INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CJ-6 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-6 relay is the master relay for voltage and current control for capacitor switching. It will respond to changes in line voltage and has the added feature of load current compensation.

CONSTRUCTION AND OPERATION

The relay contains a current-operated induction disc element, a voltage-operated induction disc element, two type SX toggle units, a counter, and two socket mounted thermally-operated time delay relays.

CURRENT SENSING UNIT (90C)

The electromagnet is an "E" type laminated structure with the tapped current coil mounted on the center leg that produces a flux which divides and returns through the outer legs. A shading coil on the right leg, front view, causes the flux to lag the main pole flux. The out-of-phase fluxes, thus produced in the air gap cause torque on the disc. The current sensing unit has a tap block which provides two current ranges.

VOLTAGE SENSING UNIT (90V)

The electromagnet is an "E" type laminated structure with the voltage coil mounted on the center leg that produces a flux which divides and returns through the outer legs. A shading coil on the right leg, front view, causes the flux to lag the main pole flux. The out-of-phase fluxes thus produced in the air gap cause torque on the disc.

TOGGLE UNITS (SX) (90CX) (90VX)

The SX toggle unit consists of two electromagnets with a common armature. One end of the armature has two pins which rest in a groove in the molded base. The other end of the armature is held in one of two positions by means of a toggle spring which produces the toggle action. The toggle spring is protected during shipment by a removable lock pin which limits the forward motion of the armature. The lock pin does not affect the normal operation of the relay and may be left in after installation. The moving contacts are mounted at one end of the armature and the stationary contacts are mounted on either side.

TIME DELAY UNITS (2, 62)

The time delay units have sealed-in glass elements and are mounted in standard radio-type octal sockets. They have a single set of contacts, which are normally open and are operated by a heater winding acting upon a bimetal arm. The construction is such that the contact gap and the time delay of a given unit are not affected by variations in ambient temperature. The time delay of a given unit is non-adjustable, but units are available with a variety of time delays, and because of the socket mounting construction, one unit can readily be substituted for another. The usual time delay is 60 seconds.

OPERATION

When the line voltage drops to a point where switching is necessary, the voltage unit moving contact closes to the left and energizes the external control circuit in preparation for a switching-in operation. When the line voltage rises above the preset value, the voltage unit moving contact closes to the right and energizes the control circuit in preparation for a switching-out operation. If the line voltage returns to normal before the switching operation starts, then the disc contact parts from the stationary contact and no switching occurs.

The contacts of the current-operated element close to the right when the load current increases to a value greater than the preset value. When the contacts close to the right, an SX unit is energized.

One set of the SX unit contacts is connected normally closed so that they shunt out the compensator rheostat which is in series with the voltage unit. When the SX unit is energized, these contacts open so that the rheostat is in series with the voltage element. This reduces the voltage drop across the voltage element and causes it to operate as if the line voltage were low.

After the switching-in operation, caused by the operation of the SX unit, is completed the load current may fall below a preset value. The contacts of the current-operated element will close to the left. This will reset the SX unit. The contacts of the SX unit will return to their normal position and the voltage operated element will regain its normal voltage sensitivity.

CHARACTERISTICS

The type CJ-6 relay has adjustable high and low voltage contacts that can be set around a calibrated scale between the limits of 105 and 135 volts (or 95 to 125 volts). It also has adjustable high and low current contacts that can be set around a calibrated scale between the limits of 1 to 4 or .5 to 2.0 amperes. The moving contacts of voltage and current elements assume a position corresponding to the voltage applied to and current through the respective elements and will stay in that position until the voltage or current changes. If the change is either gradual or sudden, the contact will assume a new position corresponding to the change unless the travel is limited by the setting of the adjustable contacts.

The induction elements have inverse timing; that is, the greater the change in voltage or current 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 unit. If the voltage on the voltage unit is barely sufficient to close the contacts, the contact resistance at this light pressure may reduce the voltage on the time delay unit 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 unit contacts, this effect is negligible. However, the time delay units themselves have a tolerance of ± 15% of the nominal delay, and the nominal value applied only when these units 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.

SX CONTACT RATING

The SX toggle unit contacts will carry 5 amperes continuously. They will interrupt non-inductive circuits carrying 20 amperes at 115 volts, a-c, 10 amperes at 230 volts a-c, 2 amperes at 125 volts d-c, or 0.75 amperes at 250 volts d-c.

