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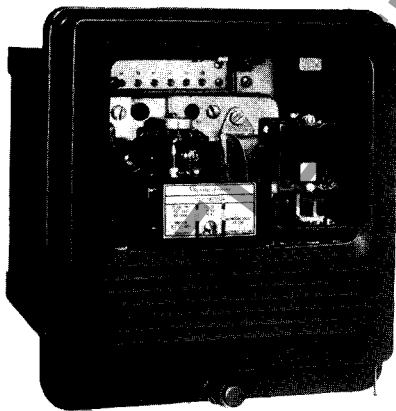
Descriptive Bulletin
41-200

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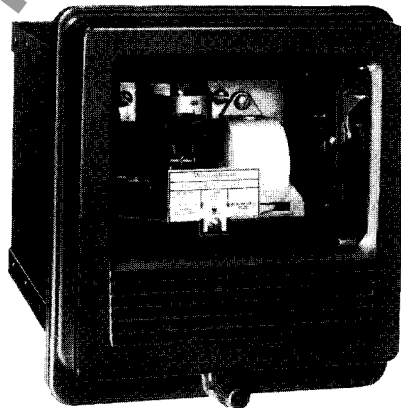
July, 1978
Supersedes DB 41-200
dated January, 1969
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For Under and/or
Overvoltage Protection

Voltage Relays Types CV, CVD, CV-8



Type CV-8
FT-21 Case



Type CVD
FT-11 Case



Type CV
FT-11 Case

Application

Low Voltage Protection

A low voltage condition will prevent motors from reaching their rated speed on starting or cause them to lose speed and draw heavy overload current. While overload relays will eventually detect this condition, the motor should be quickly disconnected when severe low voltage conditions exist. Where continuous operation is essential, such as station auxiliary service or continuous manufacturing processes, the CV relay is used for alarm purposes only.

Voltage Transfer Schemes

When alternate sources of power exist, such as double-ended transformer units, the CV relay can be applied to initiate switching of the station bus to the alternate source.

The CVD relay is used in control circuits to initiate switching when the line voltage increases or decreases beyond a predetermined value.

CV-21 to CV-27 relays are frequency compensated, and maintain a fixed pickup voltage over a wide range of frequency. They are used in hydro machines.

Timing Applications

The CV relay has an accurate operating time characteristic over a wide range of time dial positions and minimum operating voltages. It is frequently used where specific time intervals are required after application of normal voltage or the increase or decrease from normal voltage.

Induction Motor Undervoltage Protection

During transitory faults, such as lightning strokes, an overhead line may be momentarily de-energized while the fault arc is being extinguished. During this period it is desirable to prevent disconnection of the motor load, and realize maximum benefit from fast reclosing schemes. Time delay CV relays are used to keep the motor load in service.

Ground Fault Protection of Ac Generator Windings

The single unit CV-8 relay provides effective ground fault protection for generator stator windings. It is relatively insensitive to third harmonic (180 hertz) voltage, and will not operate for third harmonic load unbalance which normally flows in the generator neutral. The CV-8 has a 60-hertz pickup voltage of 8% of rating, and provides good sensitivity for light ground faults in the machine.

Features

Low burden due to high efficiency of "E" type electromagnet.

Small size FT-11 case permits optimum use of panel space.

Frequency compensated designs having a variation in pickup of less than 5% over the frequency range of 30 to 90 hertz, applied on hydro operation.

Variety of designs available including units with single, double, or single-pole double-throw contacts with dc or ac seal-in units or instantaneous voltage units.

Harmonically restrained CV-8 relay provides excellent ground fault detection of generator stator windings.

Device Numbers

CV-1, CV-2, CV-21, CV-22	27
CV-4, CV-5, CV-24, CV-25	59
CV-6, CV-7, CV-26, CV-27	27 or 59
CV-8	59N
CVD	27 or 59

Operation and Construction

1 Mounting Frame

Solid one-piece die-cast aluminum. Assures accurate and permanent alignment of all components.

