Primary Relay with Dynamic Line-Drop Compensator, Style No. 1017812

INSTRUCTIONS

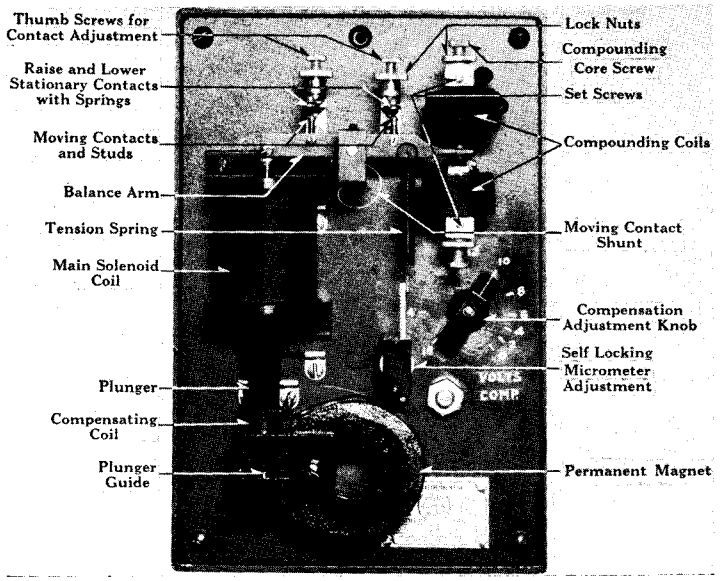

FIG. 1—RELAY WITH COVER REMOVED

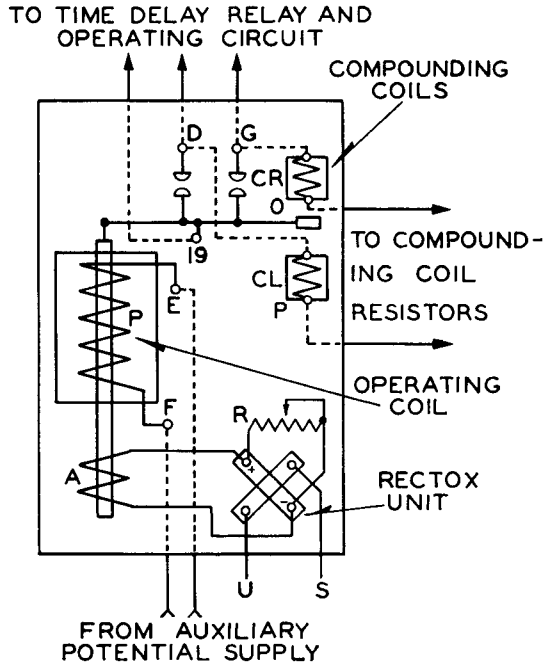

FIG. 2—SCHEMATIC DIAGRAM

GENERAL

The primary relay S#1017812 consists of a solenoid operated balance arm, pivoted at the center, with contacts on either side working in conjunction with two adjustable stationary contacts. In the balanced or horizontal position neither pair of contacts are closed. The closing of either contact energizes a corresponding compounding coil, which increases the pressure on the contacts and prevents chattering and holds the contacts firmly closed until the balance voltage is nearly reached again. In addition, a small coil, energized by rectified current from a series transformer, and attached to the lower end of the plunger and operating in a permanent magnetic field, provides a means for compensating for line drop.

CONSTRUCTION

The solenoid plunger is hung at one end of the balance arm and its weight is partially counterbalanced by a spring at the opposite end. The solenoid exerts an upward pull on the plunger, the amount of pull depending upon the voltage applied to the solenoid. By adjusting the pull on the spring, the arm can be brought to a balance position for various voltages. Voltages above this value will close the left hand contact and voltages below this value will close the right hand contact. The tension on the spring is varied by a rack and pinion having a self-locking micrometer adjustment.

This relay includes a simple compensating device. A small coil is mounted on the lower end of the main operating plunger of the voltage regulating relay and is located in a permanent magnet field. A small rectox unit is mounted on the back of the relay panel to rectify the current from the secondary of a current transformer located in the output circuit of the regulator. A rheostat on the back of the panel and operated by a knob on the front, shunts the output of the rectox unit and regulates the current to the auxiliary coil A, thereby providing means for varying the amount of compounding.

Adjusting thumb screws and lock nuts are provided on the stationary contacts and compounding coil cores so that the limits within which the relays operate may be changed. In addition, set screws are provided to positively hold the compounding coil cores in position after adjustments have been made.

The moving contacts on the balance arm can be replaced by releasing a set screw. They are not used when making ordinary adjustments but only when replacing the contacts.

The guide for the lower end of the plunger is included in the magnetic structure of the compensating device.

The contacts are of silver and the stationary ones are carried on a double leaf spring to prevent chattering.

The standard relay may be adjusted to operate from 90 to 140 volts 60 cycles (115 volts normal). One volt is the minimum change in voltage from the balance voltage at which the relay contacts should close and volt ½ is the minimum change in voltage from the balance voltage at which the compounding coils should release.

Special coils can be furnished for special voltages and frequencies.

The relay panel has a shock-proof mounting and is enclosed in a dust-proof metal cover. A glass front allows ready inspection of the operating parts.

OPERATION

Before attempting to operate the relay, remove the blocking between contacts and between the solenoid and plunger. See that the balance arm moves freely.

The schematic diagram of the relay is shown in Fig. 2.

On increase in voltage the plunger is raised, closing the left hand contact which completes a circuit from the balance arm to the external relays and also energizes the lower compounding coil which assists the solenoid to hold the contact closed. When the voltage again begins to decrease, the pull from the solenoid decreases but the compounding coil still exerts a pull until it is finally overcome by the weight of the plunger, when it suddenly releases and opens the relay contacts with a minimum of burning.

