INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CV VOLTAGE 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 CV relays are single-phase induction-disc type relays operating either on under or over voltage or both. These relays are applied as a voltage fault detector operating in conjunction with other protective relays. The relays are also used as timing devices for various automatic operations.

CONTENTS

This instruction leaflet applies to the following types of relays:

CV-1 Long Time Undervoltage Relay
CV-2 Short Time Undervoltage Relay
CV-4 Long Time Overvoltage Relay
CV-5 Short Time Overvoltage Relay
CV-6 Long Time Over or Undervoltage Relay
CV-7 Short Time Over or Under voltage Relay
CV-8 Low Voltage Pickup Overvoltage Relay

CONSTRUCTION AND OPERATION

The types CV-1, CV-2, CV-4, CV-5, CV-6, and CV-7 relays consist of a voltage unit and an indicating contactor switch (ICS). The principal component parts of the relay and their location are shown in figures 1, 2, and 3.

The type CV-8 relay in addition to the above components also has a capacitor which is series tuned with the main coil of the electromagnet. This tuned circuit offers a low impedance to fundamental current and a high impedance to third harmonic currents. Hence, the relay has a low pick up value for fundamental voltage and a much higher value of pickup for third harmonic voltage. At rated voltage the electromagnet is saturated causing the circuit to be detuned. The impedance of the circuit is increased and limits the fundamental current to a safe value.

A. Voltage Unit (CV)

The overvoltage unit operates on the induction-disc principle. A main tapped coil located on the center leg of an "E" type laminated structure produces a flux which divides and returns through the outer legs. A shading coil causes the flux through the left leg (front view) to lag the main pole flux. The out-of-phase fluxes thus produced in the air gap causes a contact closing torque.

The undervoltage unit operates on the same principle as the overvoltage unit except the shading coil is on the right leg (front view). This causes the out-of-phase fluxes to produce a contact opening torque.

B. Indicating Contactor Switch (ICS)

The indicating contactor switch is a small d-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also, during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the case.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The low pickup CV-8 Overvoltage Relay is available with the following continuous voltages.

67 volts
199 volts

* The minimum voltage required to just close the CV-8 contacts is 8% of the continuous voltage. Typical operating times of the type CV-8 relay are shown on figure 8. An adjustable 5.4 to 20 volt relay with a 67 volt continuous and a 16 to 40 volt relay with a continuous of 199 volts is also available.

SUPERSEDES I.L. 201F
*Denotes change from superseded issue.

EFFECTIVE OCTOBER 1967

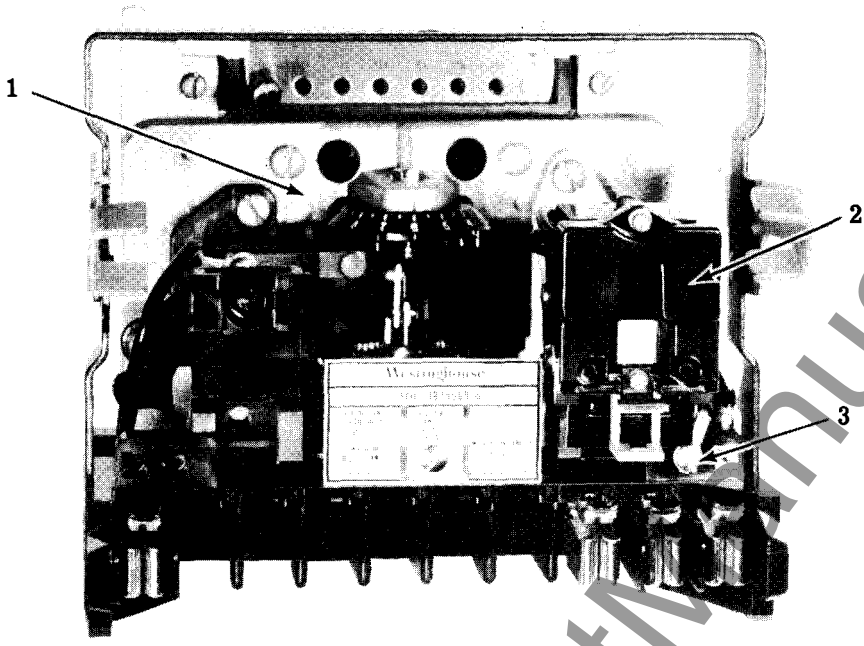


Fig. 1. Type CV-2 Relay Without Case. 1-Voltage Unit (CV). 2-Indicating Contactor Switch (ICS). 3-Indicating Contactor Switch Tap Block.

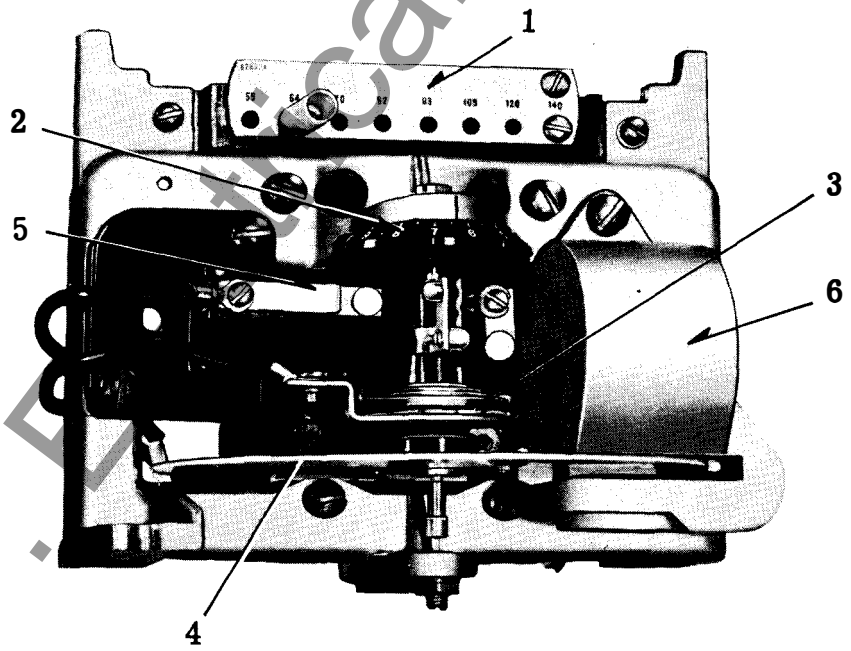


Fig. 2. Voltage Unit (CV). 1-Tap Block. 2-Time Dial. 3-Control Spring Assembly. 4-Disc. 5-Stationary Contact Assembly. 6-Permanent Magnet.

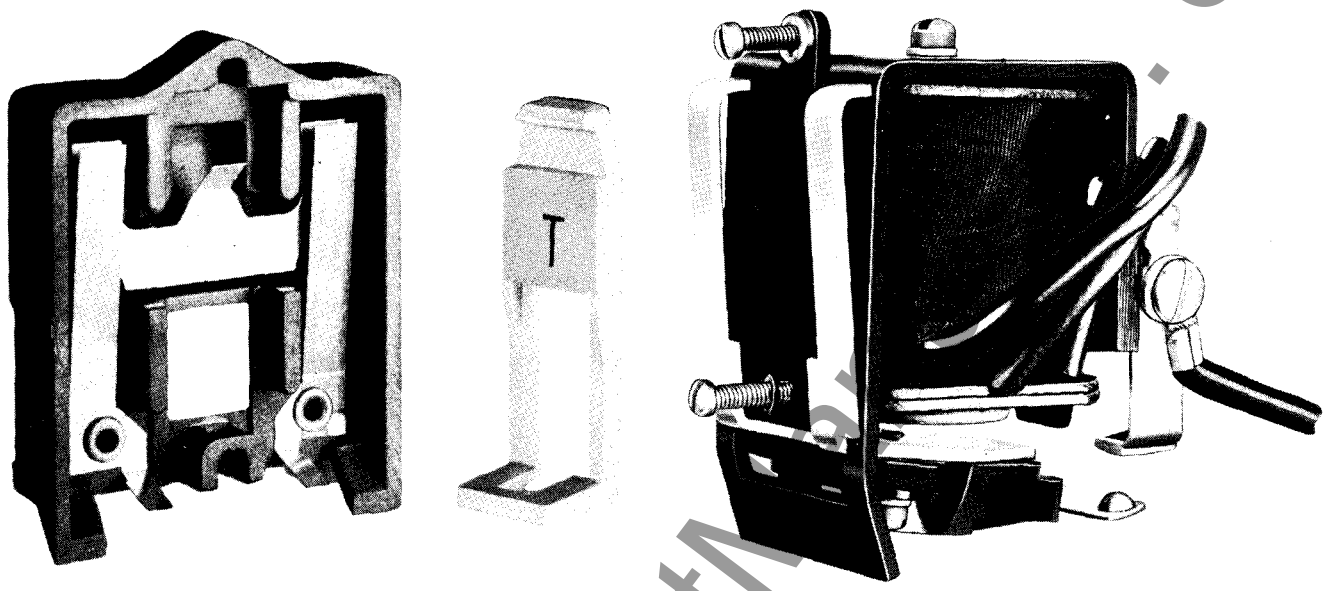


Fig. 3. Indicating Contactor Switch (ICS).

The CV-1 and CV-2 Undervoltage Relays, CV-4 and CV-5 Overvoltage Relays, and CV-6 and CV-7 Over or Undervoltage Relays are available in the following voltage ranges:

Range	Taps							
55-140	55	64	70	82	93	105	120	140
110-280	110	128	140	164	186	210	240	280

A. CV-1 and CV-2 Undervoltage Relays -- CV-4 and CV-5 Overvoltage Relays

Tap value voltage is the minimum voltage required to just close the relay contacts. At this value of voltage, the moving contacts will leave the backstop of the time dial and move to close the front contacts. Normal operation of the two relays is such that the CV-1 and CV-2 undervoltage relays will open its contacts with application of voltages greater than tap value voltage, while the CV-4 and CV-5 overvoltage relay closes its contacts with voltages greater than tap value voltage. Thus, the operating curves of figures 9 and 10 of the undervoltage relays apply when the voltage is originally higher than tap value voltage and is suddenly reduced to a value shown on the curves. The operating curves of figures 11 and 12 of the overvoltage relays apply when the voltage is initially below tap value voltage and is suddenly raised to a value shown on the curves.

B. CV-6 and CV-7 Over or Undervoltage Relays

Tap value voltage is the value of voltage at which the stationary front contact closes. The stationary back contact will close within 5% of this value.

When the relay is used as an overvoltage relay, the moving contact is made with the stationary back contact for values of applied voltage less than tap value voltage. With application of voltages greater than tap value voltage, the moving contact moves to close the front contact in a time as shown by the right-hand curves of either figures 13 or 14.

When the relay is used as an undervoltage relay, the moving contact is made with the stationary front contact for values of applied voltage greater than tap value voltage. With the application of voltages less than tap value voltage, the moving contact moves to close the back contact in a time as shown on the left-hand curves of either figures 13 or 14.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

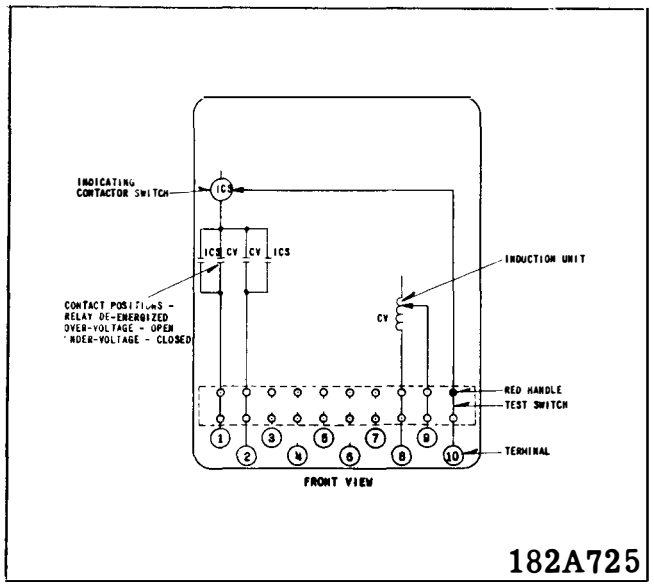


Fig. 4. Internal Schematic of the Double Trip Type CV Under or Overvoltage Relays in Type FT11 Case. For the Single Trip Relays the Circuits Associated with Terminal 2 are Omitted.

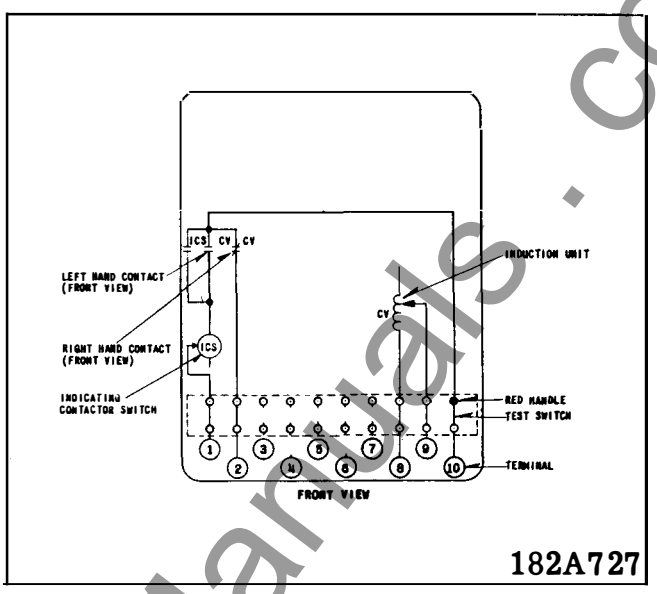


Fig. 5. Internal Schematic of the type CV Over or Undervoltage Relay in Type FT11 case.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constants

Indicating contactor switch — 0.2 amp. tap 6.5 ohms d-c resistance
2.0 amp. tap 0.15 ohms d-c resistance

ENERGY REQUIREMENTS

The burdens of the CV-1, CV-2, CV-4, CV-5, CV-6, CV-7 relays at rated voltage are as follows:

Rated△ Voltage	Taps 120 Volt Relay	Taps 240 Volt Relay	Volt-Amps.	Power Factor	Watts
	55	110	10.0	.38	3.8
	64	128	7.0	.35	2.5
	70	140	5.8	.34	2.0
120 or 240 Volts	82	164	4.0	.33	1.3
	93	186	3.1	.31	1.0
	105	210	2.4	.29	.7
	120	240	1.8	.28	.5
	140	280	1.3	.26	.3

△These relays will continuously stand either 110% of rated voltage or tap value voltage, whichever is higher.

The burdens of the CV-8 relays at continuous voltage are as follows:

Continuous Voltage	Volt Amps.	Power Factor	Watts
199	30	.342	10
67	30	.342	10

SETTINGS

* Range	Setting	Applied Voltage	VA
5.4 to 20V	5.4	67	30
	20	67	15
16 to 40V	16	199	30
	40	199	20

A. CV Unit

The setting of the CV unit can be defined either by tap setting and time dial position or by tap setting and a specific time of operation at some percentage of tap value voltage (e.g. on CV-4 120 tap setting, 2 time dial position or 120 tap setting, 12 seconds at 140 percent of tap value voltage).

To provide selective circuit breaker operation, a minimum coordinating time of 0.3 seconds plus circuit breaker time is recommended between the relay being set and the relays with which coordination is to be effected.

The connector screw on the terminal plate above the time dial connects various turns of the operating coil. By placing this screw in the various terminal plate holes, the relay will just close its contacts at the corresponding voltage of 55-64-70-82-93-105-120-140 volts or as marked on the terminal plate.

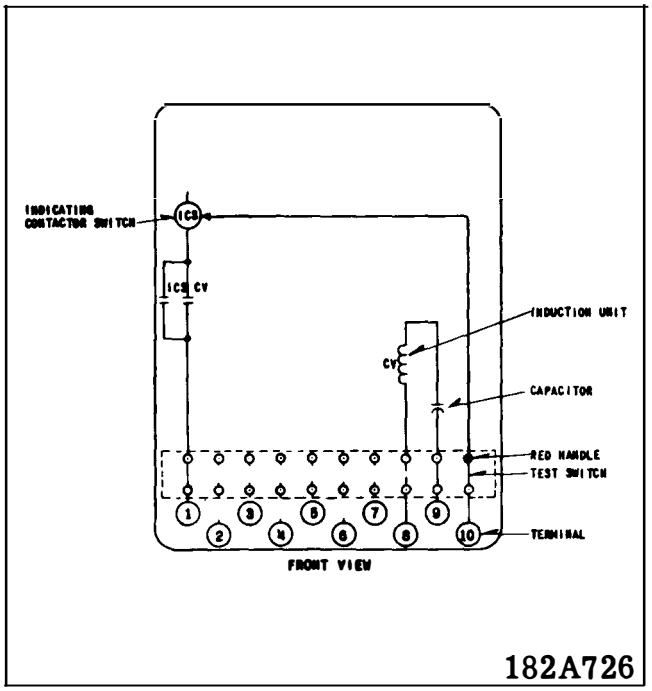


Fig. 6. Internal Schematic of the type CV8 199 volt relay in type FT11 case.

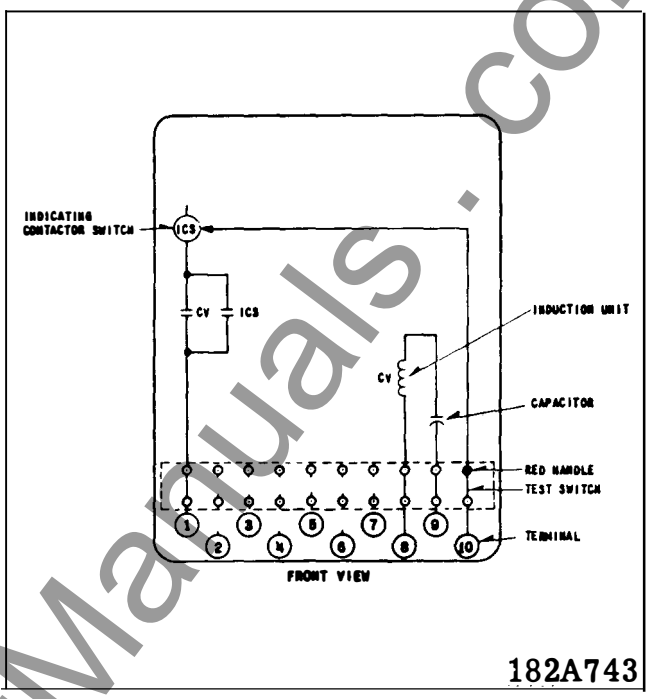
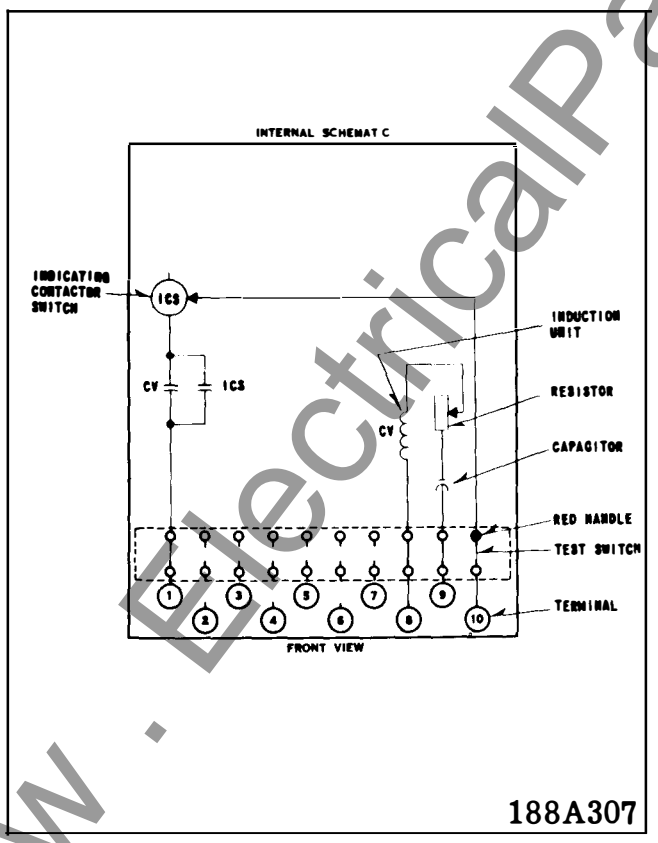
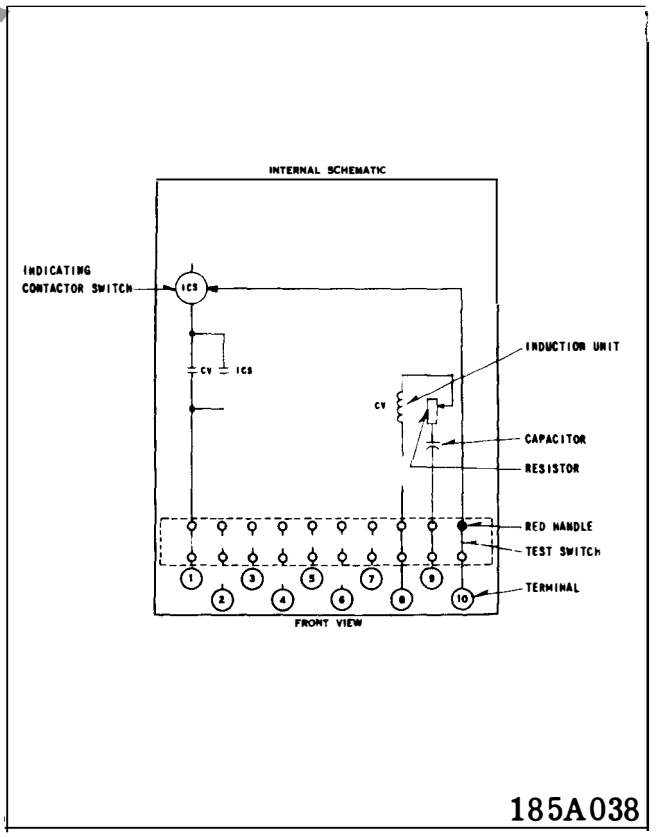


Fig. 7. Internal Schematic of the type CV8 67 volt relay in type FT21 case.



** Fig. 8. Internal Schematic of the type CV 199 volt relay in type FT11 case with adjustable pickup.*



** Fig. 9. Internal Schematic of the type CV8 67 volt relay in type FT21 case with adjustable pickup.*

The nylon screw on the terminal plate holds the tap plate in position when taps are being changed. To use the position on the terminal plate in which the nylon screw is used, remove the nylon screw and place it in one of the unused holes. Then remove the tap screw and insert it in the terminal plate hole.

Instantaneous Reclosing

The factory adjustment of the voltage unit contacts provides a contact follow. Where circuit breaker reclosing will be initiated immediately after a trip by the over voltage contact, the time of the opening of the contacts should be a minimum. This condition is obtained by loosening the stationary contact mounting screw, removing the contact plate and then replacing the plate with the bent end resting against the contact spring.

For double trip relays, the upper stationary contact is adjusted such that the contact rests solidly against the back stop. The lower stationary contact is then adjusted such that both stationary contacts make contact simultaneously with their respective moving contact.

B. Indicating Contactor Switch (ICS)

No setting is required on the ICS unit except the selection of the 0.2 to 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw.

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, other than those covered under "Settings", should be required.

Acceptance Check

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

A. CV Unit

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the "O" mark by approximately .020". (For the type CV-6 and CV-7 relays the back contact has no follow when the front contact is through one-half of its follow). The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Voltage - Set the time dial to position 6. Alternately apply tap value voltage plus 3% and tap value voltage minus 3%.

a. CV-4 and CV-5 Overvoltage Relays, CV-6 and CV-7 Over or Undervoltage Relays - The moving contact should leave the backstop at tap value voltage plus 3% and should return to the backstop at tap value voltage minus 3%.

b. CV-1 and CV-2 Undervoltage Relays - The moving contact should leave the backstop at tap value voltage minus 3% and should return to the backstop at tap value voltage plus 3%.

c. CV-8 Overvoltage Relays - The moving contact should leave the backstop at 8.5% of continuous voltage.

3. Time Curve - Table 1 shows the time curve calibration points for the various types of relays. With the time dial set to the indicated position, apply the voltages specified in table 1 (e.g. for the CV-4, 140 percent of tap value voltage) and measure the operating time of the relay. The operating time should equal those of table 1 plus or minus 5%.

B. Indicating Contactor Switch (ICS) - Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

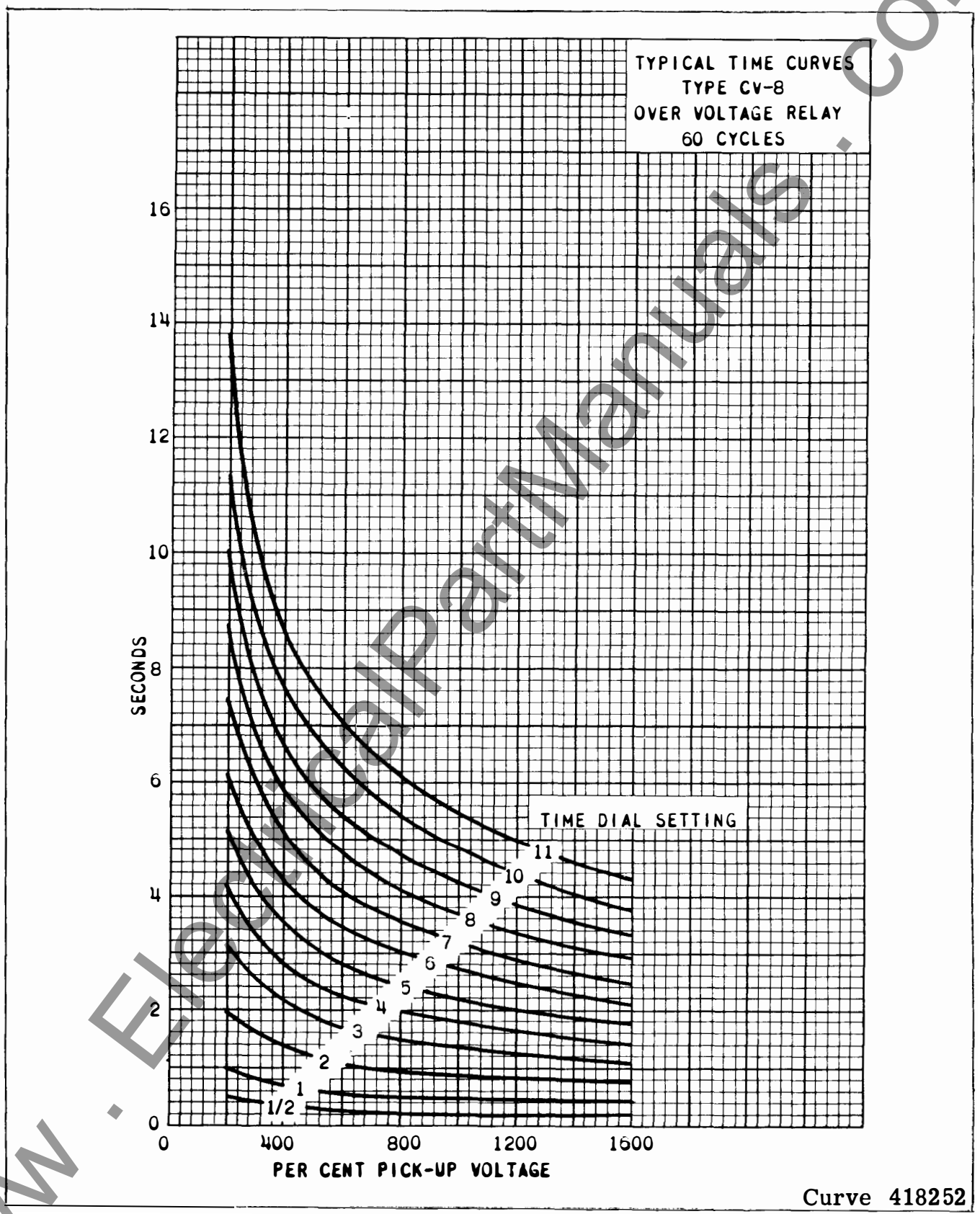


Fig. 10. Typical 60-cycle time curves of the type CV8 Low Pickup Overvoltage Relay.

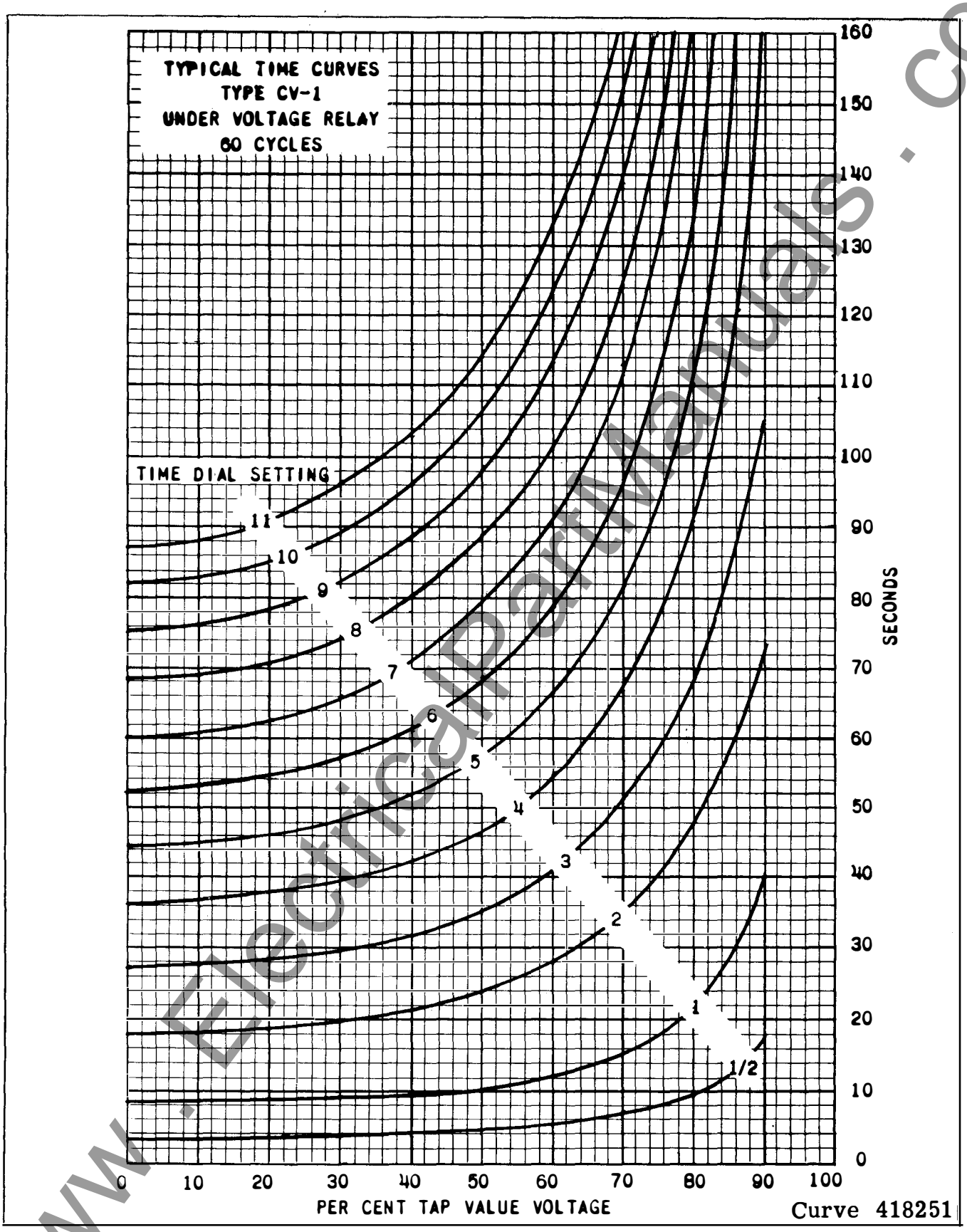


Fig. 11. Typical 60-cycle time curves or the type CV1 Long Time Undervoltage Relay.

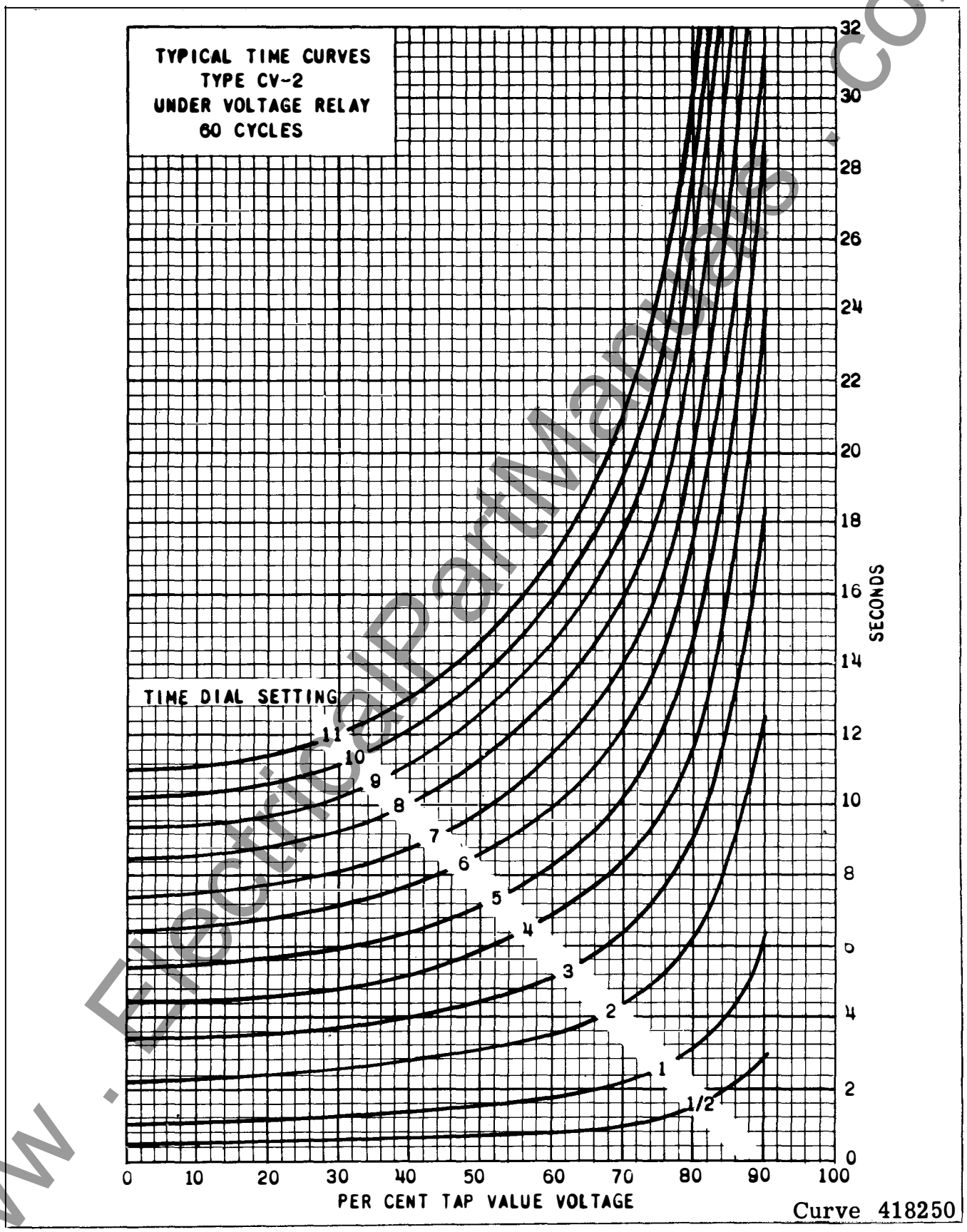


Fig. 12. Typical 60-cycle Time curves of the type CV2 Short Time Undervoltage Relay.

