ABB Power T&D Company Inc.
Power Automation and Protection Division
Coral Springs, FL 33065

Instruction Leaflet
I.L. 41-116J

# Type COV Voltage Controlled Overcurrent Relay

(50 and 60 Hertz)

Effective: May 1997
Supersedes I.L. 41-116H, Dated February 1984
( | ) Denotes Changed Since Previous Issue

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**This instruction leaflet applies to the following types of relays:**

**COV-6 Definite Minimum Time Relay**
**COV-7 Moderately Inverse Time Relay**
**COV-8 Inverse Time Relay**
**COV-9 Very Inverse Time Relay**
**COV-11 Extremely Inverse Time 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.**

## 1. APPLICATION

The COV relay is applicable where it is desired that an overcurrent unit be set to operate on less than full load current when the voltage falls below a predetermined value, and it is desired not to operate for any magnitude of current when the voltage is above the predetermined value. A typical application is overcurrent back-up protection for generators.

## 2. CONSTRUCTION AND OPERATION

The relay consists of an overcurrent unit, a voltage unit with adjustable resistor, an indicating contactor switch unit and an indicating instantaneous trip unit when required.

### 2.1. Overcurrent Unit (CO)

The electromagnets for the types COV-6, COV-7, COV-8 and COV-9 relays have a main tapped coil located on the center leg of an "E" type laminated structure that produces a flux which divides and returns through the outer legs. A shading coil causes the flux through the left leg to lag the main pole flux. The out-of-phase fluxes thus produced in the air gap cause a contact closing torque.

The electromagnet for the COV-11 relay has a main coil consisting of a tapped primary winding. Two identical coils on the outer legs of the lamination structure are connected to the main coil secondary in a manner so that the combination of all the fluxes produced by the electromagnet result in out-of-phase fluxes in the air gap. The out-of-phase air gap fluxes produced cause a contact closing torque.

### 2.2. Indicating Contactor Switch Unit (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 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 cover.

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

*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 Asea Brown Boveri representative should be contacted.*

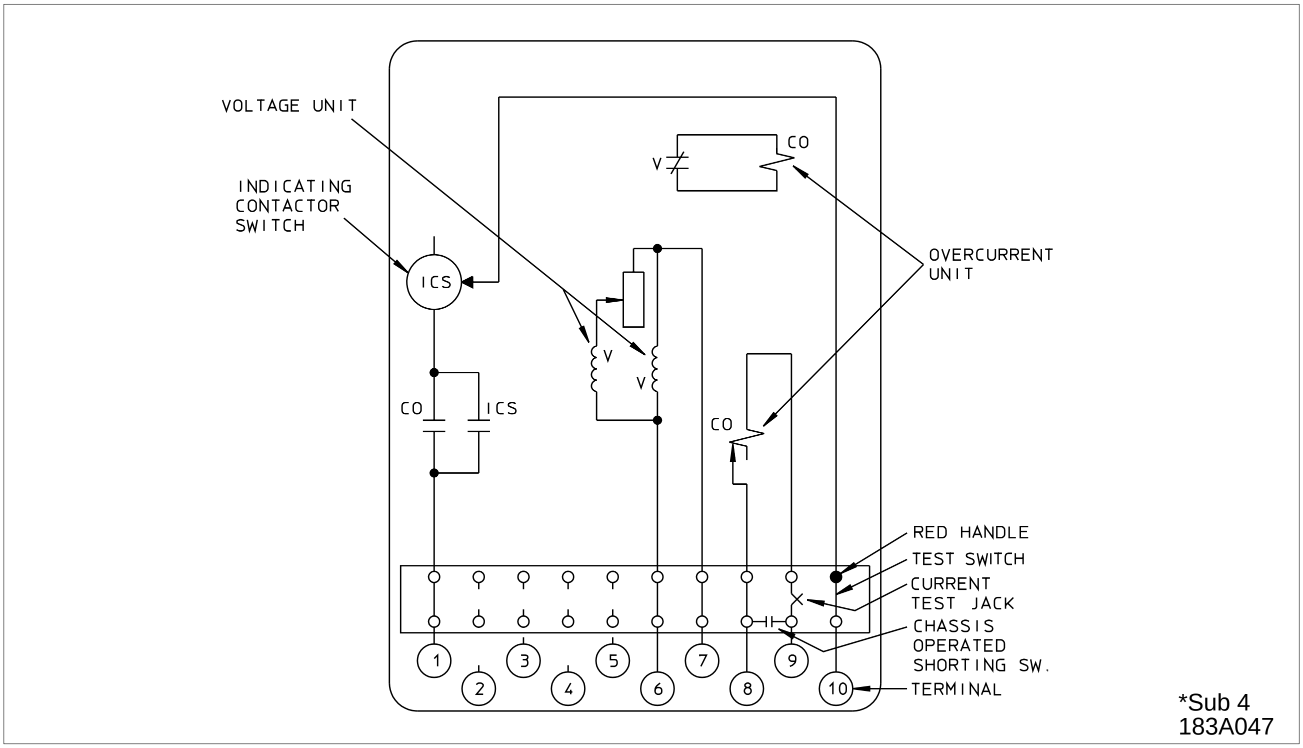



*Figure 1: Internal Schematic of the COV Relay in the Type FT-21 Case*

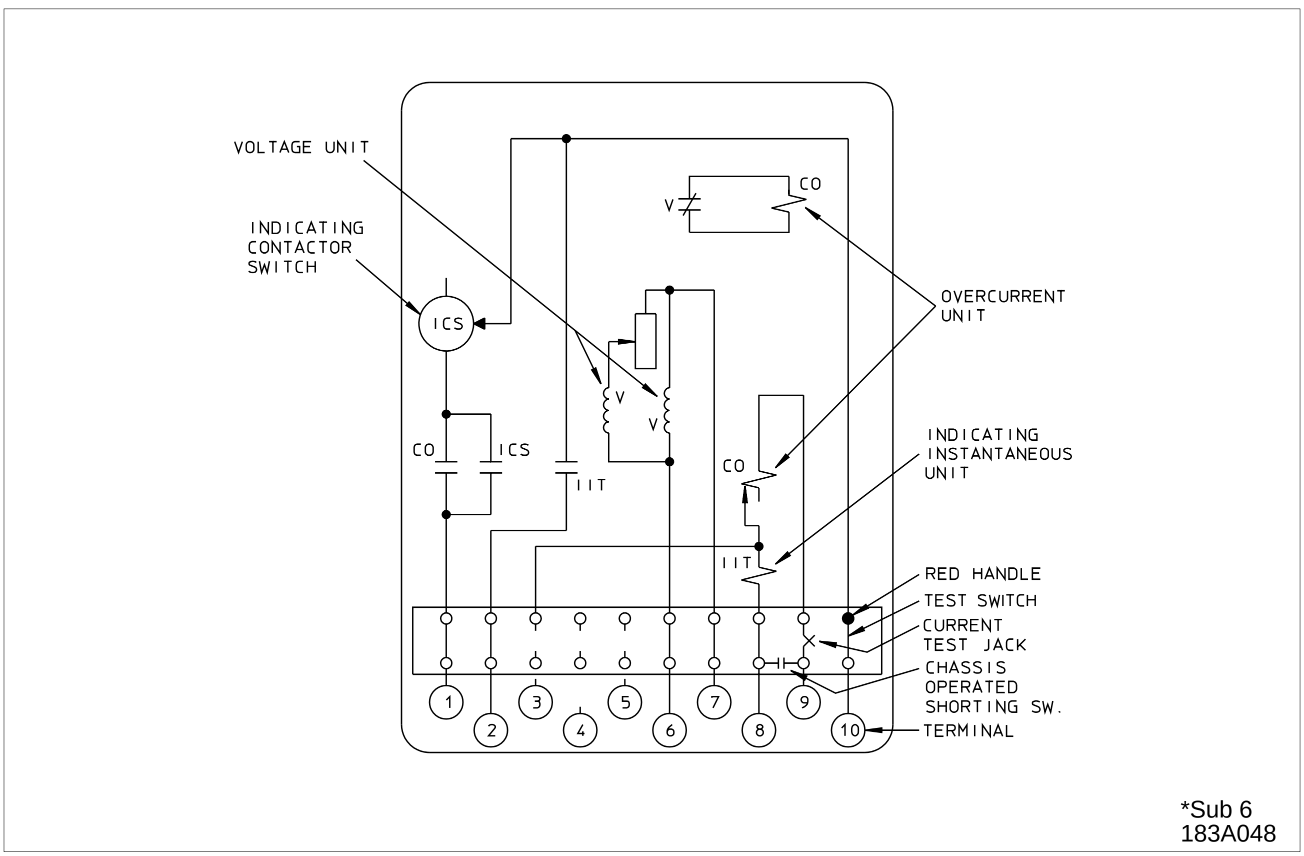



*Figure 2: Internal Schematic of the COV Relay with the Indicating Instantaneous Trip Unit in the Type FT-21 Case*

### 2.3. Indicating Instantaneous Trip Unit (IIT)

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 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.

A core screw accessible from the top of the switch provides the adjustable pickup range.

### 2.4. Voltage Unit (V)

The voltage unit is an induction cylinder type unit.

Mechanically, the voltage unit is composed of four basic components: A die-cast aluminum frame, an electromagnet, a moving element assembly, and a molded bridge.

The frame serves as the mounting structure for the magnetic core. The magnetic core which houses the lower pin bearing is secured to the frame by a locking nut. The bearing can be replaced, if necessary, without having to remove the magnetic core from the frame.

