. Voltage Unit (CP)

The electromagnet is an "E" type laminated structure with a coil mounted on each leg. A wye connection is formed by connecting one lead of each coil together. The other lead of the coils are connected to separate phases of a three phase system.

When the coils are energized with a three phase voltage, a flux is induced in each leg of the electromagnet. These fluxes are out-of-phase with respect to each other since they are induced by out-of-phase voltages. The path of the three fluxes is across an air gap in which a disc is located. The out-of-phase fluxes cause a torque to be produced on the disc which moves to a position in its travel that corresponds to the three phase voltage applied to the electromagnet. The disc will remain in this position until the applied three phase voltage is changed, at which time, the disc will move to a new position that corresponds to the new voltage.

The out-of-phase fluxes are such that a positive sequence voltage tends to close the high voltage contact while a negative sequence voltage tends to close the low voltage contact. A reversed phase (which means negative sequence phase rotation) will cause the relay's low voltage contact to close. This contact will also close on unbalance voltages that contain a negative sequence component sufficient to reduce the relay torque to its low voltage trip point.

B. Indicating Contactor Switch (ICS)

The indicating contactor switch is a small d-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also, during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the case.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

* C. Indicating Voltage Switch (IVS)

The indicating voltage switch has the same construction as the indicating contactor switch.

CHARACTERISTICS

The type CP really has adjustable high and low voltage contacts which can be set around the peri-

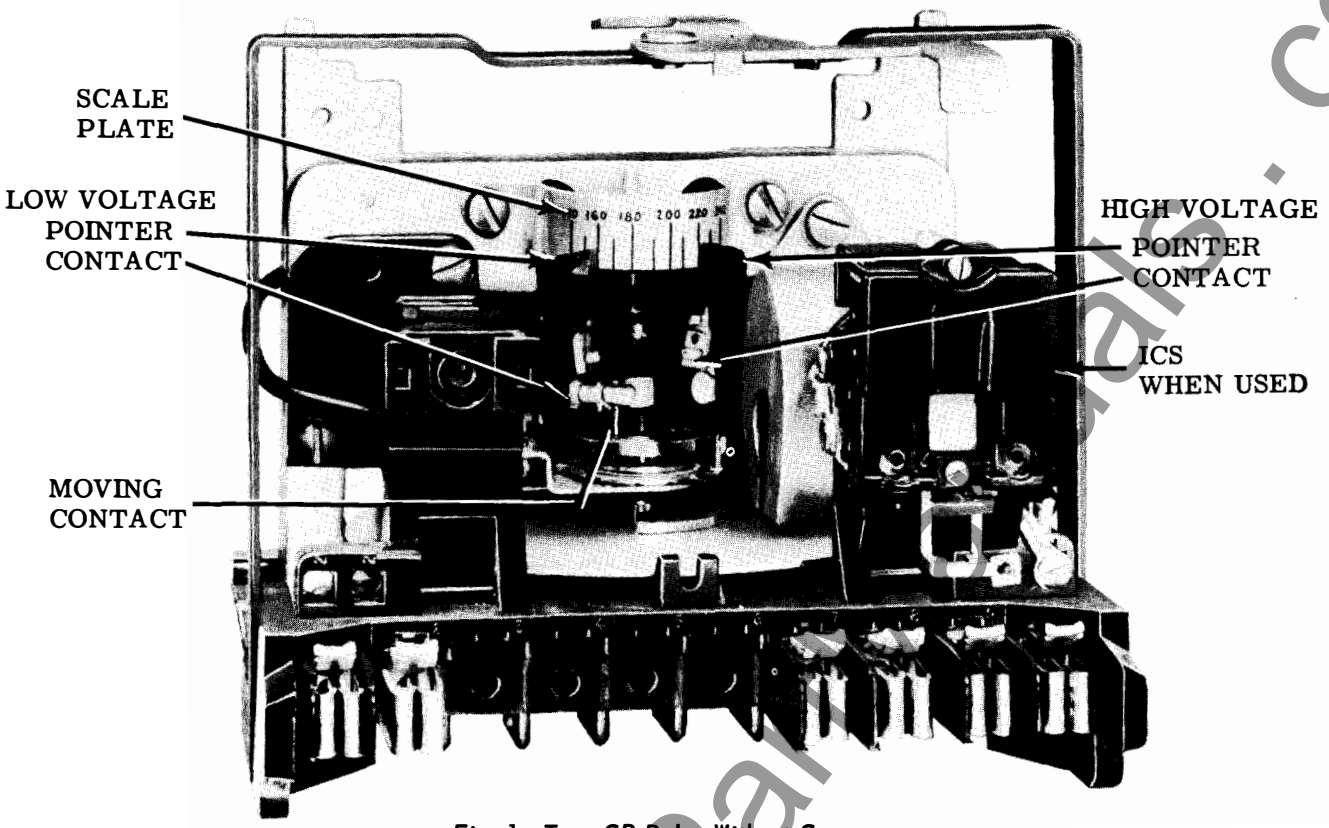
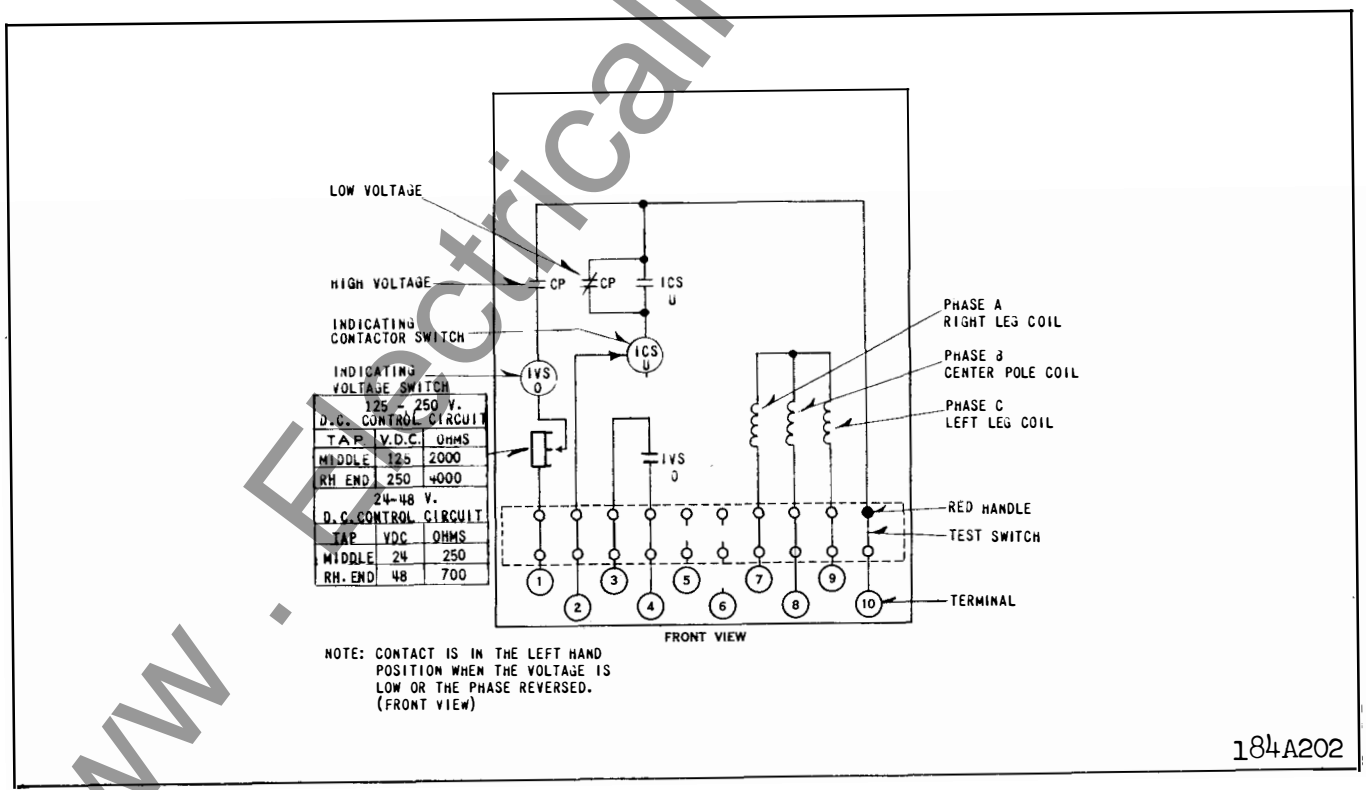


Fig. 1. Type CP Relay Without Case.



125 - 250 V. D.C. CONTROL CIRCUIT		
TAP	V.D.C.	OHMS
MIDDLE	125	2000
RH END	250	4000
24-48 V. D.C. CONTROL CIRCUIT		
TAP	VDC	OHMS
MIDDLE	24	250
RH. END	48	700

* *Fig. 2. Internal Schematic of the Type CP Relay with independent contacts in the Type FT11 case.*

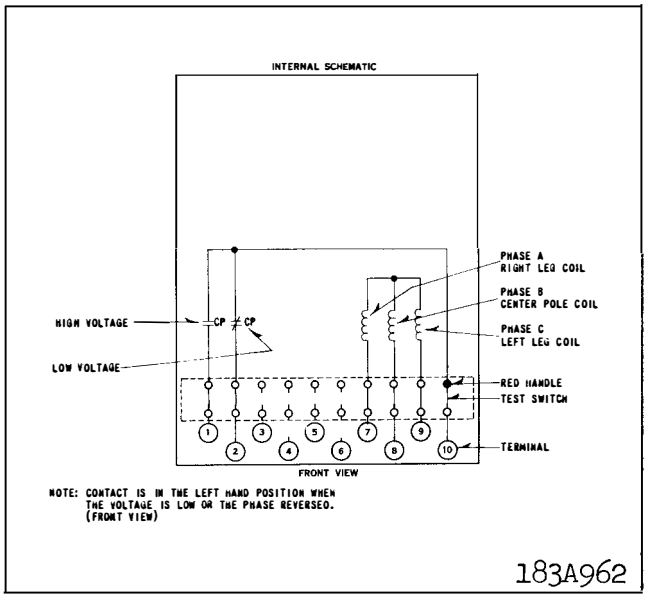


Fig. 3. Internal Schematic of the Type CP Relay in the Type FT11 Case.

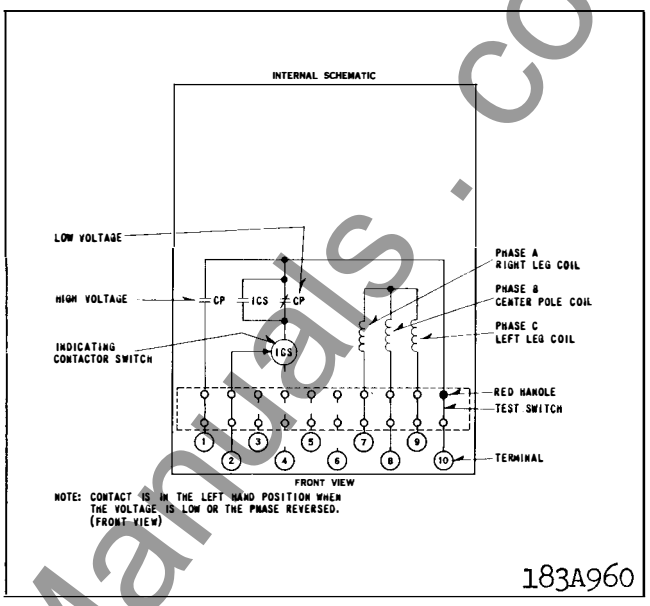


Fig. 4. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the Low Voltage Circuit in the Type FT11 Case.

phery of a scale. The range of adjustment of the contacts are as follows:

120 volt relay	70 to 120 volts
240 volt relay	140 to 240 volts
* 480 volt relay	240 to 480 volts

If either of the adjustable contacts are set for a value of voltage within these ranges, the relay will just close its contacts when the balanced three phase line to line voltages equal this value. For such a condition, the relay is operating at its minimum trip point, and the operating times on repeated operations are not repetitive within close tolerances. However, voltages greater than the overvoltage setting or less than the undervoltage setting, result in relay timing operations which are consistent for repeated trials.

The relay has inverse timing; that is, the greater the increase in voltage the faster the relay contacts will close. Typical time curves for various contact settings are shown in figures 6 and 7.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch (when supplied) will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch (when supplied) has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constant

Indicating contactor switch (ICS) (When Supplied).

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

* Indicating Voltage Switch (IVS) (When Supplied)

The indicating voltage switch (IVS) has a series resistor. The IVS will operate when 80% d.c. rated voltage is applied to the IVS circuitry.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed FT case information refer to I.L. 41-076.

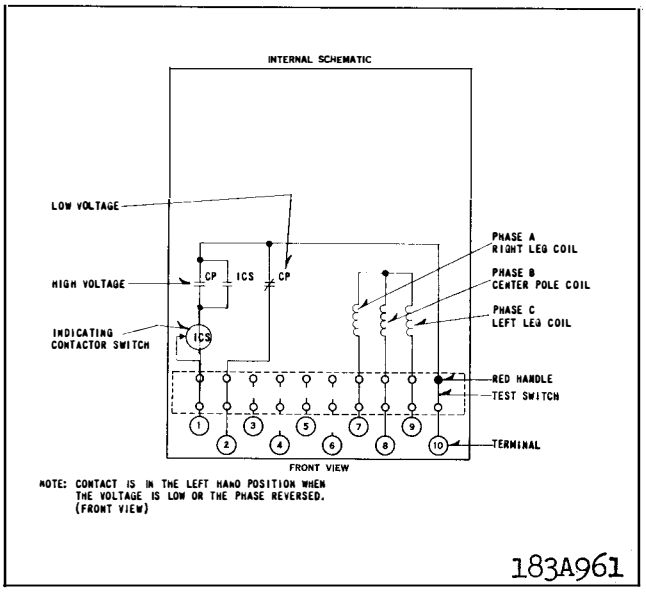


Fig. 5. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the High Voltage Circuit in the Type FT11 Case.

SETTINGS

There are two independent relay adjustments. These are the high and low voltage contact settings as described under "Characteristics". These settings determine the balanced three phase line-to-line voltage at which the relay contacts trip. The relay timing is not an independent adjustment, since it is fixed by the contact settings chosen. Typical time curves for various contact settings are given in Figs. 6 and 7.

Indicating Contactor Switch (ICS) (When Supplied)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energizes a 125 volt or 250 volt d.c. type WL relay switch, or equivalent, use the 0.2 ampere tap. For 48 volt d.c. applications set ICS in 2 ampere tap and use S#304C209G01 type WL relay or equivalent.

Indicating Voltage Switch (IVS) (When Supplied)

* No setting is required on the IVS unit except for the selection of the required voltage tap on the tapped resistor.

ADJUSTMENT AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no adjustments, other than those covered under "Settings", should be required.

Acceptance Check

The following check is recommended to insure that the relay is in proper working order:

A. CP Unit

1. Contacts — Set the left-hand adjustable contact in the center of the scale and adjust the voltage until the moving contact just makes. Set the left-hand contact back out of the way and bring the right-hand contact up until the contacts just make. The pointer should be within ± 1/32" of where the left-hand pointer was.
2. Minimum Trip Voltages — Check the scale markings by setting either of the two contacts at a value marked on the scale, then alternately apply this voltage plus 3% and minus 3%. Contacts should make and break.

   Check all of the scale markings in a similar manner.
3. Time Curve — The time curve can be checked by the use of the circuits of Figs. 8 and 9.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

* C. Indicating Voltage Switch (IVS)

Close the main relay contacts and apply rated d-c voltage across terminals 1 and 10. The contacts of the IVS unit should close and the indicator target should drop freely.

Routine Maintenance

All relays should be inspected periodically and the time of operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application.

All contacts should be periodically cleaned. A

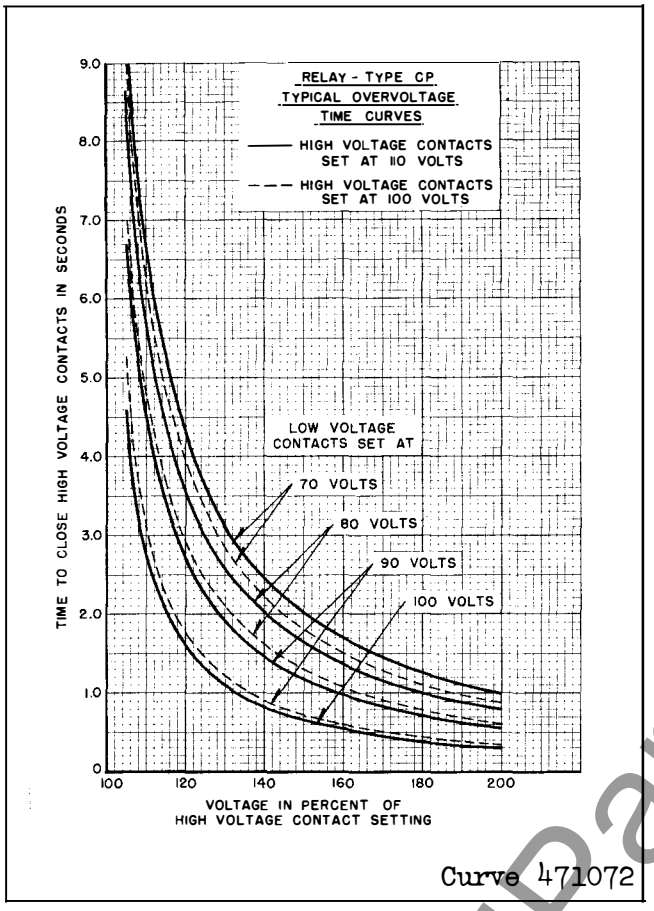


Fig. 6. Typical Overvoltage Time Curves for the Type CP Relay.

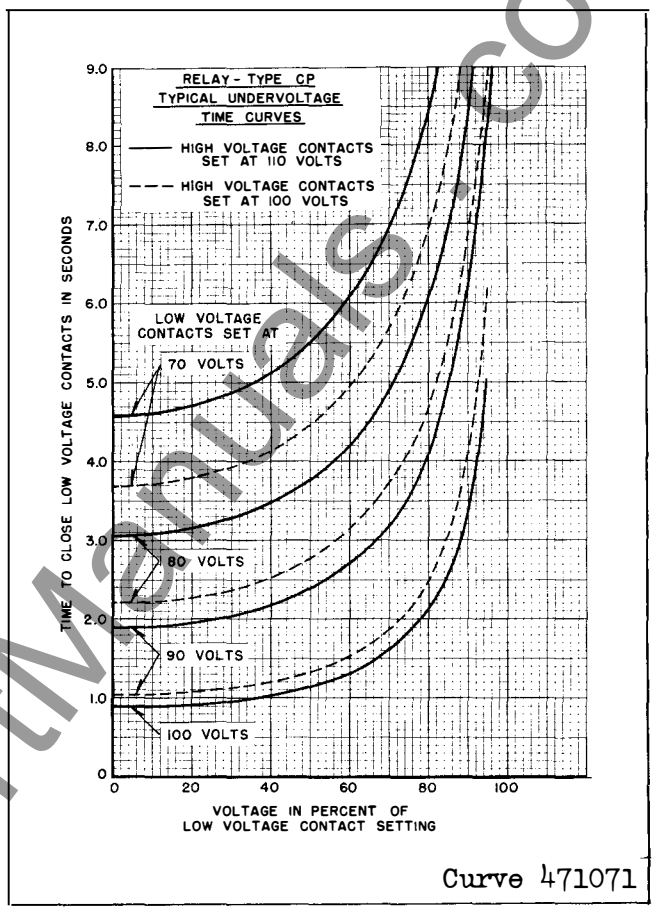


Fig. 7. Typical Undervoltage Time Curves for the Type CP Relay.

contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver contact and thus impairing the contact.

Calibration

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs, or the adjustments have been distrubed. This procedure should not be used until it is apparent that the relay is not in proper working order (See "Acceptance Check").

A. CP Unit

1. Contacts — Apply sufficient voltage to the relay, to make the disc float in the center of its travel. Move either of the adjustable contacts until it just makes with the moving contact. If the two contacts pointers do not meet at the same point on the scale, adjust the follow on both adjustable contacts. The contacts should just make with the moving contacts when the pointers meet on the scale. Approximately the same follow should be in each of the adjustable stationary contacts.

2. Minimum Trip Voltage — The adjustment of the spring tension in setting the minimum trip voltage is most conveniently made with the damping magnet removed.

   Set either of the adjustable stationary contacts in the center of its travel. (For example, on the 120 volt relay, set the contact on the 95 volt setting.) Apply this voltage to the relay. Wind up the spiral spring by means of the spring adjuster until the stationary contact and moving contact just make.

   Check the other scale markings by setting the adjustable contact on these markings and applying the corresponding voltage. The moving contact should make and break within plus or minus 3% of the value marked on the scale.

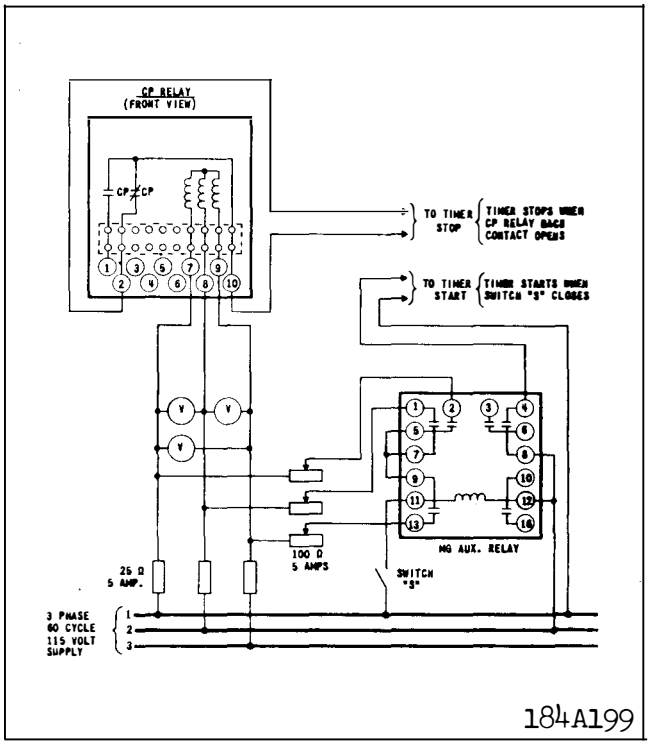


Fig. 8. Diagram of Test Connection for checking the Undervoltage Time Curves of the Type CP Relay.

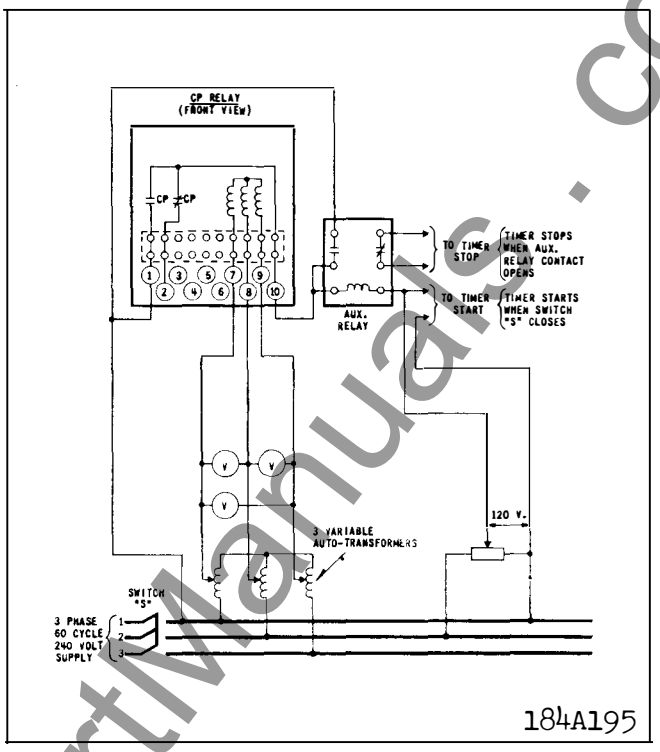


Fig. 9. Diagram of Test Connection for checking the Overvoltage Time Curves of the Type CP Relay.

3. Time Curve Calibration — Install the permanent magnet and connect the relay as per the circuit of Fig. 8.

* Set the high voltage contact on 100 volts and the low voltage contact on 70 volts. (For the 240 volt relay, multiply these values by two. Similarly for the 480 volt relay, multiply these values by four.) Apply rated voltage to the relay to allow the high voltage contact to make. Suddenly drop the voltage to zero and adjust the permanent magnet gap until the relay operates in 3.7 ± .15 sec.

Check the closing time of the high voltage contact by use of Fig. 9. With the voltage originally zero, suddenly apply rated voltage to the relay. The high voltage contact should close in 3.9 seconds ± 0.2 sec.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

RENEWAL PARTS

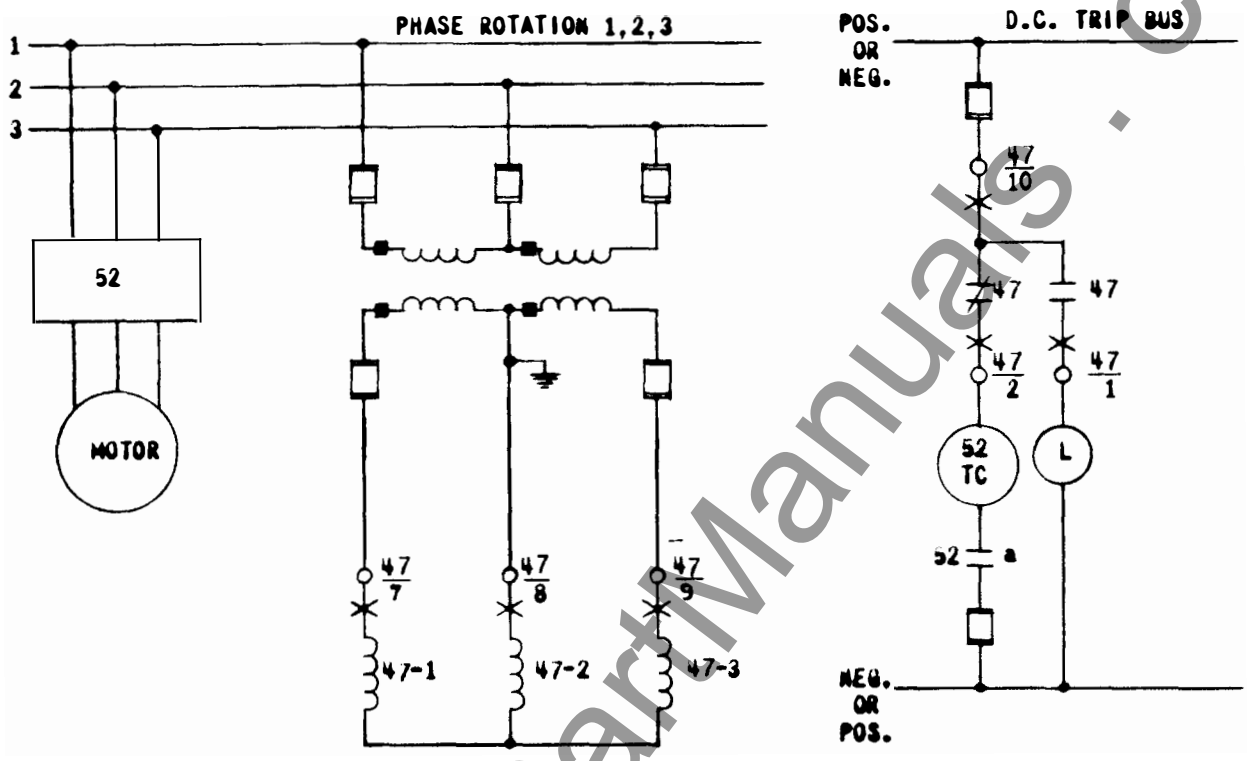
Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

* The type CP relay when energized at rated voltage balanced 3 phase has the following VA burden for each phase.

	Watts	Vars	VA	Lagging Power Factor Angle
Phase A	.25	2.82	2.83	85
Phase B	.37	1.92	1.96	79
Phase C	1.11	2.50	2.73	66

The continuous voltage rating of the relays is 110% of rated voltage.

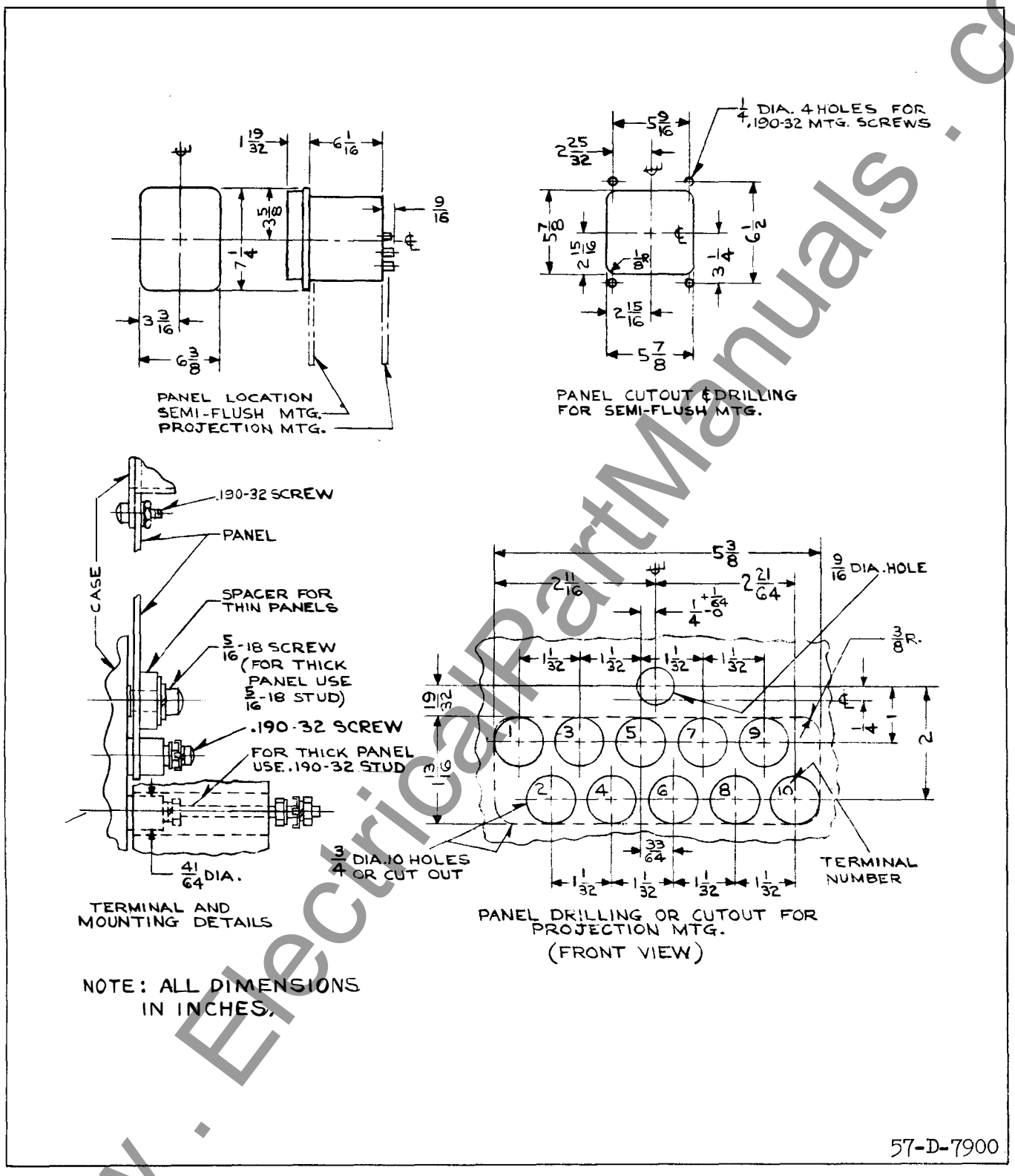


DEVICE NUMBER CHART

47 - REVERSE PHASE RELAY, TYPE CP
47-1) -
47-2) - PHASE 1,2 & 3 COILS RESPECTIVELY
47-3) -
52 - POWER CIRCUIT BREAKER
TC - BREAKER TRIP COIL
a - BREAKER AUXILIARY CONTACT
L - INDICATING LAMP

184A200

Fig. 10. External Schematic Diagram of the Type CP Relay in the Type FT11 Case.



