DESCRIPTION • OPERATION • MAINTENANCE

INSTRUCTIONS

CJ-1 VOLTAGE REGULATING RELAY

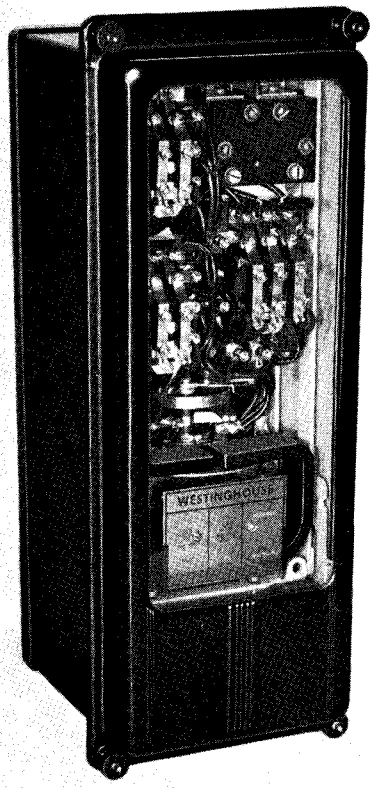


FIG. 1. CJ-1 Voltage Regulating Relay

THE CJ-1 VOLTAGE REGULATING RELAY is a "control package" designed to control the URL-8 Tap Changer. The relay consists of an induction disk type of voltage relay with auxiliary relays and equipment mounted in a M-10 semiflush Flexitest case. All that is necessary to complete the regulator control is to add QUICKLAG® breaker for short circuit protection, a manual control switch, and if desired, a line drop compensator.

The voltage sensitive element of the relay has a scale marked in one volt divisions from 105 to 135 volts. Response of the relay to a voltage change requires a time inversely proportional to the magnitude of the change. (See typical time-voltage curves). That is, the greater the change in voltage, the less time it requires for relay reaction.

Provision is made for an artificial line type line drop compensator with separate resistance and reactance controls. Terminals 15 and 16 are used for this purpose.

The general operating data for the relay on 60 cycles is:

Burden of the potential circuit at 120 volts	9 VA
100% load compensation current	0.12 Amp
Maximum volts across compensator at 100% load	42 Volts

INSTALLATION

The relays are usually mounted on the tap changer control panel. Before putting into service,