The electromagnet has two pairs of voltage coils. Each pair of diametrically opposed coils is connected in series. In addition; one pair is in series with an adjustable resistor. These sets are paralleled as shown in Figure 1 (page 2). The adjustable resistor serves not only to shift the phase angle of the one flux with respect to the other to produce torque, but it also provides a dropout adjustment.

Locating pins in the electromagnet are used to accurately position the lower pin bearing, which is mounted on the frame, with respect to the upper pin bearing, which is threaded into the bridge. The electromagnet is secured to the frame by four mounting screws.

The moving element assembly consists of a spiral spring, contact carrying member, and an aluminum cylinder assembled to a molded hub which holds the shaft. The shaft has removable top and bottom jewel bearings. The shaft rides between the bottom pin bearing and the upper pin bearing with the cylinder rotating in an air gap formed by the electromagnet and the magnetic core. The stops for the moving element contact arm are an integral part of the bridge.

The bridge is secured to the electromagnet and frame by two mounting screws. In addition to the holding the upper pin bearing, the bridge is used for mounting the adjustable stationary contact housing. The stationary contact housing is held in position by a spring type clamp. The spring adjuster is located on the underside of the bridge and is attached to the moving contact arm by a spiral spring. The spring adjuster is also held in place by a spring type clamp.

With the contacts closed, the electrical connection is made through the stationary contact housing clamp, to the moving contact, through the spiral spring out to the spring adjuster clamp.

## 3. CHARACTERISTICS

To prevent the relay from operating for currents above the overcurrent unit pick-up, the voltage unit contact is connected in the shading coil circuit of the overcurrent unit. The voltage contact is held open at voltages above the set point, to prevent torque from being produced in the overcurrent unit. This arrangement yields a tripping characteristic as shown in Figure 3 (page 4).

### 3.1. Overcurrent Unit

The relays are generally available in the following overcurrent unit current ranges:

| RANGE | TAPS | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.5 - 2.5 | 0.5 | 0.6 | 0.8 | 1.0 | 1.5 | 2.0 | 2.5 |
| 2 - 6 | 2 | 2.5 | 3 | 3.5 | 4 | 5 | 6 |
| 4 - 12 | 4 | 5 | 6 | 7 | 8 | 10 | 12 |

These relays may have either single or double circuit closing contacts for tripping either one or two circuit breakers.

The time vs. current characteristics are shown in Figures 4 to 8. These characteristics give the contact closing time for the various time dial settings when the indicated multiples of tap value current are applied to the relay.

### 3.2. IIT Unit

Current ranges available for this unit are: 2-8, 4-16, 10-40, 20-80, and 40-160.

### 3.3. Voltage Unit

The contact can be adjusted to close over a range of 80 to 100 volts. The contact opens if the voltage is

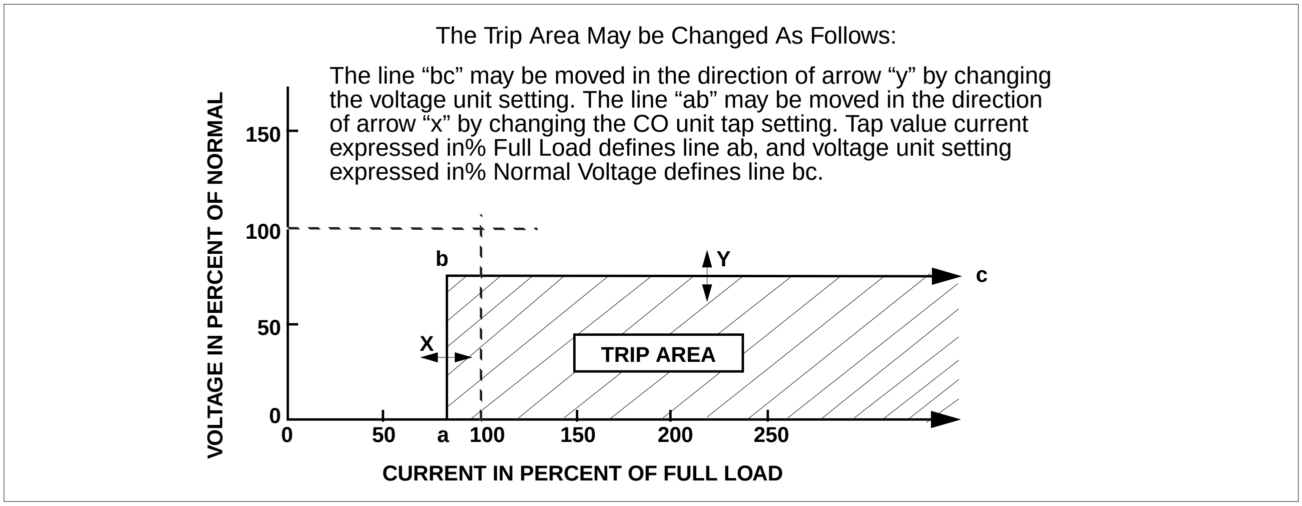



*Figure 3: Typical Tripping Characteristics of Type COV Relay*

higher than the set value. The dropout ratio of the unit is 98% or higher. Relays are shipped from the factory with a 90 volt setting.

### 3.4. Trip Circuit

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

The indicating instantaneous trip contacts will safely close 30 amperes at 250 volts dc, and will carry this current long enough to trip a 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.

#### 3.4.1. Trip Circuit Constants

Indicating Contactor Switch –

0.2 amp tap 6.5 ohms dc resistance

2.0 amp tap 0.15 ohms dc resistance

## 4. SETTINGS

**! CAUTION**

**Since the tap block screws carry operating current, be sure that the screws are turned tight.**

**In order to avoid opening current transformer circuits when changing taps under load, start with RED handles FIRST and open all switchblades. Chassis operating shorting switches on the case will short the secondary of the current transformer. Taps may then be changed with the relay either inside or outside the case. Then reclose all switchblades making sure the RED handles are closed LAST.**

### 4.1. Overcurrent Unit (CO)

The overcurrent unit settings can be defined either by tap settings and time dial position or by tap setting and a specific time of operation at some current multiple of the tap setting (e.g., 4 tap setting, 2 time dial position or 4 tap setting, 0.6 seconds at 6 times tap value current).

To provide selective circuit breaker operation, a minimum coordinating time of 0.3 seconds plus 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 makes connections to various turns on the operating coil. By placing this screw in the various terminal plate holes, the relay will respond to multiples of tap value currents in accordance with the various typical time-current curves.

#### 4.1.1. Instantaneous Reclosing

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

### 4.2. Indicating Contactor Switch (ICS)

The only setting required on the ICS unit is the selection of the 0.2 or 2.0 ampere tap setting.

### 4.3. Indicating Instantaneous Trip (IIT)

The core screw must be adjusted to the value of pick-up desired.

The nameplate data will furnish the actual current range that may be obtained from ITT unit.

### 4.4. Voltage Unit (V)

The voltage unit spring calibration is set to close its contact when the applied voltage is reduced to 80 volts. The voltage unit can be set close its contacts from 80 volts to 100 volts by adjusting the resistor located at the rear of the voltage unit. The spiral spring is not disturbed when making any settings other than the calibrated setting of 80 volts.

## 5. 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 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 terminals 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 detail information on the FT case refer to I.L. 41-076.

## 6. 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.

The indicating Instantaneous Trip unit (IIT) used in some relays requires a much higher current for tripping than is required by the other units. For this reason, the junction of the CO unit coil and the IIT unit coil is brought out to switch jaw no. 3 (whenever it is available) to permit the testing of these units separately.

**CAUTION**

**When applying current in excess of 50 amperes to the test IIT, the current should not be left on while adjusting it to the trip level. Instead, apply the current in short burst, not more than 2 seconds long, to check for tripping. Make adjustments in the current control while the current is off.**

High currents left on for excessive time periods can result in the softening and possible melting of insulation on the interconnecting wires.

### 6.1. Acceptance Check

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

#### 6.1.1. Overcurrent Unit (CO)

The directional unit contacts must be in the closed position when checking the operation of the overcurrent unit.

**A. Contact**

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".

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". 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".

**B. Minimum Trip Current**

Set the time dial to position 6. Alternately apply tap value current plus 3% and tap value current minus 3%. The moving contact should leave the backstop at tap value current plus 3% and should return to the backstop at tap value current minus 3%.

**C. 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 currents specified by Table 1 (e.g., for the COV-8, 2 and 20 time tap value current) and measure the operating time of the relay. The operating times should equal those of Table 1 plus or minus 5%.

**Table 1:**

| Time Curve Calibration Data –50/60 Hertz for Overcurrent Unit | | | | | |
|---|---|---|---|---|---|
| | | Permanent Magnet Adjustment | | Electromagnet Plug Adjustment | |
| Relay Type | Time Dial Position | Current (Multiples of Tap Value) | Operating Time (Seconds) | Current (Multiples of Tap Value) | Operating Time (Seconds) |
| 6 | 6 | 2 | 2.46 | 20 | 1.19 |
| 7 | 6 | 2 | 4.27 | 20 | 1.11 |
| 8 | 6 | 2 | 13.35 | 20 | 1.11 |
| 9 | 6 | 2 | 8.87 | 20 | 0.65 |
| 11 | 6 | 2 | 11.27 | 20 | 0.24∆ |
| ∆ *For 50 Hertz COV-11 relay, 20 times operating time limits are 0.24 + 10%, - 5%.* | | | | | |

**For type COV-11 relay only**, the 1.30 times tap value operating time from the number 6 time dial position is 54.8 $\pm$5% seconds and should be checked first. It is important that the 1.30 times tap value current be maintained accurately. The maintaining of this current accurately is necessary because of the steepness of the slope of the time-current characteristic (Figure 8, page 17). A 1% variation in the 1.30 times tap value current (including measuring instrument deviation) will change the nominal operating time by approximately 4%.