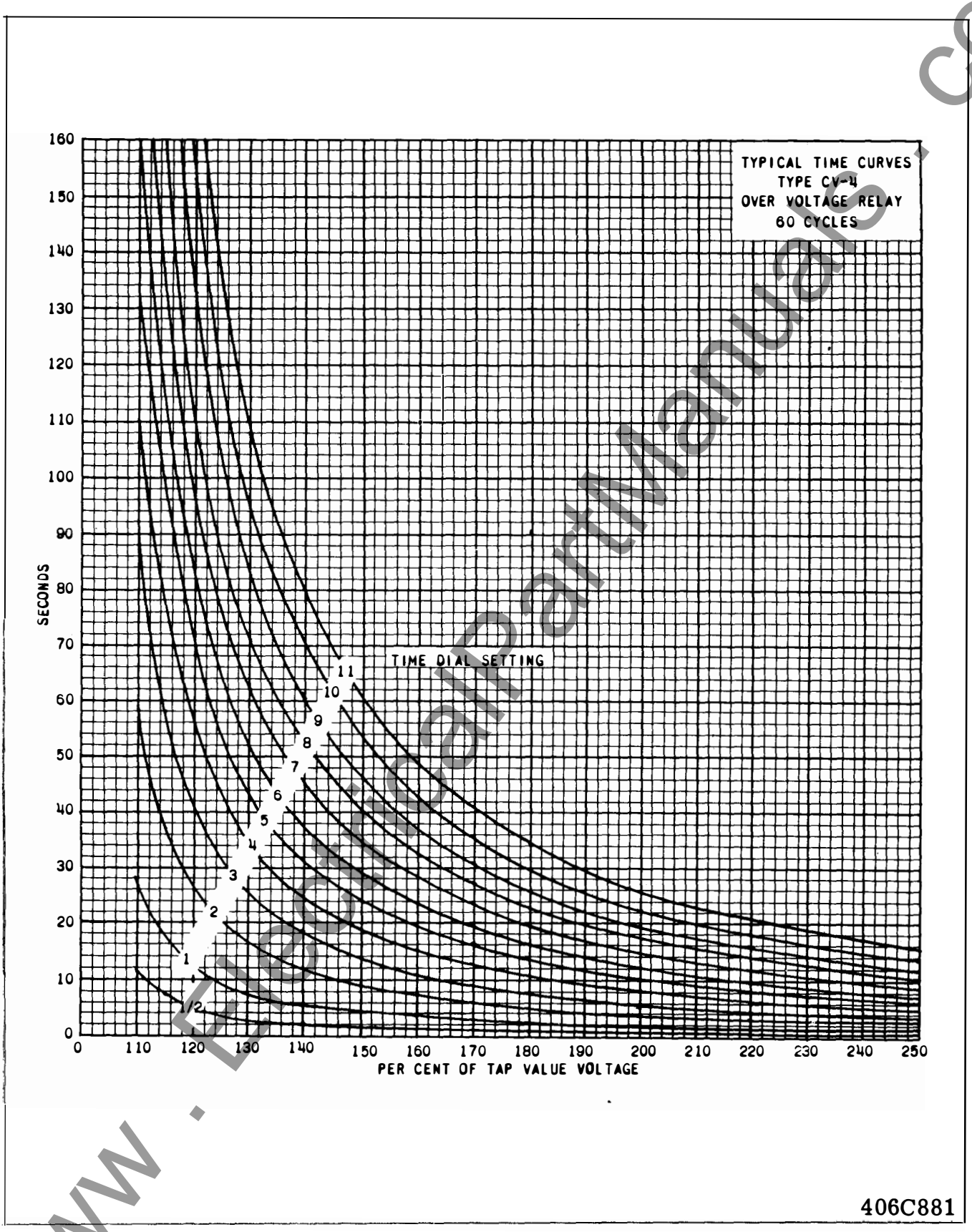


Fig. 13. Typical 60-cycle time curves of the type CV4 Long Time Overvoltage Relay.

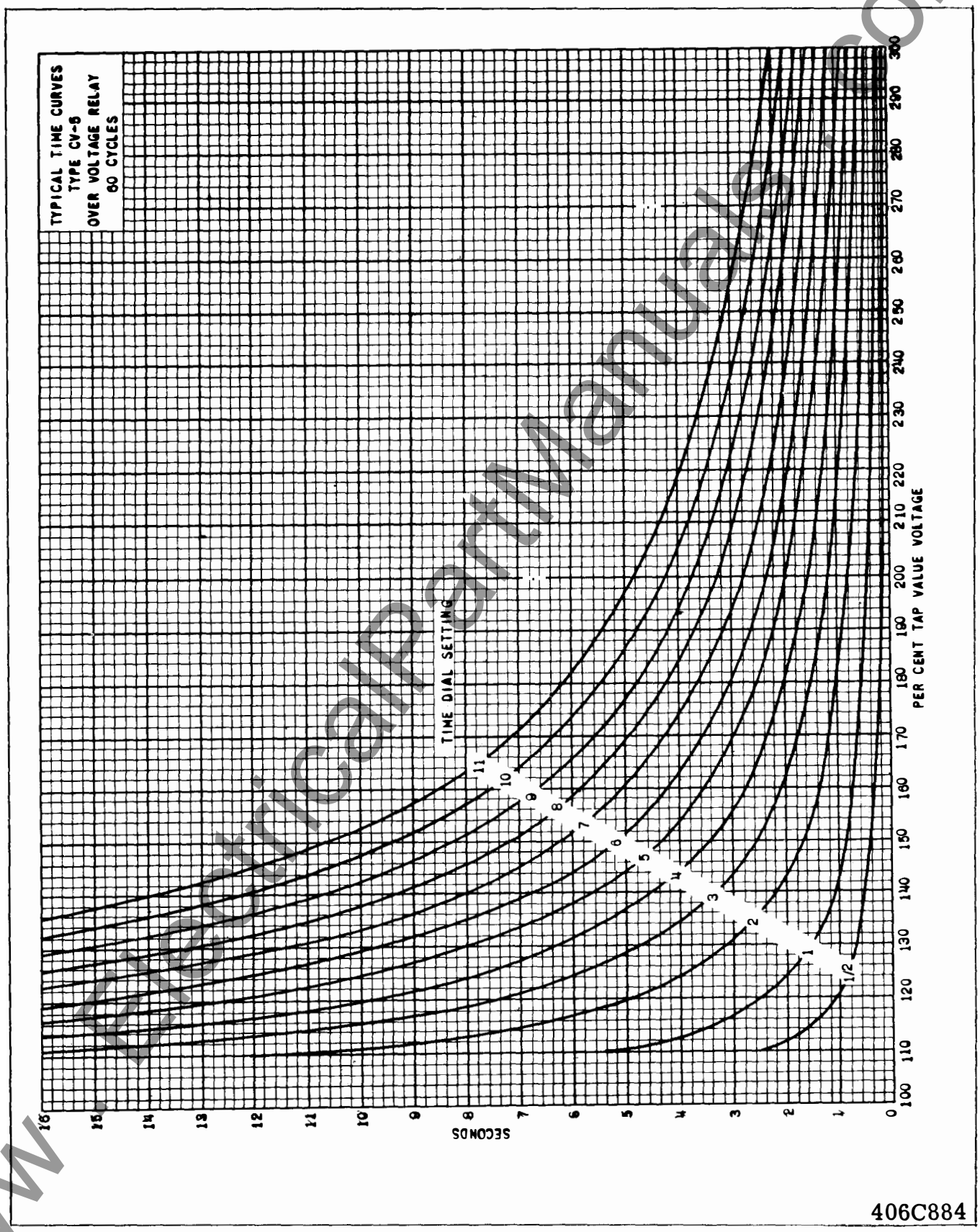


Fig. 14. Typical 60-cycle time curves of the type CV5 Short Time Overvoltage Relay.

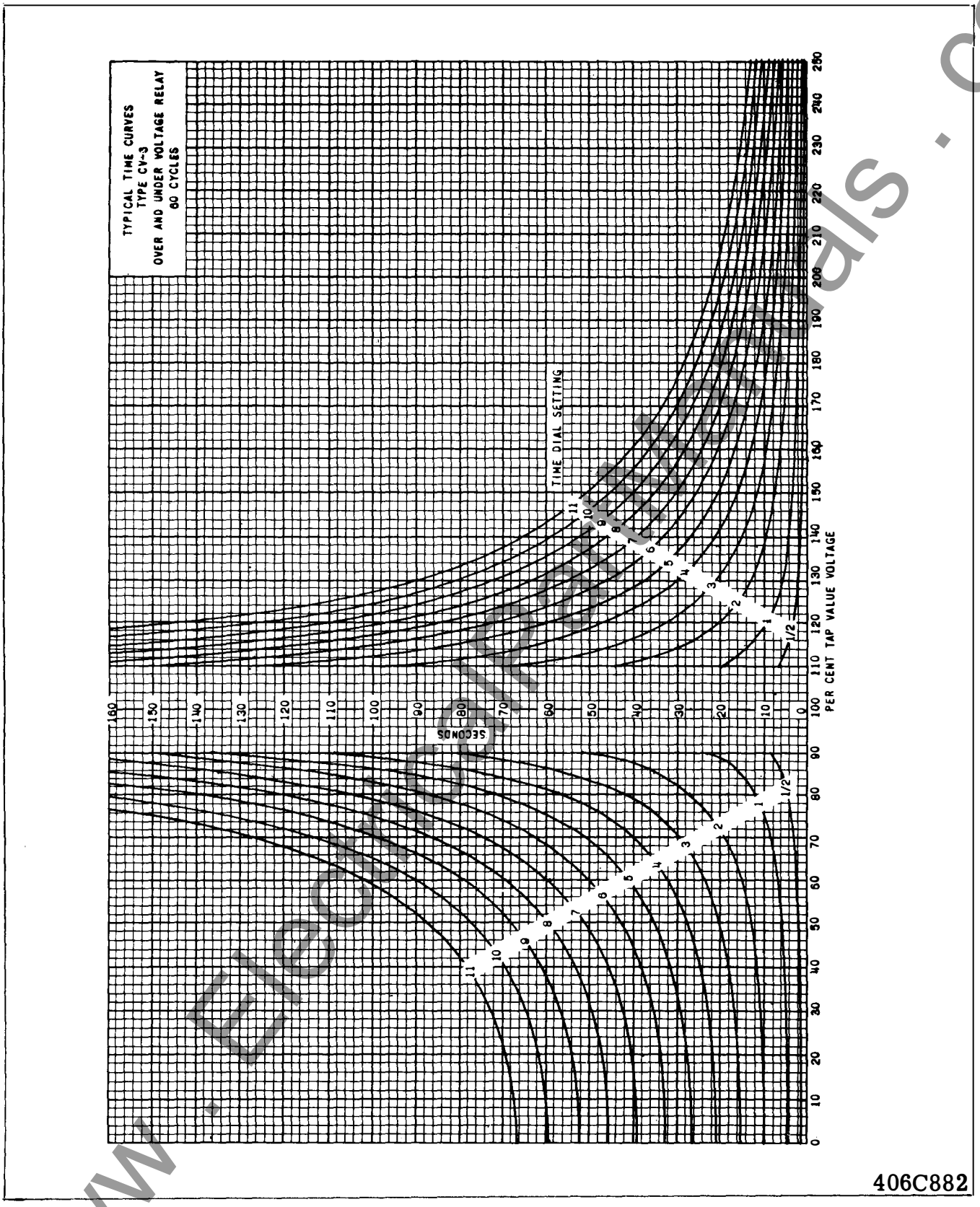


Fig. 15. Typical 60-cycle time curves of the type CV6 Long Time Over and Undervoltage Relay.

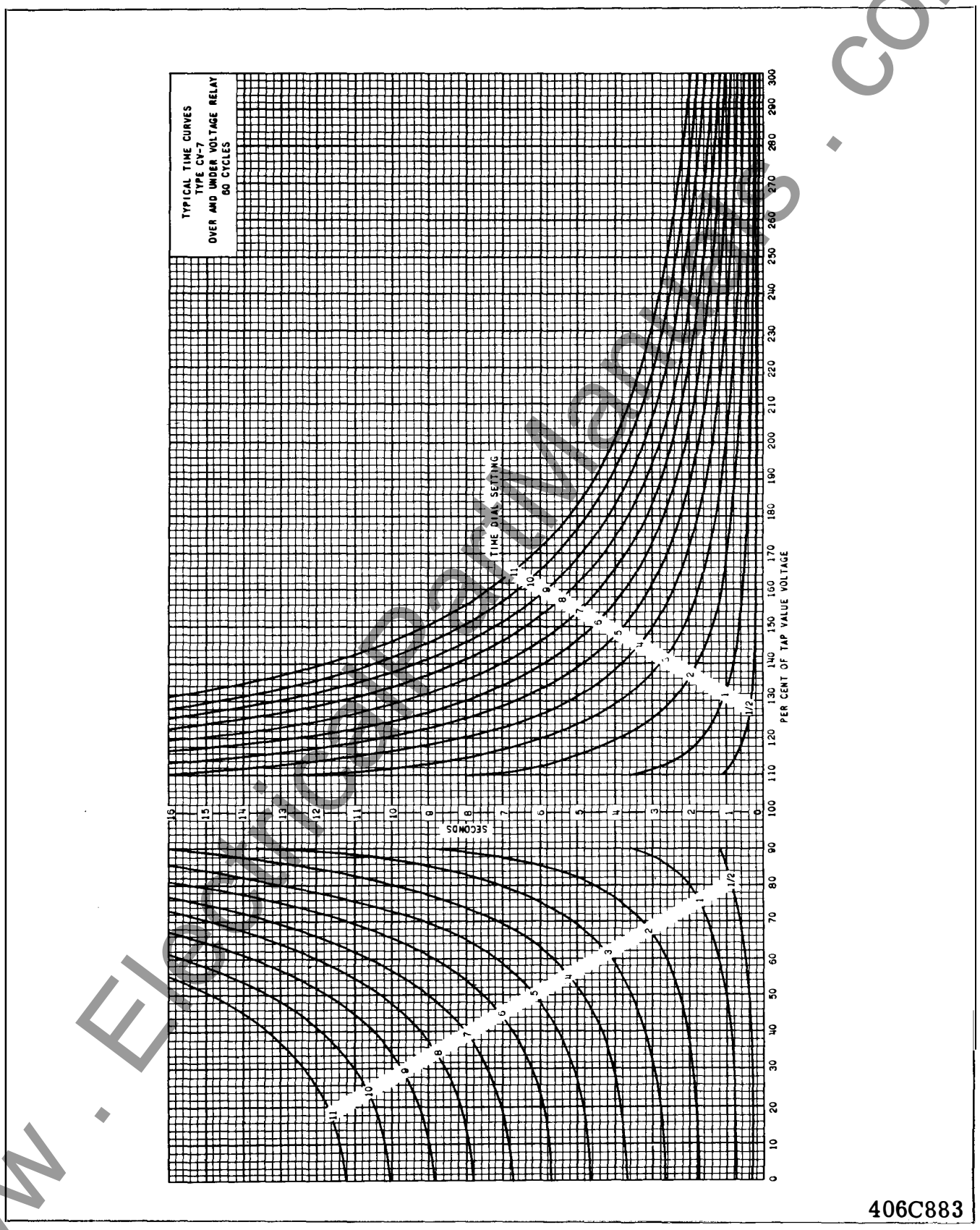


Fig. 16. Typical 60-cycle time curves of the type CV7 Short Time Over and Undervoltage Relay.

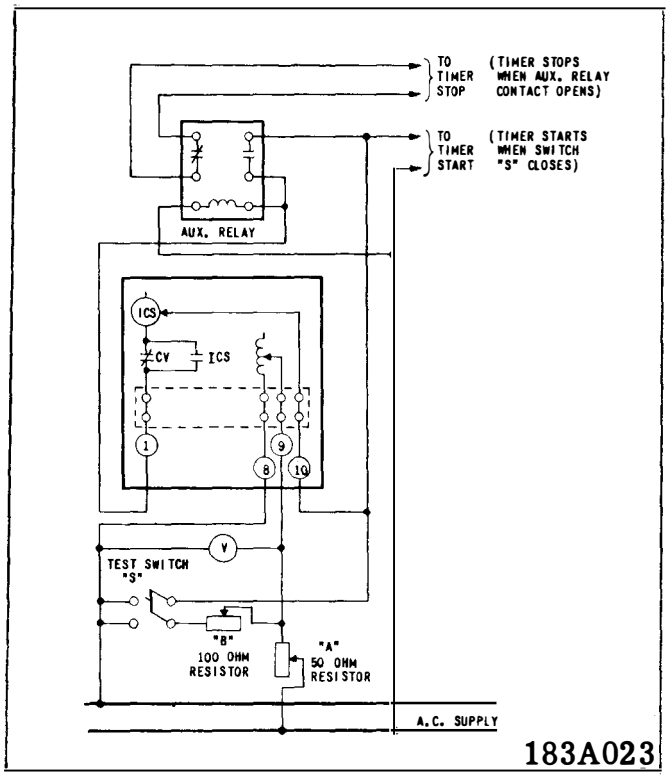


Fig. 17. Diagram of Test Connections of the type CV Undervoltage Relay.

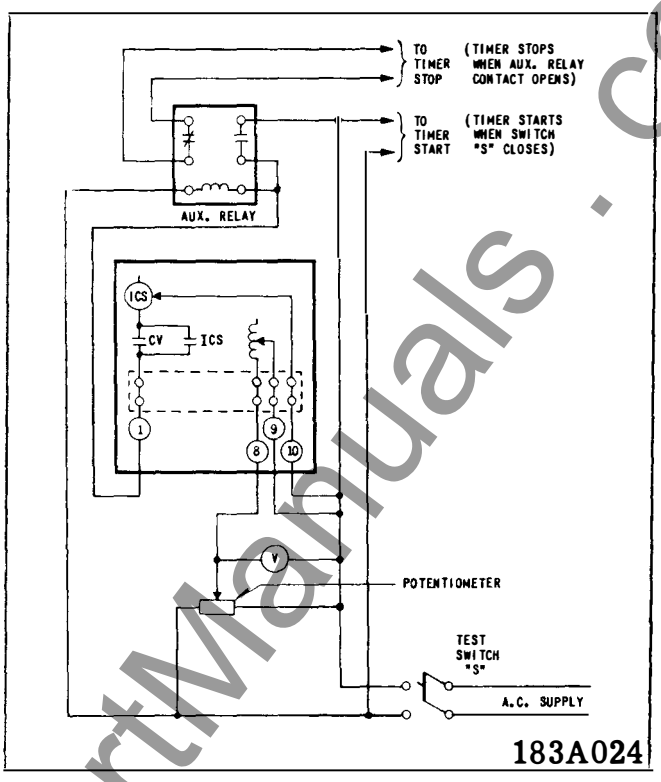


Fig. 18. Diagram of Test Connections of the type CV Overvoltage Relay.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

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. Phantom loads should not be used in testing induction-type relays because of the resulting distorted current wave form which produces 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, because of the danger of embedding small particles in the face of the soft silver contact 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 have been disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order (See "Acceptance check").

A. CV Unit

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the "O" mark by approximately .020". (For the type CV-6 and CV-7 relays the back contact has no follow when the front contact is through one-half of its follow). The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For

double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip-Voltage - The adjustment of the spring tension in setting the minimum trip voltage value of the relay is most conveniently made with the damping magnet removed.

With the time dial set on "O", wind up the spiral spring by means of the spring adjuster until approximately 6-3/4 convolutions show.

Set the relay on the minimum tap setting and the time dial to position 6.

a. CV-4 and CV-5 Overvoltage, CV-6 and CV-7 Over or Undervoltage – Adjust the control spring tension so that the moving contact will leave the backstop of the time dial at tap value voltage +1.0% and will return to the backstop at tap value voltage -1.0%.

b. CV-1 and CV-2 Undervoltage Relays - Adjust the control spring tension so that the moving contact will leave the backstop of the time dial at tap value voltage -1.0% and will return to the backstop at tap value voltage +1.0%.

c. Low Pickup Overvoltage Relay - Adjust the control spring so that the moving contact will leave the backstop of the time dial at 8.1% of continuous voltage and return at 7.9% of continuous voltage.

3. Time Curve Calibration - Install the permanent magnet.

a. CV-1 and CV-2 Undervoltage Relay - Use test circuit of figure 15. With switch "S" opened, adjust resistor "A" until voltmeter reads tap value voltage or higher. Close switch "S" and adjust resistor "B" until the voltmeter reads 50 percent of tap value voltage. Open switch "S" and allow the moving contact to move to the backstop of the time dial. Close switch "S" and measure operating time.

Adjust the permanent magnet gap until the operating time corresponds to the value given in table 1.

b. CV-4 and CV-5 Overvoltage Relay, CV-8 Low Pickup Overvoltage Relay - Apply the indicated voltage of table 1 and measure the operating time. Adjust the permanent magnet keeper until the operating time corresponds to the value given in table 1.

c. CV-6 and CV-7 Over or Undervoltage Relay - Apply the indicated voltage of table 1 and measure the operating time. Adjust the permanent magnet keeper until the operating time corresponds to the value given in table 1.

Measure the reset time of the disc from the stationary front contact to the stationary back contact. This time should be as shown in table 1.

TABLE 1

Type Relay	Percent Tap Value Voltage Or Pickup Voltage	Time Dial Setting	Operating Time in Sec.	Reset Time in Sec.
CV1	50	6	68	
CV2	50	6	8.6	
CV4	140	6	37.5	
CV5	140	6	6.8	
CV6	140	6	33	32.5
CV7	140	6	5.9	5.7
CV8	800	6	3.0	

B. Indicating Contactor Switch - Unit (ICS) - Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

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.

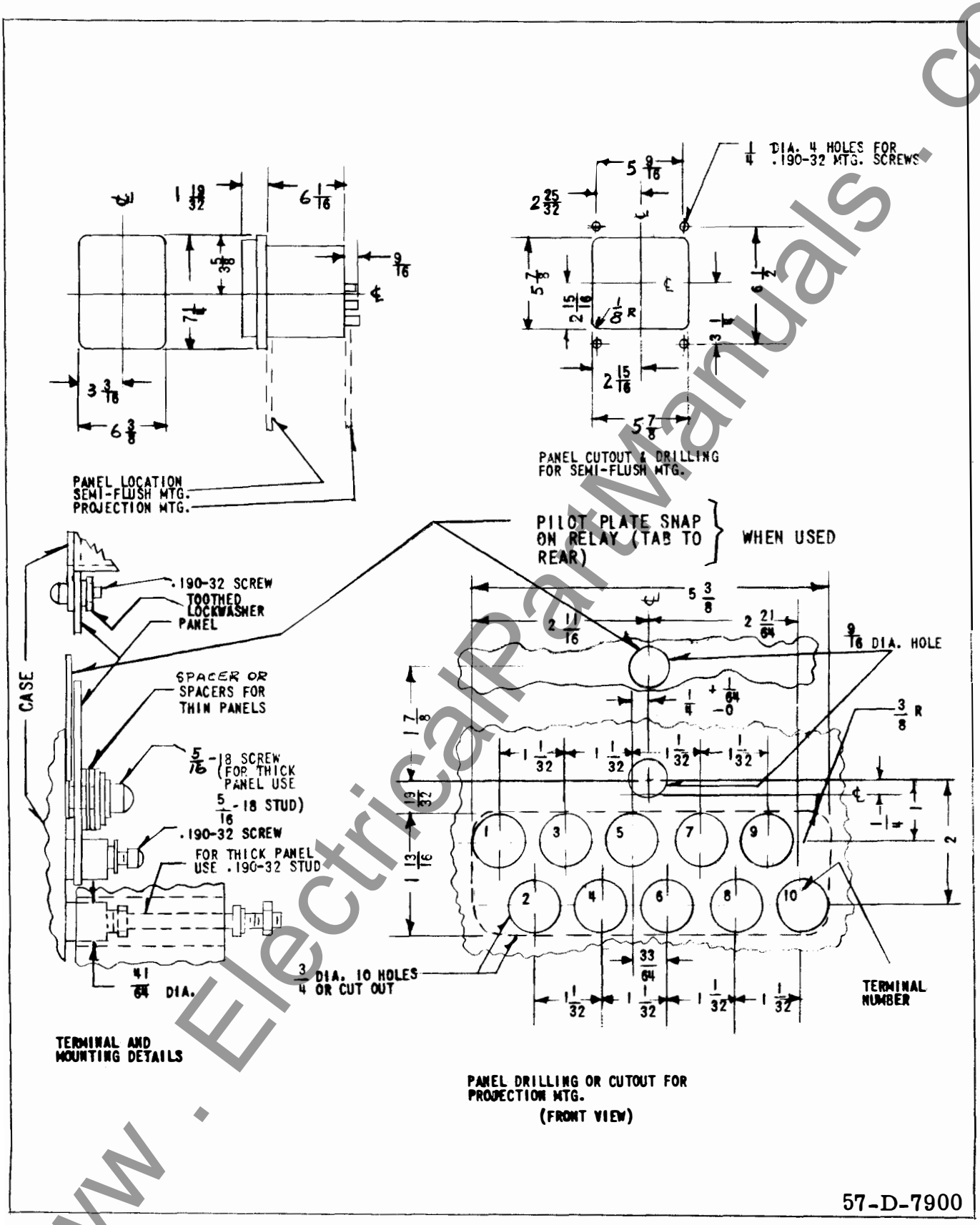


Fig. 19. Outline and drilling for FT11 case used for projection and/or semi-flush case.

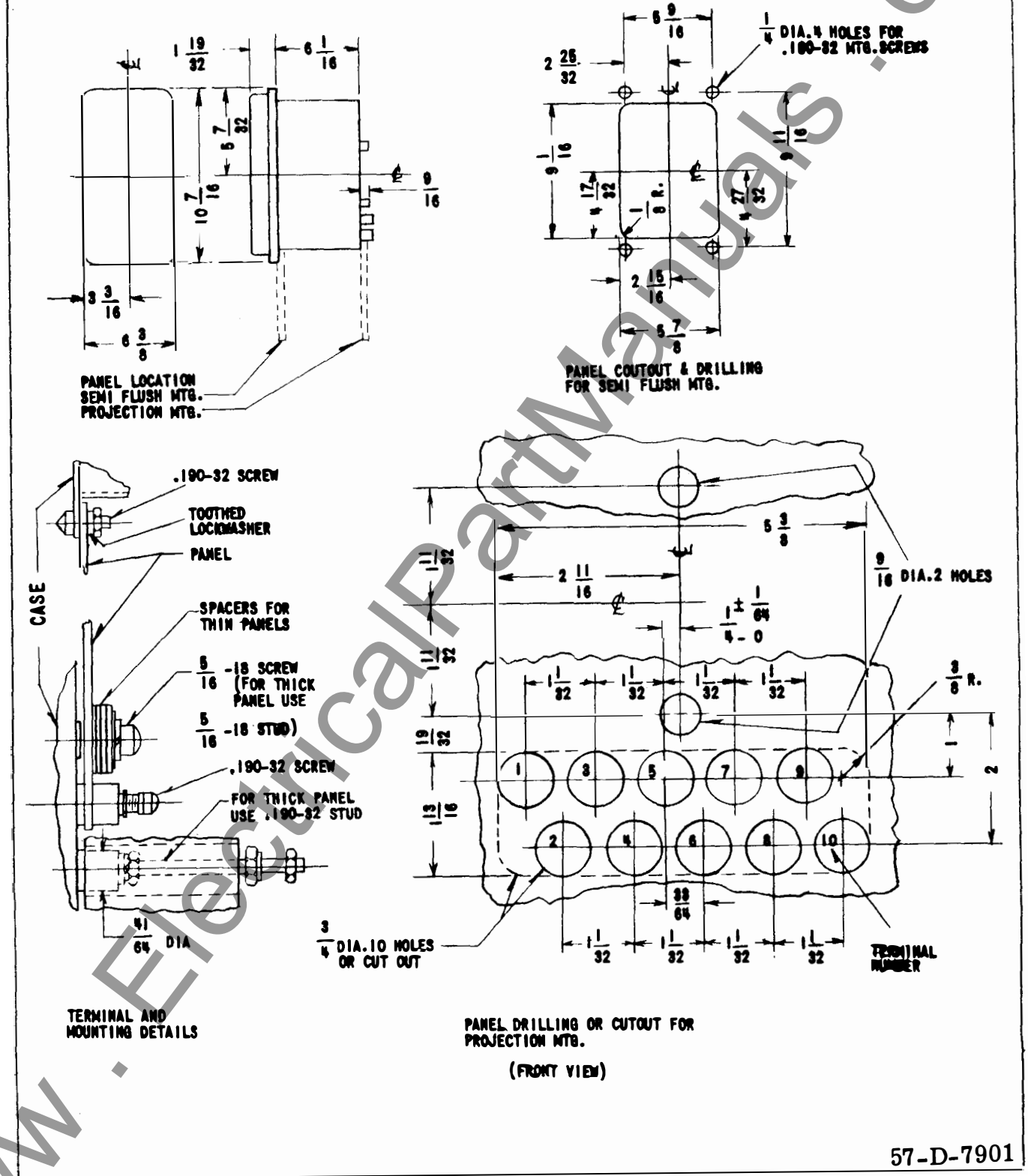
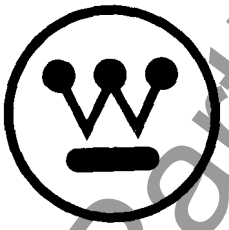


Fig. 20. Outline and drilling for FT21 case used for projection and/or semi-flush case. (For 67 volt CV-8 relay only)



WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CV FREQUENCY COMPENSATED VOLTAGE 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 operate the relay to check the settings and electrical connections.

APPLICATION

The type CV relays are single-phase induction-disc type relays operating either on under or over voltage or both. These relays are frequency compensated such that their pickup between 30 and 90 cycles is within 5 per cent of the 60 cycle value.

CONTENTS

This instruction leaflet applies to the following types of relays.

CV-21 Long Time Undervoltage Relay
CV-22 Short Time Undervoltage Relay
CV-24 Long Time Overvoltage Relay
CV-25 Short Time Overvoltage Relay
CV-26 Long Time Over or Undervoltage Relay
CV-27 Short Time Over or Undervoltage Relay.

CONSTRUCTION & OPERATION

The types CV-21, CV-22, CV-24, CV-25, CV-26, and CV-27 relays consist of a voltage unit and an indicating contactor switch (ICS). The component parts of the relays are connected as shown in the internal schematic diagram. Some style relays contain an instantaneous indicating voltage switch (IIV) which also operates independent of frequency.

A. Voltage Unit (CV)

The overvoltage unit is an "E" type laminated structure with coils on each leg. The coil on the center leg of the structure is an autotransformer, winding with a tapped primary. The secondary winding of the autotransformer is connected to identical coils on the outer legs of the "E" type laminated structure. The coils are connected in such a manner that the combination of all the fluxes produced result in out-of-phase fluxes in the air gap. The out-of-phase air gap fluxes produced cause a contact closing torque.

The undervoltage unit operates on the same principle as the overvoltage unit except the connections to the leg coils are reversed to cause the out-of-phase fluxes to produce a contact opening torque.

The units are frequency compensated by means of a resistor located in the outer leg coil circuit.

B. Instantaneous Indicating Voltage Switch (IIV)

The instantaneous trip unit is a small a-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts completing the trip circuit. Also during the operation two fingers on the armature deflect a spring located on the front of the switch which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the cover.

The adjustable pickup range is accomplished by means of an adjustable resistor.

C. Indicating Contactor Switch (ICS)

The indicating contactor switch is a small d-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also, during this operation two

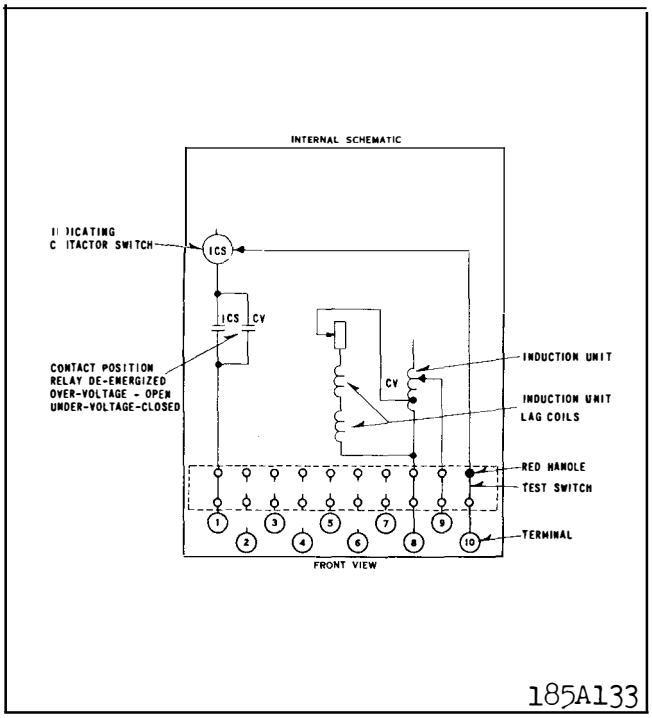


Fig. 1 Internal Schematic for the type CV (S.P.S.T.) voltage relay in the FT-11 case.

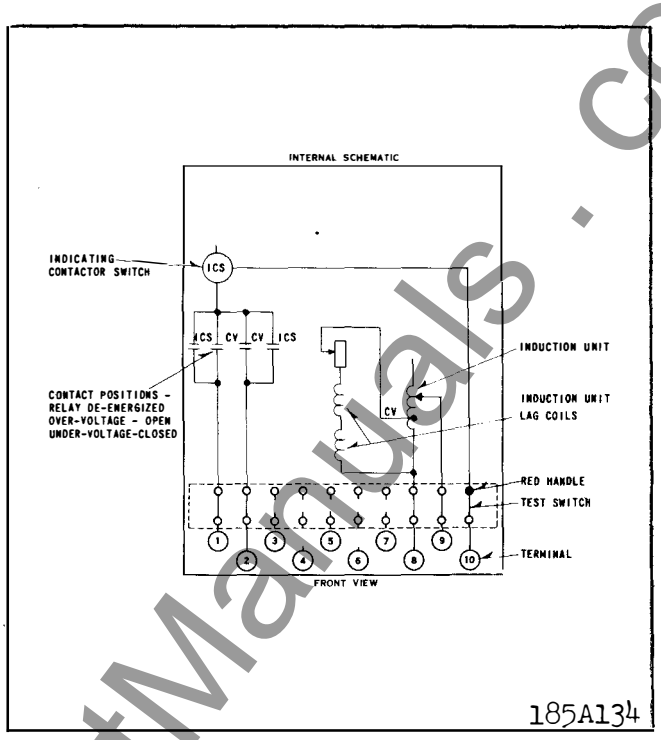


Fig. 2 Internal Schematic for the type CV (D.P.S.T.) voltage relay in the FT-11 case.

fingers on the armature deflect a spring located on front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the case.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

These relays are frequency compensated such that their pickup between 30 and 90 cycles is within 5% of the 60 cycle value.

The CV-21 and CV-22 undervoltage relays, CV-24 and CV-25 overvoltage relays, and CV-26 and CV-27 over or undervoltage relays are available in the voltage ranges:

Range	Taps							
55-140	55	64	70	82	93	105	120	140
110-280	110	128	140	164	186	210	240	280

A. CV-21 and CV-22 Undervoltage Relays – CV-24 and CV-25 Overvoltage Relays.

Tap value voltage is the minimum voltage required to just close the relay contacts. At this value of voltage, the moving contacts will leave the backstop of the time dial and move to close the front contacts. Normal operation of the two relays is such that the CV-21 and CV-22 undervoltage relays will open its contacts with application of voltages greater than tap value voltage, while the CV-24 and CV-25 overvoltage relay closes its contacts with voltages greater than tap value voltage.

B. CV-26 and CV-27 Over or Undervoltage Relays

Tap value voltage is the value of voltage at which the stationary front contact closes. The stationary back contact will close within 5% of this value.

