INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CJ-4 CAPACITOR SWITCHING RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type CJ-4 relay is the master relay for single-step voltage control for capacitor switching where fixed time-delay is required to avoid unwanted switching operations due to momentary fluctuations in voltage, or where it is desired to use fixed time-delay to coordinate with other voltage regulating devices. The fixed time-delay may be changed by plugging a new time-delay element having the desired time interval.

CONSTRUCTION AND OPERATION

The relay consists of a voltage-operated induction disc element, a reactor, a type SG auxiliary relay, and two socket-mounted thermally-operated time-delay relays. The operating element is an induction disc type element operating on voltage. The induction disc is a thin four-inch diameter conducting disc mounted on a vertical shaft. The shaft is supported on the lower end by a steel ball bearing riding between concave sapphire jewel surfaces and on the upper end by a stainless steel pin.

The moving contact is a small silver rod hemispherically shaped at either end to form a double throw arrangement. It is fastened on the end of a conducting arm. The other end of this arm is clamped to an insulating tube on the disc shaft. The electrical connection is made from the moving contact thru the arm and a spiral spring. One end of the spring is fastened to the arm, and the other to a slotted spring adjuster disc which in turn fastens to the moulded insulation block mounted on the element.

The front and back stationary contacts assemblies are both adjustable. Each mounts on a lever which can be set anywhere about the periphery of a calibrated scale. The moulded brackets, upon which the stationary contact leaf springs are mounted, are each secured to their respective lever arms by two screws. These screws may be loosened and the moulded contact supports pivoted to the positions required for correct tracking of both contact assemblies on the calibrated scale.

The moving disc is rotated by an electromagnet in the rear and damped by a permanent magnet in the front.

The reactor is connected in series with the operating element potential coil to minimize ambient temperature error.

The auxiliary type SG relay is provided with double-pole double-throw contacts. One set of double-throw contacts is used in conjunction with the induction element contacts and the time-delay element contacts to control the picking up or dropping out of the SG element. The second set of double-throw contacts is used for controlling the switch which connects or removes the capacitor from the line.

The time-delay devices have sealed-in-glass elements and are mounted in standard radio-type octal sockets. They have a single set of

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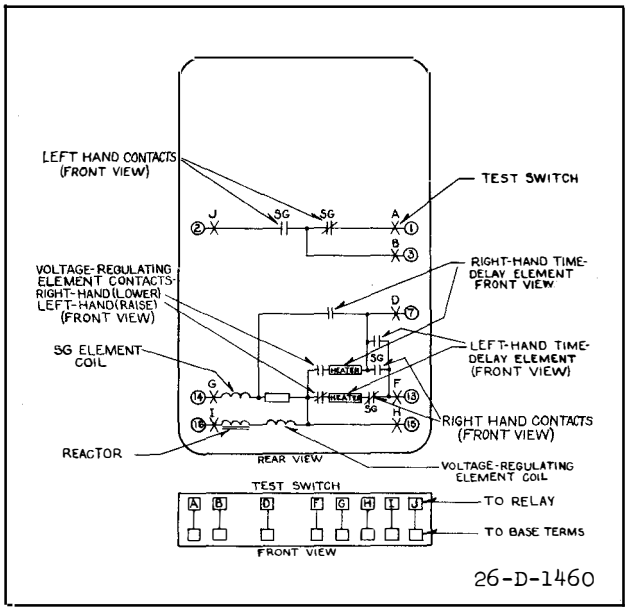

Fig. 1—Schematic Internal Connections of Type CJ-4 Relay.

contacts, which are normally open and are operated by a heater winding acting upon a bi-metal arm. The construction is such that the contact gap and the time-delay are not affected by variations in ambient temperature. The time-delay of a given element is non-adjustable, but elements are available with a variety of time-delays and because of the socket-mounting construction one element can readily be substituted for another in the CJ-4 relay. The usual time-delay is 60 seconds.

When the induction element contacts close to the left-hand side (indicating that the line voltage is lower than normal), the heater of the left-hand time-delay element is energized through the right-hand back contact of the SG element. If the induction element contact remains closed until the left-hand time-delay element contact can close, these contacts complete an energizing circuit for the SG element coil. The SG back contacts open, deenergizing the time-delay element, and the associated front contacts seal around the time-delay element contact. The front contact on the left-hand side of the SG element closes to energize the switch which connects the capacitor to the line. In case this does not raise the voltage sufficiently to open the left-hand contact of the induction element, the associated time-delay element remains de-energized because the SG element back contacts are open.