On decrease in voltage, the pull on the plunger is decreased until the weight of the plunger overcomes the spring tension and the right hand contact is closed. As previously described the circuits are completed to the external apparatus and now the upper compounding coil is energized which helps to keep the contact closed. As the voltage again increases the first additional pull on the plunger does not open the contact but finally it overcomes the pull of the upper compounding coil and the con-

Primary Relay with Dynamic Line-Drop Compensator Style No. 1017812—Continued

INSTRUCTIONS—Continued

tacts snap apart and the relay comes to the balanced position.

The action of the compensator is such that when rectified current is passed through the coil on the lower end of the plunger, a force is produced on the plunger in opposition to that produced by the field of the main operating coil, thus requiring a higher voltage on the operating coil to maintain a balance. The result is a compensation effect which is substantially proportional to the load and which, at a given load and compensator setting, is a constant value independent of the phase relation of the current and voltage of the load.

ADJUSTMENT

No provision is made for independent adjustment of resistance and reactance compensation as this device has a fixed ratio of these values, but the total amount of compensation may be readily adjusted to any value within the usual range. On feeders of small capacity a resistance drop equal to twice the reactance drop is a common ratio. With this ratio the compensation of the dynamic compensator is within the accuracy of setting of a standard full size line-drop compensator with both X and R compensation for load power factors between 70 and 98 per cent.

The correct setting is found by the following formula:

$$C = \frac{120}{\text{Line Voltage}} \left(IX \sin \varnothing + IR \cos \varnothing\right)$$

C = Compensator setting in volts.

$\varnothing$ = Angle of lag of current behind voltage at the prevailing full-load power factor.

*IX = Reactive voltage in line to be compensated.

*IR = Resistance voltage in line to be compensated.

*For single-phase circuits, use twice the values found for a single wire. For vector diagram see Fig. 3.

As received by the customer, when mounted on a regulator, no adjustment should be made to the contacts or compounding coil cores. If it is desired to operate the relay at a higher "balance" voltage this is accomplished by decreasing the spring tension and thereby increasing the unbalanced weight of the plunger. Conversely, if it is desired to lower the "balance" voltage operating point then the spring tension should be increased until the relay balances at the desired new voltage.

If the relay is out of adjustment as regards the variation in voltage required to close the contacts, balance the relay arm at a convenient steady voltage with the contacts open, then reduce the voltage an amount corresponding to one step voltage change and adjust right hand contact until it just closes and raise voltage one half this amount and adjust the upper compounding coil core by turning in or out until it just releases Now adjust the left hand contact by raising the voltage an amount corresponding to one step of voltage change above the steady balance voltage value and adjust the left hand contact until it just makes and then adjust the compounding coil until it just releases on decrease of one half of this voltage step.

Control of the amount of compensation is provided by a small rheostat connected in parallel with the compensating coil and shunting the desired portion of current from it. Adjustment is accomplished by turning a small knob on the relay panel. The scale around the knob is calibrated in volts when referred to a 120-volt circuit.

When making adjustments be sure that the contact arm does not touch the compounding coil cores or the relay will chatter. The compensating coil on the lower end of the plunger should not stop against the bottom of the guide.

The final stop should be the moving contact against the stationary contact.

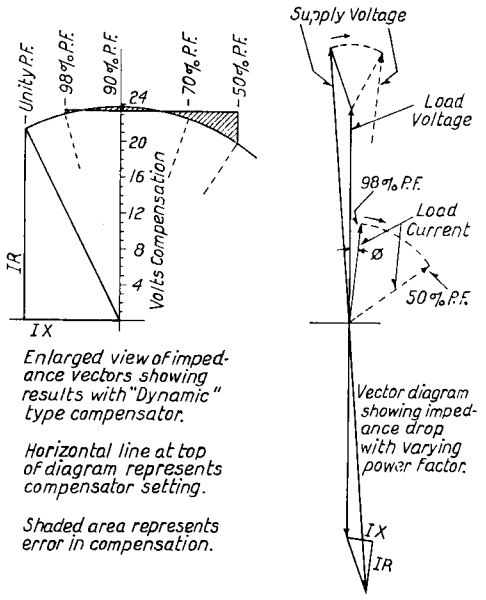

FIG. 3—VECTOR DIAGRAMS SHOWING RESULTS WITH DYNAMIC LINE-DROP COMPENSATOR

MAINTENANCE

The relay should be inspected at regular intervals to see that the balance arm works freely and that the contacts are not burned. If contacts should be burned, dress down with .000 sandpaper or crocus paper.

If plunger is sluggish, remove the screws holding the permanent magnet and then remove bearing screw at top and withdraw plunger and clean. There may be dirt or packing in the solenoid opening or dirt in the guide bearing.

CAUTION—Do not lubricate bearings.

Keep cover on tight.

RENEWAL PARTS

The following are recommended as renewal parts to provide proper maintenance of this Relay.

Description of Part	Style No.	No. Per Unit
Moving Contact and Stud	817 696	2
Stationary Contact with Spring	817 697	2
Moving Contact Shunt	127 466	1
Main Solenoid Coil	934 283	1
Compounding Coil	1 021 585	2
Compensating Coil	1 002 708	1
* Resistor	303 004	1

* This is not a part of the relay but is mounted separately.

ORDERING INFORMATION

The complete relay or resistor should be ordered from Sharon Works. Parts only should be ordered from Newark Works by either identifying, or giving a complete description of the desired part and the complete nameplate reading of the Relay.

Westinghouse Electric & Manufacturing Company

Sharon, Pa.

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