DESCRIPTION • OPERATION • MAINTENANCE

INSTRUCTIONS

VOLTAGE REGULATING RELAY TYPE CJ-1 WITH ADJUSTABLE TIME DELAY

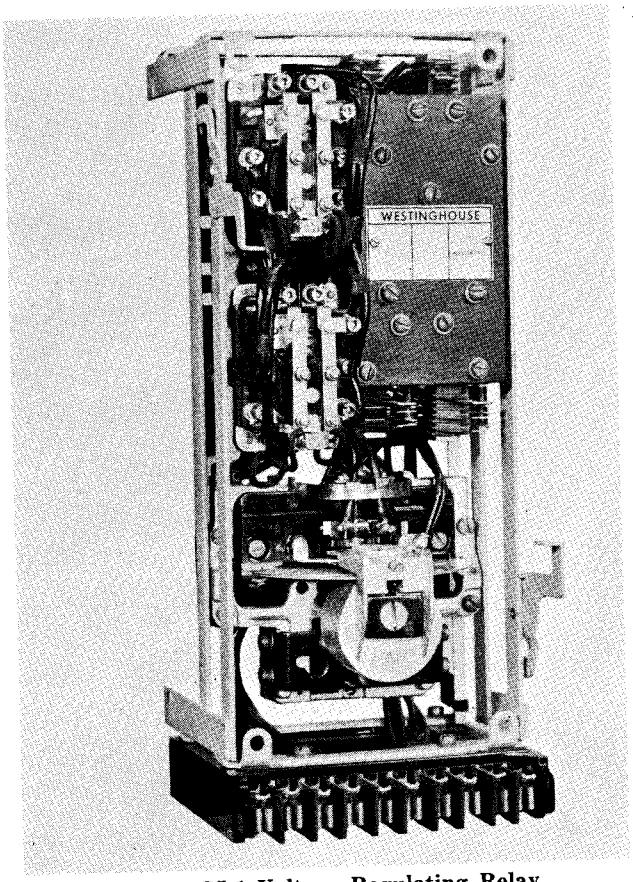


FIG. 1. CJ-1 Voltage Regulating Relay.

The CJ-1 VOLTAGE REGULATING RELAY is a "control package" designed to control the URL Tap Changer. The relay consists of an induction disc type of voltage relay with auxiliary relays and equipment mounted in an M-10 semiflush Flexitest* case. All that is necessary to complete the regulator control is to add a 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. This time delay may be adjusted to give optimum performance for particular operating conditions.

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 as follows:

	URL-8	URL-16
Burden of the potential circuit at 120 volts	10 va	10 va
Separate R and X compensation	12 volts	24 volts
100% load compensation current	0.12 amp	0.24 amp
Maximum volts across compensator at 100% load	42 volts	84 volts

