Type CV Frequency Compensated Voltage Relay

Effective: June 2008

Supersedes I.L. 41-201.2G Dated September 1999

(|) Denotes Text Change since previous issue.

Device Number: 27/59

CONTENTS

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.

1.0 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 Hz is within 5% of the value at rated frequency.

2.0 CONSTRUCTION AND OPERATION

The types CV-21, CV-22, CV-24, CV-25, CV-26 and CV-27 relays consist of a voltage unit, an auxiliary telephone type relay 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.

2.1 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 called lag coils on the outer legs of the “E” type laminated structure. The coils are connected in such a manner that the combination of all 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 principles as the overvoltage unit except the connections to the lag 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 in the outer coil circuit.

2.2 INSTANTANEOUS INDICATING VOLTAGE SWITCH (IIV)

The instantaneous trip unit is a small ac 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 loaded 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.

2.3 INDICATING CONTACTOR SWITCH (ICS)

The indicating contactor switch is a small dc operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted tot he 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 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 front springs, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

3.0 CHARACTERISTICS

These relays are frequency compensated such that their pickup between 30 and 90 hertz is within 5% of the 60 hertz 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 shown below:

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

3.1 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 relay will open its contacts with application of voltage greater than tap value voltage, while the CV-24 and CV-25 overvoltage relay closes its contacts with voltages greater than tap value voltage.

3.2 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, the moving contact moves to close the front contact in a time as shown by the right-hand curve of either figure 8 or 9 (page 11) .

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 figure 8 or 9 (page 11) .

3.2.1 Trip Circuit

The main contacts will close 30 amperes at 250 volts dc and the seal-in contacts of the indicating contactor switch will 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.

3.2.2 Trip Circuit Constants

Indicating Contactor Switch:

0.2 Amp Tap - 6.5 ohms dc resistance
2.0 Amp Tap - 0.15 ohms dc resistance

3.2.3 Instntaneous Indicating Voltage Switch (IIV)

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

4.0 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.

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
	470	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

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

Setting	Voltage Applied	Burden
120 volts	120 volts	2.0 V.A.
200 volts	200 volts	3.0 V.A.

5.0 SETTINGS

5.1 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 times 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 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.

5.1.1 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 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 simultaneously with their respective moving contact.

5.2 INSTANTANEOUS INDICATING VOLTAGE SWITCH (IIV)

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

5.3 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 screws.

6.0 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 rear mounting stud or studs for the type FT case projection case or by means of the four mounting holes on the flange for the semi-flush type FT case. Either the stud or the mounting screws may be utilized for grounding the relay. External toothed washers are provided for use

in the locations shown on the outline and drilling plan to facilitate making a good electrical connection between the relay case, its mounting screws or studs, and the relay panel. Ground wires should be affixed to the mounting screws or studs as required for poorly grounded or insulating panels. Other electrical connections may be made directly to the terminal by means of screws for steel panel mounting or to the terminal stud furnished with the relay for thick panel mounting. The terminal stud may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

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

7.0 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.

7.1 PERFORMANCE CHECK

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

7.1.1 CV Unit

1. Contact

The index mark on the movement frame will coincide with the “0” 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 right of the “0” mark by approximately .020”. (For the type CV-26, CV-27 relays, the follow on the back contact should be approximately 1/64”). The placement of the various time-dial positions in line with the index mark will give operating time 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 dc current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS tap setting being used. The operation indicator target should drop freely.

For proper contact adjustment, insert a .030” feeler gauge between the core pin and the armature. Hold the armature closed against the core pin and gauge and adjust the stationary contacts such that they just make with the moving contact. Both stationary contacts should make at approximately the same time. The contact follow will be approximately 1/64” to 3/64”.

7.2 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.

All contacts should be periodically cleaned. A contact burnisher Style #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 and thus, impairing the contact.

7.3 CALIBRATION

Use the following procedure for calibrating the relay if the relay has been taken apart for repair, 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 “7.1 Performance Check”).

7.3.1 CV Unit

1. Contact

The index mark on the movement frame will coincide with the “0” 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 ”0” mark by approximately .020”. (For the type CV-26, CV-27 relays, the follow on the back contact should be approximately 1/64”). 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 10-1/2 position within 0.5 volt of the value that it just leaves the backstop with the dial set at the 1/2 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 40 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 B.

Table B:

Type Relay	Percent Tap Value Voltage or Pickup Voltage	Time Dial Setting	Operating Time in Seconds	Reset Time in Seconds
CV-21	50	6	68.0	
CV-22	50	6	8.6	
CV-24	140	6	37.5	
CV-25	140	6	6.8	
CV-26	140	6	33.0	32.5
CV-27	140	6	5.9	5.7

b. CV-24 and CV-25 overcurrent relay: Use designated test circuit and apply the indicated voltage of Table B and measure the operating time. Adjust the permanent magnet keeper until the operating time corresponds to the value given in Table B.

c. CV-26 and CV-27 over- or undercurrent relay: Apply the indicated voltage of Table B and measure the operating time. Adjust the permanent magnet keeper until the operating time corresponds to the value given in Table B.

   Measure the reset time of the disc from the stationary front contact to the stationary back contact. This time should be shown in Table B.

7.3.2 Instantaneous Indicating Voltage Switch (IIV)

The contact gap should be 3/32 $\pm$ 1/64 between the bridging contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary 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.

7.3.3 Indicating Contactor Switch - Unit (ICS)

Close the main relay contacts and pass sufficient dc 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.