Table 1 shows the time curve calibration points for the various types of relays.

**6.1.2. 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 indicator target should drop freely.

#### 6.1.3. Indicating Instantaneous Trip Unit (IIT)

The core screw which is adjustable from the top of the trip unit determines the pickup value. The trip unit has a nominal ratio of adjustment of 1 to 4 and an accuracy within the limits of 10%.

Apply sufficient current to operate the IIT. The indicator target should drop freely.

#### 6.1.4. Voltage Unit (V)

**A. Contact Gap**

The gap between the stationary contact and moving contact with the relay in a de-energized position should be approximately .020”.

**B. Sensitivity**

The contacts should close when voltage is reduced to approximately 90 volts. The voltage unit should be energized for one hour before checking the sensitivity.

### 6.2. 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. 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 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.

### 6.3. 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 unless it is apparent that the relay is not in proper working order. (See “Acceptance Check”).

#### 6.3.1. Overcurrent Unit (CO)

**A. Contact**

1) 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”.

2) 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”. 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”.

**B. Minimum Trip Current**

The adjustment of the spring tension in setting the minimum trip current 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, the time dial to position 6.

Adjust the control spring tension so that the moving contact will leave the backstop at tap value current +1.0% and will return to the backstop at tap value current -1.0%.

**C. Time Curve Calibration**

Install the permanent magnet

Apply the indicated current per Table 1 for the permanent magnet adjustment (e.g., COV-8, 2 times tap value) and measure the operating time. Adjust the permanent magnet keeper until the operating time corresponds to the value of Table 1.

**For type COV-11 relay only**, the 1.30 times tap value operating time from the number 6 time dial position is 54.9 ±5% seconds. It is important that the 1.30 times tap value current be maintained accurately. The maintaining of this current accurately is necessary because of the steepness of the slope of the time-current characteristic (Figure 8, page 17). A 1% variation in the 1.30 times tap value current (including measuring instrument deviation) will change the nominal operating time by approximately 4%. If the operating time at 1.3 times tap value is not within these limits, a minor adjustment of the control spring will give the correct operating time without any undue effect on the minimum pick-up of the relay. This check is to be made after the 2 times tap value adjustment has been completed.

Apply the indicated current per Table 1 for the electromagnet plug adjustment (e.g., COV-8, 20 times tap value) and measure the operating time. Adjust the proper plug until the operating time corresponds to the value in Table 1. (Withdrawing the left-hand plug, front view, increases the operating time and withdrawing the right-hand plug, front view, decreases the time.) In adjusting the plugs, one plug should be screwed in completely and the other plug run in our out until the proper operating time has been obtained.

Recheck the permanent magnet adjustment. If the operating time for this calibration point has changed, readjust the permanent magnet and then recheck the electromagnet plug adjustment.

#### 6.3.2. 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 tap setting being used. The indicator target should drop freely.

#### 6.3.3. Indicating Instantaneous Trip Unit (IIT)

The core screw must be adjusted to the value of pickup current desired.

The nameplate data will furnish the actual current range that may be obtained from IIT unit.

#### 6.3.4. Voltage Unit (V)

A. The upper pin bearing should be screwed down until there is approximately .025” clearance between it and the top of shaft bearing. The upper pin bearing should then be securely locked in position with the lock nut. The lower bearing position is fixed and cannot be adjusted.

B. The contact gap adjustment for the directional unit is made as follows:

With the moving contact in the normally closed position, i.e., against the left stop on bridge, screw in the stationary contact until both contacts just close as indicated by a neon lamp in the contact circuit. Then, screw the stationary contact in towards the moving contact an additional one-half turn. The clamp holding the stationary contact housing need not be loosened for the adjustment since the clamp utilizes a spring-type action in holding the stationary contact in position.

C. The sensitivity adjustment is made in two steps. The voltage unit should be energized for one hour before these adjustment are made.

1) The adjustable resistor, located at the rear of the voltage unit, is adjusted such that the maximum resistance is in the circuit (Approximately 2500 ohms).

2) The tension of the spiral spring, attached to the moving element assembly, is then varied. The spring is adjusted by placing a screwdriver or similar tool into one of the notches located on the periphery of the spring adjuster and rotating it. The spring adjuster is located on the underside of the bridge and is held in place by a spring type clamp that does not have to be loosened prior to making the necessary adjustments.

The spring is to be adjusted such that the contacts will close as indicated by a neon lamp in the contact circuit when the applied voltage is reduced to 80 volts. The contacts should open with 80 plus volts applied.

Any setting other than the 80 volts then can be made by adjusting the resistor for the desired contact closing voltage.

## 7. Renewal Parts

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

## ENERGY REQUIREMENTS

| VOLTAGE UNIT | | | | |
|---|---|---|---|---|
| Frequency | Drop-Out Adjustment Volts | Maximum Volts Continuous | Volt-Ampere + Burden at 120 Volts | Drop-Out Ratio |
| 60 | 80-100 | 132 | 8.0 | 98% |
| 50 | 80-100 | 132 | 7.2 | 98% |

*+ Volt-Ampere burden is average for the various settings*

| COV-6 OVERCURRENT UNITS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 60 HZ VOLT AMPERES ** (xΔ FOR 50 Hz) | | | | |
| Ampere Range | Tap | Continuous Rating (Amperes) | One Second Rating* (Amperes) | Power Factor Angle Ø | At Tap Value Current (Δ = .86) | At 3 Times Tap Value Current (Δ = .88) | At 10 Times Tap Value Current (Δ = .90) | At 20 Times Tap Value Current (Δ= .91) |
| 0.5/2.5 | 0.5 | 2.7 | 88 | 69 | 3.92 | 20.6 | 103 | 270 |
| | 0.6 | 3.1 | 88 | 68 | 3.96 | 20.7 | 106 | 288 |
| | 0.8 | 3.7 | 88 | 67 | 3.96 | 21 | 114 | 325 |
| | 1.0 | 4.1 | 88 | 66 | 4.07 | 21.4 | 122 | 360 |
| | 1.5 | 5.7 | 88 | 62 | 4.19 | 23.2 | 147 | 462 |
| | 2.0 | 6.8 | 88 | 60 | 4.30 | 24.9 | 168 | 548 |
| | 2.5 | 7.7 | 88 | 58 | 4.37 | 26.2 | 180 | 630 |
| 2/6 | 2 | 8 | 230 | 67 | 3.88 | 21 | 110 | 308 |
| | 2.5 | 8.8 | 230 | 66 | 3.90 | 21.6 | 118 | 342 |
| | 3 | 9.7 | 230 | 64 | 3.93 | 22.1 | 126 | 381 |
| | 3.5 | 10.4 | 230 | 63 | 4.09 | 23.1 | 136 | 417 |
| | 4 | 11.2 | 230 | 62 | 4.12 | 23.5 | 144 | 448 |
| | 5 | 12.5 | 230 | 59 | 4.20 | 24.8 | 162 | 540 |
| | 6 | 13.7 | 230 | 57 | 4.38 | 26.5 | 183 | 624 |
| 4/12 | 4 | 16 | 460 | 65 | 4.00 | 22.4 | 126 | 376 |
| | 5 | 18.8 | 460 | 63 | 4.15 | 23.7 | 143 | 450 |
| | 6 | 19.3 | 460 | 61 | 4.32 | 25.3 | 162 | 531 |
| | 7 | 20.8 | 460 | 59 | 4.37 | 26.4 | 183 | 611 |
| | 8 | 22.5 | 460 | 56 | 4.40 | 27.8 | 204 | 699 |
| | 10 | 25 | 460 | 53 | 4.60 | 30.1 | 247 | 880 |
| | 12 | 28 | 460 | 47 | 4.92 | 35.6 | 288 | 1056 |

* *Thermal capacities for short times other than one second may be calculated on the basis of time being inversely proportional to the square of the current.*

