Effective: March 2000
Supersedes I.L. 41-116.1B dated September 1999
(|) Denotes Change Since Previous Issue

Type COV Voltage Controlled Overcurrent Relay

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.

This instruction leaflet applies to the following types of relays:

TYPE	TIME CHARACTERISTIC
COV-6	Definite Minimum Time
COV-7	Moderately Inverse Time
COV-8	Inverse Time
COV-9	Very Inverse Time
COV-11	Extremely Inverse Time

1.0 APPLICATION

The type 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.

These relays have been specially designed and tested to establish their suitability for Class 1E applications in accordance with the ABB Relay Division program for Class 1E Qualification Testing, as detailed in Bulletin STR-1. Materials have been selected and tested to insure that the relays will perform their intended functions for their design life when operated in a normal environment as defined in ANSI/IEEE standard C37.90, 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 electronic equipment and systems in nuclear power generating stations that are essential to emergency shutdown of the reactor, containment isolation, cooling the reactor, and heat removal from the containment and reactor, or otherwise are essential in preventing significant release of radioactive material to the environment.

2.0 CONSTRUCTION AND OPERATION

The relay consists of: (see Figure 1, page 10).

1. an overcurrent unit (CO)
2. a voltage unit (V) with adjustable resistor
3. an indicating contactor switch unit (ICS)
4. a slow-release telephone type relay, (T)

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 type 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 pro-

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 Inc. representative should be contacted.

Printed in U.S.A.

duced 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 VOLTAGE UNIT (V)

The voltage unit is an induction type 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 electromagnet and for a magnetic core. The magnetic core houses the lower pin bearing and 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 2, page 11. 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 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.

2.3 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.

3.0 CHARACTERISTICS

To prevent the relay from operating for currents above the overcurrent unit pickup, the voltage unit contact is connected to control the telephone relay whose contacts are connected in the shading coil circuit of the overcurrent unit. The voltage contact is held open at voltage 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 12.

3.1 OVERCURRENT UNIT

The relays are generally available in the following overcurrent unit 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 contacts for tripping either one or two circuit breakers.

The time vs. current characteristics are shown in Figures 4 to 8, starting on page 13. 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 VOLTAGE UNIT

The contacts can be adjusted to close and energize the slow-release telephone relay over a range of 80 to 100 volts. The contacts open to de-energize the telephone relay if the voltage is higher than the set value. The drop-out ratio of the unit is 98% or higher. Relays are shipped from the factory with a 90 volt setting.

3.3 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.

3.4 TRIP CIRCUIT CONSTANTS

Indicating Contactor Switch Coils.

Ampere Pickup	Ohms dc Resistance
0.2	8.5
1.0	0.37
2.0	0.10

4.0 RELAY SETTINGS

CAUTION

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. Since the tap block screws carry operating current, be sure that the screws are turned tight. Then reclose all switchblades making sure the RED handles are closed LAST.

4.1 OVERCURRENT UNIT (CO)

The overcurrent unit setting can be defined by tap setting 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). The tap setting is the minimum current required to make the disc move.

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 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.

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 contact make contact simultaneously with their respective moving contact.

4.2 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 to close its contacts from 80 volts to 100 volts ***by adjusting the resistor*** located at the top left of the voltage unit. The spiral spring is not disturbed when making any setting other than the calibrated setting of 80 volts.

4.3 INDICATING CONTACTOR SWITCH (ICS)

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

5.0 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 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 insulated 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 IL 41-076 for semi-flush mounting.

Ref. Dwgs: External Schematic (Figure 10, page 19)
Outline and Drilling Plan (Figure 11, page 20)

6.0 ACCEPTANCE TEST

CAUTION

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

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 "RELAY SETTINGS", should be required.

The following check is recommended to insure that the relay is in proper working order. (See Figure 9, page 18.)

6.1 OVERCURRENT UNIT (CO)

The directional unit contacts must be in the closed position and the "T" unit picked up when checking the operation of the overcurrent unit.

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 – 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 curves 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 times tap value

Table 1:

		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 + 20%, -5%

current) and measure the operating time of the relay. The operating times should equal those of Table 1 plus or minus 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 ± 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 slight variation, ± 1%, in the 1.3 times tap value current (including measuring instrument deviation) will change the timing tolerance to ± 10% and the effects of different taps can make the total variations appear to be ± 15%.

6.2 VOLTAGE UNIT (V)

1) Contact Gap – The gap between the stationary contact and moving contact with the relay in a de-energized position should be approximately .020".

2) Sensitivity – The contacts should close when voltage is reduced to approximately 90 volts.

6.3 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.

6.4 TELEPHONE RELAY (T)

The telephone relay has a dropout time of 250 milliseconds ± 50 milliseconds. It has a burden of 1.56 watts at 125 volts dc nominal. It should pickup whenever the voltage unit contacts close.

7.0 ROUTINE MAINTENANCE

All relays should be inspected and checked once a year or at other time intervals as dictated by experience to assure proper operation. Generally a visual inspection should call attention to any noticeable changes. A minimum suggested check on the relay system is to close the contacts manually to assure that the breaker trips and the target drops. Then release the contacts and observe that the reset is smooth and positive.

If an additional time check is desired, pass secondary current through the relay and check the time of operation. It is preferable to make this at several times pick-up current at an expected operating point for the particular application. For the .05 to 2.5 amperes range CO-6 induction unit use the alternative test circuit in Figure 9 (page 18) as these relays are affected by a distorted waveform. With this connection the 25/5 amperes current transformers should be worked well below the knee of the saturation (i.e., use C 50 or better).

All contacts should be periodically cleaned. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

8.0 CALIBRATION

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or the adjustments disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order (see "ACCEPTANCE TEST").

NOTE: A spring shield covers the reset spring of the CO unit. Removing 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 re-assembly of the moving contact assembly.) Slide the spring shield outward and remove from relay. Tighten the screw holding the moving contact assembly to the molding block.

8.1 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 "0" mark on the time dial. For double trip relays, the follow on the sta-

tionary 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 "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". 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".