8.0 RENEWAL PARTS

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

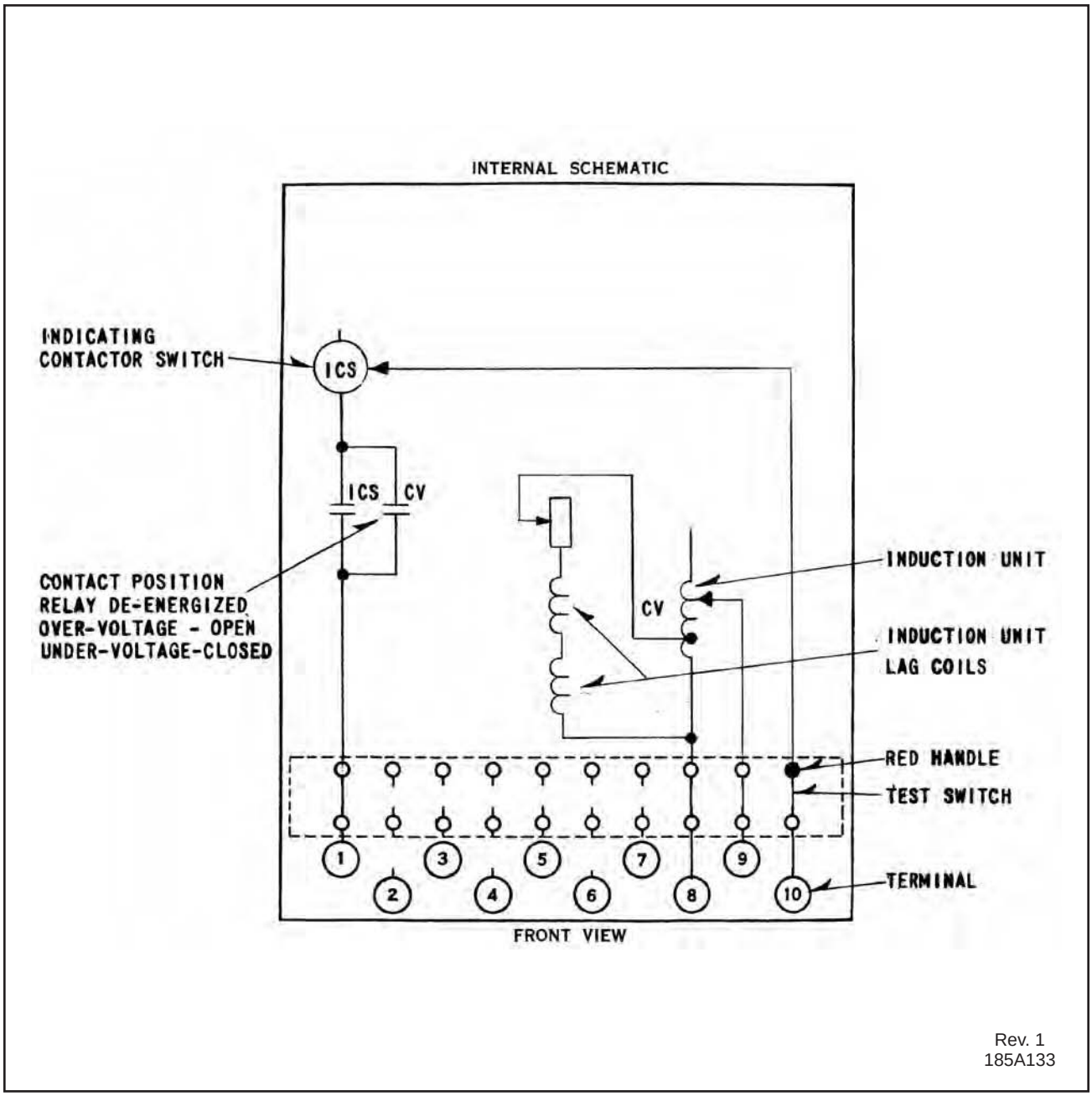

Figure 1 - Internal Schematic for CV Frequency Compensated Relay, Over or Undervoltage, (S.P.S.T.) - in FT-11 Case

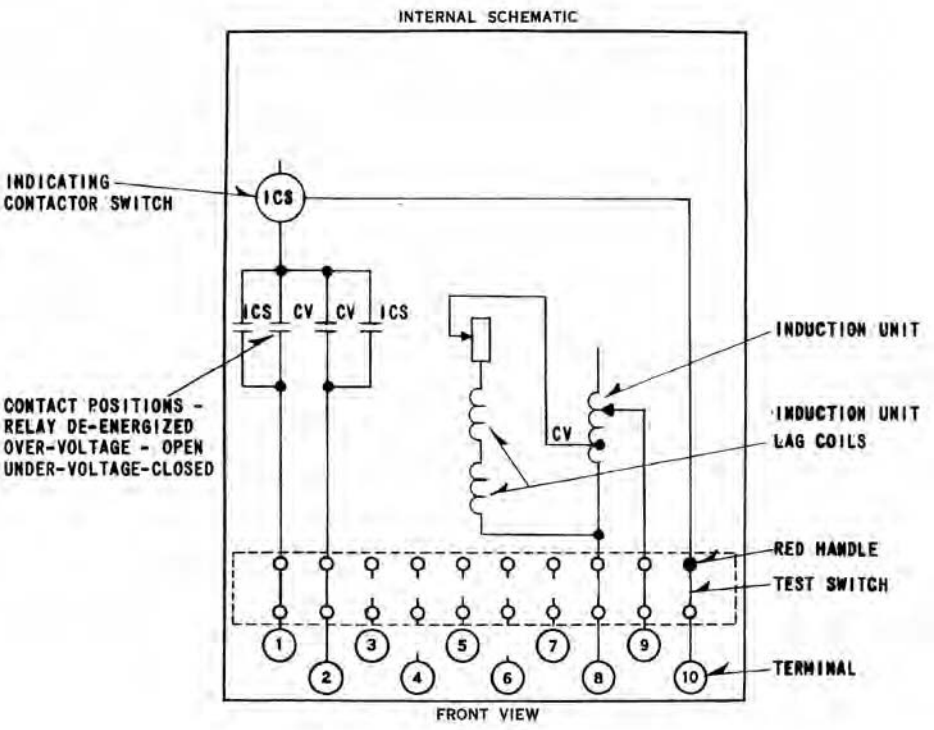

Figure 2 - Internal Schematic for CV Frequency Compensated Relay, Over or Undervoltage, (D.P.S.T.) - in FT-11 Case