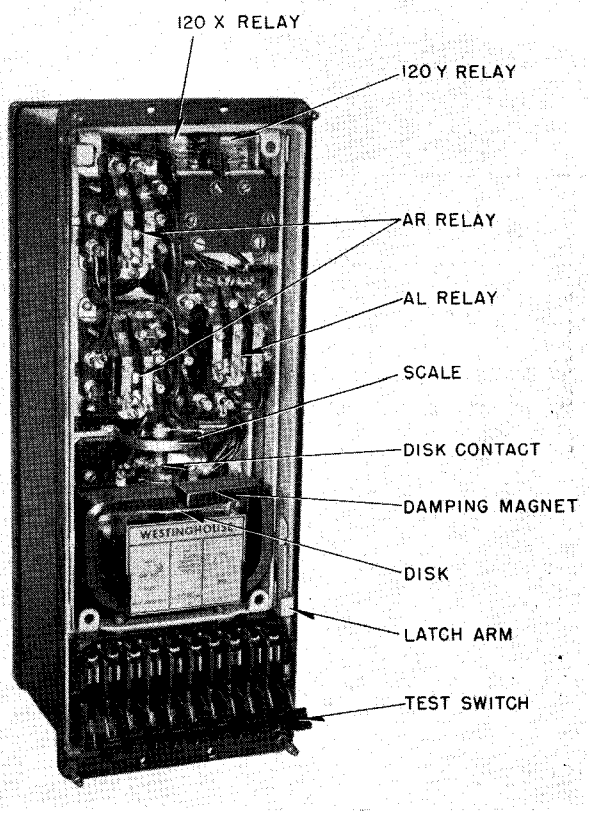


FIG. 2. CJ-1 Relay with Cover Removed, Showing Equipment Location