* *Fig. 11. Outline and Drilling Plan for the Type CP Relay in the Type FT11 Case.*

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CP REVERSE PHASE RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type CP relay is a three phase induction disc type relay that operates upon phase reversal to disconnect a motor from a circuit. The relay may not operate for an open phase on the motor unless the motor is so heavily loaded that normal voltage cannot be maintained on all phases. Normally, the relay will operate as soon as the machine is stopped and prevent it from being started again if one phase wire is open.

This relay may also be applied to close its contacts on either three phase overvoltage or three phase undervoltage conditions on a system. For example, one relay is used to initiate source breaker trip and another relay is used to supervise alternate source breaker closing on automatic bus transfer schemes.

CONSTRUCTION AND OPERATION

The type CP relay consists of a three phase voltage unit, an indicating contactor switch when supplied, and an indicating voltage switch when supplied. The principal component parts of the relay and their location are shown in figure 1.

A. Voltage Unit (CP)

The electromagnet is an "E" type laminated structure with a coil mounted on each leg. A wye connection is formed by connecting one lead of each coil together. The other lead of the coils are connected to separate phases of a three phase system.

When the coils are energized with a three phase voltage, a flux is induced in each leg of the electromagnet. These fluxes are out-of-phase with respect to each other since they are induced by out-of-phase voltages. The path of the three fluxes is across an air gap in which a disc is located. The out-of-phase fluxes cause a torque to be produced on the disc which moves to a position in its travel that corresponds to the three phase voltage applied to the electromagnet. The disc will remain in this position until the applied three phase voltage is changed, at which time, the disc will move to a new position that corresponds to the new voltage.

The out-of-phase fluxes are such that a positive sequence voltage tends to close the high voltage contact while a negative sequence voltage tends to close the low voltage contact. A reversed phase (which means negative sequence phase rotation) will cause the relay's low voltage contact to close. This contact will also close on unbalance voltages that contain a negative sequence component sufficient to reduce the relay torque to its low voltage trip point.

B. Indicating Contactor Switch (ICS)

The indicating contactor switch is a small d-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also, during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the case.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

* C. Indicating Voltage Switch (IVS)

The indicating voltage switch has the same construction as the indicating contactor switch.

CHARACTERISTICS

The type CP really has adjustable high and low voltage contacts which can be set around the peri-

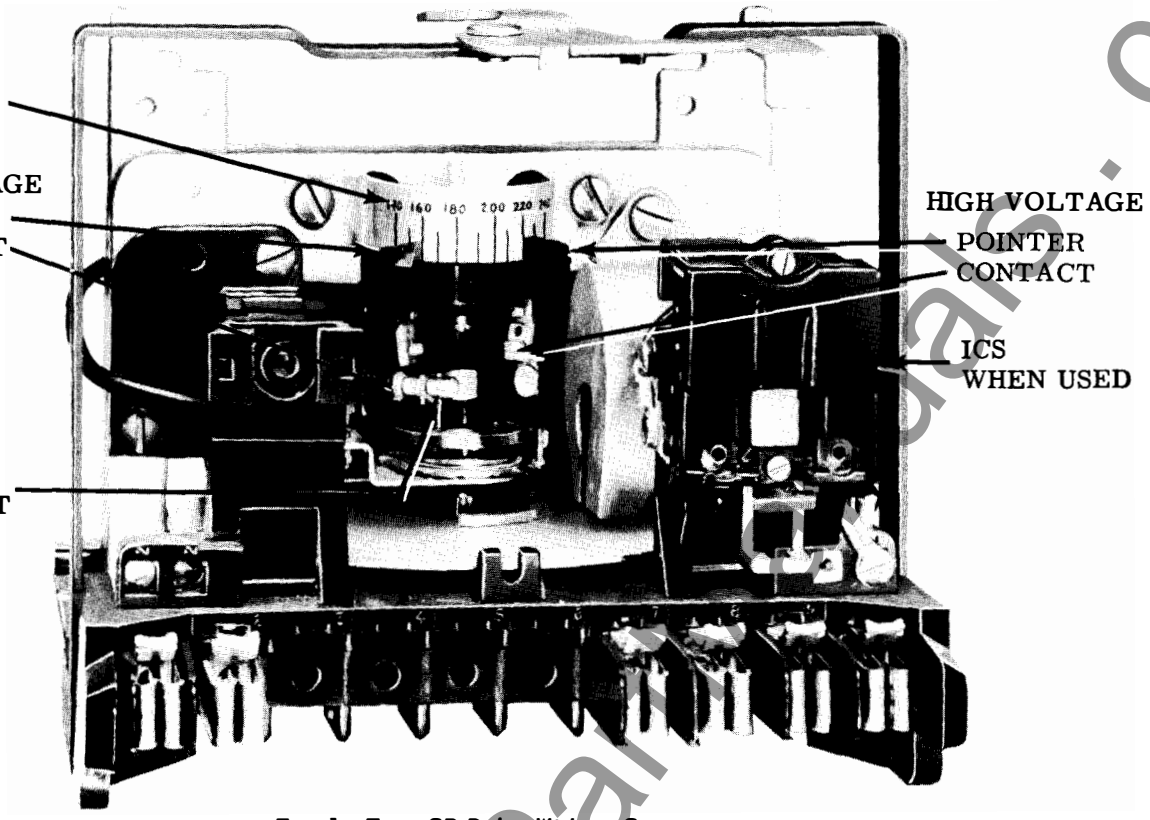
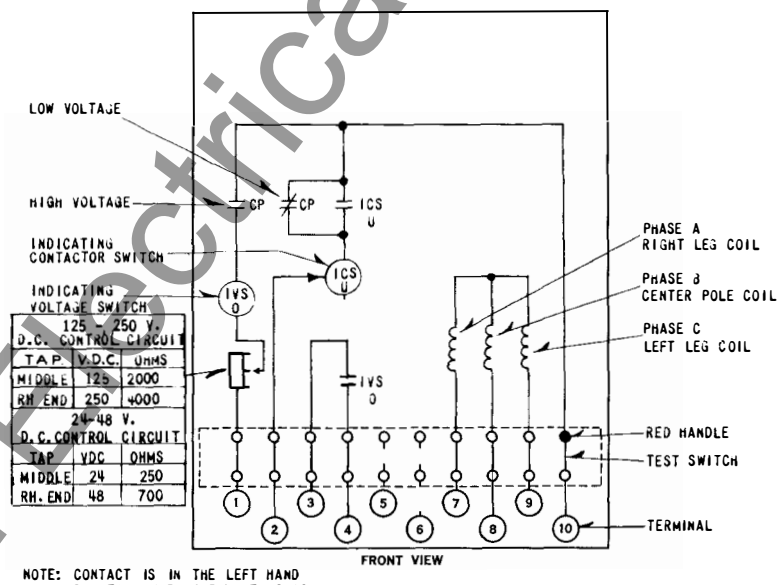


Fig. 1. Type CP Relay Without Case.



125 - 250 V. D.C. CONTROL CIRCUIT		
TAP	V.D.C.	OHMS
MIDDLE	125	2000
RH. END	250	4000
24-48 V. D.C. CONTROL CIRCUIT		
TAP	VDC	OHMS
MIDDLE	24	250
RH. END	48	700

NOTE: CONTACT IS IN THE LEFT HAND POSITION WHEN THE VOLTAGE IS LOW OR THE PHASE REVERSED. (FRONT VIEW)

184A202

* *Fig. 2. Internal Schematic of the Type CP Relay with independent contacts in the Type FT11 case.*

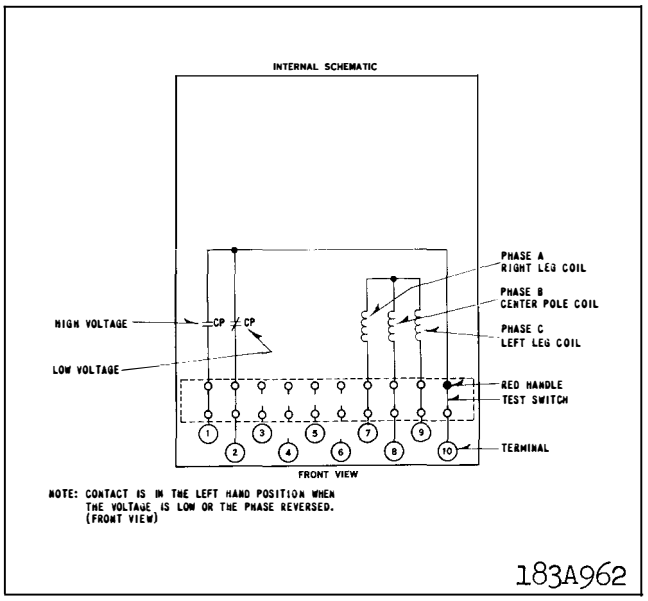


Fig. 3. Internal Schematic of the Type CP Relay in the Type FT11 Case.

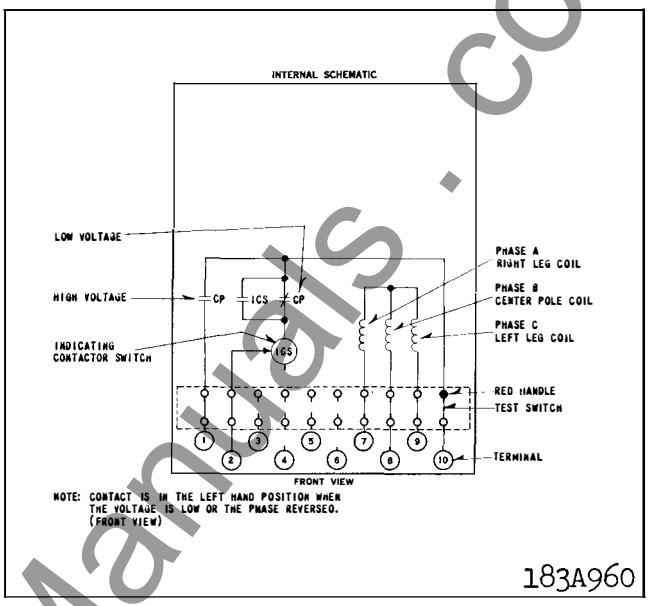


Fig. 4. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the Low Voltage Circuit in the Type FT11 Case.

phery of a scale. The range of adjustment of the contacts are as follows:

120 volt relay	70 to 120 volts
240 volt relay	140 to 240 volts
* 480 volt relay	240 to 480 volts

If either of the adjustable contacts are set for a value of voltage within these ranges, the relay will just close its contacts when the balanced three phase line to line voltages equal this value. For such a condition, the relay is operating at its minimum trip point, and the operating times on repeated operations are not repetitive within close tolerances. However, voltages greater than the overvoltage setting or less than the undervoltage setting, result in relay timing operations which are consistent for repeated trials.

The relay has inverse timing; that is, the greater the increase in voltage the faster the relay contacts will close. Typical time curves for various contact settings are shown in figures 6 and 7.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch (when supplied) will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch (when supplied) has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constant

Indicating contactor switch (ICS) (When Supplied).

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

* Indicating Voltage Switch (IVS) (When Supplied)

The indicating voltage switch (IVS) has a series resistor. The IVS will operate when 80% d.c. rated voltage is applied to the IVS circuitry.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed FT case information refer to I.L. 41-076.

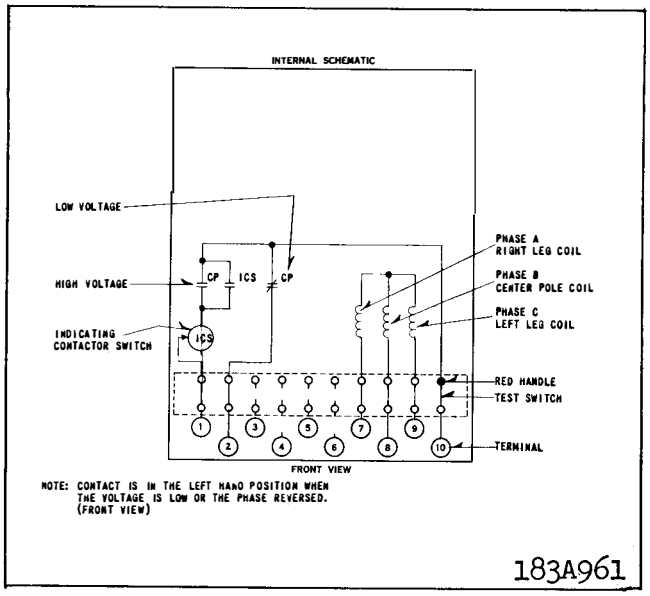


Fig. 5. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the High Voltage Circuit in the Type FT11 Case.

SETTINGS

There are two independent relay adjustments. These are the high and low voltage contact settings as described under "Characteristics". These settings determine the balanced three phase line-to-line voltage at which the relay contacts trip. The relay timing is not an independent adjustment, since it is fixed by the contact settings chosen. Typical time curves for various contact settings are given in Figs. 6 and 7.

Indicating Contactor Switch (ICS) (When Supplied)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energizes a 125 volt or 250 volt d.c. type WL relay switch, or equivalent, use the 0.2 ampere tap. For 48 volt d.c. applications set ICS in 2 ampere tap and use S#304C209G01 type WL relay or equivalent.

Indicating Voltage Switch (IVS) (When Supplied)

* No setting is required on the IVS unit except for the selection of the required voltage tap on the tapped resistor.

ADJUSTMENT AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no adjustments, other than those covered under "Settings", should be required.

Acceptance Check

The following check is recommended to insure that the relay is in proper working order:

A. CP Unit

1. Contacts – Set the left-hand adjustable contact in the center of the scale and adjust the voltage until the moving contact just makes. Set the left-hand contact back out of the way and bring the right-hand contact up until the contacts just make. The pointer should be within ± 1/32" of where the left-hand pointer was.
2. Minimum Trip Voltages – Check the scale markings by setting either of the two contacts at a value marked on the scale, then alternately apply this voltage plus 3% and minus 3%. Contacts should make and break.

   Check all of the scale markings in a similar manner.
3. Time Curve – The time curve can be checked by the use of the circuits of Figs. 8 and 9.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

* C. Indicating Voltage Switch (IVS)

Close the main relay contacts and apply rated d-c voltage across terminals 1 and 10. The contacts of the IVS unit should close and the indicator target should drop freely.

Routine Maintenance

All relays should be inspected periodically and the time of operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application.

All contacts should be periodically cleaned. A

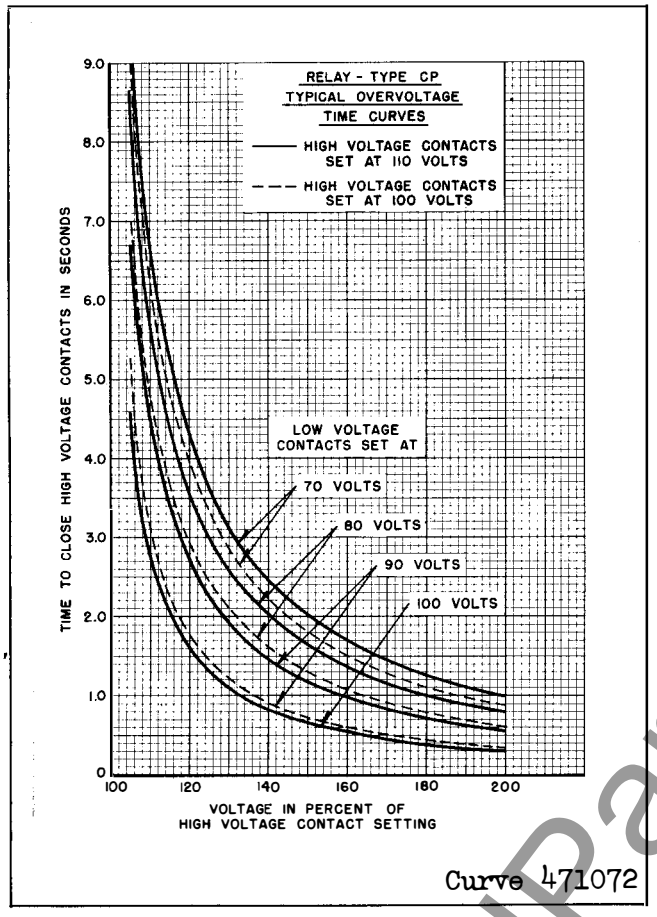


Fig. 6. Typical Overvoltage Time Curves for the Type CP Relay.

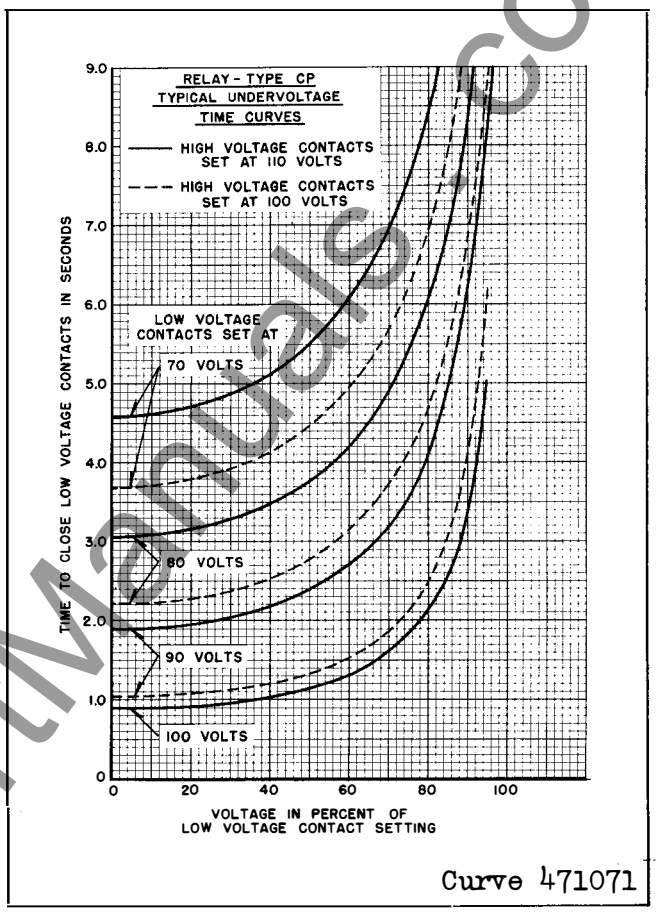


Fig. 7. Typical Undervoltage Time Curves for the Type CP Relay.

contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver contact and thus impairing the contact.

Calibration

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs, or the adjustments have been distrubed. This procedure should not be used until it is apparent that the relay is not in proper working order (See "Acceptance Check").

A. CP Unit

1. Contacts — Apply sufficient voltage to the relay, to make the disc float in the center of its travel. Move either of the adjustable contacts until it just makes with the moving contact. If the two contacts pointers do not meet at the same point on the scale, adjust the follow on both adjustable contacts. The contacts should just make with the moving contacts when the pointers meet on the scale. Approximately the same follow should be in each of the adjustable stationary contacts.

2. Minimum Trip Voltage — The adjustment of the spring tension in setting the minimum trip voltage is most conveniently made with the damping magnet removed.

   Set either of the adjustable stationary contacts in the center of its travel. (For example, on the 120 volt relay, set the contact on the 95 volt setting.) Apply this voltage to the relay. Wind up the spiral spring by means of the spring adjuster until the stationary contact and moving contact just make.

   Check the other scale markings by setting the adjustable contact on these markings and applying the corresponding voltage. The moving contact should make and break within plus or minus 3% of the value marked on the scale.

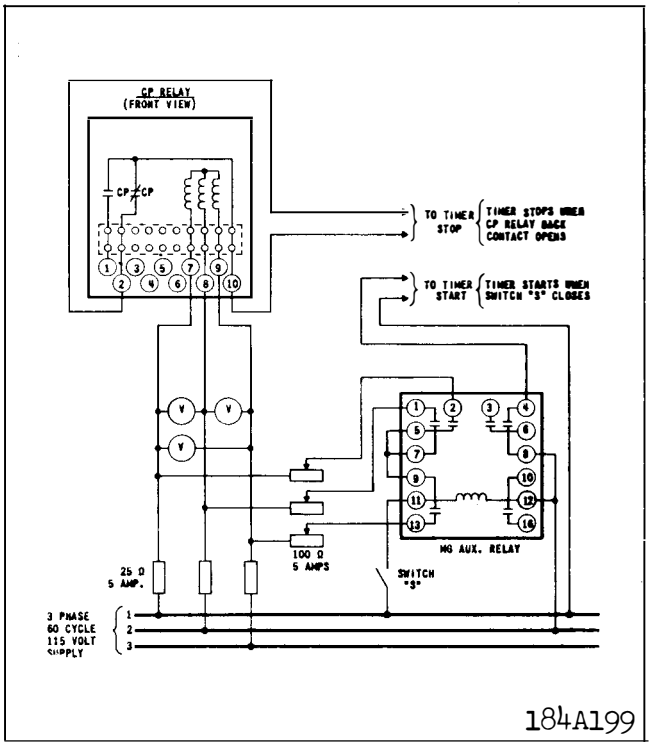


Fig. 8. Diagram of Test Connection for checking the Undervoltage Time Curves of the Type CP Relay.

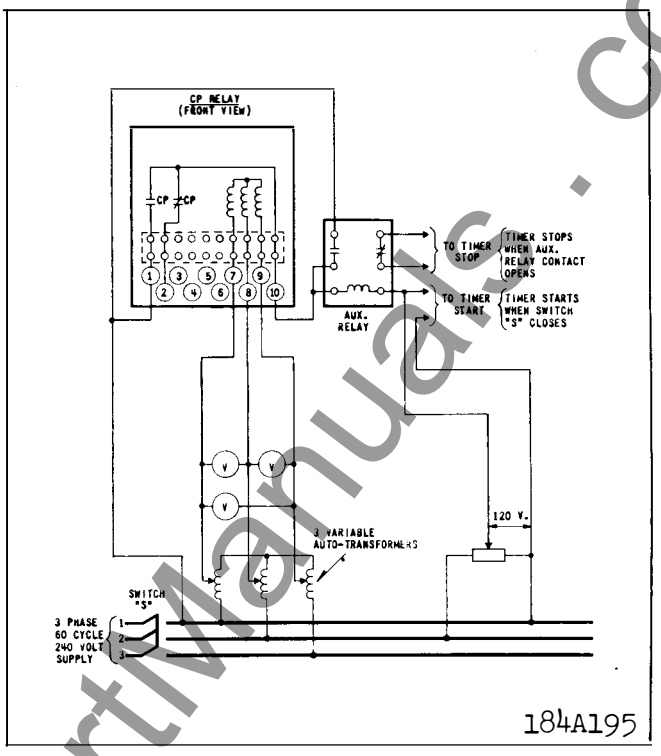


Fig. 9. Diagram of Test Connection for checking the Overvoltage Time Curves of the Type CP Relay.

3. Time Curve Calibration — Install the permanent magnet and connect the relay as per the circuit of Fig. 8.

* Set the high voltage contact on 100 volts and the low voltage contact on 70 volts. (For the 240 volt relay, multiply these values by two. Similarly for the 480 volt relay, multiply these values by four.) Apply rated voltage to the relay to allow the high voltage contact to make. Suddenly drop the voltage to zero and adjust the permanent magnet gap until the relay operates in 3.7 ± .15 sec.

Check the closing time of the high voltage contact by use of Fig. 9. With the voltage originally zero, suddenly apply rated voltage to the relay. The high voltage contact should close in 3.9 seconds ± 0.2 sec.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

* The type CP relay when energized at rated voltage balanced 3 phase has the following VA burden for each phase.

	Watts	Vars	VA	Lagging Power Factor Angle
Phase A	.25	2.82	2.83	85
Phase B	.37	1.92	1.96	79
Phase C	1.11	2.50	2.73	66

The continuous voltage rating of the relays is 110% of rated voltage.

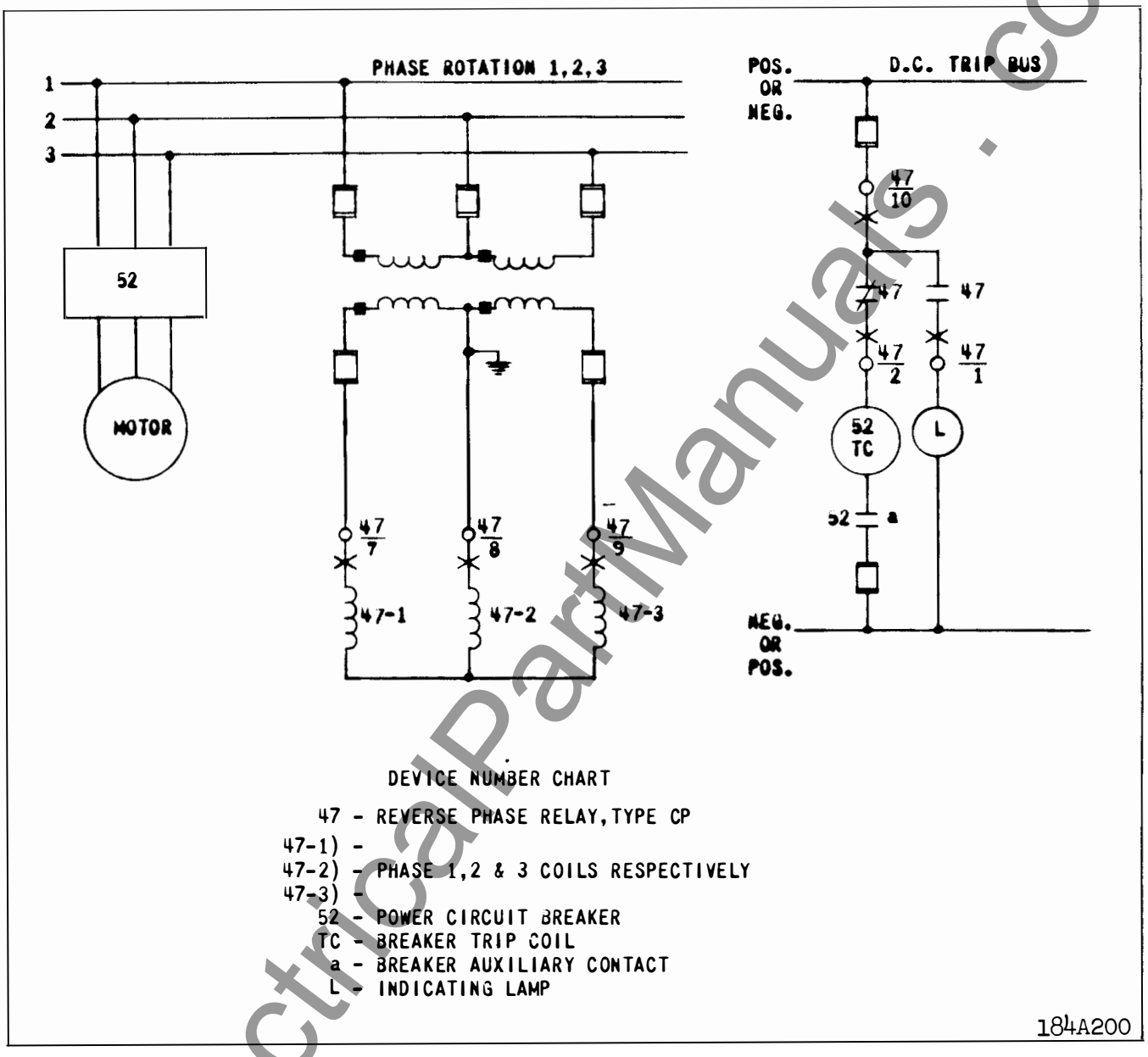
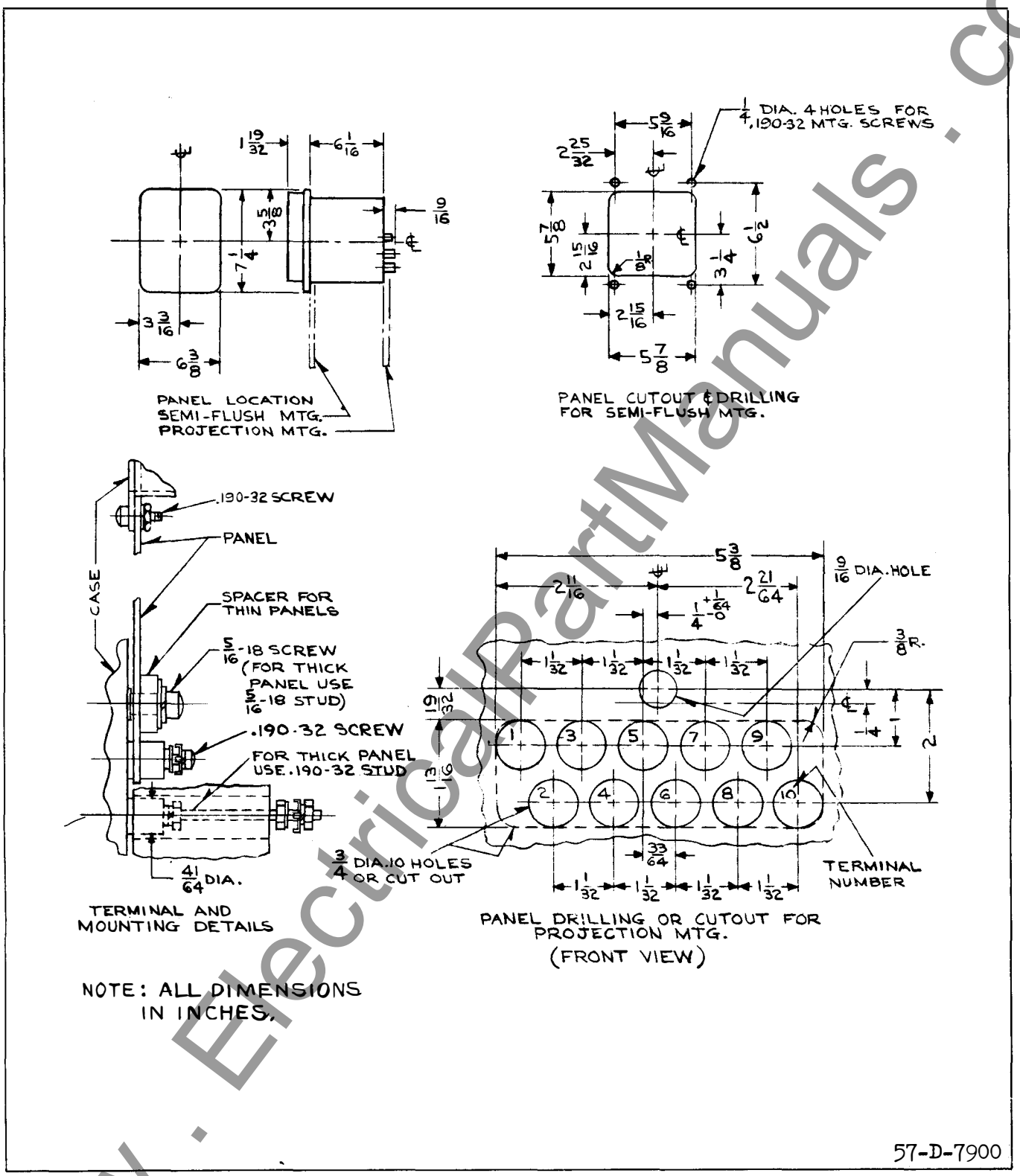


Fig. 10. External Schematic Diagram of the Type CP Relay in the Type FT11 Case.