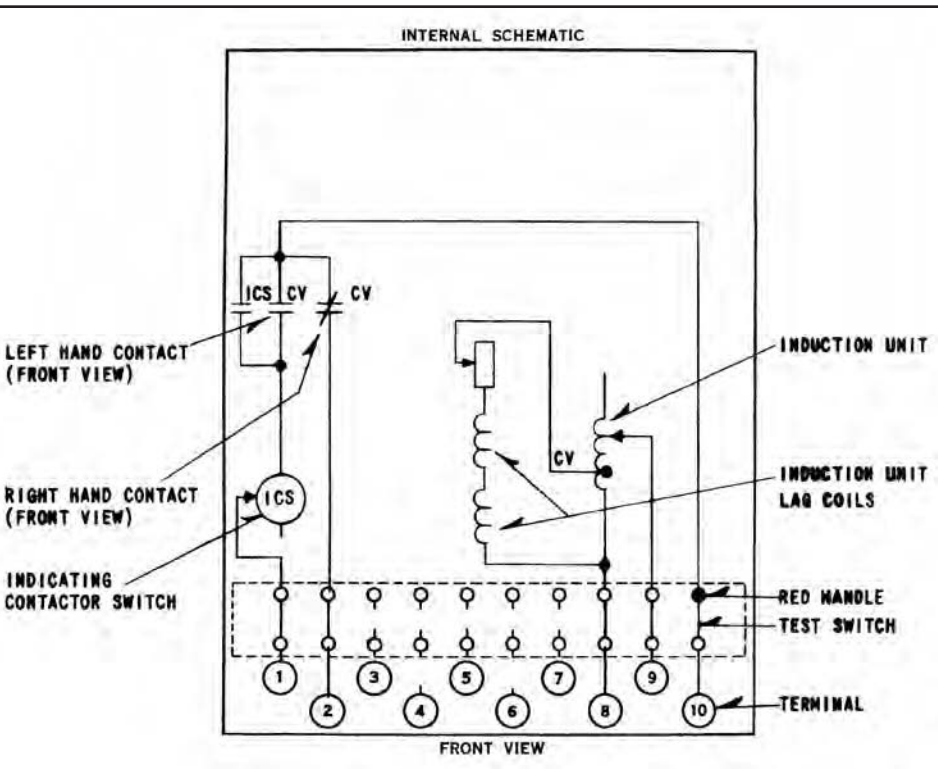

Figure 3 - Internal Schematic for CV Frequency Compensated Relay, Over and Under-Voltage, (S.P.D.T.) - in FT-11 Case

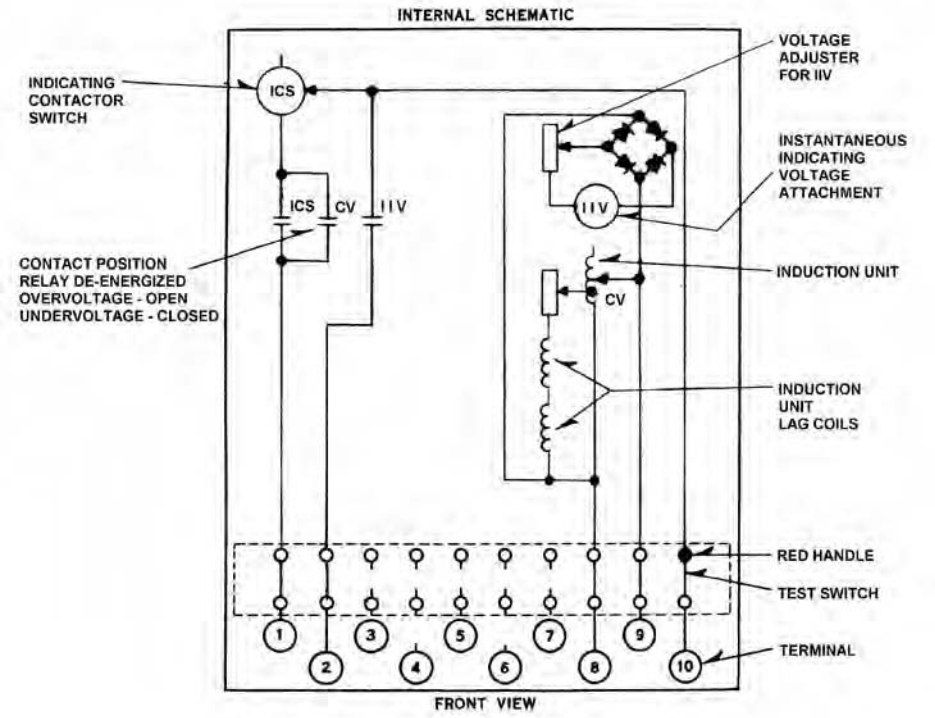

Figure 4 - Internal Schematic for CV Frequency Compensated Relay, Over or Undervoltage, (S.P.S.T.) and with IIV Unit - in FT-11 Case

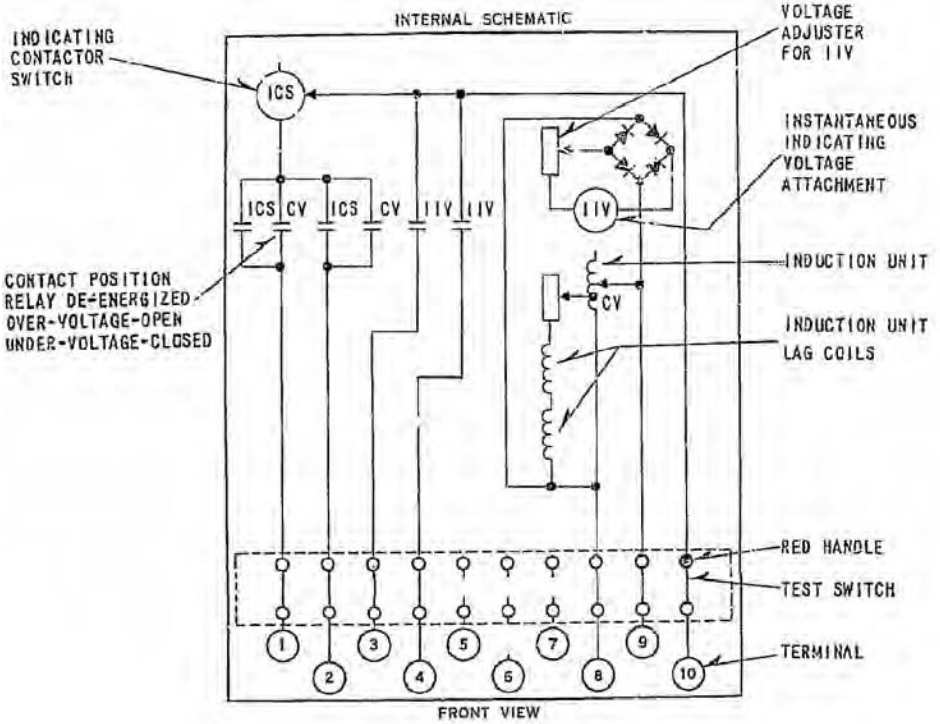

Figure 5 - Internal Schematic for CV Frequency Compensated Relay, Over or Undervoltage, (D.P.S.T.) and with IIV Unit - in FT-11 Case