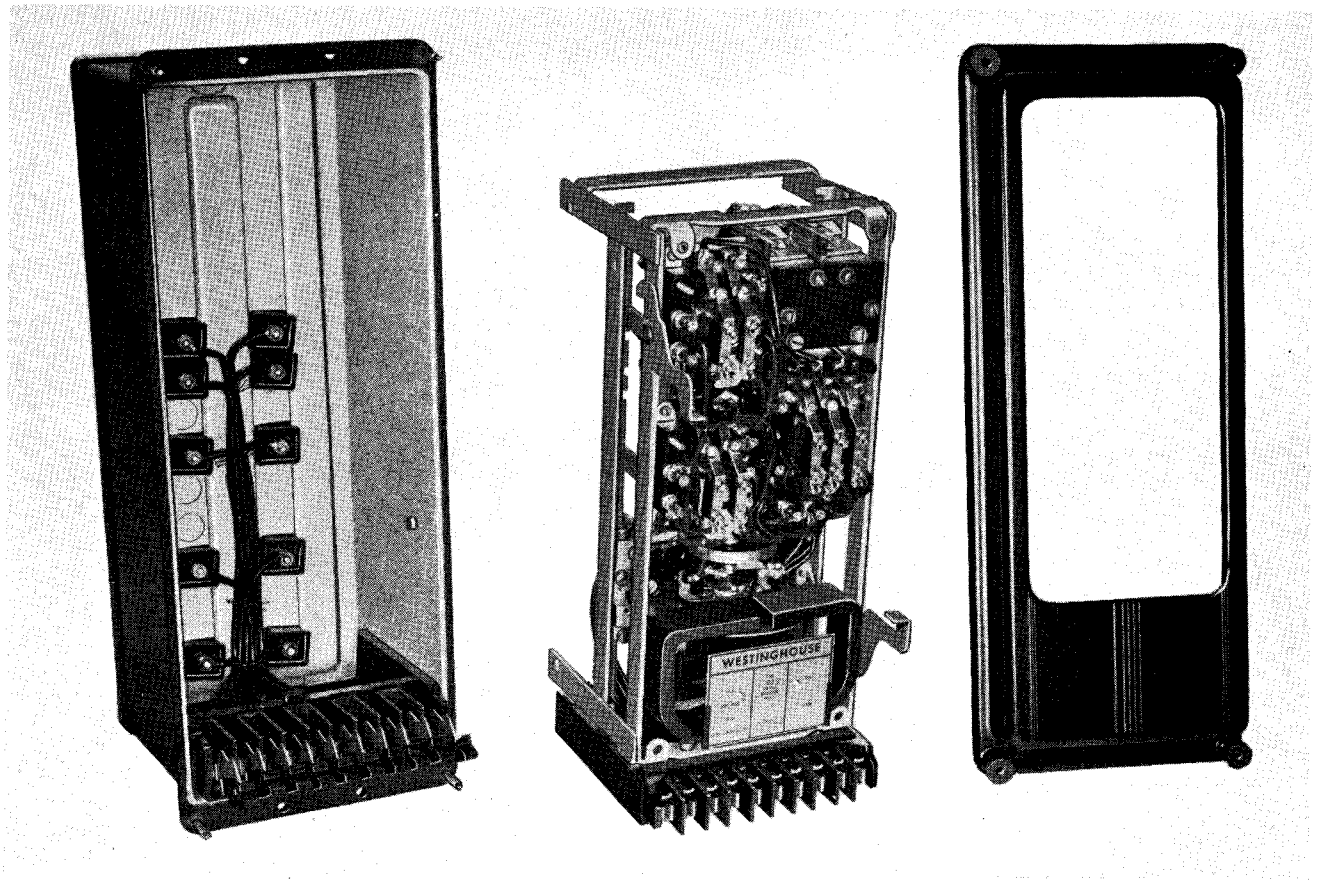
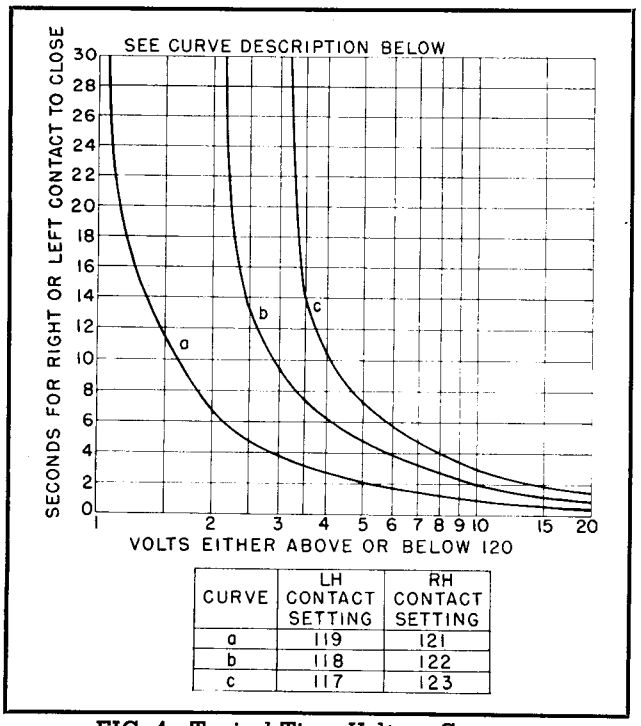


