ABB Power T&D Company Inc.
Relay Divisions
Coral Springs, FL 33065

TYPE CV FREQUENCY COMPENSATED VOLTAGE RELAY FOR CLASS 1E APPLICATIONS

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

These relays have been specially designed and tested to establish their suitability for Class 1E applications. Materials have been selected and tested so that the relays will perform their intended function for their design life when operated in a normal environment as defined by ANSI standard C37.90-1971, when exposed to radiation levels up to 10^4 rads, and when subjected to seismic events producing a Shock Response Spectrum within the limits of the relay rating.

"Class 1E" is the safety classification of the electric equipment and systems in nuclear power generating stations that are essential to emergency shutdown of the reactor, containment isolation, cooling of the reactor, and heat removal from the containment and reactor, or otherwise are essential in preventing significant release of radioactive material to the environment.

These type CV relays are single-phase induction-disc type relays operating either on undervoltage or overvoltage or both. These relays are frequency compensated such that their pickup between 30 and 90 hertz is within 5 percent of the 60 hertz 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 AND 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). When the CV contacts are not sealed around by ICS contacts, an auxiliary telephone type relay, T, is energized through the CV contacts. This is a slow dropout auxiliary unit which requires more than 100 milliseconds to reset. It is thereby able to ride through any chatter of the CV contacts which might be caused by the vibration of a seismic event. The component parts of the relays are connected as shown in the internal schematic diagram.

The CV units contain a special shield covering the spring, located above the disc, to prevent the spring from contacting grounded elements during extreme vibrations.

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 principle 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.

All possible contingencies which may arise during installation, operation or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding this particular installation, operation or maintenance of this equipment, the local ABB Power T&D Company Inc. representative should be contacted.

SUPERSEDES I.L. 41-201.21A DATED NOVEMBER 1983 EFFECTIVE APRIL 1984

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

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 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 valve of the switch.

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:

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

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 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.

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 side of the time curves.

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 side of the time curves.

Auxiliary Relays (T) (when used)

Power Requirements Per Unit: 2.9 watts as 48 volts dc. 4.7 watts at 125 volts dc.

Operate Time:
- Pick Up: 3 to 6 milliseconds.
- Drop Out: 90 to 130 milliseconds.

Contact Rating:
- A. 20 amperes noninterrupting for less than 200 milliseconds.
- B. 1.3 amperes resistive at 125Vdc.
- C. Will control MG-6, SG, or AR relays at 125Vdc.

Trip Circuit

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

Indicating Contactor Switch (ICS)

Three different operate level ratings are available for the indicating contactor switch.

Trip Circuit Constants (ICS)

0.2 Ampere dc rating—8.5 ohms dc resistance
1.0 Ampere dc rating—0.37 ohm dc resistance
2.0 Ampere dc rating—0.10 ohm dc resistance

SETTINGS

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 55-64-70-82-93-105-120-140 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.

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 and 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.

Indicating Contactor Switch (ICS)

There are no settings to make on the indicating contactor switch.

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

TAPS				
120 Volt Relay	240 Volt Relay	Volt-Amps.	Power Factor	Watts
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

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 the semi-flush type FT case. 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 and the relay panel. Ground wires should be affixed to the mounting screws as required for poorly grounded or insulating panels. Other electrical connections may be made directly to the terminals by means of screws for steel panel mounting.

For detail information on the FT case refer to I.L. 41-076 for semiflush mounting.

ADJUSTMENTS & MAINTENANCE

Proper adjustments have been made at the factory. Upon receipt of the relay no customer adjustments, other than those covered under "SETTINGS" should be required.

Performance Check

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

CV Unit

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 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".

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

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%.

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%.

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 nameplate rating. The indicator target should drop freely.

Repeat above except pass 85% of ICS nameplate rating current. Contacts should not pickup and target should not drop.

Routine Maintenance

All the relays should be inspected and the time of operation should be checked once a year or at such time intervals as may be dictated by experience to be suitable to the particular application.

All contacts should be cleaned periodically. 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 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 "Performance check").

CV Unit

Note: A spring shield covers the reset spring of the overcurrent unit. To remove the spring shield requires that the damping magnet be removed first. The screw connection holding the lead to the moving contact should be removed next. The second screw holding the moving contact assembly should then be *loosened, not removed.* (Caution: this screw terminates into a nut held captive beneath the molded block. If screw is removed, difficulty will be experienced in the reassembly of the moving contact assembly.) Slide the spring shield outward and remove from relay. Tighten the screw holding the moving contact assembly to the molded block.

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 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!'

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.

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%.

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%

Install the permanent magnet.

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 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 B.

CV-24 and CV-25 Overvoltage 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.

CV-26 and CV-27 Over or Undervoltage Relay—Apply the indicated voltage of Table B and measure the oper-

ating 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 as shown in Table B.

TABLE B

Type Relay	Percent Pickup Or Tap Value Voltage	Time Dial Setting	Operating Time in Sec.	Reset Time in Sec.
CV-21	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

Indicating Contactor Switch (ICS)

Initially adjust unit on the pedestal so that armature fingers do not touch the yoke in the reset position (viewed from top of switch between cover and frame). This can be done by loosening the mounting screw in the molded pedestal and moving the ICS in the downward position.

a. Contact Wipe—Adjust the stationary contact so that both stationary contacts make with the moving contacts simultaneously and wipe 1/64'' and 3/64'' when the armature is against the core.

b. Target—Manually raise the moving contacts and check to see that the target drops at the same time as the contacts make or up to 1/16'' ahead. The cover may be removed and the tab holding the target reformed slightly if necessary. However, care should be exercised so that the target will not drop with a slight jar.

c. Pickup—The unit should pickup at 98% rating and not pickup at 85% of rating. If necessary, the cover leaf springs may be adjusted. To lower the pickup current use a tweezer or similar tool and squeeze each leaf spring approximate equal by applying the tweezer between the leaf spring and the front surface of the cover at the bottom of the lower window.