* *Fig. 11. Outline and Drilling Plan for the Type CP Relay in the Type FT11 Case.*

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CP REVERSE PHASE RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type CP relay is a three phase induction disc type relay that operates upon phase reversal to disconnect a motor from a circuit. The relay may not operate for an open phase on the motor unless the motor is so heavily loaded that normal voltage cannot be maintained on all phases. Normally, the relay will operate as soon as the machine is stopped and prevent it from being started again if one phase wire is open.

This relay may also be applied to close its contacts on either three phase overvoltage or three phase undervoltage conditions on a system. For example, one relay is used to initiate source breaker trip and another relay is used to supervise alternate source breaker closing on automatic bus transfer schemes.

CONSTRUCTION AND OPERATION

The type CP relay consists of a three phase voltage unit and an indicating contactor switch when supplied. The principal component parts of the relay and their location are shown in figures 1 and 2.

A. Voltage Unit (CP)

The electromagnet is an "E" type laminated structure with a coil mounted on each leg. A wye connection is formed by connecting one lead of each coil together. The other lead of the coils are connected to separate phases of a three phase system.

When the coils are energized with a three phase voltage, a flux is induced in each leg of the electromagnet. These fluxes are out-of-phase with respect to each other since they are induced by out-of-phase voltages. The path of the three fluxes is across an air gap in which a disc is located. The out-of-phase fluxes cause a torque to be produced on the disc which moves to a position in its travel that corresponds to the three phase voltage applied to the electromagnet. The disc will remain in this position until the applied three phase voltage is changed, at which time, the disc will move to a new position that corresponds to the new voltage.

The out-of-phase fluxes are such that a positive sequence voltage tends to close the high voltage contact while a negative sequence voltage tends to close the low voltage contact. A reversed phase (which means negative sequence phase rotation) will cause the relay's low voltage contact to close. This contact will also close on unbalance voltages that contain a negative sequence component sufficient to reduce the relay torque to its low voltage trip point.

B. Indicating Contactor Switch (ICS)

The indicating contactor switch is a small d-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also, during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the case.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The type CP really has adjustable high and low voltage contacts which can be set around the peri-

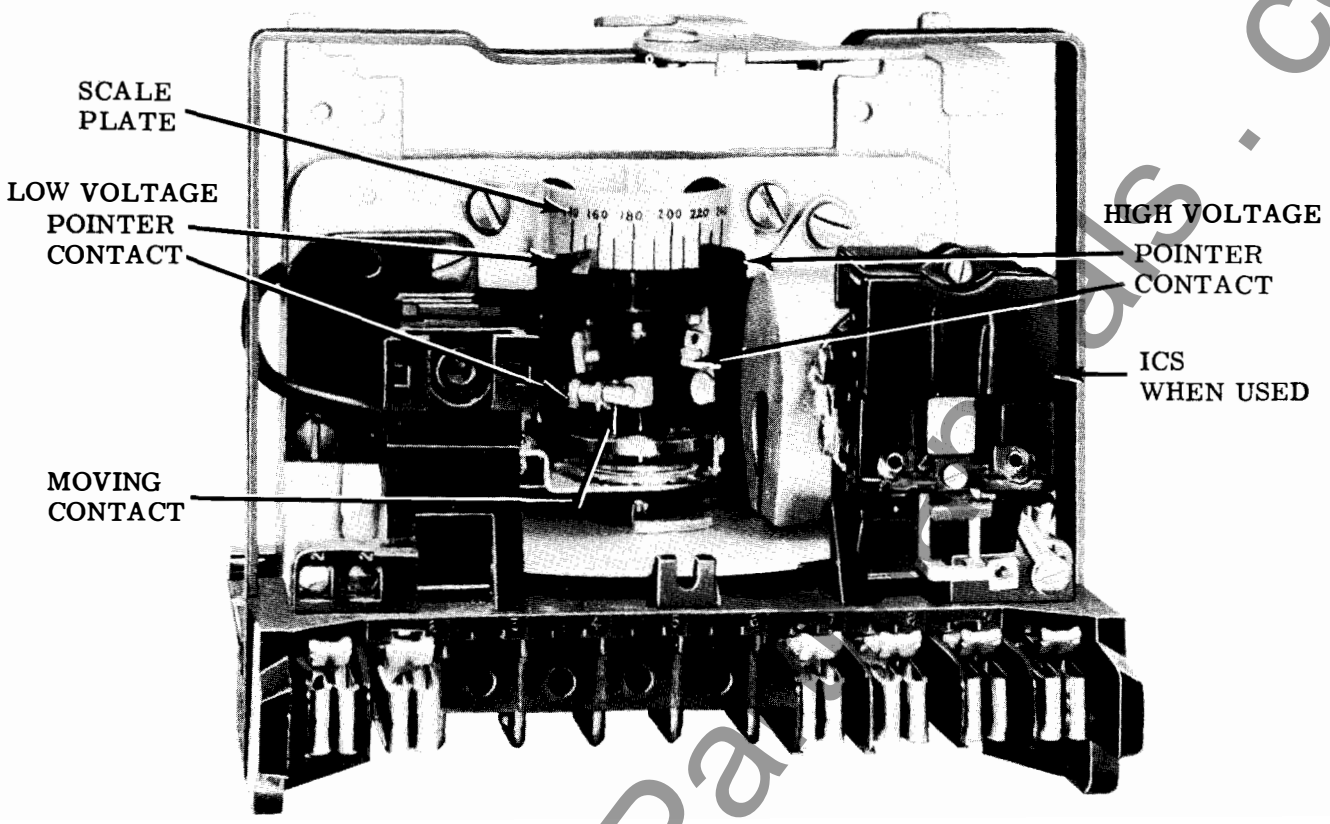


Fig. 1. Type CP Relay Without Case.

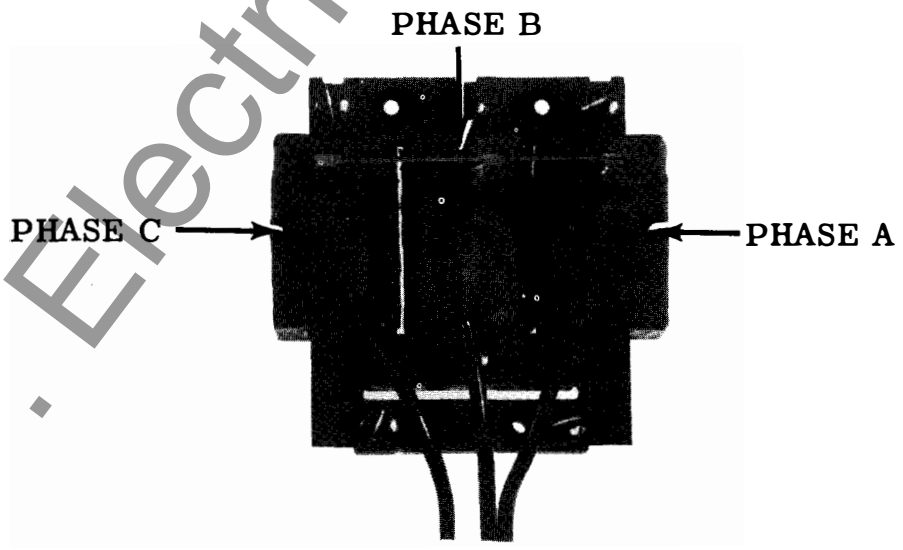


Fig. 2. CP Electromagnet, rear view.

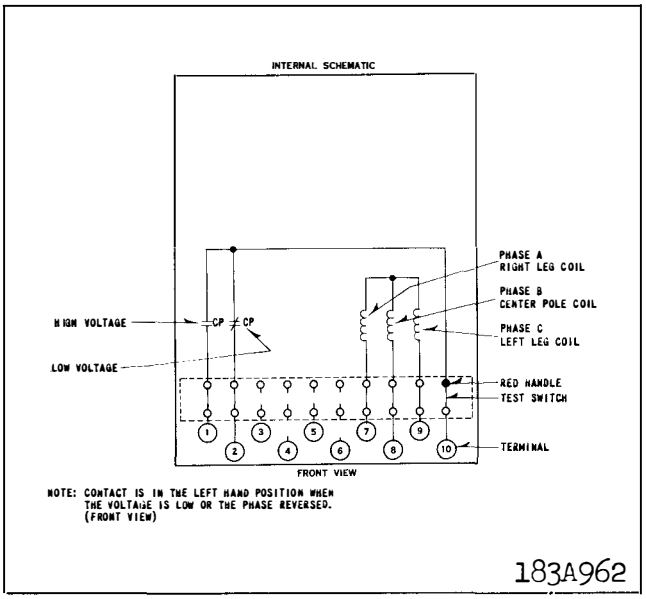


Fig. 3. Internal Schematic of the Type CP Relay in the Type FT11 Case.

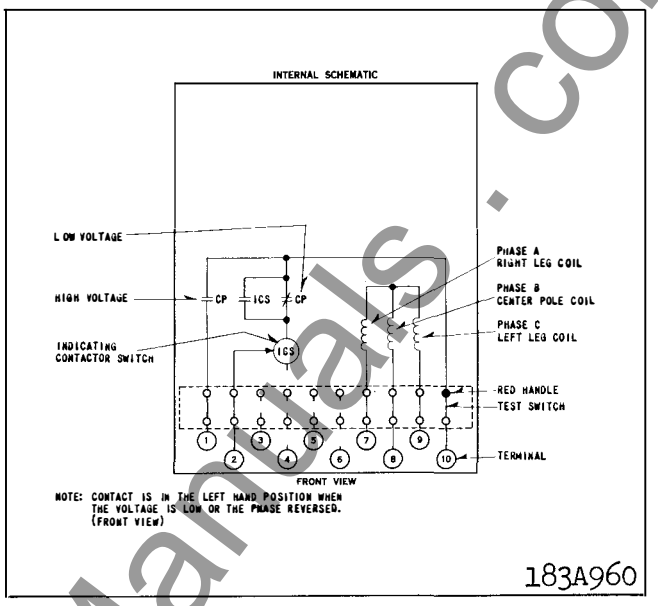


Fig. 4. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the Low Voltage Circuit in the Type FT11 Case.

phery of a scale. The range of adjustment of the contacts are as follows:

120 volt relay	70 to 120 volts
240 volt relay	140 to 240 volts

If either of the adjustable contacts are set for a value of voltage within these ranges, the relay will just close its contacts when the balanced three phase line to line voltages equal this value. For such a condition, the relay is operating at its minimum trip point, and the operating times on repeated operations are not repetitive within close tolerances. However, voltages greater than the overvoltage setting or less than the undervoltage setting, result in relay timing operations which are consistent for repeated trials.

The relay has inverse timing; that is, the greater the increase in voltage the faster the relay contacts will close. Typical time curves for various contact settings are shown in figures 6 and 7.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch (when supplied) will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch (when supplied) has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constant

Indicating contactor switch (ICS) (When Supplied).

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed FT case information refer to I.L. 41-076.

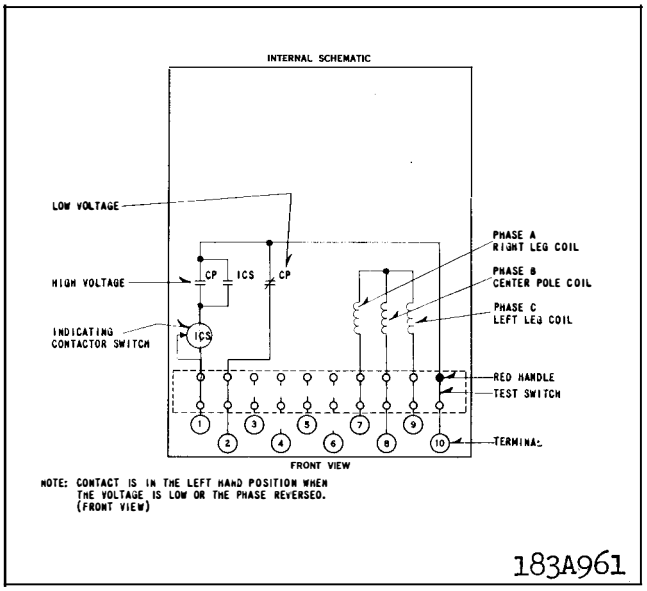


Fig. 5. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the High Voltage Circuit in the Type FT11 Case.

SETTINGS

There are two independent relay adjustments. These are the high and low voltage contact settings as described under "Characteristics". These settings determine the balanced three phase line-to-line voltage at which the relay contacts trip. The relay timing is not an independent adjustment, since it is fixed by the contact settings chosen. Typical time curves for various contact settings are given in Figs. 6 and 7.

Indicating Contactor Switch (ICS) (When Supplied)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energizes a 125 volt or 250 volt d.c. type WL relay switch, or equivalent, use the 0.2 ampere tap. For 48 volt d.c. applications set ICS in 2 ampere tap and use S#304C209G01 type WL relay or equivalent.

ADJUSTMENT AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no adjustments, other than those covered under "Settings", should be required.

Acceptance Check

The following check is recommended to insure that the relay is in proper working order:

A. CP Unit

1. Contacts — Set the left-hand adjustable contact in the center of the scale and adjust the voltage until the moving contact just makes. Set the left-hand contact back out of the way and bring the right-hand contact up until the contacts just make. The pointer should be within ± 1/32" of where the left-hand pointer was.
2. Minimum Trip Voltages — Check the scale markings by setting either of the two contacts at a value marked on the scale, then alternately apply this voltage plus 3% and minus 3%. Contacts should make and break.

   Check all of the scale markings in a similar manner.
3. Time Curve — The time curve can be checked by the use of the circuits of Figs. 8 and 9. The operating time should equal those of the curves of Figs. 6 and 7 plus or minus 5%.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

Routine Maintenance

All relays should be inspected periodically and the time of operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application. Phantom loads should not be used in testing induction-type relays because of the resulting distorted current wave form which produces an error in timing.

All contacts should be periodically cleaned. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver contact and thus impairing the contact.

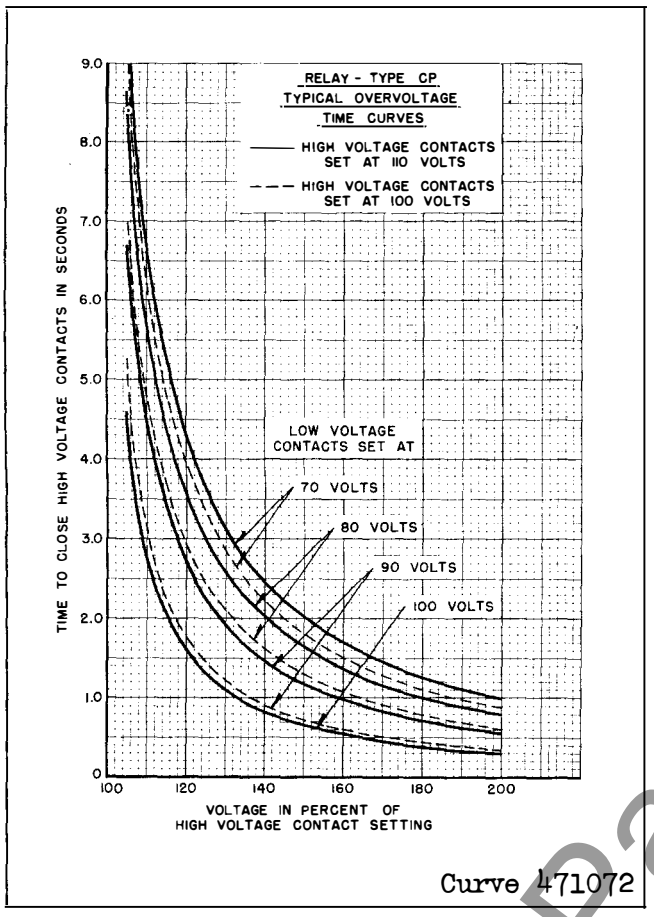


Fig. 6. Typical Overvoltage Time Curves for the Type CP Relay.

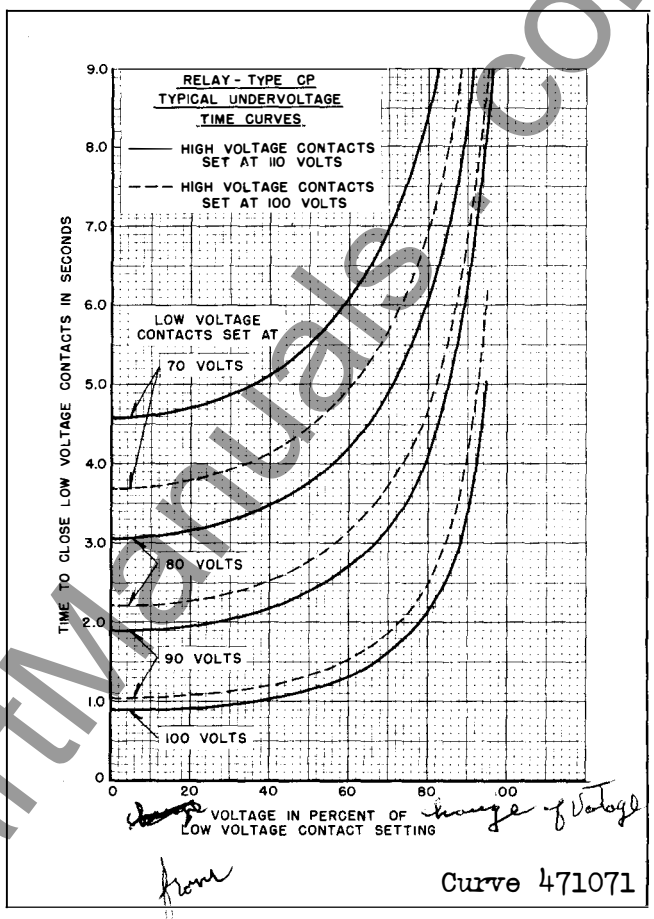


Fig. 7. Typical Undervoltage Time Curves for the Type CP Relay.

Calibration

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs, or the adjustments have been distrubed. This procedure should not be used until it is apparent that the relay is not in proper working order (See "Acceptance Check").

A. CP Unit

1. Contacts — Apply sufficient voltage to the relay, to make the disc float in the center of its travel. Move either of the adjustable contacts until it just makes with the moving contact. If the two contacts pointers do not meet at the same point on the scale, adjust the follow on both adjustable contacts. The contacts should just make with the moving contacts when the pointers meet on the scale. Approximately the same follow should be in each of the adjustable stationary contacts.

2. Minimum Trip Voltage — The adjustment of the spring tension in setting the minimum trip voltage is most conveniently made with the damping magnet removed.

   Set either of the adjustable stationary contacts in the center of its travel. (For example, on the 120 volt relay, set the contact on the 95 volt setting.) Apply this voltage to the relay. Wind up the spiral spring by means of the spring adjuster until the stationary contact and moving contact just make.

   Check the other scale markings by setting the adjustable contact on these markings and applying the corresponding voltage. The moving contact should make and break within plus or minus 3% of the value marked on the scale.

3. Time Curve Calibration — Install the permanent magnet and connect the relay as per the circuit of Fig. 8.

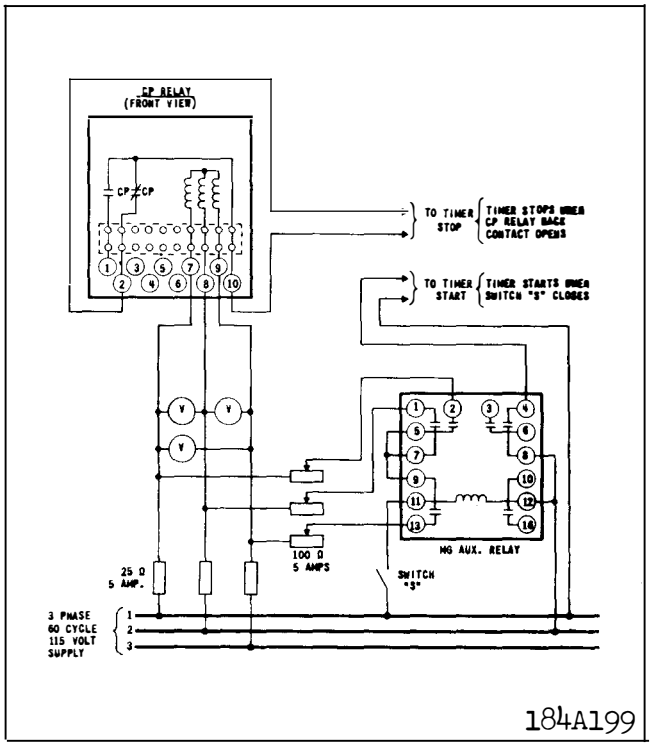


Fig. 8. Diagram of Test Connection for checking the Undervoltage Time Curves of the Type CP Relay.

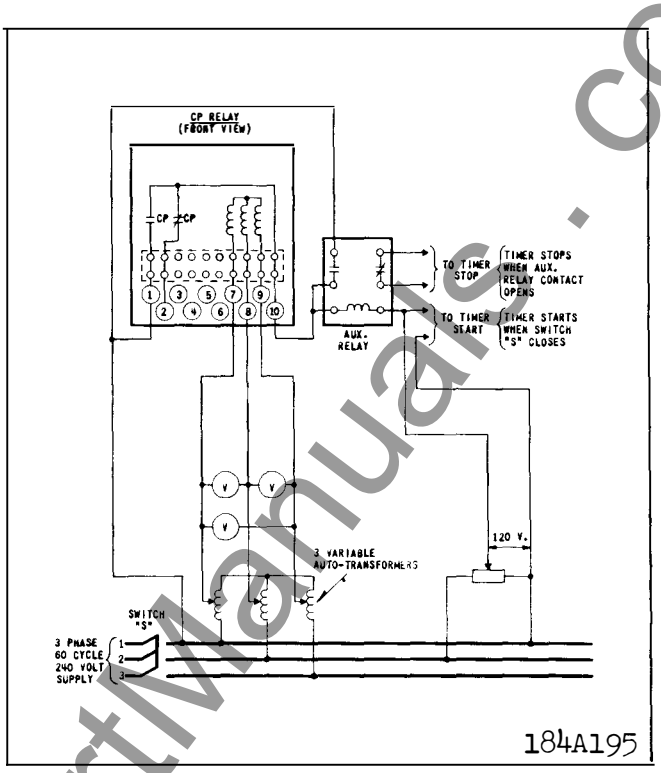


Fig. 9. Diagram of Test Connection for checking the Overvoltage Time Curves of the Type CP Relay.

Set the high voltage contact on 100 volts and the low voltage contact on 70 volts. (For the 240 volt relay, multiply these values by two.) Apply rated voltage to the relay to allow the high voltage contact to make. Suddenly drop the voltage to zero and adjust the permanent magnet gap until the relay operates in 3.7 ± .15 sec.

Check the closing time of the high voltage contact by use of Fig. 9. With the voltage originally zero, suddenly apply rated voltage to the relay. The high voltage contact should close in 3.9 seconds ± 0.2 sec.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

The type CP relay when energized at 120 volts balanced 3 phase has the following VA burden for each phase.

	Watts	Vars	VA	Lagging Power Factor Angle
Phase A	.25	2.82	2.83	85
Phase B	.37	1.92	1.96	79
Phase C	1.11	2.50	2.73	66

The continuous voltage rating of the relays is 110% of rated voltage.

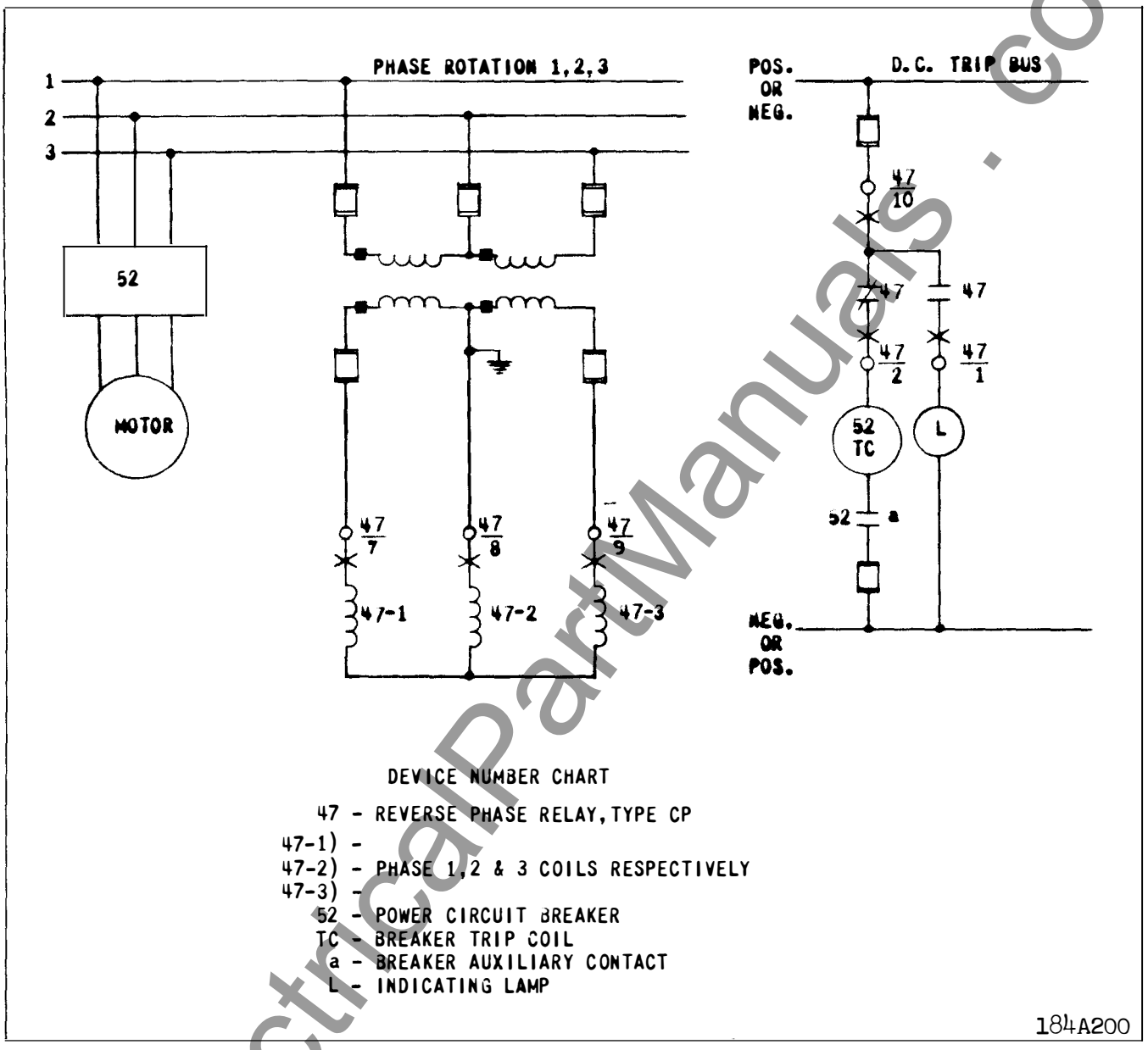


Fig. 10. External Schematic Diagram of the Type CP Relay in the Type FT11 Case.