3) Set the time dial in position 6.

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.

The spiral spring can be adjusted with the spring shield in place as follows. One slot of the spring adjuster will be available for a screwdriver in one window of the front barrier of the spring shield. By adjusting this slot until a barrier of the spring shield prevents further adjustment, a second slot of the spring adjustment will appear in the window on the other side of the spring shield barrier. Adjusting the second slot in a similar manner will reveal a third slot in the opposite window of the spring shield.

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., COV8, 2 times tap value) and measure the operating time. Adjust the permanent magnet keeper until the operation time corresponds to the value ofTable 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 $\pm$ 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 or out until the proper operating time has been obtained.

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

8.2 VOLTAGE UNIT (V)

A. The upper pin bearing should be screwed down until there is approximately. 0.25" clearance between it and the top of shaft bearing. The upper pin bearing should then be securely locked into 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 toward 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:

1) The adjustable resistor, located at the top left of the voltage unit, is adjusted such that the maximum resistance is in the circuit (approximately 2500 ohm).

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 (indicated by pickup of telephone relay “T”) 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.

8.3 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” to 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.

8.4 TELEPHONE RELAY (T)

No calibration is required. The telephone relay should have a dropout time of 250 msec. ±50 msec.

9.0 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.

Class 1E certification of a repaired relay is the responsibility of the agent who makes the repair.

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%

†*Volt-Ampere burden is average for the various settings.*

ENERGY REQUIREMENTS

COV-6 OVERCURRENT UNITS

Ampere Range	Tap	Continuous Rating * (Amperes)	One Second Rating * (Amperes Ø	Power Factor Angle Ø	Volt Amperes * *			
					At Tap Value Current	At 3 Times Tap Value Current	At 10 Times Tap Value Current	At 20 Times Tap Value Current
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	21.0	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	8.0	230	67	3.88	21.0	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	16.0	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	25.0	460	53	4.60	30.1	247	880
	12	28.0	460	47	4.92	35.6	288	1056

COV-7 OVERCURRENTS UNITS

Ampere Range	Tap	Continuous Rating (Amperes)	One Second Rating * (Amperes)	Power Factor Angle Ø	Volt Amperes * *			
					At Tap Value Current	At 3 Times Tap Value Current	At 10 Times Tap Value Current	At 20 Times Tap Value Current
0.5/2.5	0.5	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	320
	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	63	4.09	23.1	136	417
	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 high impedance type voltmeter.

ENERGY REQUIREMENTS

COV-8 INVERSE TIME AND COV-9 VERY INVERSE TIME RELAYS

Ampere Range	Tap	Continuous Rating (Amperes)	One Second Rating * (Amperes)	Power Factor Angle Ø	VOLT AMPERES * * At Tap Value Current	At 3 Times Tap Value Current	At 10 Times Tap Value Current	At 20 Times Tap Value Current
0.5/2.5	0.5	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	180	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

TYPE COV-11 RELAY

Ampere Range	Tap	Continuous Rating (Amperes)	One Second Rating * (Amperes)	Power Factor Angle Ø	VOLT AMPERES * * At Tap Value Current	At 3 Times Tap Value Current	At 10 Times Tap Value Current	At 20 Times Tap Value Current
0.5/2.5	0.5	1.7	88	36	0.72	6.54	71.8	250
	0.6	1.9	88	34	0.75	6.80	75.0	267
	0.8	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	0.73	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 high impedance type voltmeter.