When the relay is used as an overvoltage relay, the moving contact is made with the stationary back contact for values of applied voltage less than tap value voltage. With application of voltages greater than tap value voltage, the moving contact moves to close the front contact in a time as shown by the right hand curve of either Fig. 8 or 9.

When the relay is used as an undervoltage relay, the moving contact is made with the stationary front contact for values of applied voltage greater than tap value voltage. With the application of voltages less than tap value voltage, the moving contact moves to close the back contact in a time as shown on the left-hand curves of either figures 8 or 9.

*** TABLE A**

Rated Voltage	TAPS		Volt-Amps.	Power Factor	Watts
	120 Volt Relay	240 Volt Relay			
120 or 240 Volts	55	110	14.38	.44	6.3
	64	128	10.38	.41	4.23
	70	140	8.35	.39	3.26
	82	164	6.00	.37	2.23
	93	186	4.66	.35	1.63
	105	210	3.64	.34	1.25
	120	240	2.77	.33	.92
	140	280	2.04	.31	.63

C. Instantaneous Indicating Voltage Switch (IIV)

The range of operation is 120 to 200 volts ac. The pickup is adjusted by means of an adjustable resistor.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constants

Indicating contactor Switch — 0.2 Amp. tap 6.5 ohms d-c resistance

* 2 Amp. tap 0.15 ohms d-c resistance

ENERGY REQUIREMENTS

* The burdens of the CV-21, CV-22, CV-24, CV-25, CV-26, CV-27 relays at rated voltage are shown in Table A above.

The burden of the 11V (when used) is in addition to the above burdens and is as follows:

Setting	Voltage Applied	Burden
120 Volts	120 Volts	2.0 VA.
200 Volts	200 Volts	3.0 VA.

SETTINGS

A. CV Unit

The setting of the CV unit can be defined either by tap setting and time dial position or by tap setting and a specific time of operation at some percentage of tap value voltage (e.g. on CV-24 120 tap setting, 2 time dial position or 120 tap setting, 12 seconds at 140 per cent of tap value voltage).

To provide selective circuit breaker operation, a minimum coordinating time of 0.3 seconds plus circuit breaker time is recommended between the relay being set and the relays with which coordination is to be effected.

The connector screw on the terminal plate above the time dial connects various turns of the operating coil. By placing this screw in the various terminal plate holes, the relay will just close its contacts at the corresponding voltage of 55-64-70-82-93-105-120-150 volts or as marked on the terminal plate.

The nylon screw on the terminal plate holds the tap plate in position when taps are being changed. To use the position on the terminal plate in which the nylon screw is used, remove the nylon screw and place it in one of the unused holes. Then remove the tap screw and insert it in the terminal plate hole.

Instantaneous Reclosing

The factory adjustment of the voltage unit contacts provides a contact follow. Where circuit breaker reclosing will be initiated immediately after a

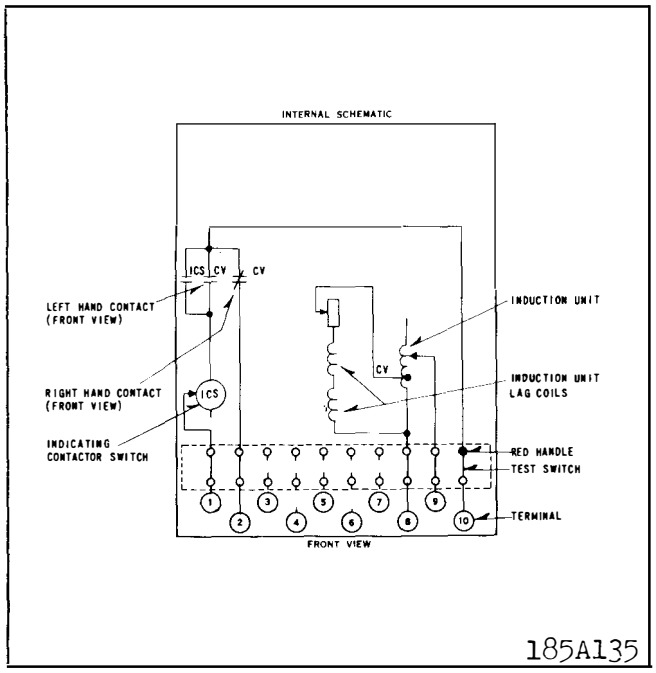


Fig. 3 Internal Schematic for the type CV (S.P.D.T.) voltage relay in the FT-11 case.

trip by the overvoltage contact, the time of the opening of the contacts should be a minimum. This condition is obtained by loosening the stationary contact mounting screw, removing the contact plate and then replacing the plate with the bent end resting against the contact spring.

For double trip relays, the upper stationary contact is adjusted such that the contact rests solidly against the back stop. The lower stationary contact is then adjusted such that both stationary contacts make contact simultaneously with their respective moving contact.

B. Instantaneous Indicating Voltage Switch (IIV)

The adjustable resistor must be adjusted for the desired pickup voltage.

C. Indicating Contactor Switch (ICS)

Only one setting is required on the ICS unit; that is, the selection of the 0.2 to 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw.

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 the proper nut with a wrench.

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

ADJUSTMENTS & 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, other than those covered under "Settings," should be required.

Acceptance Check

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

A. CV Unit

1. Contact

   The index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the "O" mark by approximately .020". (For the type CV-26 and CV-27 relays the back contact has no follow when the front contact is through one-half of its follow). The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Voltage — set the time dial to position 6. Alternately apply tap value voltage plus 3% and tap value voltage minus 3%.

   a. CV-24 and CV-25 Overvoltage Relays,

CV-26 and CV-27 Over or Undervoltage Relays – The moving contact should leave the backstop at tap value voltage plus 3% and should return to the backstop at tap value voltage minus 3%

b. CV-21 and CV-22 Undervoltage Relays – The moving contact should leave the backstop at tap value voltage minus 3% and should return to the backstop at tap value voltage plus 3%.

3. Instantaneous Indicating Voltage Switch (IIV) - Apply desired pickup voltage and adjust the internal adjustable resistor until the contacts just make. The target should drop freely.

4. Indicating Contactor Switch (ICS) – Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting being used. The operation indicator target should drop freely.

The contact gap should be approximately .047'' between the bridging moving contact and the adjustable stationary contacts. The bridging moving could touch both stationary contacts simultaneously.

Routing 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 #182A836H01 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 filver 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 have been distrubed. This procedure should not be used until it is apparent that the relay is not in proper working order (See ''Acceptance check'')

A. CV Unit

1. Contact

The index mark on the movement frame will coincide with the ''O'' mark on the time dial when the stationary contact has moved through approximately one half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the ''O'' mark by approximately .020''. (For the type CV-26 and CV-27 relays the back contact has no follow when the front contact is through one-half of its follow). The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32''.

2. Minimum Trip Voltage

The adjustment of the spring tension in setting the minimum trip voltage value of the relay is most conveniently made with the damping magnet removed.

* Set the relay on the minimum tap setting. Adjust the spring until the contact just leaves the backstop of the time dial at the 10½ position within 0.5 volt of the value that it just leaves the backstop with the time dial set at the ½ position.

Set the relay on the 6 time position.

a. CV-24 and CV-25 Overvoltage, CV-26 and CV-27 Over or Undervoltage – Adjust the resistor in the rear so that the moving contact will leave the backstop of the time dial at tap value voltage +1.0% and will return to the backstop at tap value voltage – 1.0%.

b. CV-21 and CV-22 Undervoltage Relays – Adjust the resistor in the rear so that the moving contact will leave the backstop of the time dial at tap value voltage –1.0% and will return to the backstop at tap value voltage +1.0%.

3. Install the permanent magnet.

a. CV-21 and CV-22 Undervoltage Relay – Use designated test circuit. With switch ''S'' opened, adjust resistor ''A'' until voltmeter reads tap value voltage or higher. Close switch ''S'' and adjust resistor ''B'' until the voltmeter reads

TABLE I

Type Relay	Percent Tap Value Voltage Or Pickup Voltage	Time Dial Setting	Operating Time in Sec.	Reset Time in Sec.
CV21	50	6	68	
CV-22	50	6	8.6	
CV-24	140	6	37.5	
CV-25	140	6	6.8	
CV-26	140	6	33	32.5
CV-27	140	6	5.9	5.7

40 per cent of tap value voltage. Open switch "S" and allow the moving contact to move to the backstop of the time dial. Close switch "S" and measure operating time.

Adjust the permanent magnet gap until the operating time corresponds to the value given in table 1.

b. CV-24 and CV-25 Overvoltage Relay – Apply the indicated voltage of table 1 and measure the operating time. Adjust the permanent magnet keeper until the operating time corresponds to the value given in table 1.

c. CV-26 and CV-27 Over or Undervoltage Relay – Apply the indicated voltage of table 1 and measure the operating time. Adjust the permanent magnet keeper until the operating time corresponds to the value given in table 1.

Measure the reset time of the disc from the stationary front contact to the stationary back contact. This time should be as shown in table 1.

B. Instantaneous Indicating Voltage Switch (IIV)

The contact gap should be 3/32 ± 1/64 between the bridging contact and the adjustable stationary contacts. The bridging moving contact should touch both stationery contacts simultaneously. When the armature is fully picked up there should be some wipe of the contacts.

The core screw should be all the way in prior to setting the pickup. Apply desired pickup voltage and adjust the adjustable resistor until the contacts just make. The target should drop at the same time.

C. Indicating Contactor Switch – Unit (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

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 name data.

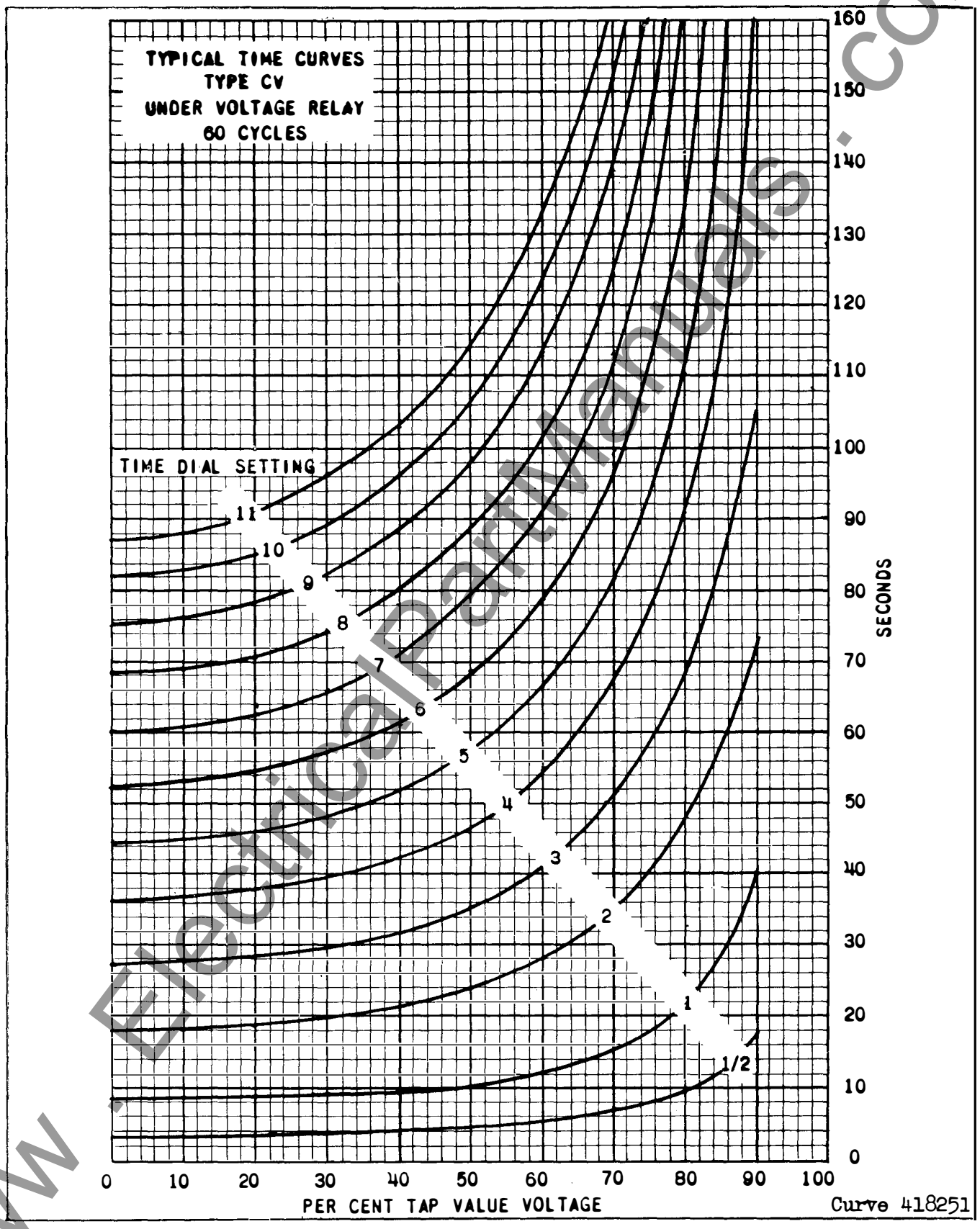


Fig. 4 Typical 60-cycle time curves or the type CV-21 Long Time Undervoltage Relay.

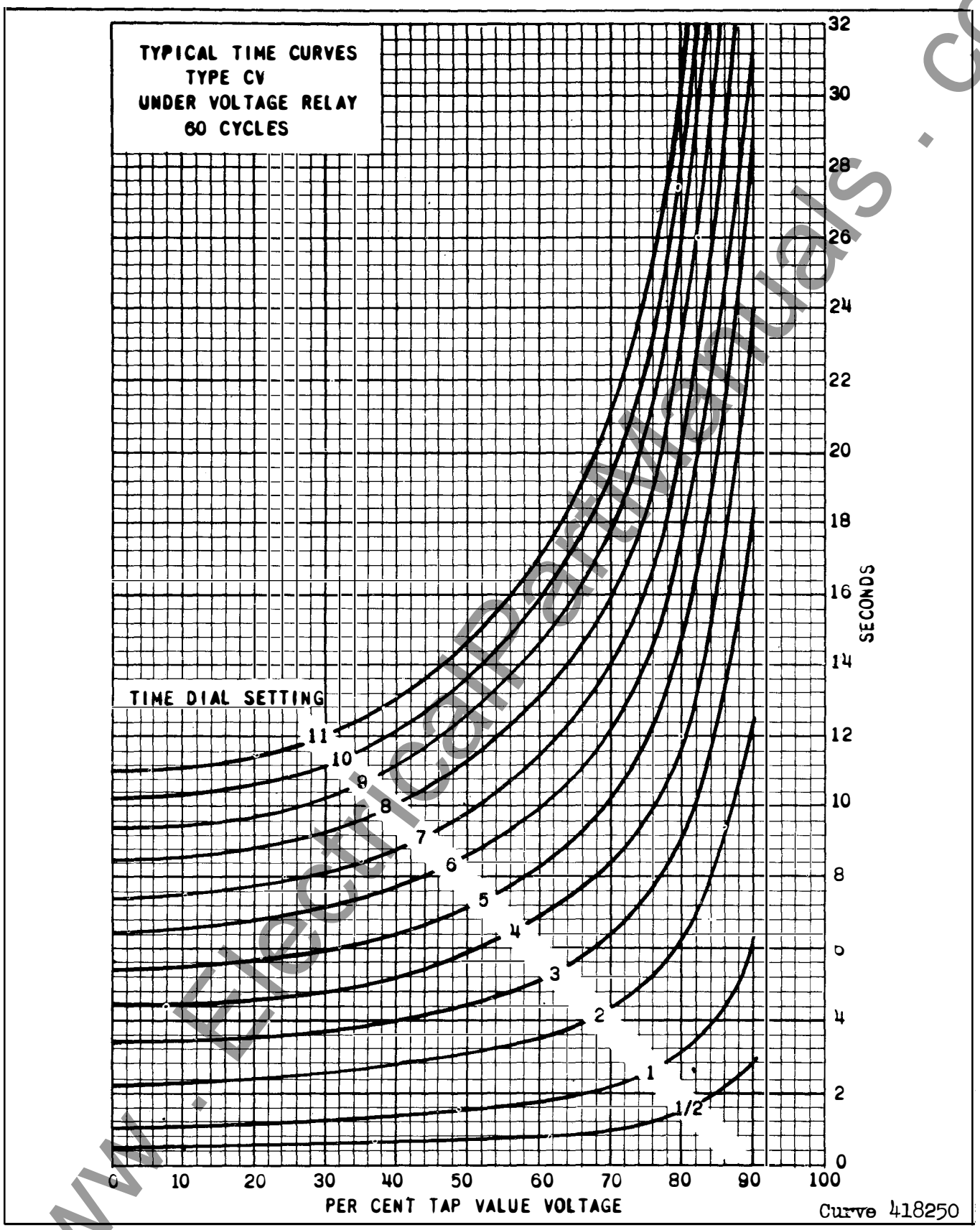


Fig. 5 Typical 60-cycle Time curves of the type CV-22 Short Time Undervoltage Relay.

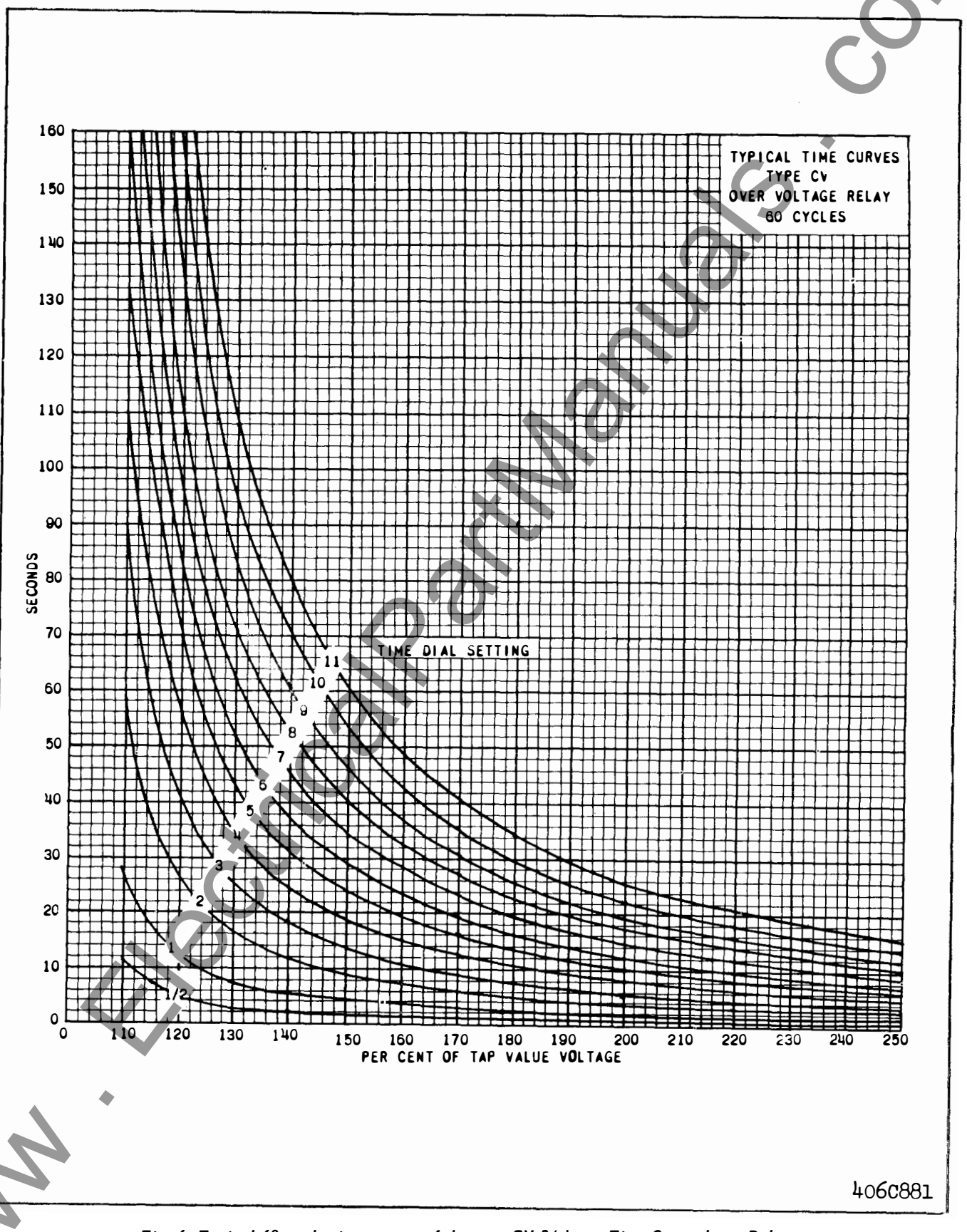


Fig. 6 Typical 60-cycle time curves of the type CV-24 Long Time Overvoltage Relay.

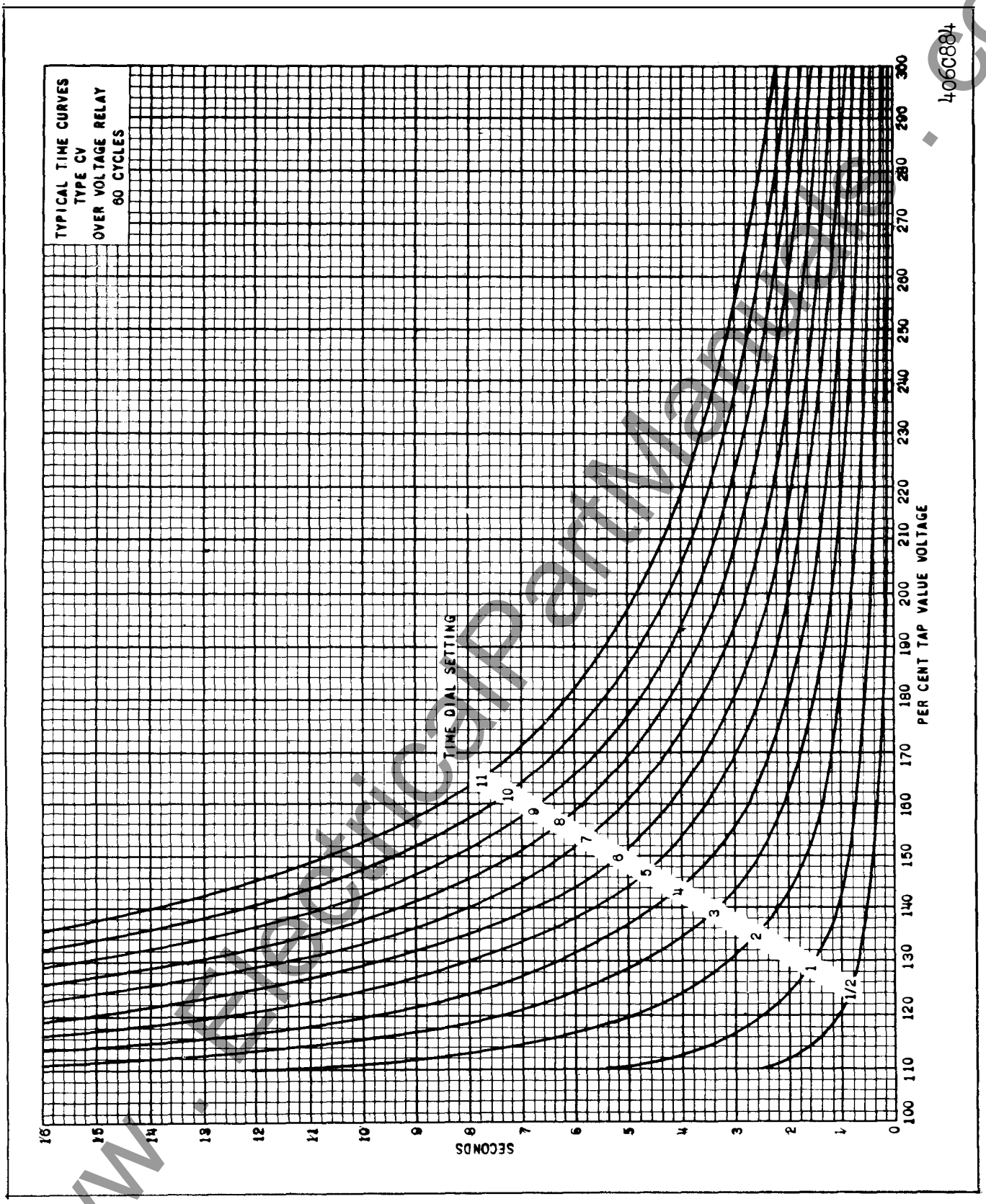


Fig. 7 Typical 60-cycle time curves of the type CV-25 Short Time Overvoltage Relay.

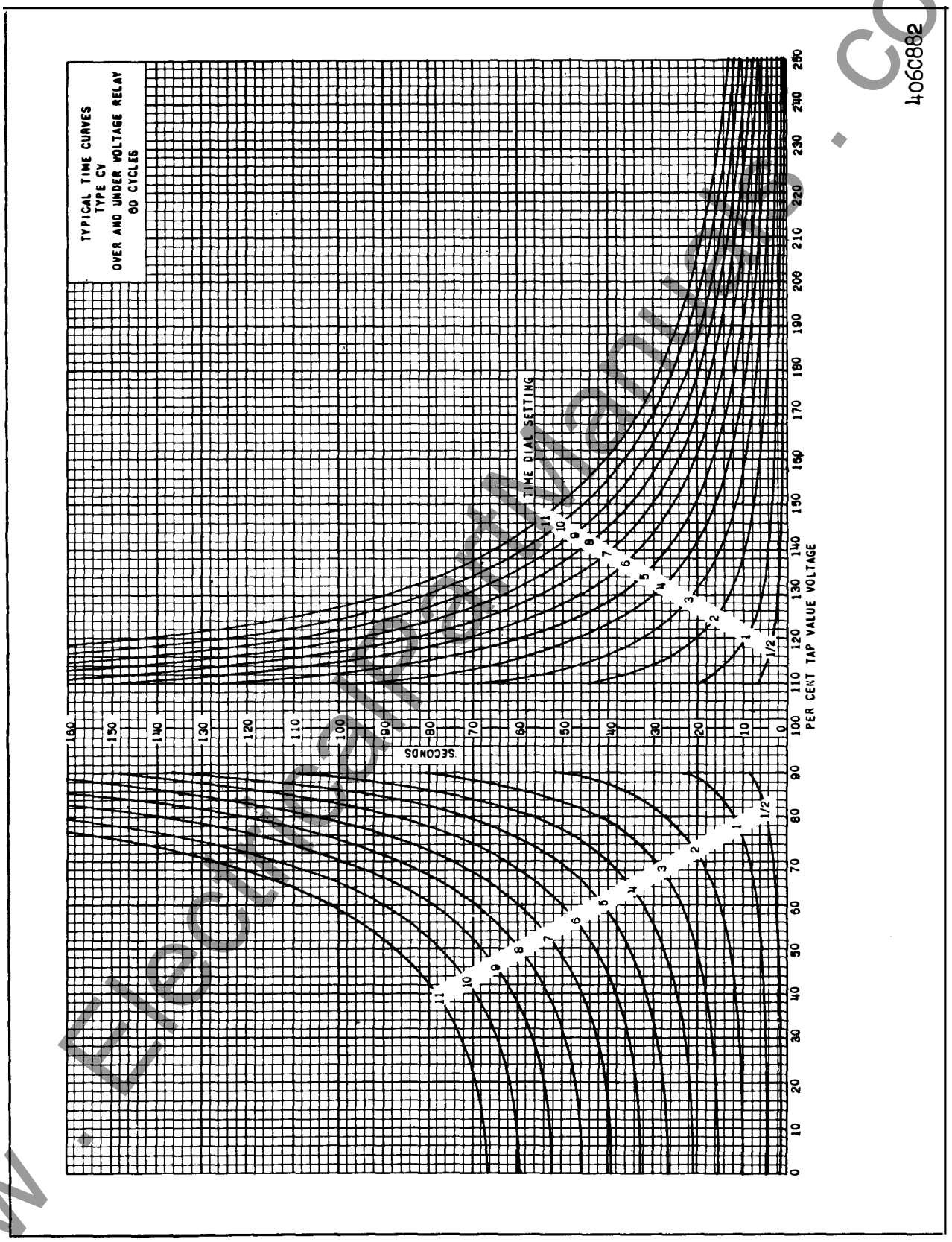


Fig. 8 Typical 60-cycle time curves of the type CV-26 Long Time Over and Undervoltage Relay.

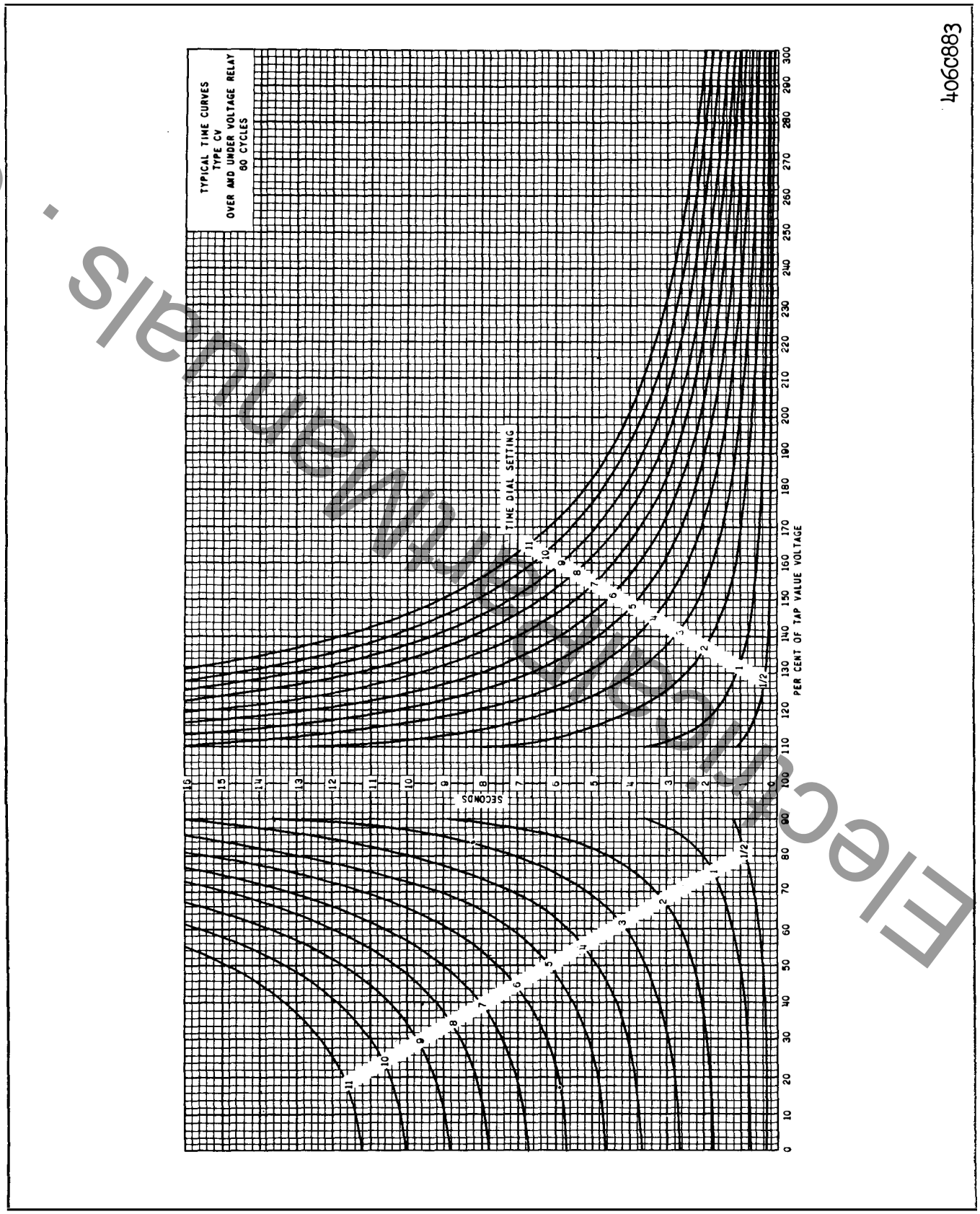


Fig. 9 Typical 60-cycle time curves of the type CV-27 Short Time Over and Undervoltage Relay.

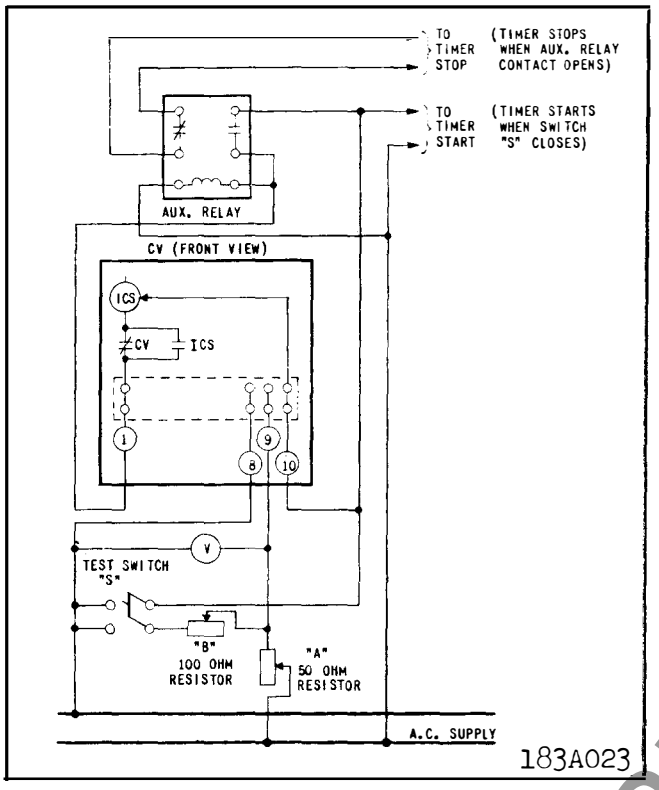


Fig. 10 Diagram of test connections for Type CV Under-voltage relays.

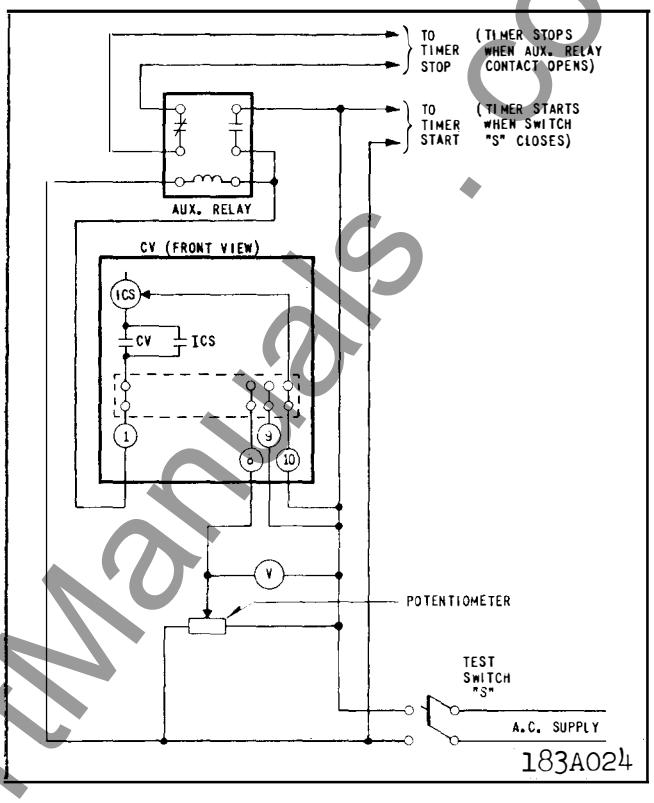


Fig. 11 Diagram of test connections for Type CV Over-voltage relays.