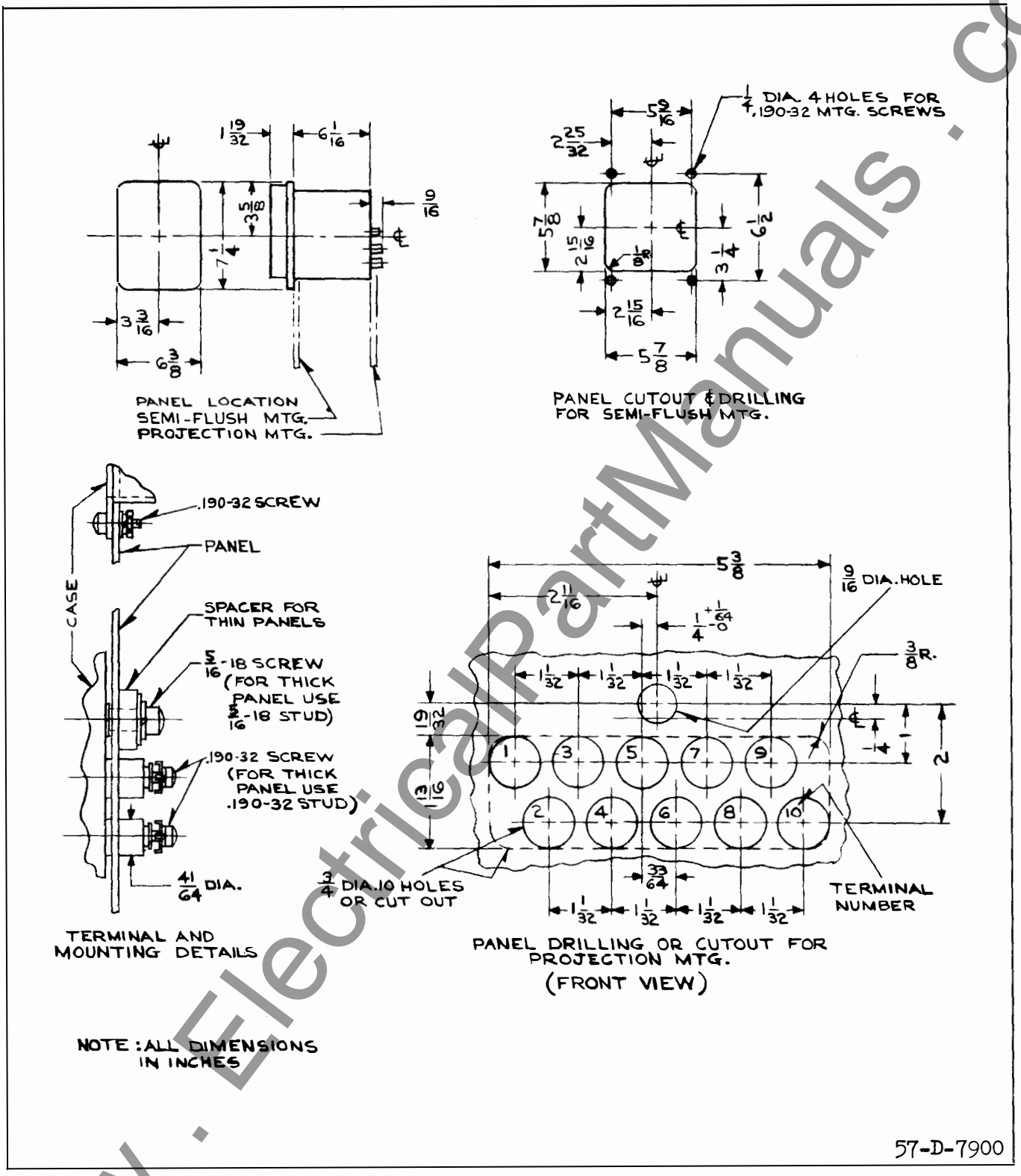


Fig. 11. Outline and Drilling Plan for the Type CP Relay in the Type FT11 Case.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CP REVERSE PHASE RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type CP reverse-phase relay operates upon phase reversal to disconnect motors from the circuit. However if one phase opens resulting from a blown fuse or some similar interruption of service, with polyphase motors operating on the system, the relay may not operate unless the motors are so heavily loaded that normal voltage cannot be maintained on all phases. Normally, the relay will operate as soon as the machines are stopped, thus preventing them from being started again if one phase wire is open.

Since the relay is essentially a three phase contact making voltmeter, it may also be applied to close one set of contacts on 3 phase overvoltage conditions, and the other set of contacts on three phase undervoltage conditions.

CONSTRUCTION AND OPERATION

The type CP relay consists of an induction disc type unit, and an indicating contactor switch when supplied. In addition an external box containing three resistors is supplied. Each of these resistors is to be connected in series with one phase winding of the relay.

The operating element is an induction disc type unit operating on three phase voltage. The induction disc is a thin four-inch diameter conducting disc mounted on a vertical shaft. The shaft is supported on the lower end by a steel ball bearing riding between concave sapphire jewel surfaces, and on the upper end by a stainless steel pin.

On the relays, the moving contact is a small silver rod hemispherically shaped at either end to form a double throw arrangement. It is fastened on the end of a conducting arm. The other end of this arm is clamped to an insulating tube on the disc shaft. The electrical connection is made from the moving contact thru the arm and a spiral spring. One end of the spring is fastened to the arm, and the other to a slotted spring adjusted disc which in turn fastens to the moulded insulation block mounted on the element.

The front and back stationary contact assemblies are both adjustable. Each mounts on a lever which can be set anywhere about the periphery of a calibrated scale. The moulded brackets, upon which the stationary contact leaf springs are mounted, are each secured to their respective lever arms by two screws. These screws may be loosened and the moulded contact supports pivoted to the positions required for correct tracking of both contact assemblies on the calibrated scale.

The relay electromagnet consists of a main potential coil, and two upper pole potential coils. The main coil is tapped, and the tap point is used as a neutral (not brought out) for a wye connection of the relay coils. The three legs of the wye are respectively, the two upper pole coils connected in series, and each half of the tapped main pole winding.

When energized by three phase voltages, the fluxes of the main and upper pole circuits react to produce torque on the induction disc. This torque is a function of the positive and negative sequence components of voltage, each set tending to produce opposite rotation of the induction disc. Thus positive sequence voltage tends to make the high voltage contacts close while negative sequence tends to close the low voltage contacts. A reversed phase (which means negative sequence phase rotation) will cause the relay low voltage contacts to trip. In addition, unbalance in the voltages impressed on the relay will also cause the low voltage contacts to close, if due to unbalance sufficient negative sequence voltage is present to reduce the relay torque to the low voltage tripping point.

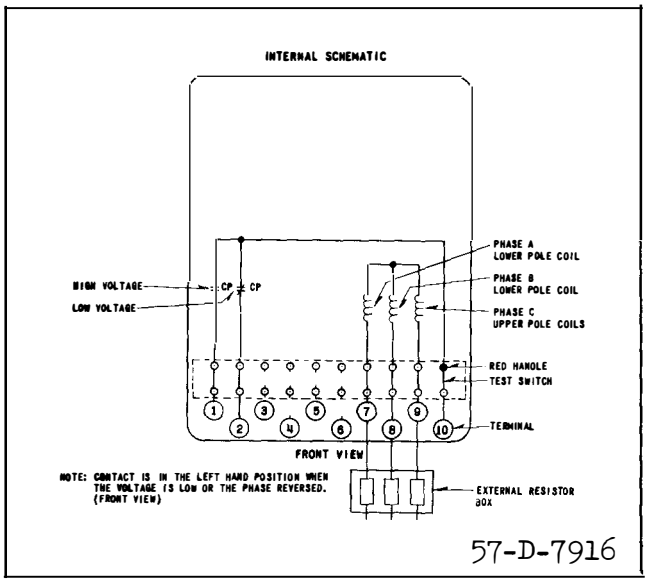


Fig. 1. Internal Schematic of the Type CP Relay in the Type FT21 Case.

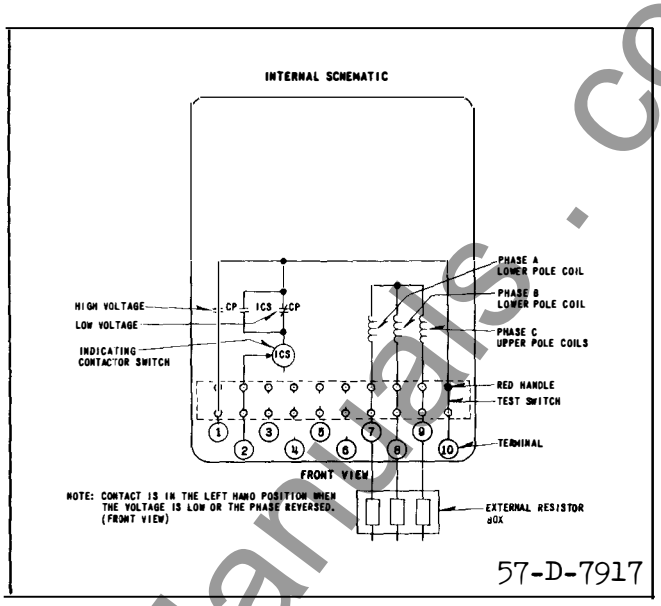


Fig. 2. Internal Schematic of the Type CP Relay in the Type FT21 Case with Indicating Contactor Switch in the Low Voltage Circuit.

Indicating Contactor Switch Unit (ICS) (When Supplied)

The d-c indicating contactor switch is a small clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the cover.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The type CP reverse phase relay has adjustable high and low voltage contacts which can be set around the periphery of a scale. For the 115 volt relay this scale is calibrated from 70 to 120 volts, and for the 230 volt relay, the scale is calibrated from 140 to 240 volts.

The voltage values indicated on the scale, represent balanced three phase voltages applied to the relay. The relay contacts will just close when the balanced three phase line to line voltages reach the value indicated by the pointer of either of the adjustable stationary contacts.

If the contacts are set to close for a particular line to line value of balanced three phase voltage, and if that exact voltage is applied, then the relay is operating at its minimum trip point and the times on repeated operations are not repetitive within close tolerances. However, voltages appreciably greater than the overvoltage setting, or appreciably less than the undervoltage setting, result in relay timing operations which are consistent for repeated trials.

The relay has inverse timing; that is, the greater the increase in voltage the faster the relay contact will travel. Typical time curves for various contact settings are shown in Figs. 3 and 4.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch (when supplied) will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch (when supplied) has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

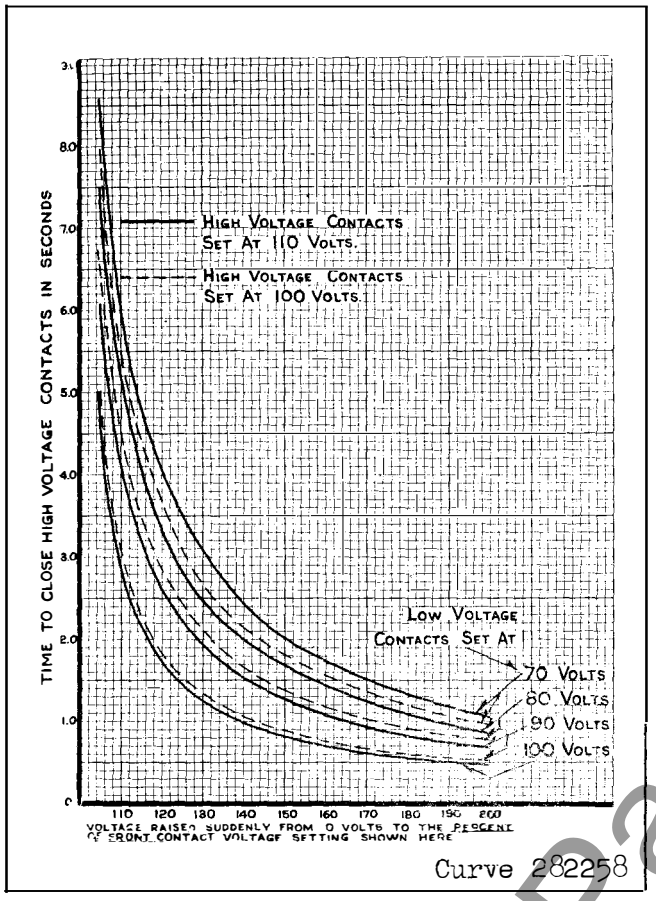


Fig. 3. Typical Overvoltage Time Curves for the Type CP Relay.

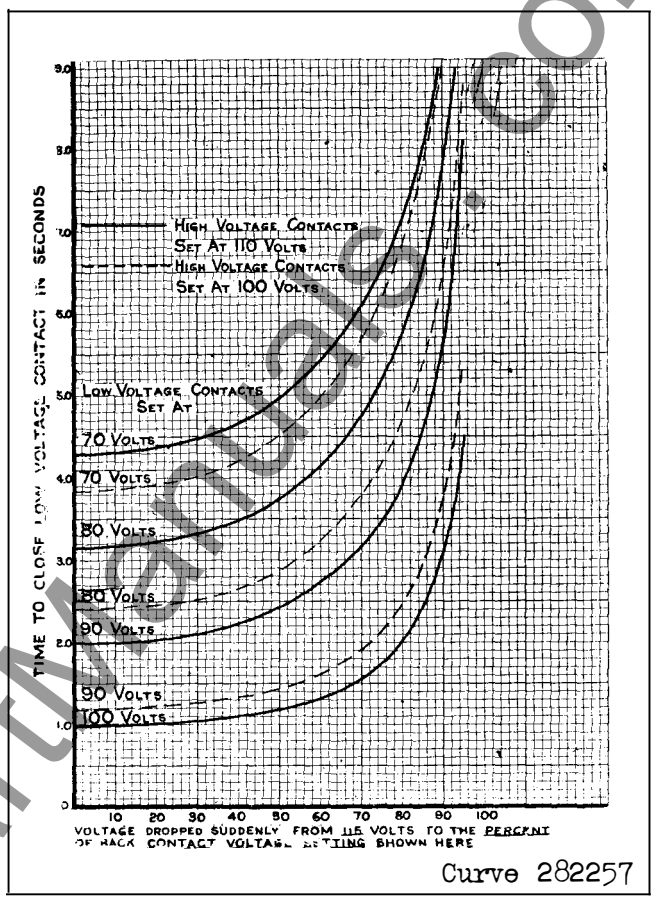


Fig. 4. Typical Undervoltage Time Curves for the Type CP Relay.

Trip Circuit Constant

Indicating contactor Switch (ICS) (When Supplied).

0.2 ampere tap	6.5	ohms d-c resistance
2.0 ampere tap	0.15	ohms d-c resistance

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed FT case information refer to I.L.41-076.

SETTINGS

There are two independent relay adjustments. These are the high voltage and low voltage contact settings as described under "Characteristics". These settings determine the balanced three phase line-to-line voltage at which the relay contacts trip. The relay timing is not an independent adjustment, since it is fixed by the contact settings chosen. Typical time curves for various contact settings are given in Figs. 3 and 4.

Indicating Contactor Switch (ICS) (When Supplied)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in nt of the tap block to the desired setting by eans of the connecting screw. When the relay

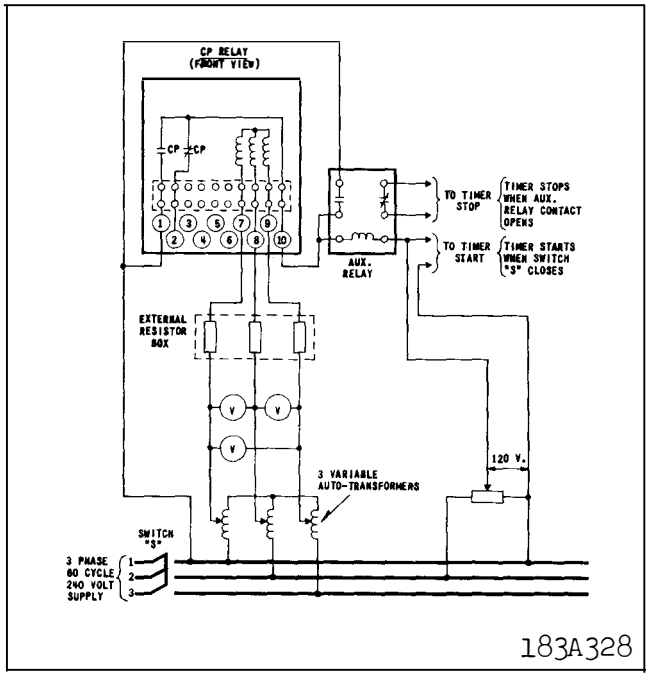


Fig. 5. Diagram of Test Connections for Checking the Overvoltage Time Curves of the Type CP Relay.

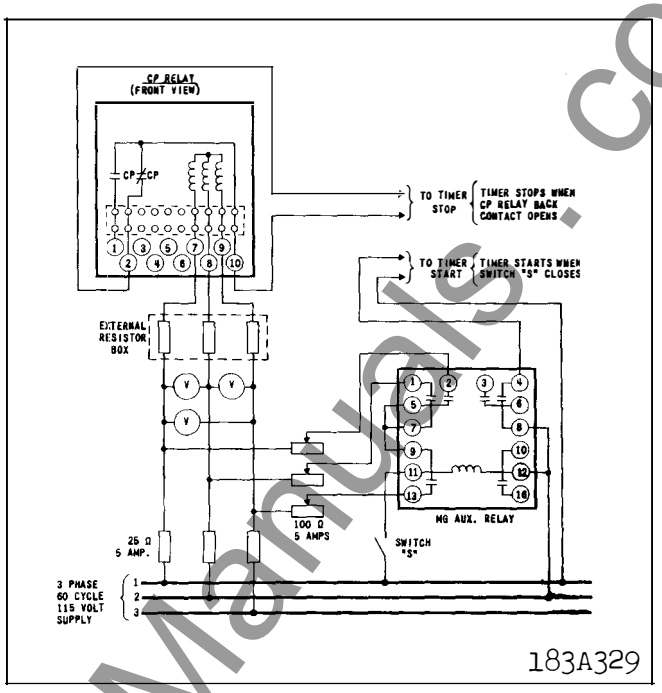


Fig. 6. Diagram of Test Connections for Checking the Undervoltage Time Curves of the Type CP Relay.

energizes a type WL relay switch, or equivalent, use the 0.2 ampere tap.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be disturbed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be cleaned periodically. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

The relay has front and back adjustable stationary contacts; to adjust these properly set the two levers so they are at approximately the mid-scale position with both pointers indicating the same voltage value on the scale. Then adjust the position of the front and back contacts so they both just touch on either side of the moving contact. This is done by loosening the two screws at the top of each lever and rotating the adjustable contact assembly slightly until the desired contact positions are obtained. The screws should be tightened securely.

To check the relay calibration, and adjustable three phase voltage source must be used. Various balanced three phase voltages may be impressed on the relay, and the position of the adjustable contacts checked for the various values. This may be best done by means of an indicating lamp suitably connected in the trip circuit.

If readjustments are necessary, they can be made by rotating the notched spring adjuster with a screw driver blade inserted in one of the notches.

The relay time curves may be checked with the arrangements given in Figs. 5 and 6 the former for the overvoltage curve, the latter for the undervoltage curve.

Indicating Contactor Switch (ICS) (When Supplied)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS tap setting being used. The indicator target should drop freely.

REPAIRS AND RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be

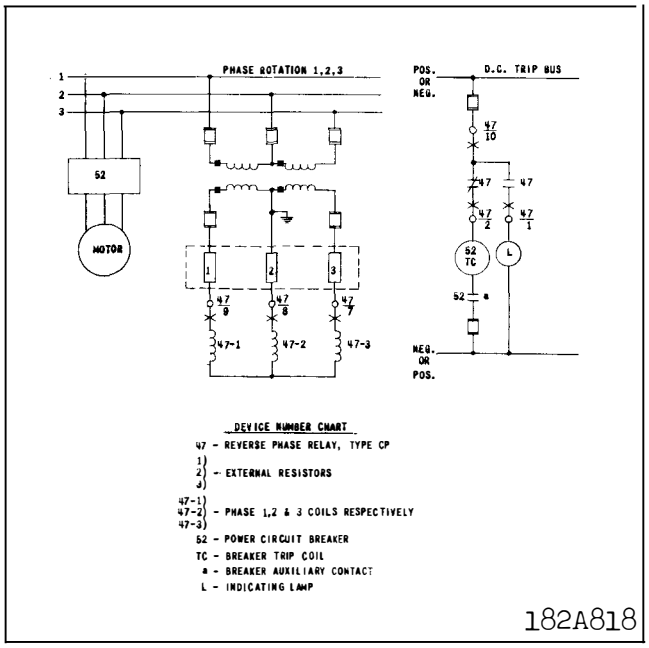


Fig. 7. External Schematic Diagram of the Type CP Relay in the Type FT21 Case.

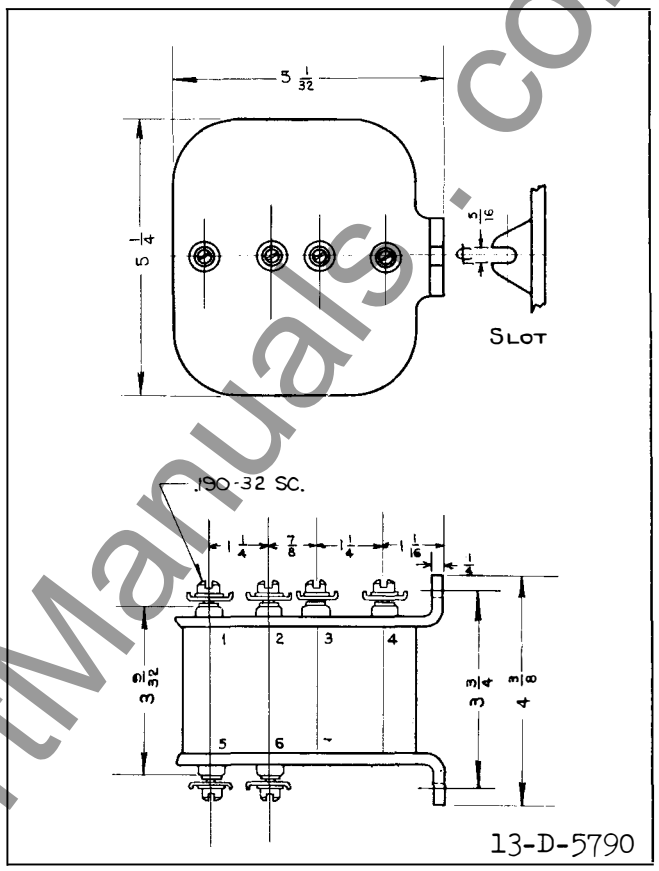


Fig. 8. Outline and Drilling Plan of the External Resistor Box.

furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

The type CP Relay when energized at 115 volts balanced 3 phase, and with the external resistance box connected, has the following VA burdens for each phase.

	Watts	Vars	VA	Lagging Power Factor Angle
Phase A	8.5	.30	8.5	2.0°
Phase B	9.0	1.6	9.1	10.2°
Phase C	7.6	1.2	7.7	9.0°

The continuous voltage rating of the relays is 110% of rated voltage.

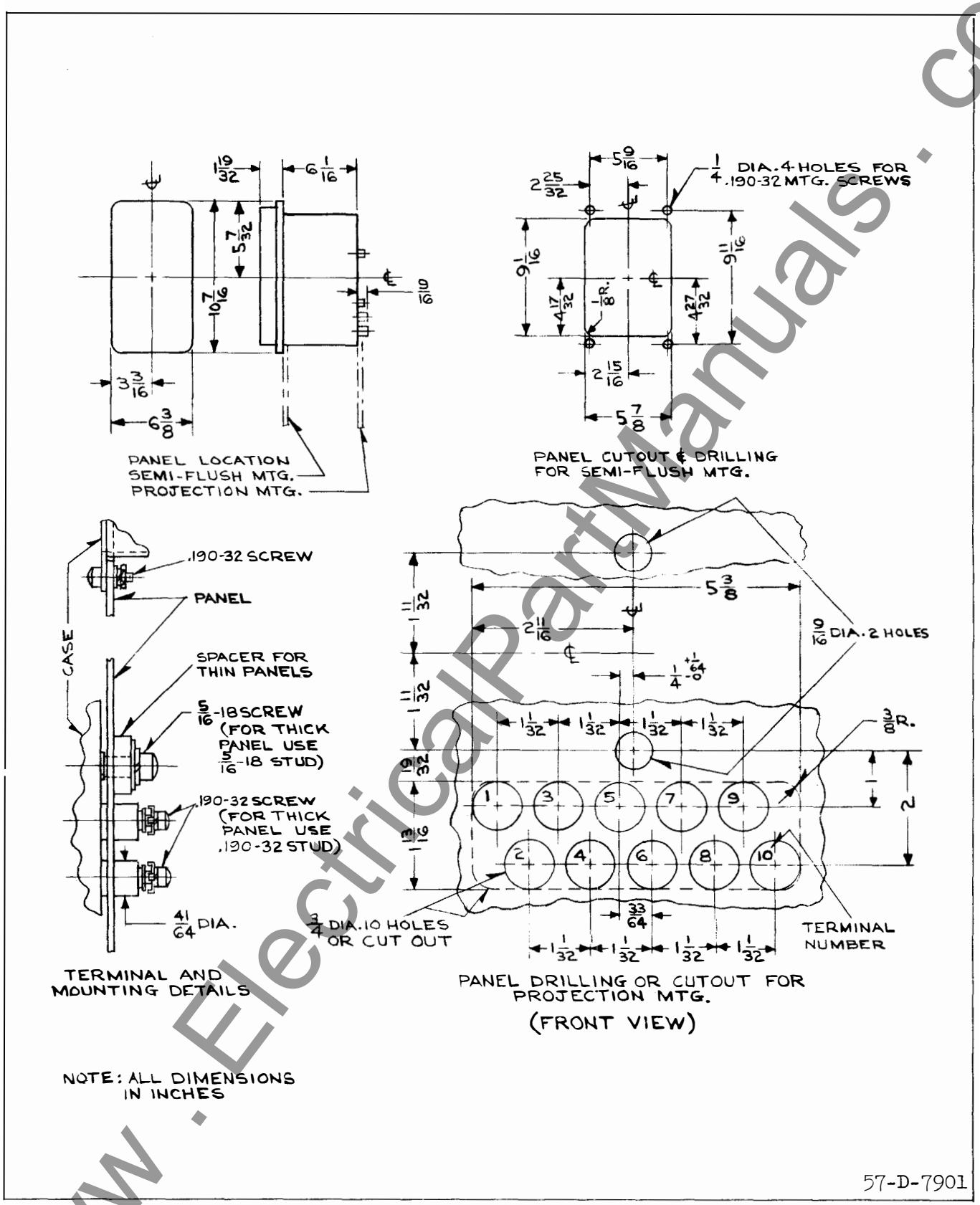


Fig. 9. Outline and Drilling Plan for the Type CP Relay in the Type FT21 Case.

WESTINGHOUSE ELECTRIC CORPORATION
METER DIVISION
NEWARK, N.J.
Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CP REVERSE PHASE RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type CP reverse-phase relay operates upon phase reversal to disconnect motors from the circuit. However if one phase opens resulting from a blown fuse or some similar interruption of service, with polyphase motors operating on the system, the relay may not operate unless the motors are so heavily loaded that normal voltage cannot be maintained on all phases. Normally, the relay will operate as soon as the machines are stopped, thus preventing them from being started again if one phase wire is open.

Since the relay is essentially a three phase contact making voltmeter, it may also be applied to close one set of contacts on 3 phase overvoltage conditions, and the other set of contacts on three phase undervoltage conditions.

CONSTRUCTION AND OPERATION

The type CP relay consists of an induction disc type unit, and an indicating contactor switch when supplied. In addition an external box containing three resistors is supplied. Each of these resistors is to be connected in series with one phase winding of the relay.

The operating element is an induction disc type unit operating on three phase voltage. The induction disc is a thin four-inch diameter conducting disc mounted on a vertical shaft. The shaft is supported on the lower end by a steel ball bearing riding between concave sapphire jewel surfaces, and on the upper end by a stainless steel pin.

On the relays, the moving contact is a small silver rod hemispherically shaped at either end to form a double throw arrangement. It is fastened on the end of a conducting arm. The other end of this arm is clamped to an insulating tube on the disc shaft. The electrical connection is made from the moving contact thru the arm and a spiral spring. One end of the spring is fastened to the arm, and the other to a slotted spring adjusted disc which in turn fastens to the moulded insulation block mounted on the element.

The front and back stationary contact assemblies are both adjustable. Each mounts on a lever which can be set anywhere about the periphery of a calibrated scale. The moulded brackets, upon which the stationary contact leaf springs are mounted, are each secured to their respective lever arms by two screws. These screws may be loosened and the moulded contact supports pivoted to the positions required for correct tracking of both contact assemblies on the calibrated scale.

The relay electromagnet consists of a main potential coil, and two upper pole potential coils. The main coil is tapped, and the tap point is used as a neutral (not brought out) for a wye connection of the relay coils. The three legs of the wye are respectively, the two upper pole coils connected in series, and each half of the tapped main pole winding.

When energized by three phase voltages, the fluxes of the main and upper pole circuits react to produce torque on the induction disc. This torque is a function of the positive and negative sequence components of voltage, each set tending to produce opposite rotation of the induction disc. Thus positive sequence voltage tends to make the high voltage contacts close while negative sequence tends to close the low voltage contacts. A reversed phase (which means negative sequence phase rotation) will cause the relay low voltage contacts to trip. In addition, unbalance in the voltages impressed on the relay will also cause the low voltage contacts to close, if due to unbalance sufficient negative sequence voltage is present to reduce the relay torque to the low voltage tripping point.

* SUPERSEDES I.L. 41-222.1
Denotes change from superseded issue.

EFFECTIVE MAY 1958

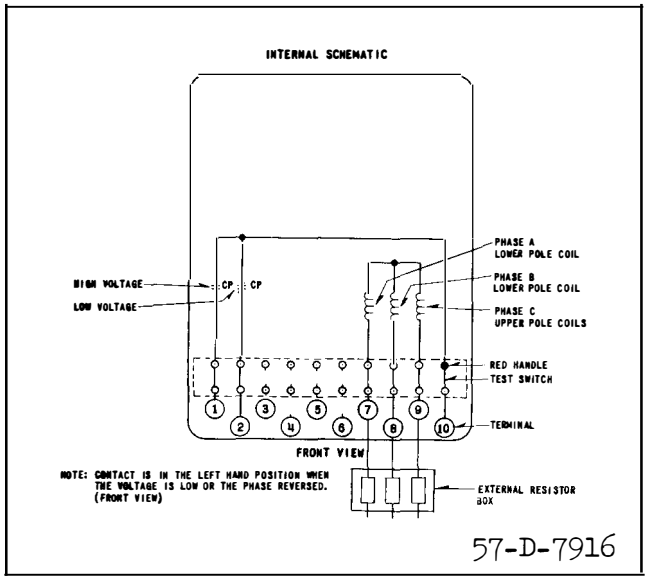


Fig. 1. Internal Schematic of the Type CP Relay in the Type FT21 Case.

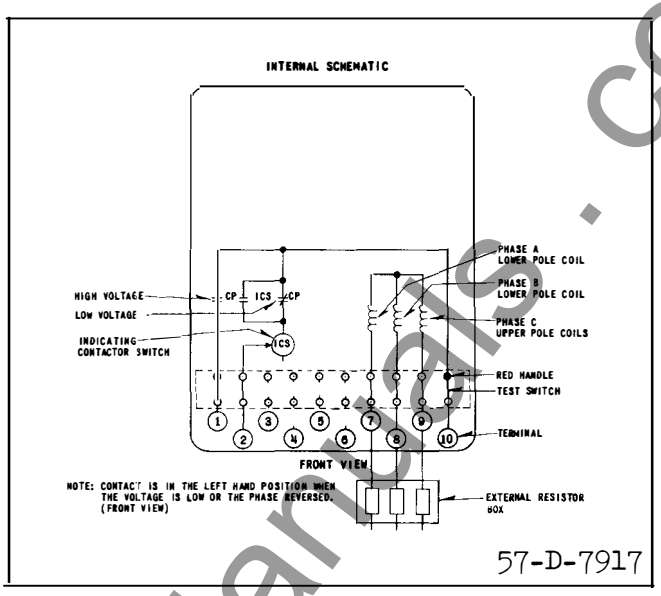


Fig. 2. Internal Schematic of the Type CP Relay in the Type FT21 Case with Indicating Contactor Switch in the Low Voltage Circuit.