SETTINGS

CURRENT SENSING UNIT (90C)

The current sensing unit settings is defined by the contact setting and tap setting. The lower and raise contact settings are described under "Characteristics."

There are two tap settings: the .5-2 amp tap and the 1-4 amp tap. The connector screw, on the tap plate to the left of the scale makes connections to the two taps on the operating coil. The tap setting is made by placing this screw in the desired tap as marked on the tap plate.

CAUTION

Since the tap block connector screw carries operating current, be sure that the screw is turned tight. In order to avoid opening the current transformer circuits when changing taps under load, connect the spare connector screw in the desired tap position before removing the other tap screw from the original tap position.

VOLTAGE SENSING UNIT (90V)

There are two independent relay adjustments. These are the high voltage and low voltage contact settings as described under "Characteristics."

COMPENSATOR RHEOSTAT

The compensator rheostat is adjustable through a calibrated range equivalent to 14% (or 25%) compensation depending upon the relay style. The dial is calibrated in per cent of voltage setting.

INSTALLATION

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

For detailed FT case information, refer to I.L. 41-076.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay no customer adjustments should be made, other than those covered under "SETTINGS."

ACCEPTANCE CHECK

The following checks are recommended to insure that the relay is in proper working order:

A. CURRENT SENSING UNIT (90C)

ADJUSTMENT CHECK

1. Contact – Set the left-hand contact in the center of the scale and adjust the current until the moving contact just makes. Set the left-hand contact back out of the way and bring the right-hand contact up until the contacts just make. The right pointer should be within ± 1/32" of where the left-hand pointer was.
2. Calibration Check – Check the scale markings by setting either of the two contacts at a value marked on the scale, then alternately apply this current plus .1 amp and minus .1 amp. Contacts should make and break respectively. The 1.25 amp setting on the .5-2 amp range should coincide with 2.5 amp setting on the 1-4 range.

B. VOLTAGE SENSING UNIT (90V)

1. Contact Adjustment Check – Set the left-hand adjustable contact in the center of the scale and adjust the voltage until the moving contact just makes. Set the left-hand contact back out of the way and bring the right-hand contact up until the contacts just make. The pointer should be within ± 1/32" of where the left-hand pointer was.
2. Calibration Check – Check the scale markings by setting either of the two contacts at a value marked on the scale, then alternately apply this voltage plus and minus 1 volt. Contacts should make and break respectively. Open SX contact shunting the compensator rheostat. Contact action will remain the same except at a new voltage level corresponding to the rheostat dial setting.
3. Operating Time – The time delay of the thermally operated units should be 60 seconds, plus or minus 15% at 117 volts.

C. SX TOGGLE UNITS (90CX) (90VX)

1. Calibration Check – If correctly adjusted, the unit will operate through its own contacts, without chattering at 80% of rated voltage.

ROUTINE MAINTENANCE

All relays should be inspected periodically and the time of operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application. The use of phantom loads, in testing induction-type relays, should be avoided, since the resulting distorted current wave form will produce an error in timing.

All contacts should be periodically cleaned. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not 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.

CALIBRATION

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or the adjustments disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order. (See "Acceptance Check.")

A. CURRENT SENSING UNIT (90C)

1. Contacts – Apply sufficient current to the relay, to make the disc float in the center of its travel. Move both of the adjustment contacts until they just make with the moving contact. If the two contact pointers do not meet at the same point on the scale, adjust the follow on both adjustable contacts. Approximately the same follow should be in each of the adjustable stationary contacts.

2. Calibration Check – The adjustment of the spring tension in calibrating the relay is most conveniently made with the damping magnet removed.

   Set either of the adjustable stationary contacts in the center of its travel and apply this current to the relay. Wind up the spiral spring by means of the spring adjuster until the stationary contact and moving contact just make.

   Check the other scale markings by setting the adjustable contact on these markings and applying the corresponding current to the relay. The contacts should make within plus or minus .1 amp of scale marking for the 1-4 amp range and .05 amps for the .5 to 2 amp range. The 1.25 amp marking on the .5-2 amp range should coincide with the 2.5 amp marking on the 1-4 amp range.

B. VOLTAGE SENSING UNIT (90V)

1. Contacts – Apply sufficient voltage to the relay, to make the disc float in the center of its travel. Move both of the adjustable contacts until they just make with the moving contacts. If the two contact pointers do not meet at the same point on the scale, adjust the follow on both adjustable contacts. Approximately the same follow should be in each of the adjustable stationary contacts.