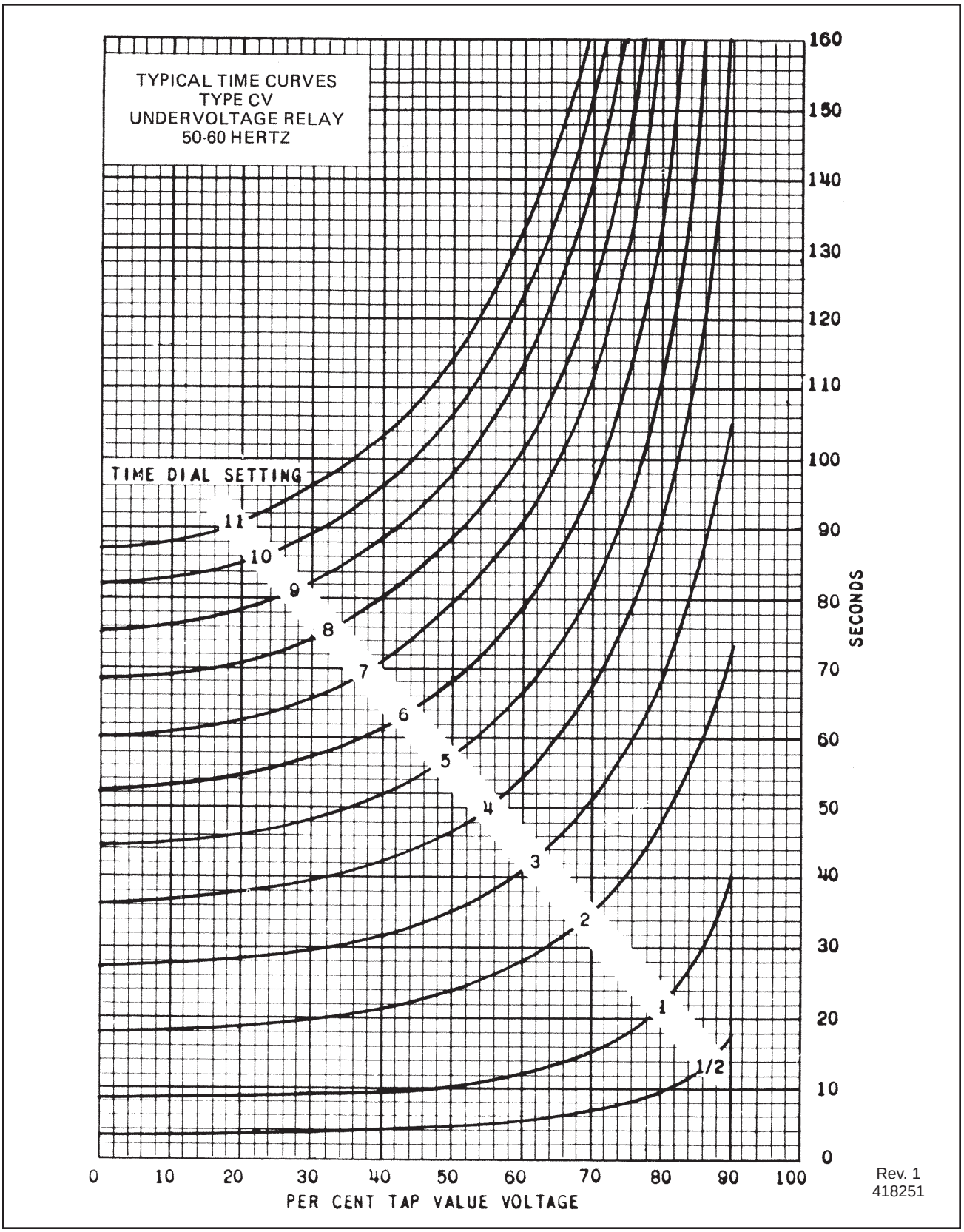

Figure 6 - Typical Time Curves for CV-21, Long Time Undervoltage Relay

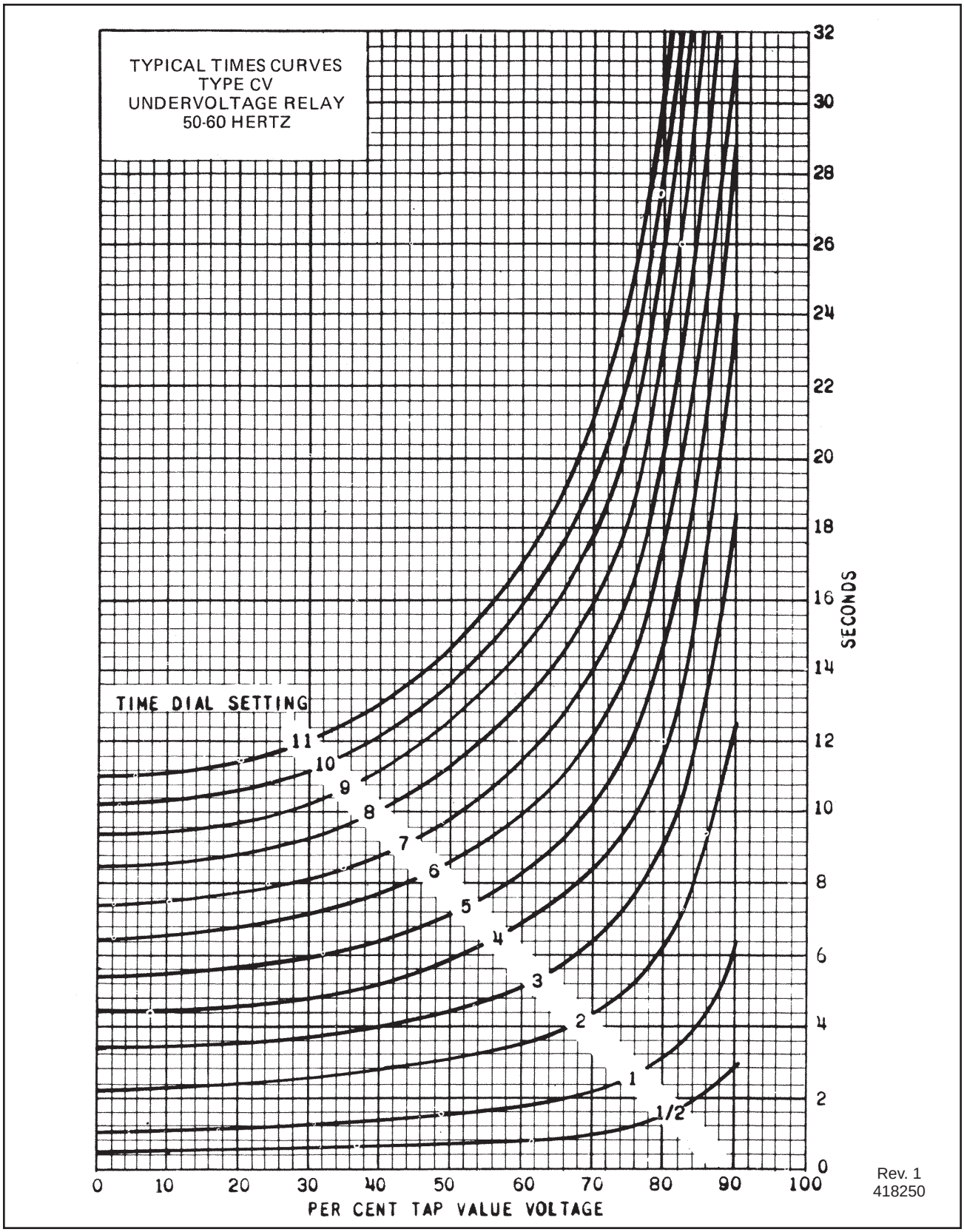

Figure 7 - Typical Time Curves for CV-22, Short Time Undervoltage Relay