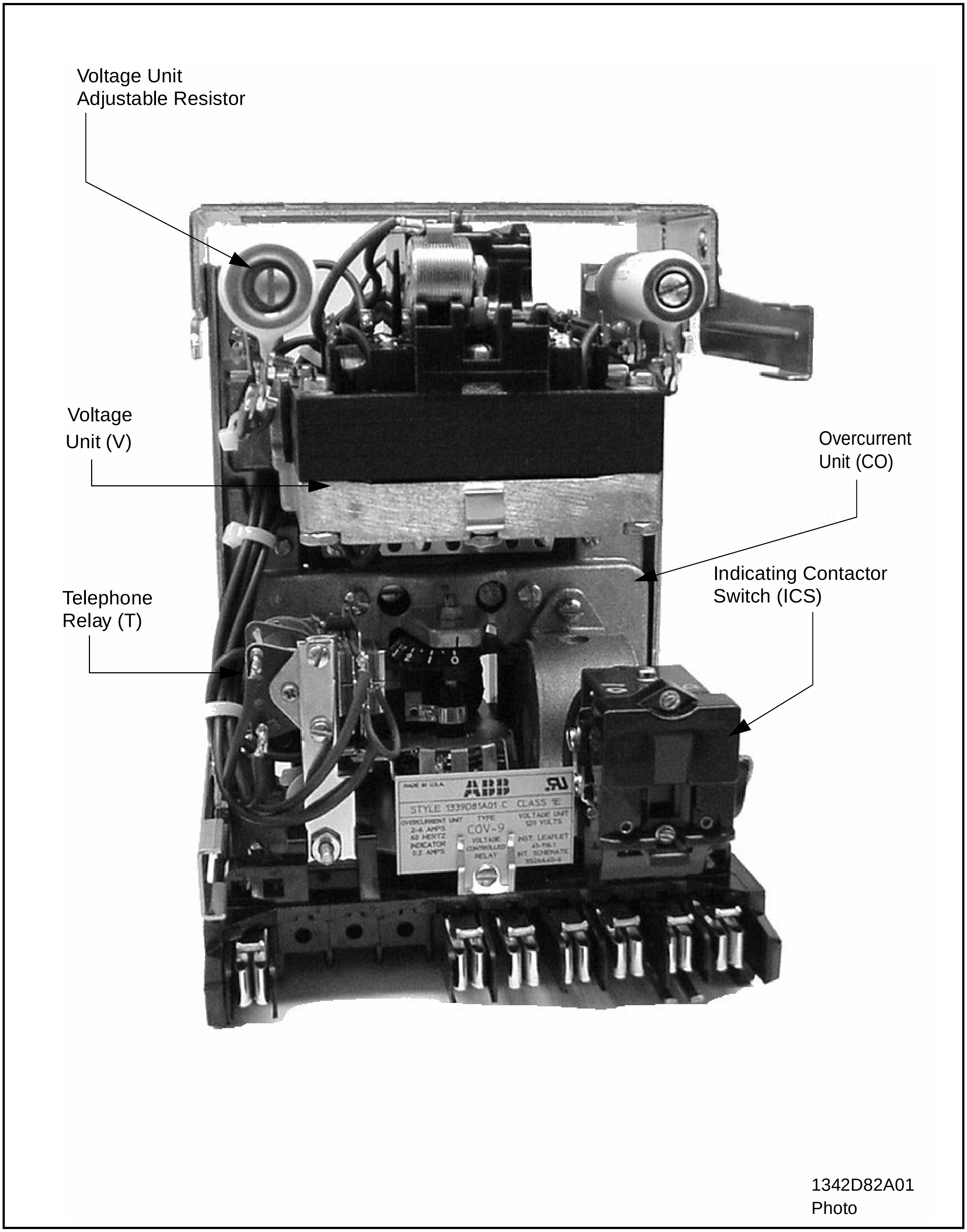

Figure 1: Type COV Relay without case

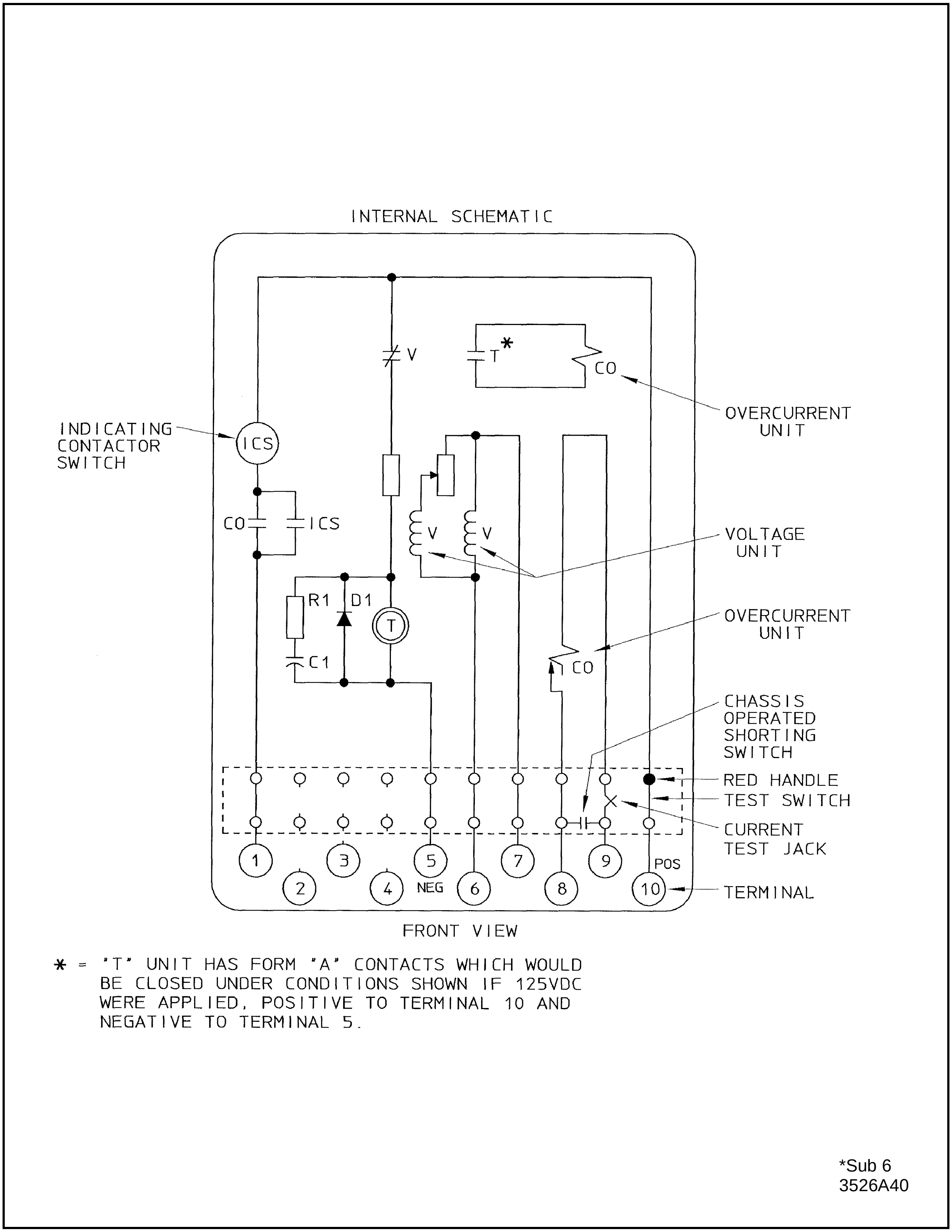

Figure 2: Internal Schematic of the Type COV Relay in the Type FT-21 Case (For Class 1E Application)