Indicating Contactor Switch Unit (ICS) (When Supplied)

The d-c indicating contactor switch is a small clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the cover.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The type CP reverse phase relay has adjustable high and low voltage contacts which can be set around the periphery of a scale. For the 115 volt relay this scale is calibrated from 70 to 120 volts, and for the 230 volt relay, the scale is calibrated from 140 to 240 volts.

The voltage values indicated on the scale, represent balanced three phase voltages applied to the relay. The relay contacts will just close when the balanced three phase line to line voltages reach the value indicated by the pointer of either of the adjustable stationary contacts.

If the contacts are set to close for a particular line to line value of balanced three phase voltage, and if that exact voltage is applied, then the relay is operating at its minimum trip point and the times on repeated operations are not repetitive within close tolerances. However, voltages appreciably greater than the overvoltage setting, or appreciably less than the undervoltage setting, result in relay timing operations which are consistent for repeated trials.

The relay has inverse timing; that is, the greater the increase in voltage the faster the relay contact will travel. Typical time curves for various contact settings are shown in Figs. 3 and 4.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch (when supplied) will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch (when supplied) has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

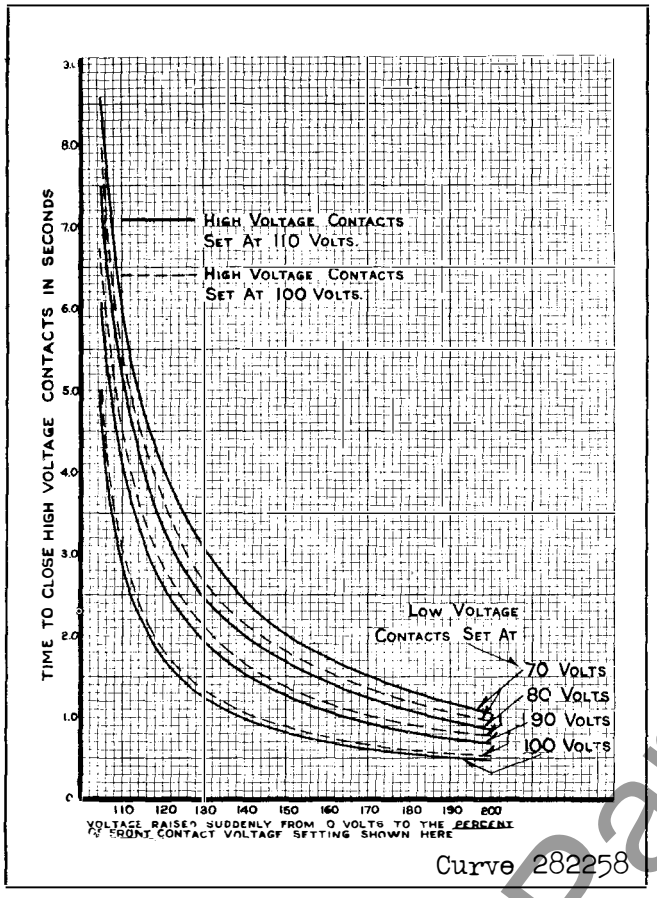


Fig. 3. Typical Overvoltage Time Curves for the Type CP Relay.

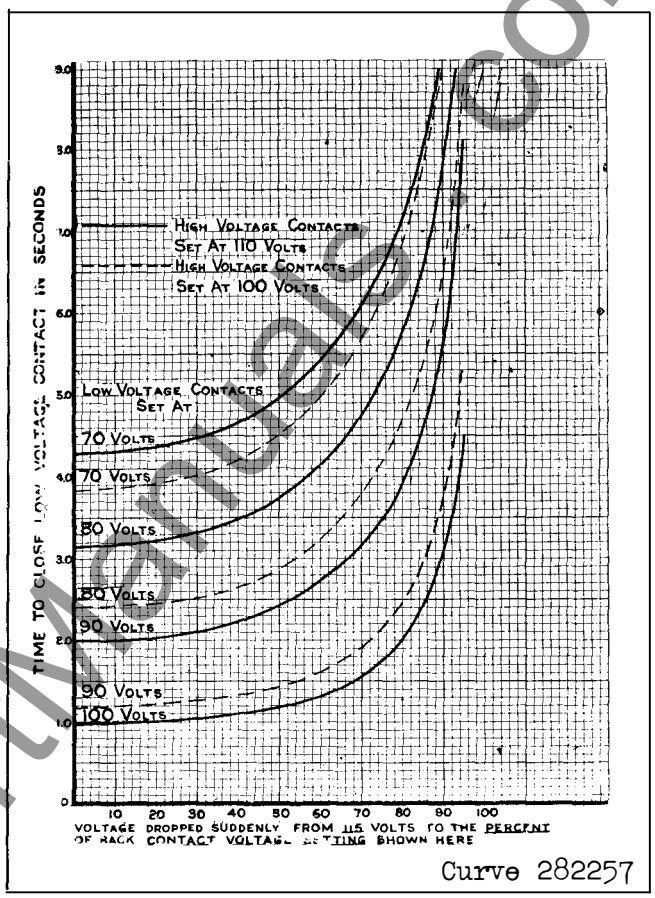


Fig. 4. Typical Undervoltage Time Curves for the Type CP Relay.

Trip Circuit Constant

Indicating contactor Switch (ICS) (When Supplied).

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed FT case information refer to I.L.41-076.

SETTINGS

There are two independent relay adjustments. These are the high voltage and low voltage contact settings as described under "Characteristics". These settings determine the balanced three phase line-to-line voltage at which the relay contacts trip. The relay timing is not an independent adjustment, since it is fixed by the contact settings chosen. Typical time curves for various contact settings are given in Figs. 3 and 4.

Indicating Contactor Switch (ICS) (When Supplied)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in nt of the tap block to the desired setting by eans of the connecting screw. When the relay

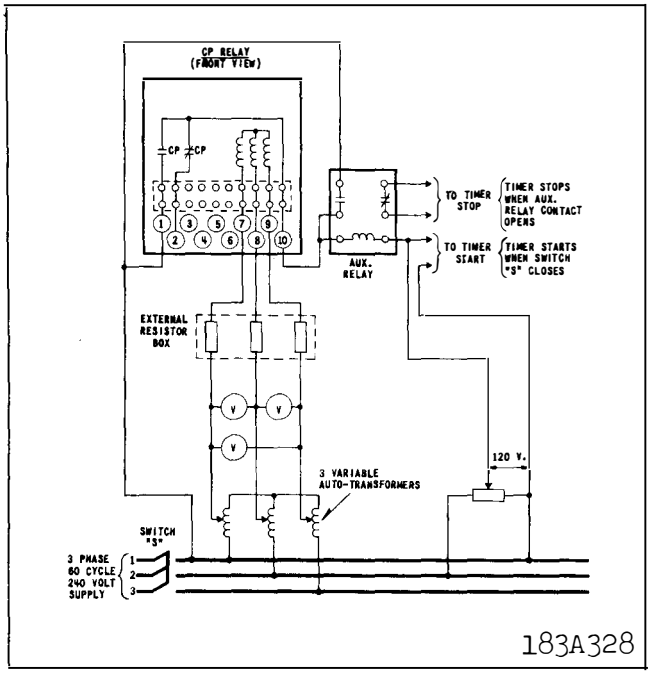


Fig. 5. Diagram of Test Connections for Checking the Overvoltage Time Curves of the Type CP Relay.

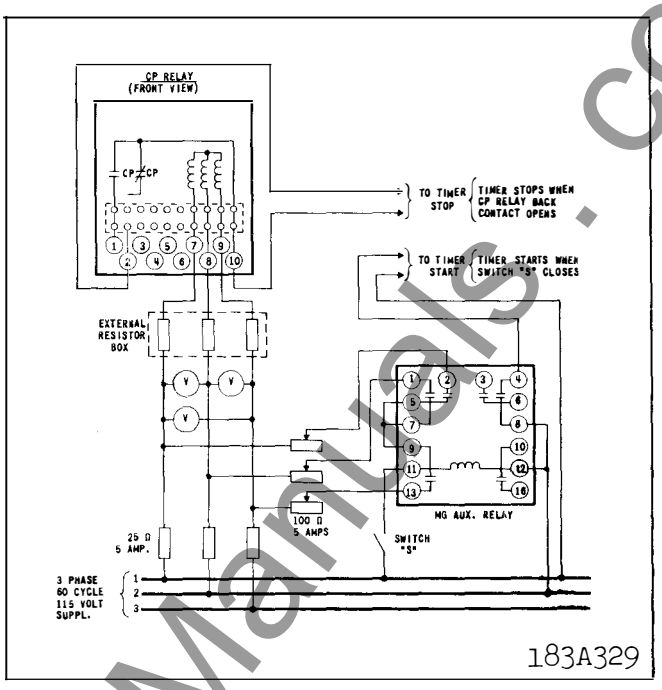


Fig. 6. Diagram of Test Connections for Checking the Undervoltage Time Curves of the Type CP Relay.

energizes a type WL relay switch, or equivalent, use the 0.2 ampere tap.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be disturbed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be cleaned periodically. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

The relay has front and back adjustable stationary contacts; to adjust these properly set the two levers so they are at approximately the mid-scale position with both pointers indicating the same voltage value on the scale. Then adjust the position of the front and back contacts so they both just touch on either side of the moving contact. This is done by loosening the two screws at the top of each lever and rotating the adjustable contact assembly slightly until the desired contact positions are obtained. The screws should be tightened securely.

To check the relay calibration, and adjustable three phase voltage source must be used. Various balanced three phase voltages may be impressed on the relay, and the position of the adjustable contacts checked for the various values. This may be best done by means of an indicating lamp suitably connected in the trip circuit.

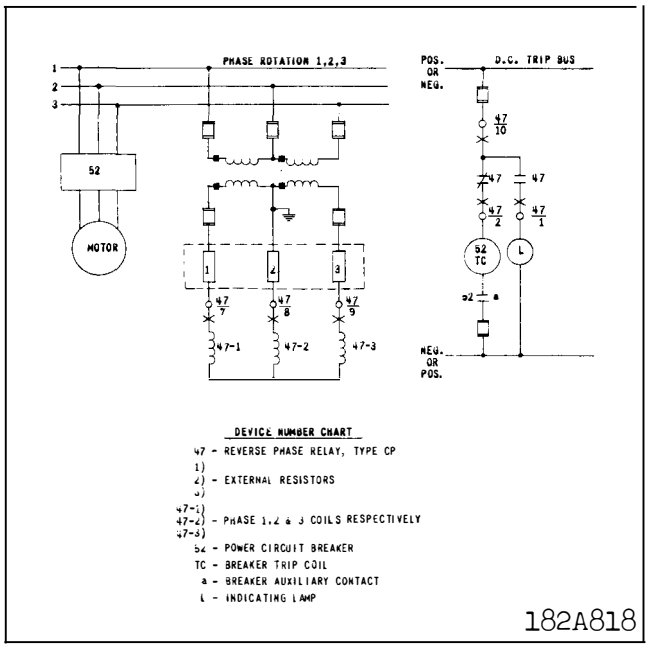
If readjustments are necessary, they can be made by rotating the notched spring adjuster with a screw driver blade inserted in one of the notches.

The relay time curves may be checked with the arrangements given in Figs. 5 and 6 the former for the overvoltage curve, the latter for the undervoltage curve.

Indicating Contactor Switch (ICS) (When Supplied)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS tap setting being used. The indicator target should drop freely.

* The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.



* *Fig. 7. External Schematic Diagram of the Type CP Relay in the Type FT21 Case.*

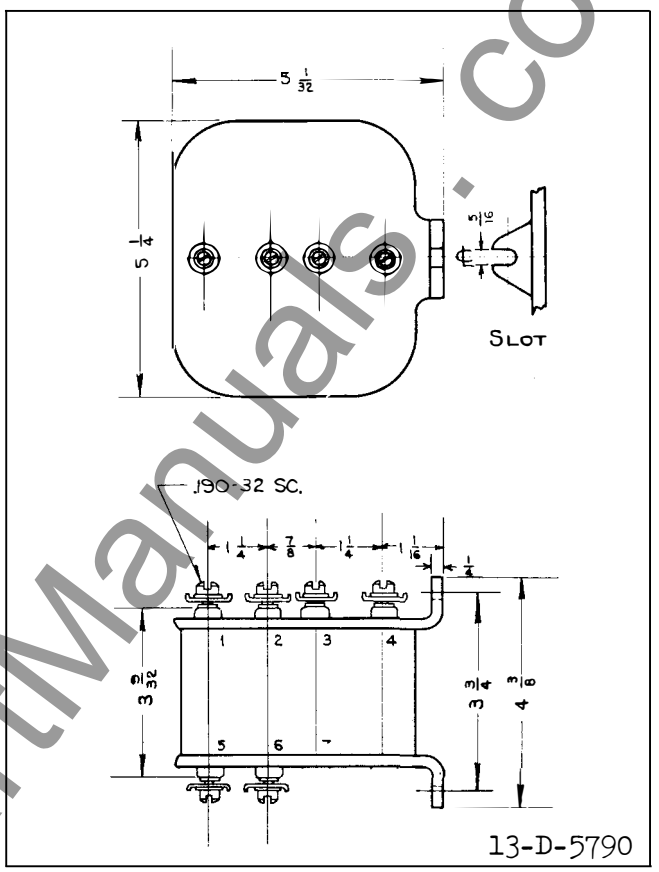


Fig. 8. Outline and Drilling Plan of the External Resistor Box.

REPAIRS AND RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

The type CP Relay when energized at 115 volts balanced 3 phase, and with the external resistance box connected, has the following VA burdens for each phase.

	Watts	Vars	VA	Lagging Power Factor Angle
Phase A	8.5	.30	8.5	2.0°
Phase B	9.0	1.6	9.1	10.2°
Phase C	7.6	1.2	7.7	9.0°

The continuous voltage rating of the relays is 110% of rated voltage.

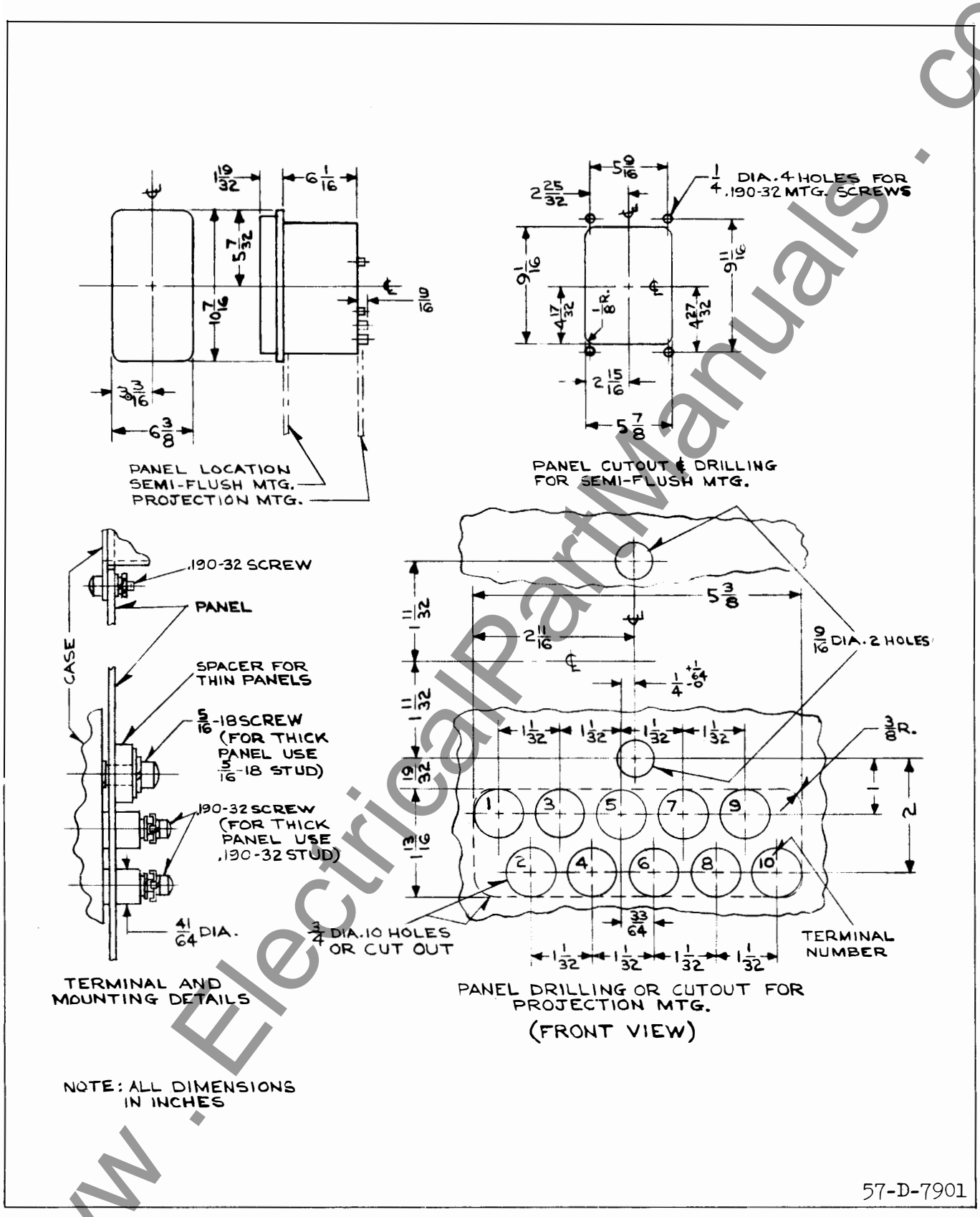


Fig. 9. Outline and Drilling Plan for the Type CP Relay in the Type FT21 Case.

WESTINGHOUSE ELECTRIC CORPORATION
METER DIVISION
NEWARK, N.J.
Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CP REVERSE PHASE RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type CP reverse-phase relay operates upon phase reversal to disconnect motors from the circuit. However if one phase opens resulting from a blown fuse or some similar interruption of service, with polyphase motors operating on the system, the relay may not operate unless the motors are so heavily loaded that normal voltage cannot be maintained on all phases. Normally, the relay will operate as soon as the machines are stopped, thus preventing them from being started again if one phase wire is open.

Since the relay is essentially a three phase contact making voltmeter, it may also be applied to close one set of contacts on 3 phase overvoltage conditions, and the other set of contacts on three phase undervoltage conditions.

CONSTRUCTION AND OPERATION

The type CP relay consists of an induction disc type element, a contactor switch, and an operation indicator when supplied. In addition an external box containing three resistors is supplied. Each of these resistors is to be connected in series with one phase winding of the relay.

The operating element is an induction disc type element operating on three phase voltage. The induction disc is a thin four-inch diameter conducting disc mounted on a vertical shaft. The shaft is supported on the lower end by a steel ball bearing riding between concave sapphire jewel surfaces, and on the upper end by a stainless steel pin.

On the single pole relays, the moving contact is a small silver rod hemispherically shaped at either end to form a double throw arrangement. It is fastened on the end of a conducting arm. The other end of this arm is clamped to an insulating tube on the disc shaft. The electrical connection is made from the moving contact thru the arm and a spiral spring. One end of the spring is fastened to the arm, and the other to a slotted spring adjusted disc which in turn fastens to the moulded insulation block mounted on the element.

On the double pole relays, two silver contacts are fastened (one vertically above the other) to the end of the conducting arm. The stationary contacts may be wired to provide a double pole, double throw contact arrangement, or may be supplied to give an independent front and back tripping arrangement with the moving contacts acting as a conducting bridge.

The front and back stationary contact assemblies are both adjustable. Each mounts on a lever which can be set anywhere about the periphery of a calibrated scale. The moulded brackets, upon which the stationary contact leaf springs are mounted, are each secured to their respective lever arms by two screws. These screws may be loosened and the moulded contact supports pivoted to the positions required for correct tracking of both contact assemblies on the calibrated scale.

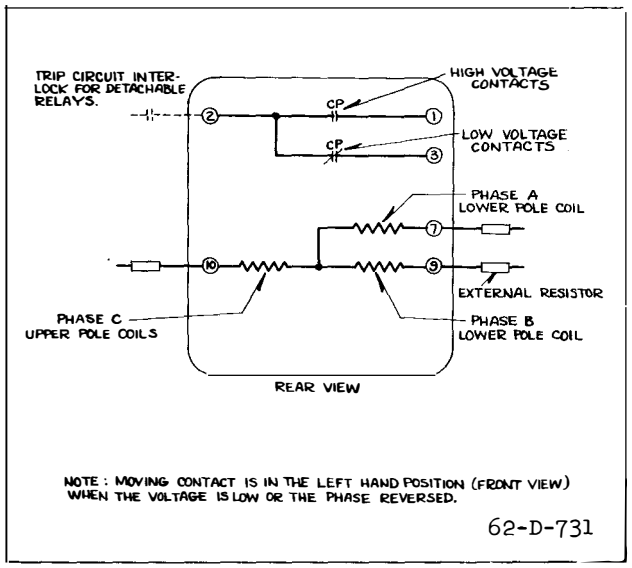


Fig. 1—Internal Schematic of The Type CP Relay in the Standard Case Without Operation Indicator or Contactor Switch.

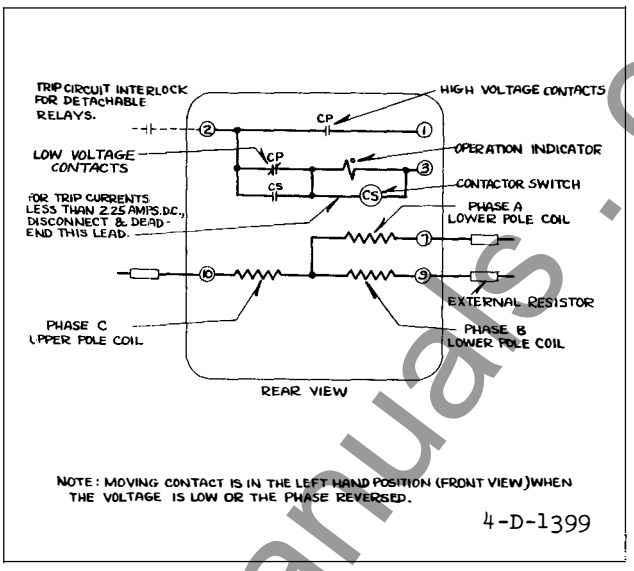


Fig. 2—Internal Schematic of The Type CP Relay in the Standard Case With Operation Indicator and Contactor Switch in the Low Voltage Circuit.

The relay electromagnet consists of a main potential coil, and two upper pole potential coils. The main coil is tapped, and the tap point is used as a neutral (not brought out) for a WYE connection of the relay coils. The three legs of the WYE are respectively, the two upper pole coils connected in series, and each half of the tapped main pole winding.

When energized by three phase voltages, the fluxes of the main and upper pole circuits react to produce torque on the induction disc. This torque is a function of the positive and negative sequence components of voltage, each set tending to produce opposite rotation of the induction disc. Thus positive sequence voltage tends to make the high voltage contacts close while negative sequence tends to close the low voltage contacts. A reversed phase (which means negative sequence phase rotation) will cause the relay low voltage contacts to trip. In addition, unbalance in the voltages impressed on the relay will also cause the low voltage contacts to close, if due to unbalance sufficient negative sequence voltage is present to reduce the relay torque to the low voltage tripping point.

Contactor Switch (When Supplied)

The d-c contactor switch in the relay is a small solenoid type switch. A cylindrical plunger with a silver disc mounted on its lower end moves in the core of the solenoid. As the plunger travels upward, the disc bridges three silver stationary contacts. The coil is in series with the main contacts of the relay and with the trip coil of the breaker. When the relay contacts close, the coil becomes energized and closes the switch contacts. This shunts the main relay contacts, thereby relieving them of the duty of carrying tripping current. These contacts remain closed until the trip circuit is opened by the auxiliary switch on the breaker.

Operation Indicator (When Supplied)

The operation indicator is a small solenoid coil connected in the trip circuit. When the coil is energized, a spring-restrained armature releases the white target which falls by gravity to indicate completion of the trip circuit. The indicator is reset from outside of the case by a push rod in the cover or cover stud.

CHARACTERISTICS

The type CP reverse phase relay has adjustable high and low voltage contacts which can be set around the periphery of a scale. For

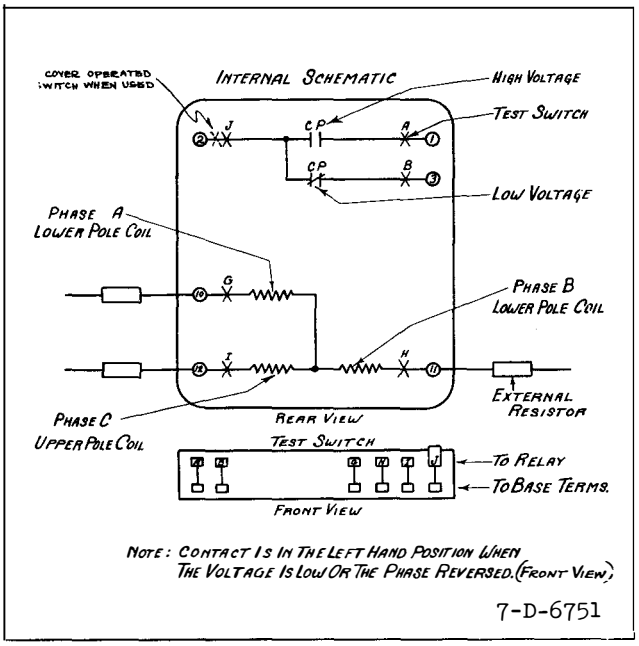


Fig. 3—Internal Schematic of The Type CP Relay in the Type FT Case Without Operation Indicator or Contactor Switch.

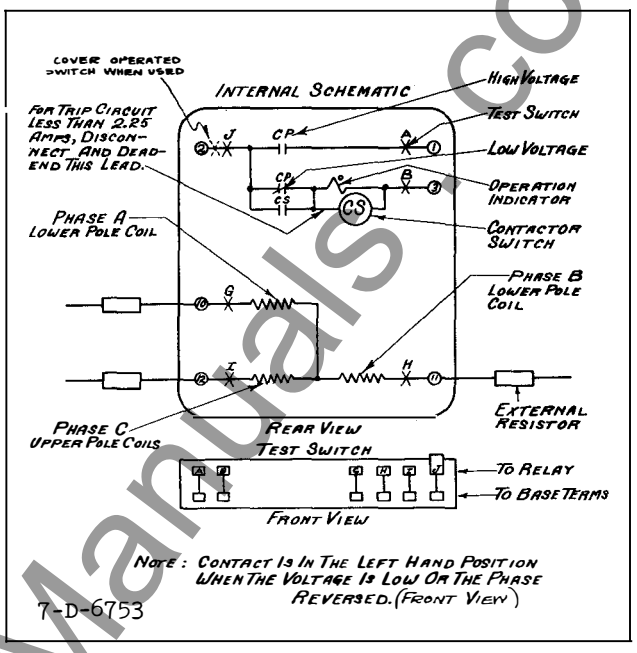


Fig. 4—internal Schematic of The Type CP Relay in the Type FT Case With Operation Indicator and Contactor Switch in the Low Voltage Circuit.

the 115 volt relay this scale is calibrated from 70 to 120 volts, and for the 230 volt relay, the scale is calibrated from 140 to 240 volts.

The voltage values indicated on the scale, represent balanced three phase voltages applied to the relay. The relay contacts will just close when the balanced three phase line to line voltages reach the value indicated by the pointer of either of the adjustable stationary contacts.

If the contacts are set to close for a particular line to line value of balanced three phase voltage, and if that exact voltage is applied, then the relay is operating at its minimum trip point and the times on repeated operations are not repetitive within close tolerances. However, voltages appreciably greater than the overvoltage setting, or appreciably less than the undervoltage setting, result in relay timing operations which are consistent for repeated trials.

The relay has inverse timing; that is, the greater the increase in voltage the faster the relay contact will travel. Typical time curves for various contact settings are shown in Figures 5 and 6.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration and heat. Mount the relay vertically by means of the two mounting studs for the standard cases and the type FT projection case or by means of the four mounting holes on the flange for the semi-flush type FT case. Either of the studs or the mounting screws may be utilized for grounding the relay. The electrical connections may be made direct to the terminals by means of screws for steel panel mounting or to terminal studs furnished with the relay for ebony-asbestos or slate panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the studs and then turning the proper nut with a wrench.

The relays with operation indicator and contactor switch are normally supplied with the universal connection, which consists of the 0.2 ampere indicator (Resistance = 2.8 ohms) and the 2.0 ampere contactor switch (Resistance = .25 ohm) in parallel. This provides a trip circuit resistance of approxi-

mately 0.25 ohm, and is suitable for all trip currents above 2.25 amperes d-c. If the trip current is less, disconnect the contactor switch coil. To disconnect the coil in the standard case relays, remove the short lead to the coil on the front stationary contact of the switch. This lead should be fastened (dead ended) under the small filister head screw located in the Micarta base of the contactor switch. To disconnect the coil in the type FT case relays, remove the coil lead at the spring adjuster and dead end it under the screw near the top of the moulded bracket.

SETTINGS

There are two independent relay adjustments. These are the high voltage and low voltage contact settings as described under "Characteristics". These settings determine the balanced three phase line-to-line voltage at which the relay contacts trip. The relay timing is not an independent adjustment, since it is fixed by the contact settings chosen. Typical time curves for various contact settings are given in Figures 5 & 6.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be disturbed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

* All contacts should be cleaned periodically. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

The relay has front and back adjustable stationary contacts; to adjust these properly set the two levers so they are at approximately the mid-scale position with both pointers indicating the same voltage value on the scale. Then adjust the position of the front and back contacts so they both just touch on either side of the moving contact. This is done by loosening the two screws at the top of each lever and rotating the adjustable contact assembly slightly until the desired contact positions are obtained. The screws should be tightened securely.

To check the relay calibration, and adjustable three phase voltage source must be used. Various balanced three phase voltages may be impressed on the relay, and the position of the adjustable contacts checked for the various values. This may be best done by means of an indicating lamp suitably connected in the trip circuit.

If readjustments are necessary, they can be made by rotating the notched spring adjuster with a screw driver blade inserted in one of the notches.

The relay time curves may be checked with the arrangements given in Figures 7 and 8 the former for the overvoltage curve, the latter for the undervoltage curve.

Operation Indicator (When Supplied)

Adjust the indicator to operate at 0.2 ampere d-c gradually applied by loosening the two screws on the underside of the assembly, and moving the bracket forward or backward. If the two helical springs which reset the armature are replaced by new springs, they should be weakened slightly by stretching to obtain the .2 ampere calibration. The coil resistance is approximately 2.8 ohms.