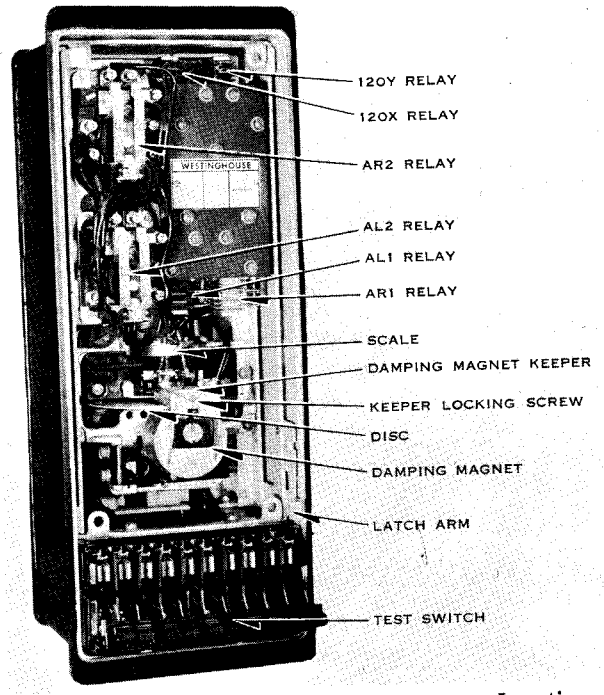
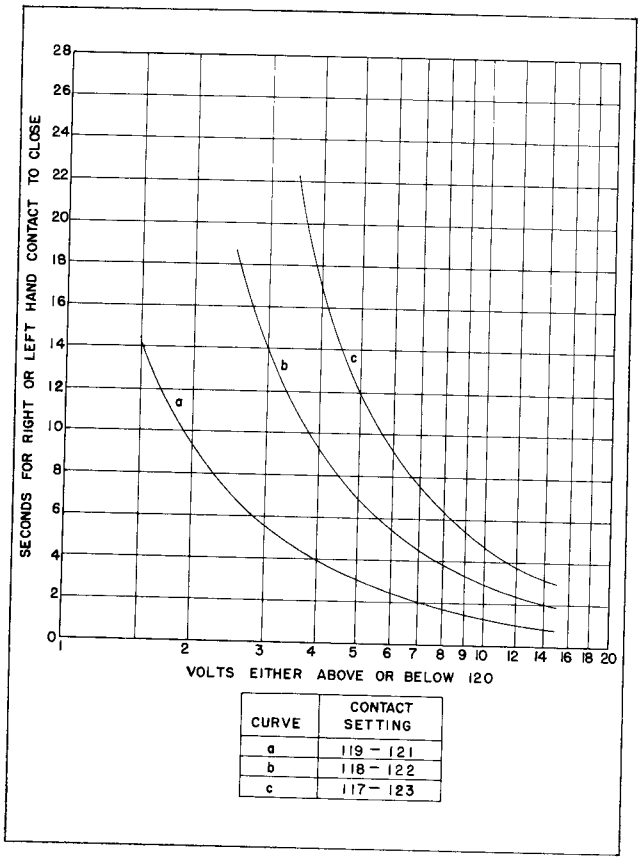


FIG. 2. CJ-1 Relay Showing Equipment Location.

* Trade Mark

NEW INFORMATION

EFFECTIVE JUNE, 1955



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

FIG. 3. Typical Time-Voltage Curve for Minimum Damping.

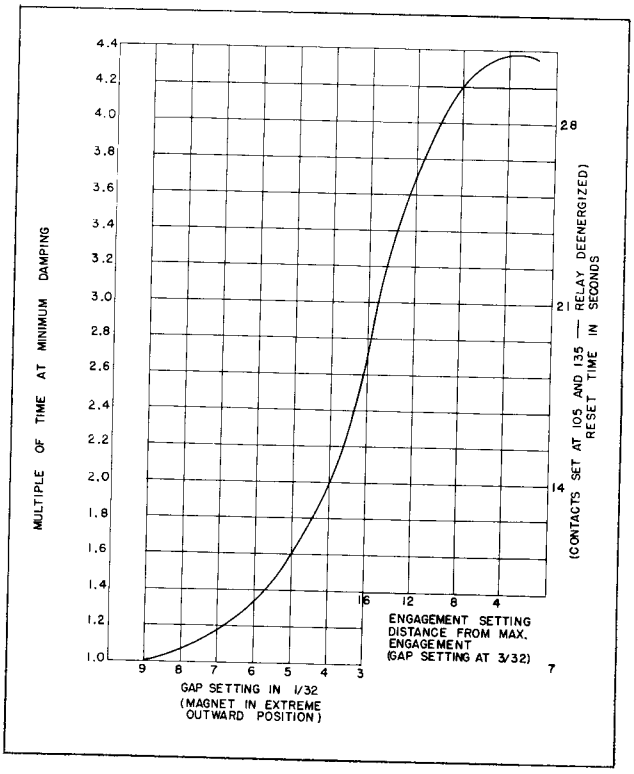


FIG. 4. Typical Permanant Magnet Setting and Time Factors.