2 Left Stationary Contact

Has supporting plate which is reversible to eliminate wipe when used in quick opening applications with high speed reclosers.

3 Right Stationary Contact

On CV-6, 7, 26, and 27 relays, the left (front) stationary contact is closed at tap value voltage, and the right (back) contact will close at a lower voltage which is within 5% of this value.

4 Time Dial

Indicates initial position of the moving contact. It is indexed from position $\frac{1}{2}$ (minimum time) to 11 (maximum time). See time curves, pages 4 and 5.

3 Damping Magnet

High strength Alnico. Used for damping the induction disc.

CV-1, 2, 4, 5, 6, 7

These relays consist of a voltage unit employing the electromagnetic induction disc construction (as shown in figure 1), and an Indicating Contactor Switch unit (ICS). See Performance Data 41-100.

The voltage unit consists of an "E" shaped laminated core which has a main tapped coil and a shading coil on one of the outer legs to shift the flux out of phase.

In operation, the out-of-phase flux interacts with the main coil flux to create a torque on the disc. Rotation of the disc is opposed by a spiral spring which resets the contacts and disc to their normal position when the applied voltage falls below the tap setting value. The voltage values indicated by the tap plate are the minimum voltages required to close the relay contacts.

On overvoltage relays types CV-4 and CV-5, the contacts close at tap value or above. On undervoltage types CV-1 and CV-2, the contacts open at tap value or above. On the over and undervoltage types CV-6 and CV-7, the tap value is the voltage at which the relay's front contact closes. The back contact will close within 5% of this value.

CV-8

The CV-8 uses the same basic induction

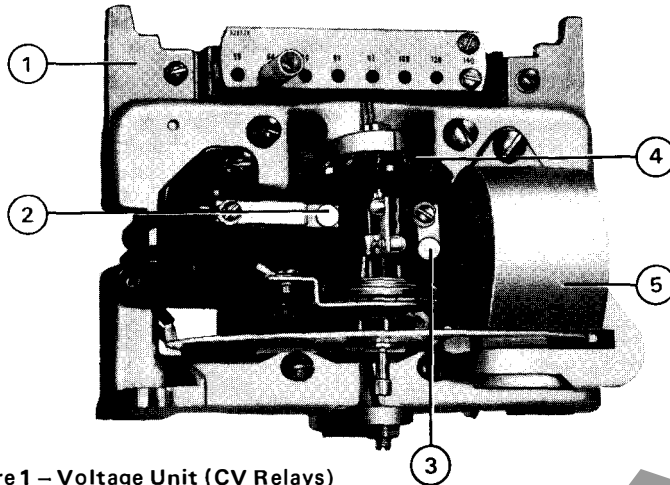


Figure 1 – Voltage Unit (CV Relays)