If the line voltage rises sufficiently to maintain the right-hand contact of the induction element closed for the required time, the right-hand time-delay contact closes and by-passes the SG element coil. A resistor in series with the coil limits the current to slightly over one ampere. The SG element drops out and this current is interrupted by opening of the right-hand make contact of the SG relay. Closing of the left-hand break contact of the SG element opens the switch which connected the capacitor to the line. The equipment then is in readiness to go through another similar cycle.

* INSTALLATION

The relay should be mounted on switchboard panel or its equivalent in a location free from dirt, moisture, excessive vibration and heat. Mount the relay vertically by means of the two mounting studs for the type FT projection case or by means of the four mounting holes on the flange for the semi-flush type FT case. Either of the studs or the mounting screws may be utilized for grounding the relay. The electrical connections may be made direct to the terminals by means of screws for steel panel mounting or to terminal studs furnished with the relay for ebony-asbestos or slate panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the studs and then turning the proper nut with a wrench.

CHARACTERISTICS

The type CJ-4 relay has adjustable high and low voltage contacts that can be set around a calibrated scale between the limits of 105 and 135 volts. The moving contacts will assume a position corresponding to the voltage applied to the relay and will stay in that position until the voltage changes. If the voltage changes either gradually or suddenly, the contact will assume a new position corresponding to the change unless the travel is limited by

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the setting of the adjustable contacts.

The induction element has inverse timing; that is, the greater the change in voltage the faster the relay contact will travel. However, the time-delay of the induction element usually is only a few seconds and is negligible as compared to the delay of the thermally-operated elements. If the voltage on the induction elements is barely sufficient to close the contacts, the contact resistance at this light pressure may reduce the voltage on the time-delay element sufficiently to cause a substantial increase in the time. If the voltage change is 1/2 to 1 volt greater than that required to barely close the induction-element contacts, this effect is negligible. However, the time delay-elements themselves have a tolerance of ± 15% of the nominal delay, and the nominal value applies only when these elements are energized at their 117 volt rating. Variations from this value affect the timing approximately inversely as the square of the voltage. Because of these factors, precise time-delays should not be expected.

ADJUSTMENTS AND 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. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be periodically cleaned with a fine file. S#1002110 file is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

The relay has front and back adjustable stationary contacts; to adjust these properly, set the two levers so they both point to the same calibration point at approximately mid-scale. The contact leaf springs of the operating element should be positioned such that they are just free of the contact hook brackets to insure no initial tension in the leaf-springs. Then adjust the position of the front and back contacts so they both just touch on either side of the moving contact. This is done by loosening the two screws at the top of each lever and rotating the adjustable contact assembly slightly until the desired contact positions are obtained. The screws should be tightened securely.

To calibrate the relay, it should be connected to a suitable 60 cycle voltage source. Voltage corresponding to the various values marked on the semi-circular scale plate should be applied to the relay and the position of the adjustable contacts checked for the various values. Re-adjustments can be made by rotating the notched spring adjuster with a screw driver blade inserted in one of the notches.

The time-delay elements will give long, trouble-free service, and because of their construction it is not possible to adjust or to perform any maintenance on them.

The SG relay element should have approximately 1/8" contact gap, with about 3/64" follow on the make contacts and 1/32" follow on the break contacts.

ENERGY REQUIREMENTS

The 60 cycle burdens of the type CJ-4 relay are as follows:

Induction element potential coil plus reactor, VA = $8.2 \angle 72°$ lag at 120 volts. SG element plus resistor, VA = $11 \angle 60°$ lag at 120 volts. Time-delay element, VA= 5 at unity p.f. at 117 volts.

