Construction

(1) Calibrated Scale

Has indexed marking of 70-120 volts, 140-240 volts, or 240-480 volts. Range of contact adjustment is as follows:

120 volt relay .......................... 70-120 volts
208 volt relay .......................... 120-220 volts
240 volt relay .......................... 140-240 volts
480 volt relay .......................... 240-480 volts

(2) Adjustable Low Voltage Contact

(3) Adjustable High Voltage Contact

Both adjustable contacts are made of silver, and both have a vernier screw to provide adjustable contact wipe and assure positive contact.

(4) Die Cast Aluminum Frame

Assures correct alignment of disc, bearings, and electromagnet assembly.

(5) Moving Contact

The moving contact is also made of silver. It provides common connection between the high and low voltage contacts. CP relay designs which provide independent contact circuits are available. See figure 6. It floats between the stationary contacts for intermediate values of relay voltage between overvoltage and undervoltage stationary contact settings.

(6) Spiral Spring

A strong spiral spring assures good contact action when the relay is de-energized. Adjustment of the spring tension determines the minimum pickup of the relay.

(7) Damping Magnet

High strength Alnico, with adjustable keeper to damp the induction disc, and thus control operating time of the relay according to published time curves.

Indicating Voltage Switch (IVS)

CP relays can also be supplied with an Indicating Voltage Switch which is similar in construction to the ICS unit, except that it has a series connected resistor.

The IVS unit will operate when 80% of dc rated voltage is applied.

Voltage Operating Electromagnet

Located at the rear of the relay, the type "E" electromagnet is a laminated structure with a coil winding on each of the three legs. When the wye-connected coils are energized by three-phase voltage, a flux is induced in each leg of the electromagnet.
These out-of-phase fluxes create torque on the induction disc so that positive sequence voltage tends to close the high voltage contact, and negative sequence voltage tends to close the low voltage contact. Design of the electromagnet creates high operating torque to provide positive contact action.

**Burden Data**

**120, 240, and 480 Volt Relays**

When energized at nominal rated line-to-line balanced three-phase voltage, CP relay burden is as follows:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Watts</th>
<th>Vars</th>
<th>Volt Amperes</th>
<th>Power Factor Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.25</td>
<td>2.82</td>
<td>2.83</td>
<td>85° lag</td>
</tr>
<tr>
<td>B</td>
<td>.37</td>
<td>1.92</td>
<td>1.96</td>
<td>79° lag</td>
</tr>
<tr>
<td>C</td>
<td>1.11</td>
<td>2.50</td>
<td>2.73</td>
<td>66° lag</td>
</tr>
</tbody>
</table>

**Ratings**

**Relay Voltage Unit**

The CP relay will withstand 110% of rated voltage, continuously.

**Relay Contacts**

The main contacts of the relay will close 30 amperes at 250 volts dc, and will carry this current for sufficient time to trip a circuit breaker.

**Trip Circuit Data**

<table>
<thead>
<tr>
<th>ICS Tap, Amps Dc</th>
<th>Coil Rating in Amps Dc</th>
<th>Resistance in Ohms</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>Continuous</td>
<td>1-Second</td>
</tr>
<tr>
<td>2.0</td>
<td>0.4</td>
<td>11.5</td>
</tr>
<tr>
<td></td>
<td>3.2</td>
<td>88.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.15</td>
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</tbody>
</table>

**Operation**

When energized with three-phase positive sequence voltage, the high voltage contacts tend to close.

A reversed phase (negative sequence phase rotation) will close the low voltage contact. The low voltage contact will also close on unbalanced voltages which contain a sufficient negative sequence component to reduce the net relay torque to its low voltage trip point.

The voltage values indicated on the calibrated scale of the relay are the balanced, three-phase, line-to-line voltages required to close the relay contact when the adjustable stationary contact is set at that point on the scale. The CP relay has inverse timing, i.e., the greater the change in voltage, the faster it will operate.

The only setting required is the selection of the adjustable low and high voltage stationary contact positions. These positions are the desired voltage values at which contact closing operation is desired.

**Fig. 2**

**Relay Operating Time**

**Simultaneous Change in Three-Phase Voltage**

Timing of the relay is not adjustable, since it is dependent upon the position of the stationary contacts.

The curves shown in figures 4 and 5 indicate relay operating time for a simultaneous change in three-phase voltage.

**Reduced Phase-to-Phase Voltage Conditions**

The relay contact closing time for a given variation in phase-to-phase voltage can be determined by reference to the conversion curve shown in figure 3, and use of the time curves in figures 4 and 5.

To determine the contact closing time for a reduced phase-to-phase voltage, it is necessary to convert the reduced delta voltage triangle ABC to three-phase voltage or equilateral triangle A'B'C'.

