Westinghouse

TYPE CWK RELAY

Instructions for Installation and Operation

APPLICATION

The Westinghouse type CWK power factor relay is an A-C. relay suitable for applications which require a circuit to be opened or to be closed when the power factor of a circuit drops below a predetermined amount. One such application is in connection with synchronous motors where the power factor decreases considerably when the machine falls out of step.

INSTALLATION

Unpack the relay carefully and remove all dust and packing materials from the relay case. The cover should be removed and the relay inspected for any damage that may have occurred in shipment. Remove any packing material between pole pieces and disc, and carefully close the contacts by hand to see whether there is any evidence of friction.

The relay should be mounted on a vertical panel by means of the two mounting studs. On steel panels, the mounting studs should be removed and be replaced with fillister head screws. Connections to the terminals should be made in a like manner.

CONSTRUCTION AND OPERATION

The type CWK power factor relay consists of an induction disc, an operating electromagnet, a damping magnet, and a set of single pole, double throw contacts. The moving contacts can be biased by means of a spiral control spring, so that when the relay is de-energized they stand against the front or the back contacts.

The operating electromagnet of the relay consists of a potential and a current winding so arranged on the laminations that the flux set up by both pass through the induction disc. When the two fluxes are in phase, no torque is produced in the disc as the torque is proportional to the product of the two, times the sine of the angle between them.

To this extent, the relay is structurally an induction wattmeter, just like the directional element of Reverse Power Relays.

When the relay is de-energized, the moving contacts are held against the right-hand stationary contact (front view) by the spiral spring. When the relay is energized, the position of the moving contacts depends on the magnitude of the current and voltage as well as the phase-angle position of the two. The electrical torque of the relay disc is proportional to the voltage, current and the cosine of the angle between the two. In other words, if the current in the relay lags 90° behind the voltage impressed on the relay, the electrical torque is zero. For all other phase-angle positions of the current, between leading 90° and lagging 90°, the torque will hold the moving contacts against the right-hand stationary contact (front view), providing the polarity of the external connections are as shown in figure 1.

If the current leads or lags the applied potential more than 90°, that is, lags from 90° to 270°, the torque is reversed and the moving contacts will move to the opposite side, if the current magnitude is sufficient to overcome the spring tension. Likewise, if the external connections to either the current or potential coil are reversed, the direction of torque is reversed and the contacts will move to the opposite side.

The type CWK power factor relay is often used to remove a synchronous motor from the line upon the loss of field or after it has pulled out of step. For either case, the power factor of the load drawn by the motor falls below 50%. That is, the line current lags the line-to-neutral voltage by more than 60°. However, by selecting the proper delta voltage, an extra 30° shift is secured so that the line current will lag this delta voltage by more than 90 when the motor pulls out of step. If the type CWK relay is properly connected to receive this voltage and current, the moving contact will leave the right-hand stationary contact and move to the left-hand contact when the motor pulls out of step.

These relays are made in 3 types of cases, as indicated in outline drawings, figures 2, 5, or 6. The internal connections are respectively as shown in figures 1 and 3.

CONNECTIONS

It is absolutely essential that the relay be correctly connected to the line or proper operation will not be secured. For three-phase circuits proper phase rotation must also be provided. With phase rotation A, B, C, the proper connections to the relay should be phase A current and phase A B voltage. Of course, either of the other two-phase currents may be used, provided the proper voltage is selected.

One of the following methods may be used to insure that the relays are connected to the proper phase of a three-phase system:-

(a) For 3-phase circuits, connect the current coils of a single-phase wattmeter in series with the current winding of the relay. With the synchronous motor running, if the power factor is between 100 percent and 50 percent leading, select a pair of voltage leads which gives the highest reading on the wattmeter. If the power factor is between 100 percent and 86 percent lagging, select a pair of voltage leads which give the second highest reading on the meter. See (d).

(b) For 3-phase circuits, connect the current coils of a single-phase power factor meter in series with the current coils of thr relay. Select a pair of potential leads which will give 86.6 percent power factor lag on the power factor meter when the line power factor is 100 percent. See (d).

(c) For 3-phase circuits, the portable phase angle indicator made by the Company is very suitable for checking relay connections, since the angle between the voltage and current in a polyphase system may be directly determined. In using this instrument, the normal power factor of the load must be taken into consideration and allowance made for it. See (d).

(d) After proceeding per a, b or c, inspect contacts on the relay, and if the moving contact closes against the left-hand contact, front view, with the motor operating above 50 percent power factor lagging, reversing the potential leads on the terminals of the relay will provide the most commonly used connection.