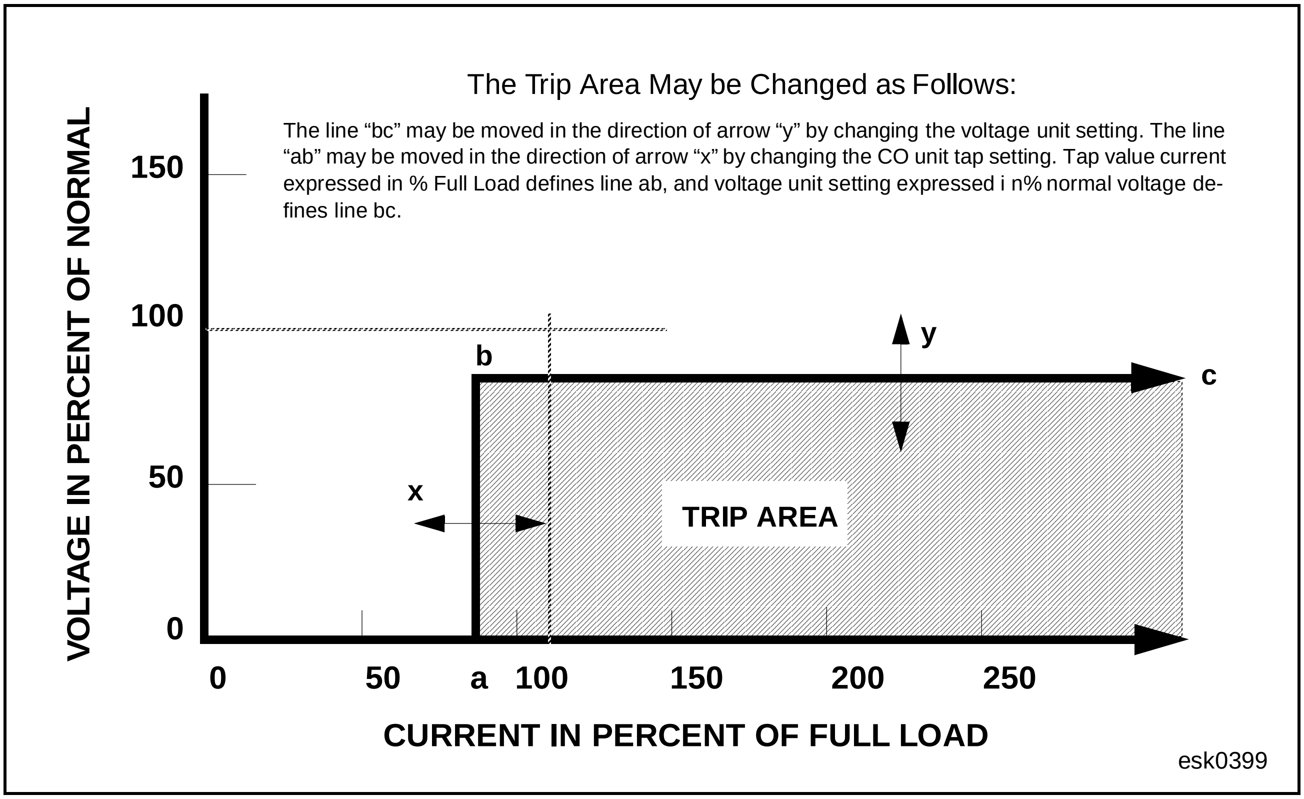

Figure 3: Typical Tripping Characteristics of Type COV Relay

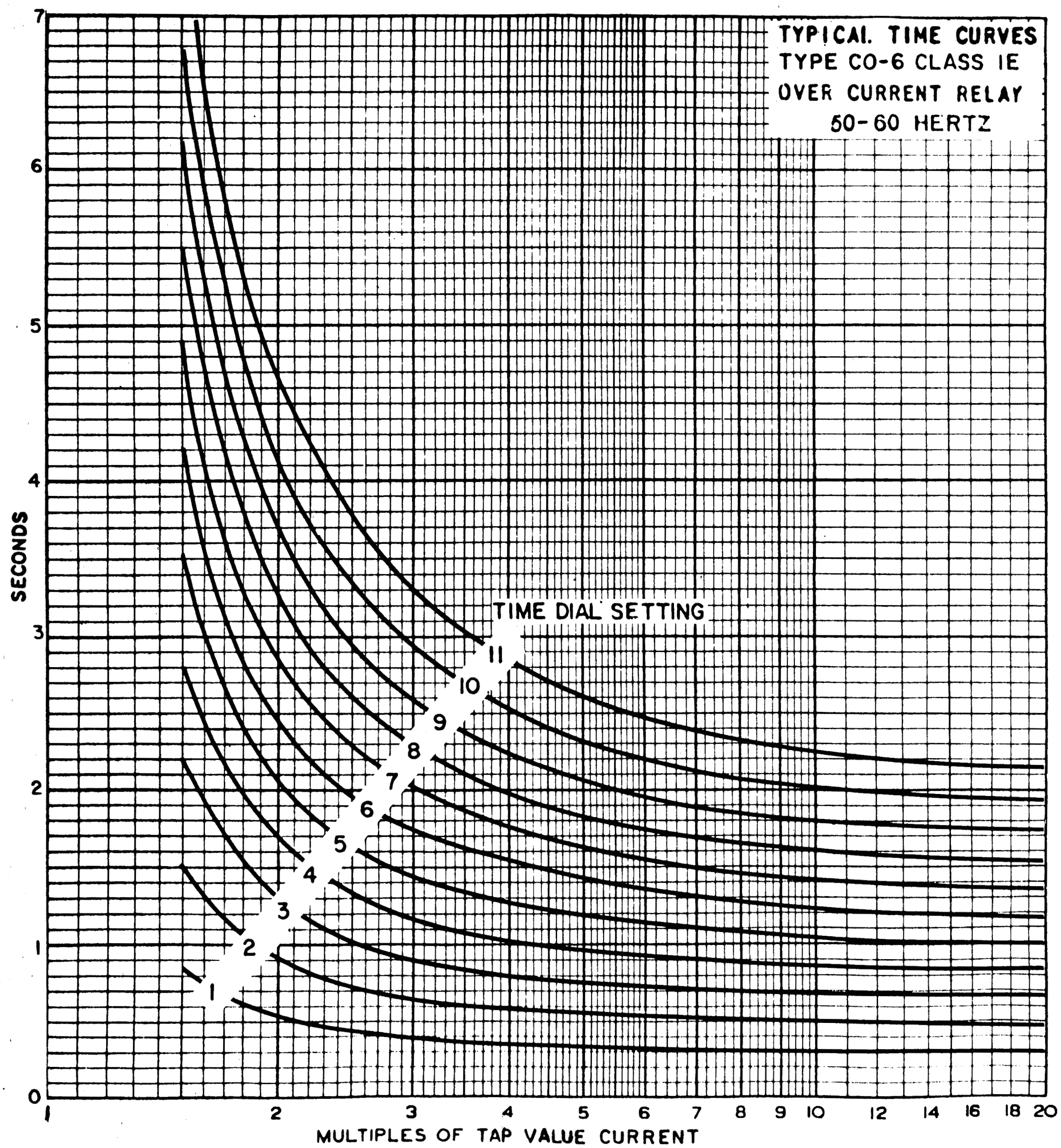

Figure 4: Typical 50 and 60 