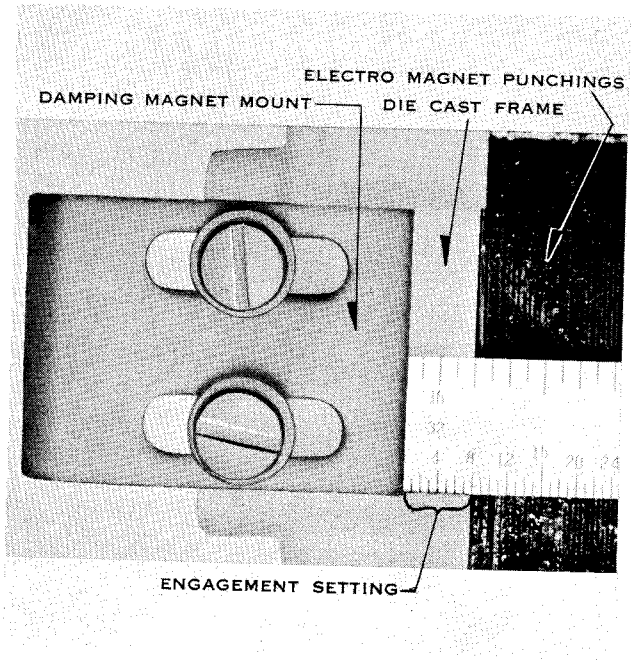


FIG. 5. Measure Engagement Setting.

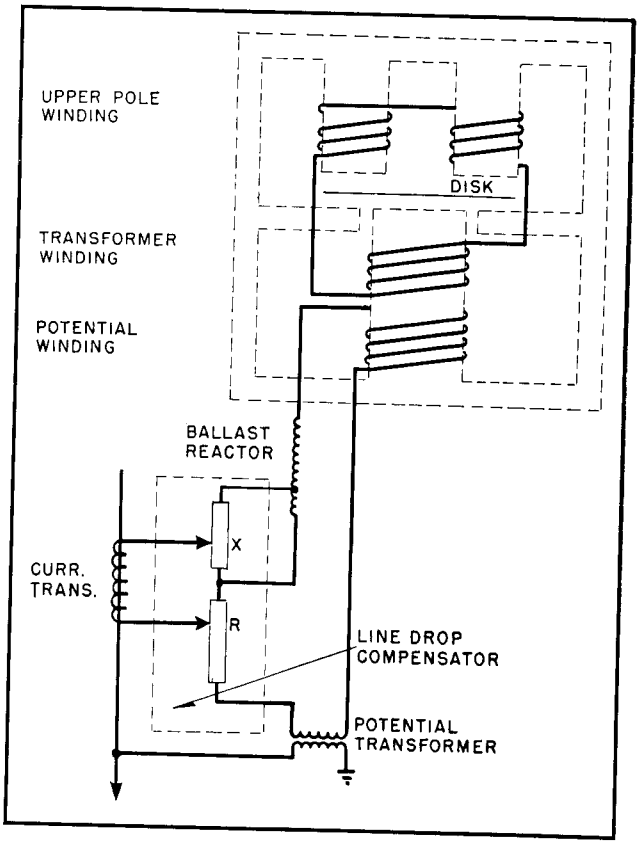


FIG. 6. Schematic Diagram of Voltage Element.