Ø *Degrees current lags voltage at tap value current.*

** *Voltages taken with Rectox type voltmeter*

## ENERGY REQUIREMENTS

### COV-7 OVERCURRENT UNITS

| Ampere Range | Tap | Continuous Rating ( Amperes ) | One Second Rating* ( Amperes ) | Power Factor Angle Ø | 60 HZ VOLT AMPERES ** (xΔ FOR 50 Hz) At Tap Value Current (Δ =.86) | At 3 Times Tap Value Current (Δ =.88) | At 10 Times Tap Value Current (Δ =.90) | At 20 Times Tap Value Current (Δ =.91) |
|---|---|---|---|---|---|---|---|---|
| 0.5/2.5 | .05 | 2.7 | 88 | 68 | 3.88 | 20.7 | 103 | 278 |
| | 0.6 | 3.1 | 88 | 67 | 3.93 | 20.9 | 107 | 288 |
| | 0.8 | 3.7 | 88 | 66 | 3.93 | 21.1 | 114 | 230 |
| | 1.0 | 4.1 | 88 | 64 | 4.00 | 21.6 | 122 | 356 |
| | 1.5 | 5.7 | 88 | 61 | 4.08 | 22.9 | 148 | 459 |
| | 2.0 | 6.8 | 88 | 58 | 4.24 | 24.8 | 174 | 552 |
| | 2.5 | 7.7 | 88 | 56 | 4.38 | 25.9 | 185 | 640 |
| | | | | | | | | |
| 2/6 | 2 | 8 | 230 | 66 | 4.06 | 21.3 | 111 | 306 |
| | 2.5 | 8.8 | 230 | 63 | 4.07 | 21.8 | 120 | 342 |
| | 3 | 9.7 | 230 | 63 | 4.14 | 22.5 | 129 | 366 |
| | 3.5 | 10.4 | 230 | 62 | 4.34 | 23.4 | 141 | 413 |
| | 4 | 11.2 | 230 | 61 | 4.34 | 23.8 | 149 | 448 |
| | 5 | 12.5 | 230 | 59 | 4.40 | 25.2 | 163 | 530 |
| | 6 | 13.7 | 230 | 58 | 4.62 | 27 | 183 | 624 |
| | | | | | | | | |
| 4/12 | 4 | 16 | 460 | 64 | 4.24 | 22.8 | 129 | 392 |
| | 5 | 18.8 | 460 | 61 | 4.30 | 24.2 | 149 | 460 |
| | 6 | 19.3 | 460 | 60 | 4.62 | 25.9 | 168 | 540 |
| | 7 | 20.8 | 460 | 58 | 4.69 | 27.3 | 187 | 626 |
| | 8 | 22.5 | 460 | 55 | 4.80 | 29.8 | 211 | 688 |
| | 10 | 25 | 460 | 51 | 5.20 | 33 | 260 | 860 |
| | 12 | 28 | 460 | 46 | 5.40 | 37.5 | 308 | 1032 |

* *Thermal capacities for short times other than one second may be calculated on the basis of time being inversely proportional to the square of the current.*

Ø *Degrees current lags voltage at tap value current.*

** *Voltages taken with Rectox type voltmeter.*

## ENERGY REQUIREMENTS

### COV-8 AND COV-9 OVERCURRENT UNITS

| Ampere Range | Tap | Continuous Rating ( Amperes ) | One Second Rating* ( Amperes ) | Power Factor Angle Ø | 60 HZ VOLT AMPERES ** (xΔ FOR 50 Hz) At Tap Value Current (Δ =.86) | At 3 Times Tap Value Current (Δ =.88) | At 10 Times Tap Value Current (Δ =.90) | At 20 Times Tap Value Current (Δ =.91) |
|---|---|---|---|---|---|---|---|---|
| 0.5/2.5 | .05 | 2.7 | 88 | 72 | 2.38 | 21 | 132 | 350 |
| | 0.6 | 3.1 | 88 | 71 | 2.38 | 21 | 134 | 365 |
| | 0.8 | 3.7 | 88 | 69 | 2.40 | 21.1 | 142 | 400 |
| | 1.0 | 4.1 | 88 | 67 | 2.42 | 21.2 | 150 | 440 |
| | 1.5 | 5.7 | 88 | 62 | 2.51 | 22 | 170 | 530 |
| | 2.0 | 6.8 | 88 | 57 | 2.65 | 23.5 | 200 | 675 |
| | 2.5 | 7.7 | 88 | 53 | 2.74 | 24.8 | 228 | 800 |
| 2/6 | 2 | 8 | 230 | 70 | 2.38 | 21 | 136 | 360 |
| | 2.5 | 8.8 | 230 | 66 | 2.40 | 21.1 | 142 | 395 |
| | 3 | 9.7 | 230 | 64 | 2.42 | 21.5 | 149 | 430 |
| | 3.5 | 10.4 | 230 | 62 | 2.48 | 22 | 157 | 470 |
| | 4 | 11.2 | 230 | 60 | 2.53 | 22.7 | 164 | 500 |
| | 5 | 12.5 | 230 | 58 | 2.64 | 24 | 480 | 580 |
| | 6 | 13.7 | 230 | 56 | 2.75 | 25.2 | 198 | 660 |
| 4/12 | 4 | 16 | 460 | 68 | 2.38 | 21.3 | 146 | 420 |
| | 5 | 18.8 | 460 | 63 | 2.46 | 21.8 | 158 | 480 |
| | 6 | 19.3 | 460 | 60 | 2.54 | 22.6 | 172 | 550 |
| | 7 | 20.8 | 460 | 57 | 2.62 | 23.6 | 190 | 620 |
| | 8 | 22.5 | 460 | 54 | 2.73 | 24.8 | 207 | 700 |
| | 10 | 25 | 460 | 48 | 3.00 | 27.8 | 248 | 850 |
| | 12 | 28 | 460 | 45 | 3.46 | 31.4 | 292 | 1020 |

* *Thermal capacities for short times other than one second may be calculated on the basis of time being inversely proportional to the square of the current.*