hertz Time Curves of COV-6 Overcurrent Unit

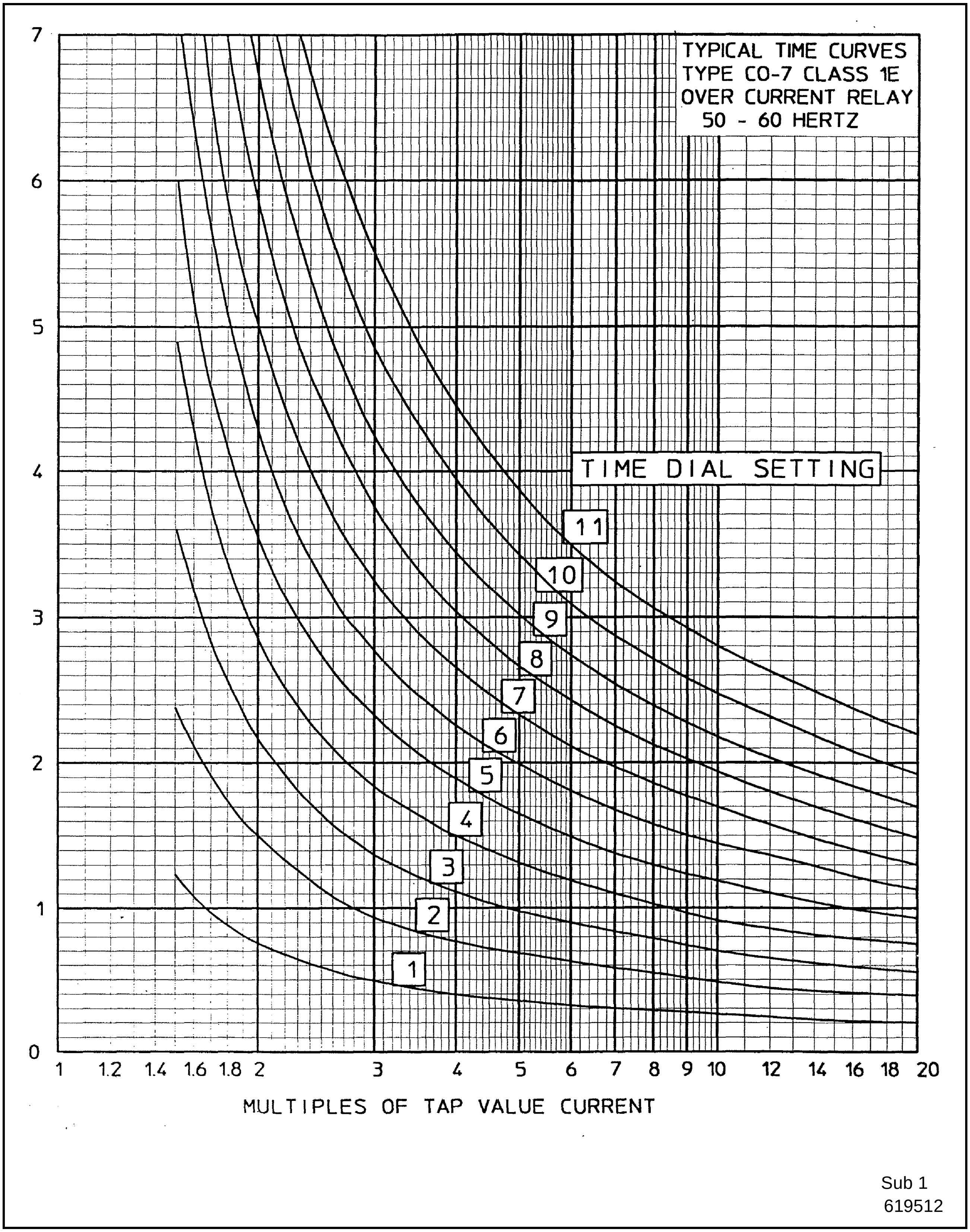

Figure 5: Typical 50 and 60 hertz Time Curves of COV-7 Overcurrent Unit