Contactor Switch (When Supplied)

Adjust the stationary core of the switch for a clearance between the stationary core and the moving core when the switch is picked

up. This can be most conveniently done by turning the relay up-side-down. Screw up the core screw until the moving core starts rotating. Now, back off the core screw until the moving core stops rotating. This indicates the point where the play in the moving contact assembly is taken up and where the core just separates from the stationary core screw. Back off the stationary core screw one turn beyond this point and lock in place. This prevents the moving core from striking and sticking to the stationary core because of residual magnetism. Adjust the contact clearance for 3/32 inch by means of the two small nuts on either side of the Micarta disc. The switch should pick up at 2 amperes d-c. Test for sticking after 30 amperes d-c have been passed thru the coil. The coil resistance is approximately 0.25 ohms.

REPAIRS AND RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

The type CP Relay when energized at 115 volts balanced 3 phase, and with the external resistance box connected, has the following VA burdens for each phase.

	Watts	Vars	VA	Lagging Power Factor Angle
Phase A	8.5	.30	8.5	2.0°
Phase B	9.0	1.6	9.1	10.2°
Phase C	7.6	1.2	7.7	9.0°

The continuous voltage rating of the relays is 110% of rated voltage.

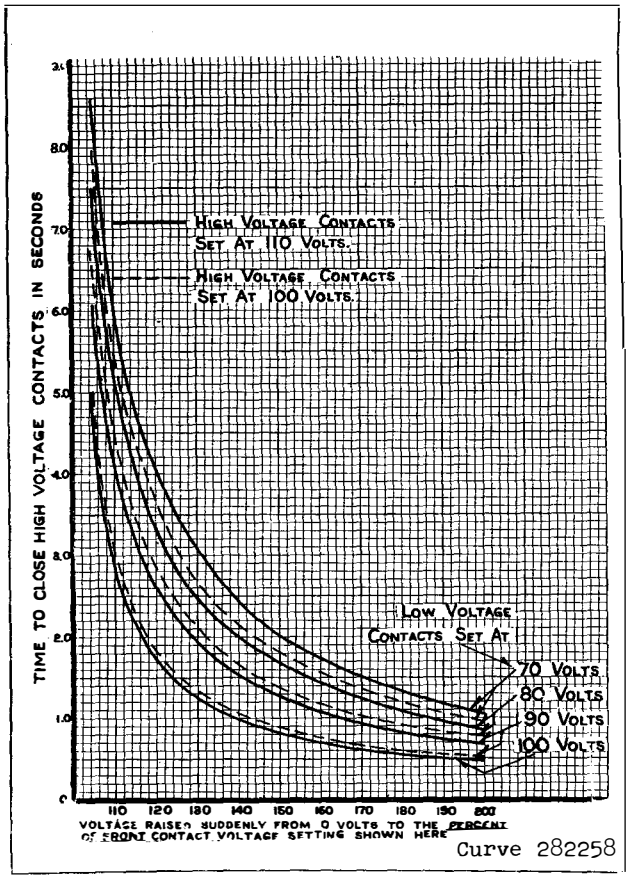


Fig. 5—Typical Overvoltage Time Curves for the Type CP Relay.

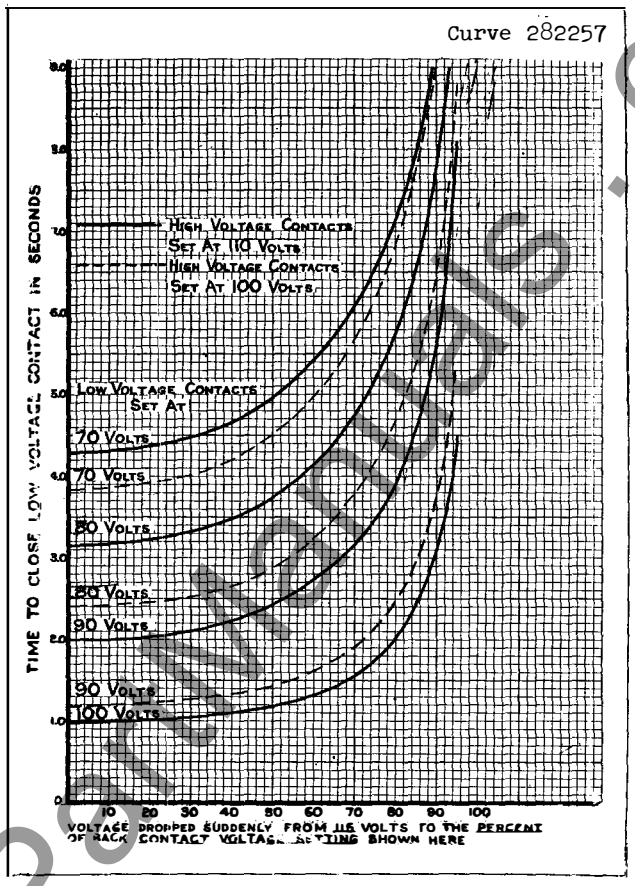


Fig. 6—Typical Undervoltage Time Curves for the Type CP Relay.

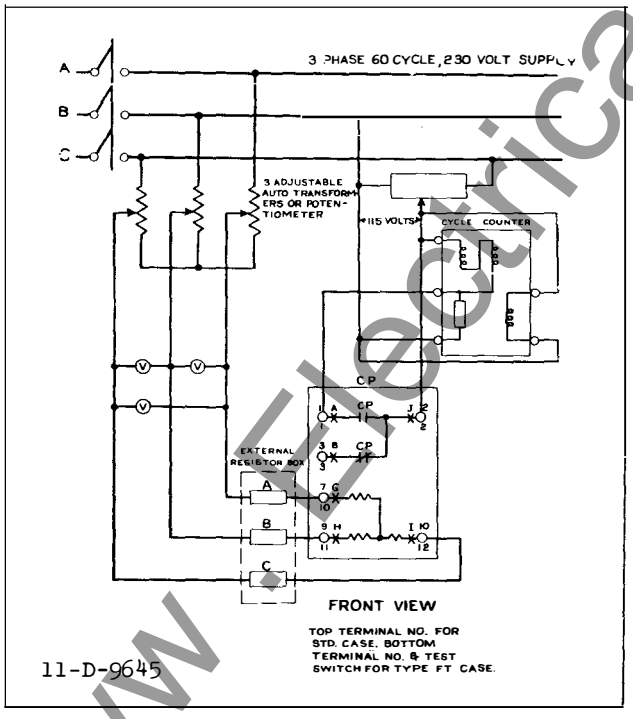


Fig. 7—Diagram of Test Connections for Checking The Overvoltage Time Curves of the Type CP Relay.

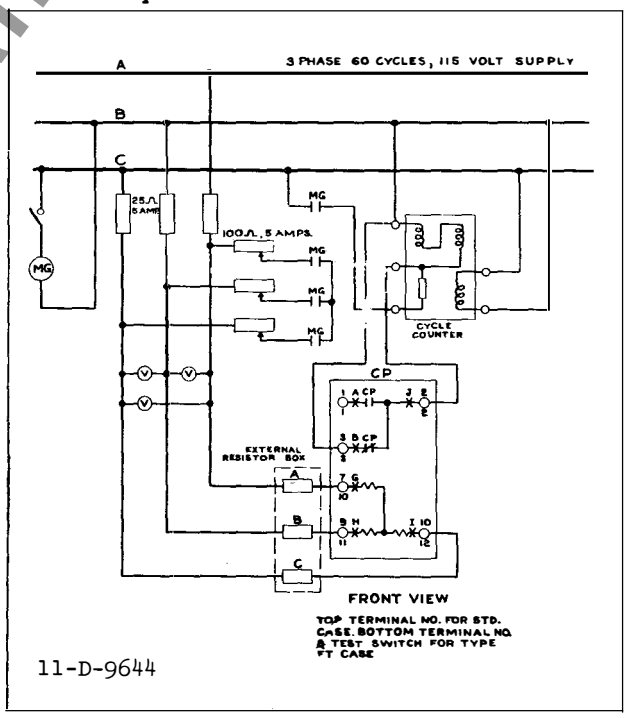


Fig. 8—Diagram of Test Connections for Checking The Undervoltage Time Curves of the Type CP Relay.

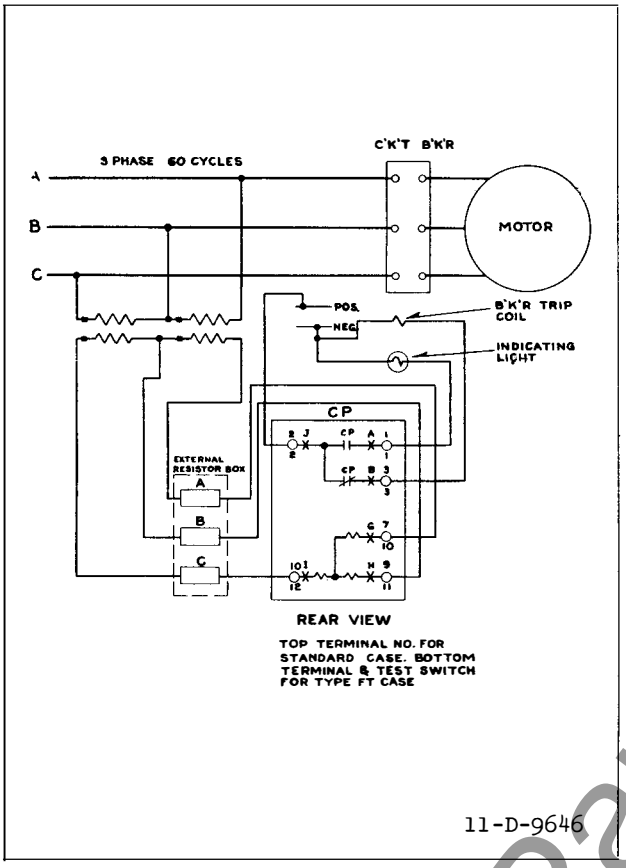


Fig. 9—Typical External Connections of the Type CP Reverse Phase Relay.

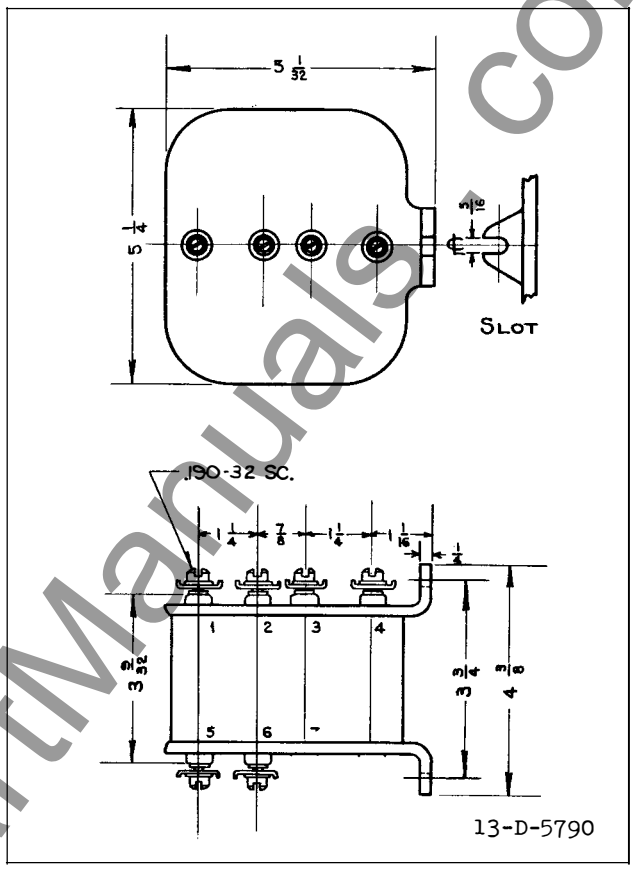


Fig. 10—Outline and Drilling Plan of the External Resistor. For Reference Only.

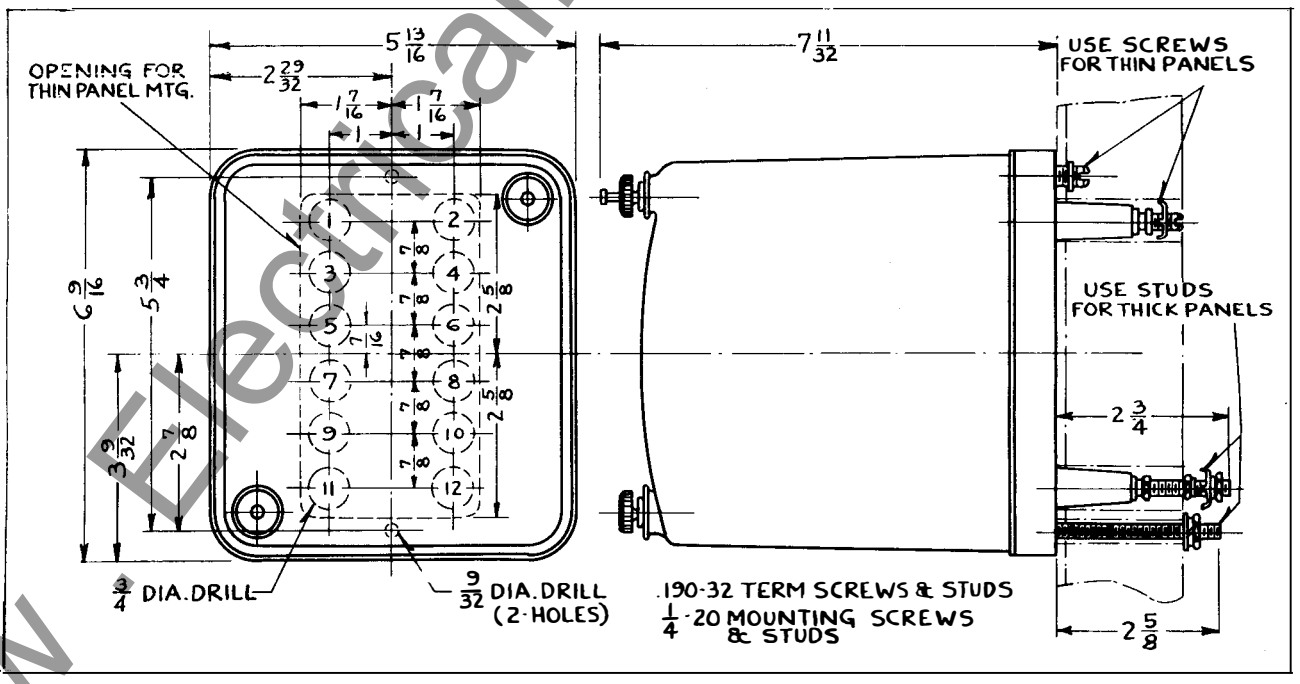


Fig. 11—Outline and Drilling Plan for The Standard Projection Case. See the Internal Schematic for The Terminals Supplied. For Reference Only.

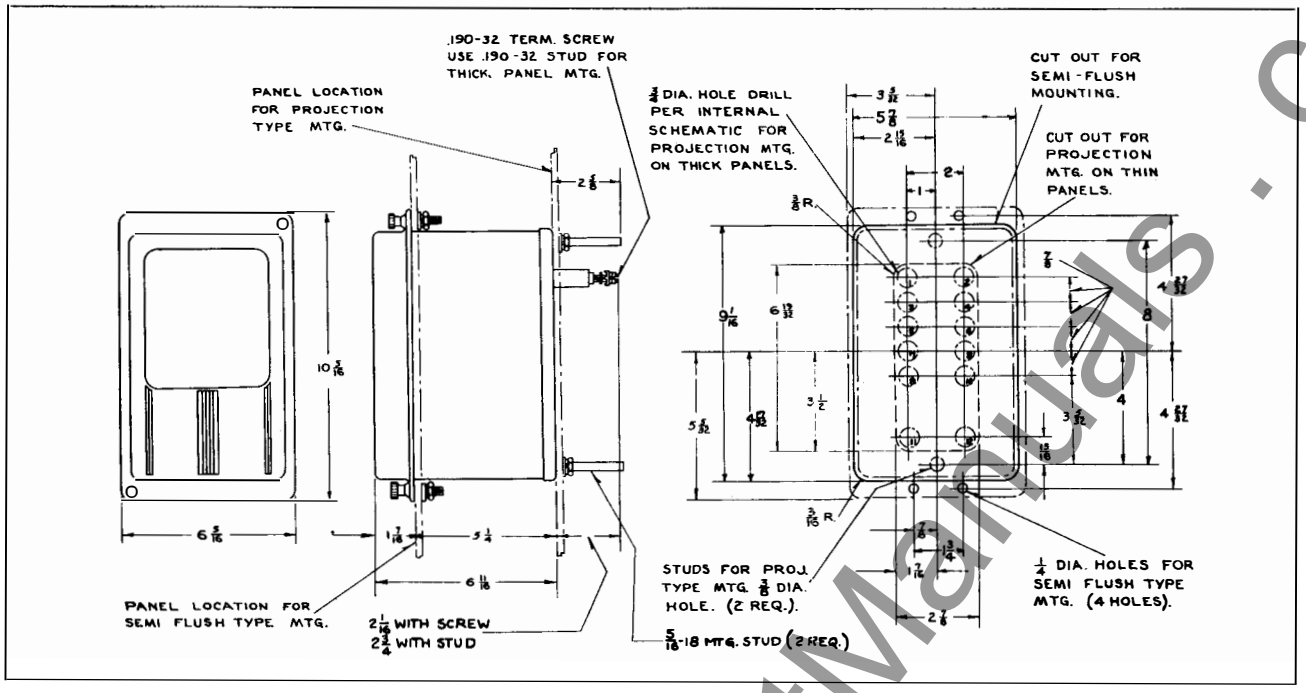


Fig. 12—Outline and Drilling Plan for the S10 Projection or Semi-Flush Type FT Flexitest Case. See the Internal Schematics for the Terminals Supplied. For Reference Only.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CP REVERSE PHASE RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type CP relay is a three phase induction disc type relay that operates upon phase reversal to disconnect a motor from a circuit. The relay may not operate for an open phase on the motor unless the motor is so heavily loaded that normal voltage cannot be maintained on all phases. Normally, the relay will operate as soon as the machine is stopped and prevent it from being started again if one phase wire is open.

This relay may also be applied to close its contacts on either three phase overvoltage or three phase undervoltage conditions on a system. For example, one relay is used to initiate source breaker trip and another relay is used to supervise alternate source breaker closing on automatic bus transfer schemes.

The CVQ relay performs a similar function for motor protection – supervision of supply breaker closing, low-voltage, and single-phasing protection. The CVQ is a more sophisticated relay, providing more sensitive single-phasing protection than does the CP relay; that is, the CVQ will detect single-phasing of a predominately motor load, where the motors are lightly loaded.

CONSTRUCTION AND OPERATION

The type CP relay consists of a three phase voltage unit, an indicating contactor switch when supplied, and an indicating voltage switch when supplied. The principal component parts of the relay and their location are shown in figure 1.

A. Voltage Unit (CP)

The electromagnet is an "E" type laminated structure with a coil mounted on each leg. A wye connection is formed by connecting one lead of each coil together. The other lead of the coils are connected to separate phases of a three phase system.

When the coils are energized with a three phase voltage, a flux is induced in each leg of the electromagnet. These fluxes are out-of-phase with respect to each other since they are induced by out-of-phase voltages. The path of the three fluxes is across an air gap in which a disc is located. The out-of-phase fluxes cause a torque to be produced on the disc which moves to a position in its travel that corresponds to the three phase voltage applied to the electromagnet. The disc will remain in this position until the applied three phase voltage is changed, at which time, the disc will move to a new position that corresponds to the new voltage.

The out-of-phase fluxes are such that a positive sequence voltage tends to close the high voltage contact while a negative sequence voltage tends to close the low voltage contact. A reversed phase (which means negative sequence phase rotation) will cause the relay's low voltage contact to close. This contact will also close on unbalance voltages that contain a negative sequence component sufficient to reduce the relay torque to its low voltage trip point.

B. Indicating Contactor Switch (ICS)

The indicating contactor switch is a small d-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also, during this operation two fingers on the armature deflect a spring located on

All possible contingencies which may arise during installation, operation, or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding his particular installation, operation or maintenance of his equipment, the local Westinghouse Electric Corporation representative should be contacted.

SUPERSEDES I.L. 41-222.2F, dated Jan. 1975

✪Denotes change from superseded issue.

EFFECTIVE SEPTEMBER 1977

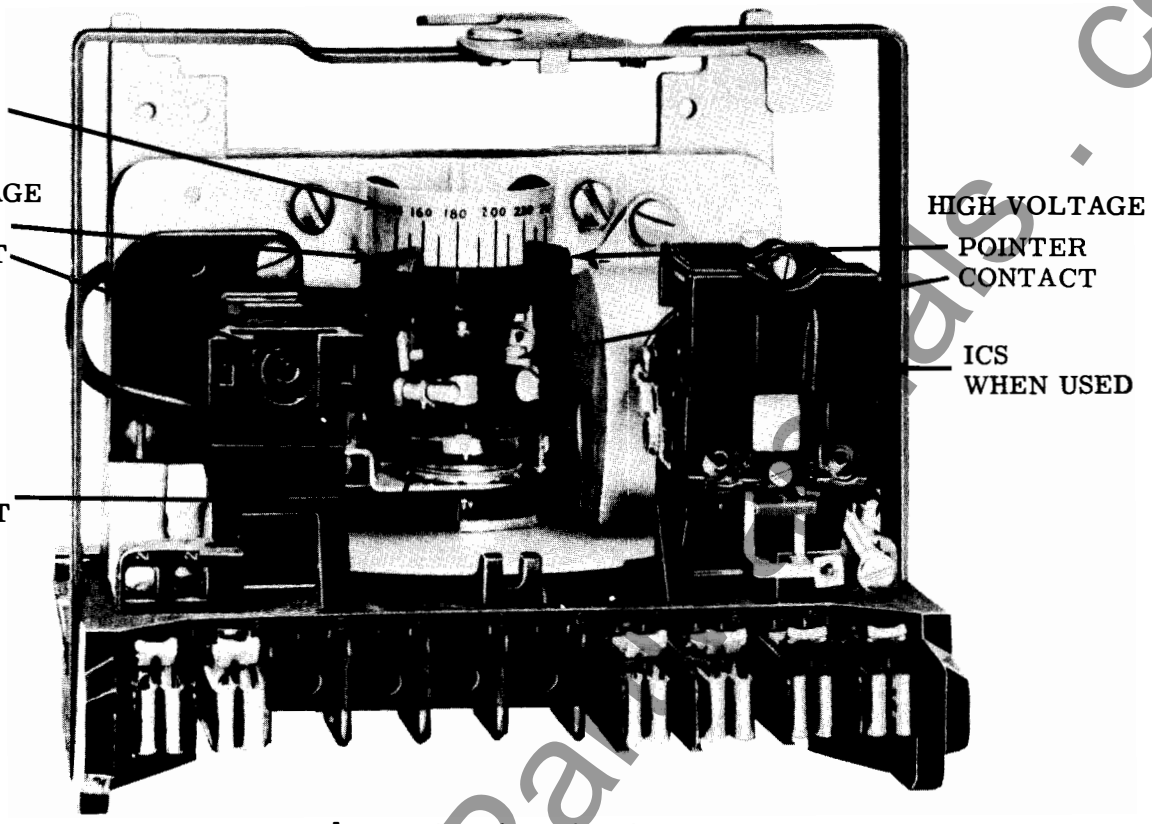
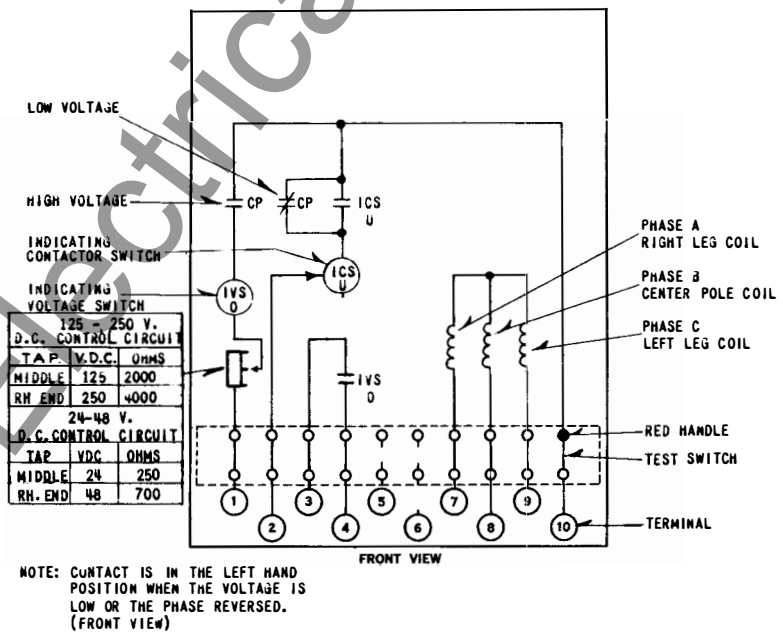


Fig. 1. Type CP Relay Without Case.



125 - 250 V. D.C. CONTROL CIRCUIT		
TAP	V.D.C.	OHMS
MIDDLE	125	2000
RH END	250	4000
24-48 V. D.C. CONTROL CIRCUIT		
TAP	VDC	OHMS
MIDDLE	24	250
RH. END	48	700

NOTE: CONTACT IS IN THE LEFT HAND POSITION WHEN THE VOLTAGE IS LOW OR THE PHASE REVERSED. (FRONT VIEW)

184A202

Fig. 2. Internal Schematic of the Type CP Relay with independent contacts in the Type FT11 case.

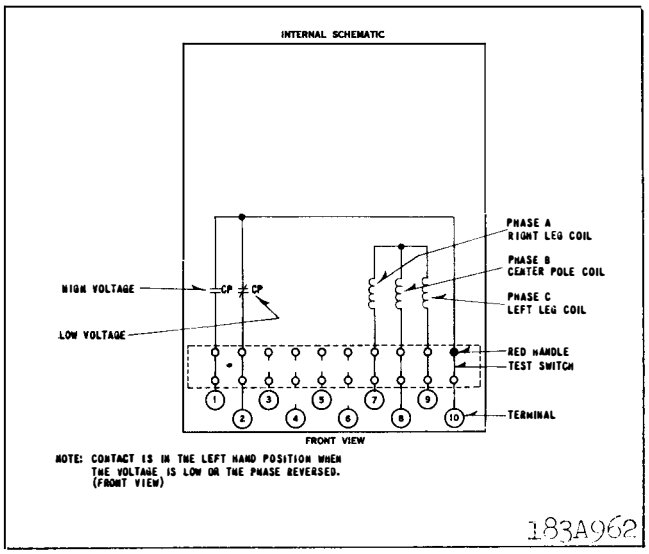


Fig. 3. Internal Schematic of the Type CP Relay in the Type FT11 Case.

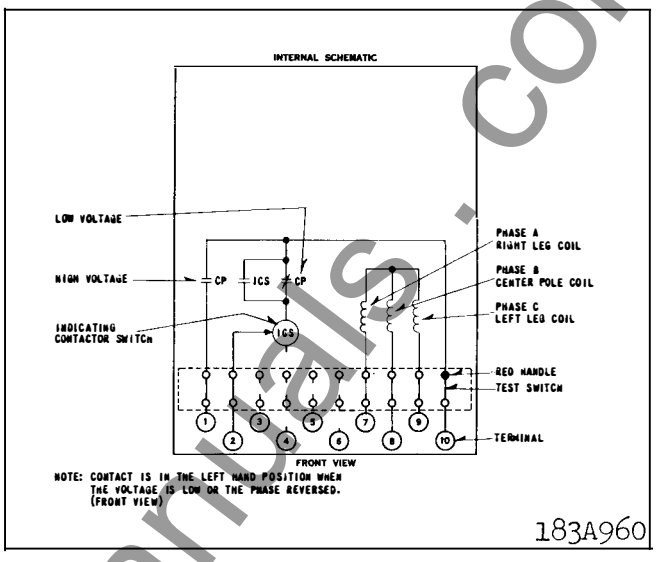


Fig. 4. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the Low Voltage Circuit in the Type FT11 Case.

the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the case.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

An AC indicating contact switch (ACS) is used where the relay contacts connect to an AC trip or control circuit.

C. Indicating Voltage Switch (IVS)

The indicating voltage switch has the same construction as the indicating contactor switch.

CHARACTERISTICS

The type CP relay has adjustable high and low voltage contacts which can be set around the periphery of a scale. The range of adjustment of the contacts are as follows:

120 volt relay	70 to 120 volts
240 volt relay	140 to 240 volts
480 volt relay	280 to 480 volts
208 volt relay	120 to 220 volts

If either of the adjustable contacts are set for a value of voltage within these ranges, the relay will just close its contacts when the balanced three phase line to line voltages equal this value. For such a condition, the relay is operating at its minimum trip point, and the operating times on repeated operations are not repetitive within close tolerances. However, voltages greater than the overvoltage setting or less than the undervoltage setting, result in relay timing operations which are consistent for repeated trials.

The relay has inverse timing; that is, the greater the increase in voltage the faster the relay contacts will close. Typical time curves for various contact settings are shown in figures 6 and 7.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch (when supplied) will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch (when supplied) has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constont

Indicating contactor switch (ICS) (When Supplied).

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

Indicating Voltage Switch (IVS) (When Supplied)

The indicating voltage switch (IVS) has a series resistor. The IVS will operate when 80% d.c. rated voltage is applied to the IVS circuitry.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration and heat. Mount the relay vertically by means of the rear mounting stud or studs for the type FT projection case or by means of the four mounting holes on the flange for the semi-flush type FT case. Either the stud or the mounting screws may be utilized for grounding the relay. Ex-

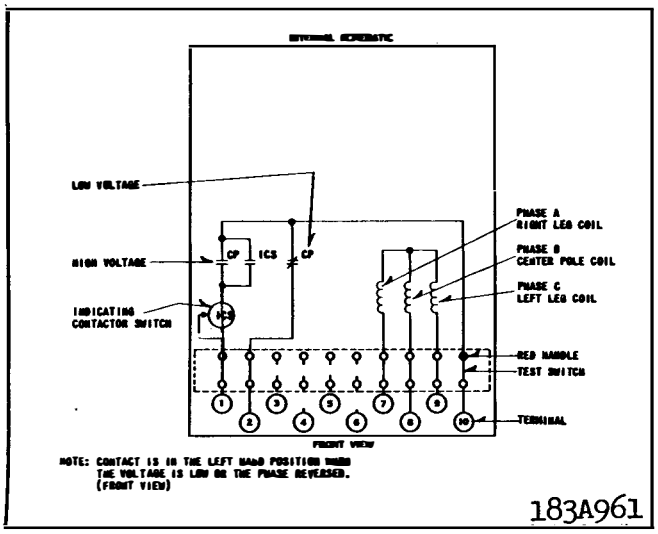


Fig. 5. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the High Voltage Circuit in the Type FT11 Case.

ternal toothed washers are provided for use in the locations shown on the outline and drilling plan to facilitate making a good electrical connection between the relay case, its mounting screws or studs, and the relay panel. Ground wires are affixed to the mounting screws or studs as required for poorly grounded or insulating panels. Other electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal stud furnished with the relay for thick panel mounting. The terminal stud may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detail information on the FT case refer to I.L. 41-076.