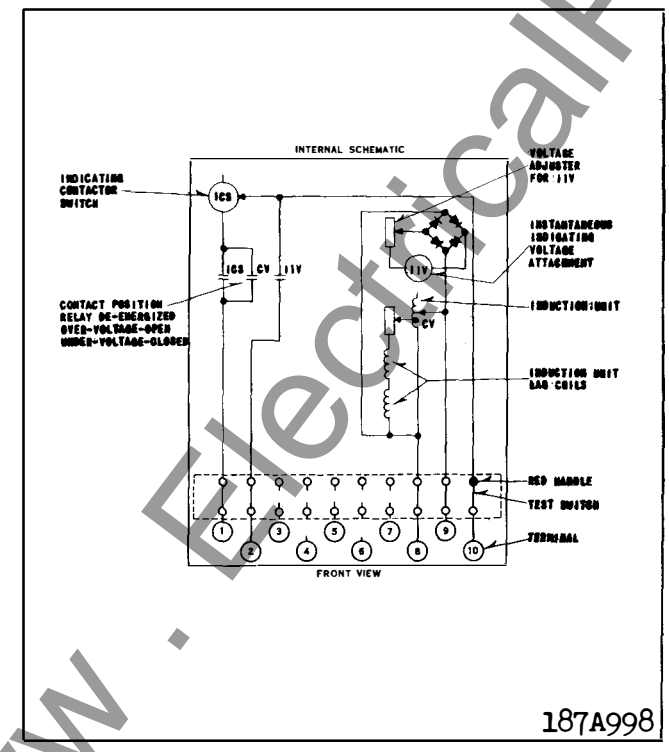


Fig. 12 Internal Schematic for type CV. (S.P.S.T.) with instantaneous indicating voltage attachment in type FT-11 case.

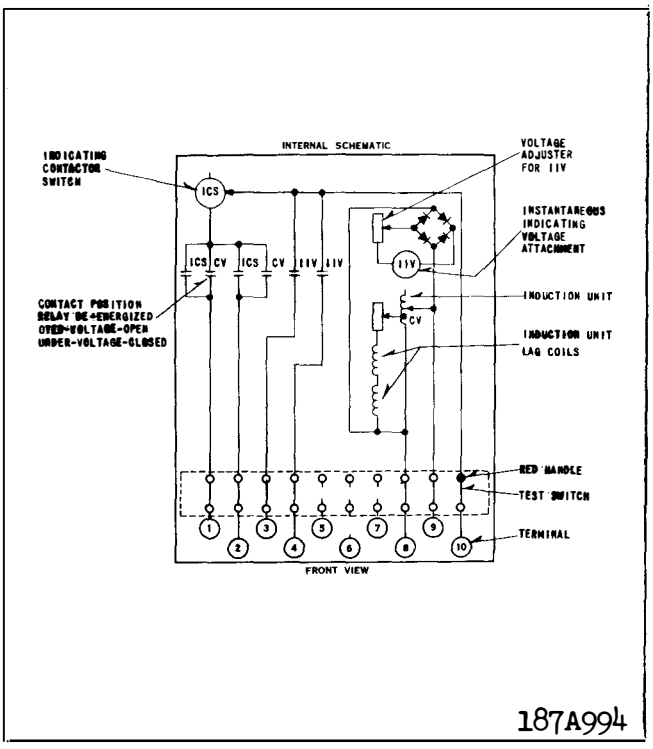


Fig. 13 Internal Schematic for type CV (D.P.S.T.) with instantaneous indicating voltage attachment in type FT-11 case.

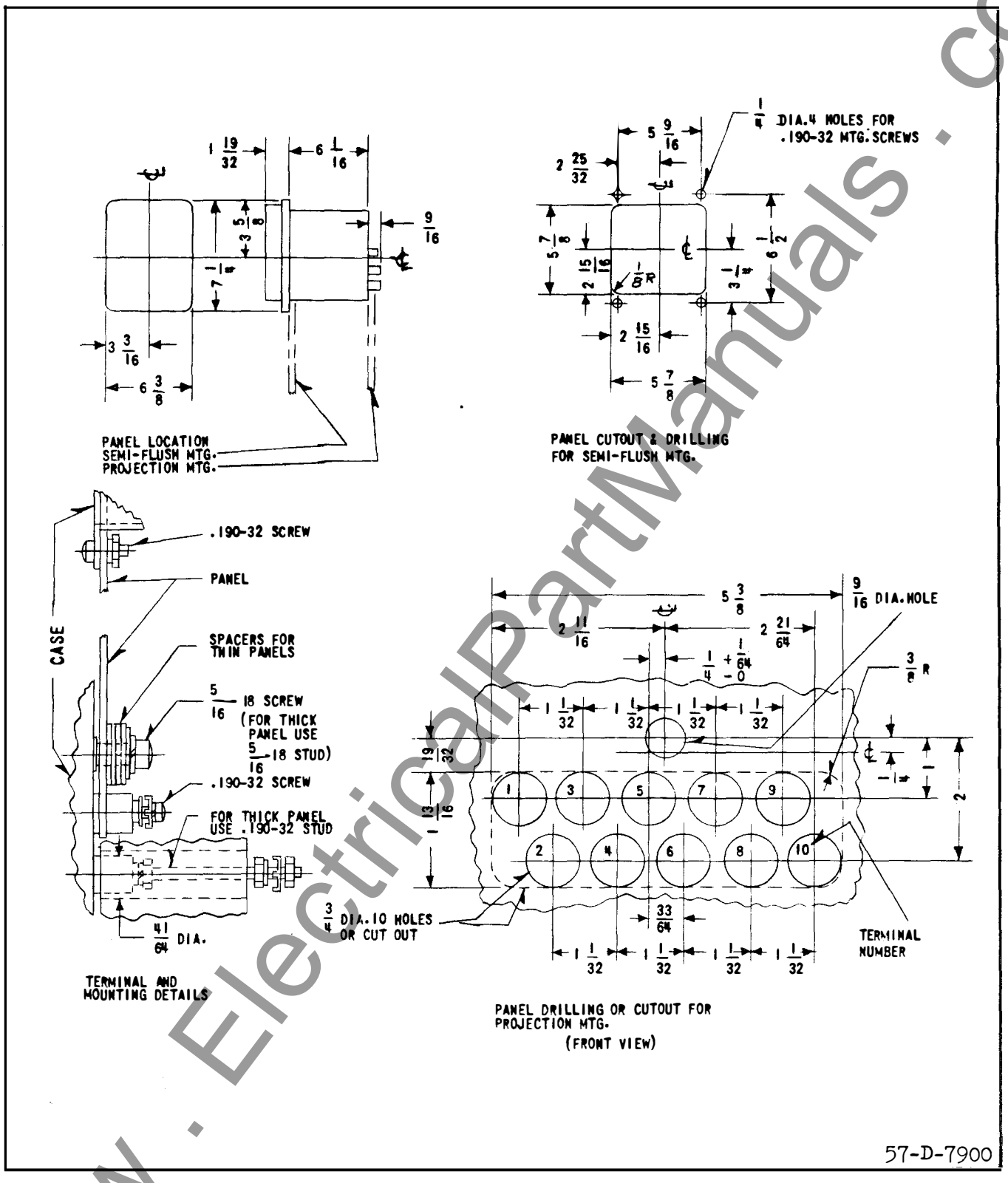
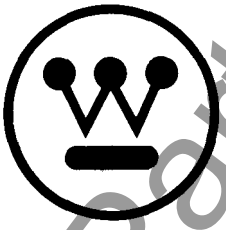


Fig. 14 Outline and drilling plan for type CV relays in the type FT-11 case.



WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CV FREQUENCY COMPENSATED VOLTAGE 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 operate the relay to check the settings and electrical connections.

APPLICATION

The type CV relays are single-phase induction-disc type relays operating either on under or over voltage or both. These relays are frequency compensated such that their pickup between 30 and 90 cycles is within 5 per cent of the 60 cycle value.

CONTENTS

This instruction leaflet applies to the following types of relays.

CV-21 Long Time Undervoltage Relay
CV-22 Short Time Undervoltage Relay
CV-24 Long Time Overvoltage Relay
CV-25 Short Time Overvoltage Relay
CV-26 Long Time Over or Undervoltage Relay
CV-27 Short Time Over or Undervoltage Relay.

CONSTRUCTION & OPERATION

* The types CV-21, CV-22, CV-24, CV-25, CV-26, and CV-27 relays consist of a voltage unit and an indicating contactor switch (ICS). The component parts of the relays are connected as shown in the internal schematic diagram. Some style relays contain an instantaneous indicating voltage switch (IIV) which also operates independent of frequency.

A. Voltage Unit (CV)

The overvoltage unit is an "E" type laminated structure with coils on each leg. The coil on the center leg of the structure is an autotransformer, winding with a tapped primary. The secondary winding of the autotransformer is connected to identical coils on the outer legs of the "E" type laminated structure. The coils are connected in such a manner that the combination of all the fluxes produced result in out-of-phase fluxes in the air gap. The out-of-phase air gap fluxes produced cause a contact closing torque.

The undervoltage unit operates on the same principle as the overvoltage unit except the connections to the leg coils are reversed to cause the out-of-phase fluxes to produce a contact opening torque.

The units are frequency compensated by means of a resistor located in the outer leg coil circuit.

B. Instantaneous Indicating Voltage Switch (IIV)

* The instantaneous trip unit is a small a-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts completing the trip circuit. Also during the operation two fingers on the armature deflect a spring located on the front of the switch which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the cover.

The adjustable pickup range is accomplished by means of an adjustable resistor.

C. Indicating Contactor Switch (ICS)

The indicating contactor switch is a small d-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also, during this operation two

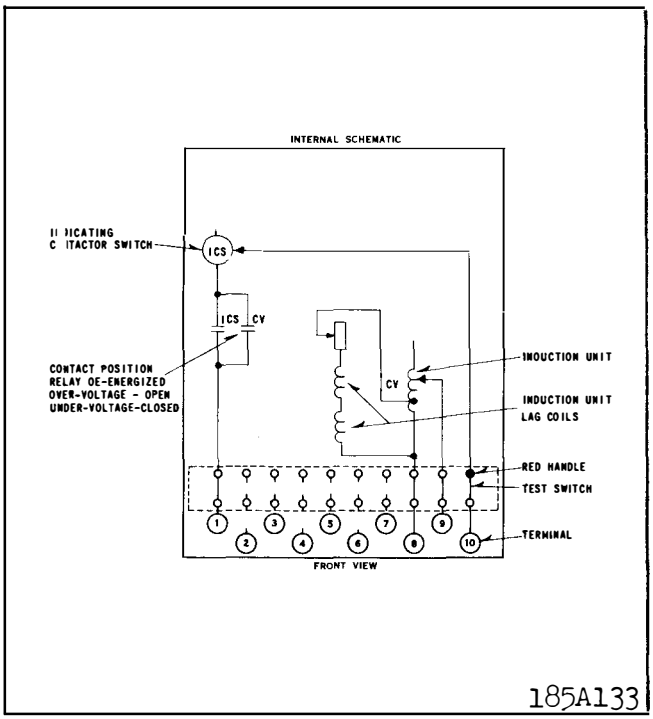


Fig. 1 Internal Schematic for the type CV (S.P.S.T.) voltage relay in the FT-11 case.

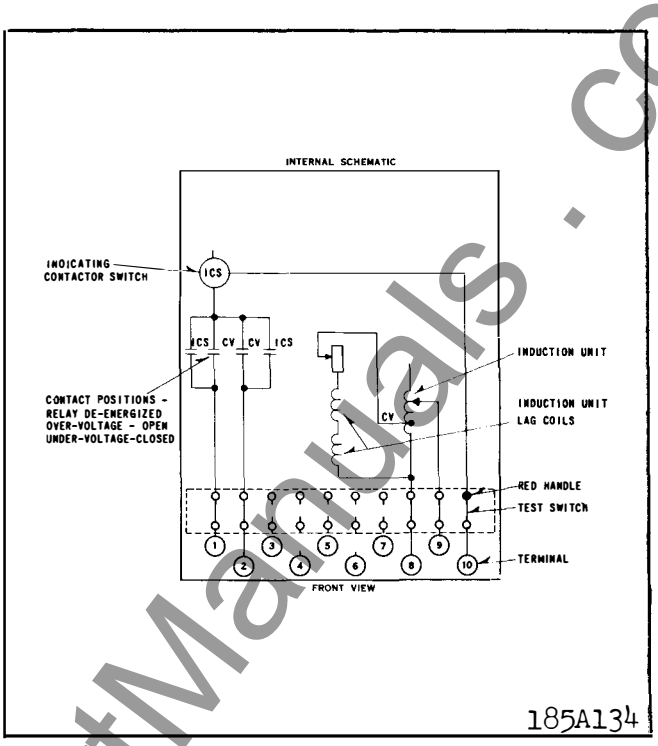


Fig. 2 Internal Schematic for the type CV (D.P.S.T.) voltage relay in the FT-11 case.

fingers on the armature deflect a spring located on front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the case.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

* These relays are frequency compensated such that their pickup between 30 and 90 cycles is within 5% of the 60 cycle value.

The CV-21 and CV-22 undervoltage relays, CV-24 and CV-25 overvoltage relays, and CV-26 and CV-27 over or undervoltage relays are available in the voltage ranges:

Range	Taps							
55-140	55	64	70	82	93	105	120	140
110-280	110	128	140	164	186	210	240	280

A. CV-21 and CV-22 Undervoltage Relays – CV-24 and CV-25 Overvoltage Relays.

Tap value voltage is the minimum voltage required to just close the relay contacts. At this value of voltage, the moving contacts will leave the backstop of the time dial and move to close the front contacts. Normal operation of the two relays is such that the CV-21 and CV-22 undervoltage relays will open its contacts with application of voltages greater than tap value voltage, while the CV-24 and CV-25 overvoltage relay closes its contacts with voltages greater than tap value voltage.

B. CV-26 and CV-27 Over or Undervoltage Relays

Tap value voltage is the value of voltage at which the stationary front contact closes. The stationary back contact will close within 5% of this value.

* When the relay is used as an overvoltage relay, the moving contact is made with the stationary back contact for values of applied voltage less than tap value voltage. With application of voltages greater than tap value voltage, the moving contact moves to close the front contact in a time as shown by the right hand curve of either Fig. 8 or 9.

* When the relay is used as an undervoltage relay, the moving contact is made with the stationary front contact for values of applied voltage greater than tap value voltage. With the application of voltages less than tap value voltage, the moving contact moves to close the back contact in a time as shown on the left-hand curves of either figures 8 or 9.

Rated Voltage	TAPS		Volt-Amps.	Power Factor	Watts
	120 Volt Relay	240 Volt Relay			
120 or 240 Volts	55	110	14.38	.44	6.3
	64	128	10.38	.41	4.23
	70	140	8.35	.39	3.26
	82	164	6.00	.37	2.23
	93	186	4.66	.35	1.63
	105	210	3.64	.34	1.25
	120	240	2.77	.33	.92
	140	280	2.04	.31	.63

* **C. Instantaneous Indicating Voltage Switch (IIV)**

The range of operation is 120 to 200 volts ac. The pickup is adjusted by means of an adjustable resistor.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constants

Indicating contactor Switch — 0.2 Amp. tap 6.5 ohms d-c resistance

0.2 Amp. tap 0.15 ohms d-c resistance

ENERGY REQUIREMENTS

The burdens of the CV-21, CV-22, CV-24, CV-25, CV-26, CV-27 relays at rated voltage are as follows

* The burden of the 11V (when used) is in addition to the above burdens and is as follows:

Setting	Voltage Applied	Burden
120 Volts	120 Volts	2.0 VA.
200 Volts	200 Volts	3.0 VA.

SETTINGS

A. CV Unit

The setting of the CV unit can be defined either by tap setting and time dial position or by tap setting and a specific time of operation at some percentage of tap value voltage (e.g. on CV-24 120 tap setting, 2 time dial position or 120 tap setting, 12 seconds at 140 per cent of tap value voltage).

To provide selective circuit breaker operation, a minimum coordinating time of 0.3 seconds plus circuit breaker time is recommended between the relay being set and the relays with which coordination is to be effected.

The connector screw on the terminal plate above the time dial connects various turns of the operating coil. By placing this screw in the various terminal plate holes, the relay will just close its contacts at the corresponding voltage of 55-64-70-82-93-105-120-150 volts or as marked on the terminal plate.

The nylon screw on the terminal plate holds the tap plate in position when taps are being changed. To use the position on the terminal plate in which the nylon screw is used, remove the nylon screw and place it in one of the unused holes. Then remove the tap screw and insert it in the terminal plate hole.

Instantaneous Reclosing

The factory adjustment of the voltage unit contacts provides a contact follow. Where circuit breaker reclosing will be initiated immediately after a

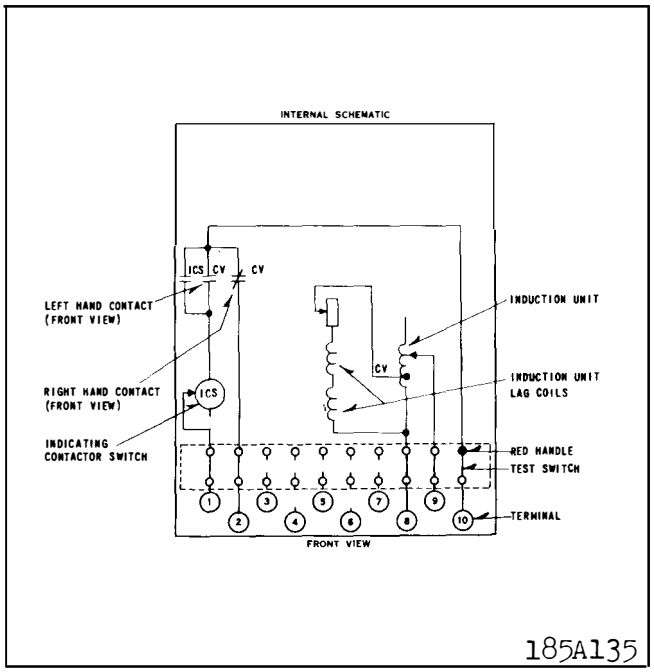


Fig. 3 Internal Schematic for the type CV (S.P.D.T.) voltage relay in the FT-11 case.

trip by the overvoltage contact, the time of the opening of the contacts should be a minimum. This condition is obtained by loosening the stationary contact mounting screw, removing the contact plate and then replacing the plate with the bent end resting against the contact spring.

For double trip relays, the upper stationary contact is adjusted such that the contact rests solidly against the back stop. The lower stationary contact is then adjusted such that both stationary contacts make contact simultaneously with their respective moving contact.

* **B. Instantaneous Indicating Voltage Switch (IIV)**

The adjustable resistor must be adjusted for the desired pickup voltage.

C. Indicating Contactor Switch (ICS)

Only one setting is required on the ICS unit; that is, the selection of the 0.2 to 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw.

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 the proper nut with a wrench.

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

ADJUSTMENTS & 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, other than those covered under "Settings," should be required.

Acceptance Check

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

A. CV Unit

1. Contact

   The index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the "O" mark by approximately .020". (For the type CV-26 and CV-27 relays the back contact has no follow when the front contact is through one-half of its follow). The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Voltage — set the time dial to position 6. Alternately apply tap value voltage plus 3% and tap value voltage minus 3%.

   a. CV-24 and CV-25 Overvoltage Relays,

CV-26 and CV-27 Over or Undervoltage Relays – The moving contact should leave the backstop at tap value voltage plus 3% and should return to the backstop at tap value voltage minus 3%

b. CV-21 and CV-22 Undervoltage Relays – The moving contact should leave the backstop at tap value voltage minus 3% and should return to the backstop at tap value voltage plus 3%.

* 3. Instantaneous Indicating Voltage Switch (IIV) - Apply desired pickup voltage and adjust the internal adjustable resistor until the contacts just make. The target should drop freely.

4. Indicating Contactor Switch (ICS) – Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting being used. The operation indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving could touch both stationary contacts simultaneously.

Routing 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 #182A836H01 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 filver 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 have been distrubed. This procedure should not be used until it is apparent that the relay is not in proper working order (See "Acceptance check")

A. CV Unit

1. Contact

The index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the "O" mark by approximately .020". (For the type CV-26 and CV-27 relays the back contact has no follow when the front contact is through one-half of its follow). The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Voltage

The adjustment of the spring tension in setting the minimum trip voltage value of the relay is most conveniently made with the damping magnet removed.

Set the relay on the minimum tap setting. Adjust the spring such that the same voltage is required to just move the contact from the backstop of the time dial to the ½ and 10½ position.

Set the relay on the 6 time position.

a. CV-24 and CV-25 Overvoltage, CV-26 and CV-27 Over or Undervoltage – Adjust the resistor in the rear so that the moving contact will leave the backstop of the time dial at tap value voltage +1.0% and will return to the backstop at tap value voltage – 1.0%.

b. CV-21 and CV-22 Undervoltage Relays – Adjust the resistor in the rear so that the moving contact will leave the backstop of the time dial at tap value voltage –1.0% and will return to the backstop at tap value voltage +1.0%.

3. Install the permanent magnet.

a. CV-21 and CV-22 Undervoltage Relay – Use designated test circuit. With switch "S" opened, adjust resistor "A" until voltmeter reads tap value voltage or higher. Close switch "S" and adjust resistor "B" until the voltmeter reads

TABLE I

Type Relay	Percent Tap Value Voltage Or Pickup Voltage	Time Dial Setting	Operating Time in Sec.	Reset Time in Sec.
CV21	50	6	68	
CV-22	50	6	8.6	
CV-24	140	6	37.5	
CV-25	140	6	6.8	
CV-26	140	6	33	32.5
CV-27	140	6	* 5.9	* 5.7

40 per cent of tap value voltage. Open switch "S" and allow the moving contact to move to the backstop of the time dial. Close switch "S" and measure operating time.

Adjust the permanent magnet gap until the operating time corresponds to the value given in table 1.

b. CV-24 and CV-25 Overvoltage Relay – Apply the indicated voltage of table 1 and measure the operating time. Adjust the permanent magnet keeper until the operating time corresponds to the value given in table 1.

c. CV-26 and CV-27 Over or Undervoltage Relay – Apply the indicated voltage of table 1 and measure the operating time. Adjust the permanent magnet keeper until the operating time corresponds to the value given in table 1.

Measure the reset time of the disc from the stationary front contact to the stationary back contact. This time should be as shown in table 1.

* **B. Instantaneous Indicating Voltage Switch (IIV)**

The contact gap should be 3/32 ± 1/64 between the bridging contact and the adjustable stationary contacts. The bridging moving contact should touch both stationery contacts simultaneously. When the armature is fully picked up there should be some wipe of the contacts.

The core screw should be all the way in prior to setting the pickup. Apply desired pickup voltage and adjust the adjustable resistor until the contacts just make. The target should drop at the same time.

C. Indicating Contactor Switch – Unit (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

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 name data.

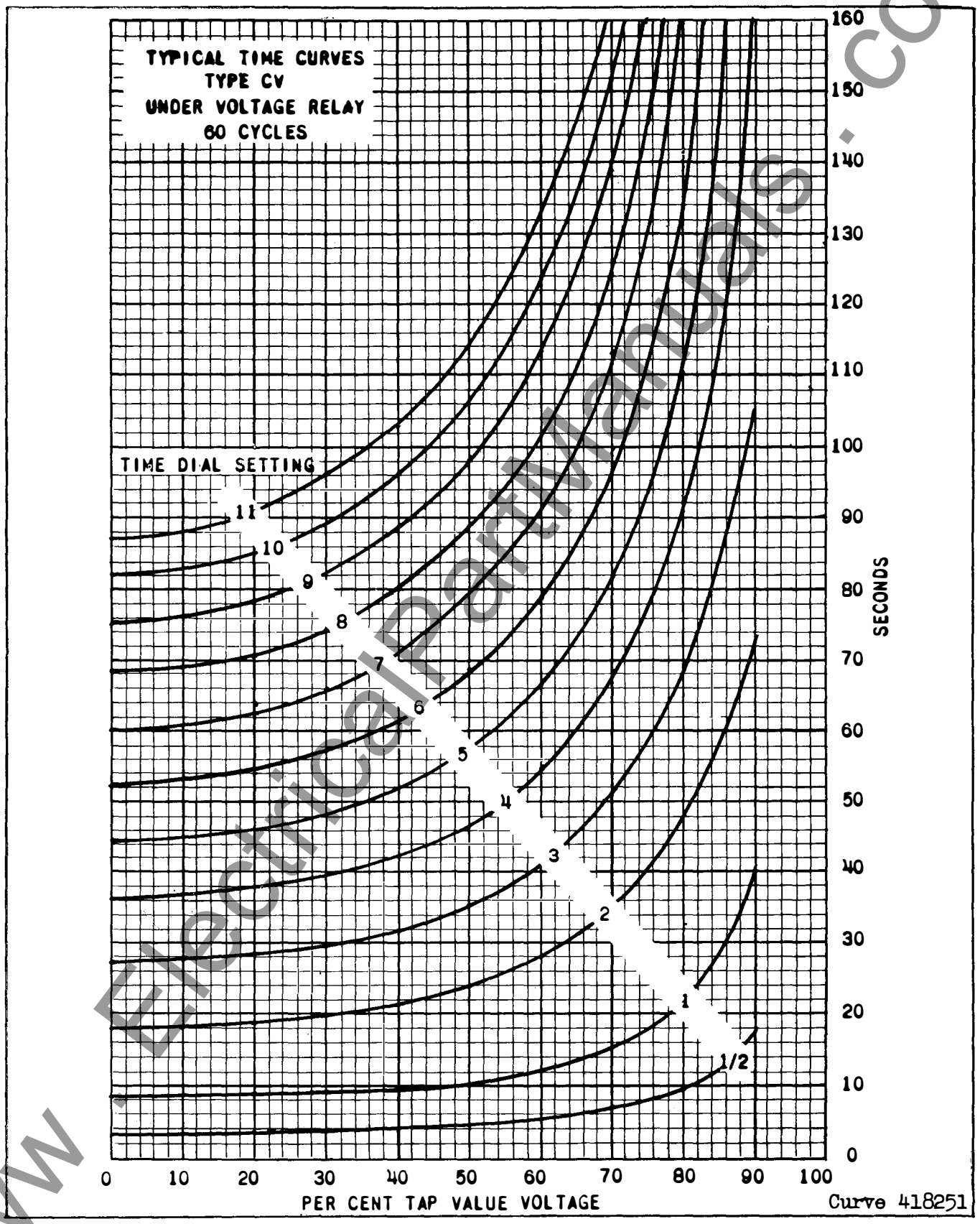


Fig. 4 Typical 60-cycle time curves or the type CV-21 Long Time Undervoltage Relay.

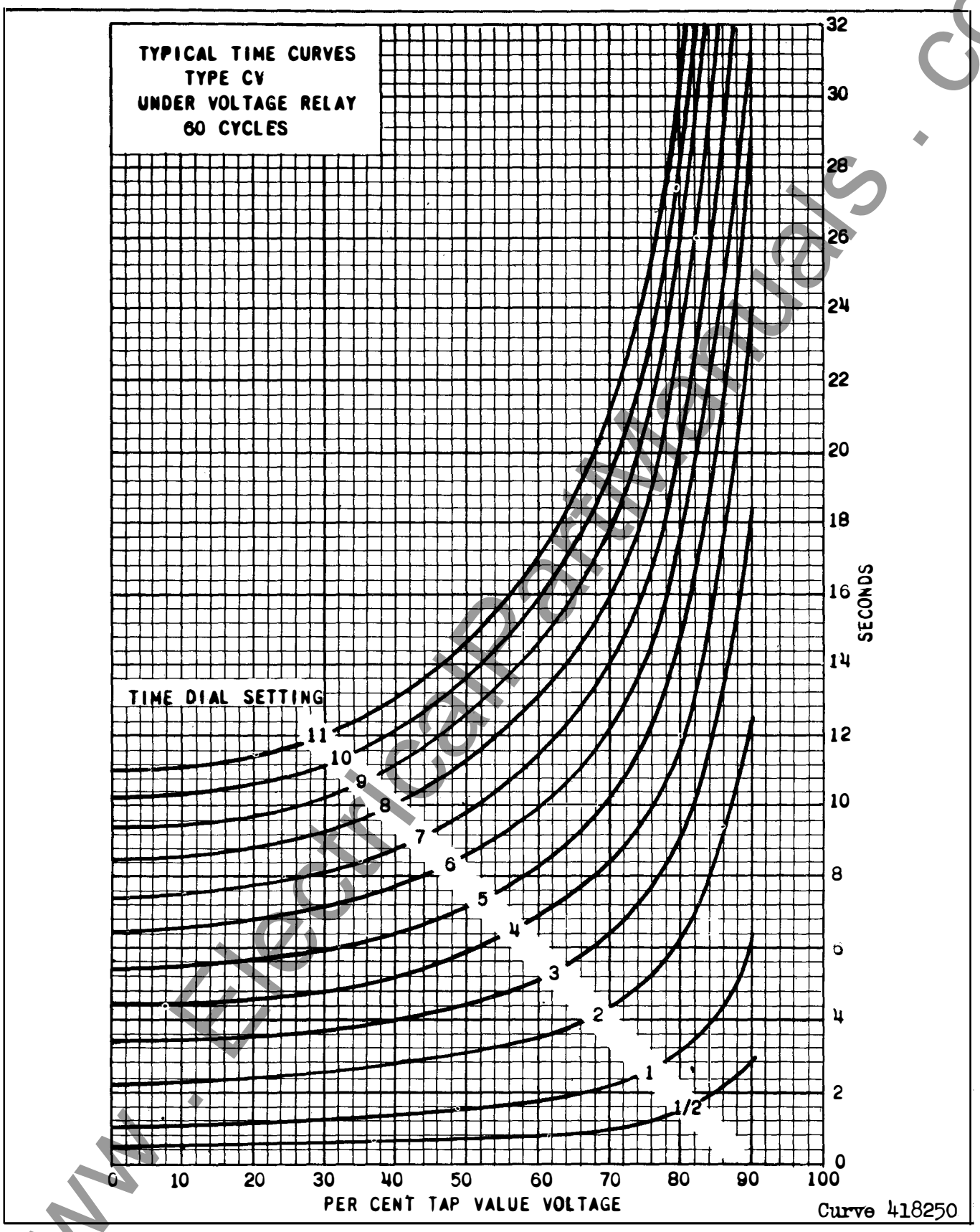


Fig. 5 Typical 60-cycle Time curves of the type CV-22 Short Time Undervoltage Relay.

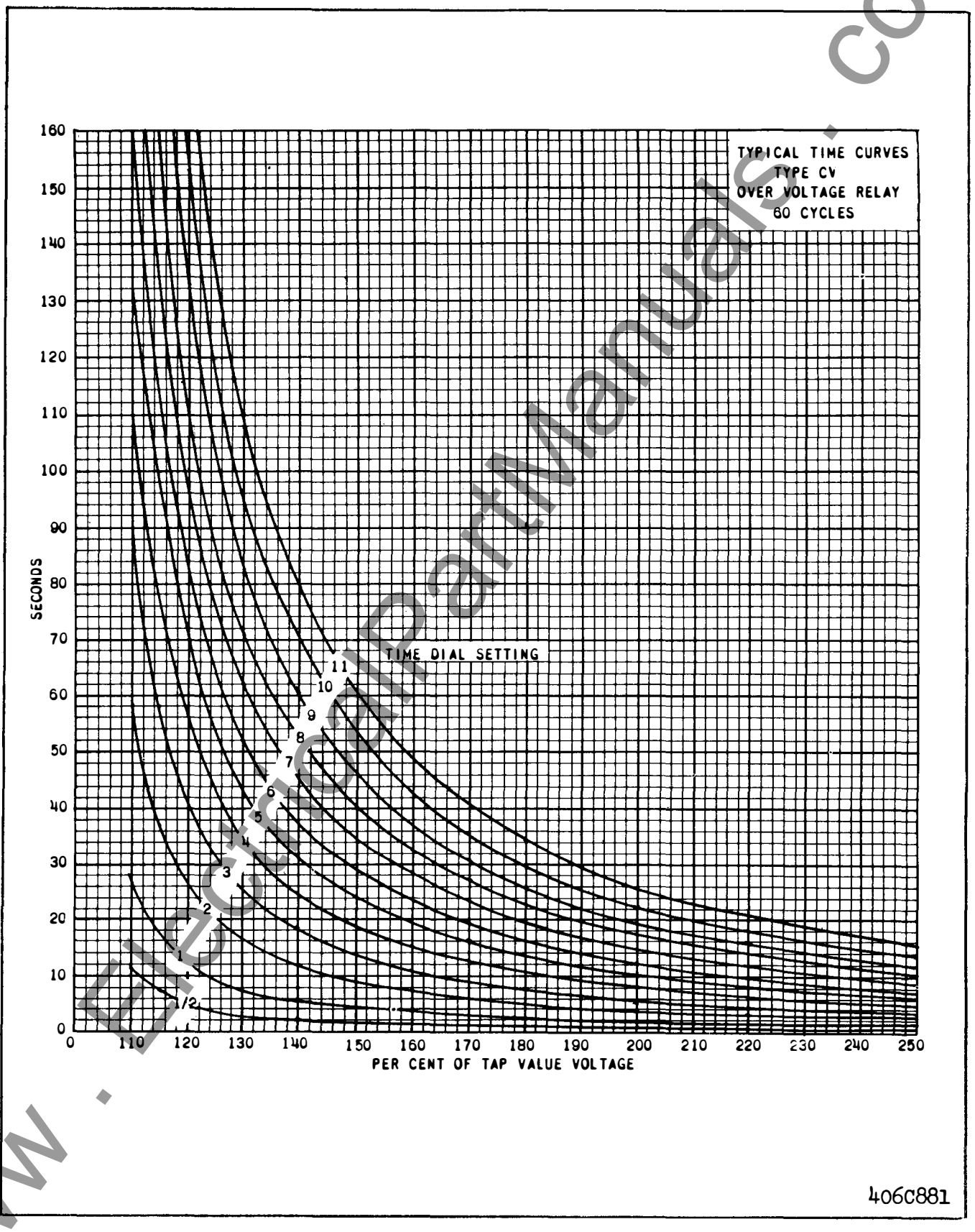


Fig. 6 Typical 60-cycle time curves of the type CV-24 Long Time Overvoltage Relay.