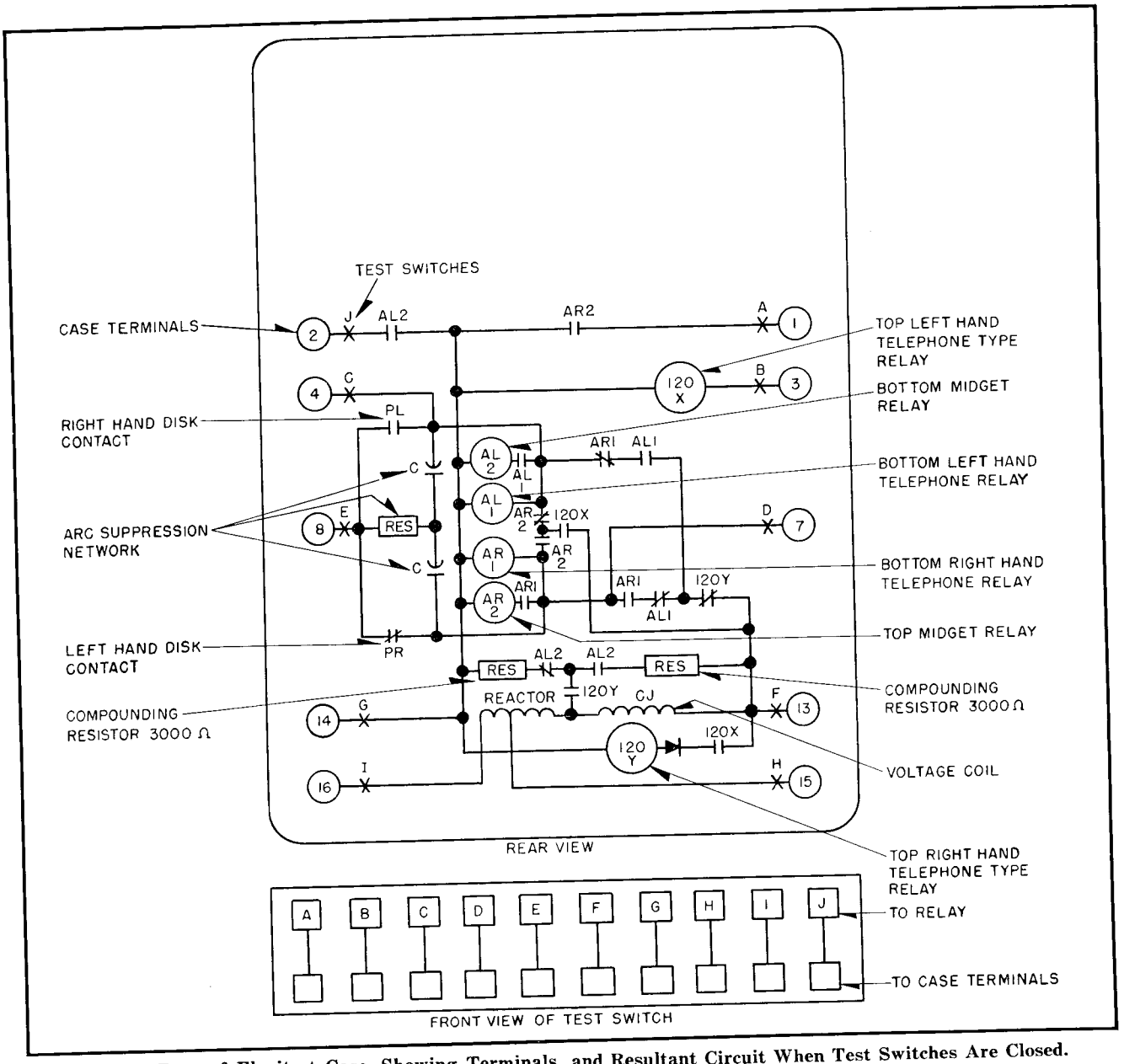


FIG. 7. Rear of Flexitest Case, Showing Terminals, and Resultant Circuit When Test Switches Are Closed.

INSTALLATION

The relays are usually mounted on the tap changer control panel. Before putting into service, remove the blocking which may have been inserted for the purpose of securing parts during shipment, make sure that all parts operate freely, and 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 (arc-suppressor network) 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