Ø *Degrees current lags voltage at tap value current.*

** *Voltages taken with Rectox type voltmeter.*

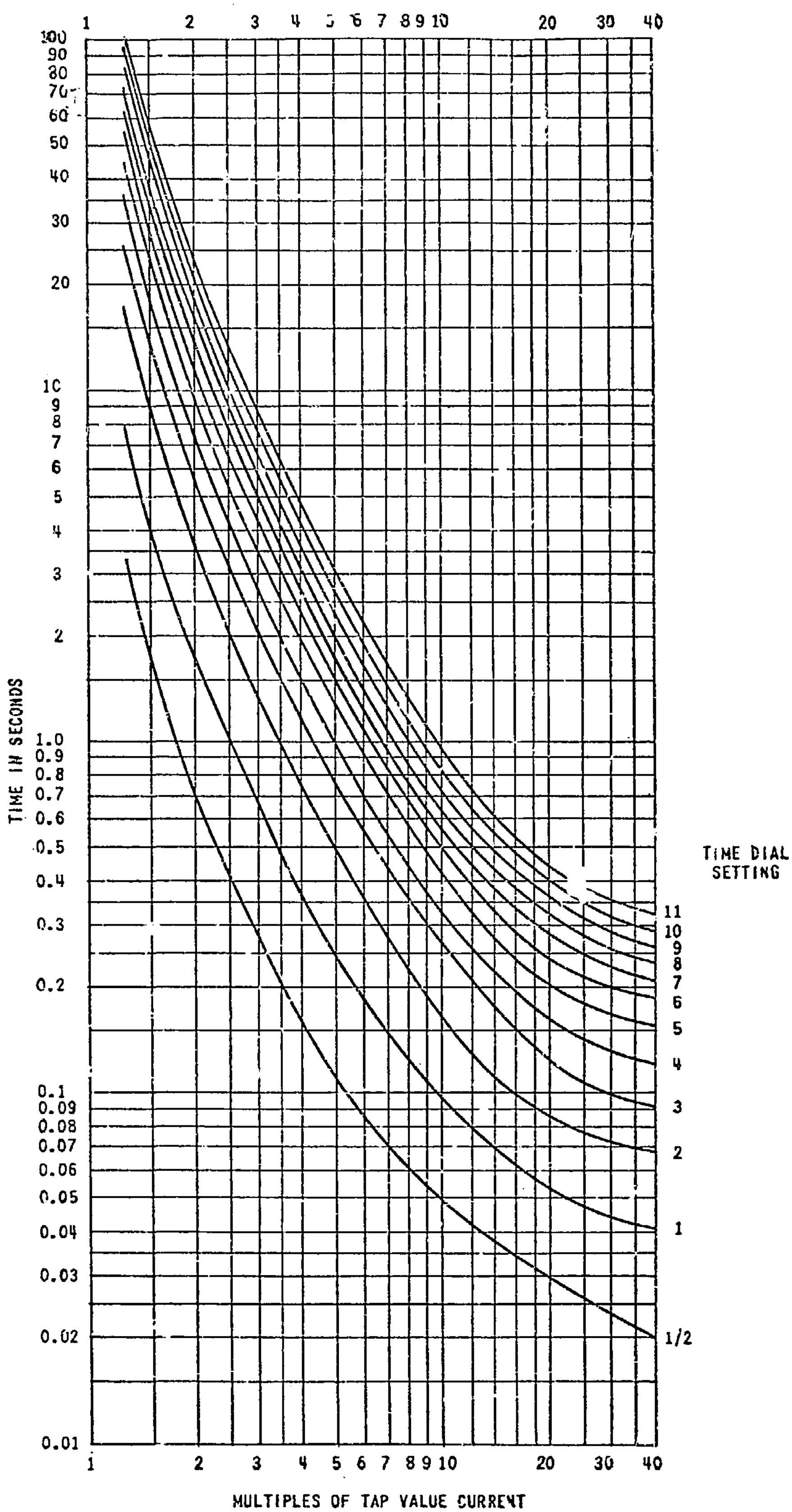
## ENERGY REQUIREMENTS

| COV-11 RELAY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 60 HZ VOLT AMPERES ** (x∆ FOR 50 HZ) | | | |
| Ampere Range | Tap | Continuous Rating ( Amperes ) | One Second Rating* ( Amperes ) | Power Factor Angle Ø | At Tap Value Current (∆ =.86) | At 3 Times Tap Value Current (∆ =.88) | At 10 Times Tap Value Current (∆ =.90) | At 20 Times Tap Value Current (∆ =.91) |
| 0.5/2.5 | .05 | 1.7 | 88 | 36 | .072 | 6.54 | 71.8 | 250 |
| | .06 | 1.9 | 88 | 34 | 0.75 | 6.80 | 75.0 | 267 |
| | .08 | 2.2 | 88 | 30 | 0.81 | 7.46 | 84.0 | 298 |
| | 1.0 | 2.5 | 88 | 27 | 0.89 | 8.30 | 93.1 | 330 |
| | 1.5 | 3.0 | 88 | 22 | 1.13 | 10.04 | 115.5 | 411 |
| | 2.0 | 3.5 | 88 | 17 | 1.30 | 11.95 | 136.3 | 502 |
| | 2.5 | 3.8 | 88 | 16 | 1.48 | 13.95 | 160.0 | 610 |
| | | | | | | | | |
| 2/6 | 2.0 | 7.0 | 230 | 32 | .073 | 6.30 | 74.0 | 264 |
| | 2.5 | 7.8 | 230 | 30 | 0.78 | 7.00 | 78.5 | 285 |
| | 3.0 | 8.3 | 230 | 27 | 0.83 | 7.74 | 84.0 | 309 |
| | 3.5 | 9.0 | 230 | 24 | 0.88 | 8.20 | 89.0 | 340 |
| | 4.0 | 10.0 | 230 | 23 | 0.96 | 9.12 | 102.0 | 372 |
| | 5.0 | 11.0 | 230 | 20 | 1.07 | 9.80 | 109.0 | 430 |
| | 6.0 | 12.0 | 230 | 20 | 1.23 | 11.34 | 129.0 | 504 |
| | | | | | | | | |
| 4/12 | 4.0 | 14 | 460 | 29 | 0.79 | 7.08 | 78.4 | 296 |
| | 5.0 | 16 | 460 | 25 | 0.89 | 8.00 | 90.0 | 340 |
| | 6.0 | 17 | 460 | 22 | 1.02 | 9.18 | 101.4 | 378 |
| | 7.0 | 18 | 460 | 20 | 1.10 | 10.00 | 110.0 | 454 |
| | 8.0 | 20 | 460 | 18 | 1.23 | 11.1 | 124.8 | 480 |
| | 10.0 | 22 | 460 | 17 | 1.32 | 14.9 | 131.6 | 600 |
| | 12.0 | 26 | 460 | 16 | 1.8 | 16.3 | 180.0 | 720 |

* *Thermal capacities for short times other than one second may be calculated on the basis of time being inversely proportional to the square of the current.*

Ø *Degrees current lags voltage at tap value current.*

** *Voltages taken with Rectox type voltmeter.*

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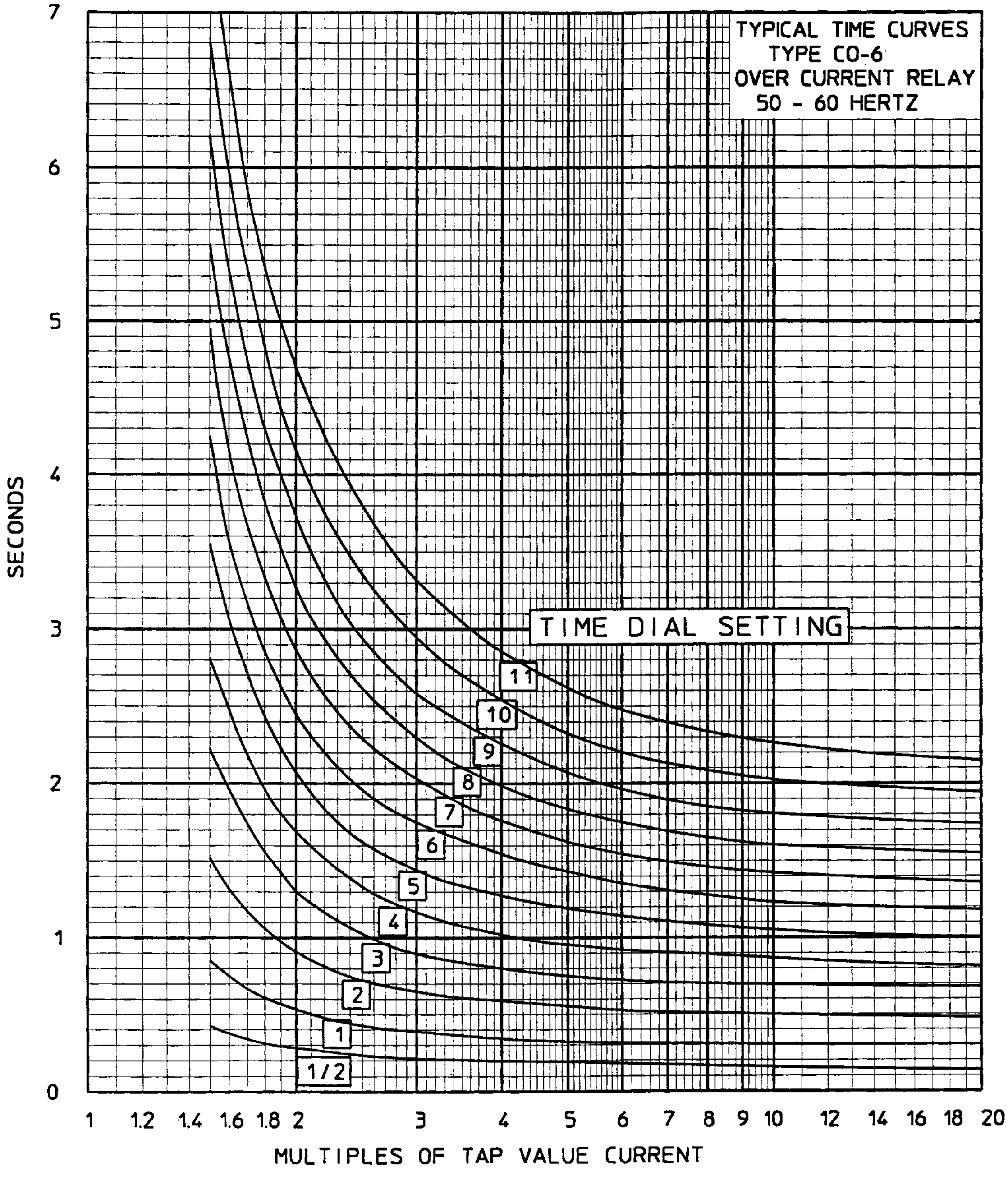
288B655

*Figure 4: Typical 50 and 60 Hz Time Curves of COV-11 Overcurrent Unit*

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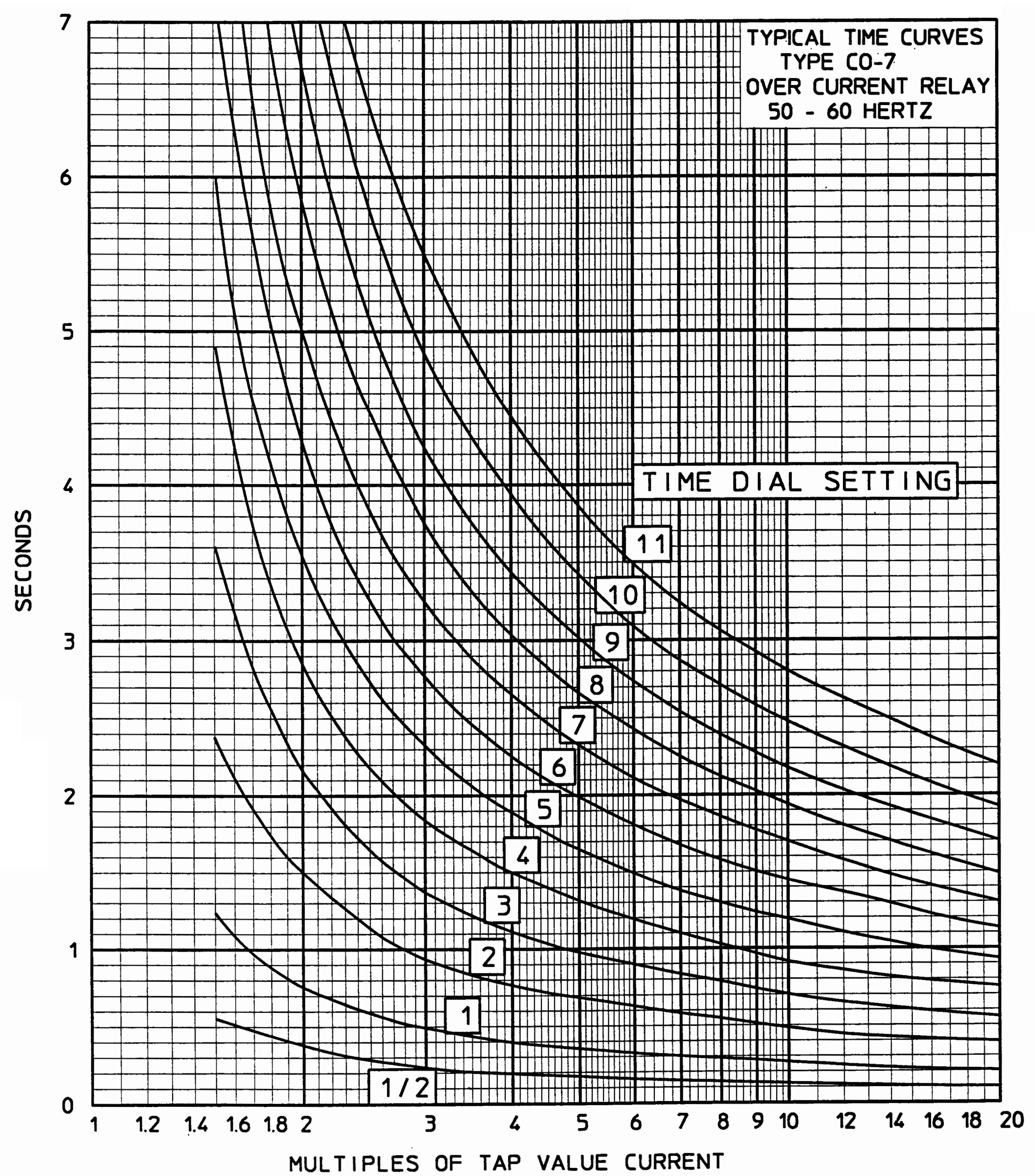
418246