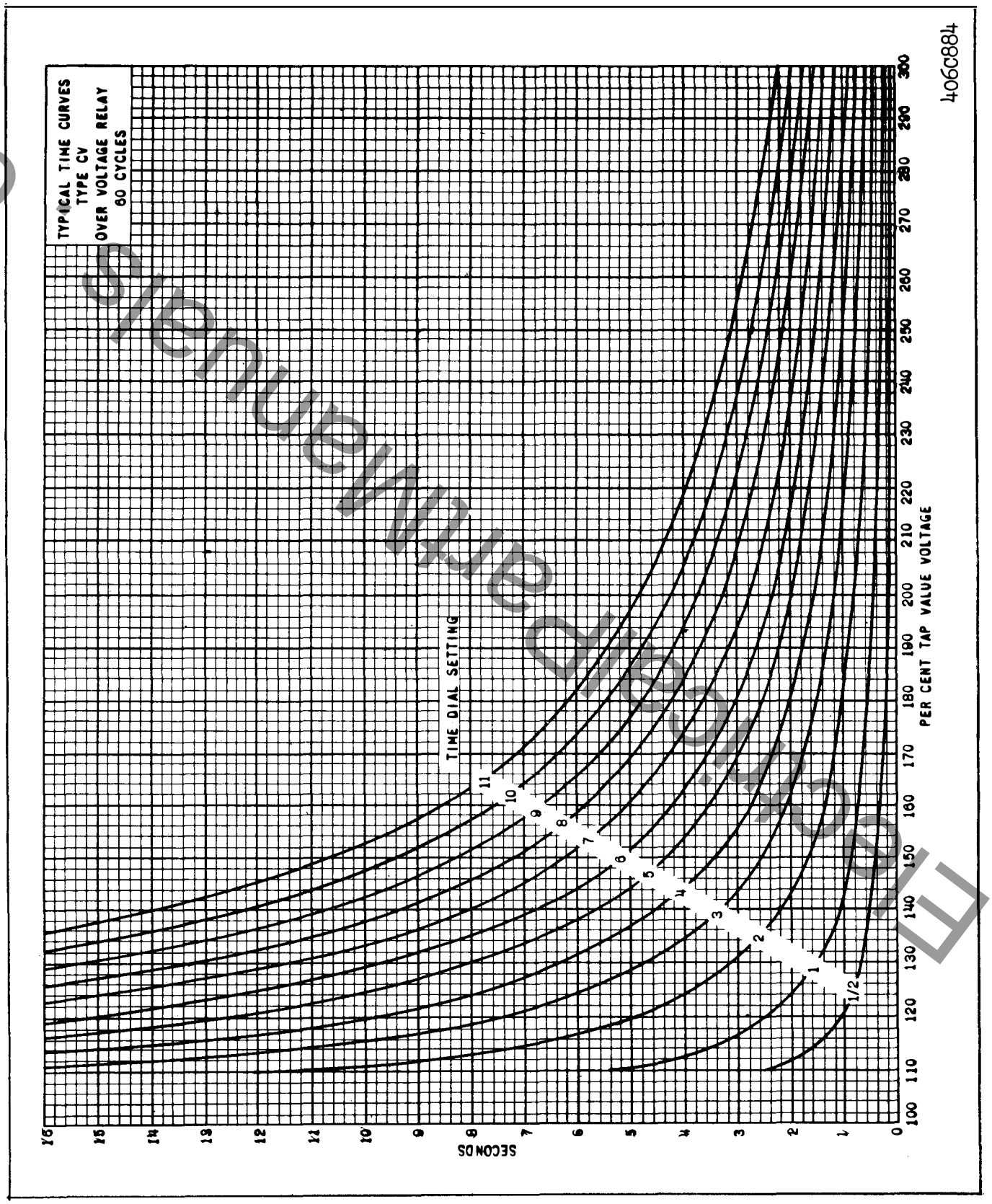


Fig. 7 Typical 60-cycle time curves of the type CV-25 Short Time Overvoltage Relay.

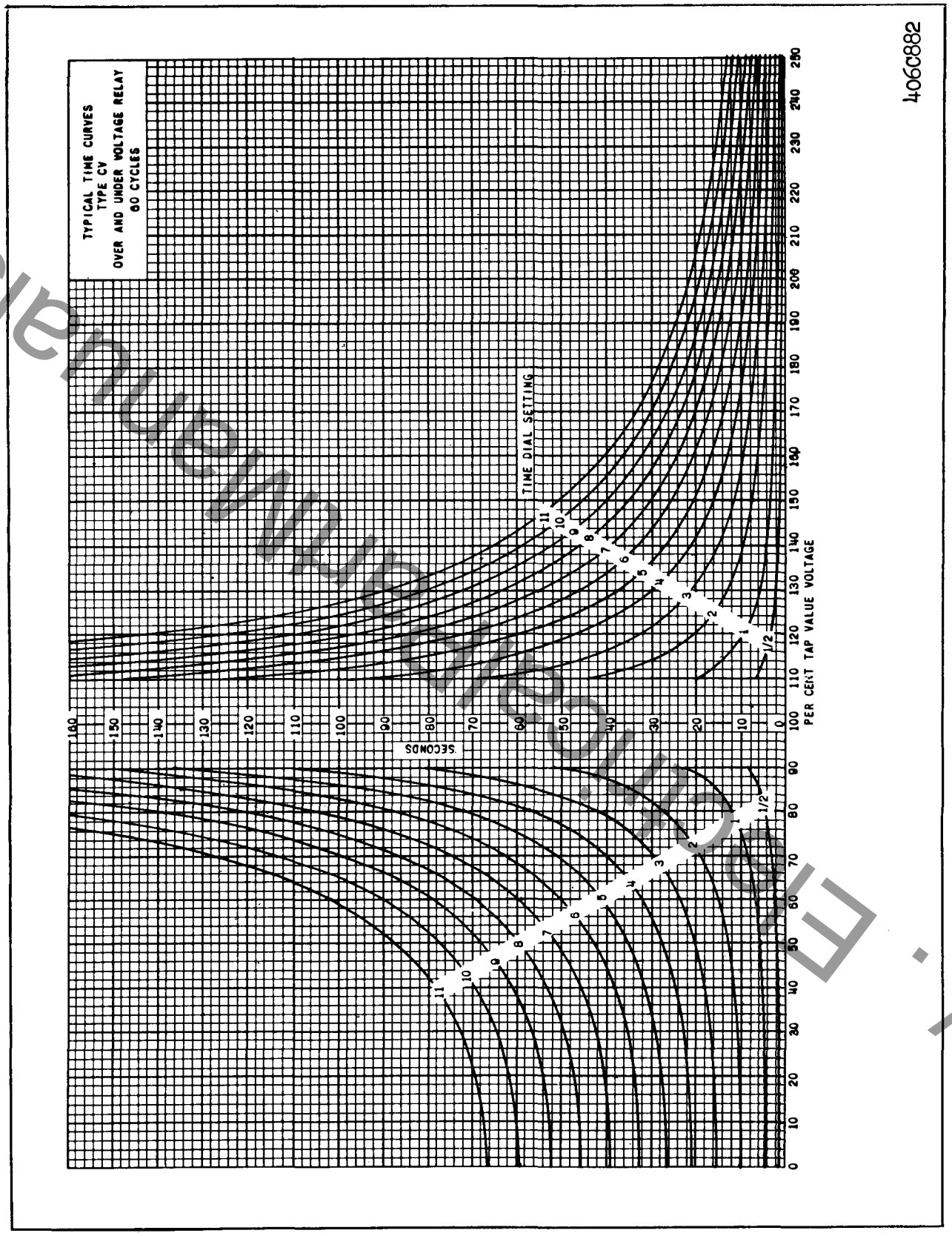


Fig. 8 Typical 60-cycle time curves of the type CV-26 Long Time Over and Undervoltage Relay.

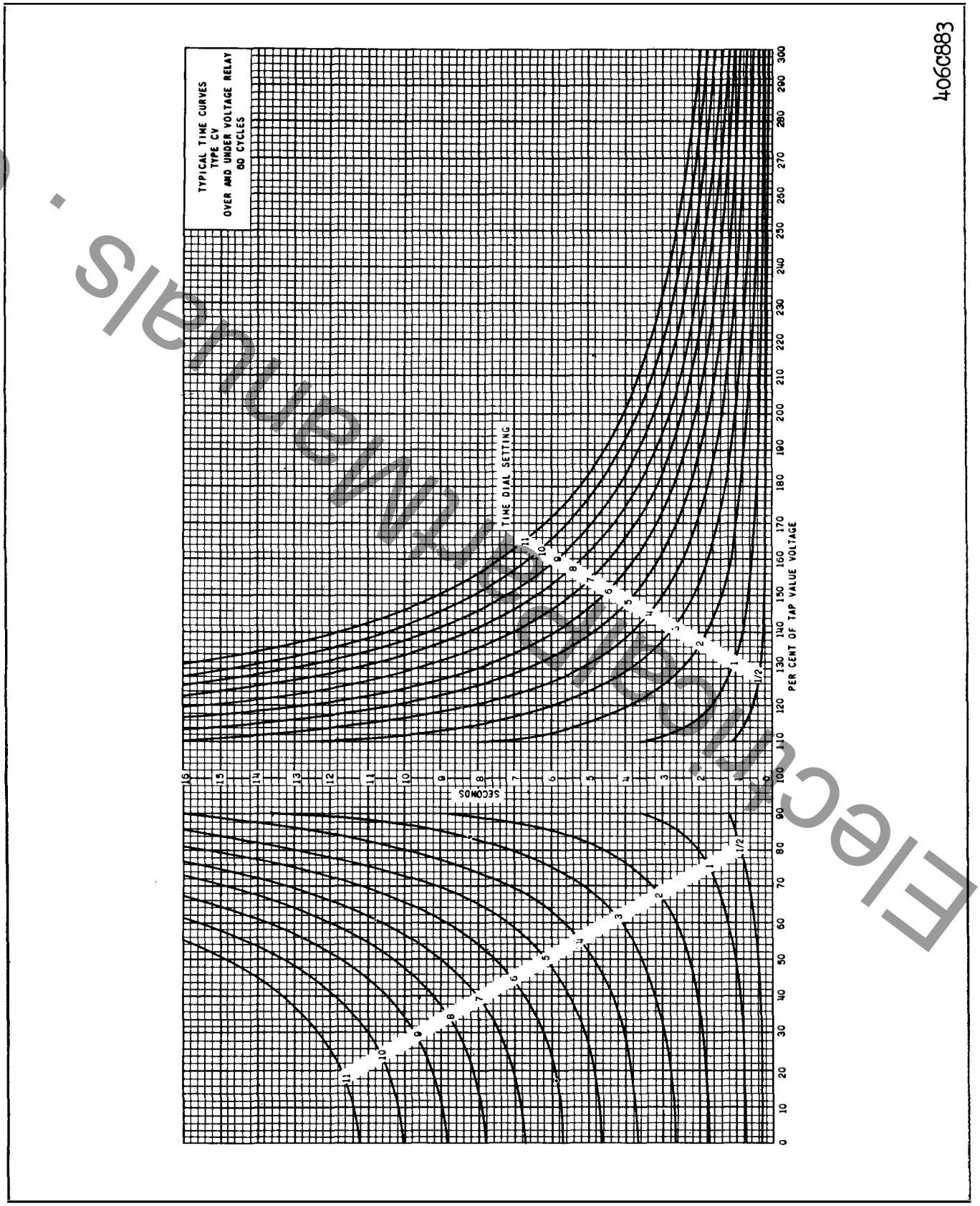


Fig. 9 Typical 60-cycle time curves of the type CV-27 Short Time Over and Undervoltage Relay.

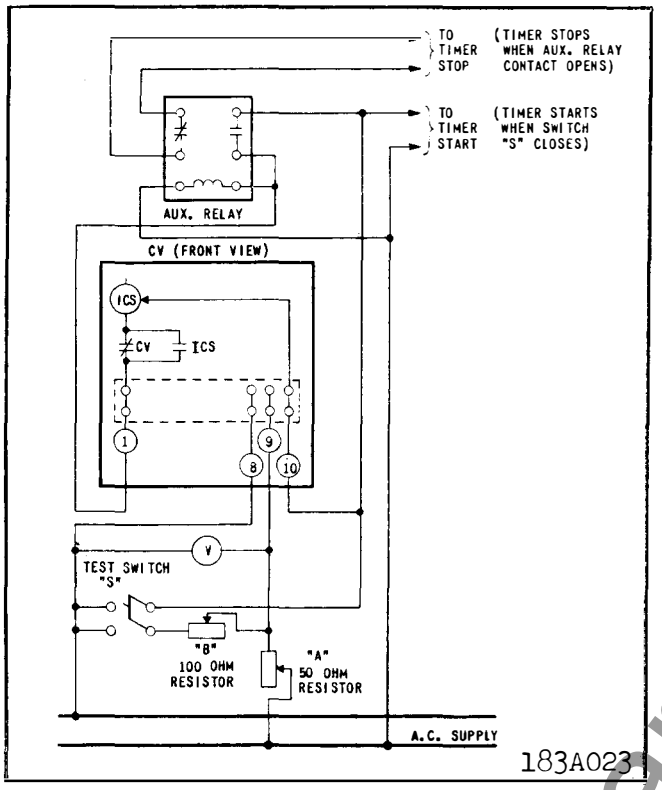


Fig. 10 Diagram of test connections for Type CV Under-voltage relays.

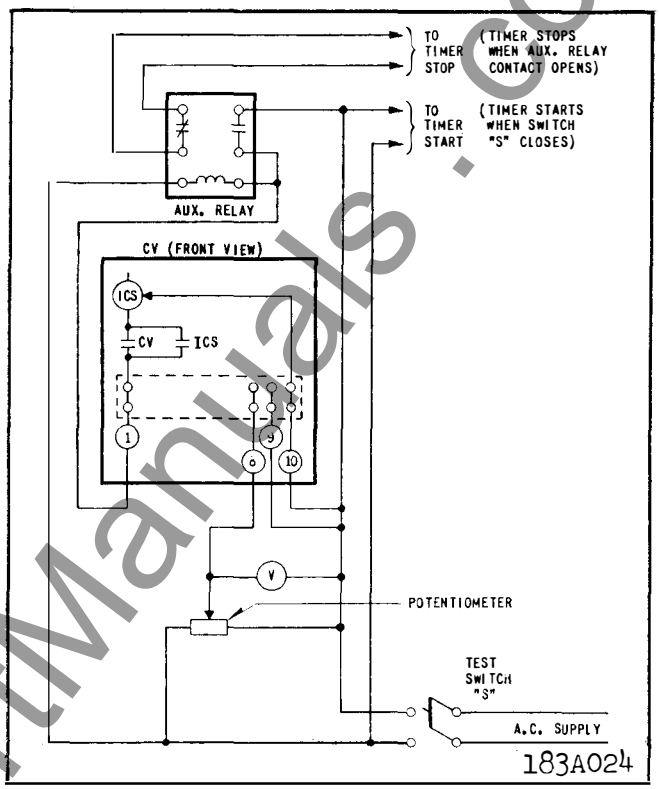
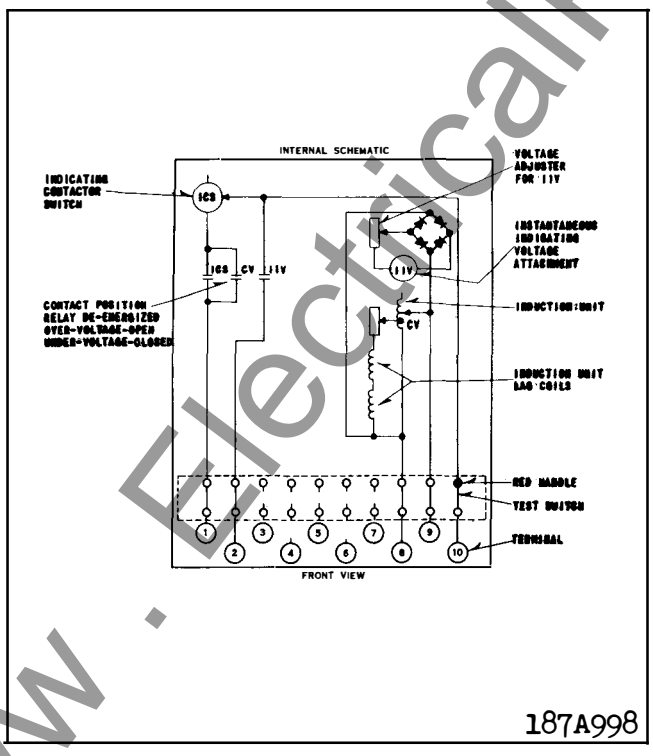
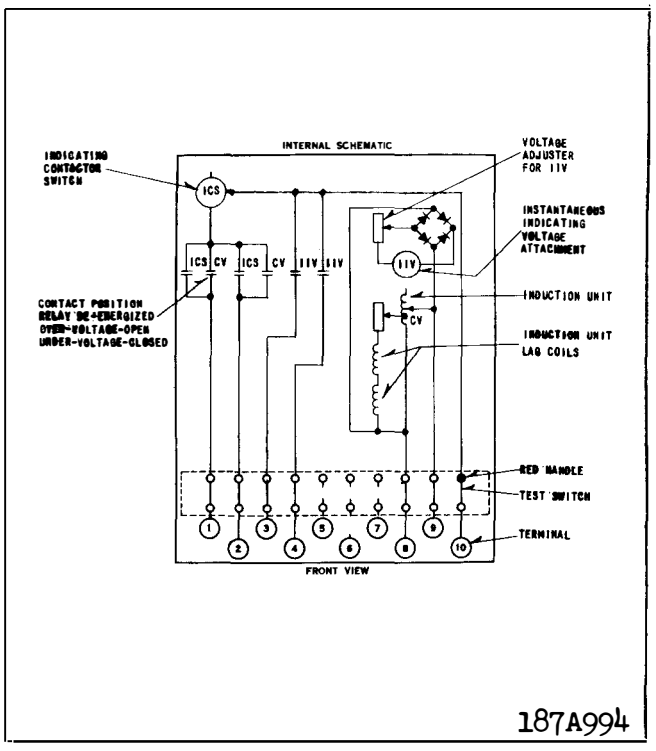


Fig. 11 Diagram of test connections for Type CV Over-voltage relays.



* *Fig. 12 Internal Schematic for type CV. (S.P.S.T.) with instantaneous indicating voltage attachment in type FT-11 case.*



* *Fig. 13 Internal Schematic for type CV (D.P.S.T.) with instantaneous indicating voltage attachment in type FT-11 case.*

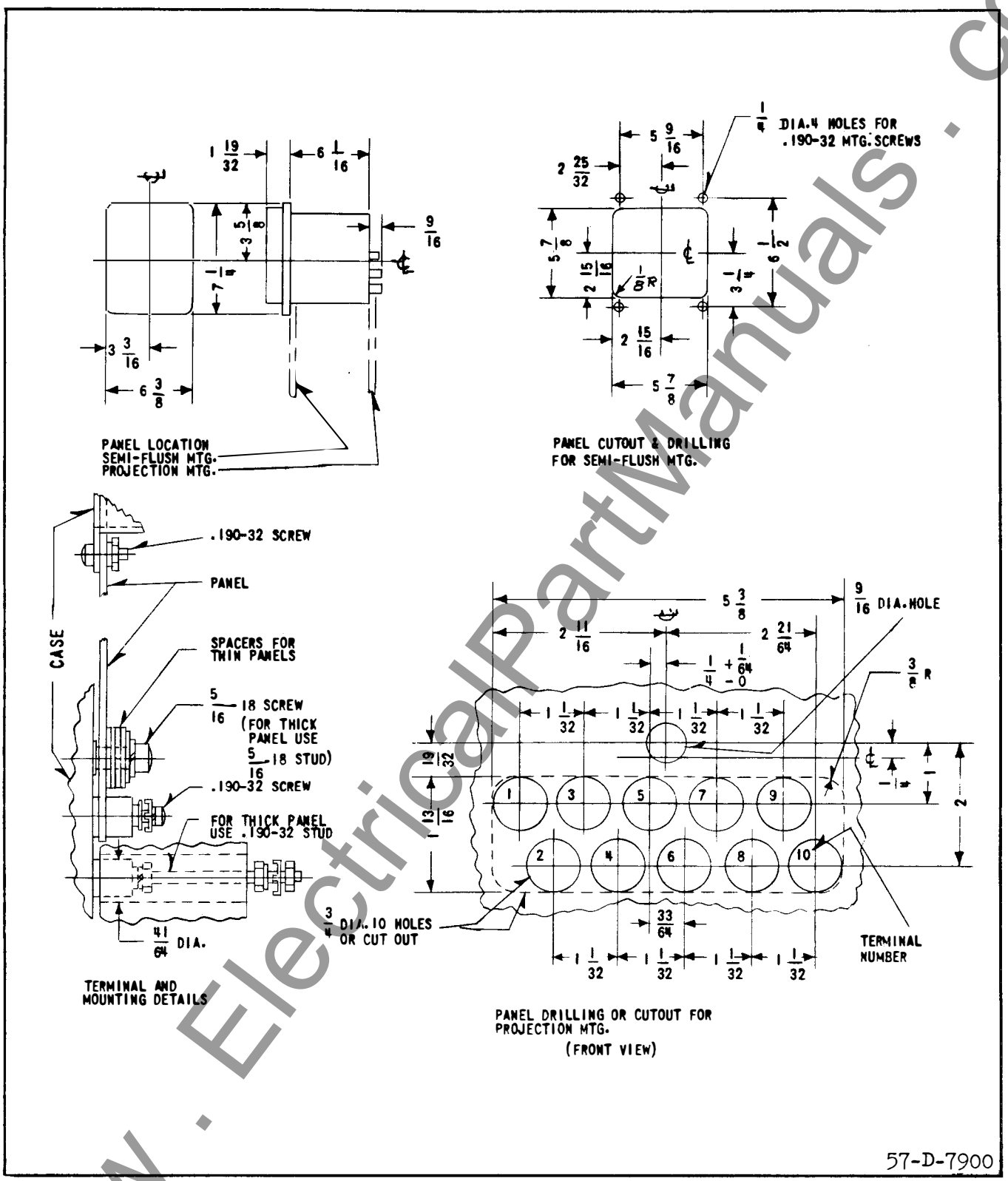
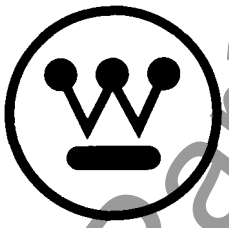


Fig. 14 Outline and drilling plan for type CV relays in the type FT-11 case.



WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CV VOLTAGE 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 CV relays are single-phase induction-disc type relays operating either on under or over voltage or both. These relays are applied as a voltage fault detector operating in conjunction with other protective relays. The relays are also used as timing devices for various automatic operations.

CONTENTS

This instruction leaflet applies to the following types of relays:

CV-1 Long Time Undervoltage Relay
CV-2 Short Time Undervoltage Relay
CV-4 Long Time Overvoltage Relay
CV-5 Short Time Overvoltage Relay
CV-6 Long Time Over or Undervoltage Relay
CV-7 Short Time Over or Under voltage Relay
CV-8 Low Voltage Pickup Overvoltage Relay

CONSTRUCTION AND OPERATION

The types CV-1, CV-2, CV-4, CV-5, CV-6, and CV-7 relays consist of a voltage unit and an indicating contactor switch (ICS). The principal component parts of the relay and their location are shown in figures 1, 2, and 3.

The type CV-8 relay in addition to the above components also has a capacitor which is series tuned with the main coil of the electromagnet. This tuned circuit offers a low impedance to fundamental current and a high impedance to third harmonic currents. Hence, the relay has a low pick up value for fundamental voltage and a much higher value of pickup for third harmonic voltage. At rated voltage the electromagnet is saturated causing the circuit to be detuned. The impedance of the circuit is increased and limits the fundamental current to a safe value.

A. Voltage Unit (CV)

The overvoltage unit operates on the induction-disc principle. A main tapped coil located on the center leg of an "E" type laminated structure produces a flux which divides and returns through the outer legs. A shading coil causes the flux through the left leg (front view) to lag the main pole flux. The out-of-phase fluxes thus produced in the air gap causes a contact closing torque.

The undervoltage unit operates on the same principle as the overvoltage unit except the shading coil is on the right leg (front view). This causes the out-of-phase fluxes to produce a contact opening torque.

B. Indicating Contactor Switch (ICS)

The indicating contactor switch is a small d-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also, during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the case.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The low pickup CV-8 Overvoltage Relay is available with the following continuous voltages.

67 volts
199 volts

* The minimum voltage required to just close the CV-8 contacts is 8% of the continuous voltage. Typical operating times of the type CV-8 relay are shown on figure 8. An adjustable 5.4 to 20 volt relay with a 67 volt continuous and a 16 to 40 volt relay with a continuous of 199 volts is also available.

SUPERSEDES I.L. 201F
*Denotes change from superseded issue.

EFFECTIVE OCTOBER 1967

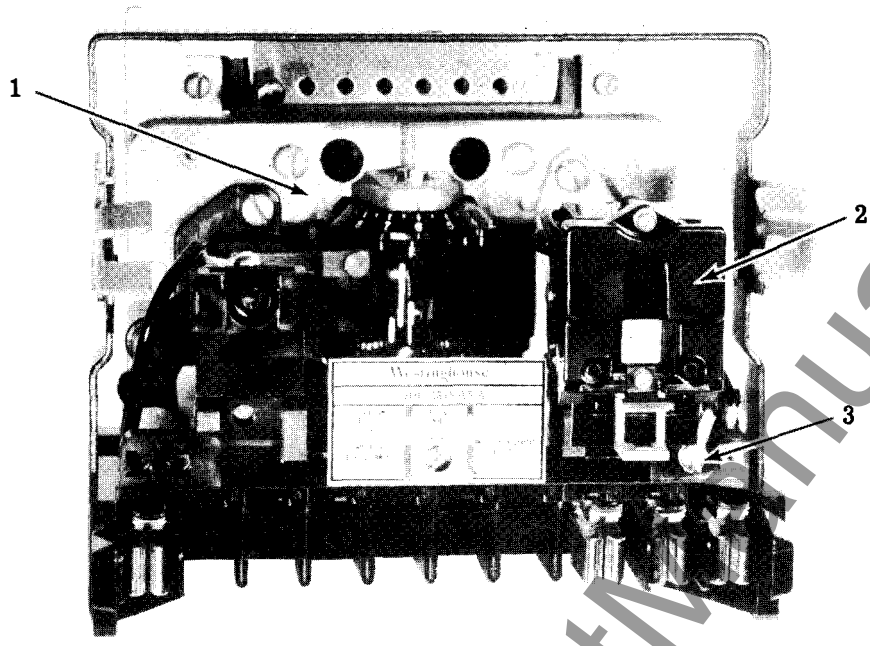


Fig. 1. Type CV-2 Relay Without Case. 1-Voltage Unit (CV). 2-Indicating Contactor Switch (ICS). 3-Indicating Contactor Switch Tap Block.

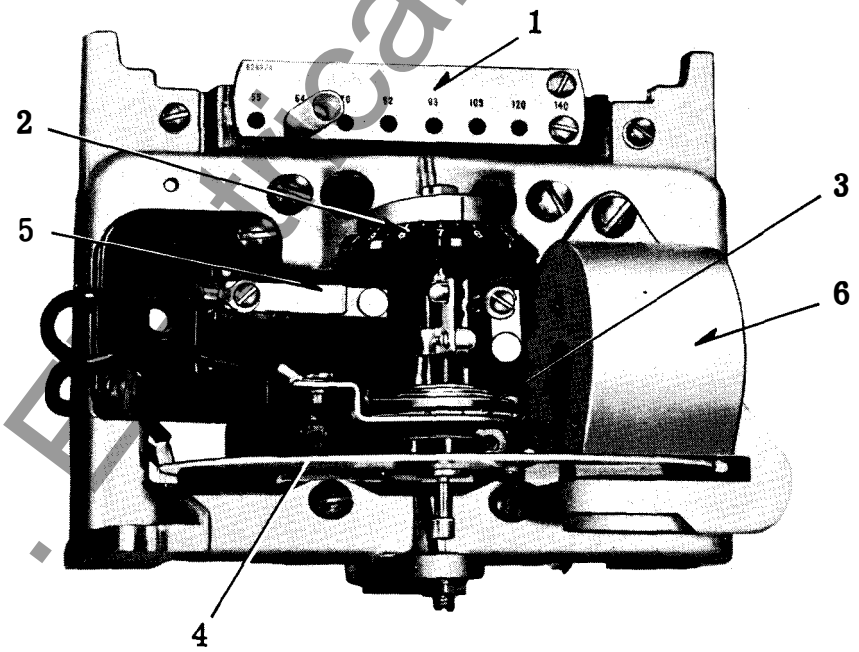


Fig. 2. Voltage Unit (CV). 1-Tap Block. 2-Time Dial. 3-Control Spring Assembly. 4-Disc. 5-Stationary Contact Assembly. 6-Permanent Magnet.

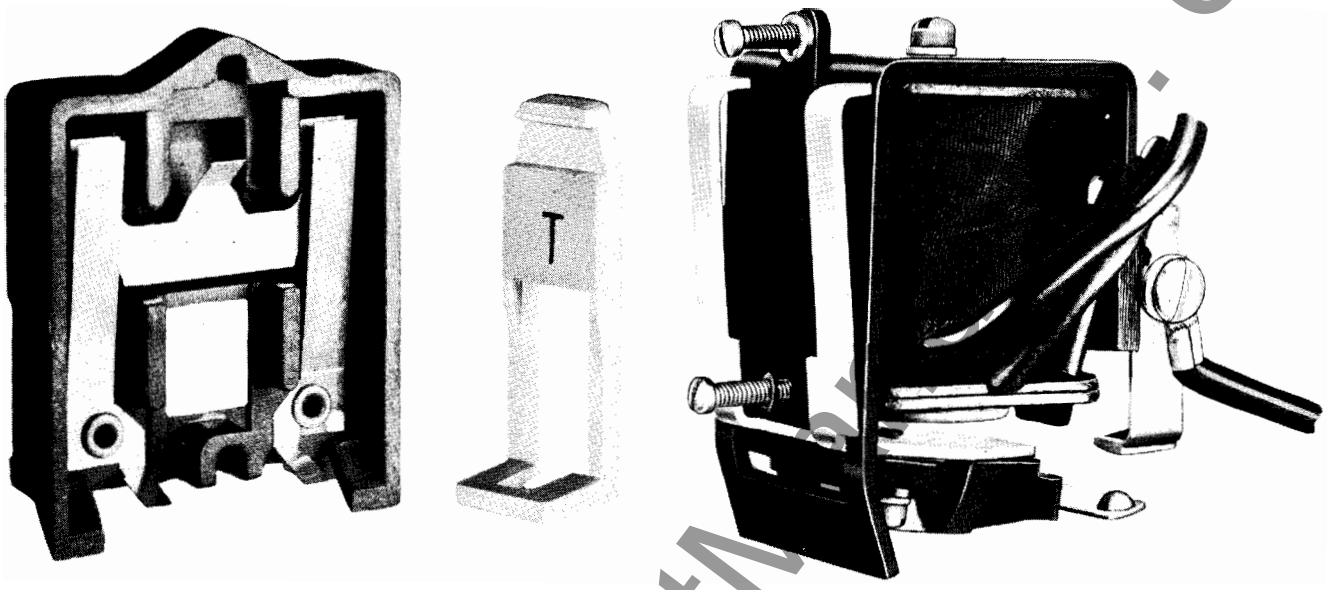


Fig. 3. Indicating Contactor Switch (ICS).

The CV-1 and CV-2 Undervoltage Relays, CV-4 and CV-5 Overvoltage Relays, and CV-6 and CV-7 Over or Undervoltage Relays are available in the following voltage ranges:

Range	Taps							
55-140	55	64	70	82	93	105	120	140
110-280	110	128	140	164	186	210	240	280

A. CV-1 and CV-2 Undervoltage Relays -- CV-4 and CV-5 Overvoltage Relays

Tap value voltage is the minimum voltage required to just close the relay contacts. At this value of voltage, the moving contacts will leave the backstop of the time dial and move to close the front contacts. Normal operation of the two relays is such that the CV-1 and CV-2 undervoltage relays will open its contacts with application of voltages greater than tap value voltage, while the CV-4 and CV-5 overvoltage relay closes its contacts with voltages greater than tap value voltage. Thus, the operating curves of figures 9 and 10 of the undervoltage relays apply when the voltage is originally higher than tap value voltage and is suddenly reduced to a value shown on the curves. The operating curves of figures 11 and 12 of the overvoltage relays apply when the voltage is initially below tap value voltage and is suddenly raised to a value shown on the curves.

B. CV-6 and CV-7 Over or Undervoltage Relays

Tap value voltage is the value of voltage at which the stationary front contact closes. The stationary back contact will close within 5% of this value.

When the relay is used as an overvoltage relay, the moving contact is made with the stationary back contact for values of applied voltage less than tap value voltage. With application of voltages greater than tap value voltage, the moving contact moves to close the front contact in a time as shown by the right-hand curves of either figures 13 or 14.

When the relay is used as an undervoltage relay, the moving contact is made with the stationary front contact for values of applied voltage greater than tap value voltage. With the application of voltages less than tap value voltage, the moving contact moves to close the back contact in a time as shown on the left-hand curves of either figures 13 or 14.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

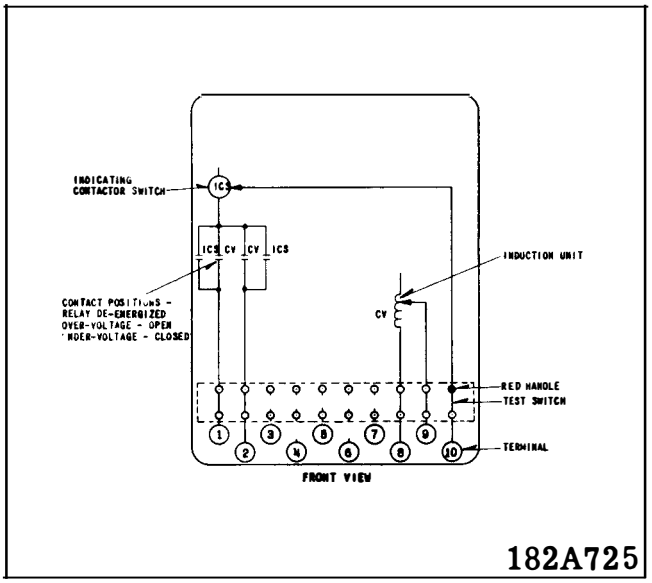


Fig. 4. Internal Schematic of the Double Trip Type CV Under or Overvoltage Relays in Type FT11 Case. For the Single Trip Relays the Circuits Associated with Terminal 2 are Omitted.

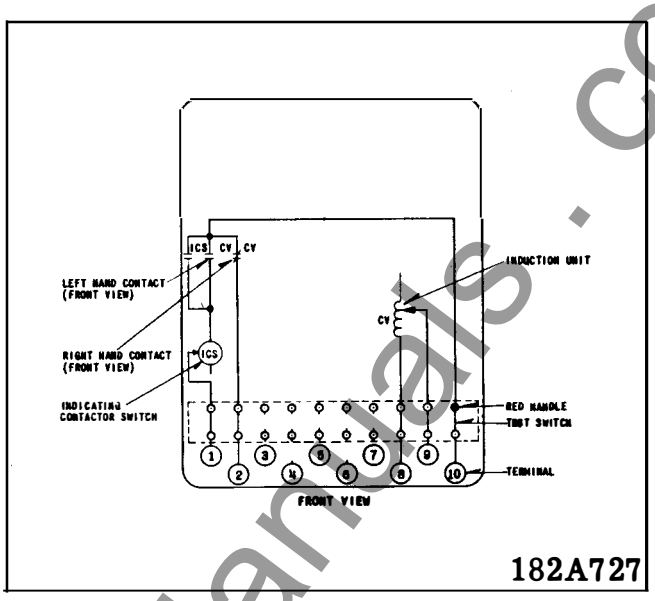


Fig. 5. Internal Schematic of the type CV Over or Undervoltage Relay in Type FT11 case.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constants

Indicating contactor switch	—	0.2 amp. tap 6.5 ohms d-c resistance
		2.0 amp. tap 0.15 ohms d-c resistance

ENERGY REQUIREMENTS

The burdens of the CV-1, CV-2, CV-4, CV-5, CV-6, CV-7 relays at rated voltage are as follows:

Rated△ Voltage	Taps 120 Volt Relay	Taps 240 Volt Relay	Volt-Amps.	Power Factor	Watts
120 or 240 Volts	55	110	10.0	.38	3.8
	64	128	7.0	.35	2.5
	70	140	5.8	.34	2.0
	82	164	4.0	.33	1.3
	93	186	3.1	.31	1.0
	105	210	2.4	.29	.7
	120	240	1.8	.28	.5
	140	280	1.3	.26	.3

△These relays will continuously stand either 110% of rated voltage or tap value voltage, whichever is higher.

The burdens of the CV-8 relays at continuous voltage are as follows:

Continuous Voltage	Volt Amps.	Power Factor	Watts
199	30	.342	10
67	30	.342	10

SETTINGS

* Range	Setting	Applied Voltage	VA
5.4 to 20V	5.4	67	30
	20	67	15
16 to 40V	16	199	30
	40	199	20

A. CV Unit

The setting of the CV unit can be defined either by tap setting and time dial position or by tap setting and a specific time of operation at some percentage of tap value voltage (e.g. on CV-4 120 tap setting, 2 time dial position or 120 tap setting, 12 seconds at 140 percent of tap value voltage).