If the pickup is low, the front cover must be removed and the leaf spring bent outward equally.

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. Check with the factory to determine what affect any field repairs might have on factory certification of this relay.

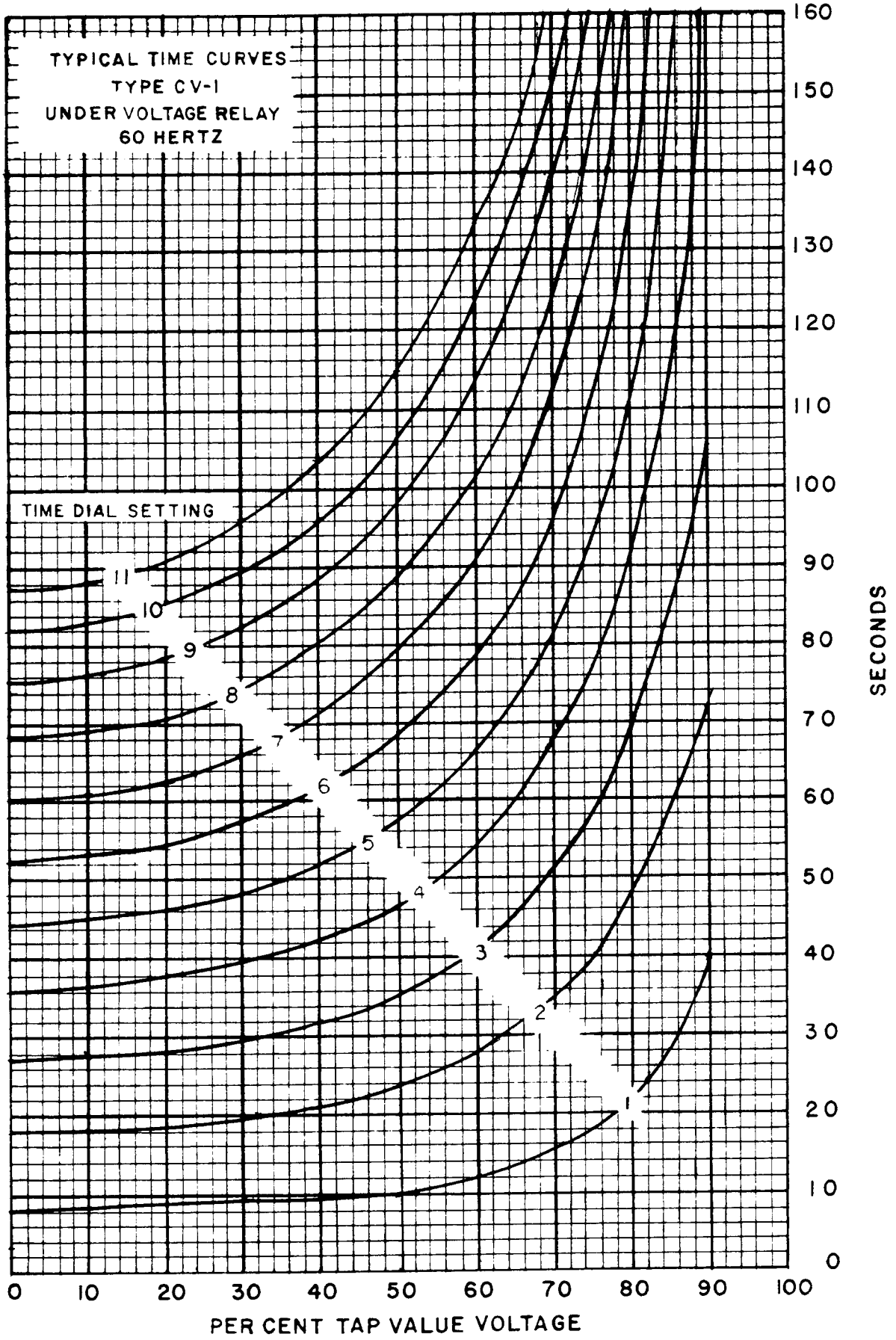

Fig. 1. Typical 60 Hz Time Curves for Type CV-21 Long Time Undervoltage Relay. (Curve 619536)