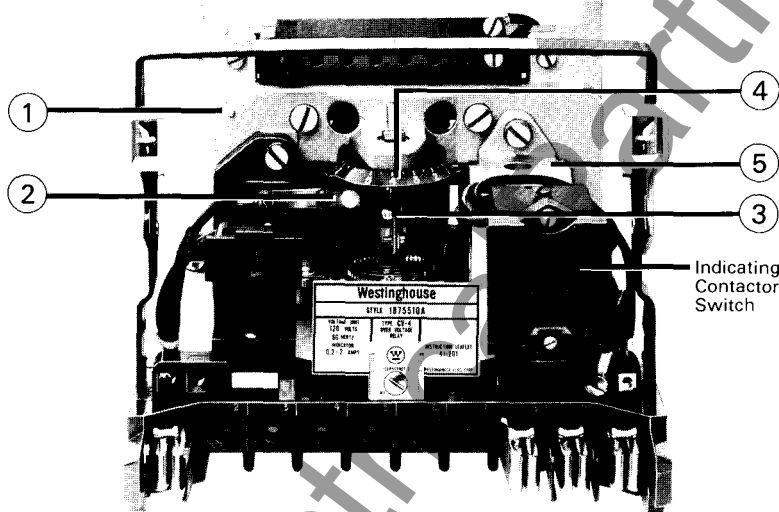


Figure 2 – Type CV-4 Relay – Front View, Chassis

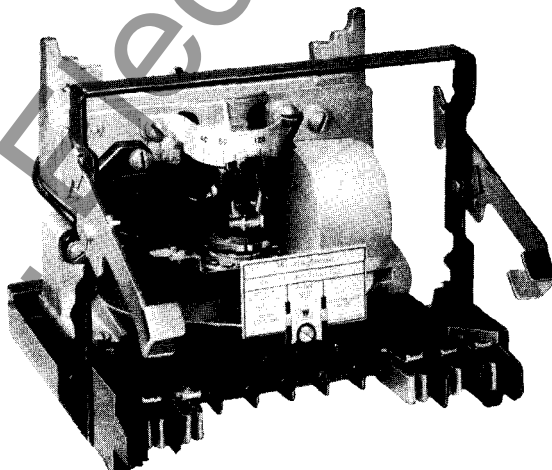


Figure 3 – Type CVD, Chassis View

disc voltage unit and Indicating Contactor Switch as types CV-1 to CV-7, but in addition includes a built-in capacitor connected in series with the electromagnet coil to filter out third harmonic voltage.

It is designed for low pickup value (8% of continuous voltage rating) in generator ground fault detection schemes. Additional data on this application is given on page 6.

CV-21, 22, 24, 25, 26, 27

These relays employ the same basic induction disc voltage unit and Indicating Contactor Switch and operate similar to types CV-1 to CV-7, except that they include a frequency compensating resistor connected in the outer leg coil circuit of the "E" type electromagnet. The compensating resistor enables them to maintain their 60 cycle pickup voltage and/or dropout values within 5% over a variable input frequency of from 30 to 90 hertz.

Their contact arrangements and characteristic curves are the same as those for the comparable CV-1 to CV-7 types.

CVD (Fig. 3)

Type CVD incorporates the same basic electromagnetic induction disc voltage unit used in the CV-1 to CV-7 types, but is constructed to operate essentially as a contact making voltmeter, with high and low voltage contacts, which are independently adjustable over a calibrated scale.

Upon application of voltage to the relay, the disc moves to a position in its travel that corresponds to the applied voltage, and remains in this position until the applied voltage changes. It then moves to a position corresponding to the new voltage value. Since the movement of the disc from one position to another is under the control of the restraining spring and the damping magnet, the relay has inverse timing characteristics. The greater the change in applied voltage, the faster the relay disc and moving contact will travel.

ICS, ACS, and IIV Units

ICS: The Indicating Contactor Switch is a dc current operated device having a magnetic armature to which leaf-spring contacts are attached. When energized at pickup value, the moving contacts bridge the stationary contacts and seal in around the main relay contacts, relieving them of carrying heavy trip currents. The switch has a target which indicates completion of the trip circuit.

ACS: Similar to the ICS unit, except that it is ac current operated.

IIV: Also similar to the ICS unit, except that it is ac voltage operated

Refer to Performance Data 41-100 for further details.

Contact Arrangements Available

Relay	Contacts	De-energized Position ^①	Energized Position ^①
Undervoltage CV-1, CV-2, CV-21, CV-22	Spst, dpst	Left contact closed	Left contact open at tap value or above
Overvoltage CV-4, CV-5, CV-24, CV-25	Spst, dpst	Left contact open	Left contact closed at tap value or above
Under or Overvoltage CV-6, CV-7, CV-26, CV-27	Spdt	Left contact open Right contact closed	Left contact closes at tap value or above Right contact closes below tap value
Low Pickup Overvoltage CV-8	Spst, dpst	Left contact open	Left contact closed at minimum pickup or above
Harmonic Restraint CV-8	Spdt	Left contact open Right contact closed	Left contact closed at minimum pickup or above Right contact open
Over and Undervoltage CVD	Spdt	Left contact closed Right contact open	Left contact opens at low voltage setting Right contact closes at high voltage setting

① Front view.