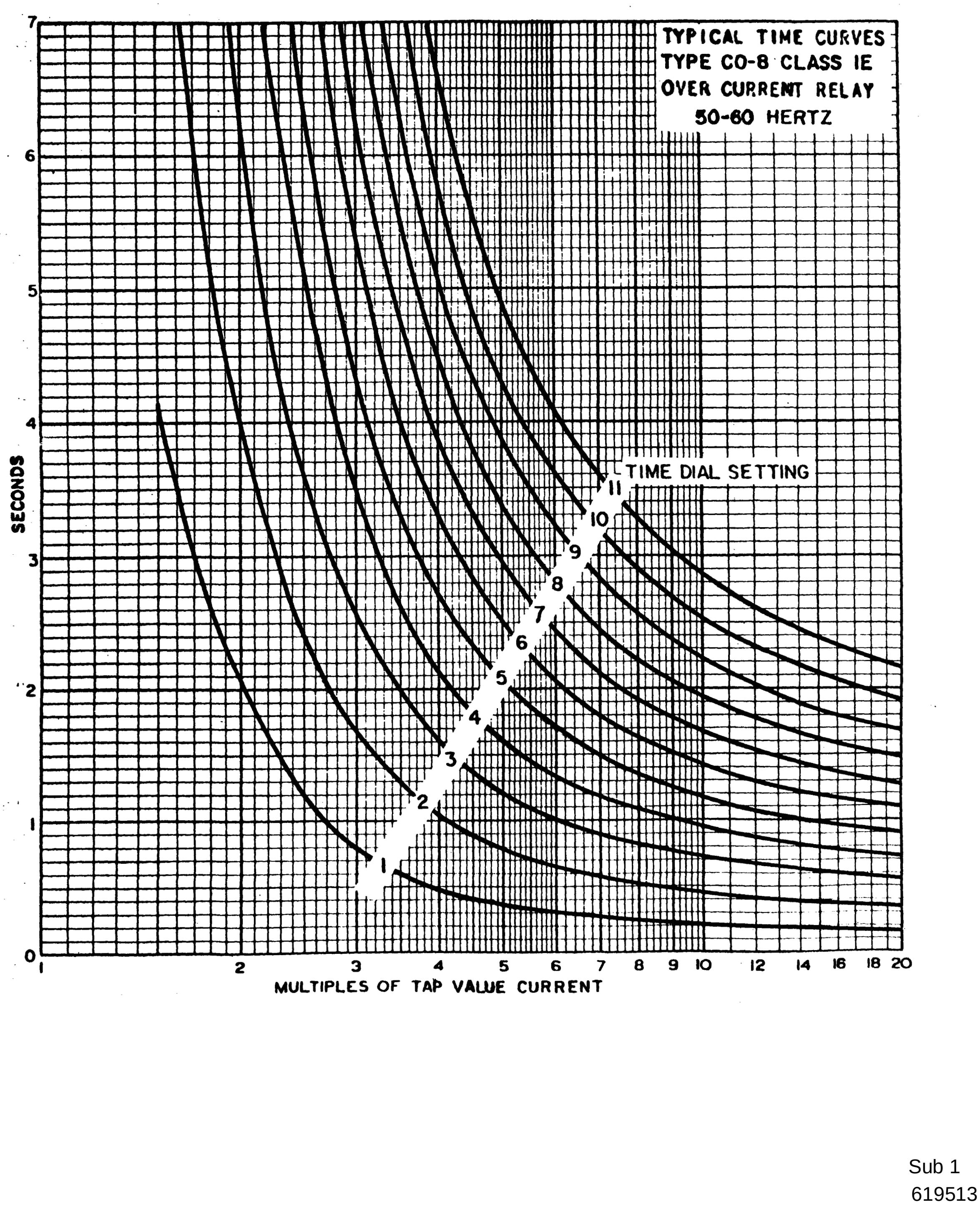

Figure 6: Typical 50 and 60 hertz Time Curves of COV-8 Overcurrent Unit

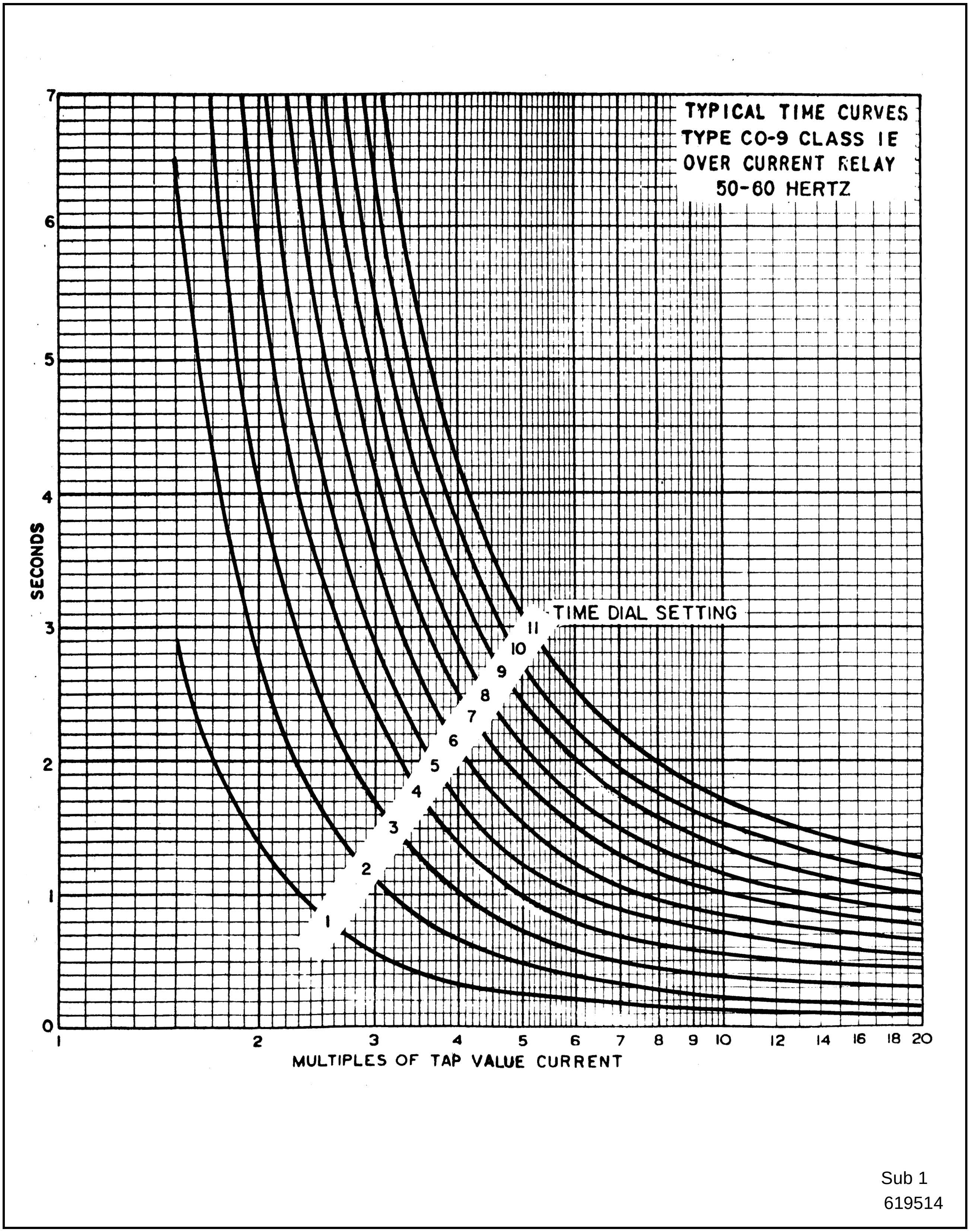

Figure 7: Typical 50 and 60 hertz Time