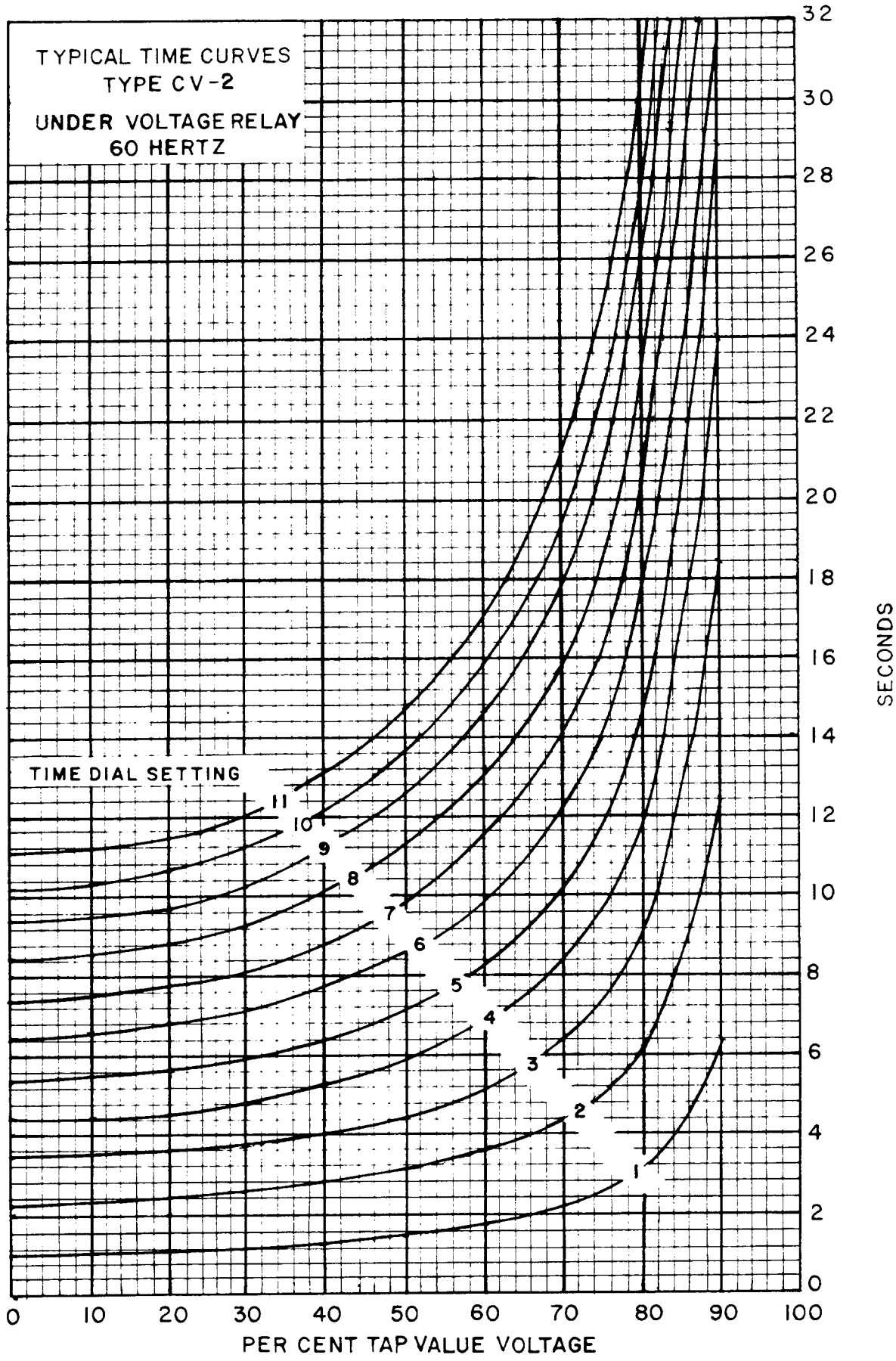

Fig. 2. Typical 60 Hz Time Curves for Type CV-22 Short Time Undervoltage Relay. (Curve 619535)