Voltage triangle ABC represents the normal three-phase delta voltage; 120 volts phase-to-phase.

Assume BC voltage is reduced 50% and the CP relay high voltage contact is set to close at 110 volts, and the low voltage contact at 90 volts.

Reference to the curve in figure 3 indicates that for a 50% reduction in phase-to-phase voltage, the equivalent three-phase voltage triangle area, A'B'C', is 71% of the normal voltage area ABC; i.e., 71% of 120 volts or 85.2 volts phase-to-phase. (85.2 = 90 x 100% = 94.7% of low voltage contact setting.)

Since the 85.2 volt value is below the 90 volt low voltage contact setting, the low voltage contact will close in 8.25 seconds. This time value is read from figure 4.

This equivalent three-phase voltage A'B'C' is made up of 75% positive sequence voltage (.75 x 120 = 90 volts) and 25% negative sequence voltage (.25 x 120 = 30 volts). These values are read from figure 3.

**Conversion Curve**

![Conversion Curve](image)

**Fig. 3**

Note: Torque of CP is equal under different voltage conditions when area of voltage triangles are equal.

**September, 1990**
**Time Curves** (For 120 Volt Relays)

**Undervoltage**
Voltage suddenly dropped from rated 120 voltage to voltages indicated on the abscissa of curve plot.

**Overvoltage**
Voltage suddenly raised from zero volts to voltage indicated on abscissa of curve plot.

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For 240 volt relays, double the indicated voltage values on above curves.
For 480 volt relays, multiply indicated voltage by 4. Curves are also valid for simultaneous change of three-phase voltage.

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September, 1990
Internal Wiring

Relay — Type CP Reverse Phase — 3 Phase, 3 or 4 Wire — S.P.D.T. Contacts with Indicating Contactor Switches — High & Low Voltage Circuit — in Type FT-11 Case

Note: Contact is in the Left Hand Position when the Voltage is Low or the Phase Reversed. (Front View)

Fig. 6

External Wiring

External Schematic Diagram of the Type CP Relay in the Type FT-11 Case

Device Number Chart

47—Reverse Phase Relay, Type CP
47-1—Phase 1, 2, and 3 Coils Respectively
47-3—Power Circuit Breaker
47-2—Breaker Trip Coil
47-4—Auxiliary Contact

Fig. 7

Shipping Weights and Carton Dimensions

<table>
<thead>
<tr>
<th>Relay Type</th>
<th>Case Type</th>
<th>Weight, Lbs.</th>
<th>Domestic, Shipping Carton Dimensions, Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP</td>
<td>FT-11</td>
<td>7</td>
<td>9 x 9 x 10</td>
</tr>
</tbody>
</table>

Further Information

List Prices: PL 41-020
Technical Data: TD 41-025
Instructions: IL 41-222.2
Renewal Parts: RPD 41-920
Flextest Case Dimensions: DB 41-076
Contactor Switches: DB 41-081
Other Protective Relays:
  Application Selector Guide, TD 41-016

September, 1990
### Type CP
#### Reverse Phase Voltage Relay

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### Three Phase, Over or Undervoltage, Reverse Phase, Time Delay (Device Number: 47)

<table>
<thead>
<tr>
<th>Type and Time Curve</th>
<th>Application</th>
<th>Contacts</th>
<th>Indicating Contactor Switch</th>
<th>Volts: Ac</th>
<th>Control Volts: Dc</th>
<th>Relay Data</th>
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</thead>
<tbody>
<tr>
<td>CP</td>
<td>Undervoltage or Reverse Phase</td>
<td>Spdt-cc and co®</td>
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<td>70-120</td>
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<td>240</td>
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### Notes:

- Denotes item available from stock.
- 50-Hertz relays and auxiliaries can be supplied at same price. Order "Similar to Style Number . . . . . . . . , except 50 Hertz".
- ICS: Indicating Contactor Switch (dc current operated) having seal-in contacts and indicating target which are actuated when the ICS coil is energized at or above pickup current setting. Suitable for dc control voltages up to and including 250 volts dc. Two current ranges available: (1) 0.2/2.0 amps dc, with tapped coil. (2) 1.0 amp dc, without taps.
- When ac current is necessary in a control trip circuit, the ICS unit can be replaced by an ACS unit.
- The ACS unit may be supplied in place of an ICS unit at no additional cost. Specify system voltage rating on order.
- Electrically common moving contact.
- Electrically independent front and back contact circuits.
- ICS in high voltage contact circuit only.
- ICS in low voltage contact circuit only.
- Separate ICS in low and high voltage contact circuits.