Curves of COV-9 Overcurrent Unit

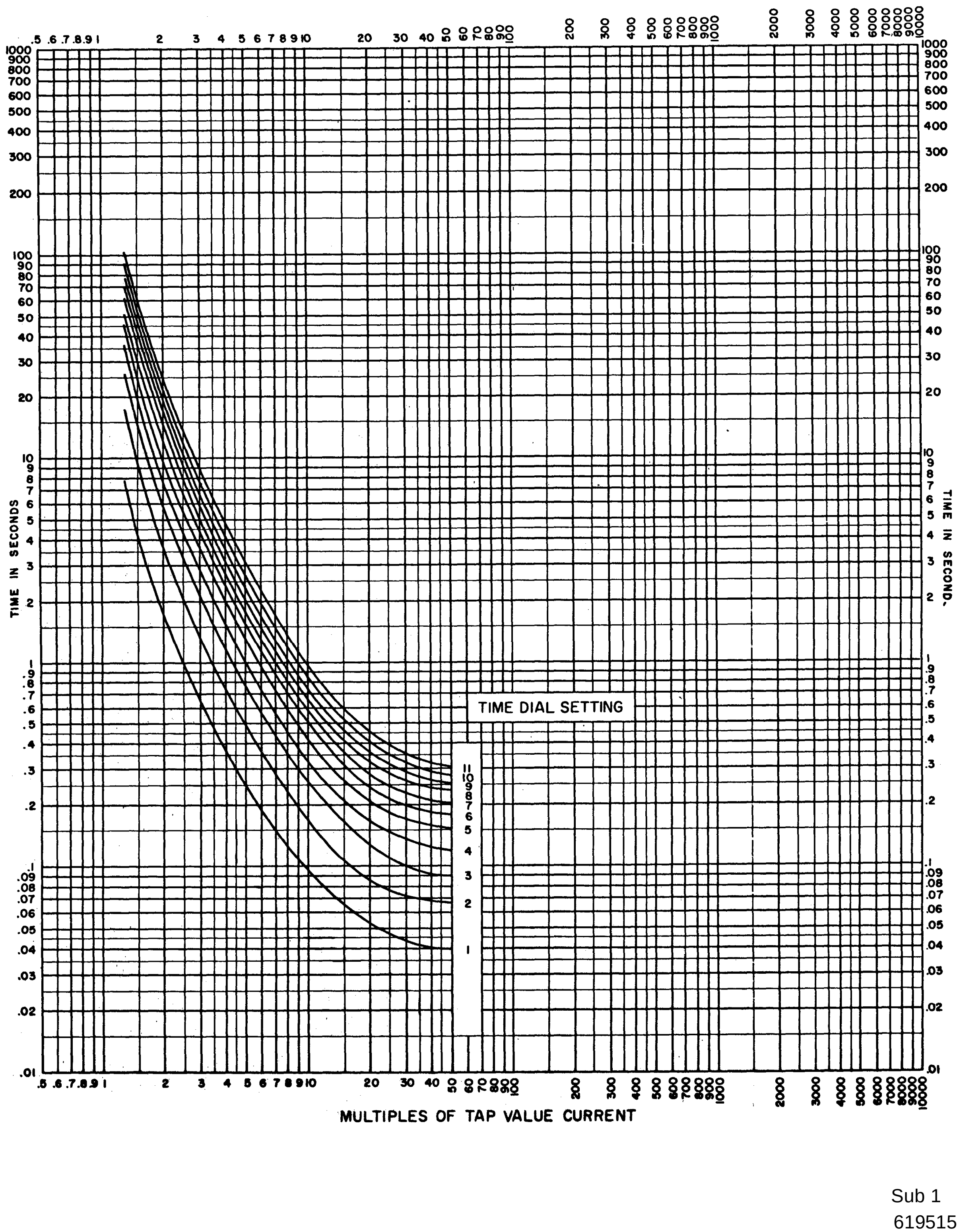

Figure 8: Typical 50 and 60 hertz Time Curves of COV-11 Overcurrent Unit

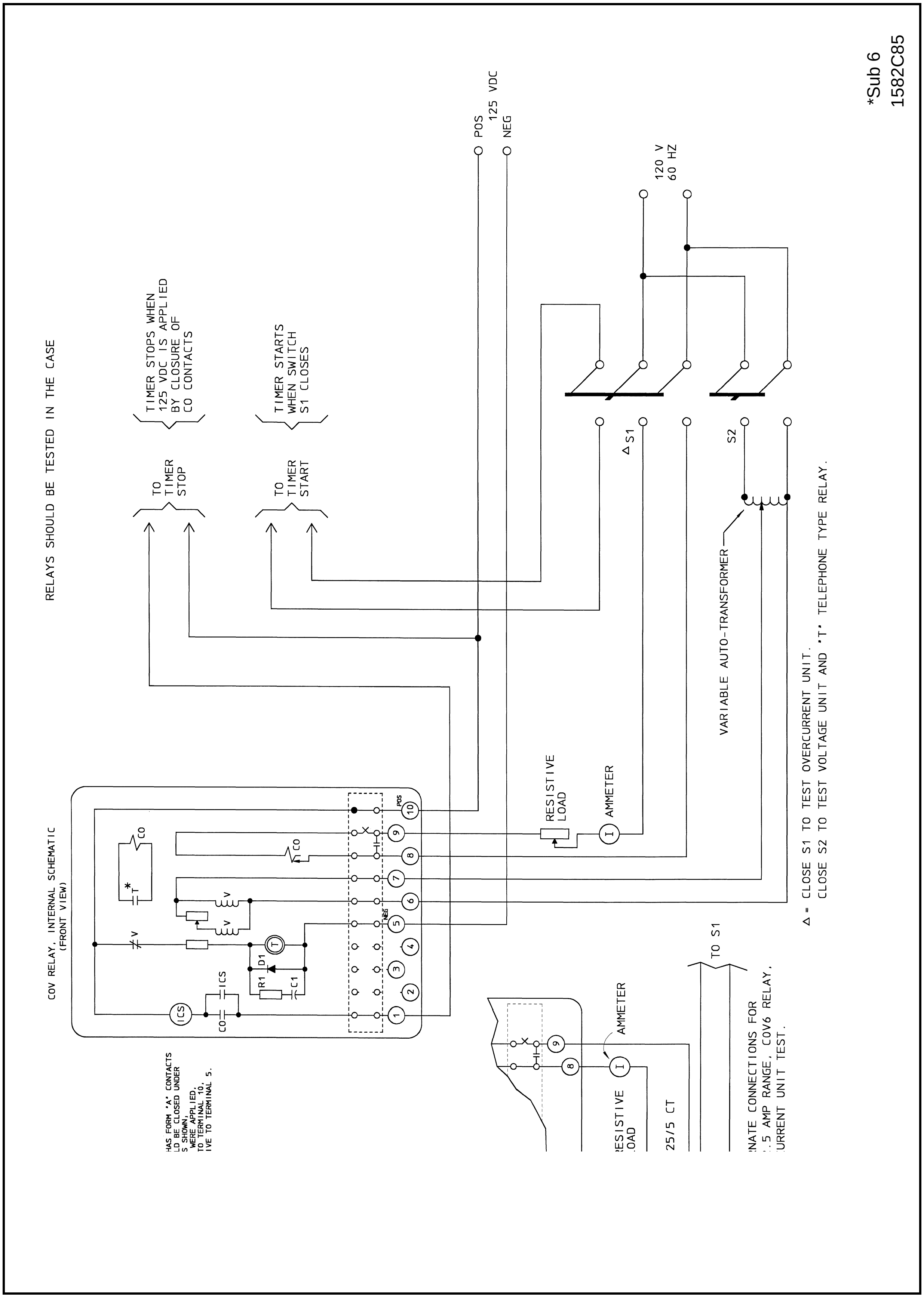