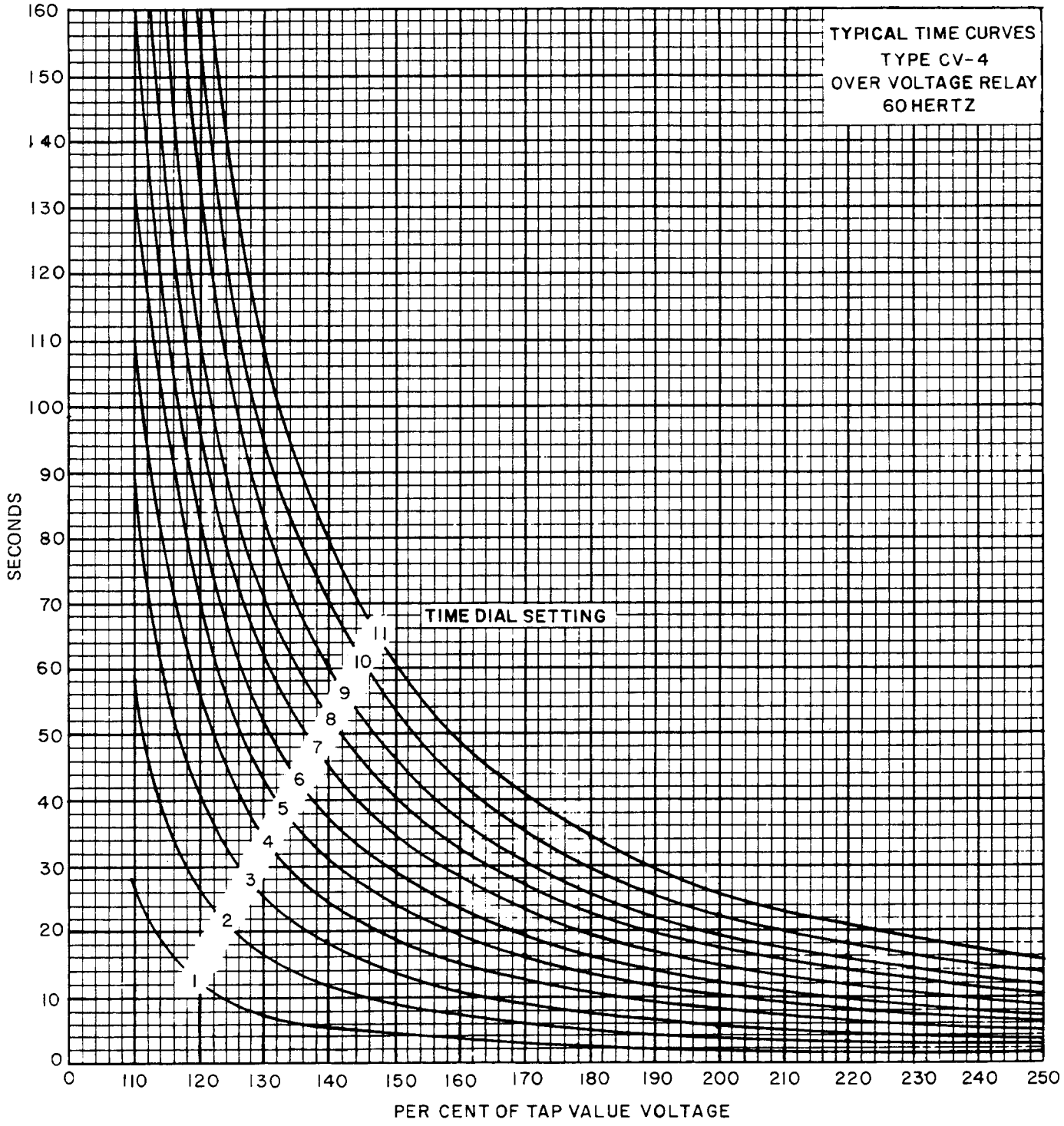

Fig. 3. Typical 60 Hz Time Curves for Type CV-24 Long Time Overvoltage Relay. (Curve 1582C28)

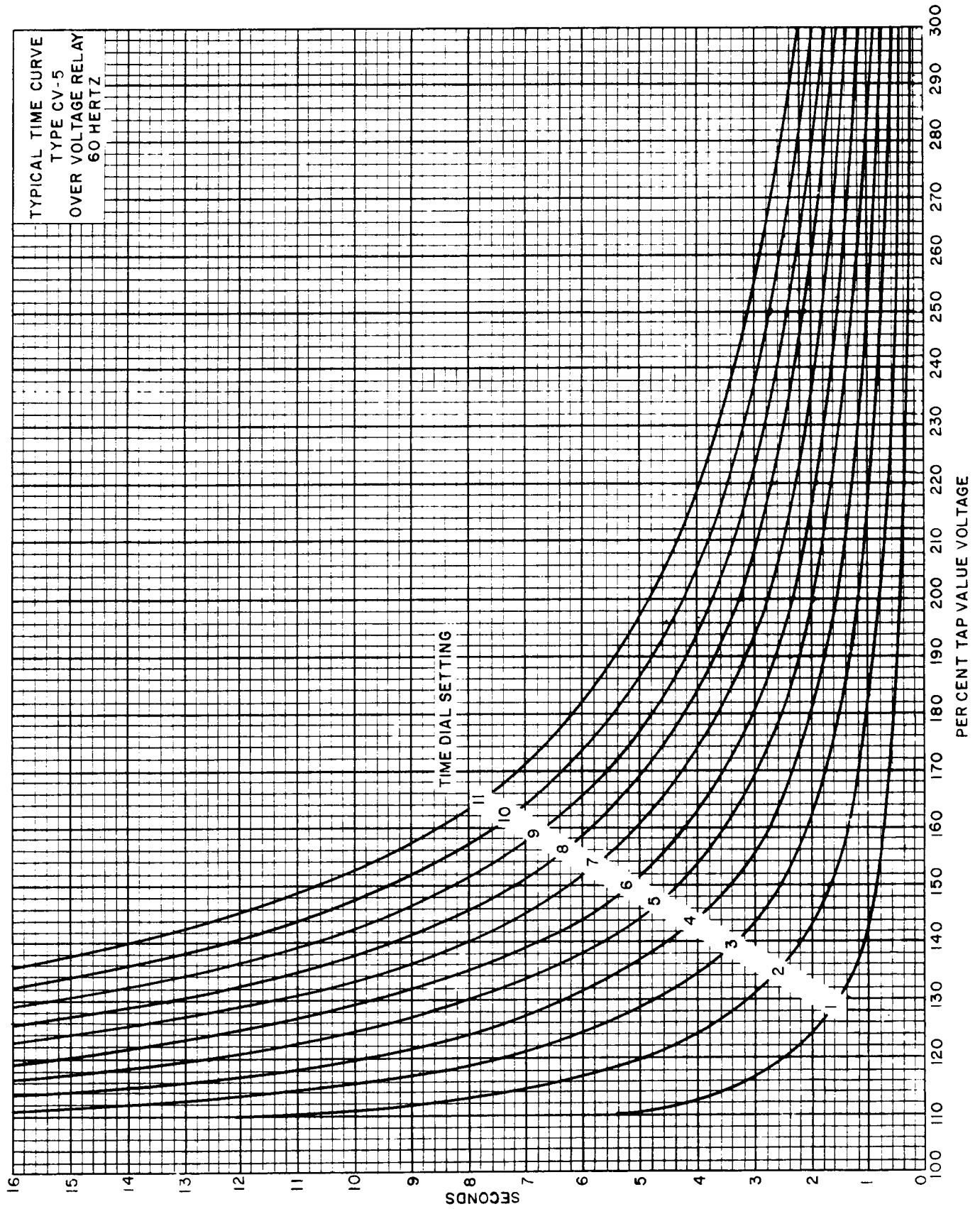

Fig. 4. Typical 60 Hz Time Curves for Type CV-25 Short Time Overvoltage Relay (Curve 1582C31)