Contact Rating

The main SG element contacts will carry 12 amperes continuously and 30 amperes for one second, and will interrupt 30 amps. non-inductive load at 105 to 135 volts 60 cycles. For d-c, the interrupting ratings for non-inductive circuits are given in the table that follows:

Volts	Amps
24	15
48	8
115	2.4
230	0.75
550	0.25

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RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

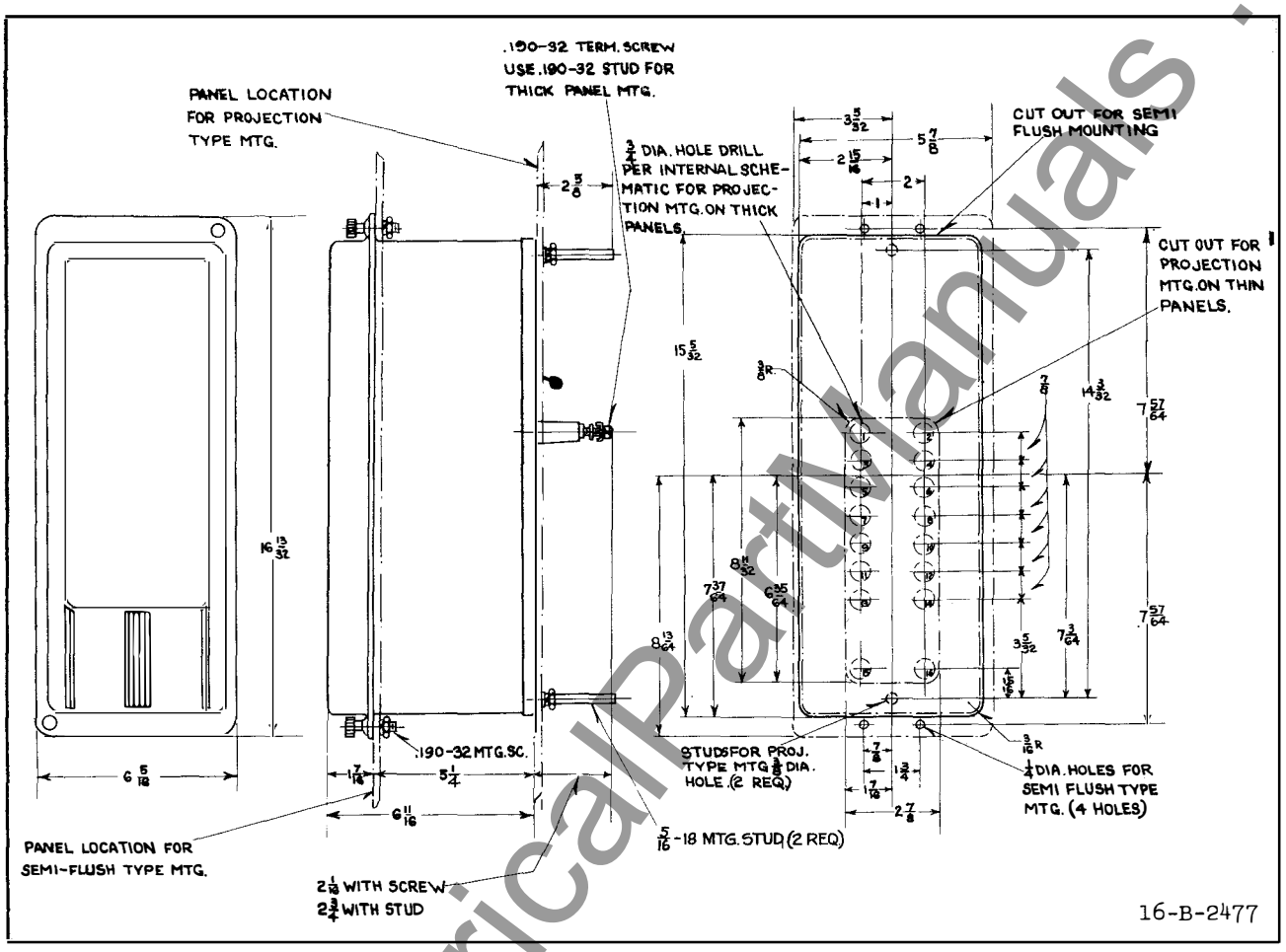

Fig 2—Outline And Drilling Plan For Type CJ-4 Relay In The Semi-Flush Or Projection Type FT Case. See The Internal Schematic For The Terminals Supplied. For Reference Only.

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