Thermal Capacities and Burden Data (60 Hertz)

Tap Value: Volts			Volt-Amperes ②	Power Factor Angle ^③	Watts
120 Volts Nominal	240 Volts Nominal	480 Volts Nominal			
CV-1, 2, 4, 5, 6, 7^④					
55	110	220	10.0	67°	3.8
64	128	256	7.0	69°	2.5
70	140	280	5.8	70°	2.0
82	164	328	4.0	71°	1.3
93	186	372	3.1	72°	1.0
105	210	420	2.4	73°	.7
120	240	480	1.8	74°	.5
140	280	560	1.3	75°	.3

CV-21, 22, 24, 25, 26, 27^④

55	110	...	14.4	64°	6.3
64	128	...	10.4	66°	4.2
70	140	...	8.3	67°	3.3
82	164	...	6.0	68°	2.2
93	186	...	4.7	69°	1.6
105	210	...	3.6	70°	1.3
120	240	...	2.8	71°	.9
140	280	...	2.0	72°	.6

Voltage Rating	Maximum Continuous Voltage	Volt-Amperes ⑤	Power Factor Angle	Watts
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CV-8^⑦

67	67	30.0	70° ^⑥	10.0
199	199	30.0	70° ^⑥	10.0

CVD

30-120	132	7.85	70° ^③	2.67
40-160	176	7.85	70° ^③	2.67
80-320	352	7.85	70° ^③	2.67
105-135	148	16.5	78° ^③	3.52
210-270	296	16.5	78° ^③	3.52

② At nominal rating.

③ Degrees current lags voltage.

④ Maximum continuous voltage is 110% of nominal or tap voltage, whichever is higher.

⑤ At maximum continuous voltage.

⑥ Degrees current leads voltage.

⑦ Minimum pickup is 8% of continuous rating



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Time Curves, 60 Hertz Undervoltage

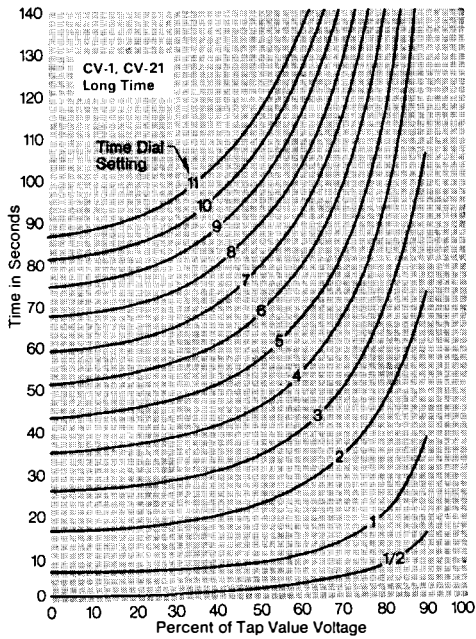


Figure 4

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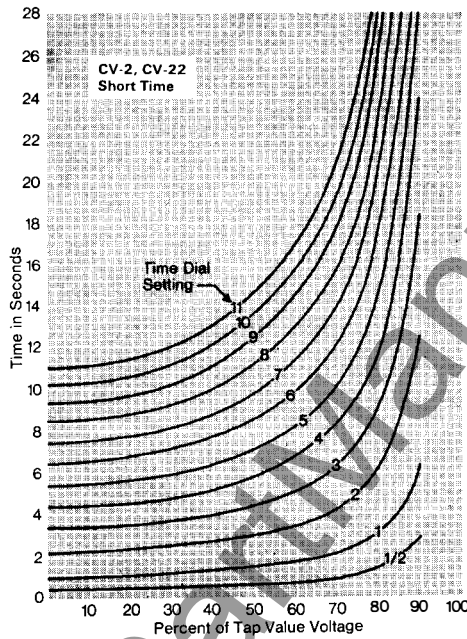