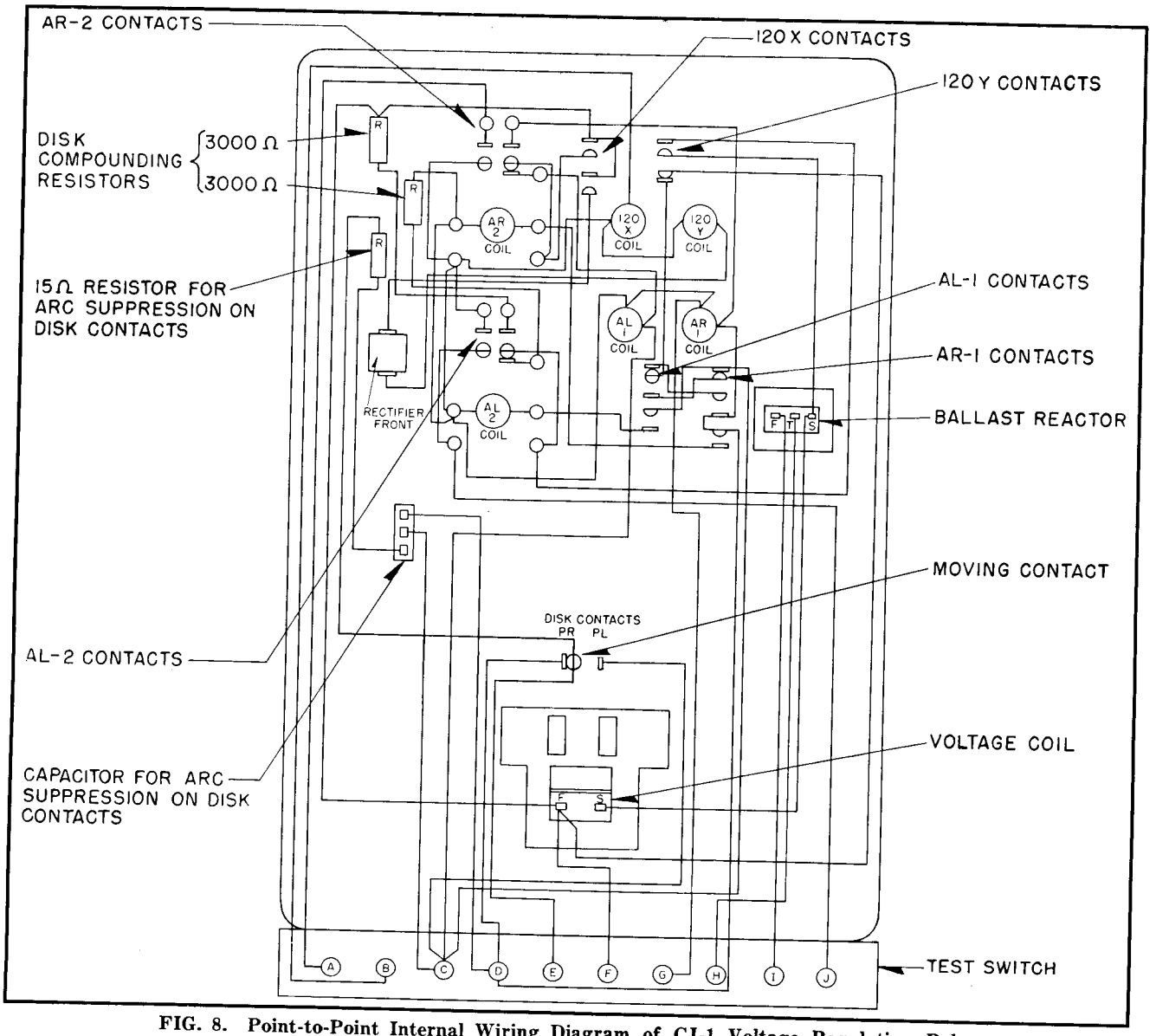


FIG. 8. Point-to-Point Internal Wiring Diagram of CJ-1 Voltage Regulating Relay.

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 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

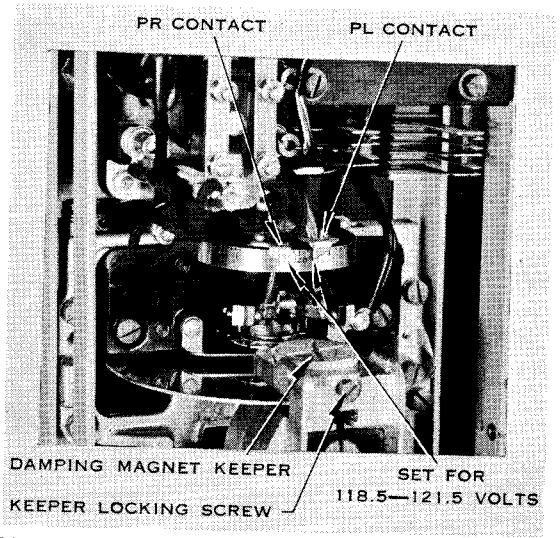


FIG. 9. Close-up View of Contact-Making Elements.