(e) When phase rotation and transformer polarity is unknown and meters are not available for checking the lines, the proper connections may be determined by proceeding as follows:

(1) Add jumpers or arrange connections so that relay operation will not affect operation of equipment.

(2) Connect as shown on diagram (Figures 6 - 8.)

(3) With the field rheostat adjusted for normal excitation, make a trial start. With the usual connections properly made, the relay contacts, front view, close in the left-hand position when starting, then retransfer back to the de-energized position after the machine has pulled into synchronism.

(4) If the contacts do not transfer when starting or when machine is synchronized, the phase rotation is wrong. (with such a connection, a low leading power factor will cause the contacts to transfer.)

To correct:-

A. For 3 phase: Change the potential lead from L2 to L3 phase (See diagram Fig. #6.).

B. For 2 phase: The current and potential coils are not in the same phase. Check and correct.

(5) If the relay contacts maintain the de-energized position when starting and transfer after the machine has synchronized, the operation may be changed to be per (3) by interchanging the connections to one of the coils.

(6) If the relay transfers at start and does not again transfer when machine is synchronized:-

A. For 3 phase: Change per 4-A, and 5 for operation per (3).

B. For 2 phase: Change per 4-B and 5 for operating per (3).

(7) If, with 3-phase machine synchronized, the relay seems to transfer near unity power factor, the potential coil is not connected to phase L1 (which supplies the current coil). Check and correct.

(8) After adjustments, return connections to normal. (See (1).)

*Superseding I.L. 2095

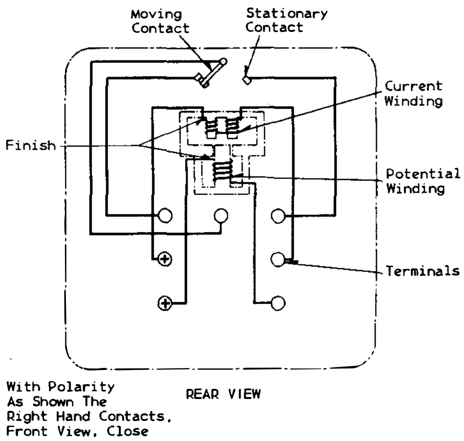
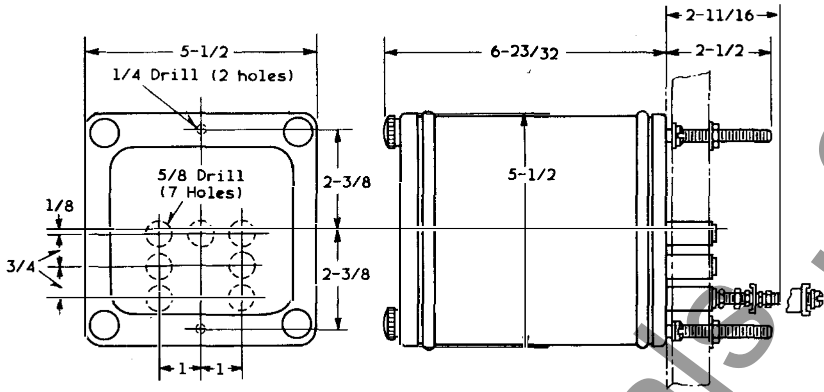


FIG. 1 - TYPE CWK POWER FACTOR RELAY WIRING DIAGRAM FOR TYPE OF CASE SHOWN IN FIG. 2.



NOTE: For 1/8 or 3/16 metal switchboards use screws for mounting relay and for terminal connections. For 1/4 to 1 switchboards use studs for mounting relay and screws for terminal connections. For all other switchboards use studs for both purposes.