SETTINGS

There are two independent relay adjustments. These are the high and low voltage contact settings as described under "Characteristics". These settings determine the balanced three phase line-to-line voltage at which the relay contacts trip. The relay timing is not an independent adjustment, since it is fixed by the contact settings chosen. Typical time curves for various contact settings are given in Figs. 6 and 7.

For motor protection set the low-voltage contact at the minimum permissible operating voltage. (This contact may also close when the motor is operated single-phased, provided the open phase voltage is not held too close to normal by the motor. A motor operating near full load or a motor connected in parallel with substantial static load will not be able to maintain near normal open-phase voltage.) Where the high voltage contact supervises supply breaker closing, it must be set lower than normal voltage. For example, set the high-voltage contact at 90% and the low-voltage contact at 80% of rated voltage. The high and low voltage contacts must be sufficiently separated to allow for a minimum contact gap of about 0.020 inches. This corresponds to a voltage setting separation of about 7%.

Indicating Contactor Switch (ICS) (When Supplied)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energizes a 125 volt or 250 volt d.c. type WL relay switch, or equivalent, use the 0.2 ampere tap. For 48 volt d.c. applications set ICS in 2 ampere tap and use S#304C209G01 type WL relay or equivalent.

Indicating Voltage Switch (IVS) (When Supplied)

No setting is required on the IVS unit except for the selection of the required voltage tap on the tapped resistor.

ADJUSTMENT AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no adjustments, other than those covered under "Settings", should be required.

Acceptance Check

The following check is recommended to insure that the relay is in proper working order:

A. CP Unit

1. Contacts — Set the left-hand adjustable contact in the center of the scale and adjust the voltage until the moving contact just makes. Set the left-hand contact back out of the way and bring the right-hand contact up until the contacts just make. The pointer should be within ± 1/32" of where the left-hand pointer was.

2. Minimum Trip Voltages — Check the scale markings by setting either of the two contacts at a value marked on the scale, then alternately apply this voltage plus 3% and minus 3%. Contacts should make and break.

   Check all of the scale markings in a similar manner.

3. Time Curve — The time curve can be checked by the use of the circuits of Figs. 8 and 9.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient

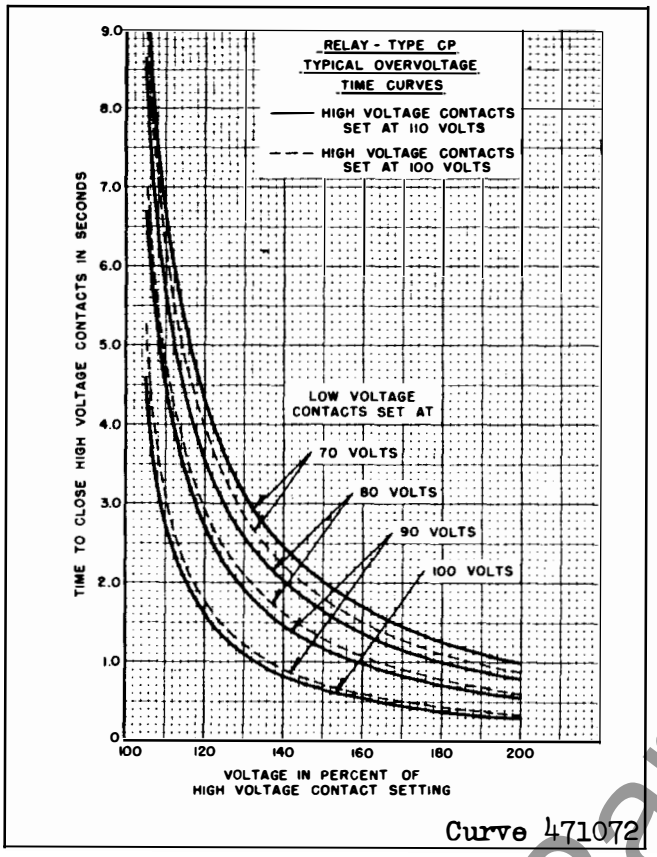


Fig. 6. Typical Overvoltage Time Curves for the Type CP Relay.

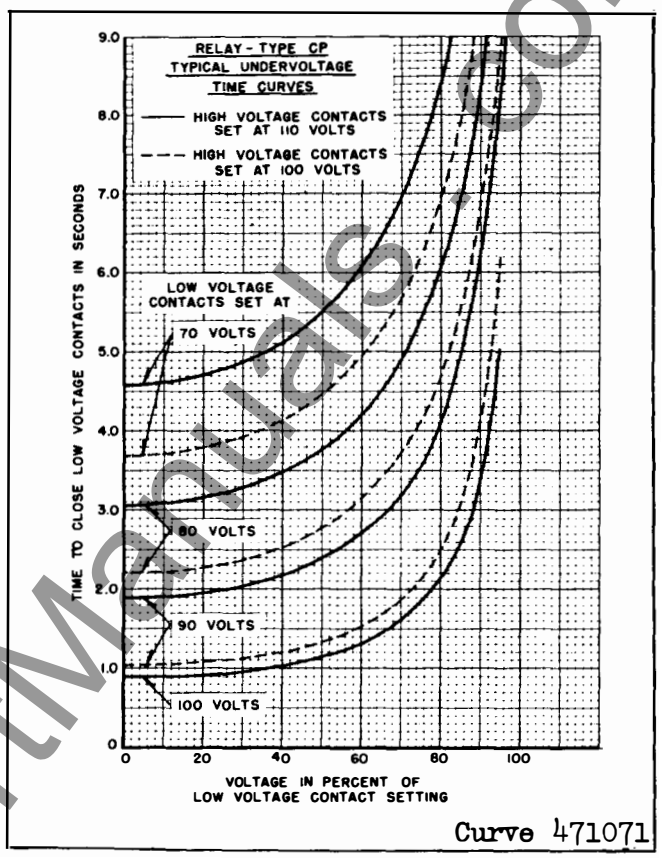


Fig. 7. Typical Undervoltage Time Curves for the Type CP Relay.

d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

C. Indicating Voltage Switch (IVS)

Close the main relay contacts and apply rated d-c voltage across terminals 1 and 10. The contacts of the IVS unit should close and the indicator target should drop freely.

Routine Maintenance

All relays should be inspected periodically and the time of operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application.

All contacts should be periodically cleaned. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver contact and thus impairing the contact.

Calibration

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs, or the adjustments have been disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order (See "Acceptance Check").

A. CP Unit

1. Contacts – Apply sufficient voltage to the relay, to make the disc float in the center of its travel. Move either of the adjustable contacts until it just makes with the moving contact. If the two contacts pointers do not meet at the same point on the scale, adjust the follow on both adjustable contacts. The contacts should just make with the moving contacts when the pointers meet on the scale. Approximately the same follow should be in each of the adjustable stationary contacts.

2. Minimum Trip Voltage – The adjustment of the spring tension in setting the minimum trip voltage is most conveniently made with the damping magnet removed.

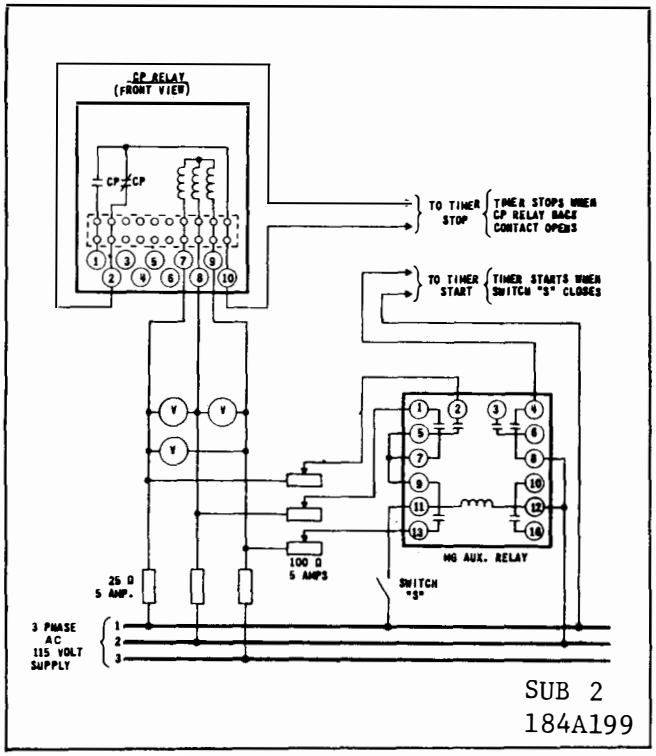


Fig. 8. Diagram of Test Connection for checking the Undervoltage Time Curves of the Type CP Relay.

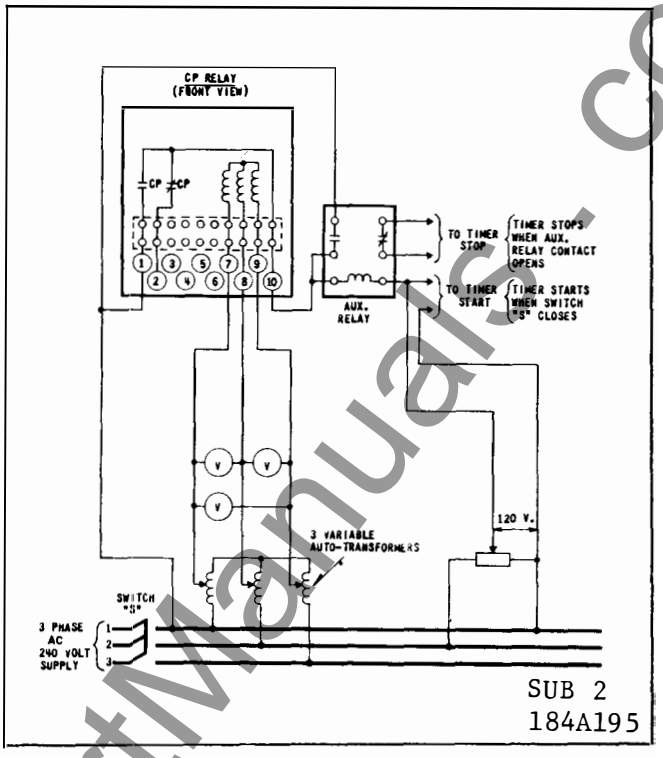


Fig. 9. Diagram of Test Connection for checking the Overvoltage Time Curves of the Type CP Relay.

Set either of the adjustable stationary contacts in the center of its travel. (For example, on the 120 volt relay, set the contact on the 95 volt setting.) Apply this voltage to the relay. Wind up the spiral spring by means of the spring adjuster until the stationary contact and moving contact just make.

Check the other scale markings by setting the adjustable contact on these markings and applying the corresponding voltage. The moving contact should make and break within plus or minus 3% of the value marked on the scale.

3. Time Curve Calibration — Install the permanent magnet and connect the relay as per the circuit of Fig. 8.

Set the high voltage contact on 100 volts and the low voltage contact on 70 volts. (For the 240 volt relay, multiply these values by two. Similarly for the 480 volt relay, multiply these values by four.) For the 208 volt relay set the high voltage contact on 170 volts and the low voltage contact on 120 volts. Apply rated voltage to the relay to allow the high voltage contact to make. Suddenly drop the voltage to zero and adjust the permanent magnet gap until the relay operates in 3.7 ± .15 sec.

Check the closing time of the high voltage contact by use of Fig. 9. With the voltage originally zero, suddenly apply rated voltage to the relay. The high voltage contact should close in 3.9 seconds ± 0.2 sec.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

The type CP relay when energized at rated voltage balanced 3 phase has the following VA burden for each phase.

	Watts	Vars	VA	Lagging Power Factor Angle
Phase A	.25	2.82	2.83	85
Phase B	.37	1.92	1.96	79
Phase C	1.11	2.50	2.73	66

The continuous voltage rating of the relays is 110% of rated voltage.

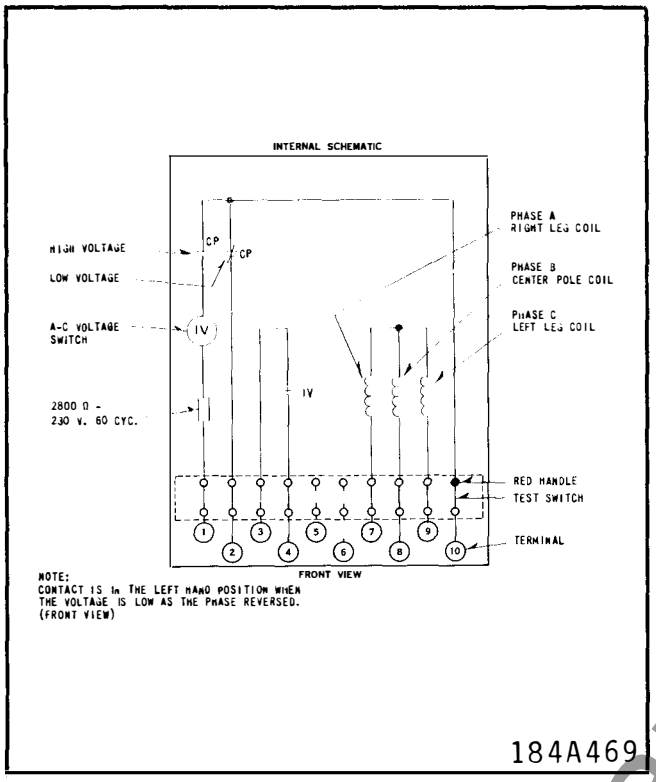


Fig. 10. Relay-Type CP Reserve Phase - 3 Phase, 3 or 4 Wire, S.P.D.T. - with A.C. independent, voltage switch in Type FT 11 Case.

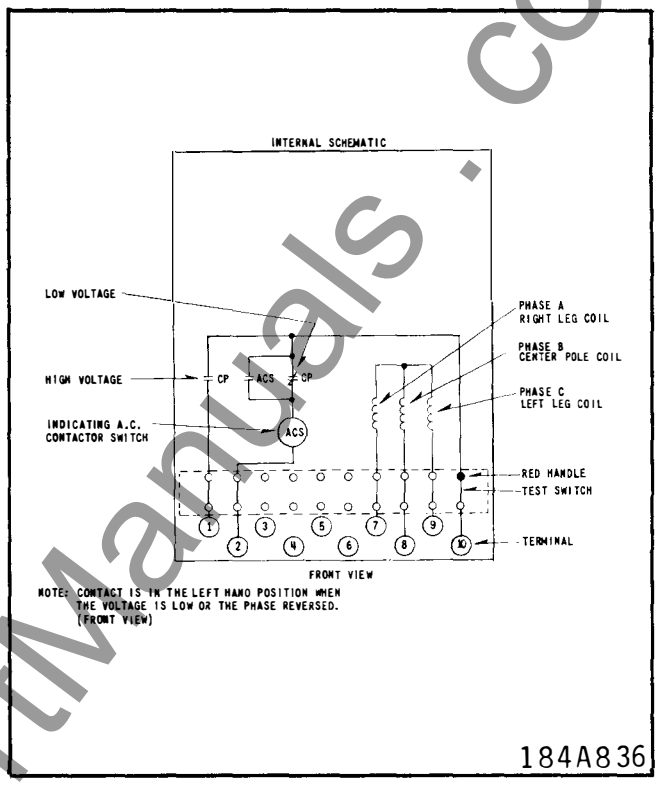


Fig. 11. Relay-Type CP Reverse Phase, 3 Phase, 3 or 4 Wire-S.P.D.T. Contacts with indicating A.C. contactor switch in low voltage circuit-in Type FT-11 Case.

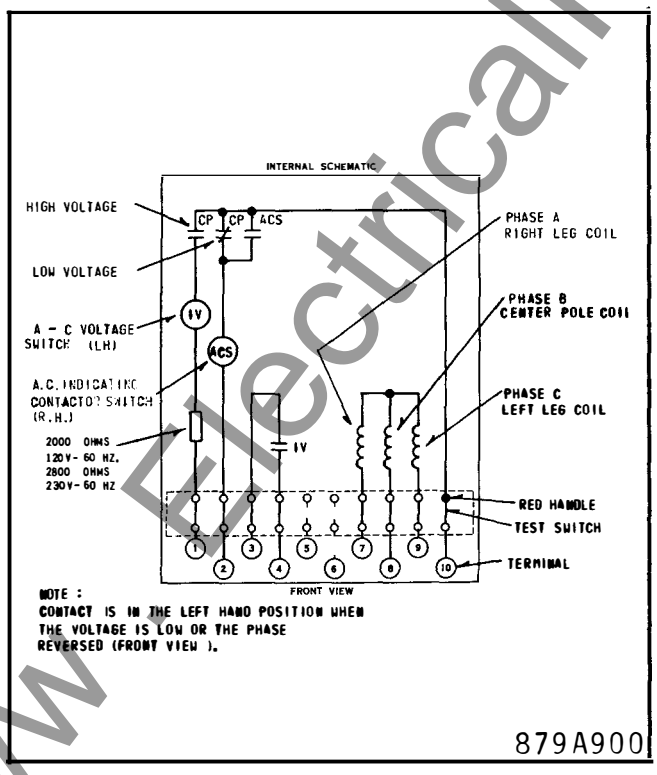


Fig. 12. Relay - Type CP Reverse Phase - 3 Phase 3 or 4, S.P.D.T. - with A.C.S. in low voltage circuit and with A.C. independent voltage switch in Type FT-11 Case.

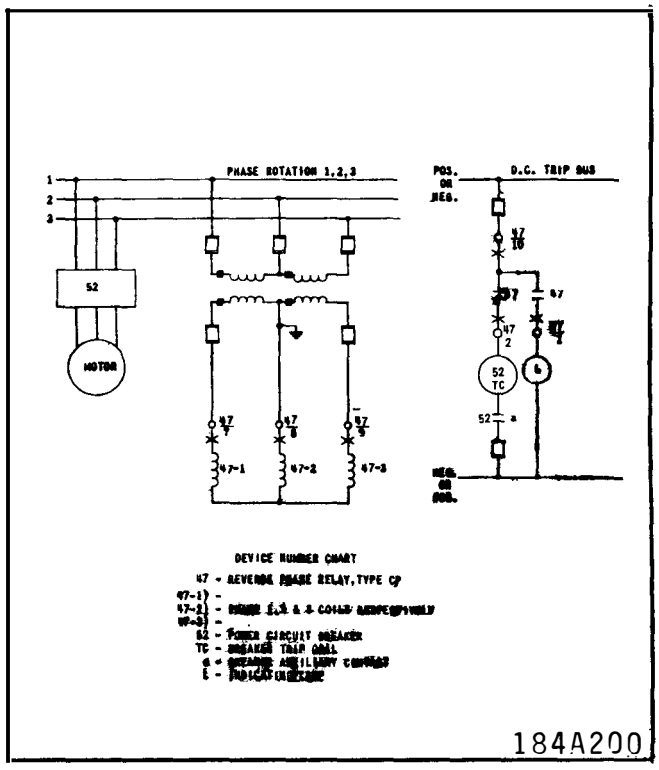
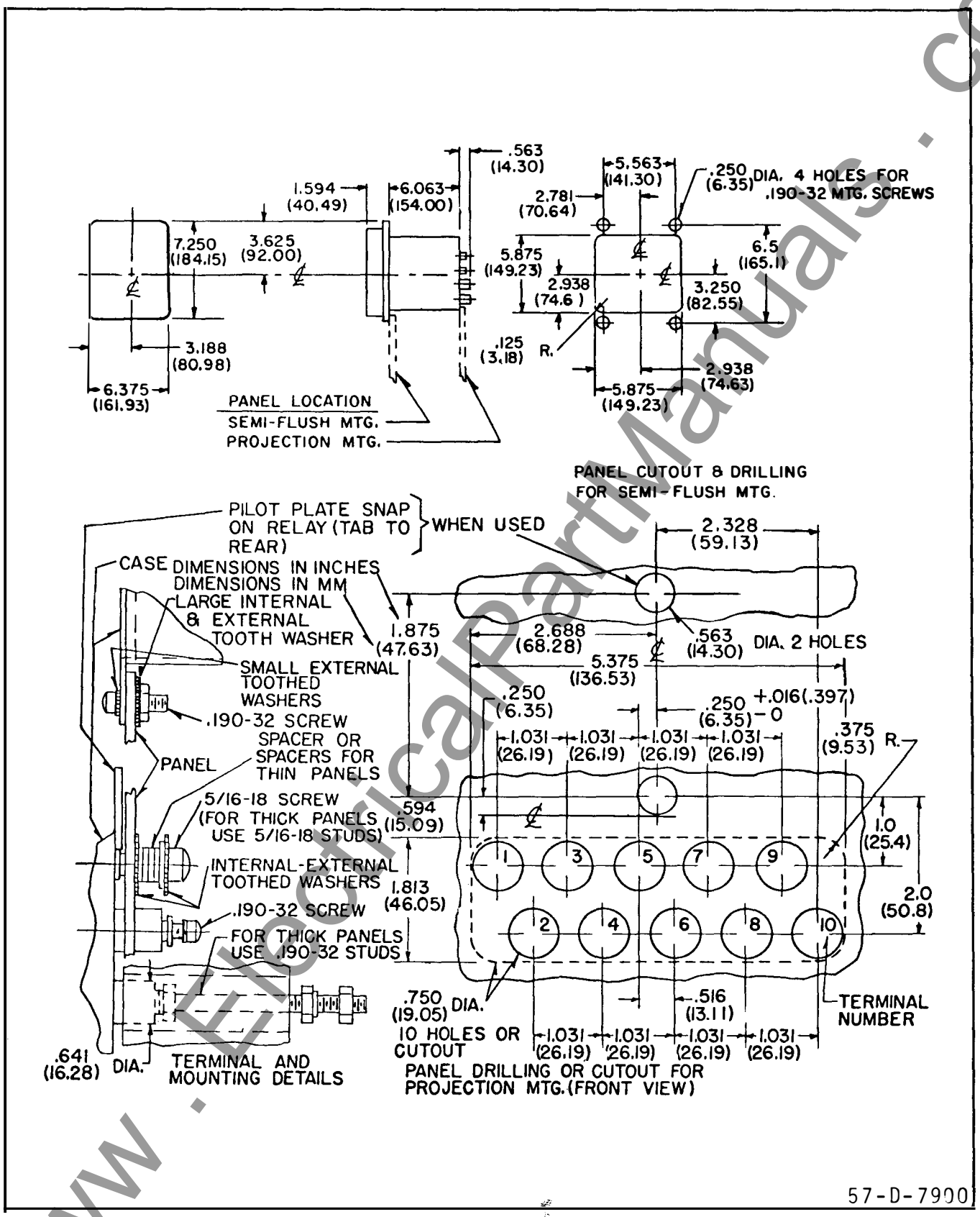


Fig. 13. External Schematic Diagram of the Type CP Relay in the Type FT11 Case.



✪ *Fig. 14. Outline and Drilling Plan for the Type CP Relay in the Type FT11 Case.*

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CP REVERSE PHASE RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type CP relay is a three phase induction disc type relay that operates upon phase reversal to disconnect a motor from a circuit. The relay may not operate for an open phase on the motor unless the motor is so heavily loaded that normal voltage cannot be maintained on all phases. Normally, the relay will operate as soon as the machine is stopped and prevent it from being started again if one phase wire is open.

This relay may also be applied to close its contacts on either three phase overvoltage or three phase undervoltage conditions on a system. For example, one relay is used to initiate source breaker trip and another relay is used to supervise alternate source breaker closing on automatic bus transfer schemes.

The CVQ relay performs a similar function for motor protection – supervision of supply breaker closing, low-voltage, and single-phasing protection. The CVQ is a more sophisticated relay, providing more sensitive single-phasing protection than does the CP relay; that is, the CVQ will detect single-phasing of a predominately motor load, where the motors are lightly loaded.

CONSTRUCTION AND OPERATION

The type CP relay consists of a three phase voltage unit, an indicating contactor switch when supplied, and an indicating voltage switch when supplied. The principal component parts of the relay and their location are shown in figure 1.

A. Voltage Unit (CP)

The electromagnet is an "E" type laminated structure with a coil mounted on each leg. A wye connection is formed by connecting one lead of each coil together. The other lead of the coils are connected to separate phases of a three phase system.

When the coils are energized with a three phase voltage, a flux is induced in each leg of the electromagnet. These fluxes are out-of-phase with respect to each other since they are induced by out-of-phase voltages. The path of the three fluxes is across an air gap in which a disc is located. The out-of-phase fluxes cause a torque to be produced on the disc which moves to a position in its travel that corresponds to the three phase voltage applied to the electromagnet. The disc will remain in this position until the applied three phase voltage is changed, at which time, the disc will move to a new position that corresponds to the new voltage.

The out-of-phase fluxes are such that a positive sequence voltage tends to close the high voltage contact while a negative sequence voltage tends to close the low voltage contact. A reversed phase (which means negative sequence phase rotation) will cause the relay's low voltage contact to close. This contact will also close on unbalance voltages that contain a negative sequence component sufficient to reduce the relay torque to its low voltage trip point.

B. Indicating Contactor Switch (ICS)

The indicating contactor switch is a small d-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also, during this operation two fingers on the armature deflect a spring located on

All possible contingencies which may arise during installation, operation, or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding his particular installation, operation or maintenance of his equipment, the local Westinghouse Electric Corporation representative should be contacted.

SUPERSEDES I.L. 41-222.2F, dated Jan. 1975
✪Denotes change from superseded issue.

EFFECTIVE SEPTEMBER 1977

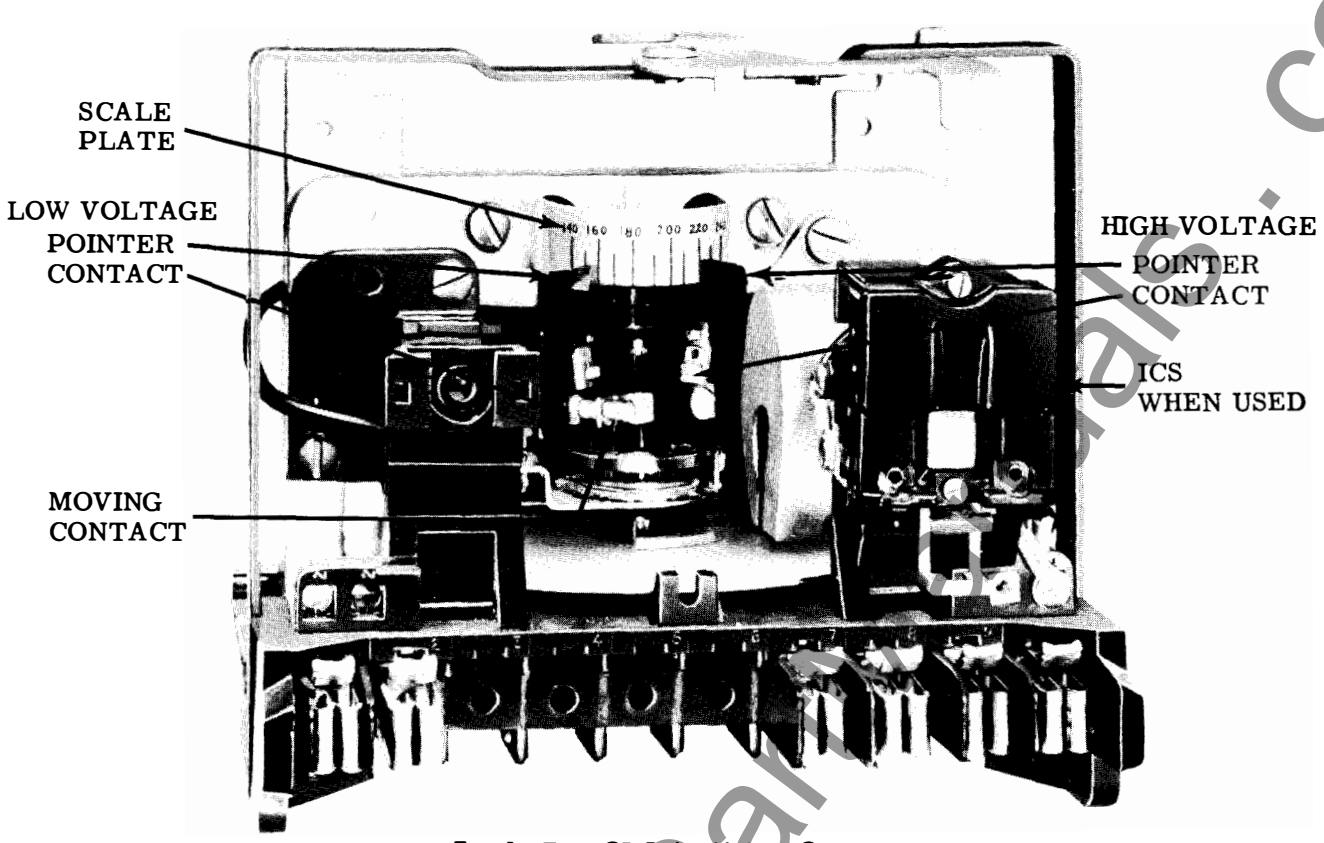


Fig. 1. Type CP Relay Without Case.