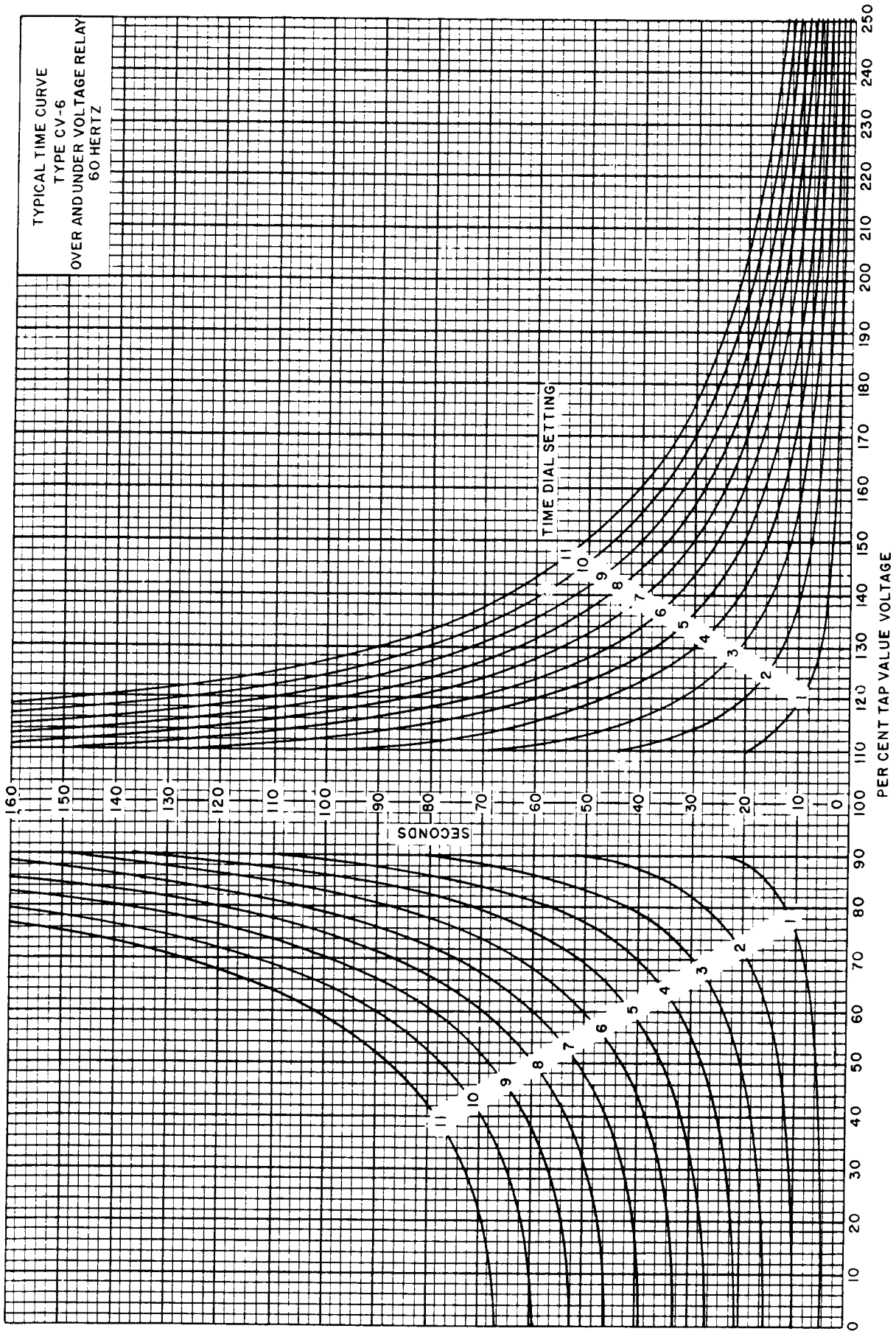

Fig. 5. Typical 60 Hz Time Curves for Type CV-26 Long Time Over and Undervoltage Relay (Curve 1582C29)