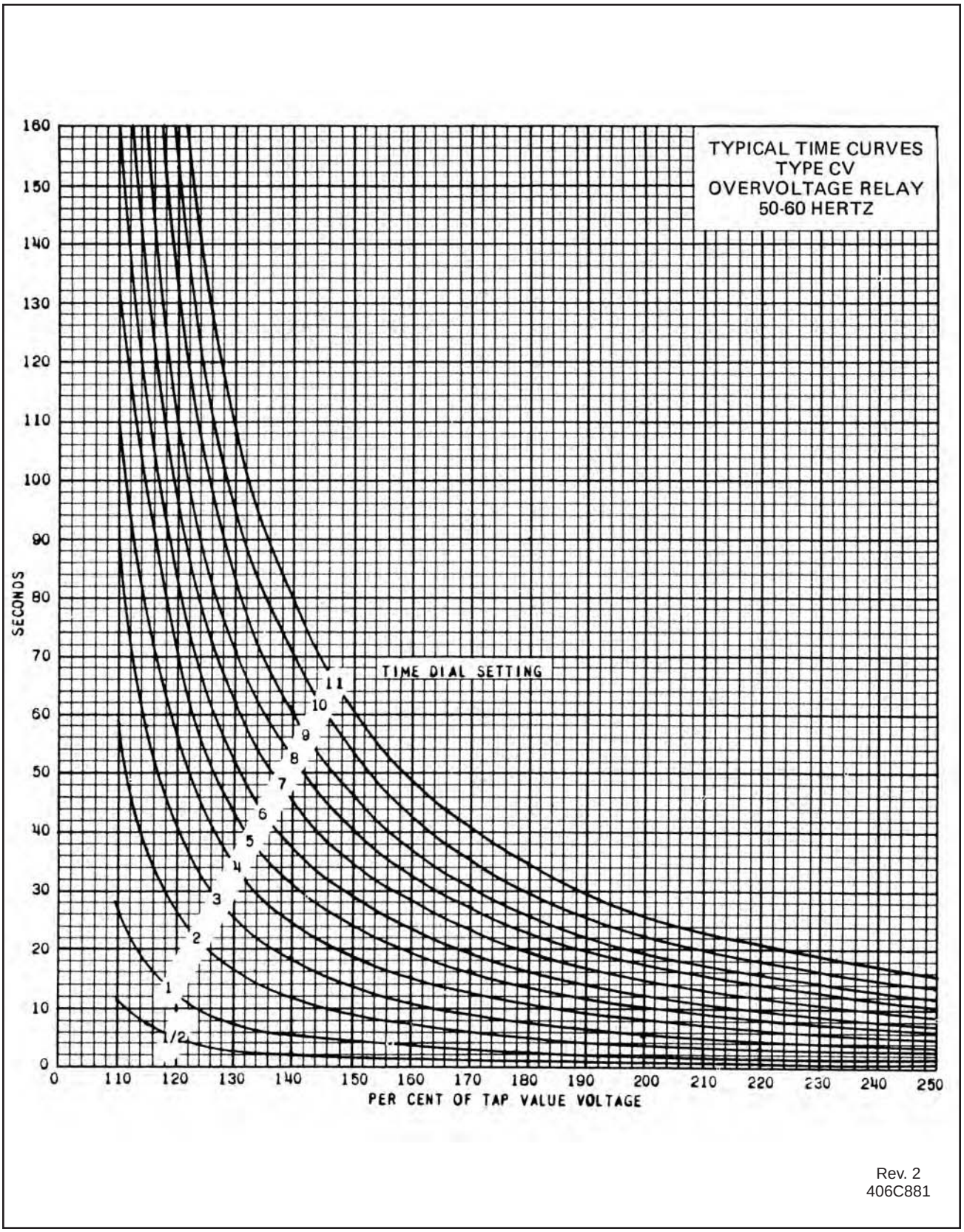

Figure 8 - Typical Time Curves for CV-24, Long Time Overvoltage Relay

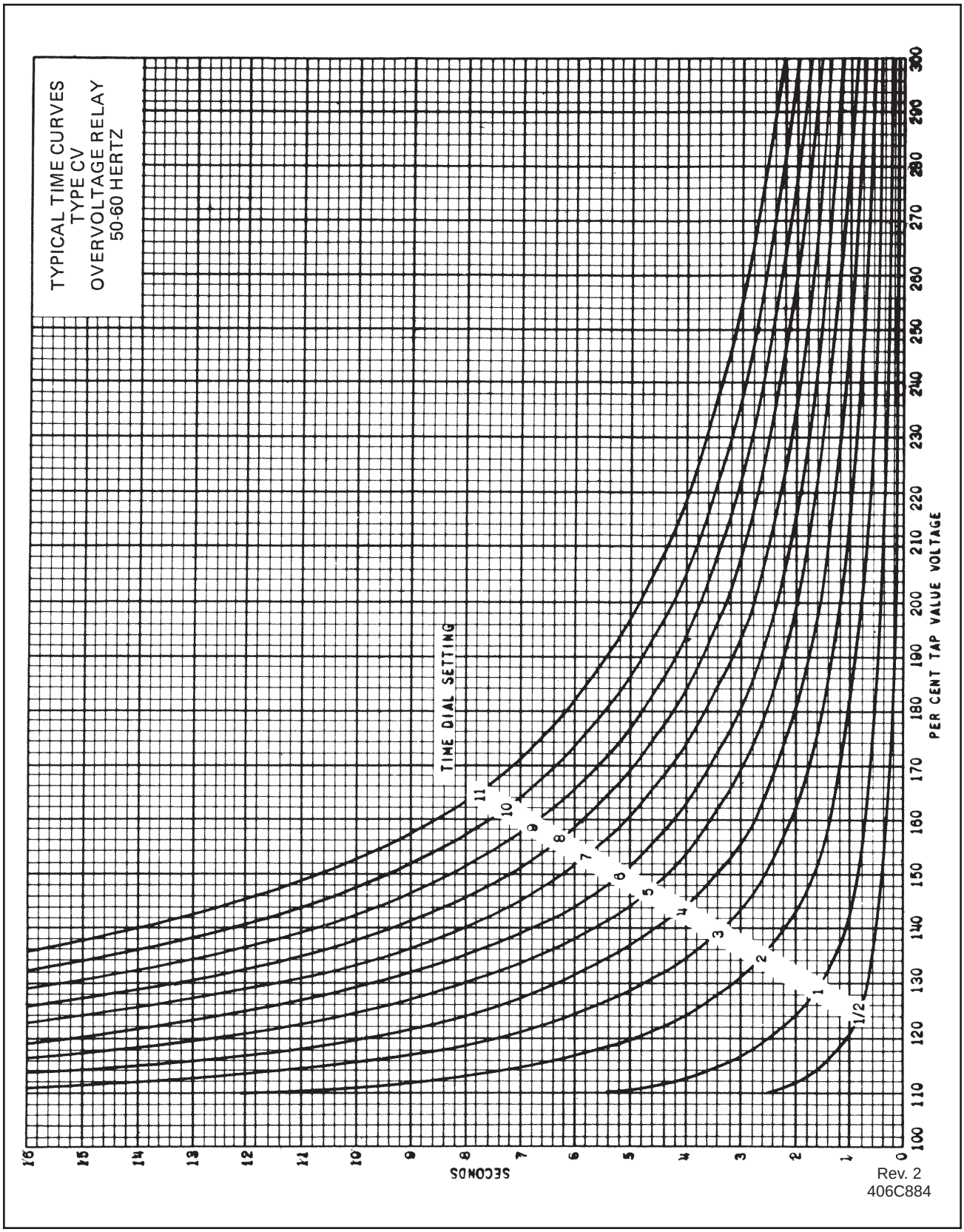

Figure 9 - Typical Time Curves for CV-25, Short Time Overvoltage Relay