FIG. 3. CJ-1 Relay Showing Cover and Chassis Removed from M-10 Flexitest Case

remove the blocking which may have been inserted for the purpose of securing parts during shipment, make sure that all parts operate freely, and



CURVE	LH CONTACT SETTING	RH CONTACT SETTING
a	119	121
b	118	122
c	117	123

FIG. 4. Typical Time-Voltage Curves

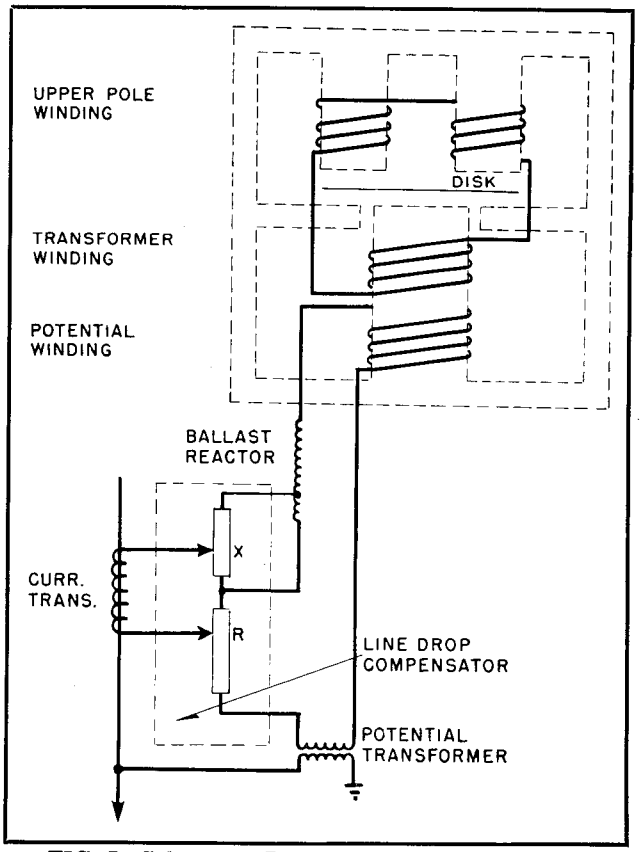


FIG. 5. Schematic Diagram of Voltage Element

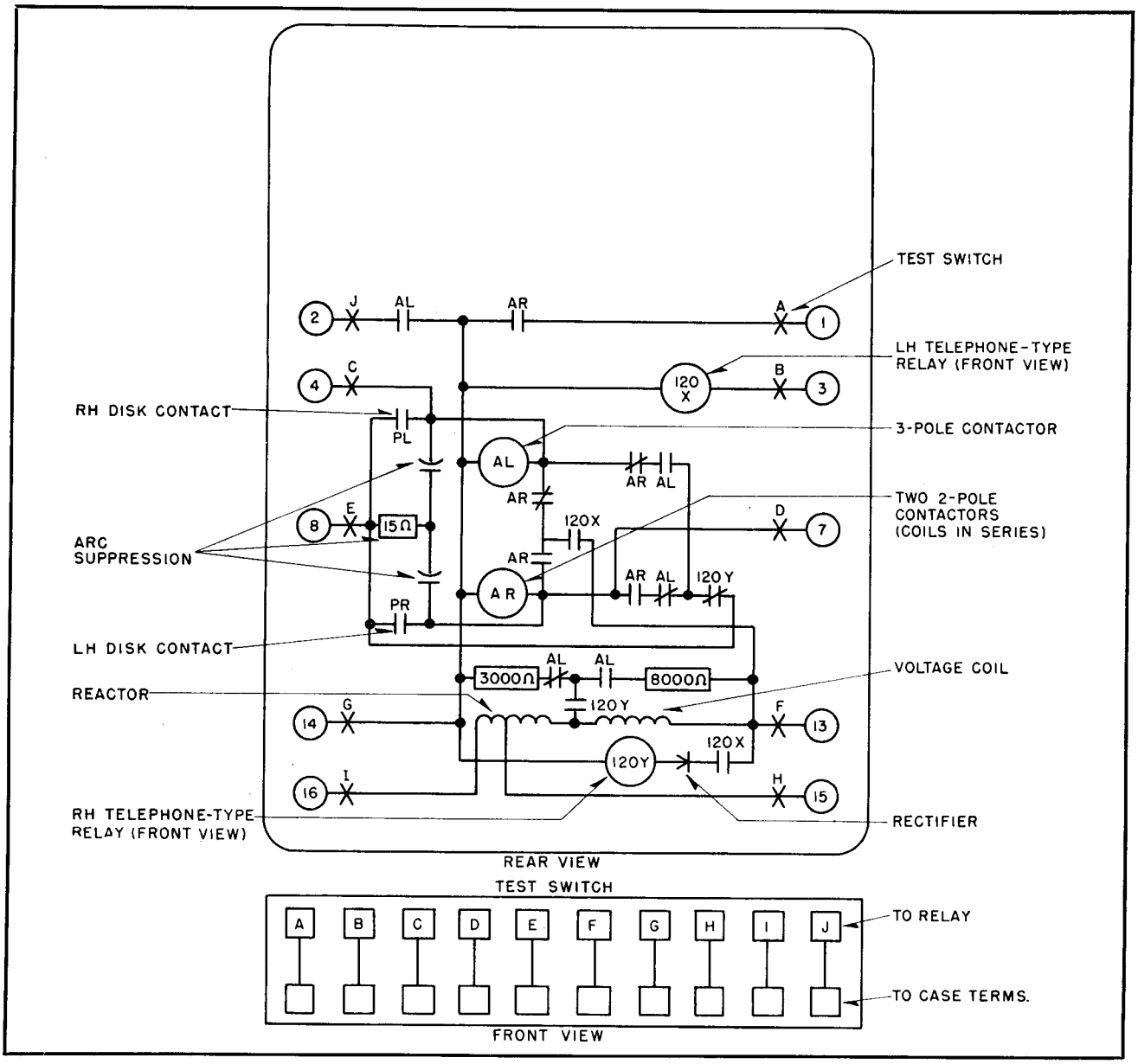


FIG. 6. Internal Connections of Type CJ-1 Relay

inspect the contacts to see that they are clean and close properly. Operate the relay to check the settings and electrical connections.

OPERATION

The voltage sensitive element of the CJ-1 relay is an induction disk voltage relay with one set of contacts making a double throw, single-pole switch. A resistor-capacitor combination is connected across the disk operated contacts and the auxiliary contactors are self-sealing to insure long contact life and positive operation.

A reactor is placed in series with the voltage sensitive element, creating a large unit of impedance. Variations of resistance due to temperature changes are thus made so small in comparison that they have practically no effect on the operation of the relay.

The voltage coil on the lower pole feeds a current to the upper pole circuit. This current induces a flux in quadrature with the lower pole flux that produces a torque on the induction disk.

The line drop compensator, when used, operates by producing a voltage proportional to the line drop and subtracts this from the applied voltage to simulate load center voltage.