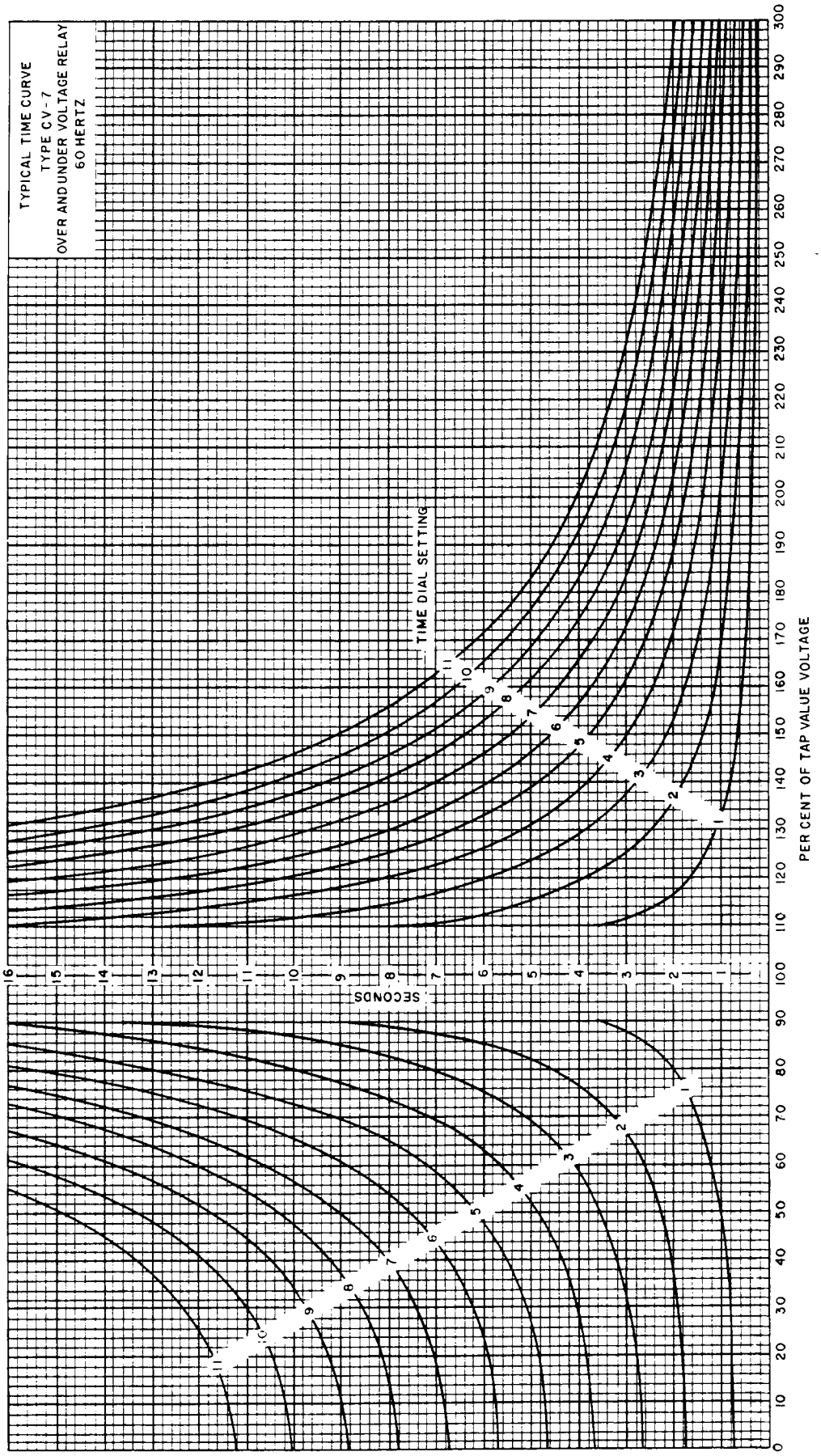

Fig. 6. Typical 60 Hz Time Curves for Type CV-27 Short Time Over and Undervoltage Relay (Curve 1582C30)

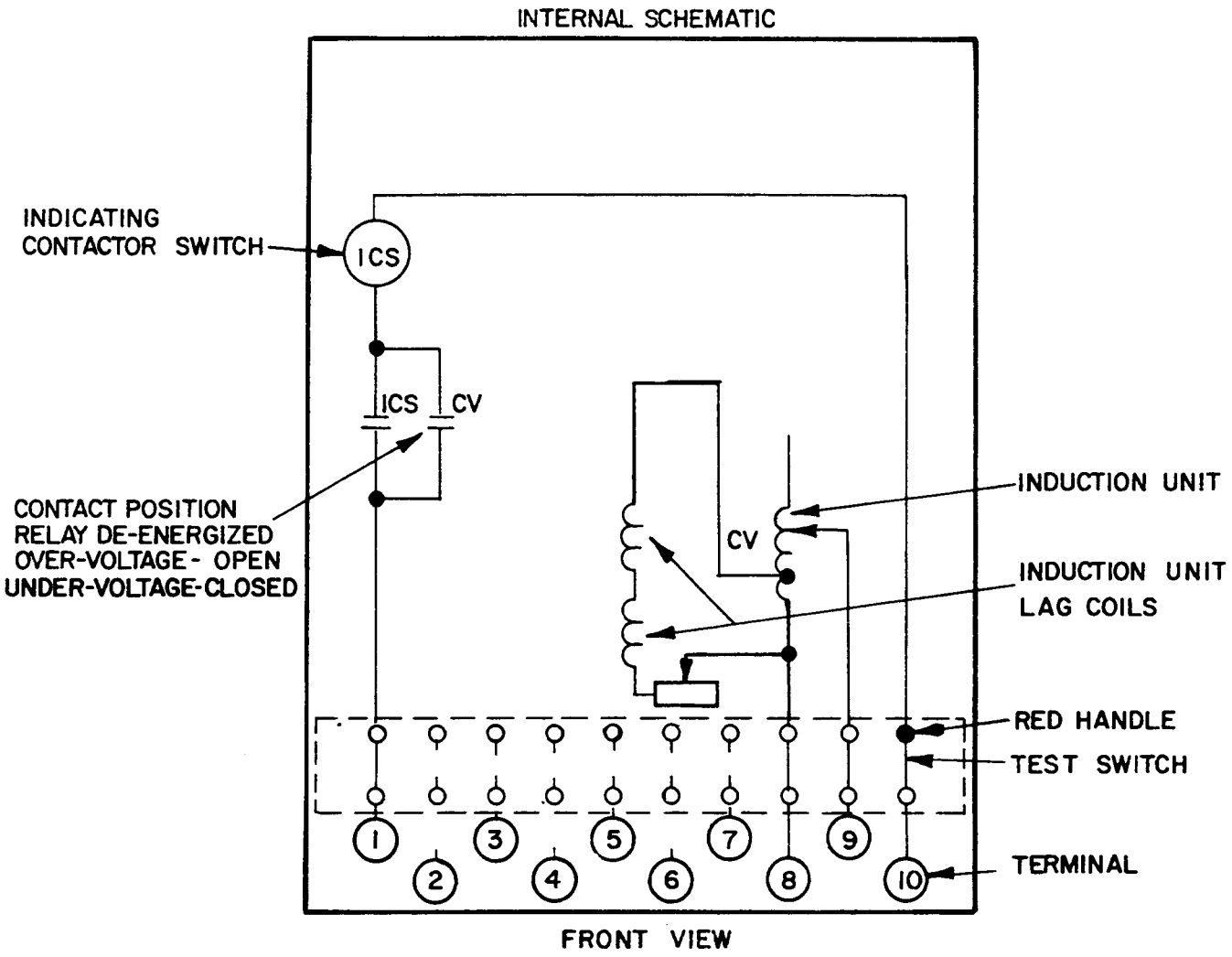

Fig. 7. Internal Schematic of Type CV Undervoltage or Overvoltage Relay in FT 11 Case. (3528A05 Sub. 2)