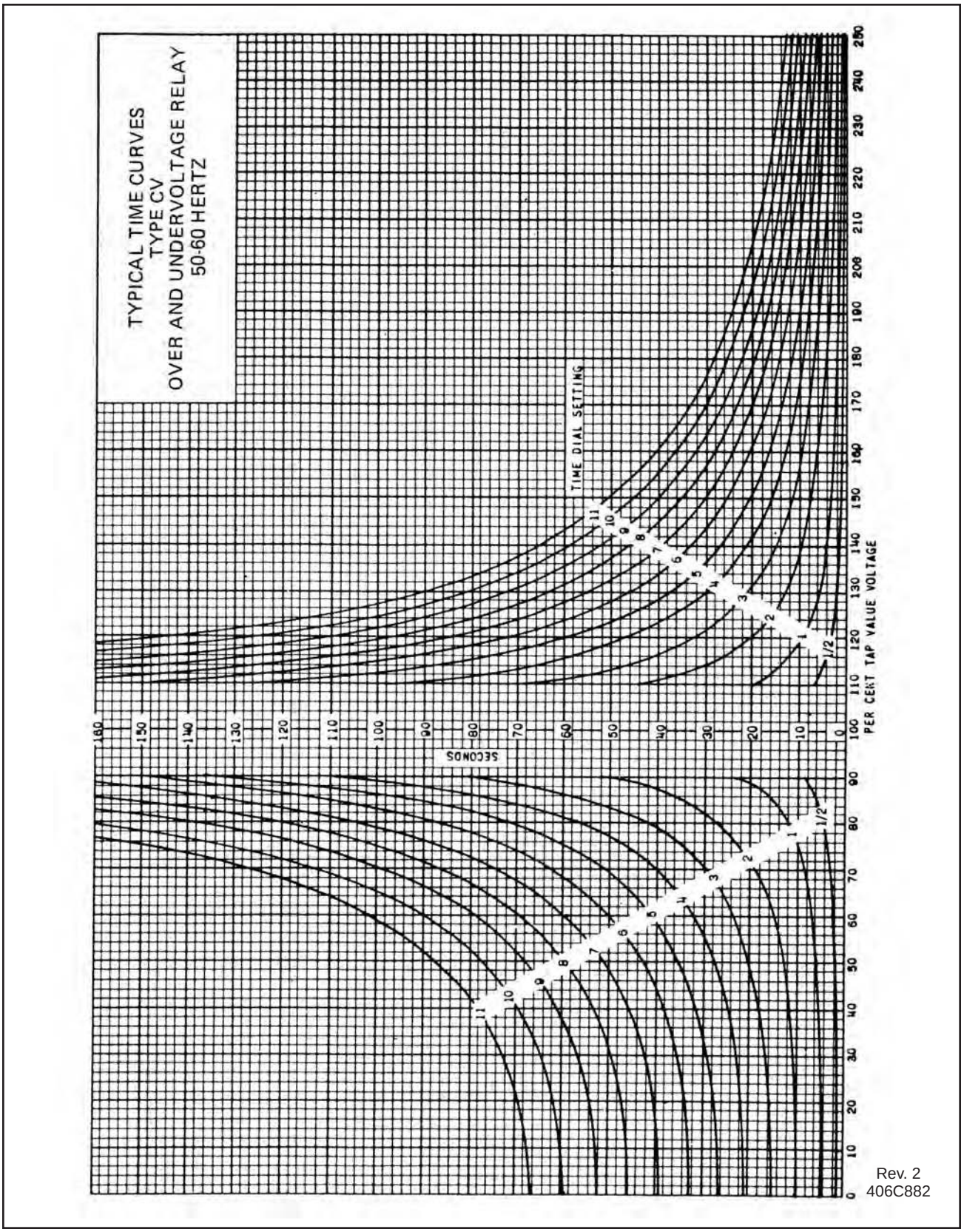

Figure 10 - Typical Time Curves for CV-26, Long Time Over and Undervoltage Relay

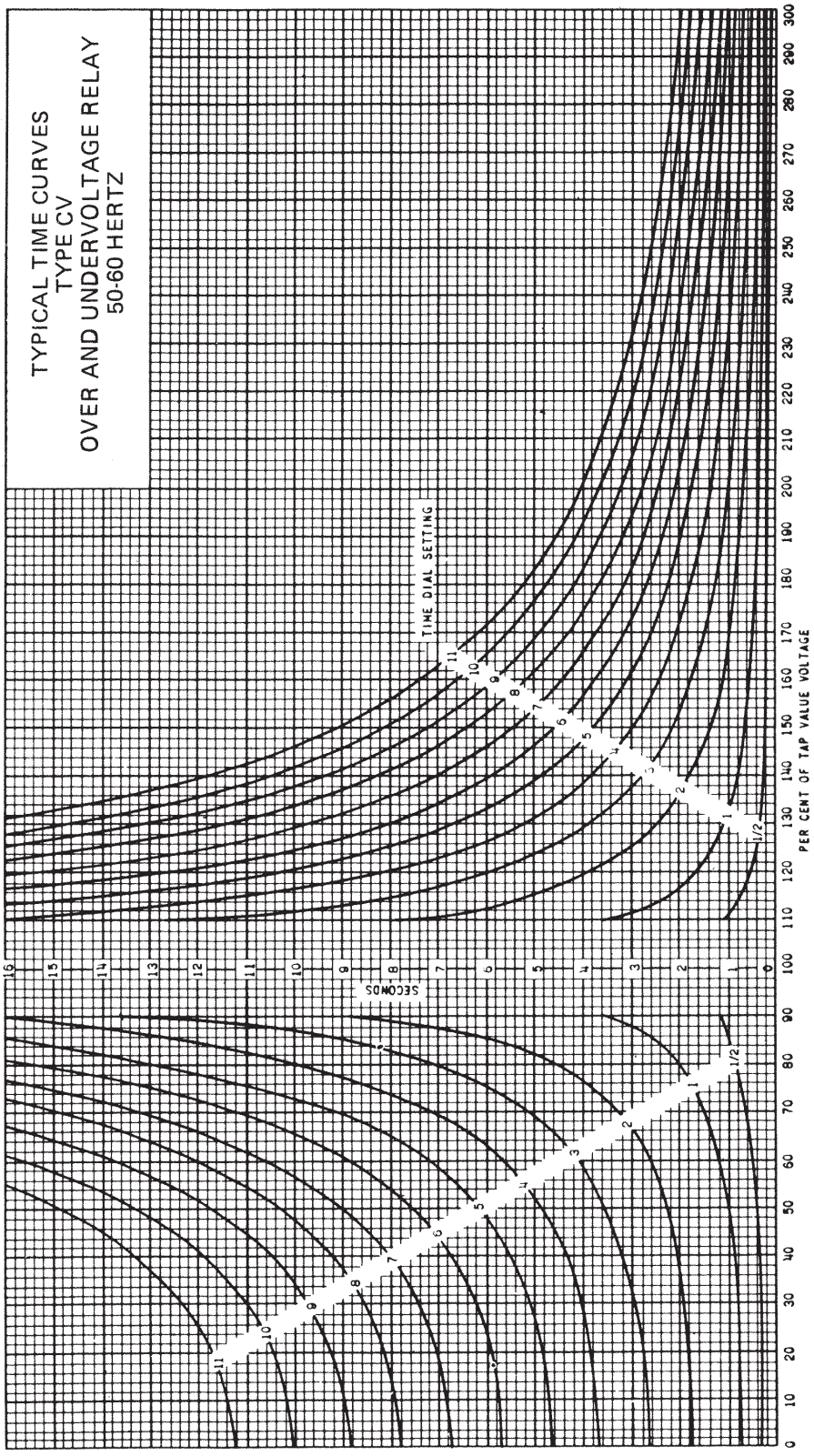

Figure 11 - Typical Time Curves for CV-27, Short Time Over and Undervoltage Relay