To provide selective circuit breaker operation, a minimum coordinating time of 0.3 seconds plus circuit breaker time is recommended between the relay being set and the relays with which coordination is to be effected.

The connector screw on the terminal plate above the time dial connects various turns of the operating coil. By placing this screw in the various terminal plate holes, the relay will just close its contacts at the corresponding voltage of 55-64-70-82-93-105-120-140 volts or as marked on the terminal plate.

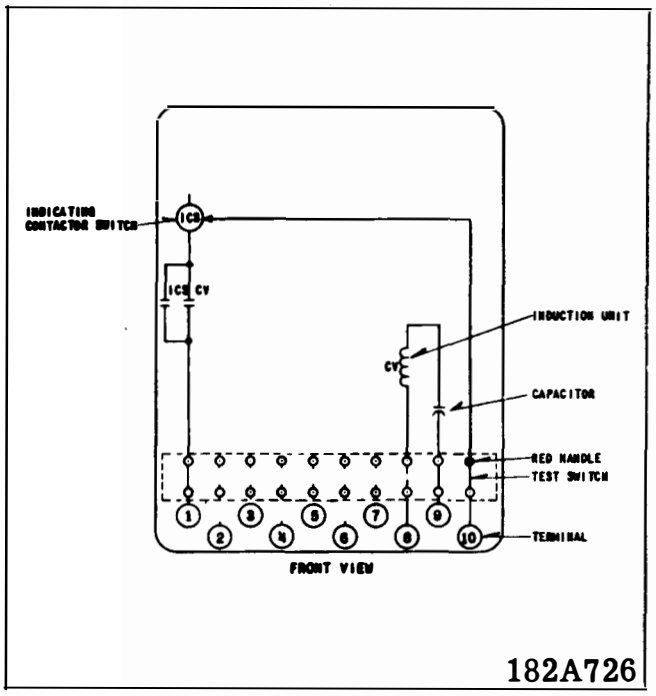


Fig. 6. Internal Schematic of the type CV8 199 volt relay in type FT11 case.

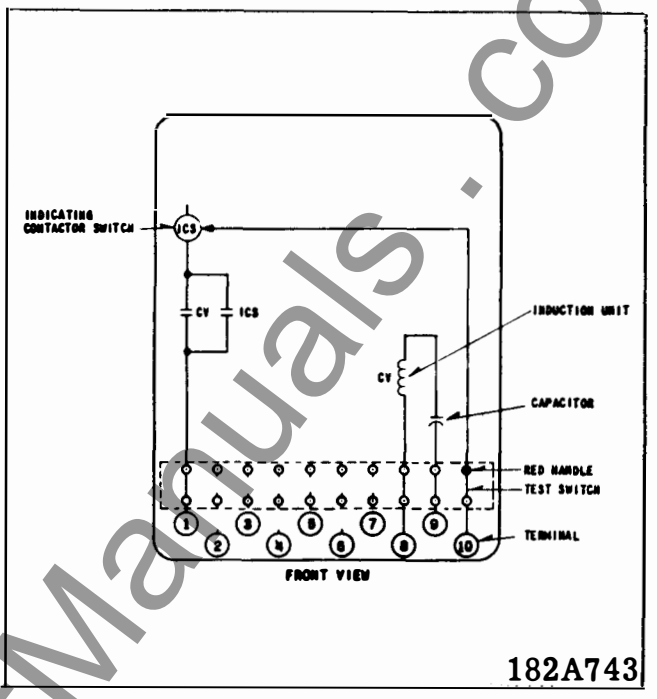
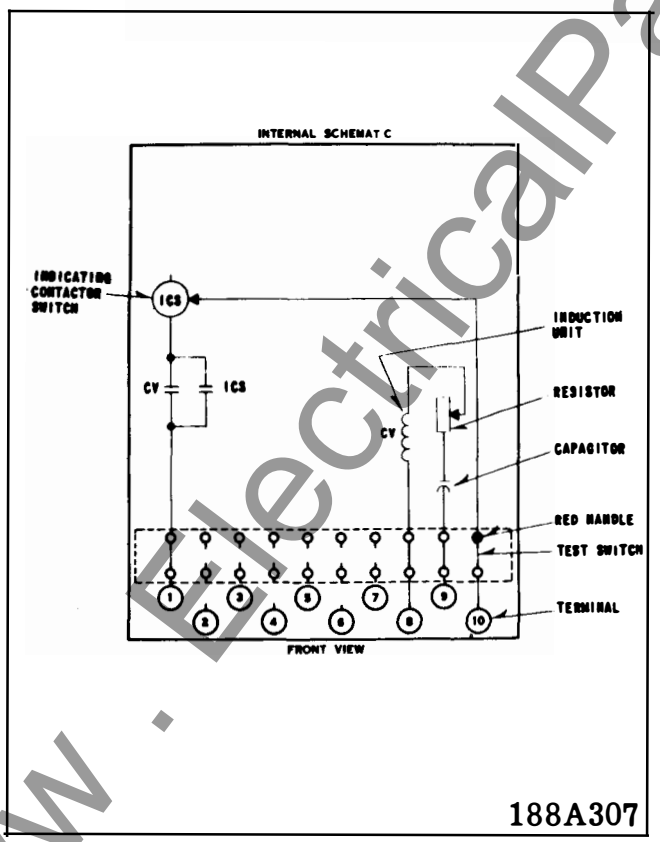
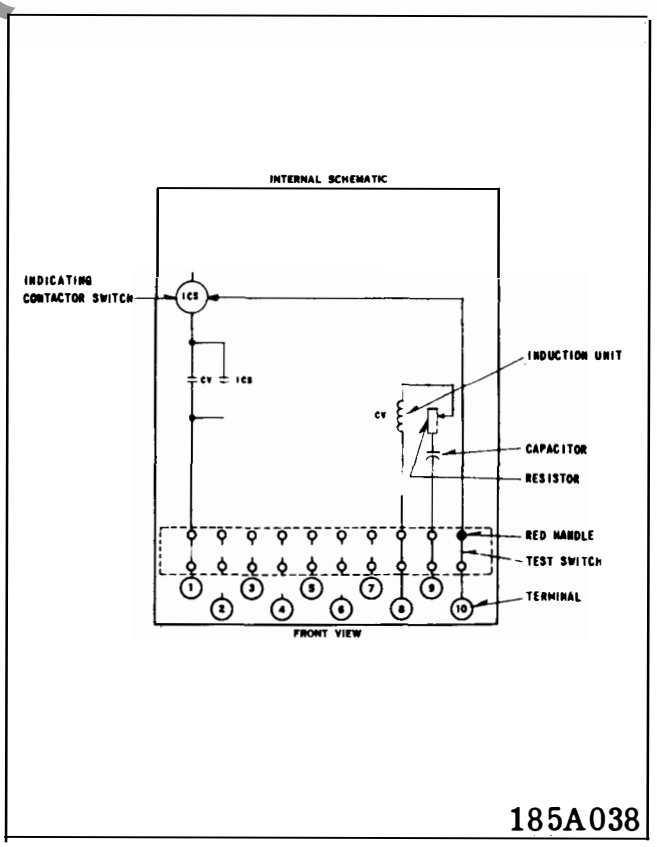


Fig. 7. Internal Schematic of the type CV8 67 volt relay in type FT21 case.



** Fig. 8. Internal Schematic of the type CV 199 volt relay in type FT11 case with adjustable pickup.*



** Fig. 9. Internal Schematic of the type CV8 67 volt relay in type FT21 case with adjustable pickup.*

The nylon screw on the terminal plate holds the tap plate in position when taps are being changed. To use the position on the terminal plate in which the nylon screw is used, remove the nylon screw and place it in one of the unused holes. Then remove the tap screw and insert it in the terminal plate hole.

Instantaneous Reclosing

The factory adjustment of the voltage unit contacts provides a contact follow. Where circuit breaker reclosing will be initiated immediately after a trip by the over voltage contact, the time of the opening of the contacts should be a minimum. This condition is obtained by loosening the stationary contact mounting screw, removing the contact plate and then replacing the plate with the bent end resting against the contact spring.

For double trip relays, the upper stationary contact is adjusted such that the contact rests solidly against the back stop. The lower stationary contact is then adjusted such that both stationary contacts make contact simultaneously with their respective moving contact.

B. Indicating Contactor Switch (ICS)

No setting is required on the ICS unit except the selection of the 0.2 to 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw.

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, other than those covered under "Settings", should be required.

Acceptance Check

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

A. CV Unit

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the "O" mark by approximately .020". (For the type CV-6 and CV-7 relays the back contact has no follow when the front contact is through one-half of its follow). The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Voltage - Set the time dial to position 6. Alternately apply tap value voltage plus 3% and tap value voltage minus 3%.

a. CV-4 and CV-5 Overvoltage Relays, CV-6 and CV-7 Over or Undervoltage Relays - The moving contact should leave the backstop at tap value voltage plus 3% and should return to the backstop at tap value voltage minus 3%.

b. CV-1 and CV-2 Undervoltage Relays - The moving contact should leave the backstop at tap value voltage minus 3% and should return to the backstop at tap value voltage plus 3%.

c. CV-8 Overvoltage Relays - The moving contact should leave the backstop at 8.5% of continuous voltage.

3. Time Curve - Table 1 shows the time curve calibration points for the various types of relays. With the time dial set to the indicated position, apply the voltages specified in table 1 (e.g. for the CV-4, 140 percent of tap value voltage) and measure the operating time of the relay. The operating time should equal those of table 1 plus or minus 5%.

B. Indicating Contactor Switch (ICS) - Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

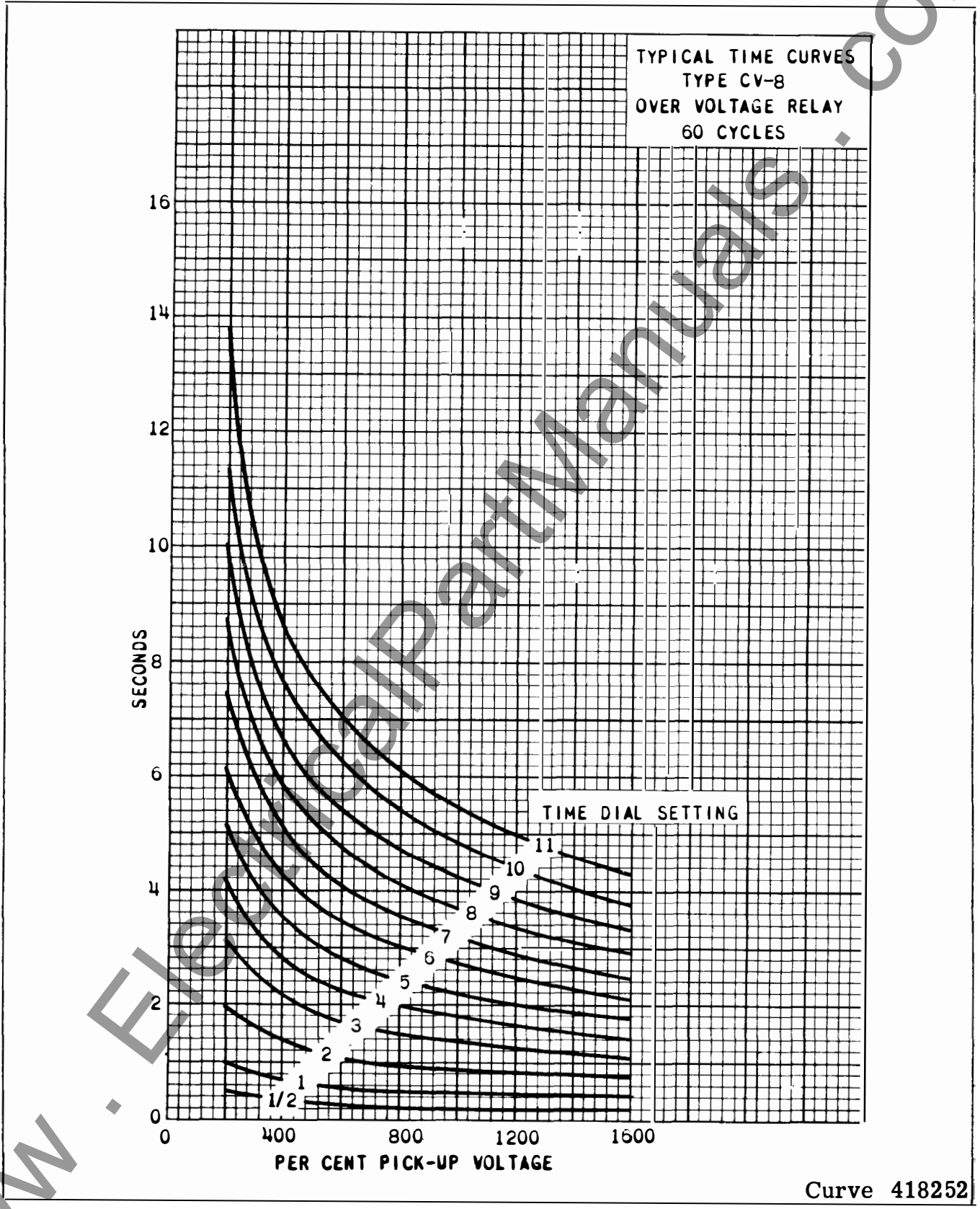


Fig. 10. Typical 60-cycle time curves of the type CV8 Low Pickup Overvoltage Relay.

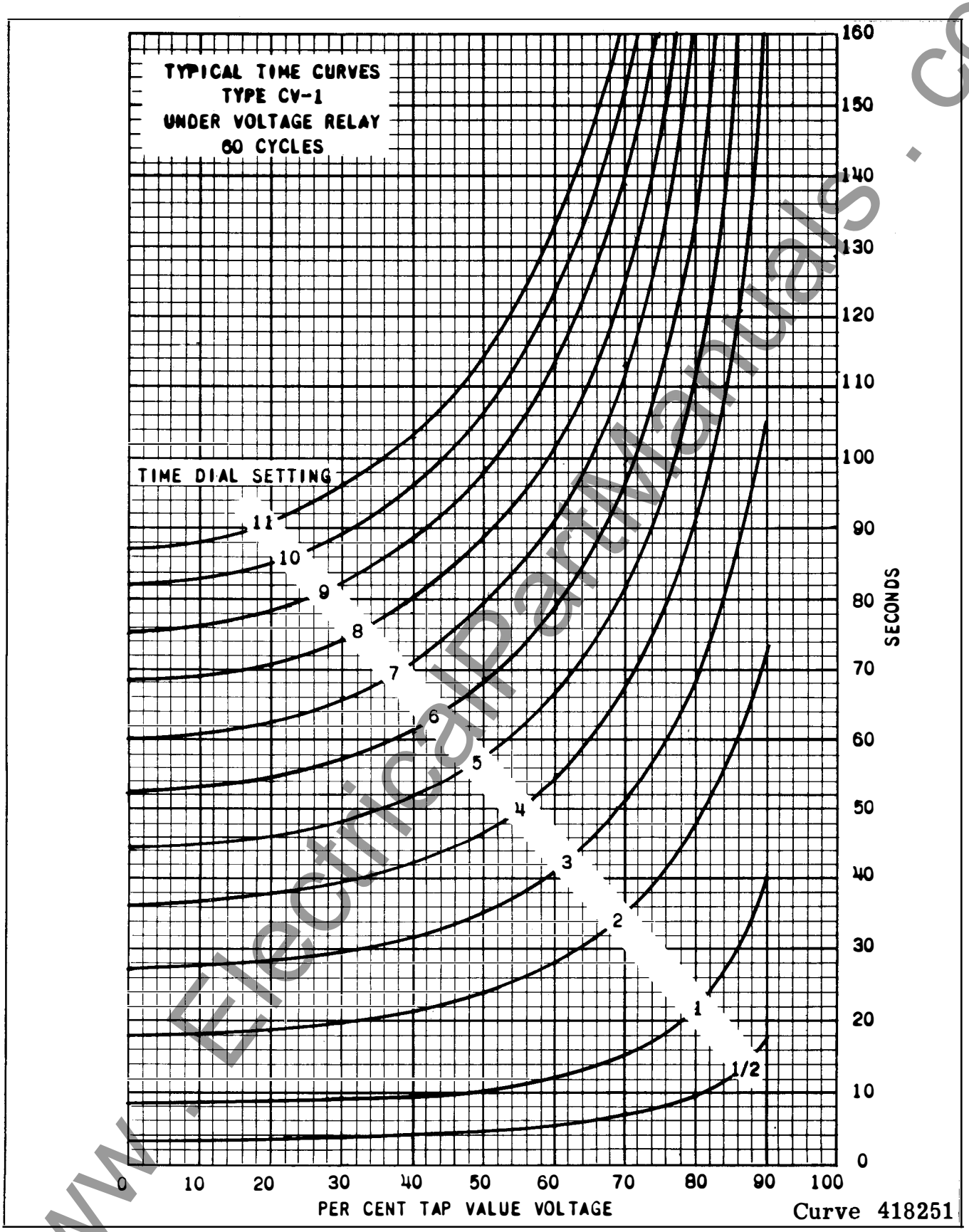


Fig. 11. Typical 60-cycle time curves or the type CV1 Long Time Undervoltage Relay.

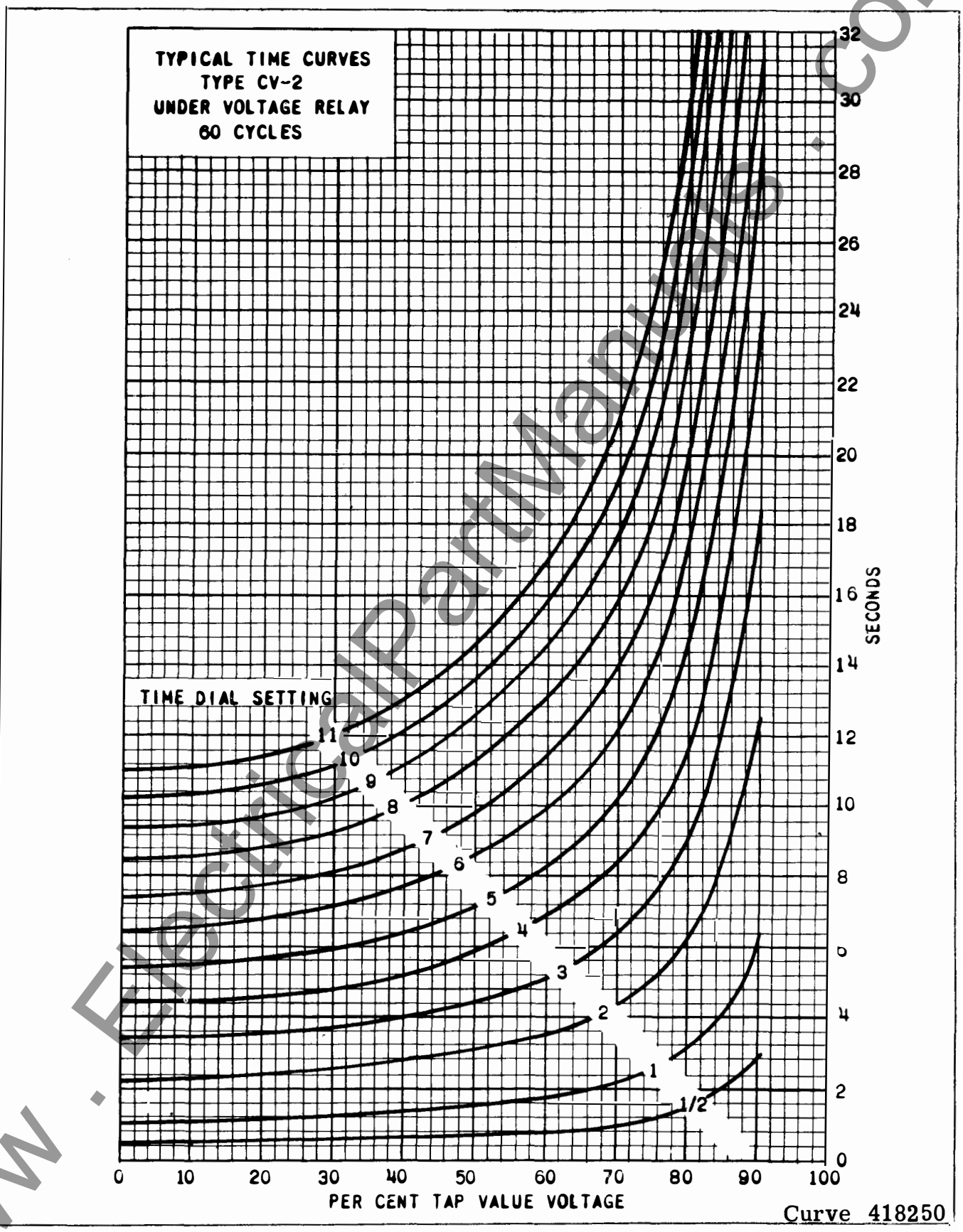


Fig. 12. Typical 60-cycle Time curves of the type CV2 Short Time Undervoltage Relay.

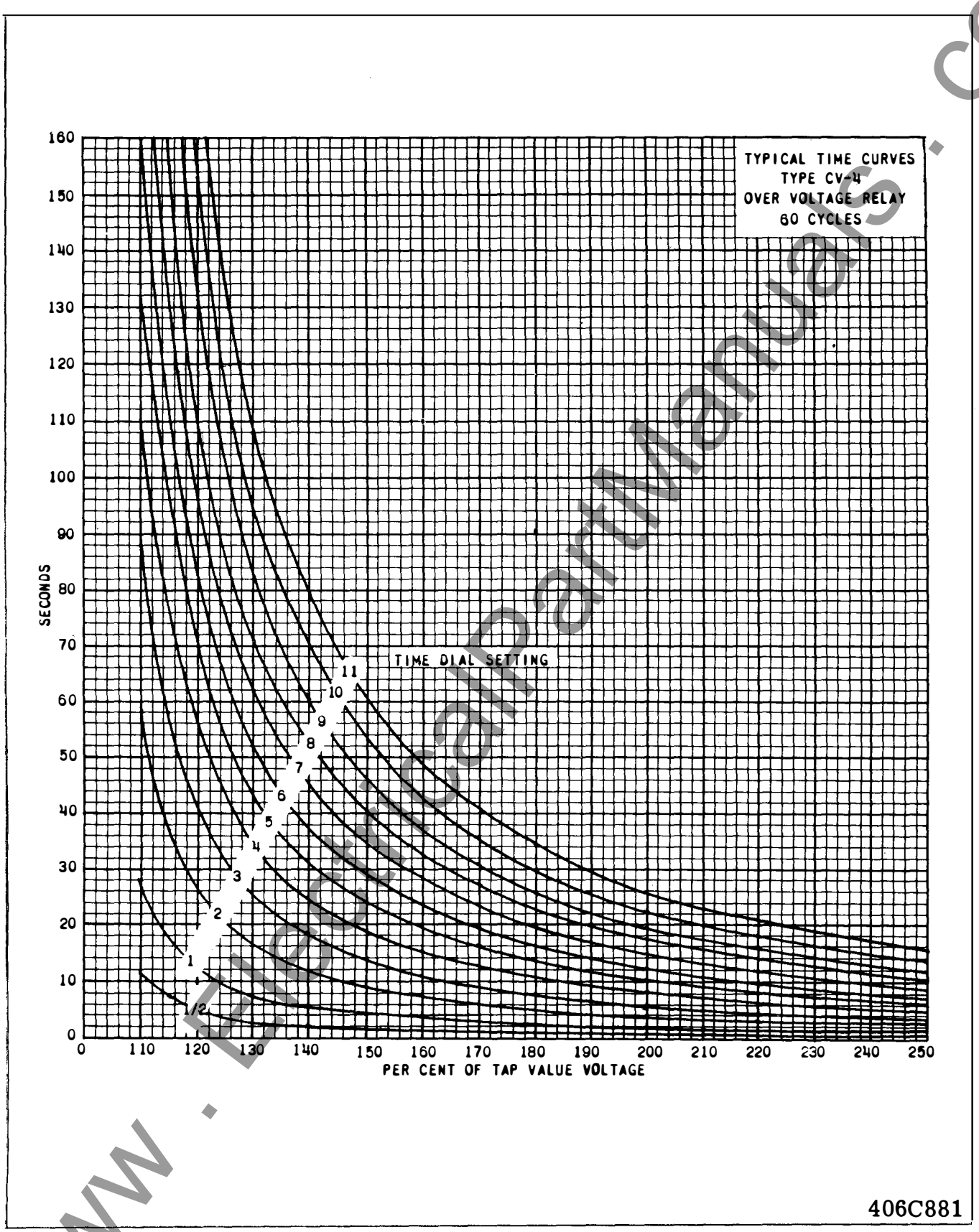


Fig. 13. Typical 60-cycle time curves of the type CV4 Long Time Overvoltage Relay.

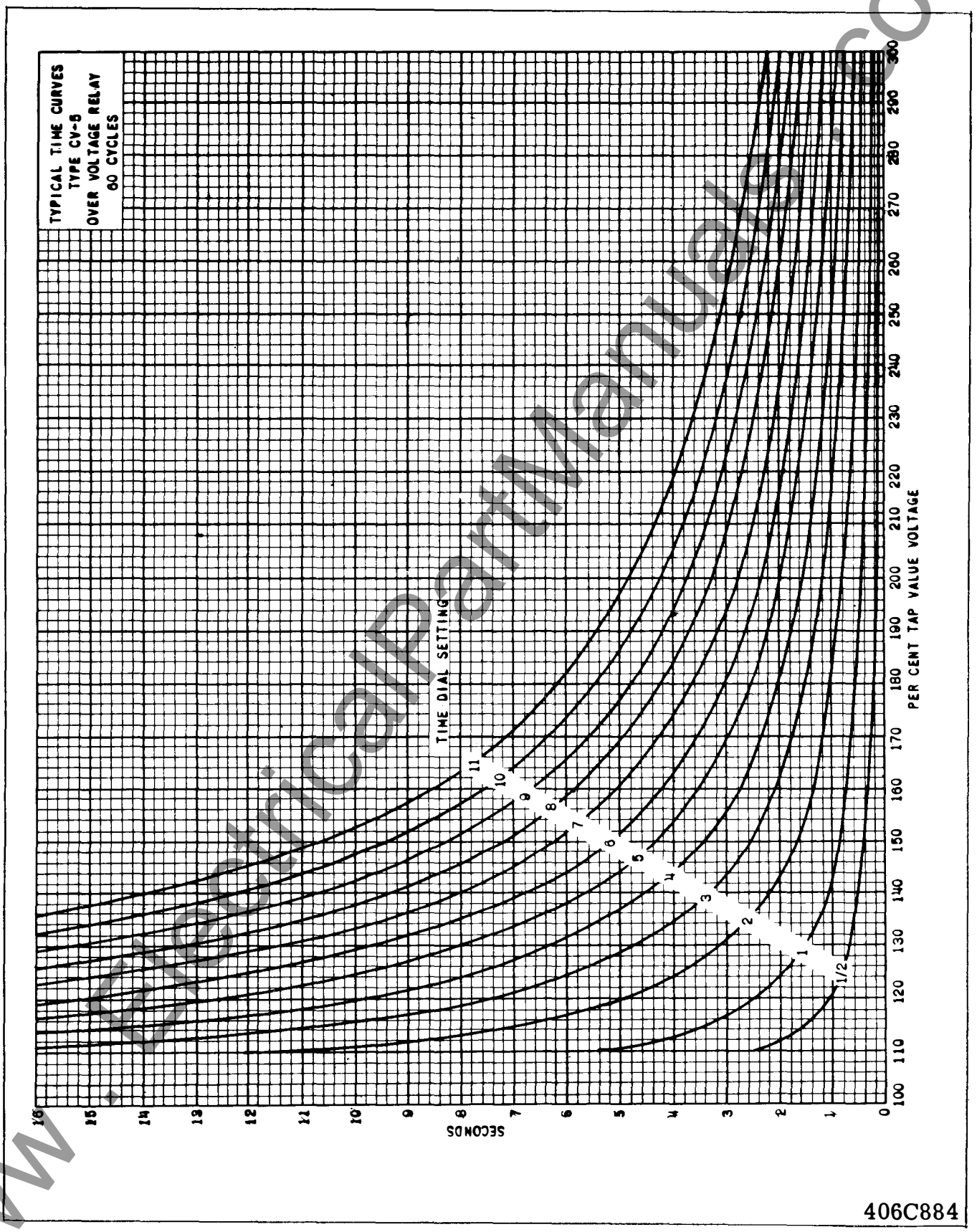


Fig. 14. Typical 60-cycle time curves of the type CV5 Short Time Overvoltage Relay.

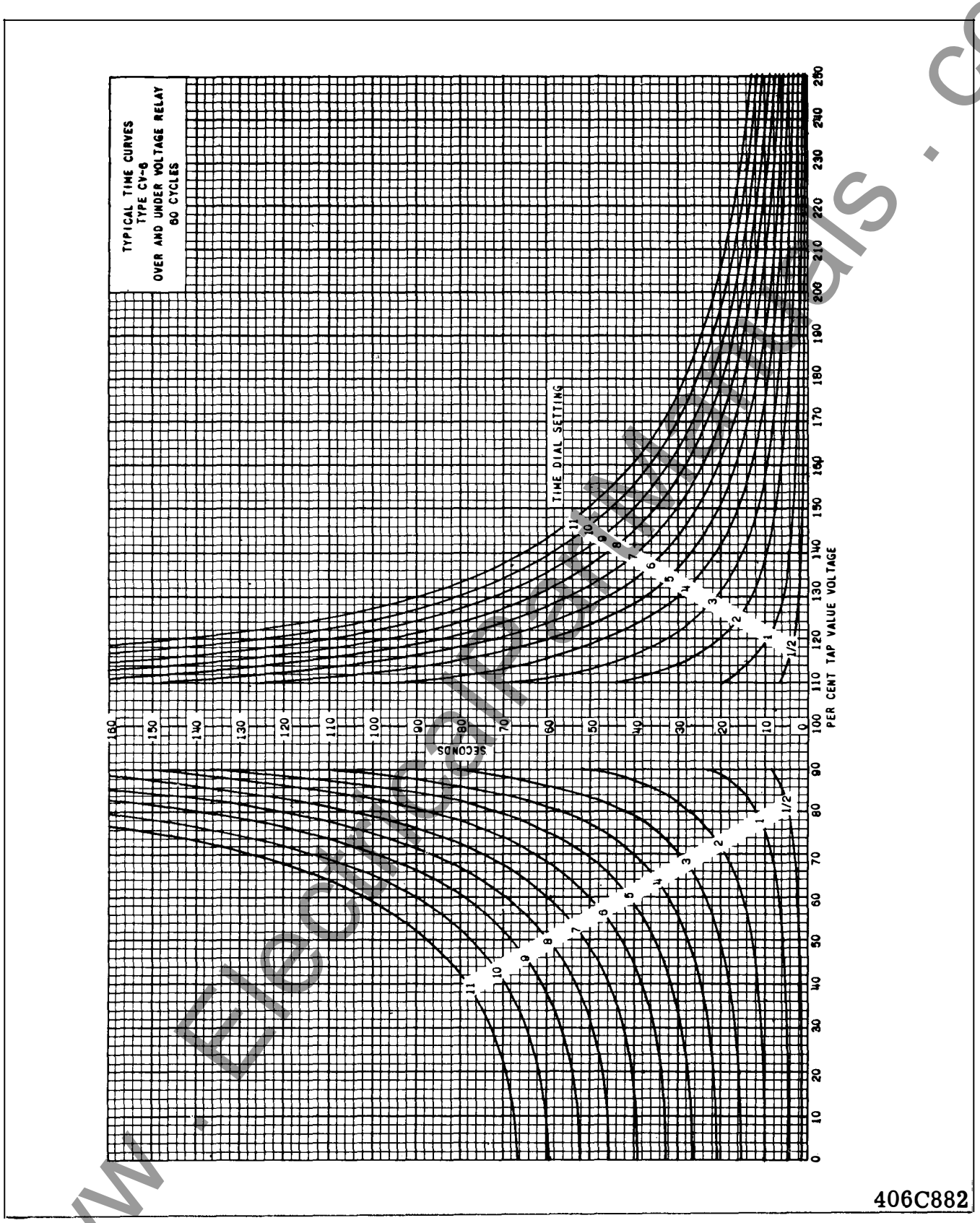


Fig. 15. Typical 60-cycle time curves of the type CV6 Long Time Over and Undervoltage Relay.

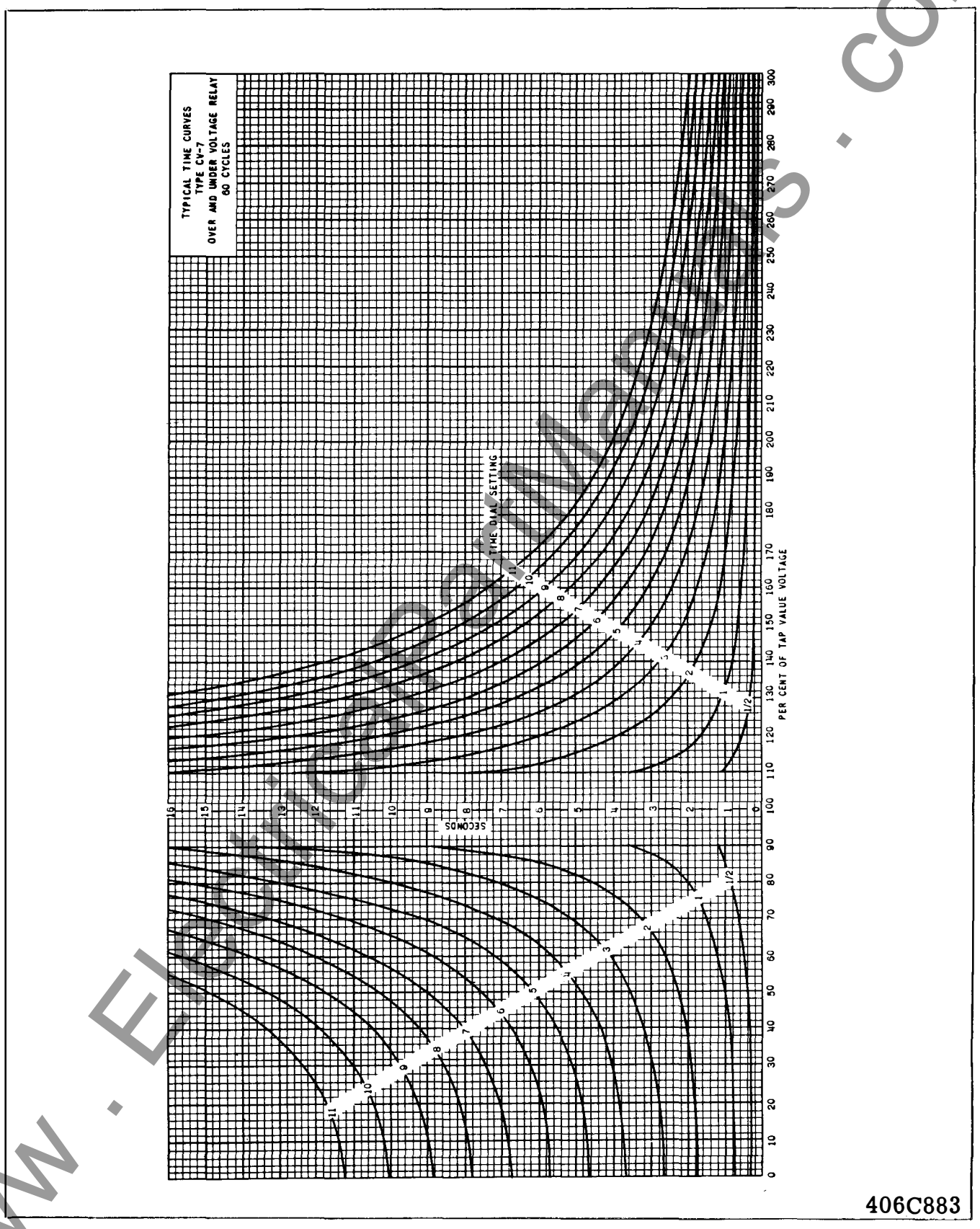


Fig. 16. Typical 60-cycle time curves of the type CV7 Short Time Over and Undervoltage Relay.