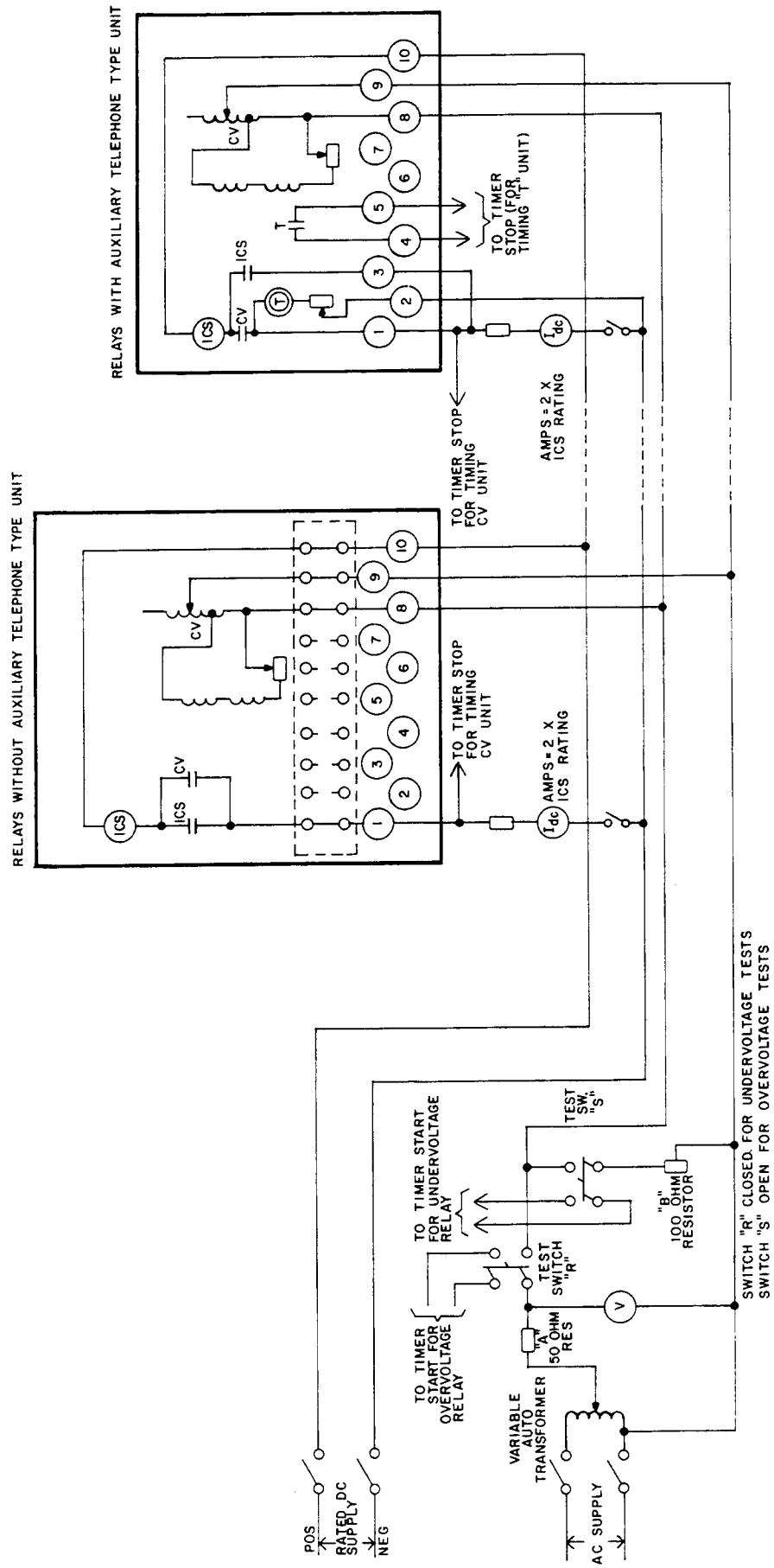

Fig. 8. Diagram of Test Connections for Type CV Undervoltage or Overvoltage Relay. (1598C44)