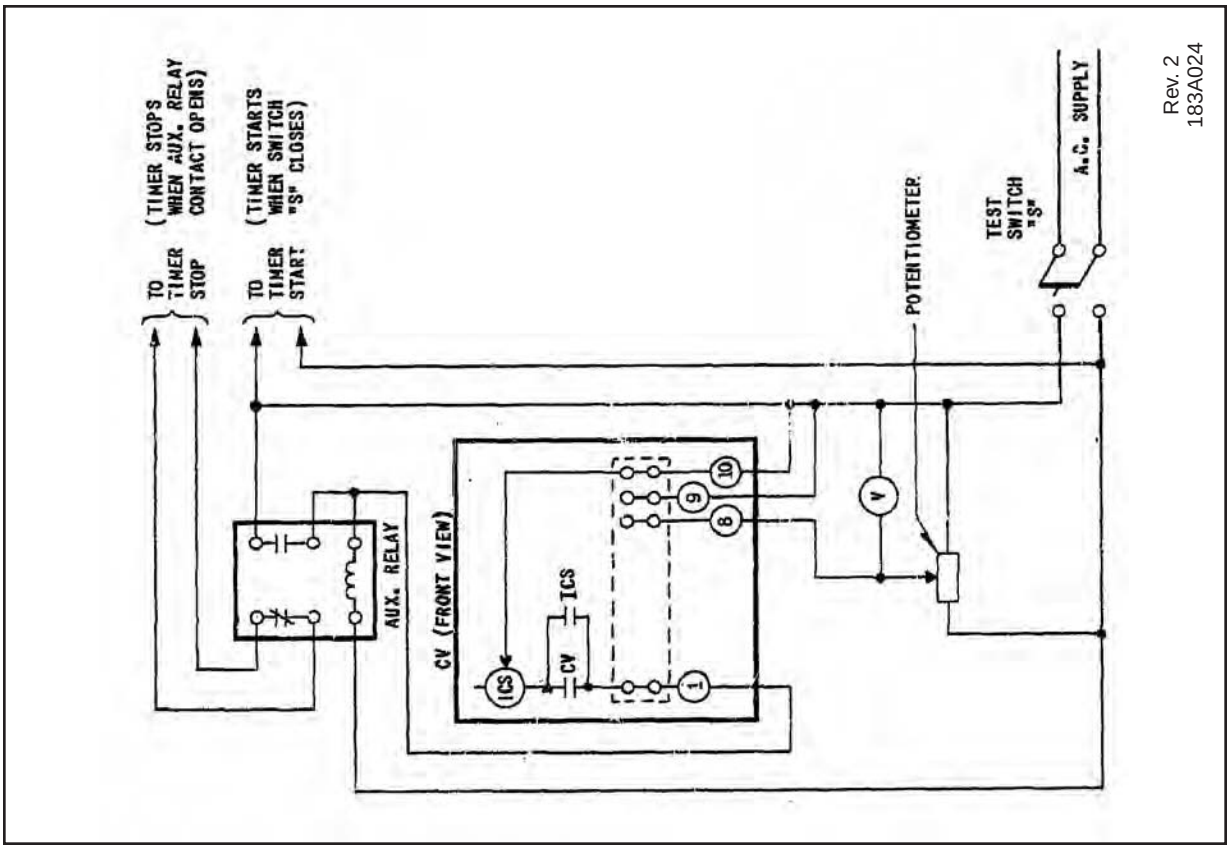

Figure 13 - Test Connections for Overvoltage CV Relays

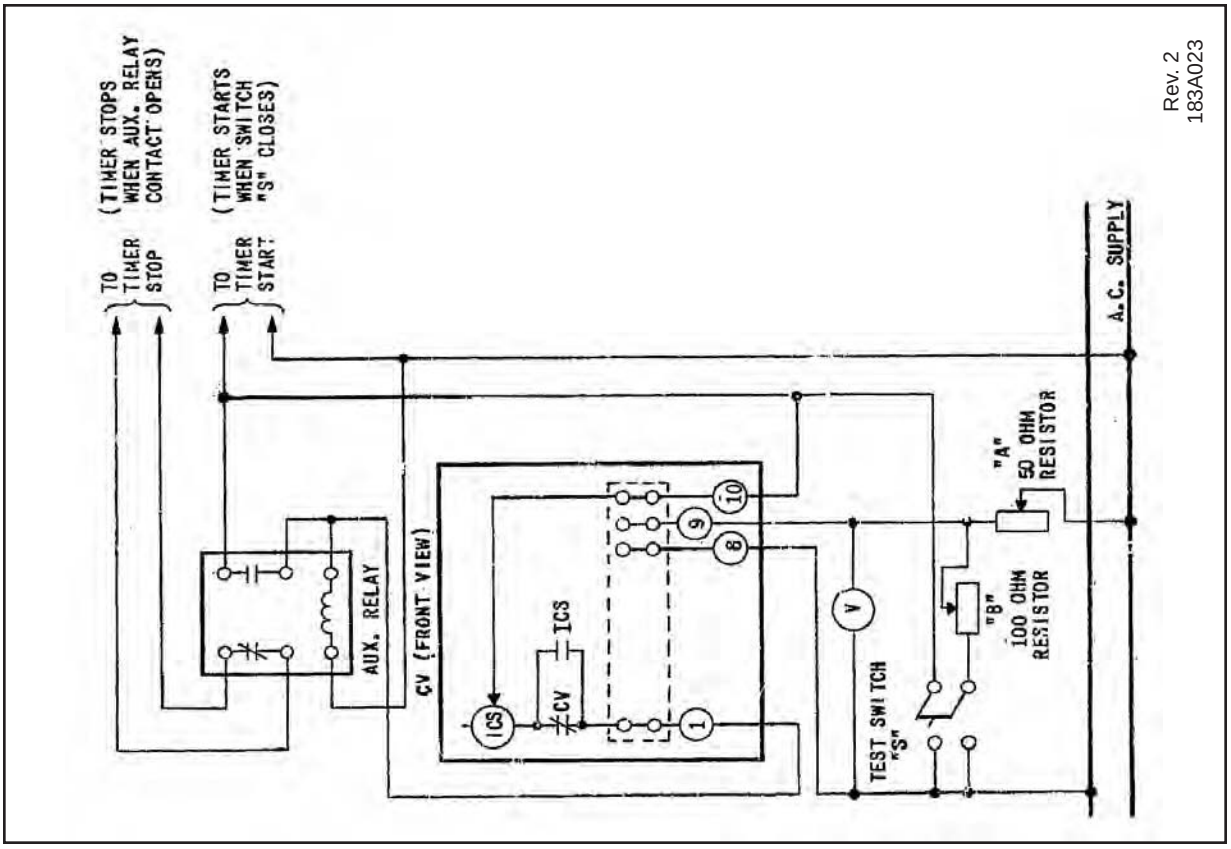

Figure 12 - Test Connections for Undervoltage CV Relays