FIG. 2 - TYPE CWK POWER FACTOR RELAY OUTLINE & DRILLING PLAN

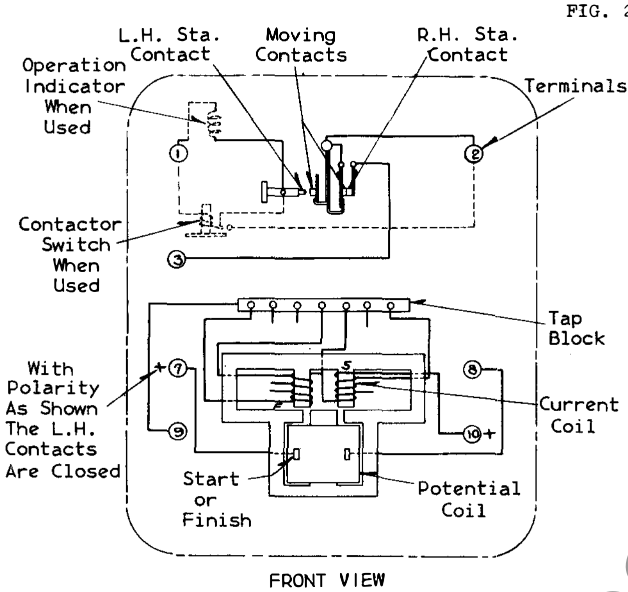


FIG. 3 - INTERNAL DIAGRAM FOR RELAYS IN CASES SHOWN IN FIGURES 4 AND 5.

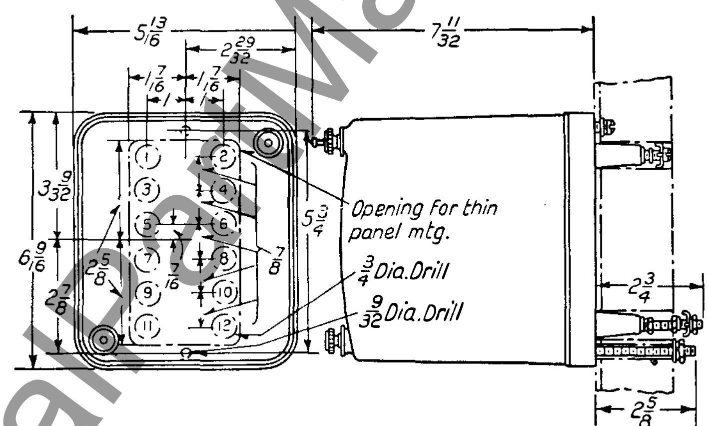


FIG. 4 - OUTLINE AND DRILLING PLAN FOR THE STANDARD PROJECTION TYPE CASE. DRILL HOLES PER FIGURE 3.

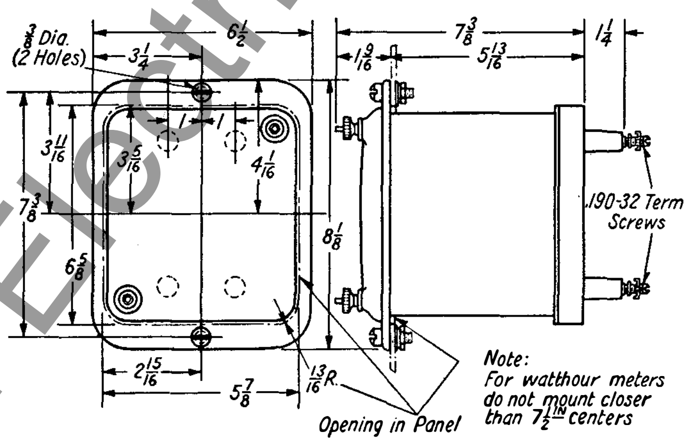


FIG. 5 - OUTLINE AND DRILLING PLAN FOR THE STANDARD FLUSH TYPE CASE.

ADJUSTMENTS

In rare instances an adjustment may be required where the sudden removal of maximum load causes an extra-heavy reverse power flow due to the motor feeding back into the line. This may cause the relay to operate unnecessarily and remove the excitation.

To adjust the relay, insert a screw-driver in the slots of the spring adjuster and increase the initial tension of the spiral spring by turning the outside end of the spring in a counter-clockwise direction (from above). The tension should be increased just sufficiently to correct the operation.

After the adjustment is made, start the motor and note whether the contacts open at the start and remain open until the motor reaches approximate synchronous speed.

Relays in cases, figures 5 and 6 have a tap block as shown in figure 4 by means of which the sensitivity of the relay may be changed to suit the load or current transformers.

OPERATION OF CONTACTS

Power off - closed on right side de-energized
Start - contact swings to left
Run - contact swings back to right
If the sequence is not as above:
One of two connections or both are wrong.

1. If contacts stay on right and do not transfer at all, the potential is across the wrong phase. With phase rotation 1-2-3 and current coil in phase one, the potential coil must be across 1-2. In a similar manner if the current coil happens to be connected in phase 2 or 3, the potential coil must be connected across 2-3 or 3-1.

2. If contact stays on right during starting and transfers to left on running condition, the polarity is wrong on one of the coils and reversing the leads at the terminals of the meter on either the current on potential will correct situation.