2. Calibration Check – The adjustment of the spring tension in calibrating the relay is most conveniently made with the damping magnet removed.

   Set either of the adjustable stationary contacts in the center of its travel and apply this voltage to the relay. Wind up the spiral spring by means of the spring adjuster until the stationary contact and moving contact just make.

   Check the other scale markings by setting the adjustable contact on these markings and applying the corresponding voltage to the relay. The contacts should make within plus or minus 1 volt of scale marking.

   Open SX contact shunting the compensator rheostat. Contact action will remain the same except at a new voltage level corresponding to the rheostat dial setting.

C. SX TOGGLE UNITS

If the SX toggle unit has been dismantled, it is necessary to check the toggle action and the contact follow after reassembling it. Set the gap between the lower pole pieces at 11/64". The contact follow should be set at .037". This may be obtained by adjusting the stationary contacts to just make when there is an .020" gap between the residual pin in the armature, and the upper pole pieces. The adjusting screw assembly should be pushed down until there is enough tension to cause the residual pin to rest against the pole piece. With the lock nut tightened, adjust the adjusting screw until there is equal toggle pressure on each side. This may be done mechanically with a gram gage or electrically by applying a voltage to the coils.

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.

ENERGY REQUIREMENTS

The 60 cycle burden for the CJ-6 relay are as follows:

A. CURRENT SENSING, INDUCTION UNIT

	.5-2 range	1.4 range
Continuous rating	4 amps	8 amps
One second rating	110 amps	230 amps
Burden	3VA/ 70° at 1.25A	3VA/ 70° 2.5A