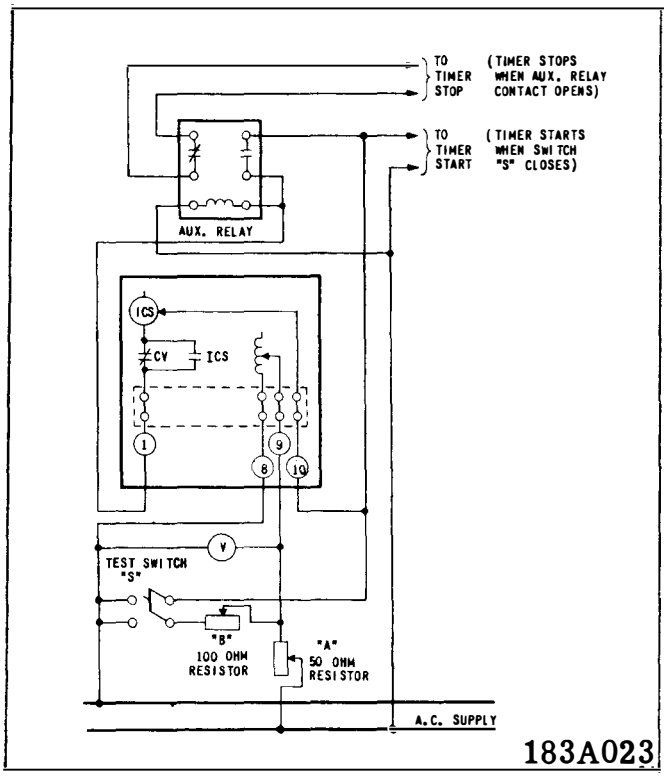


Fig. 17. Diagram of Test Connections of the type CV Undervoltage Relay.

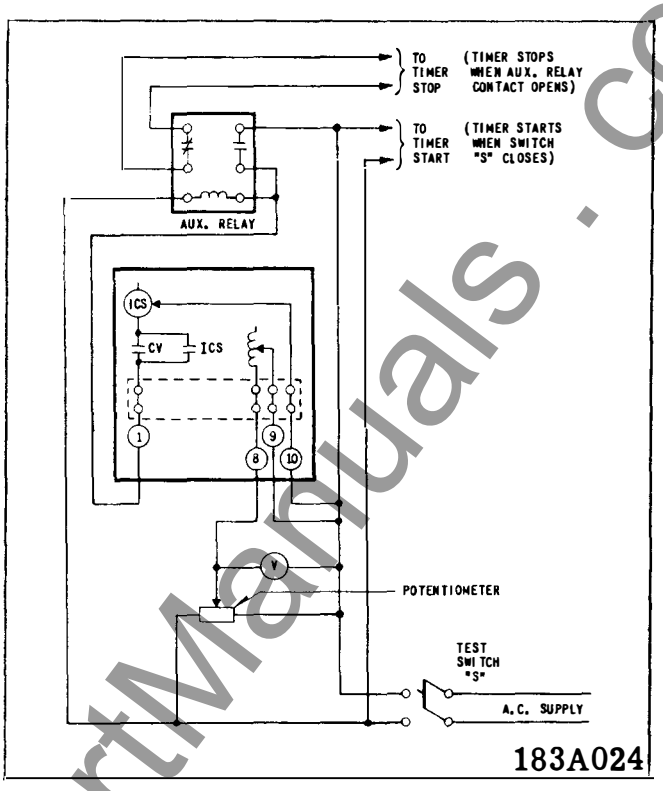


Fig. 18. Diagram of Test Connections of the type CV Overvoltage Relay.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

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. Phantom loads should not be used in testing induction-type relays because of the resulting distorted current wave form which produces 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, because of the danger of embedding small particles in the face of the soft silver contact 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 have been disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order (See "Acceptance check").

A. CV Unit

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the "O" mark by approximately .020". (For the type CV-6 and CV-7 relays the back contact has no follow when the front contact is through one-half of its follow). The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For

double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip-Voltage - The adjustment of the spring tension in setting the minimum trip voltage value of the relay is most conveniently made with the damping magnet removed.

With the time dial set on "O", wind up the spiral spring by means of the spring adjuster until approximately 6-3/4 convolutions show.

Set the relay on the minimum tap setting and the time dial to position 6.

a. CV-4 and CV-5 Overvoltage, CV-6 and CV-7 Over or Undervoltage — Adjust the control spring tension so that the moving contact will leave the backstop of the time dial at tap value voltage +1.0% and will return to the backstop at tap value voltage -1.0%.

b. CV-1 and CV-2 Undervoltage Relays - Adjust the control spring tension so that the moving contact will leave the backstop of the time dial at tap value voltage -1.0% and will return to the backstop at tap value voltage +1.0%.

c. Low Pickup Overvoltage Relay - Adjust the control spring so that the moving contact will leave the backstop of the time dial at 8.1% of continuous voltage and return at 7.9% of continuous voltage.

3. Time Curve Calibration - Install the permanent magnet.

a. CV-1 and CV-2 Undervoltage Relay - Use test circuit of figure 15. With switch "S" opened, adjust resistor "A" until voltmeter reads tap value voltage or higher. Close switch "S" and adjust resistor "B" until the voltmeter reads 50 percent of tap value voltage. Open switch "S" and allow the moving contact to move to the backstop of the time dial. Close switch "S" and measure operating time.

Adjust the permanent magnet gap until the operating time corresponds to the value given in table 1.

b. CV-4 and CV-5 Overvoltage Relay, CV-8 Low Pickup Overvoltage Relay - Apply the indicated voltage of table 1 and measure the operating time. Adjust the permanent magnet keeper until the operating time corresponds to the value given in table 1.

c. CV-6 and CV-7 Over or Undervoltage Relay - Apply the indicated voltage of table 1 and measure the operating time. Adjust the permanent magnet keeper until the operating time corresponds to the value given in table 1.

Measure the reset time of the disc from the stationary front contact to the stationary back contact. This time should be as shown in table 1.

TABLE 1

Type Relay	Percent Tap Value Voltage Or Pickup Voltage	Time Dial Setting	Operating Time in Sec.	Reset Time in Sec.
CV1	50	6	68	
CV2	50	6	8.6	
CV4	140	6	37.5	
CV5	140	6	6.8	
CV6	140	6	33	32.5
CV7	140	6	5.9	5.7
CV8	800	6	3.0	

B. Indicating Contactor Switch - Unit (ICS) - Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

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.

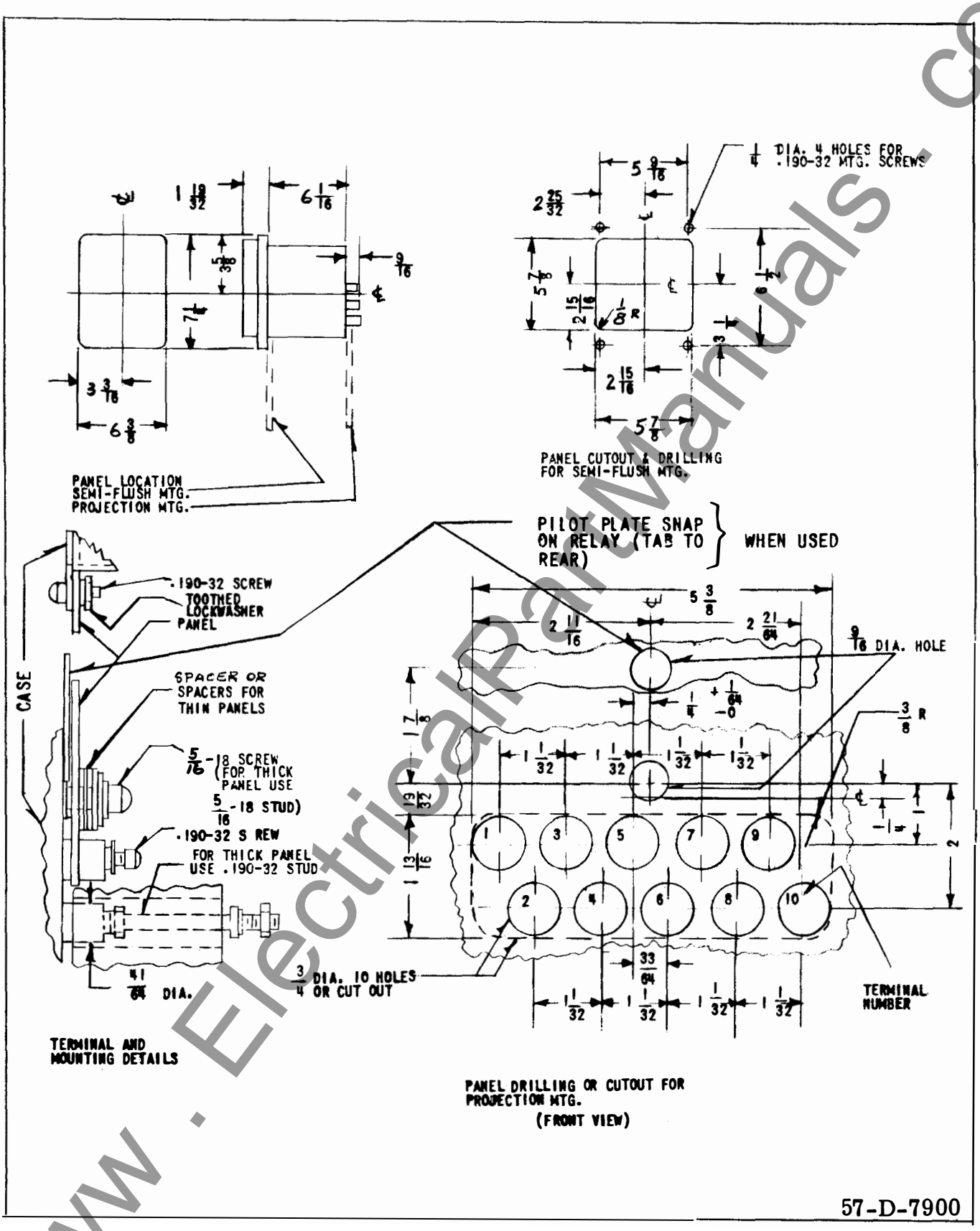


Fig. 19. Outline and drilling for FT11 case used for projection and/or semi-flush case.

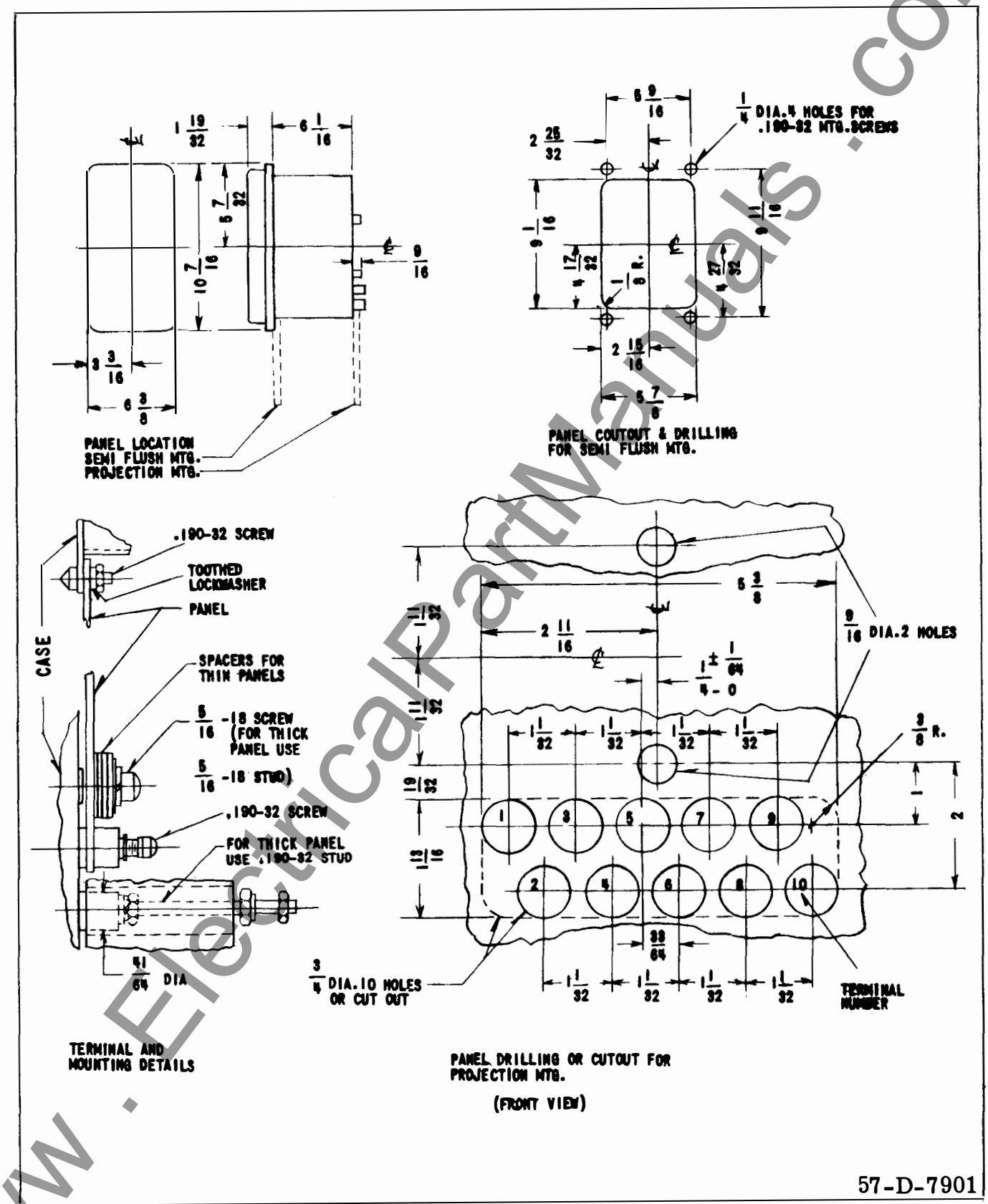
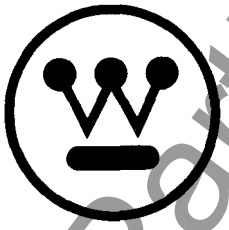


Fig. 20. Outline and drilling for FT21 case used for projection and/or semi-flush case. (For 67 volt CV-8 relay only)



WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CV VOLTAGE 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 CV relays are single-phase induction-disc type relays operating either on under or over voltage or both. These relays are applied as a voltage fault detector operating in conjunction with other protective relays. The relays are also used as timing devices for various automatic operations.

CONTENTS

This instruction leaflet applies to the following types of relays:

CV-1 Long Time Undervoltage Relay
CV-2 Short Time Undervoltage Relay
CV-4 Long Time Overvoltage Relay
CV-5 Short Time Overvoltage Relay
CV-6 Long Time Over or Undervoltage Relay
CV-7 Short Time Over or Under voltage Relay
CV-8 Low Voltage Pickup Overvoltage Relay

CONSTRUCTION AND OPERATION

The types CV-1, CV-2, CV-4, CV-5, CV-6, and CV-7relays consist of a voltage unit and an indicating contactor switch (ICS). The principal component parts of the relay and their location are shown in figures 1, 2, and 3.

The type CV-8 relay in addition to the above components also has a capacitor which is series tuned with the main coil of the electromagnet. This tuned circuit offers a low impedance to fundamental current and a high impedance to third harmonic currents. Hence, the relay has a low pick up value for fundamental voltage and a much higher value of pickup for third harmonic voltage. At rated voltage the electromagnet is saturated causing the circuit to be detuned. The impedance of the circuit is increased and limits the fundamental current to a safe value.

A. Voltage Unit (CV)

The overvoltage unit operates on the induction-disc principle. A main tapped coil located on the center leg of an "E" type laminated structure produces a flux which divides and returns through the outer legs. A shading coil causes the flux through the left leg (front view) to lag the main pole flux. The out-of-phase fluxes thus produced in the air gap causes a contact closing torque.

The undervoltage unit operates on the same principle as the overvoltage unit except the shading coil is on the right leg (front view). This causes the out-of-phase fluxes to produce a contact opening torque.

B. Indicating Contactor Switch (ICS)

The indicating contactor switch is a small d-c operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also, during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the case.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The low pickup CV-8 Overvoltage Relay is available with the following continuous voltages.

67 volts
199 volts

The minimum voltage required to just close the CV-8 contacts is 8% of the continuous voltage. Typical operating times of the type CV-8 relay are shown on figure 8.

The CV-1 and CV-2 Undervoltage Relays, CV-4 and CV-5 Overvoltage Relays, and CV-6 and CV-7

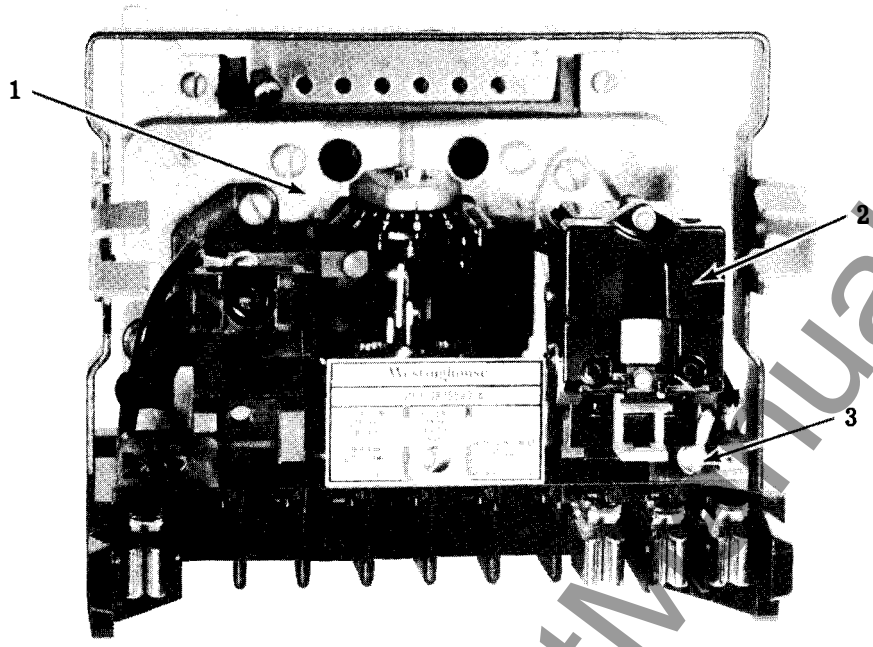


Fig. 1. Type CV-2 Relay Without Case. 1-Voltage Unit (CV). 2-Indicating Contactor Switch (ICS). 3-Indicating Contactor Switch Tap Block.

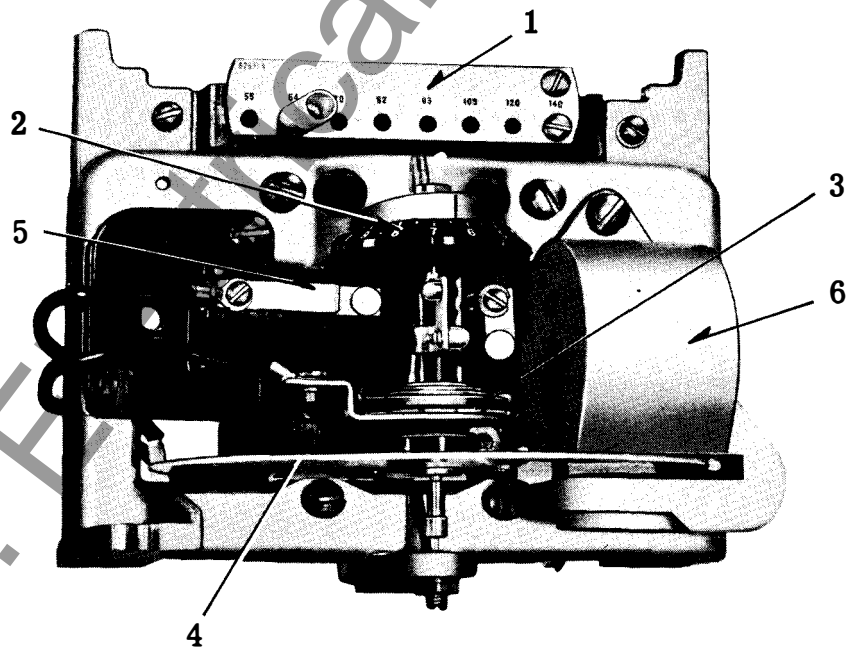


Fig. 2. Voltage Unit (CV). 1-Tap Block. 2-Time Dial. 3-Control Spring Assembly. 4-Disc. 5-Stationary Contact Assembly. 6-Permanent Magnet.

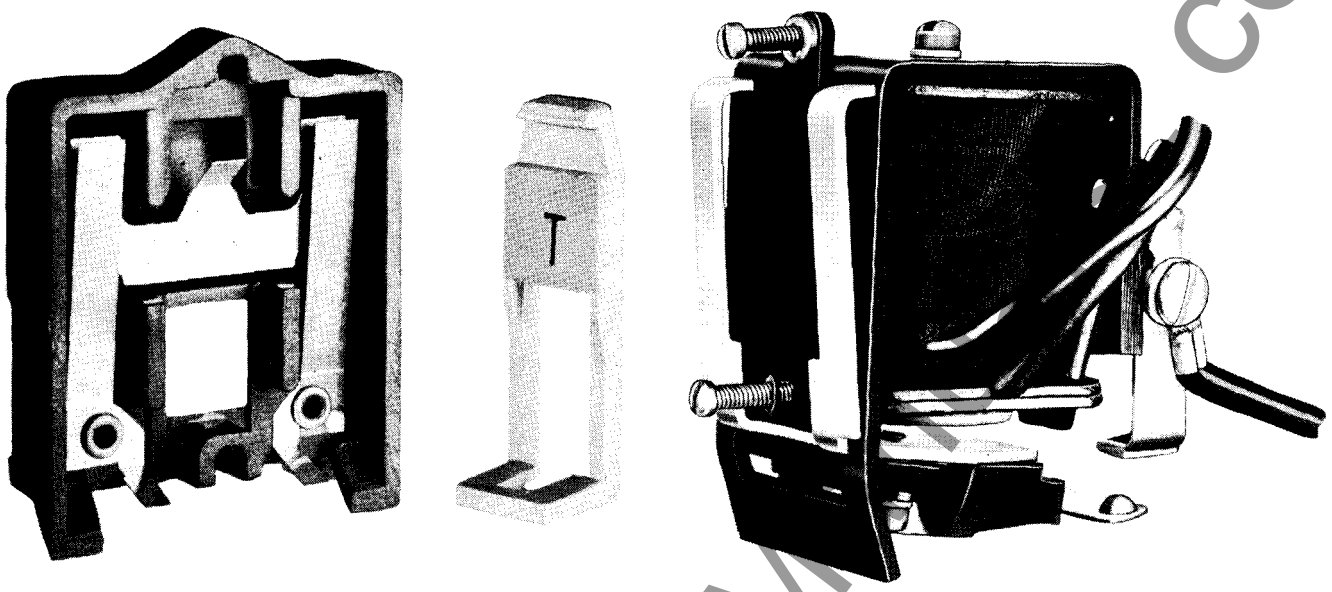


Fig. 3. Indicating Contactor Switch (ICS).

Over or Undervoltage Relays are available in the following voltage ranges:

Range	Taps							
55-140	55	64	70	82	93	105	120	140
110-280	110	128	140	164	186	210	240	280

A. CV-1 and CV-2 Undervoltage Relays -- CV-4 and CV-5 Overvoltage Relays

Tap value voltage is the minimum voltage required to just close the relay contacts. At this value of voltage, the moving contacts will leave the backstop of the time dial and move to close the front contacts. Normal operation of the two relays is such that the CV-1 and CV-2 undervoltage relays will open its contacts with application of voltages greater than tap value voltage, while the CV-4 and CV-5 overvoltage relay closes its contacts with voltages greater than tap value voltage. Thus, the operating curves of figures 9 and 10 of the undervoltage relays apply when the voltage is originally higher than tap value voltage and is suddenly reduced to a value shown on the curves. The operating curves of figures 11 and 12 of the overvoltage relays apply when the voltage is initially below tap value voltage and is suddenly raised to a value shown on the curves.

B. CV-6 and CV-7 Over or Undervoltage Relays

Tap value voltage is the value of voltage at which the stationary front contact closes. The stationary back contact will close within 5% of this value.

When the relay is used as an overvoltage relay, the moving contact is made with the stationary back contact for values of applied voltage less than tap value voltage. With application of voltages greater than tap value voltage, the moving contact moves to close the front contact in a time as shown by the right-hand curves of either figures 13 or 14.

When the relay is used as an undervoltage relay, the moving contact is made with the stationary front contact for values of applied voltage greater than tap value voltage. With the application of voltages less than tap value voltage, the moving contact moves to close the back contact in a time as shown on the left-hand curves of either figures 13 or 14.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

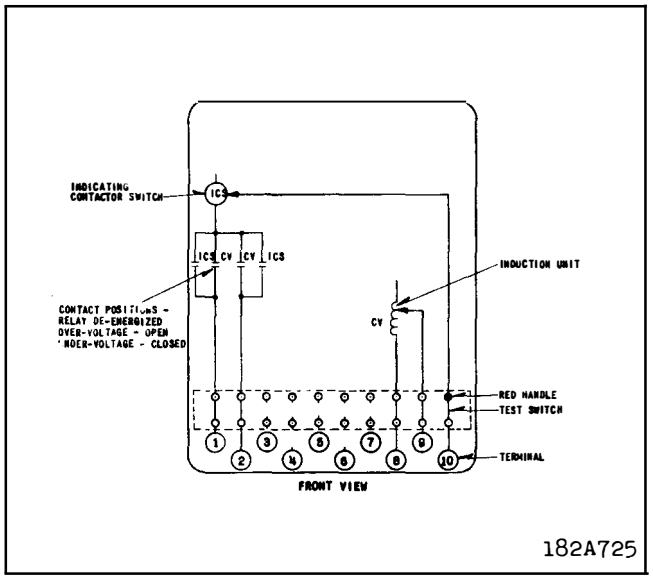


Fig. 4. Internal Schematic of the Double Trip Type CV Under or Overvoltage Relays in Type FT11 Case. For the Single Trip Relays the Circuits Associated with Terminal 2 are Omitted.

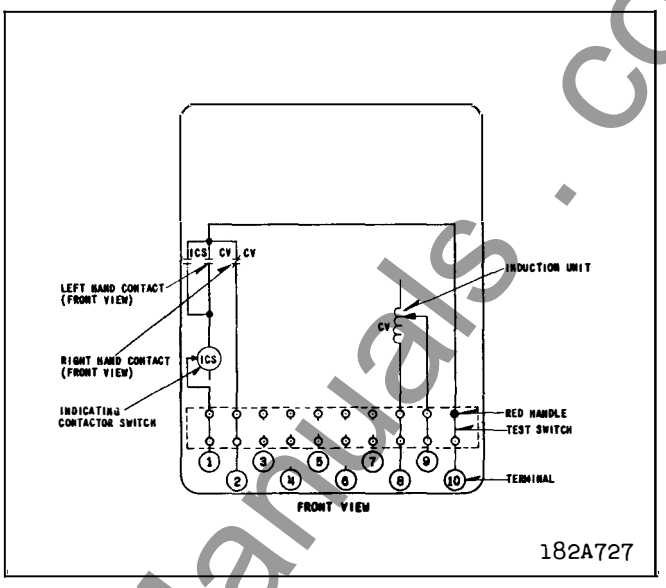


Fig. 5. Internal Schematic of the type CV Over or Undervoltage Relay in Type FT11 case.

Trip Circuit Constants

Indicating contactor switch — 0.2 amp. tap 6.5 ohms d-c resistance
2.0 amp. tap 0.15 ohms d-c resistance

ENERGY REQUIREMENTS

The burdens of the CV-1, CV-2, CV-4, CV-5, CV-6, CV-7 relays at rated voltage are as follows:

Rated△ Voltage	Taps 120 Volt Relay	Taps 240 Volt Relay	Volt-Amps.	Power Factor	Watts
120 or 240 Volts	55	110	10.0	.38	3.8
	64	128	7.0	.35	2.5
	70	140	5.8	.34	2.0
	82	164	4.0	.33	1.3
	93	186	3.1	.31	1.0
	105	210	2.4	.29	.7
	120	240	1.8	.28	.5
	140	280	1.3	.26	.3

△These relays will continuously stand either 110% of rated voltage or tap value voltage, whichever is higher.

The burdens of the CV-8 relays at continuous voltage are as follows:

Continuous Voltage	Volt Amps.	Power Factor	Watts
199	30	.342	10
67	30	.342	10

SETTINGS

A. CV Unit

The setting of the CV unit can be defined either by tap setting and time dial position or by tap setting and a specific time of operation at some percentage of tap value voltage (e.g. on CV-4 120 tap setting, 2 time dial position or 120 tap setting, 12 seconds at 140 percent of tap value voltage).

To provide selective circuit breaker operation, a minimum coordinating time of 0.3 seconds plus circuit breaker time is recommended between the relay being set and the relays with which coordination is to be effected.

The connector screw on the terminal plate above the time dial connects various turns of the operating coil. By placing this screw in the various terminal plate holes, the relay will just close its contacts at the corresponding voltage of 55-64-70-82-93-105-120-* 140 volts or as marked on the terminal plate.

The nylon screw on the terminal plate holds the tap plate in position when taps are being changed. To

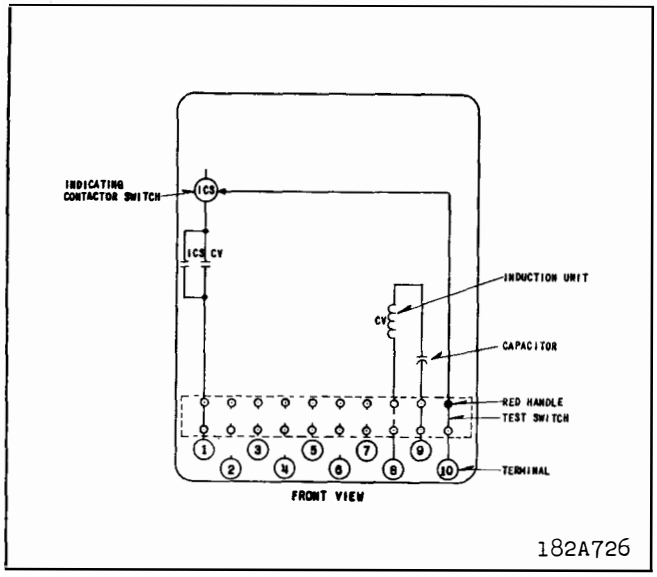


Fig. 6. Internal Schematic of the type CV8 199 volt relay in type FT11 case.

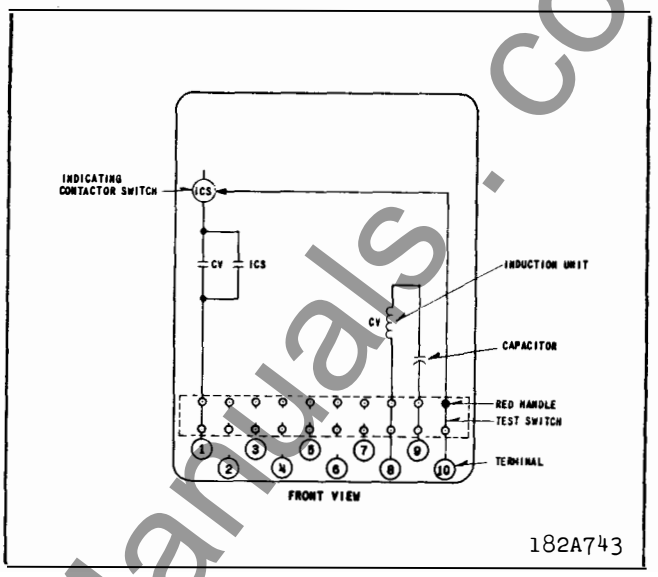


Fig. 7. Internal Schematic of the type CV8 67 volt relay in type FT21 case.

use the position on the terminal plate in which the nylon screw is used, remove the nylon screw and place it in one of the unused holes. Then remove the tap screw and insert it in the terminal plate hole.

Instantaneous Reclosing

The factory adjustment of the voltage unit contacts provides a contact follow. Where circuit breaker reclosing will be initiated immediately after a trip by the over voltage contact, the time of the opening of the contacts should be a minimum. This condition is obtained by loosening the stationary contact mounting screw, removing the contact plate and then replacing the plate with the bent end resting against the contact spring.

For double trip relays, the upper stationary contact is adjusted such that the contact rests solidly against the back stop. The lower stationary contact is then adjusted such that both stationary contacts make contact simultaneously with their respective moving contact.

B. Indicating Contactor Switch (ICS)

No setting is required on the ICS unit except the selection of the 0.2 to 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw.

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, other than those covered under "Settings", should be required.

Acceptance Check

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

A. CV Unit

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on

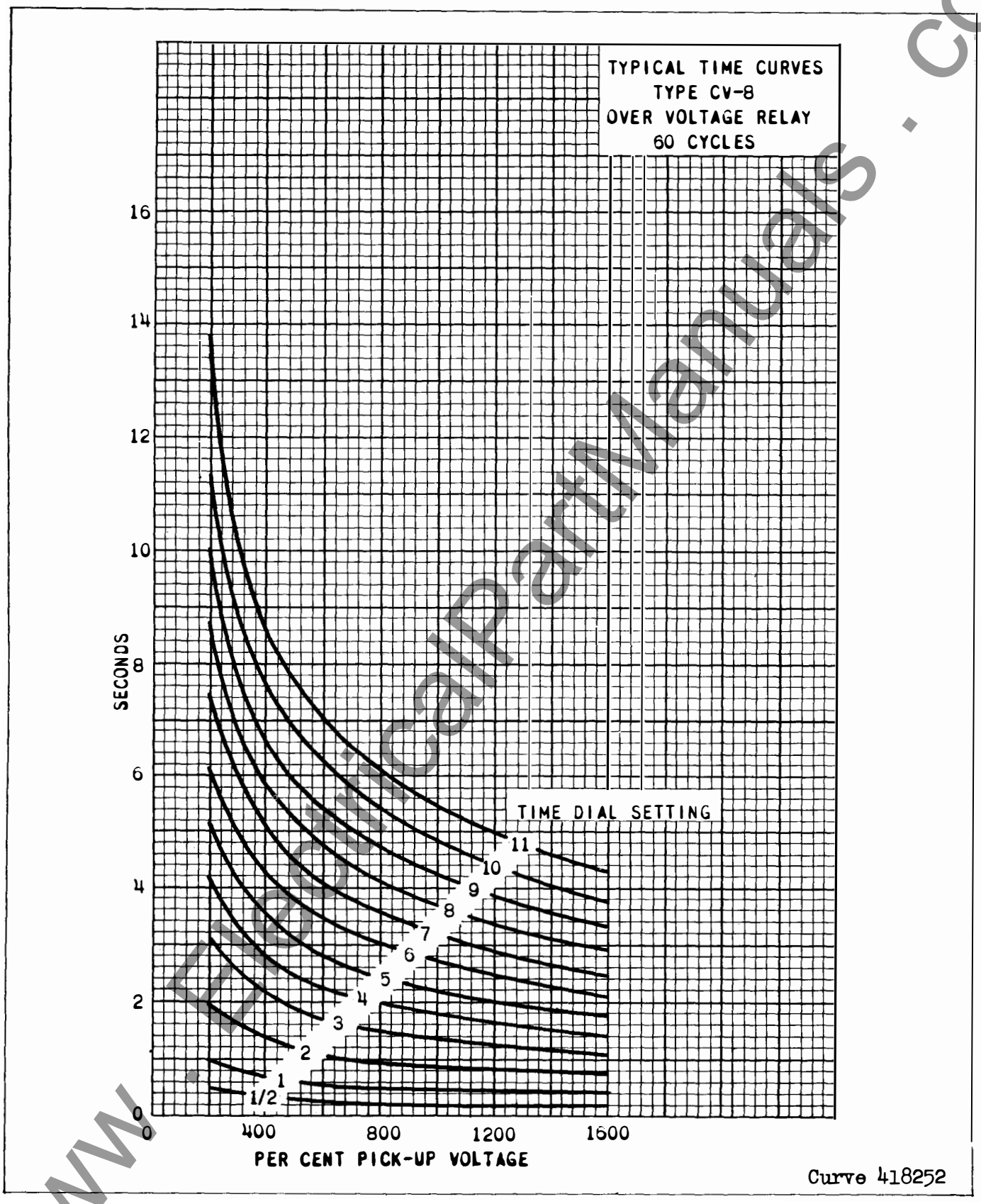


Fig. 8. Typical 60-cycle time curves of the type CV8 Low Pickup Overvoltage Relay.