Figure 5

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Overvoltage

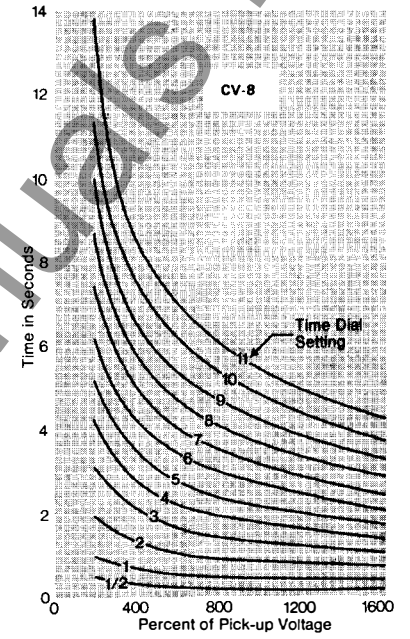


Figure 6

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Overvoltage

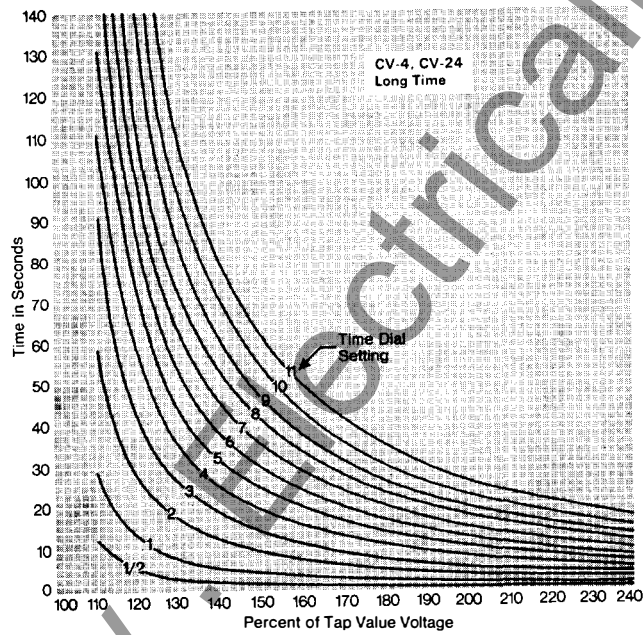


Figure 7

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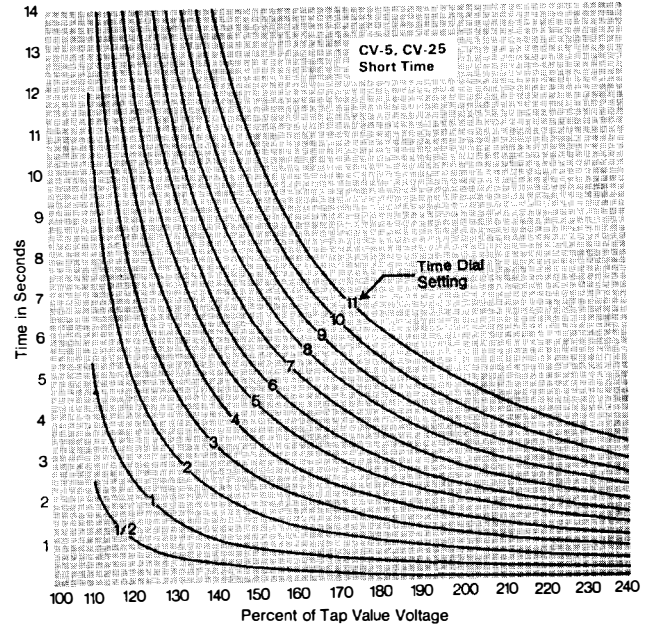
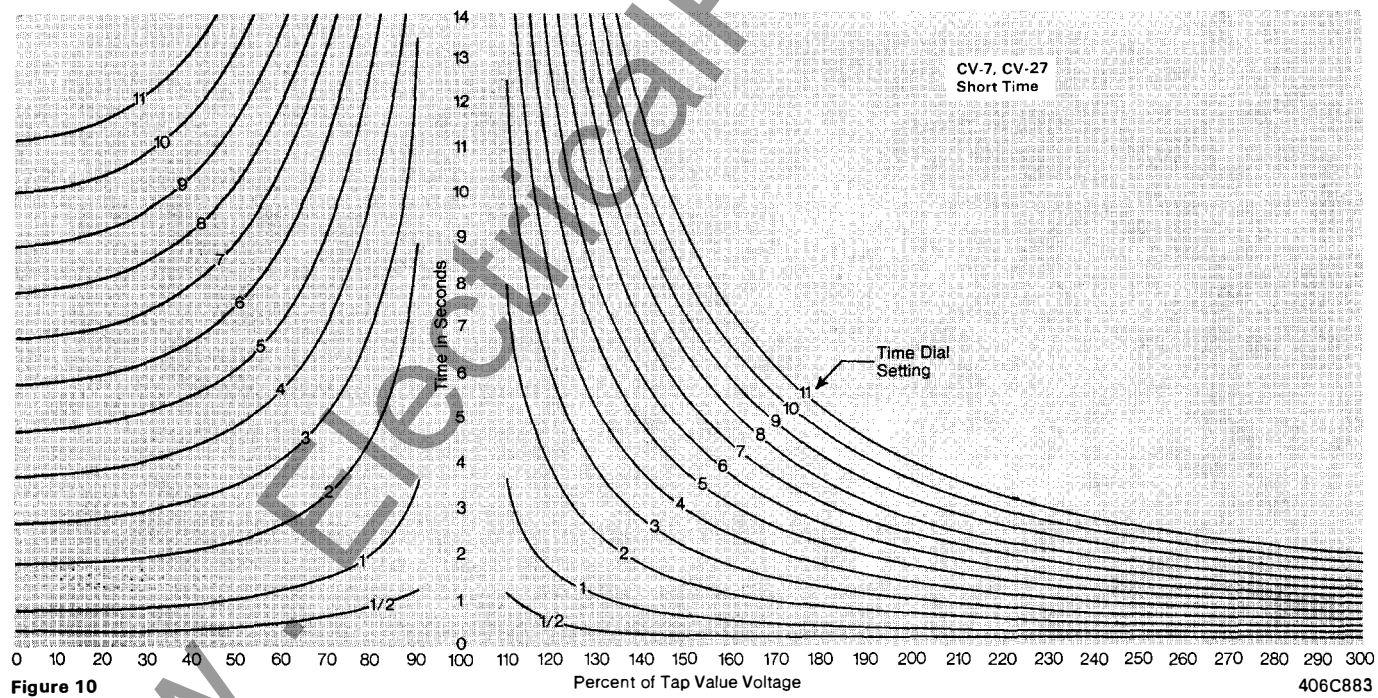
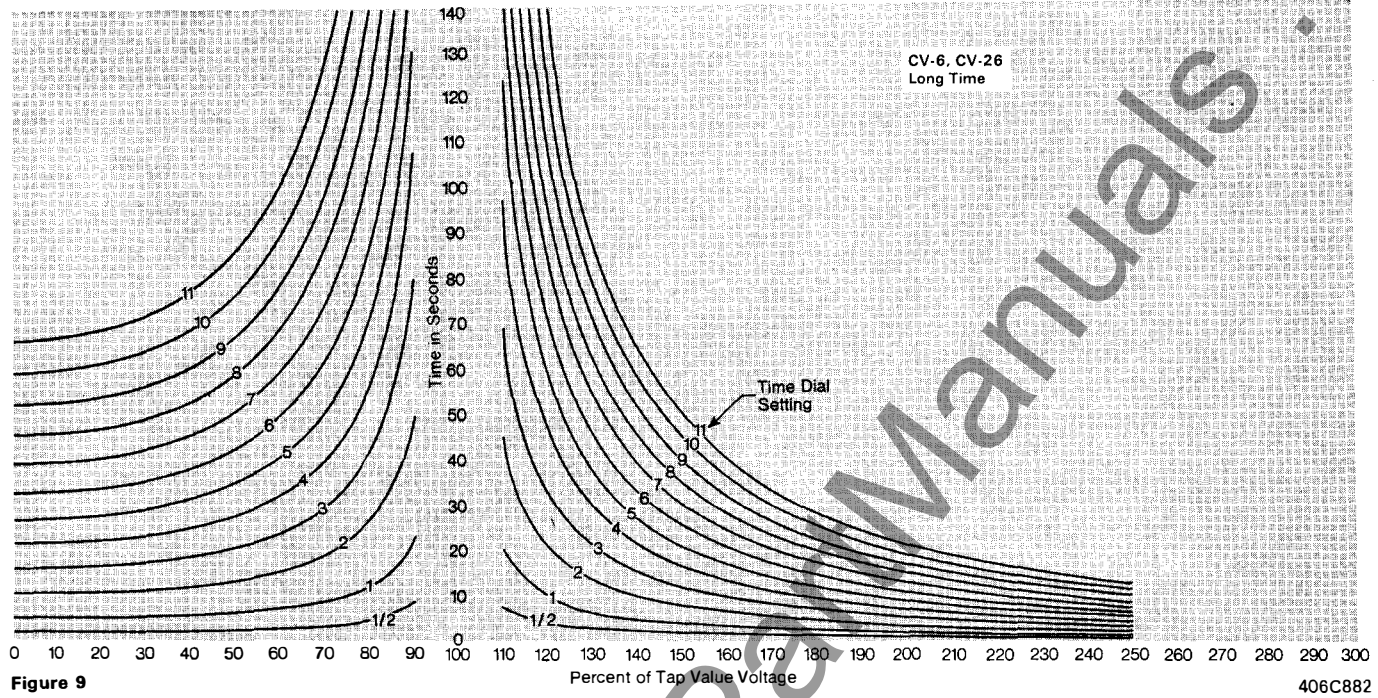