B. VOLTAGE SENSING UNIT

VA = 11/ 75.5° lag at 120 volts

C. SX toggle unit, VA = 32/ 46° lag at 120 volts. Toggle unit is rated for intermittent duty.

TIME DELAY UNITS

VA = 5 at unity P.F. at 117 volts

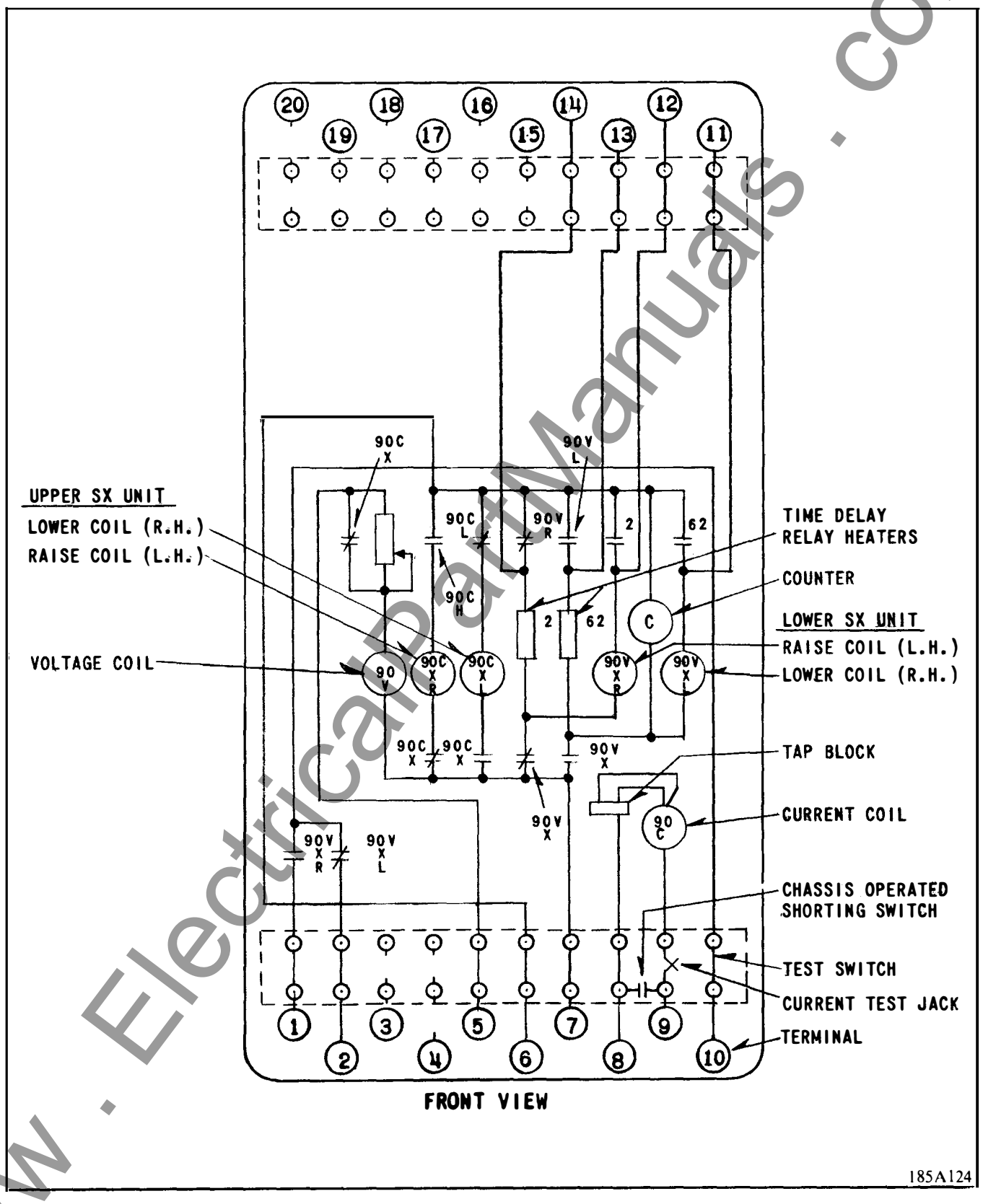

Fig. 1. Internal Schematic

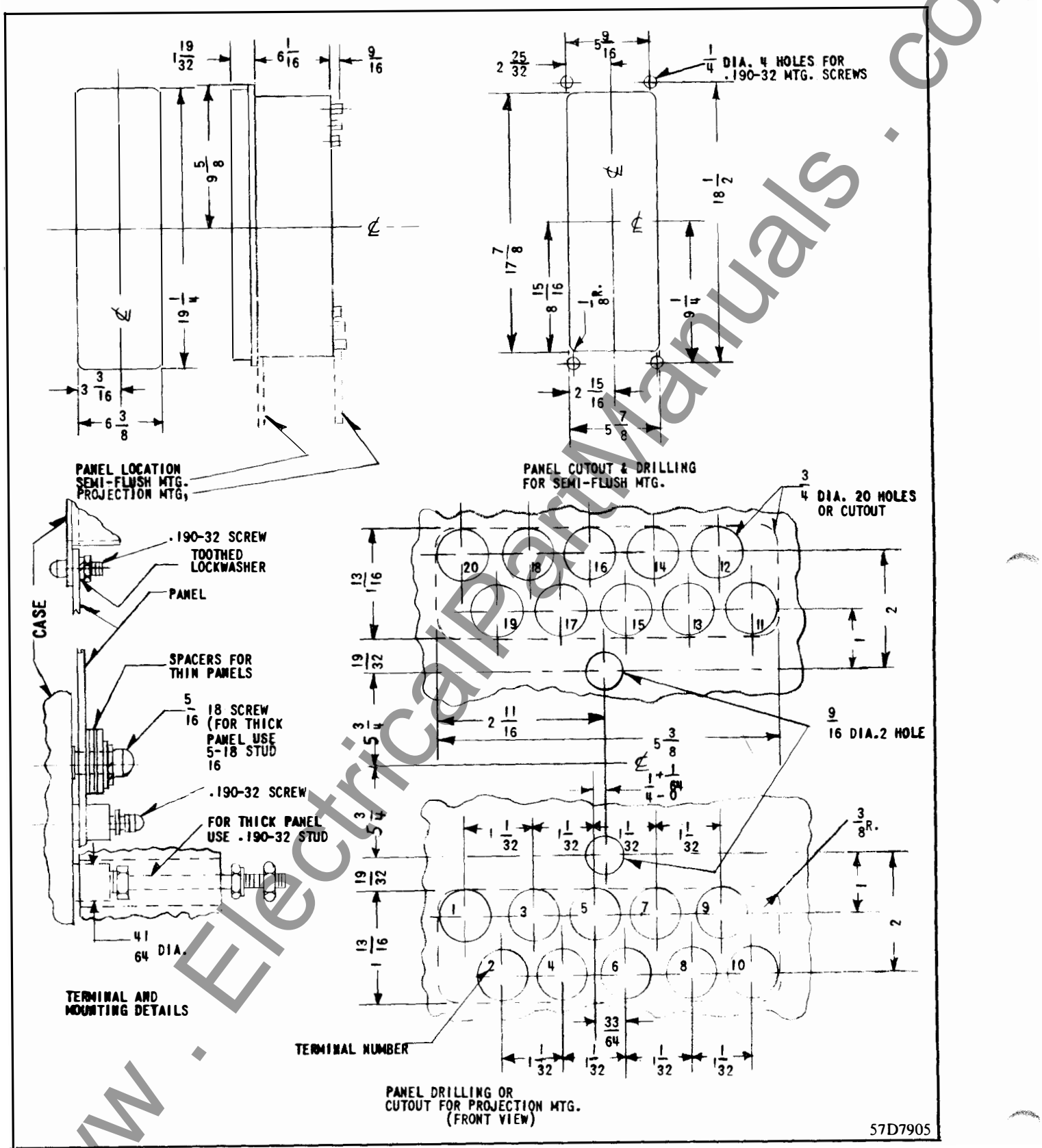

Fig. 2. Outline & Drilling (FT42 Case)