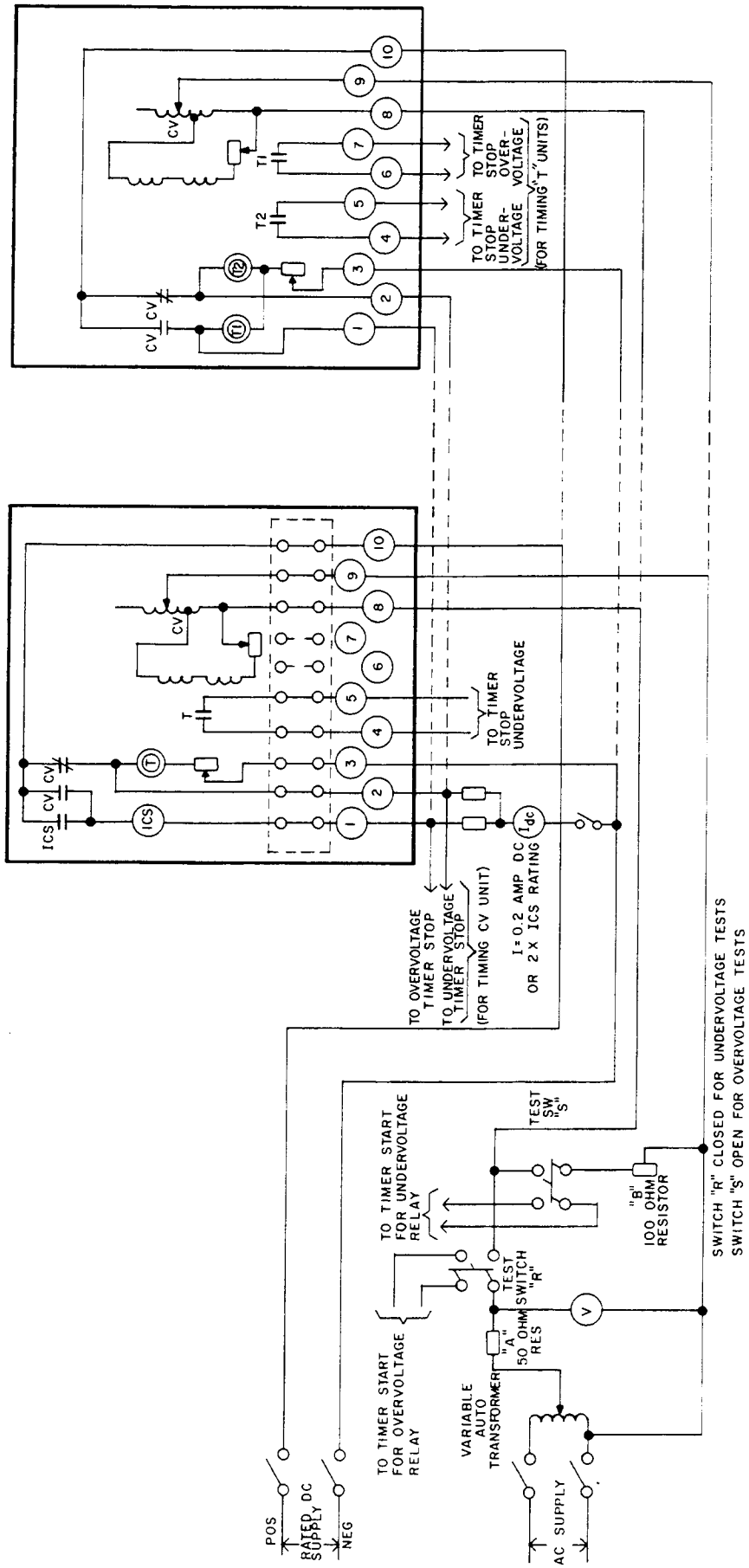

Fig. 9. Diagram of Test Connections for Type CV Over and Undervoltage Relay. (1598C39)

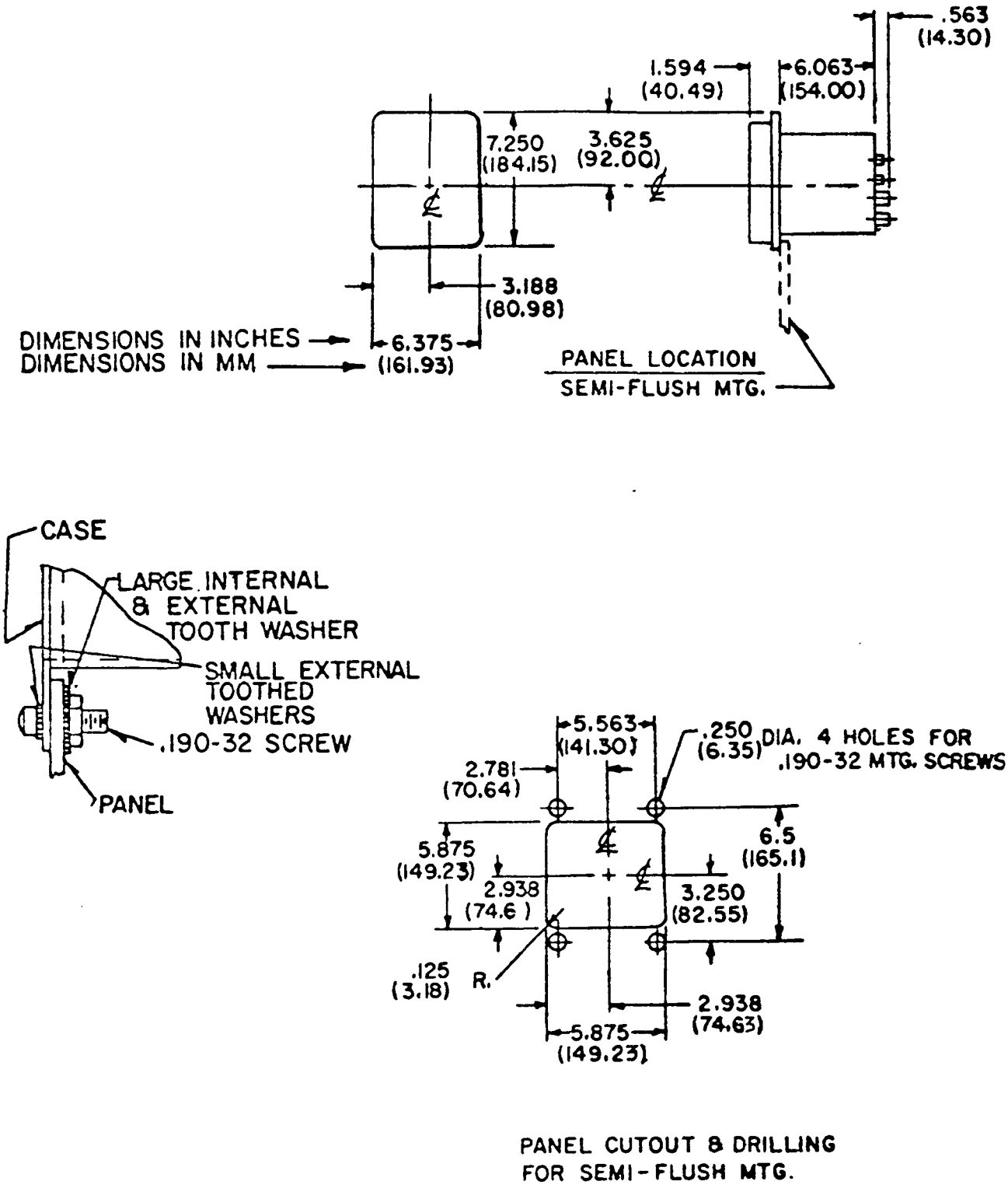

Fig. 10. Outline and Drilling Plan for the Type CV Relay in the FT 11 Case. (3519A65)