Figure 8

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Under or Overvoltage^①



^① Operating time between adjacent curves can be obtained by a continuous time dial adjustment.



Generator Ground Protection (Type CV-8) Typical Application of Low Pickup Overvoltage Relay (Ground Fault Protection of Ac Generator Windings)

The generator neutral is grounded through a distribution transformer. The primary of the transformer is rated for generator line-to-line voltage, secondary for 120 or 240 volts. A CV-8 low pickup relay is used to detect ground fault in the generator winding. The relay contains a tuned filter circuit which offers high impedance to 180 hertz voltage (third harmonic) and low impedance to 60 hertz voltage.

The 67 volt CV-8 relay can withstand 67 volts continuously and 140 volts for 2 minutes. If the relay is to be used for an alarm or a timing function where the above values are exceeded, it is advisable to use the 199 volt CV relay. If however, a more sensitive pickup is required, a 67 volt relay may be used in conjunction with one SV relay and an external resistor as shown dotted on figure 10. Using a 70-160 volt SV relay and a 375 ohm, 8½-inch external resistor, the

combination is rated at 160 volts continuous. R₂ resistor assembly is style number 1956 449. At 70 volts, the SV relay picks up, opening its contact, and inserting the resistor in series with the type CV-8 relay, thus reducing the voltage impressed across the CV-8 coil.

Due to the high impedance of the CV-8 during generator warm-up or reduced frequency operation, an additional adjustable SV relay rated 7-16 volts, 60 hertz is used to back up the CV-8. The SV is set to initiate tripping. With a 7 volt, 60 hertz setting, it will operate at 2 volts, 15 hertz or 3.5 volts at 30 hertz. During 60 hertz operation, the SV relay is disconnected by a 52b contact. A third harmonic filter circuit is not required with the SV because of the low values of third harmonic present during reduced frequency operation.