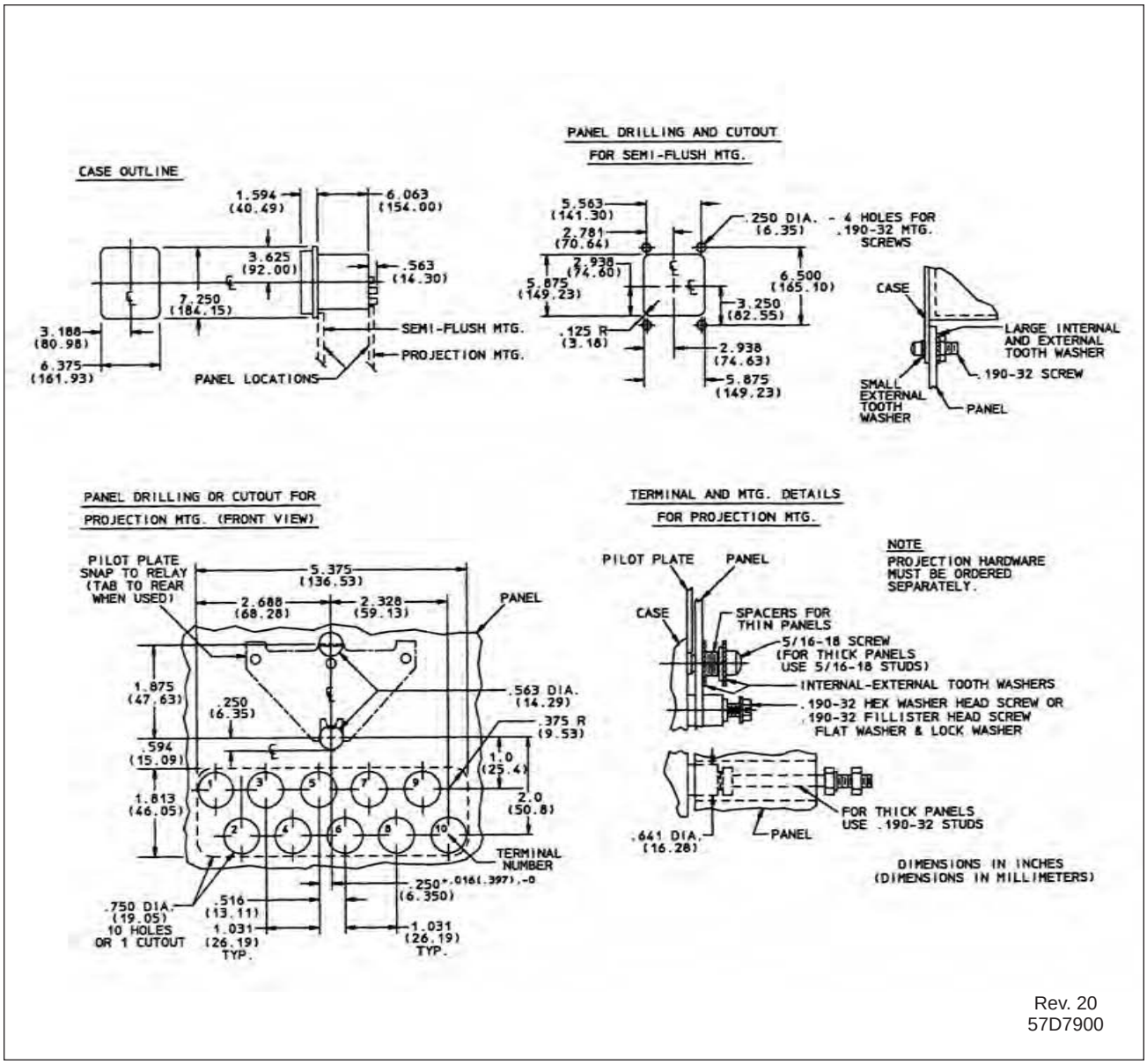

Figure 14 - Outline and Drilling Plan for CV Relays in Type FT-11 Case

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