*Figure 5: Typical 50 and 60 Hz Time Curves of COV-6 Overcurrent Unit*

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418247

*Figure 6: Typical 50 and 60 Hz Time Curves of COV-7 Overcurrent Unit*

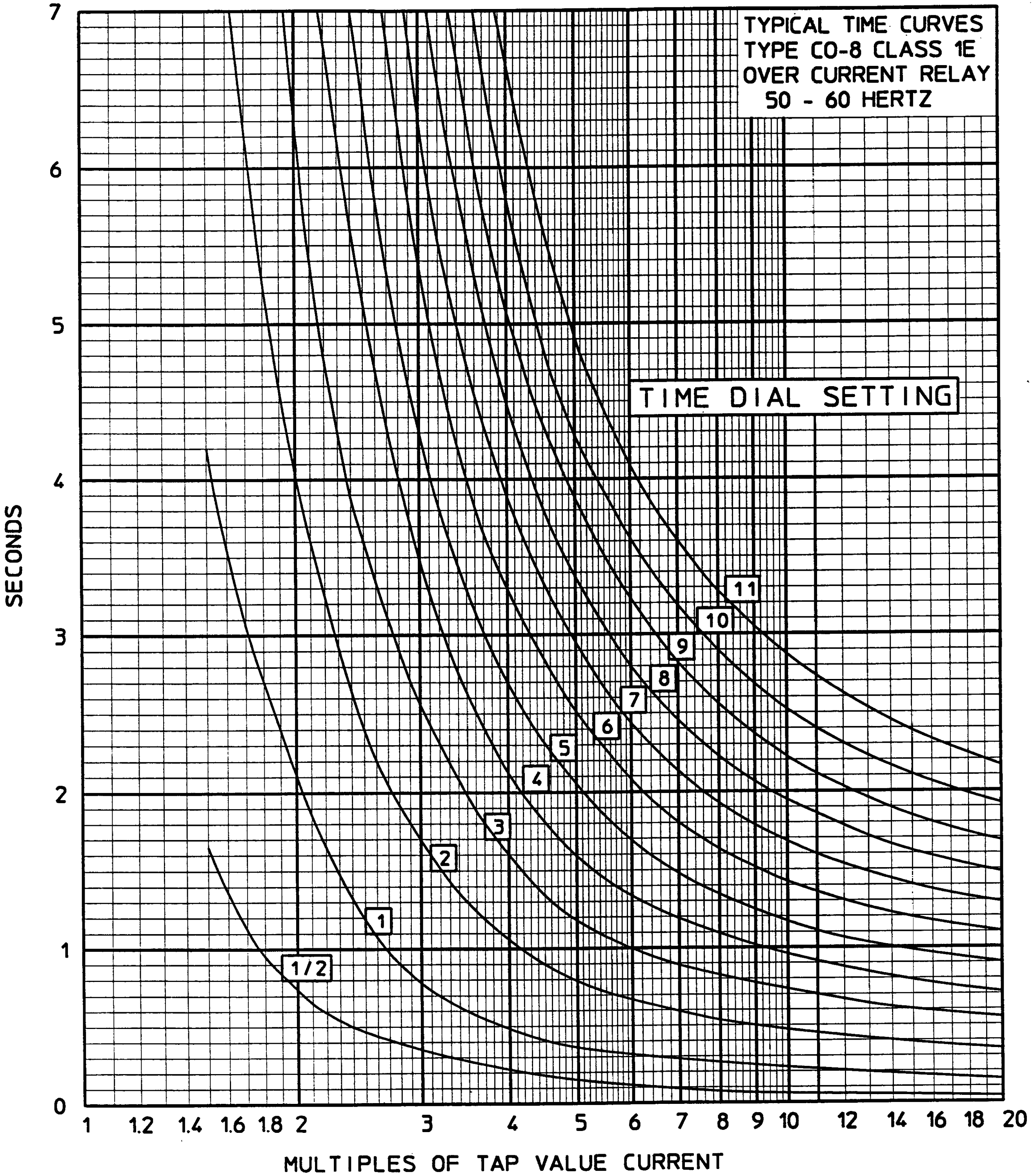


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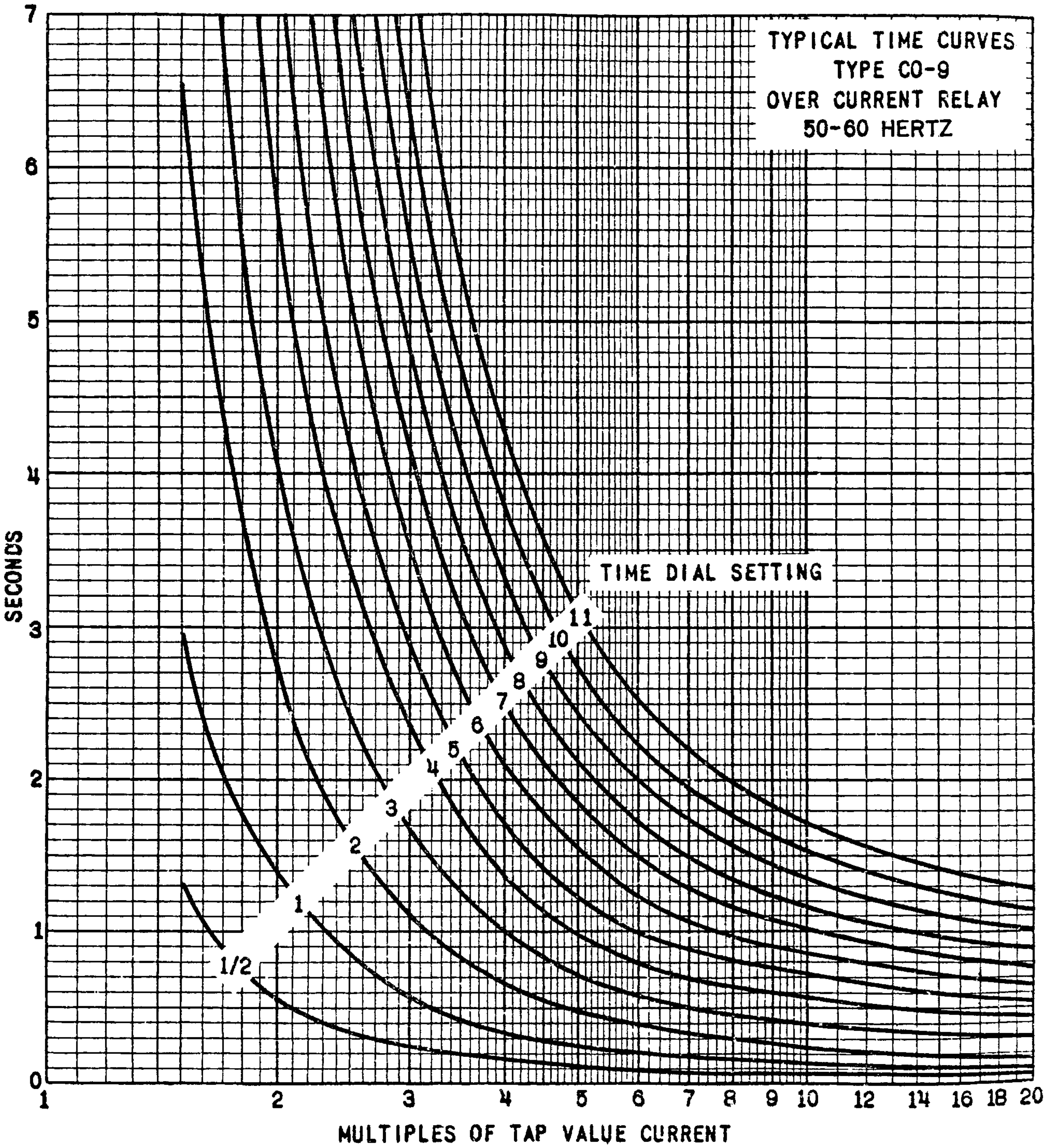
*Figure 7: Typical 50 and 60 Hz Time Curves of COV-8 Overcurrent Unit*