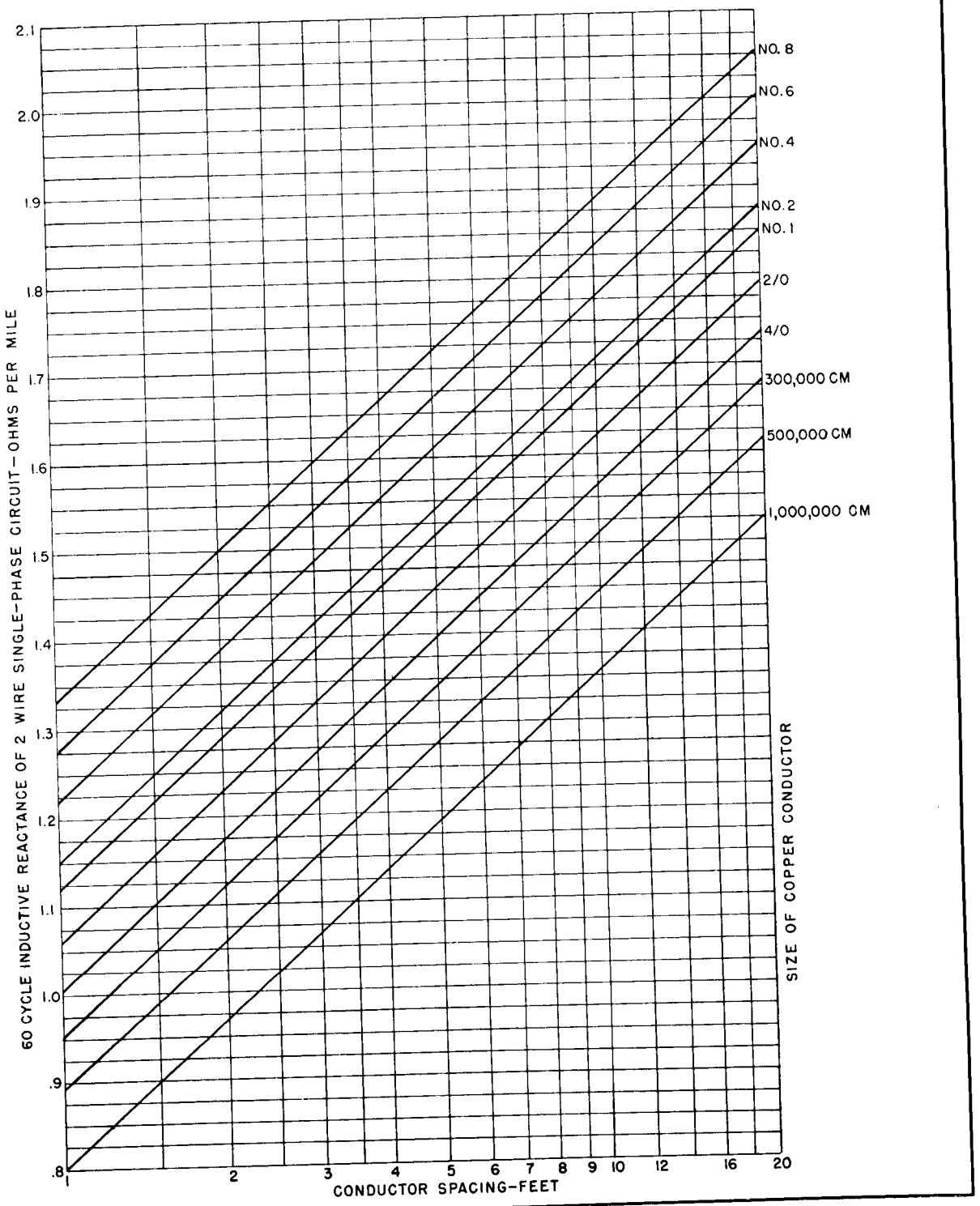


FIG. 10. Reactance Chart, Size of Conductor and Spacing, for 2-Wire Single-Phase, 60 Cycle Circuit.