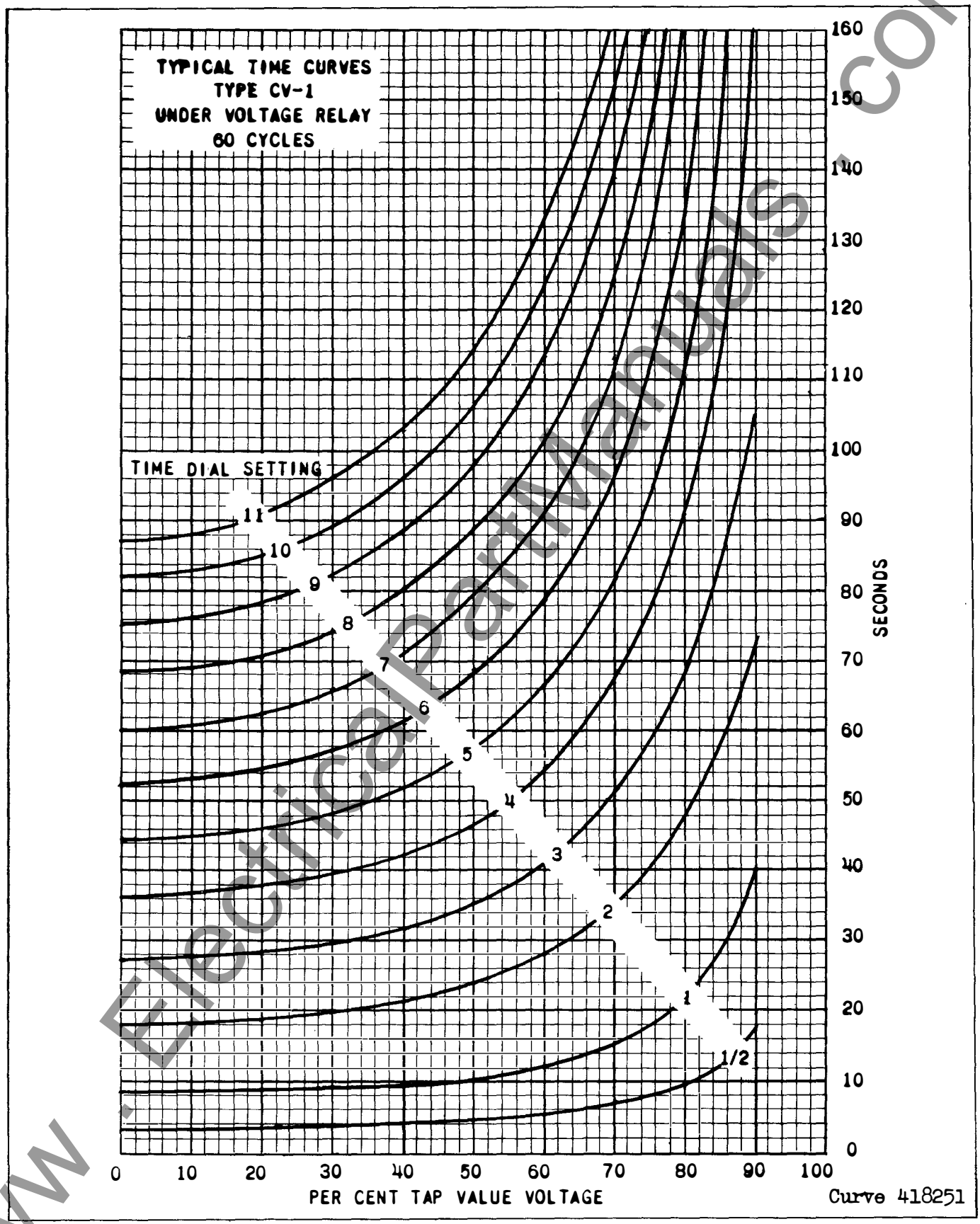


Fig. 9. Typical 60-cycle time curves or the type CV1 Long Time Undervoltage Relay.

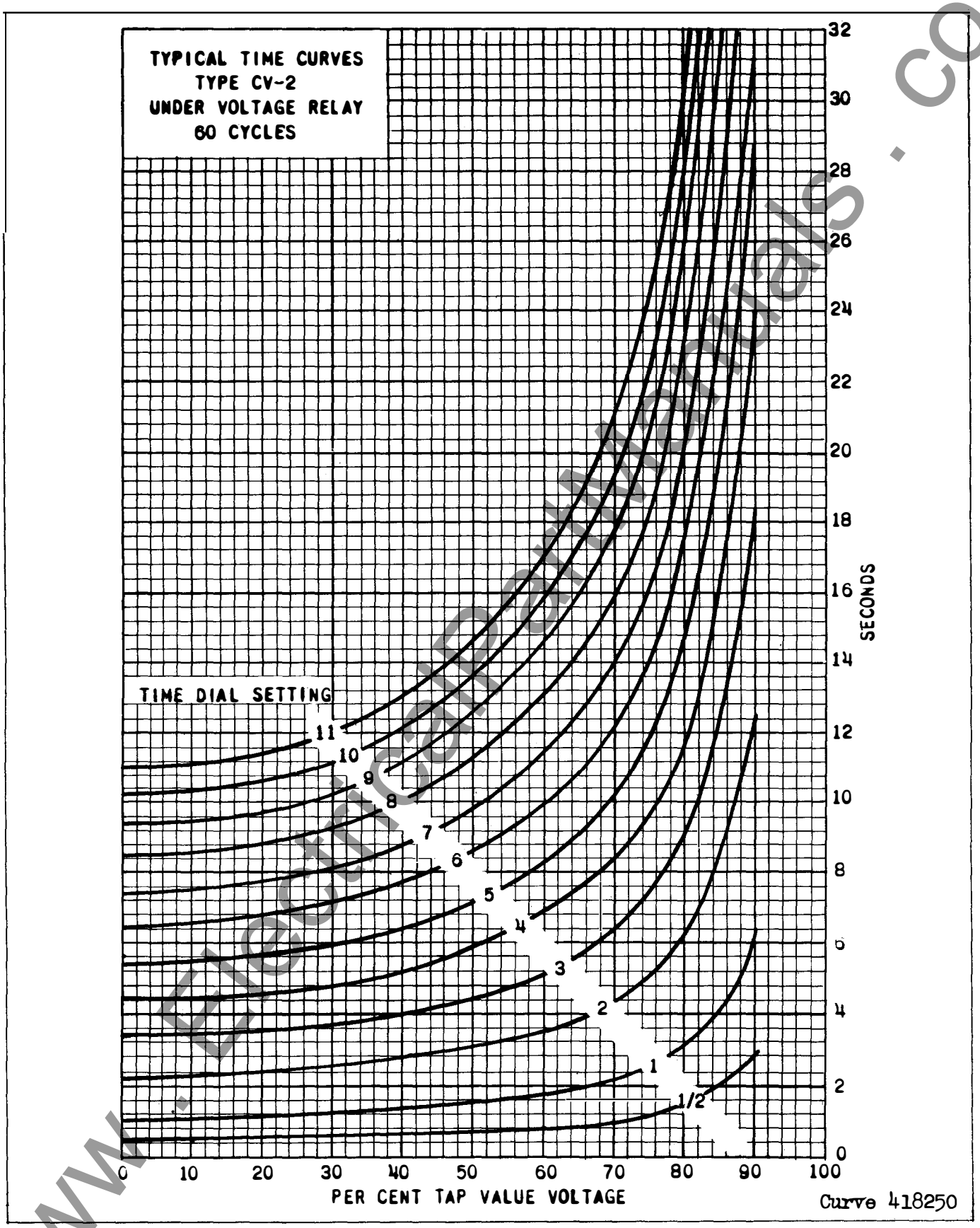


Fig. 10. Typical 60-cycle Time curves of the type CV2 Short Time Undervoltage Relay.

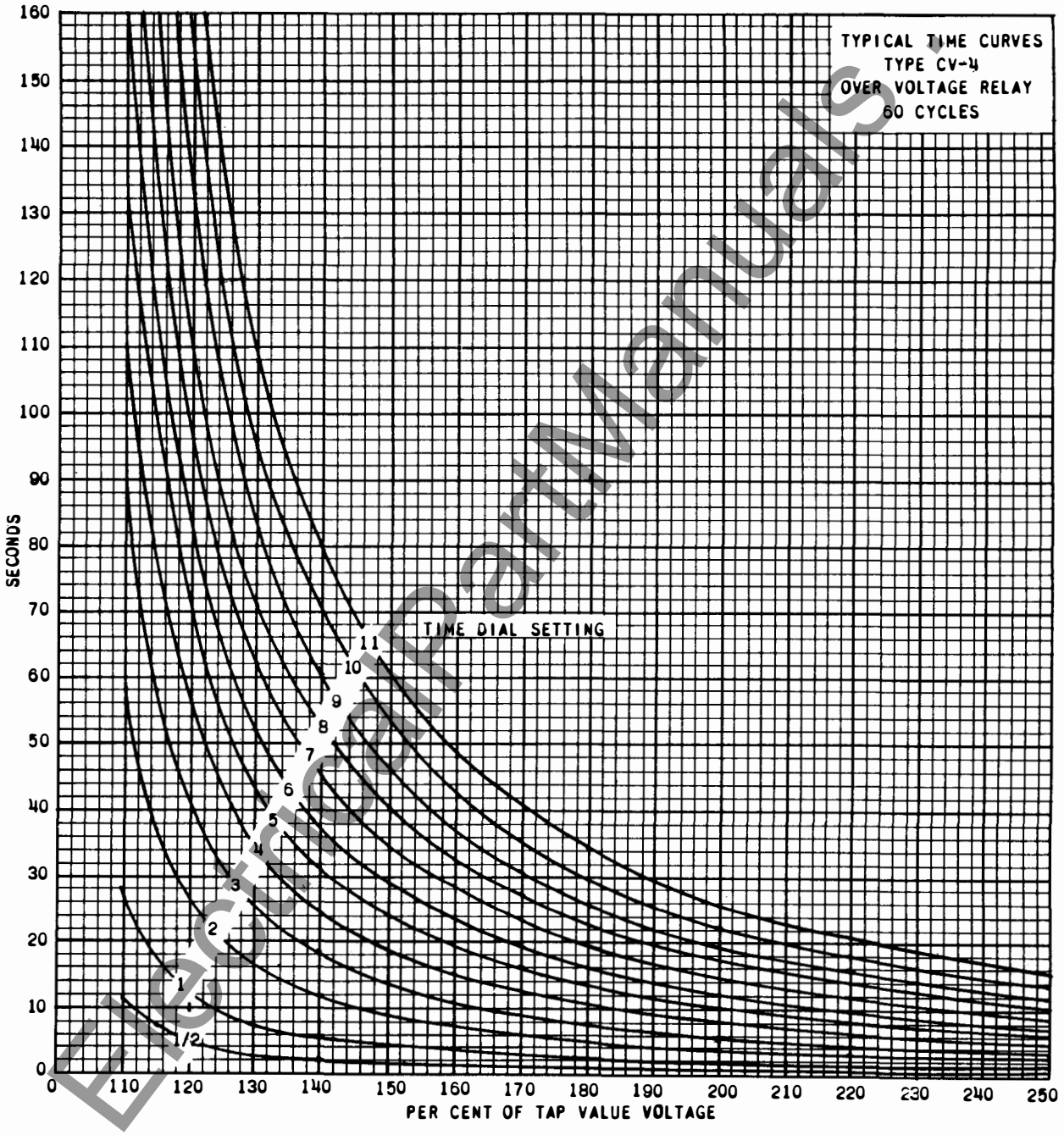


Fig. 11. Typical 60-cycle time curves of the type CV4 Long Time Overvoltage Relay.

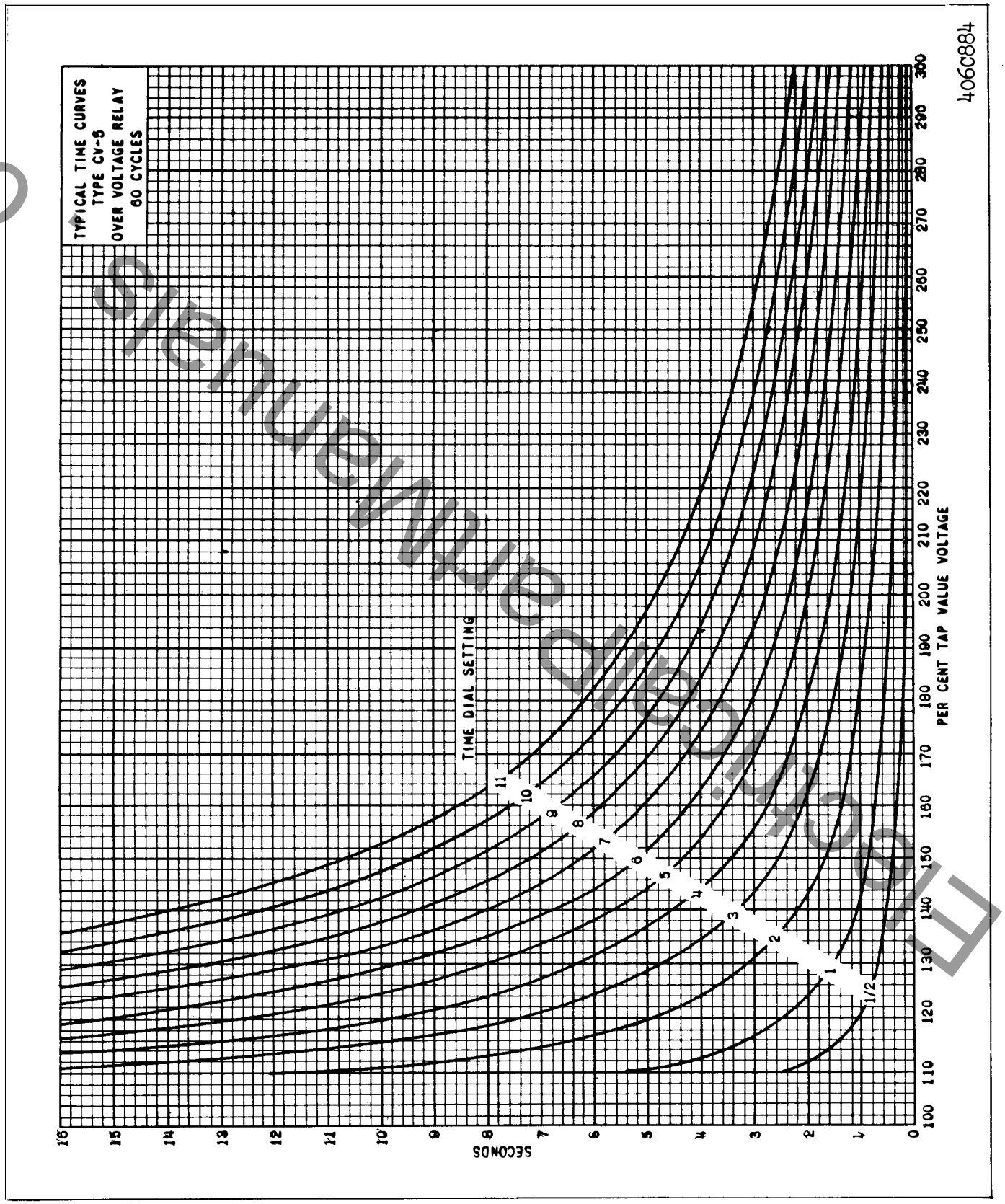


Fig. 12. Typical 60-cycle time curves of the type CV5 Short Time Overvoltage Relay.

Fig. 13. Typical 60-cycle time curves of the type CV6 Long Time Over and Undervoltage Relay.

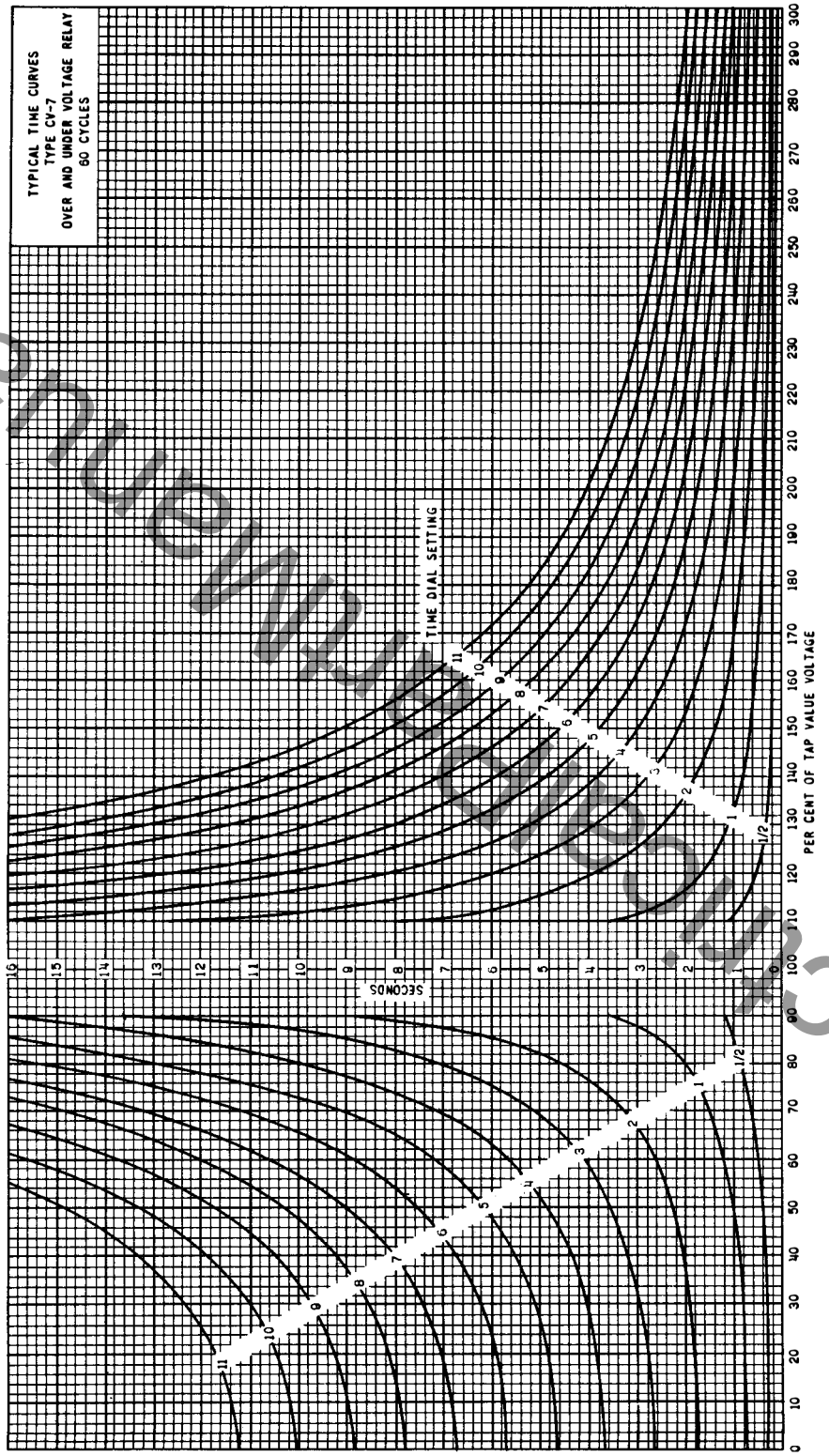


Fig. 14. Typical 60-cycle time curves of the type CV7 Short Time Over and Undervoltage Relay.

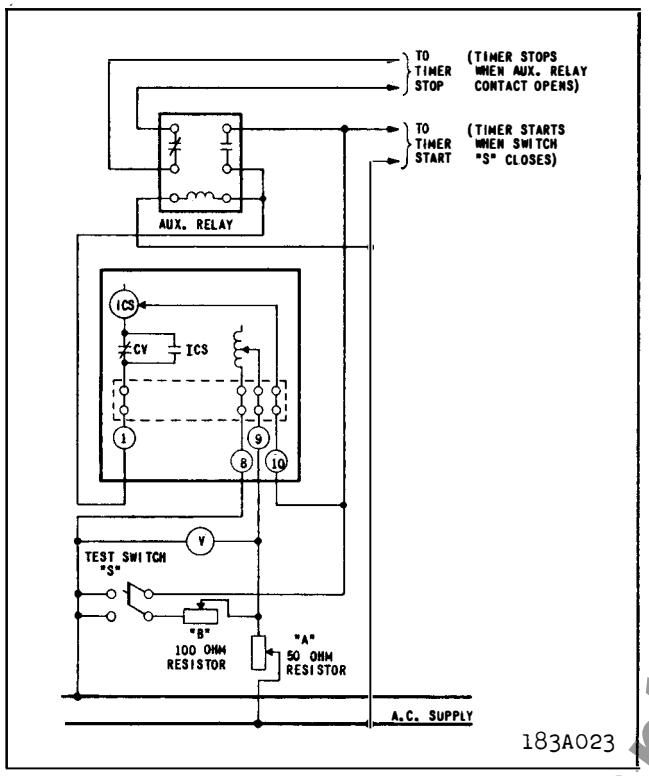


Fig. 15. Diagram of Test Connections of the type CV Undervoltage Relay.

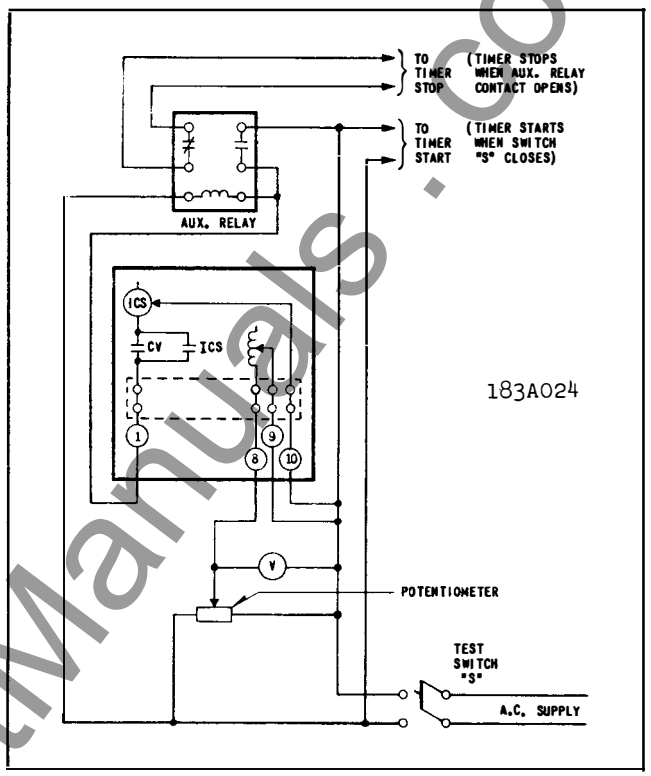


Fig. 16. Diagram of Test Connections of the type CV Overvoltage Relay.

the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the "O" mark by approximately .020". (For the type CV-6 and CV-7 relays the back contact has no follow when the front contact is through one-half of its follow). The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Voltage - Set the time dial to position 6. Alternately apply tap value voltage plus 3% and tap value voltage minus 3%.

a. CV-4 and CV-5 Overvoltage Relays, CV-6 and CV-7 Over or Undervoltage Relays - The moving contact should leave the backstop at tap value voltage plus 3% and should return to the backstop at tap value voltage minus 3%.

b. CV-1 and CV-2 Undervoltage Relays - The moving contact should leave the backstop at tap value voltage minus 3% and should return to the backstop at tap value voltage plus 3%.

c. CV-8 Overvoltage Relays - The moving contact should leave the backstop at 8.5% of continuous voltage.

3. Time Curve - Table 1 shows the time curve calibration points for the various types of relays. With the time dial set to the indicated position, apply the voltages specified in table 1 (e.g. for the CV-4, 140 percent of tap value voltage) and measure the operating time of the relay. The operating time should equal those of table 1 plus or minus 5%.

B. Indicating Contactor Switch (ICS) - Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjust-

able stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

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. Phantom loads should not be used in testing induction-type relays because of the resulting distorted current wave form which produces 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, because of the danger of embedding small particles in the face of the soft silver contact 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 have been disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order (See "Acceptance check").

A. CV Unit

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the "O" mark by approximately .020". (For the type CV-6 and CV-7 relays the back contact has no follow when the front contact is through one-half of its follow). The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip-Voltage - The adjustment of the spring tension in setting the minimum trip voltage value of the relay is most conveniently made with the damping magnet removed.

With the time dial set on "O", wind up the spiral spring by means of the spring adjuster until approximately 6-3/4 convolutions show.

Set the relay on the minimum tap setting and the time dial to position 6.

a. CV-4 and CV-5 Overvoltage, CV-6 and CV-7 Over or Undervoltage – Adjust the control spring tension so that the moving contact will leave the backstop of the time dial at tap value voltage +1.0% and will return to the backstop at tap value voltage -1.0%.

b. CV-1 and CV-2 Undervoltage Relays - Adjust the control spring tension so that the moving contact will leave the backstop of the time dial at tap value voltage -1.0% and will return to the backstop at tap value voltage +1.0%.

c. Low Pickup Overvoltage Relay - Adjust the control spring so that the moving contact will leave the backstop of the time dial at 8.1% of continuous voltage and return at 7.9% of continuous voltage.

3. Time Curve Calibration - Install the permanent magnet.

a. CV-1 and CV-2 Undervoltage Relay - Use test circuit of figure 15. With switch "S" opened, adjust resistor "A" until voltmeter reads tap value voltage or higher. Close switch "S" and adjust resistor "B" until the voltmeter reads 50 percent of tap value voltage. Open switch "S" and allow the moving contact to move to the backstop of the time dial. Close switch "S" and measure operating time.

Adjust the permanent magnet gap until the operating time corresponds to the value given in table 1.

b. CV-4 and CV-5 Overvoltage Relay, CV-8 Low Pickup Overvoltage Relay - Apply the indicated voltage of table 1 and measure the operating time. Adjust the permanent magnet keeper until the operating time corresponds to the value given in table 1.

c. CV-6 and CV-7 Over or Undervoltage Relay - Apply the indicated voltage of table 1 and measure the operating time. Adjust the permanent magnet keeper until the operating time corresponds to the value given in table 1.

Measure the reset time of the disc from the stationary front contact to the stationary back contact. This time should be as shown in table 1.

TABLE I

Type Relay	Percent Tap Value Voltage Or Pickup Voltage	Time Dial Setting	Operating Time in Sec.	Reset Time in Sec.
CV1	50	6	68	
CV2	50	6	8.6	
CV4	140	6	37.5	
CV5	140	6	6.8	
CV6	140	6	33	32.5
CV7	140	6	5.9	5.7
CV8	800	6	3.0	

B. Indicating Contactor Switch - Unit (ICS) - Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS setting being used. The indicator target should drop freely.

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.

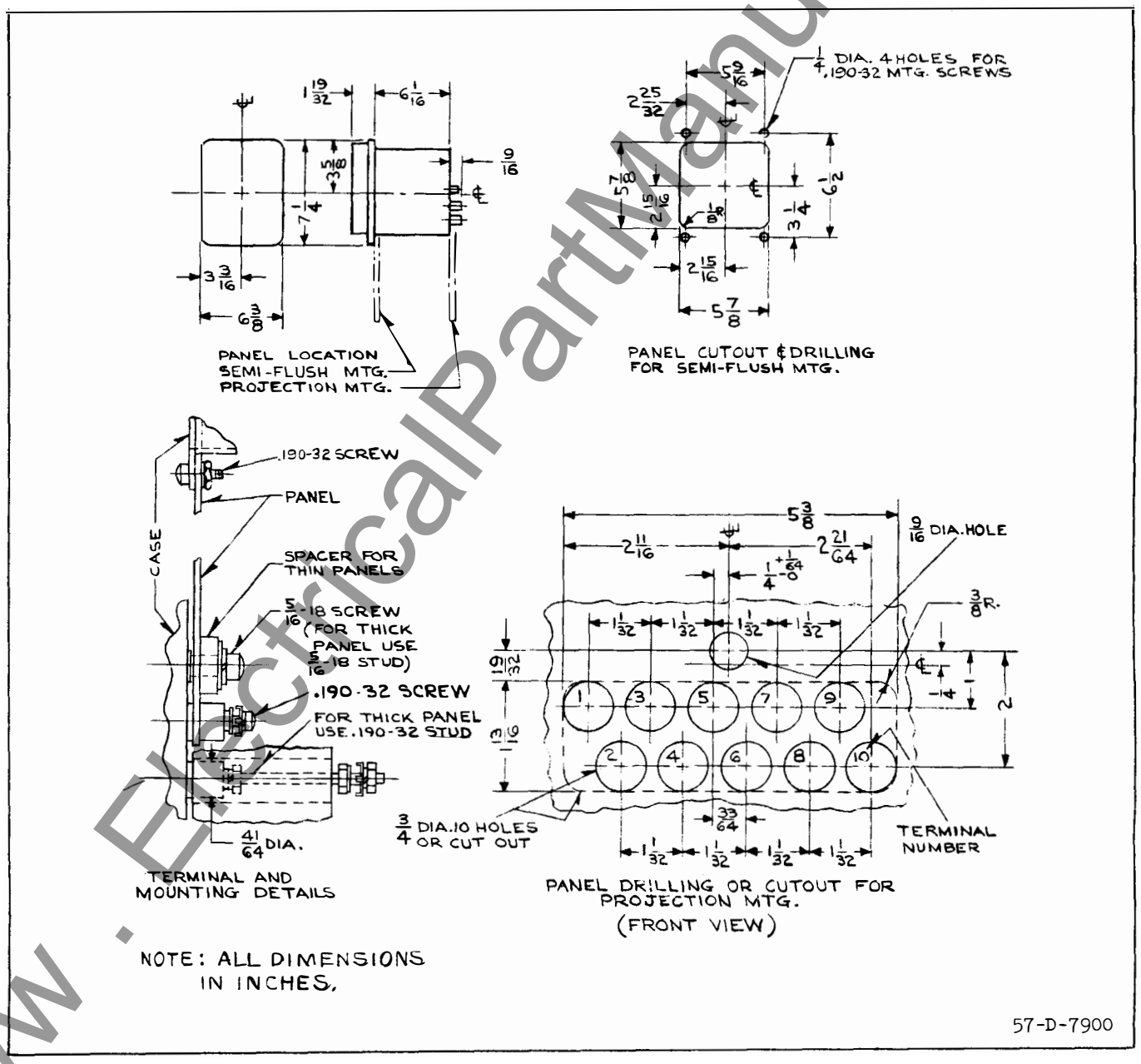


Fig. 17. Outline and drilling for FT11 case used for projection and/or semi-flush case.

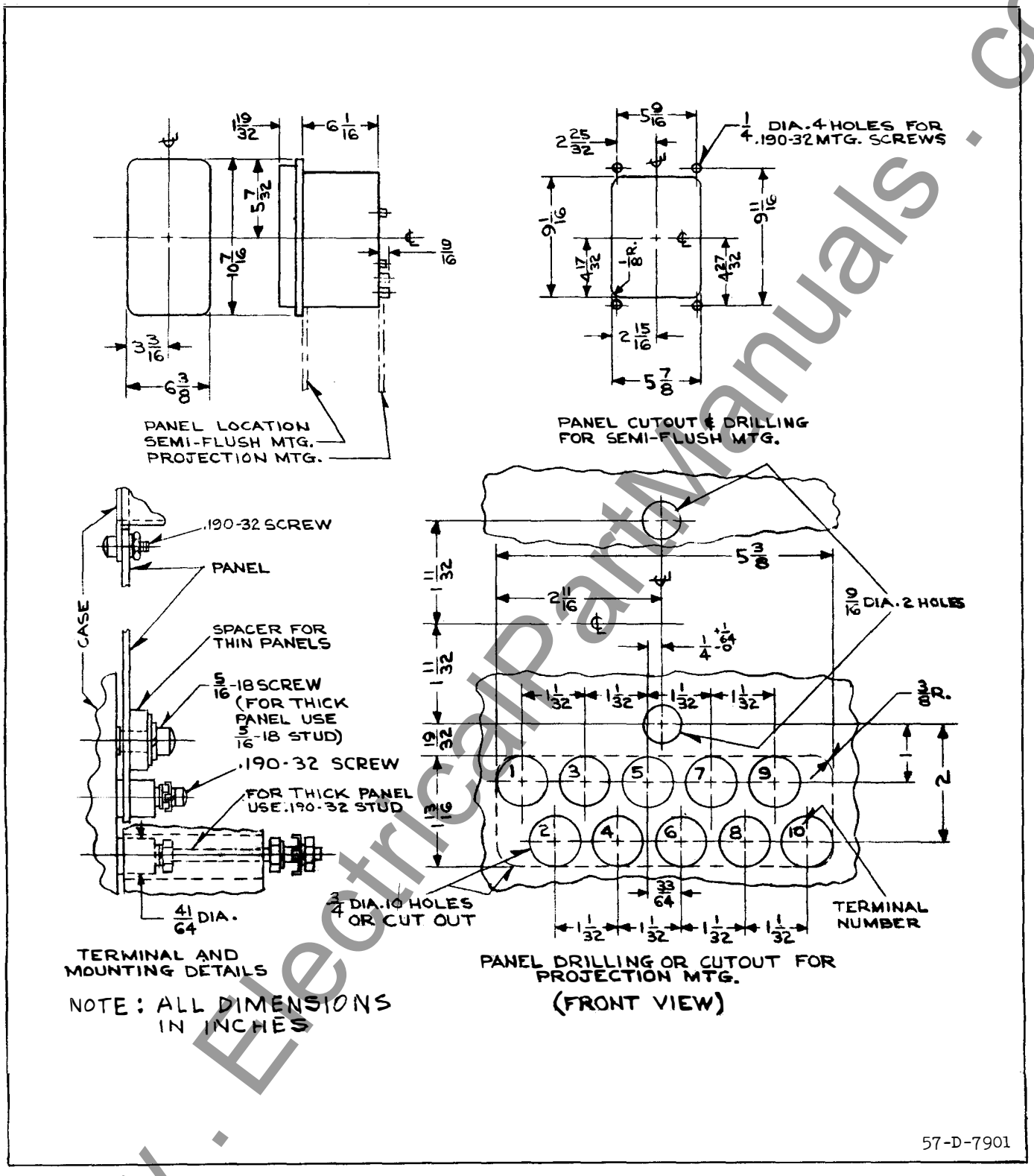


Fig. 18. Outline and drilling for FT21 case used for projection and/or semi-flush case. (For 67 volt CV-8 relay only)