If the voltage falls below the left hand, PR, contact setting long enough for the disk operated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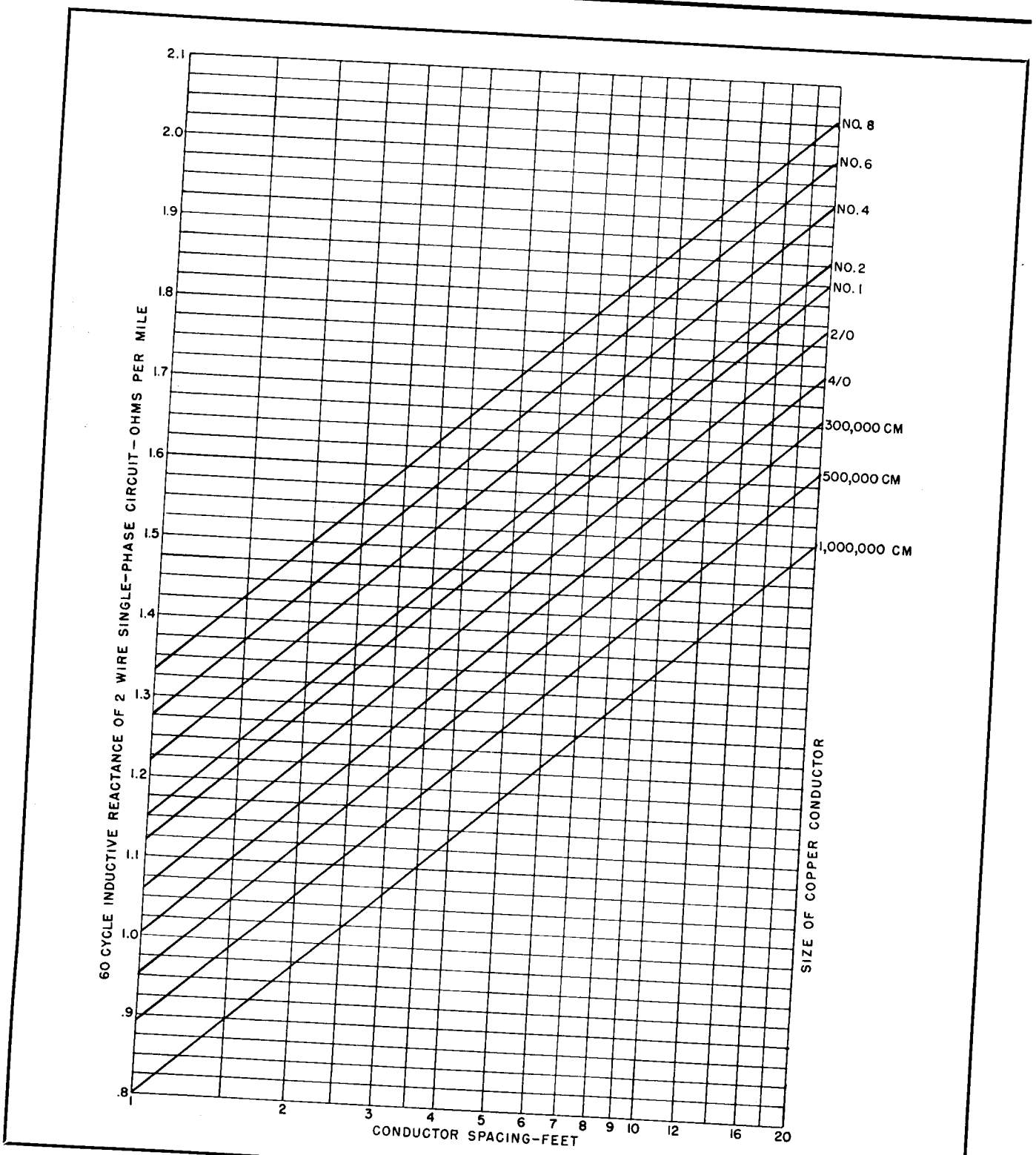

FIG. 7. Reactance Chart, Size of Conductor and Spacing, for 2-Wire, Single-Phase, 60 Cycle Circuit

PR contact to close, the auxiliary relay AR is energized and seals itself in through the normally closed 120Y relay contact. Closing the AR relay motor contacts causes the tap changer to move to raise the voltage. Before the tap changer arcing contact has opened, the 120 cam-operated pilot switch closes to energize the 120X relay which takes over the sealing of the AR relay by operating the 120Y slug delayed relay. The normally open 120Y relay contact closes and shorts the reactor with a 3000 ohm resistor to cause the disk to rotate and open contact PR, so that there is only