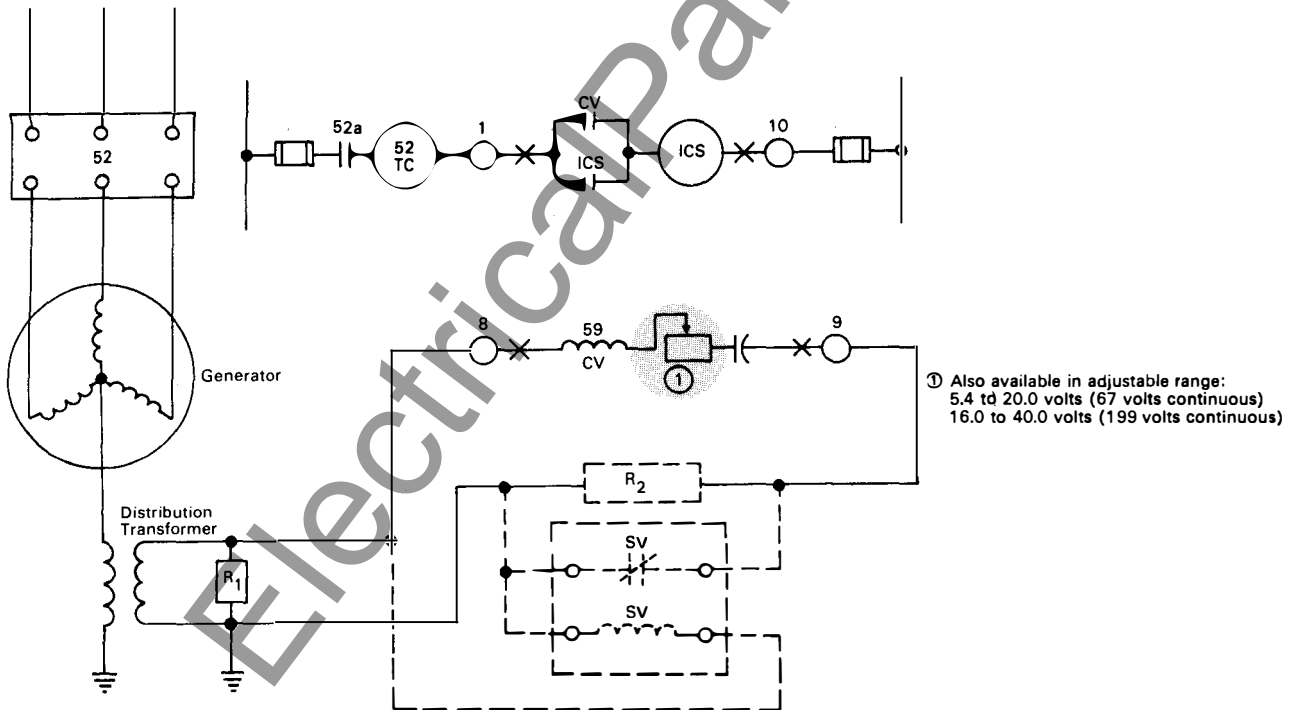


Figure 11

Device Number Chart

- 52 - Power Circuit Breaker
- 52a - Breaker Auxiliary Contact
- 52TC - Breaker Trip Coil
- 59 - Non-Directional Voltage Relay Type CV-8

- ICS - Indicating Contactor Switch
- R₁ - Resistor Supplied by Customer
- R₂ - Voltage Drop Resistor
- SV - Voltage Relay (see DB 41-765)



Shipping Weights and Carton Dimensions

Case Size	Weight: Lbs. (kg)		Domestic Shipping Carton Dimensions: Inches (mm)
	Net	Shipping	
FT-11	8 (3.6)	11 (5)	9 x 9 x 12 (23 x 23 x 31)
FT-21	10 (4.5)	13 (5.9)	9 x 12 x 13 (23 x 31 x 33)

Further Information

Ordering Information: TD 41-020; Prices: PL 41-020
Case Dimensions: DB 41-075
Instruction, Maintenance and Installation: IL 41-201, IL 41-201.2
SV Voltage Relay: DB 41-765
Other Protective Relays: Selector Guides 41-000 A, B and C