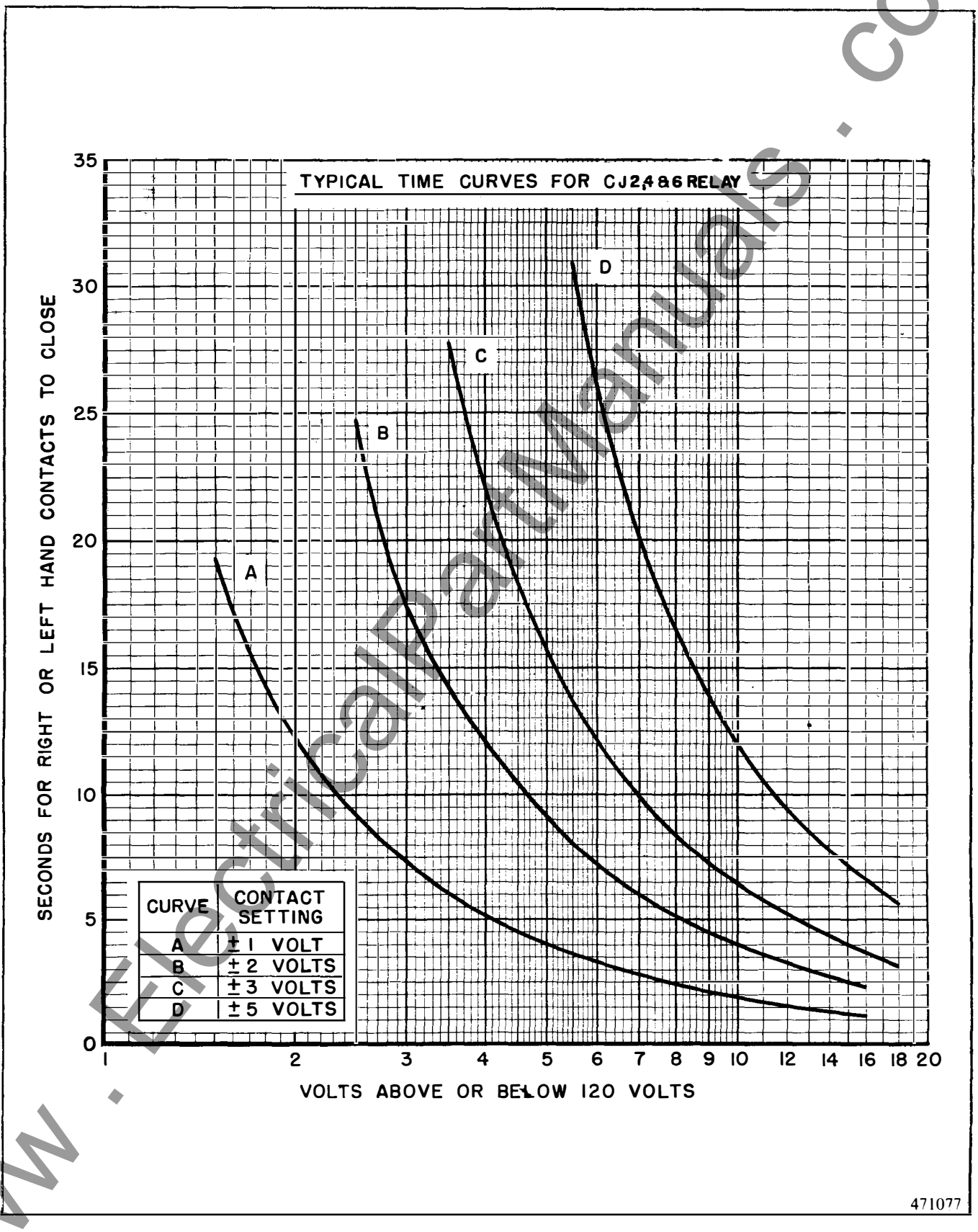

Fig. 3a. Voltage unit

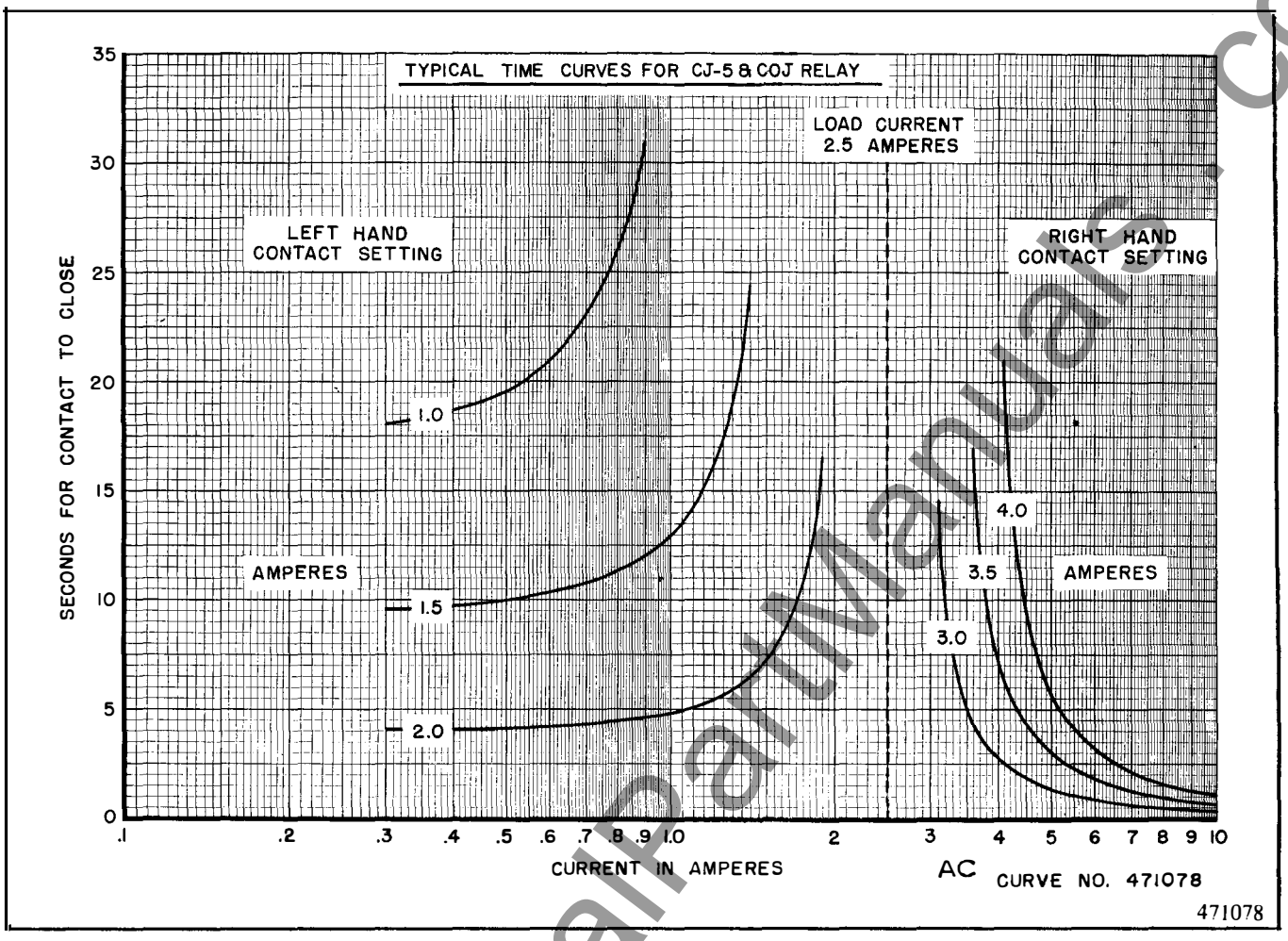

Fig. 3b. Current Unit