CJ-1 VOLTAGE REGULATING RELAY

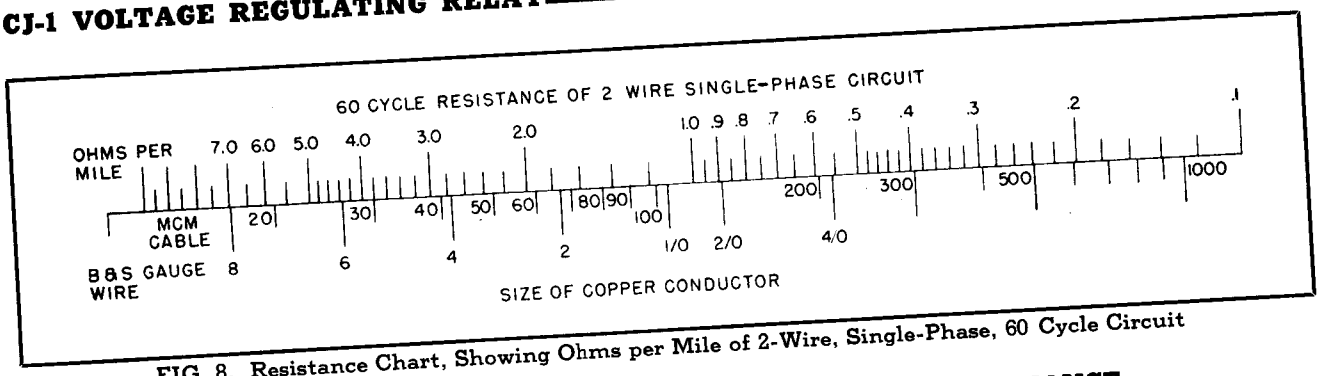

FIG. 8. Resistance Chart, Showing Ohms per Mile of 2-Wire, Single-Phase, 60 Cycle Circuit

one tap change operation at a time. After the tap changer arcing contact has closed on the next position, the 120 pilot switch opens allowing the 120X relay to release the AR relay. The tap changer motor is then stopped by the spring operated brake cam. If the voltage change is not corrected, the sequence is repeated after time delays until the voltage is corrected or a tap changer limit is reached. If the voltage rises until the right hand, PL, contact closes, a similar sequence operates to lower the voltage.

SETTING

The settings on the relay may most satisfactorily be made by field adjustment, but if the data on the particular line is known, the curves in Figs. 7 and 8 may be used.

A typical installation might be:
Single Phase, 2-Wire Circuit
7200 Volts (120 Volts Control)
Plus or Minus 1.5 Volts Band Width
2/0 Copper Conductor with 3 Ft. Spacing
4 Miles to Load Center
100 Amp Regulator with 100/.12 Amp C.T.
80 Amps Load Current

Set the left contact at 118.5 volts and the right contact at 121.5 volts.

From the Resistance Chart (Fig. 8) the resistance is 0.9 ohms per mile and from the Reactance Chart (Fig. 7) the reactance is approximately 1.33 ohms per mile.

The line drop compensator setting is:

$$\text{CT Primary Rating}^{*} \times \frac{\text{Control Voltage}}{\text{Line Voltage}} \times \text{Ohms per mile} \times \text{miles to the Load Center.}$$

$$100 \times \frac{120}{7200} \times 0.9 \times 4 = 6.0 \text{ Resistance Volts}$$

$$100 \times \frac{120}{7200} \times 1.33 \times 4 = 8.8 \text{ Reactance Volts}$$

These settings may be adjusted as found necessary as shown by load center voltage measurements.

* For URL-8 Regulators this equals the regulator rating.

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. Repair work can be most satisfactorily done at the factory. If it is desired to check the adjustment at regular maintenance, the following instructions should be followed.

Note: Before opening the test switches set the line drop compensator dials on zero and turn the power supply and manual control switches off.

Remove the cover by unscrewing the captive nuts of the cover corners. The relay can then be inspected and tested in the case or out of the case. External test circuits may be made to the relay with test clip leads or with a test plug.

To remove the chassis from the case, be sure the knife switches are fully open, grasp the two cam action latch arms, and pull outward. This releases the chassis from the case. Using the latch arms as handles, pull the chassis from the case. After removing the chassis, a duplicate chassis may be inserted in the case or the blade portion of the switches closed and the cover replaced without the chassis.

All contacts should be periodically cleaned with a fine file similar to S#1002110. Abrasive material should not be used because any small particles embedded in the soft silver surface will impair the contact.

To check the voltage circuit, apply 135 volt, 60 cycles a-c to terminals F & G until the relay reaches operating temperature (about one hour). If the line drop compensator is not used, 100 and 1000 ohm resistors should be connected to terminals G to I and I to H. Set one of the contacts at the control voltage. Adjust the spring until the contact just makes. Check the calibration at several points, using the left hand contact up to 120 volts and the right hand contact from 120 to 135 volts.

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