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418249

*Figure 8: Typical 50 and 60 Hz Time Curves of COV-9 Overcurrent Unit*

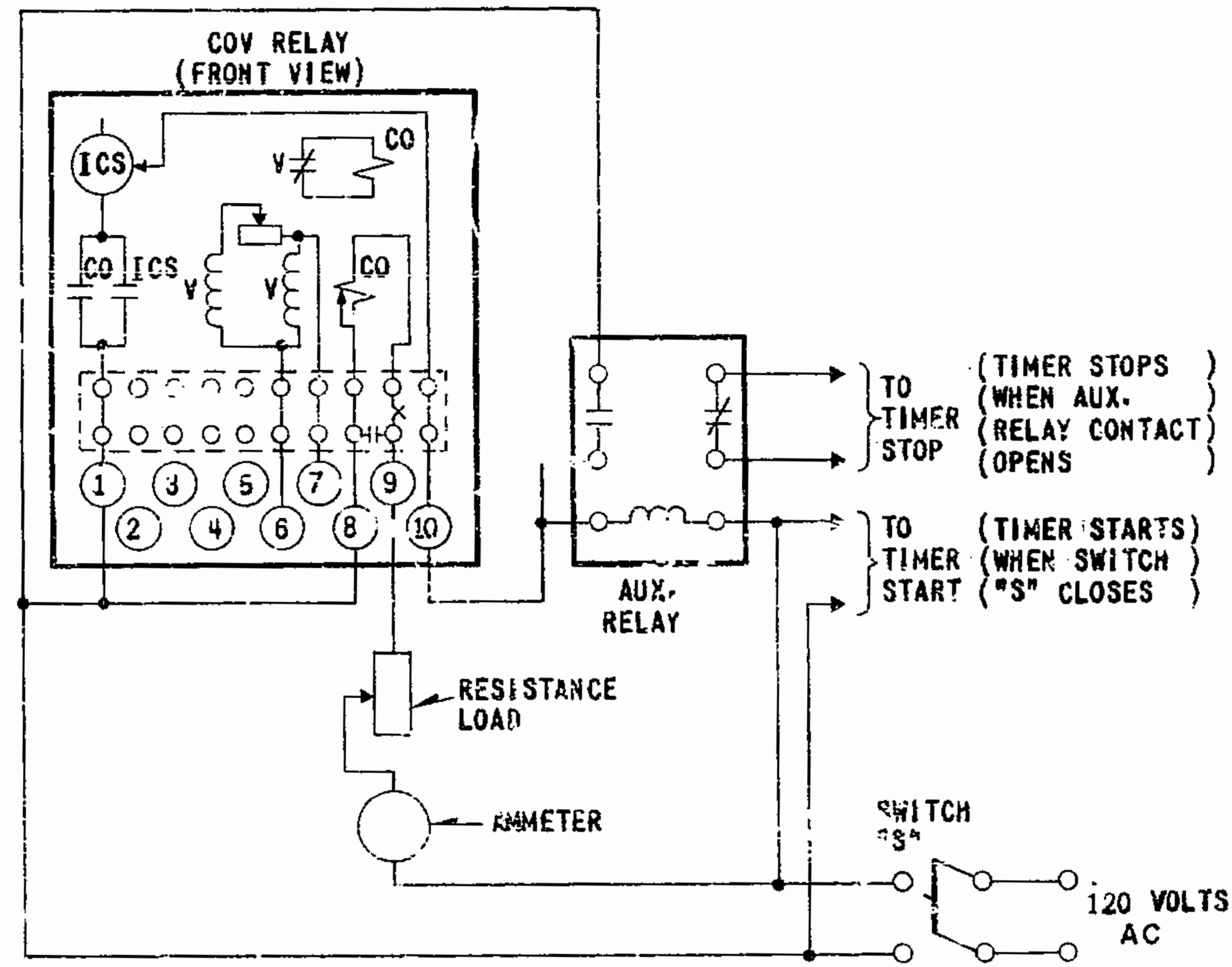


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*Figure 9: Diagram of Test Connections of the Overcurrent Unit.*

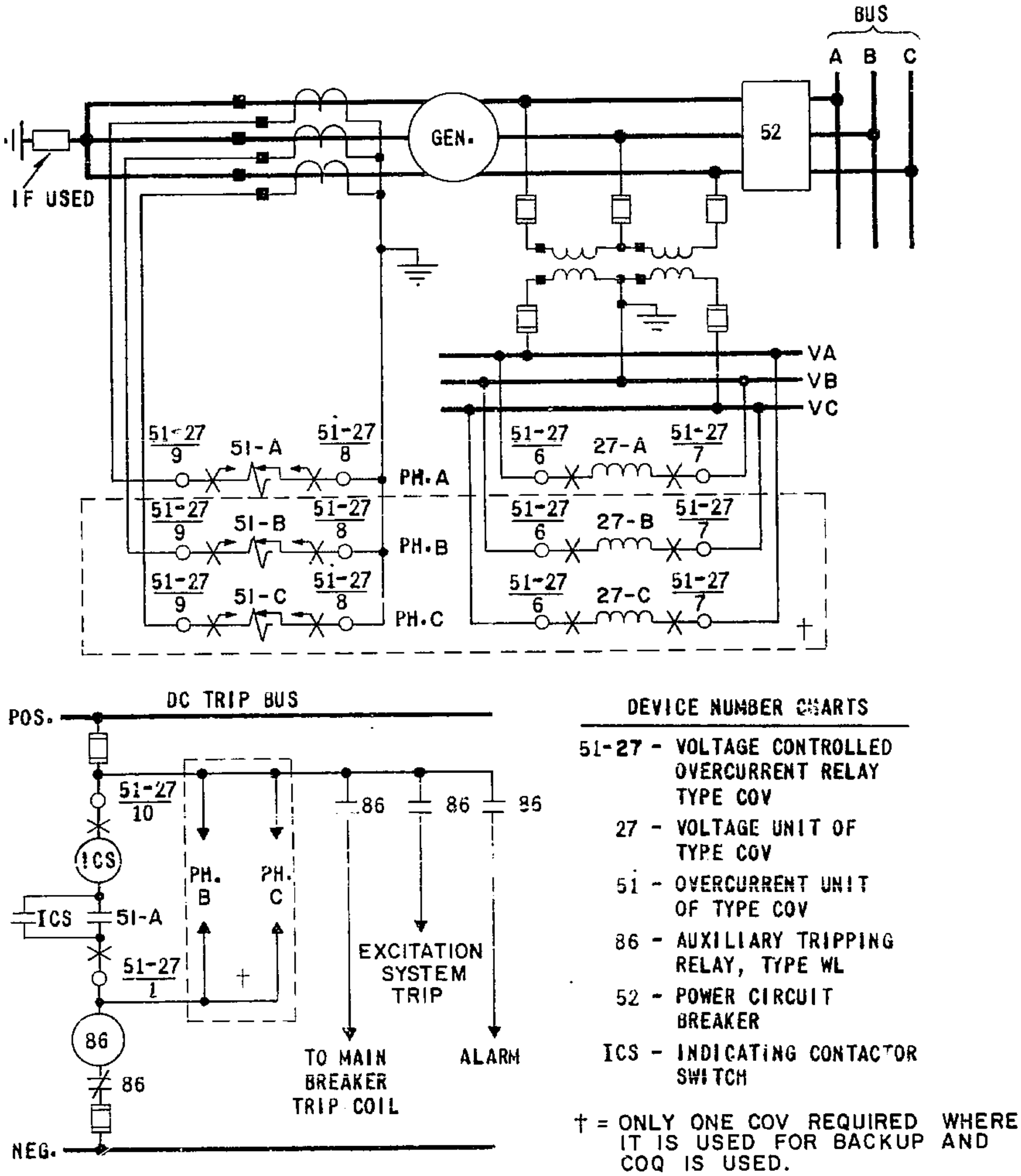


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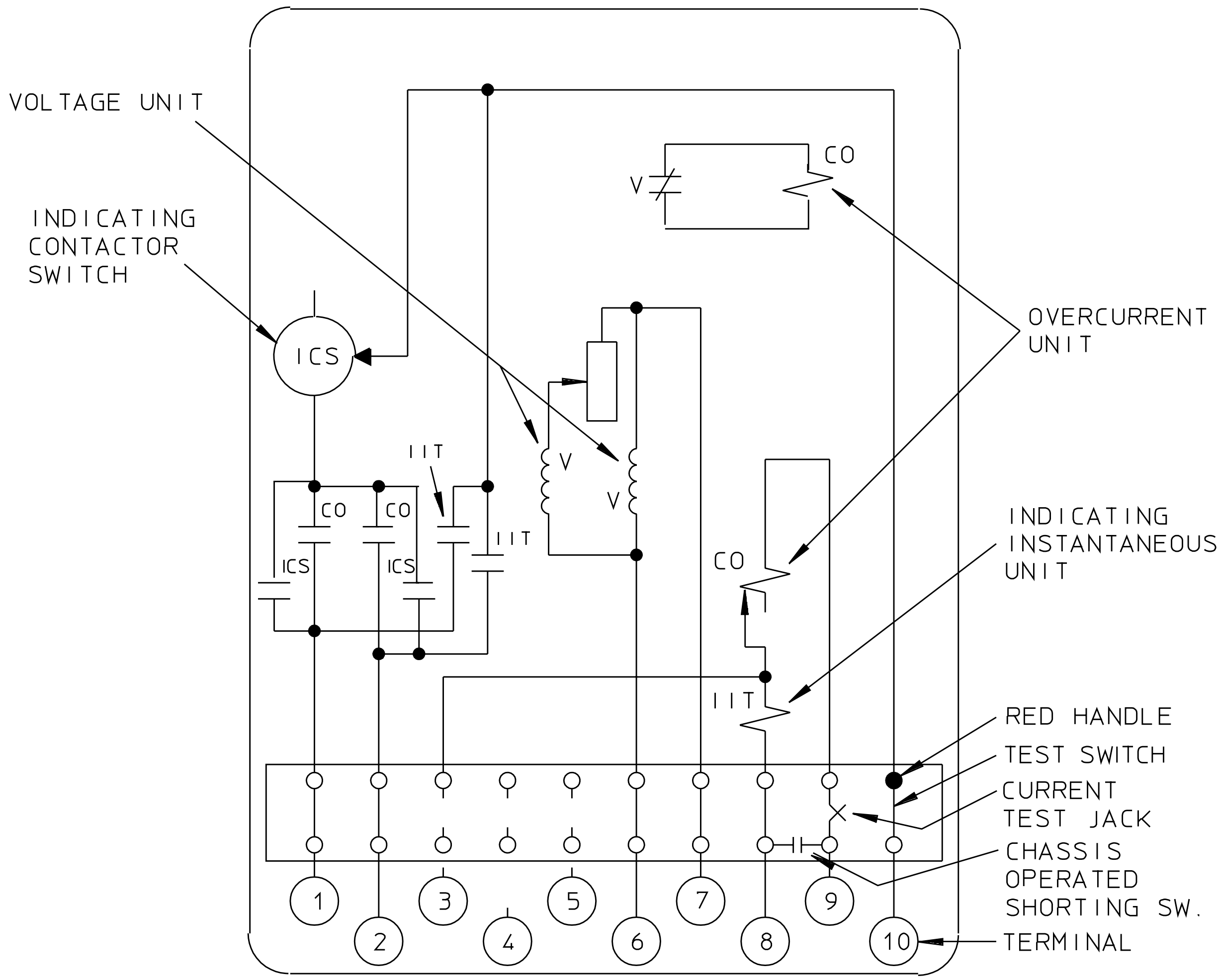
*Figure 10: External Schematic of the Type COV Relay on a Generator*