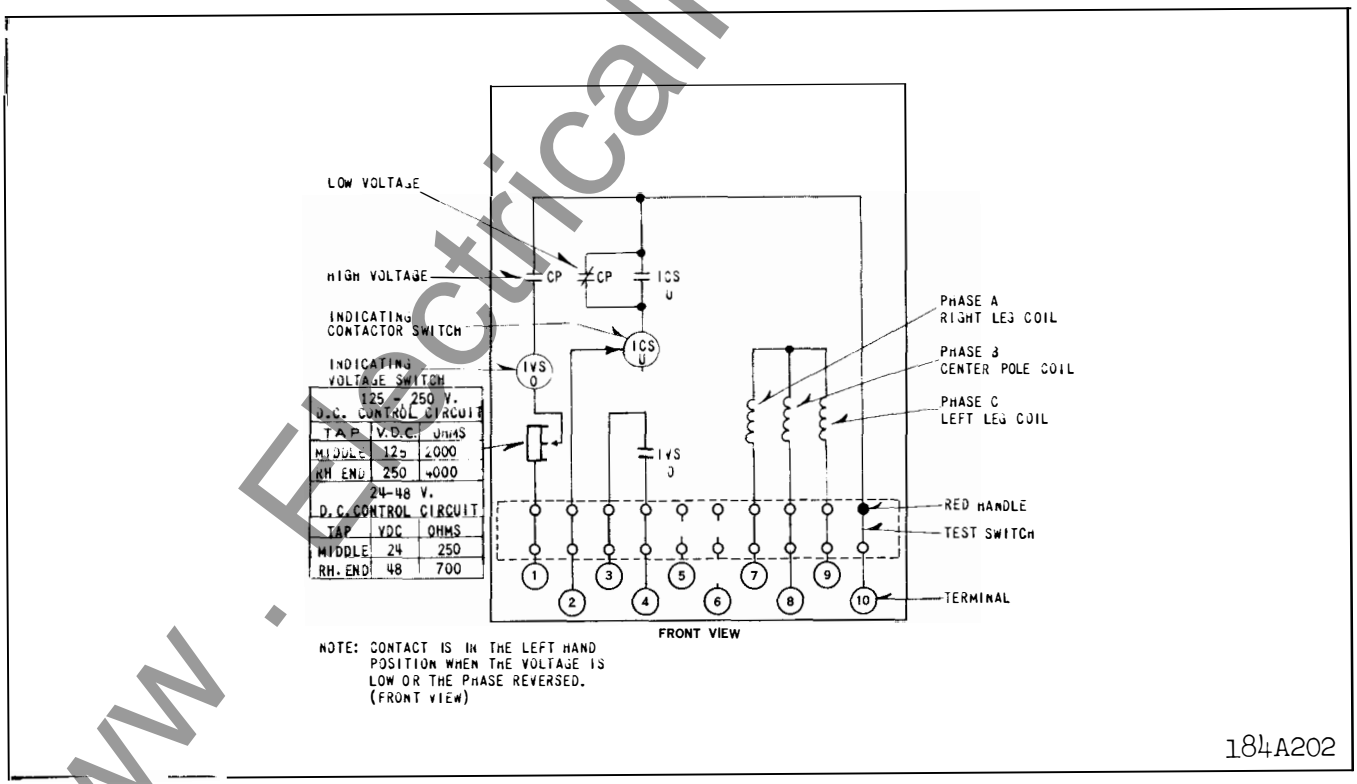


Fig. 2. Internal Schematic of the Type CP Relay with independent contacts in the Type FT11 case.

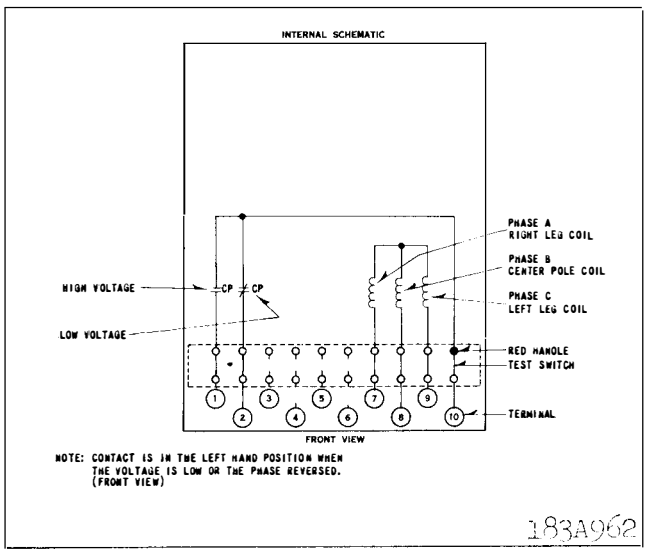


Fig. 3. Internal Schematic of the Type CP Relay in the Type FT11 Case.

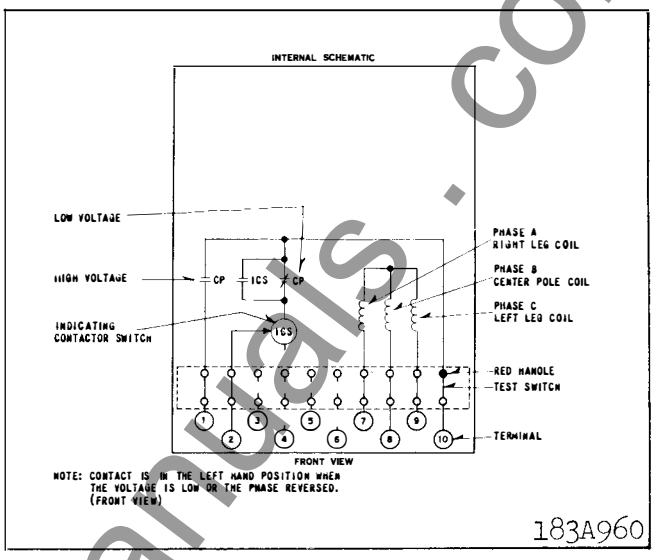


Fig. 4. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the Low Voltage Circuit in the Type FT11 Case.

the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the case.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

An AC indicating contact switch (ACS) is used where the relay contacts connect to an AC trip or control circuit.

C. Indicating Voltage Switch (IVS)

The indicating voltage switch has the same construction as the indicating contactor switch.

CHARACTERISTICS

The type CP relay has adjustable high and low voltage contacts which can be set around the periphery of a scale. The range of adjustment of the contacts are as follows:

120 volt relay..... 70 to 120 volts
240 volt relay..... 140 to 240 volts
480 volt relay..... 280 to 480 volts
208 volt relay..... 120 to 220 volts

If either of the adjustable contacts are set for a value of voltage within these ranges, the relay will just close its contacts when the balanced three phase line to line voltages equal this value. For such a condition, the relay is operating at its minimum trip point, and the operating times on repeated operations are not repetitive within close tolerances. However, voltages greater than the overvoltage setting or less than the undervoltage setting, result in relay timing operations which are consistent for repeated trials.

The relay has inverse timing; that is, the greater the increase in voltage the faster the relay contacts will close. Typical time curves for various contact settings are shown in figures 6 and 7.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch (when supplied) will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch (when supplied) has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constant

Indicating contactor switch (ICS) (When Supplied).

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

Indicating Voltage Switch (IVS) (When Supplied)

The indicating voltage switch (IVS) has a series resistor. The IVS will operate when 80% d.c. rated voltage is applied to the IVS circuitry.

✪ INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration and heat. Mount the relay vertically by means of the rear mounting stud or studs for the type FT projection case or by means of the four mounting holes on the flange for the semi-flush type FT case. Either the stud or the mounting screws may be utilized for grounding the relay. Ex-

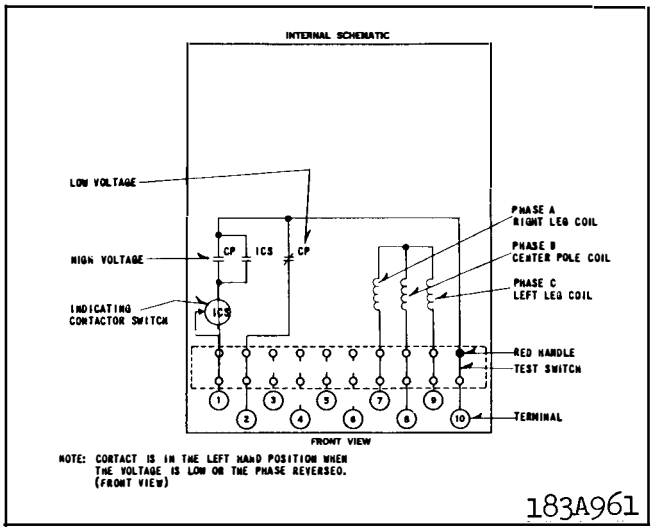


Fig. 5. Internal Schematic of the Type CP Relay with Indicating Contactor Switch in the High Voltage Circuit in the Type FT11 Case.

ternal toothed washers are provided for use in the locations shown on the outline and drilling plan to facilitate making a good electrical connection between the relay case, its mounting screws or studs, and the relay panel. Ground wires are affixed to the mounting screws or studs as required for poorly grounded or insulating panels. Other electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal stud furnished with the relay for thick panel mounting. The terminal stud may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detail information on the FT case refer to I.L. 41-076.

SETTINGS

There are two independent relay adjustments. These are the high and low voltage contact settings as described under "Characteristics". These settings determine the balanced three phase line-to-line voltage at which the relay contacts trip. The relay timing is not an independent adjustment, since it is fixed by the contact settings chosen. Typical time curves for various contact settings are given in Figs. 6 and 7.

For motor protection set the low-voltage contact at the minimum permissible operating voltage. (This contact may also close when the motor is operated single-phased, provided the open phase voltage is not held too close to normal by the motor. A motor operating near full load or a motor connected in parallel with substantial static load will not be able to maintain near normal open-phase voltage.) Where the high voltage contact supervises supply breaker closing, it must be set lower than normal voltage. For example, set the high-voltage contact at 90% and the low-voltage contact at 80% of rated voltage. The high and low voltage contacts must be sufficiently separated to allow for a minimum contact gap of about 0.020 inches. This corresponds to a voltage setting separation of about 7%.

Indicating Contactor Switch (ICS) (When Supplied)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energizes a 125 volt or 250 volt d.c. type WL relay switch, or equivalent, use the 0.2 ampere tap. For 48 volt d.c. applications set ICS in 2 ampere tap and use S#304C209G01 type WL relay or equivalent.

Indicating Voltage Switch (IVS) (When Supplied)

No setting is required on the IVS unit except for the selection of the required voltage tap on the tapped resistor.

ADJUSTMENT AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no adjustments, other than those covered under "Settings", should be required.

Acceptance Check

The following check is recommended to insure that the relay is in proper working order:

A. CP Unit

1. Contacts — Set the left-hand adjustable contact in the center of the scale and adjust the voltage until the moving contact just makes. Set the left-hand contact back out of the way and bring the right-hand contact up until the contacts just make. The pointer should be within ±1/32" of where the left-hand pointer was.

2. Minimum Trip Voltages — Check the scale markings by setting either of the two contacts at a value marked on the scale, then alternately apply this voltage plus 3% and minus 3%. Contacts should make and break.

   Check all of the scale markings in a similar manner.

3. Time Curve — The time curve can be checked by the use of the circuits of Figs. 8 and 9.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient

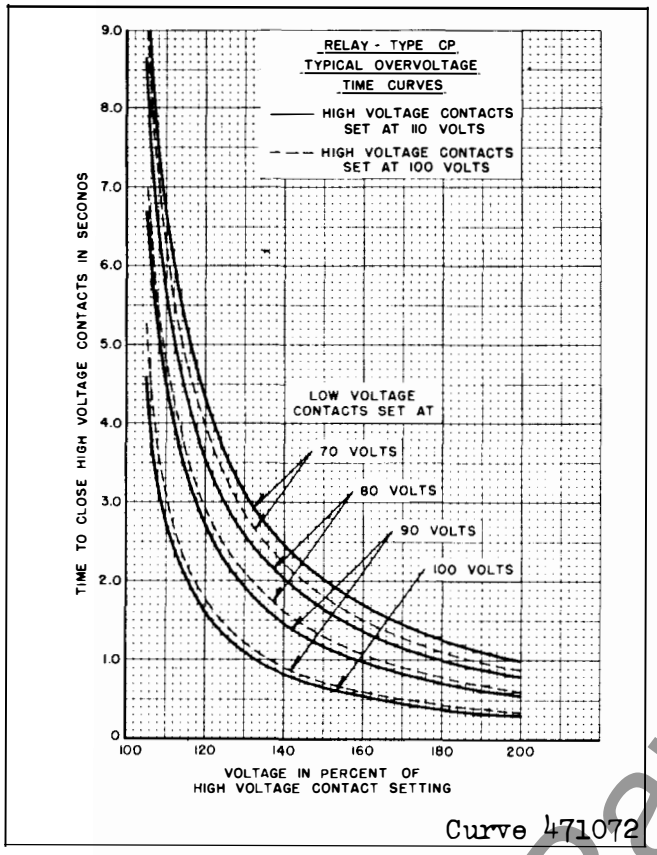


Fig. 6. Typical Overvoltage Time Curves for the Type CP Relay.

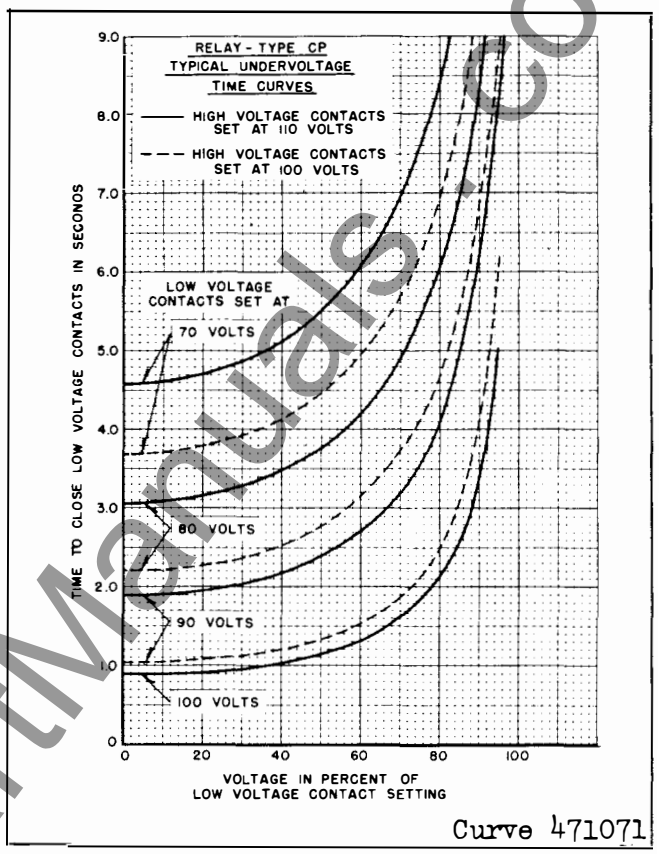


Fig. 7. Typical Undervoltage Time Curves for the Type CP Relay.

d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

C. Indicating Voltage Switch (IVS)

Close the main relay contacts and apply rated d-c voltage across terminals 1 and 10. The contacts of the IVS unit should close and the indicator target should drop freely.

Routine Maintenance

All relays should be inspected periodically and the time of operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application.

All contacts should be periodically cleaned. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver contact and thus impairing the contact.

Calibration

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs, or the adjustments have been disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order (See "Acceptance Check").

A. CP Unit

1. Contacts — Apply sufficient voltage to the relay, to make the disc float in the center of its travel. Move either of the adjustable contacts until it just makes with the moving contact. If the two contacts pointers do not meet at the same point on the scale, adjust the follow on both adjustable contacts. The contacts should just make with the moving contacts when the pointers meet on the scale. Approximately the same follow should be in each of the adjustable stationary contacts.

2. Minimum Trip Voltage — The adjustment of the spring tension in setting the minimum trip voltage is most conveniently made with the damping magnet removed.

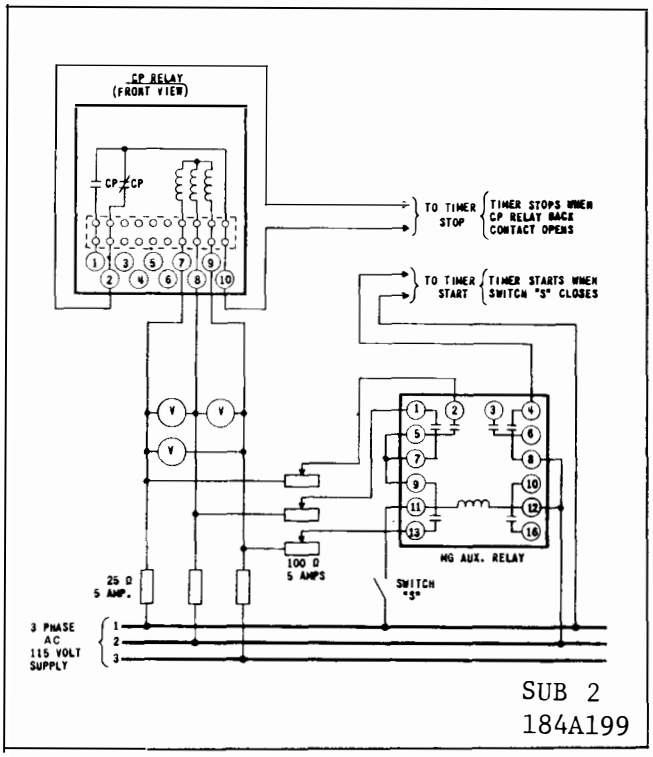


Fig. 8. Diagram of Test Connection for checking the Undervoltage Time Curves of the Type CP Relay.

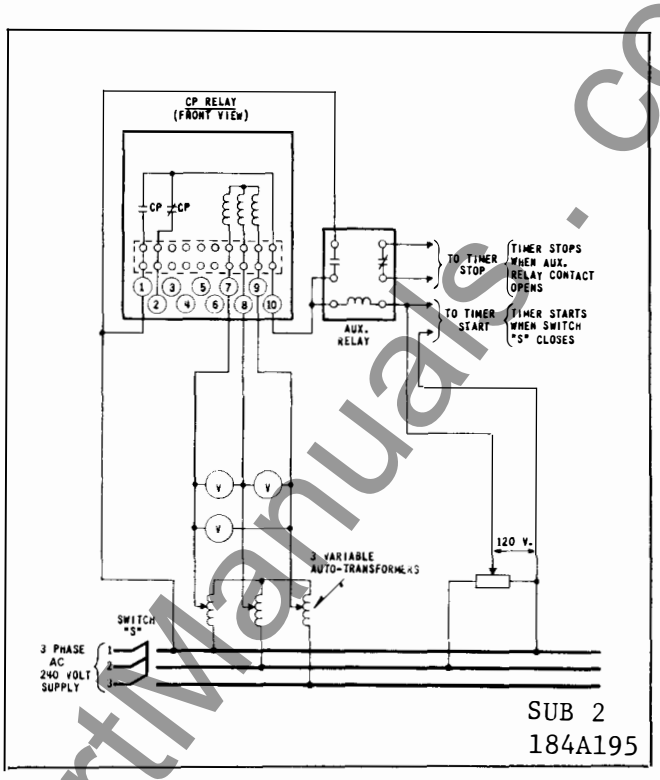


Fig. 9. Diagram of Test Connection for checking the Overvoltage Time Curves of the Type CP Relay.

Set either of the adjustable stationary contacts in the center of its travel. (For example, on the 120 volt relay, set the contact on the 95 volt setting.) Apply this voltage to the relay. Wind up the spiral spring by means of the spring adjuster until the stationary contact and moving contact just make.

Check the other scale markings by setting the adjustable contact on these markings and applying the corresponding voltage. The moving contact should make and break within plus or minus 3% of the value marked on the scale.

3. Time Curve Calibration — Install the permanent magnet and connect the relay as per the circuit of Fig. 8.

Set the high voltage contact on 100 volts and the low voltage contact on 70 volts. (For the 240 volt relay, multiply these values by two. Similarly for the 480 volt relay, multiply these values by four.) For the 208 volt relay set the high voltage contact on 170 volts and the low voltage contact on 120 volts. Apply rated voltage to the relay to allow the high voltage contact to make. Suddenly drop the voltage to zero and adjust the permanent magnet gap until the relay operates in 3.7 ± .15 sec.

Check the closing time of the high voltage contact by use of Fig. 9. With the voltage originally zero, suddenly apply rated voltage to the relay. The high voltage contact should close in 3.9 seconds ± 0.2 sec.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

The type CP relay when energized at rated voltage balanced 3 phase has the following VA burden for each phase.

	Watts	Vars	VA	Lagging Power Factor Angle
Phase A	.25	2.82	2.83	85
Phase B	.37	1.92	1.96	79
Phase C	1.11	2.50	2.73	66

The continuous voltage rating of the relays is 110% of rated voltage.

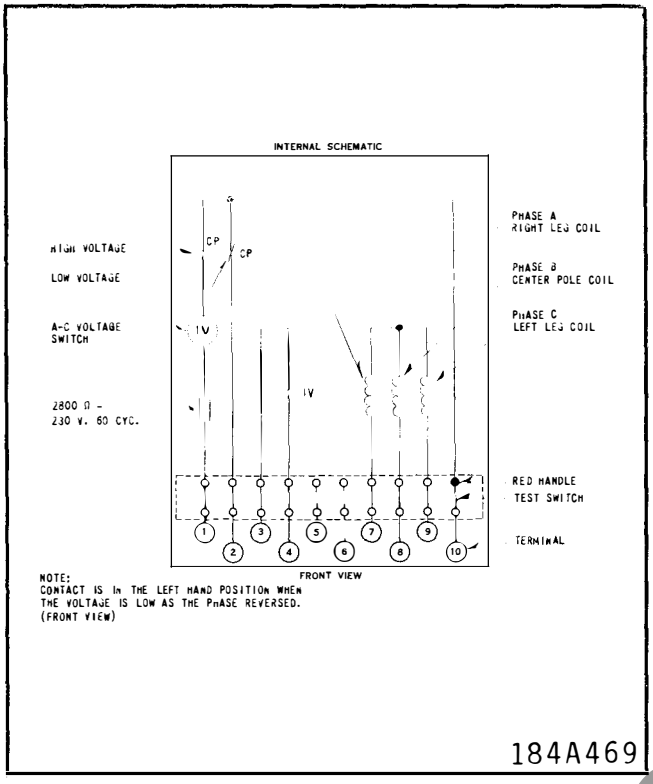


Fig. 10. Relay-Type CP Reserve Phase - 3 Phase, 3 or 4 Wire, S.P.D.T. - with A.C. independent, voltage switch in Type FT 11 Case.

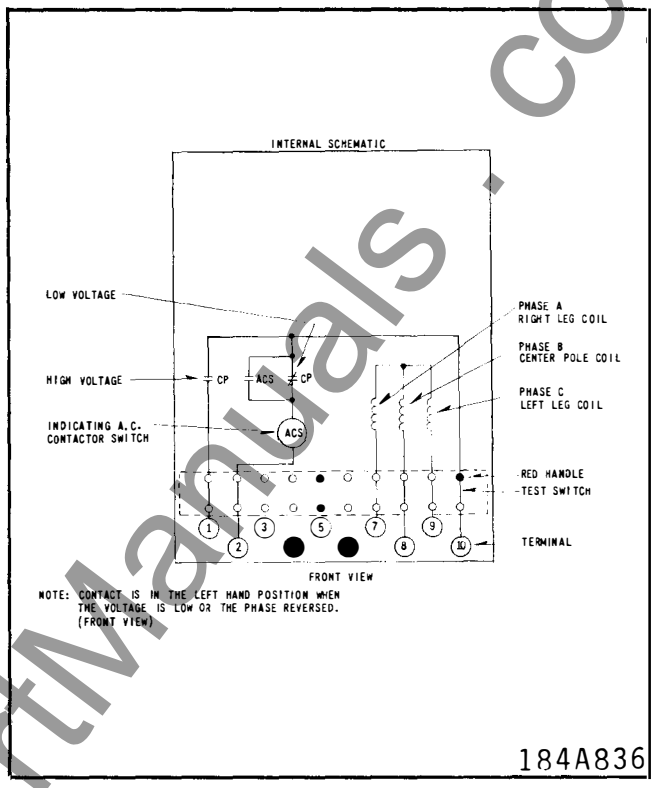


Fig. 11. Relay-Type CP Reverse Phase, 3 Phase, 3 or 4 Wire-S.P.D.T. Contacts with indicating A.C. contactor switch in low voltage circuit - in Type FT-11 Case.

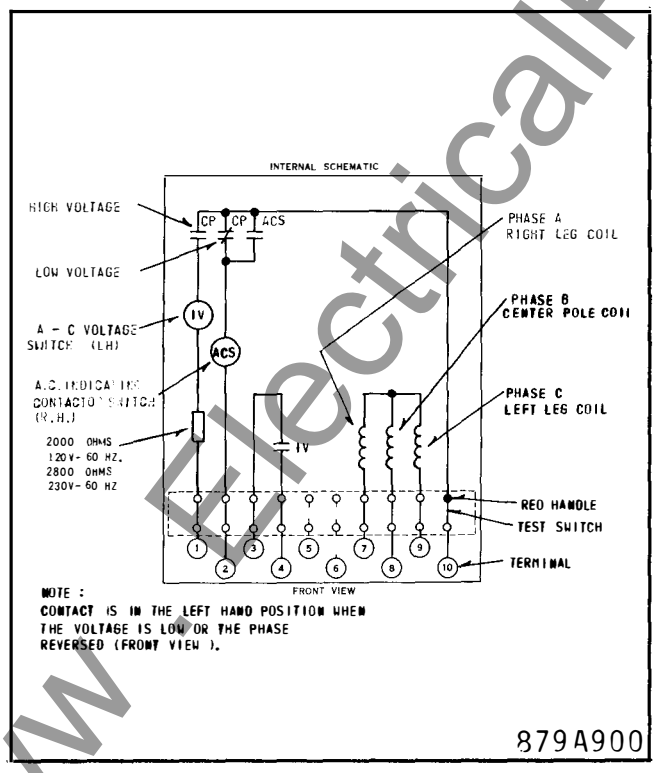


Fig. 12. Relay - Type CP Reverse Phase - 3 Phase 3 or 4, S.P.D.T. - with A.C.S. in low voltage circuit and with A.C. independent voltage switch in Type FT-11 Case.

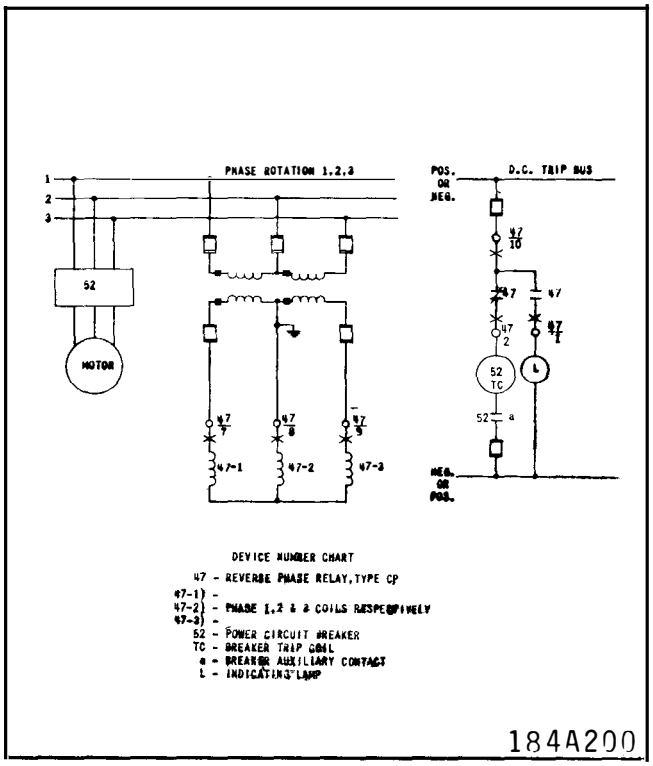
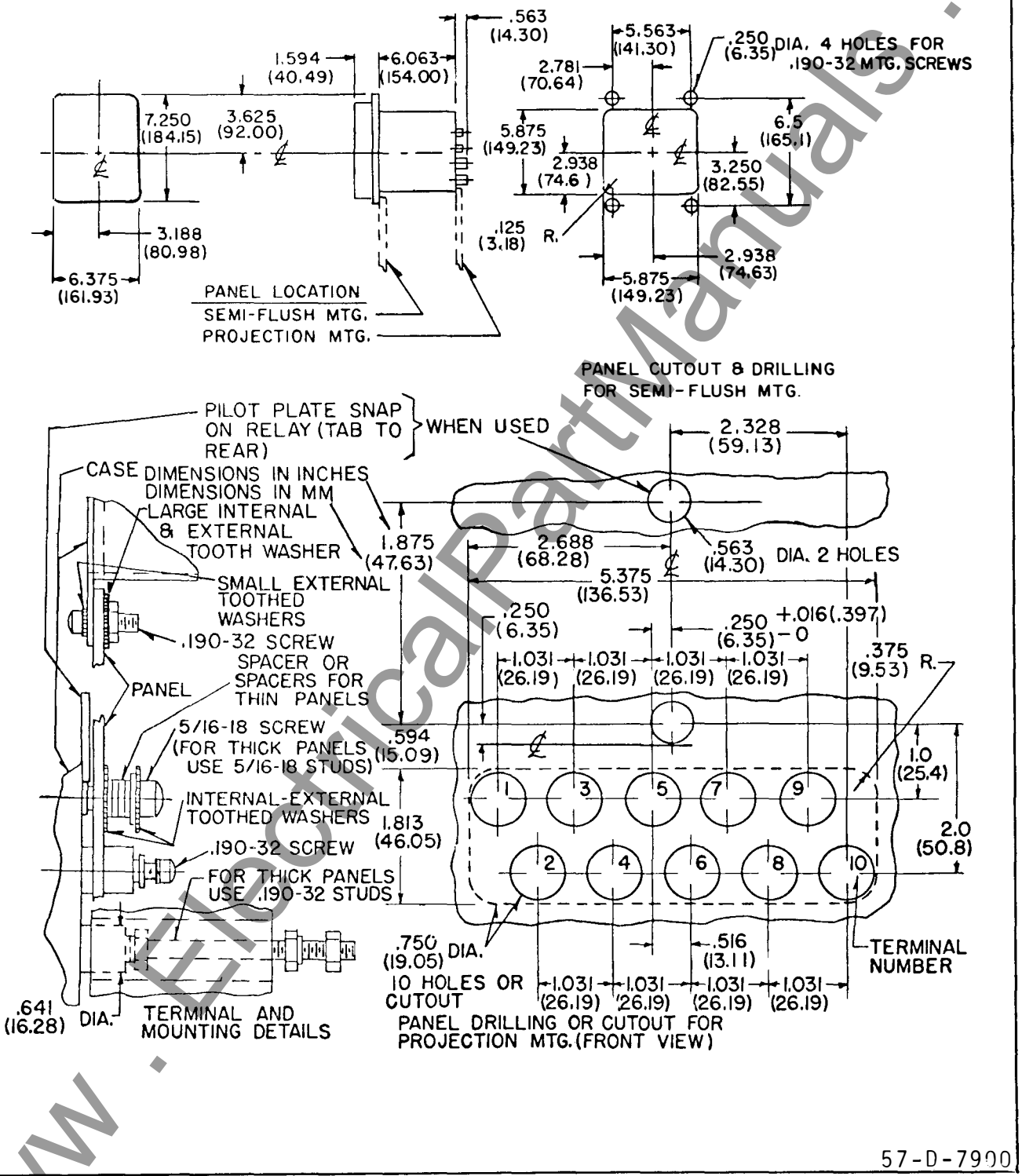


Fig. 13. External Schematic Diagram of the Type CP Relay in the Type FT11 Case.



✪ *Fig. 14. Outline and Drilling Plan for the Type CP Relay in the Type FT11 Case.*