3. If contact swings to left in start and does not swing to right when synchronized, the potential coil is connected to wrong phase (see 1) and the polarity is wrong (see 2).

MAINTENANCE AND RENEWAL PARTS

The type CWK power factor relay requires very little maintenance. If the contacts have been subjected to very severe service and have become pitted, they should be smoothed with a very fine file. Always replace the cover after inspecting the relay, as dust or dirt may affect the operation.

With the exception of the contacts, the various parts of the relay should show little wear, and very few parts will need to be replaced. However, as a guide in stocking renewal parts and for identification of parts when ordering, the following list has been prepared.

GENERAL REPAIRS

The Newark Works maintains an efficient repair service department, and it will be found, generally, advantageous to return relays to the factory when important repairs are required.

When returning apparatus for this or any other reason, please first communicate with our nearest Sales Office for shipping instructions and identification tag.

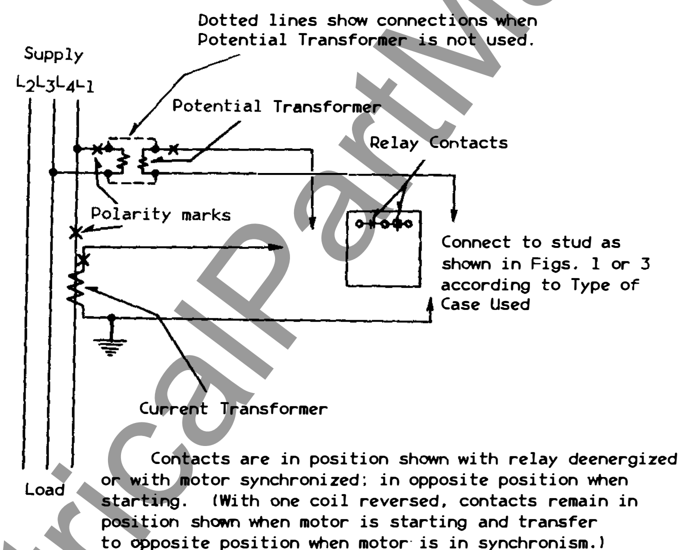


FIG. 6 - WIRING DIAGRAM FOR 3 - PHASE 3 - WIRE CIRCUITS
PHASE SEQUENCE IS L_1, L_2, L_3

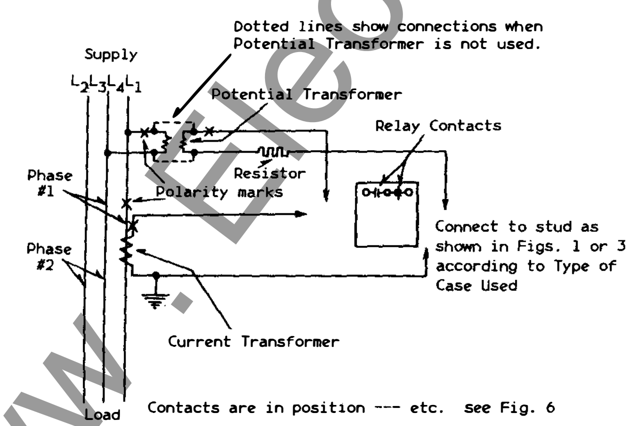


FIG.7 - WIRING DIAGRAM FOR 2 - PHASE 3 - WIRE CIRCUITS

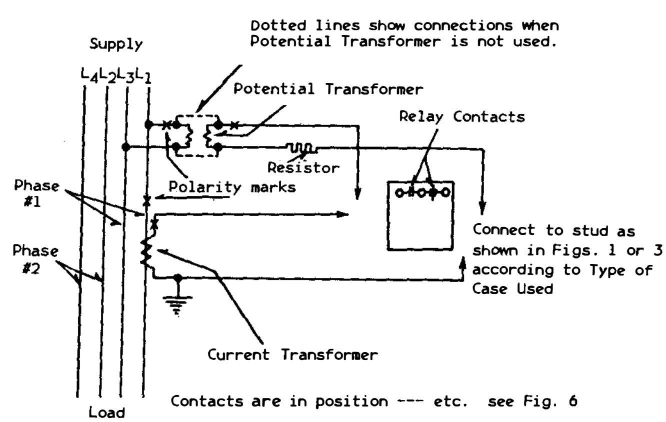


FIG.8 - WIRING DIAGRAM FOR 2 - PHASE 4 WIRE CIRCUITS

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