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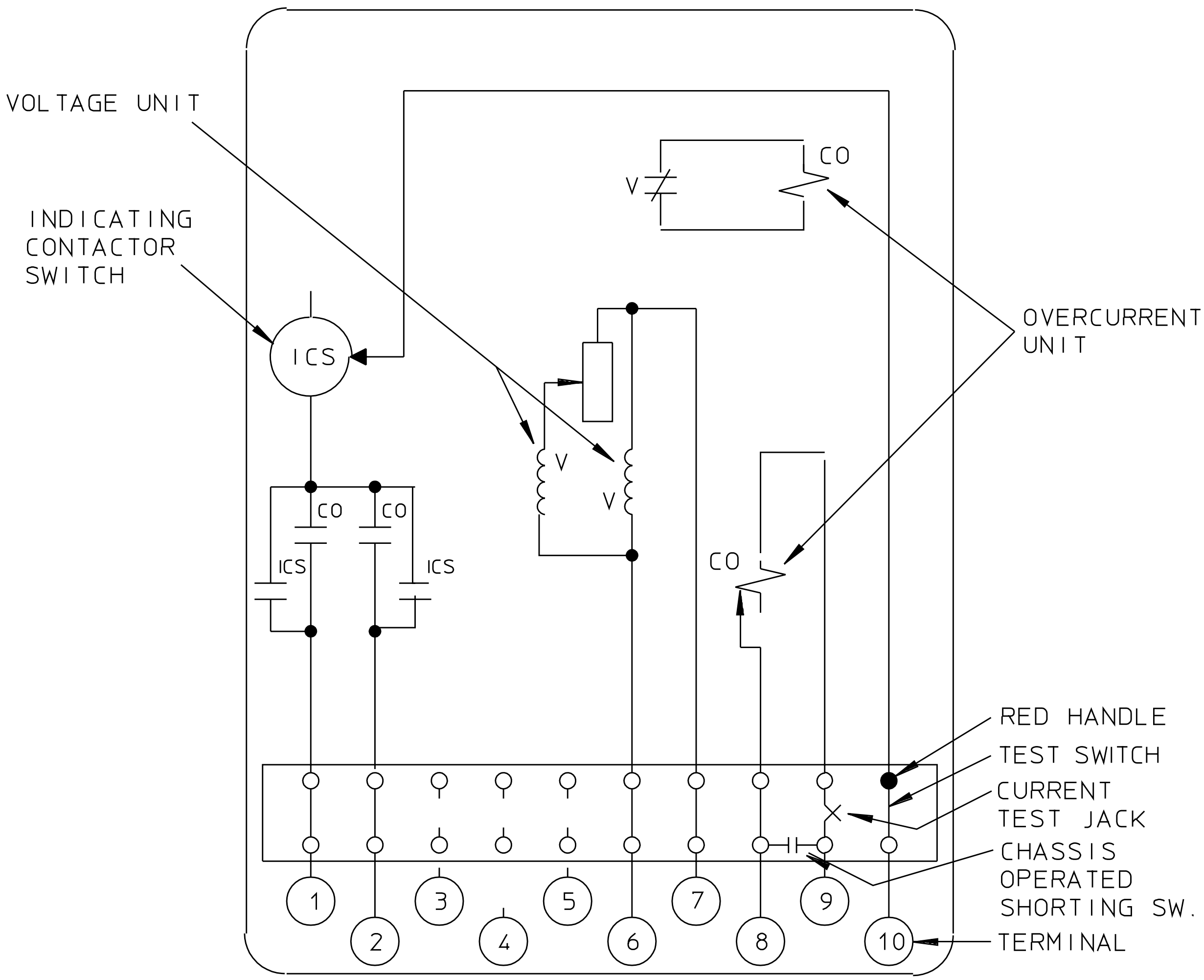
184A471

*Figure 11: Relay Types COV-6, COV-7, COV-8, COV-9 & COV-11 Voltage Controlled Overcurrent Relay, Double Trip with Indicating Instantaneous Trip, in Type FT21 Case*

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184A400

*Figure 12: Relay Types COV-6, COV-7, COV-8, COV-9 Voltage Controlled Overcurrent Relay, Double Trip, In Type FT-21 Case.*

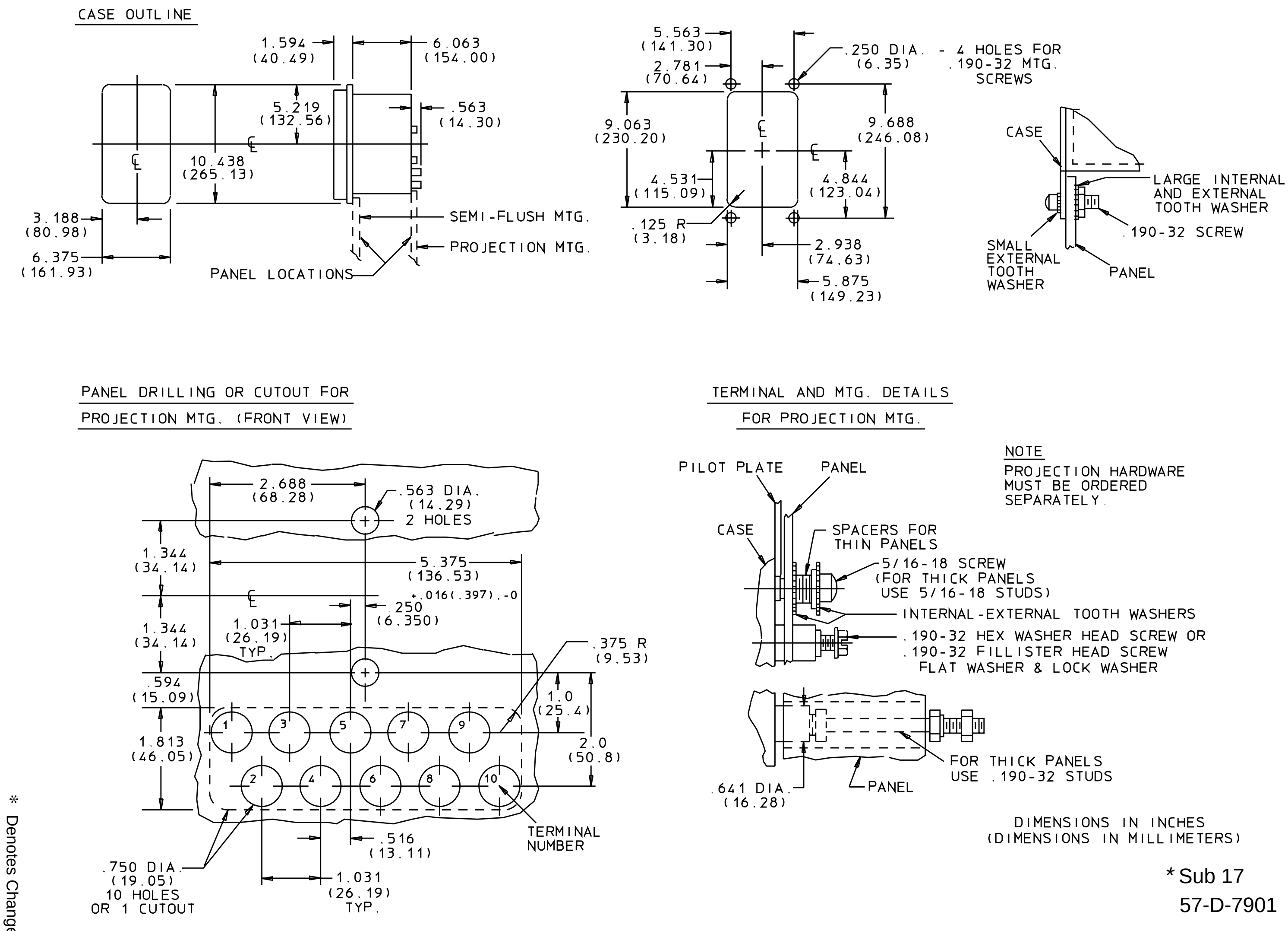


*Figure 13: Outline and Drilling Plan for the Type COV Relay in Type FT-21 Case*

* Denotes Change