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 one tap changer 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

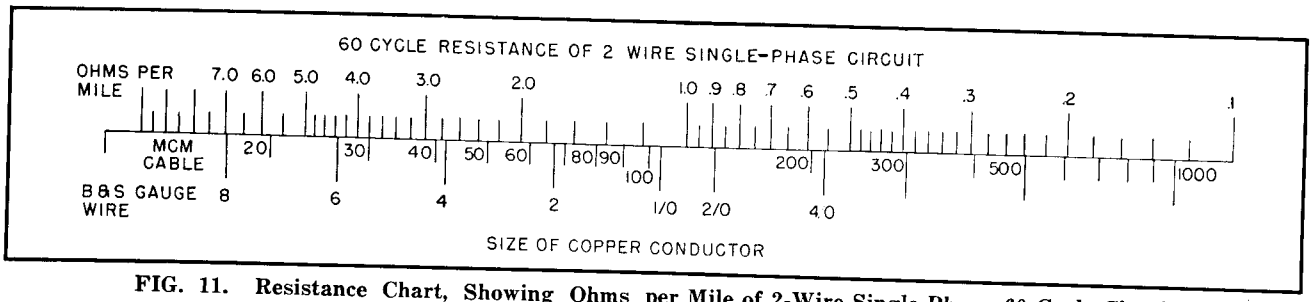


FIG. 11. Resistance Chart, Showing Ohms per Mile of 2-Wire Single-Phase, 60 Cycle Circuit.

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.

SETTINGS

CJ-1 Relay. The scale can be used to position the stationary contacts. A more accurate setting may be made by applying voltages measured with an accurate voltmeter, if sufficient time is given the disc to reach its balance position.

The CJ-1 package control has only two adjustments to be made by the customer. That is, band width and time delay (other than the line-drop compensator which is an external network). The voltage sensing element of the CJ-1 relay is essentally a very highly damped voltmeter with limits in the form of the PL and PR contacts. To adjust the band width of the relay on the regulator, apply a voltage of about 120 volts to the test terminals for approximately one hour. This allows the elements of the relay to reach normal operating temperature. After this time, apply to the test terminals the voltages which determine when the tap changer is to operate. For example, if 120 volts $\pm$ 1.5 volts is desired, 118.5 volts should be applied to the test terminals. After the disc has reached this balance position, move the left hand or PR contact until it makes the disk contact of the contact-making voltmeter. This sets the lower limit of the band. The next step is to apply 121.5 volts to the test terminals and move the PL or right hand contact until it makes on the disk contact. This sets the raise limit of the band and the regulator will now operate when the voltage falls to 118.5 or below or increases to 121.5 or above and in such a direction as to correct the voltage to within the 118.5 and 121.5 volt value.

To check the relay when not in the regulator, it is recommended that a Flexitest plug Style No. 1164 046 be used and inserted in the jack at the base of the relay chassis. A 100 ohm resistor should then be inserted between G and I. Next, apply the desired voltages as suggested above (considering points F and G equivalent to the test terminals on the complete regulator) and set the contacts as outlined above. The CJ-1 is a self-sealing network and the relays will clear by putting a jumper from point B to F. This has the same effect as closing of the 120 switch during tap changer operation on the regulator, clears the self-sealing network and applies the negative contacts to the disk.

The time delay may be adjusted by changing the damping magnet engagement of the disc and the gap setting between the damping magnet and keeper. The magnet engagement of the disc should be minimum (magnet all the way out) before increasing the magnet to keeper gap setting to prevent interference with the stationary contacts.

Approximate time delay performance may be predicted by multiplying the ordinates of Figure 3 by a time factor which is numerically equal to 1/7 of the reset time in seconds. The reset time is the time required for the disc to move from the 135 V position to the 105 V position with the electromagnet deenergized. Figure 4 shows typical time factors and reset times for different magnet to keeper gap settings and different magnet engagement settings. Each turn of the magnet keeper changes the gap 3/2 inch.

Line-drop Compensator. The settings on the line-drop compensator may most satisfactorily be made by field adjustment, but if the data on the particuar line is known, the curves in Figs. 10 and 11 may be used, and values calculated.

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 Current Transformer (URL-8)

(100 Amp Regulator with 100/.24 Amp CT.) (URL-16)

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. 11) the resistance is 0.9 ohms per mile and from the Reactance Chart (Fig. 10) the reactance is approximately 1.33 ohms per mile.

The line-drop compensator setting is:

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

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

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

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

*For URL 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 (with the exception of bandwidth or time delay settings). 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. 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 handes, 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.

When necessary, the contacts should be cleaned with a fine file similar to S#1002 110. Abrasive material should not be used because any small particles embedded in the contact surface will impair the contact operation.

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