Figure 9: Diagram of Test Connections of COV Relays

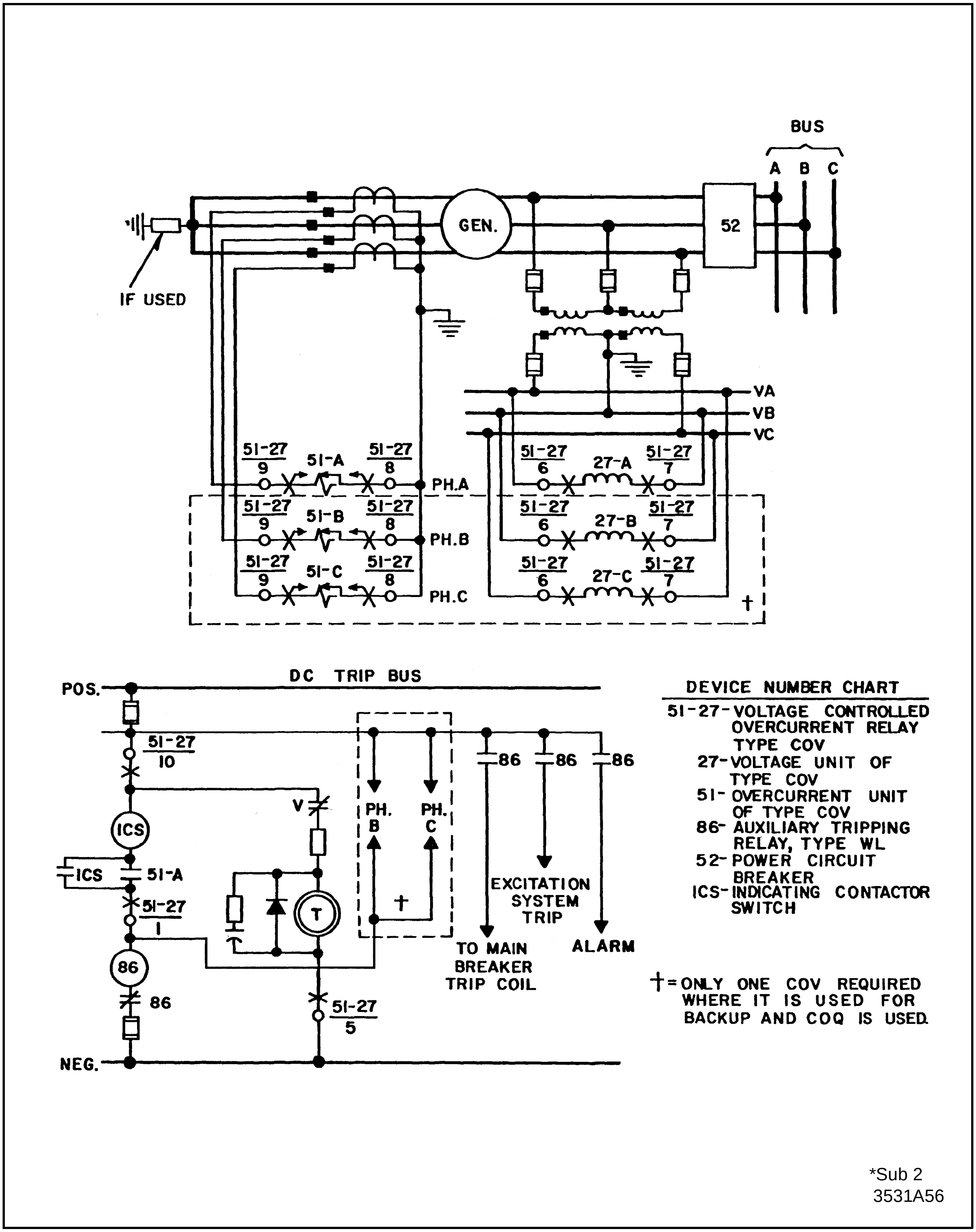

Figure 10: External Schematic of the COV Relay on a Generator

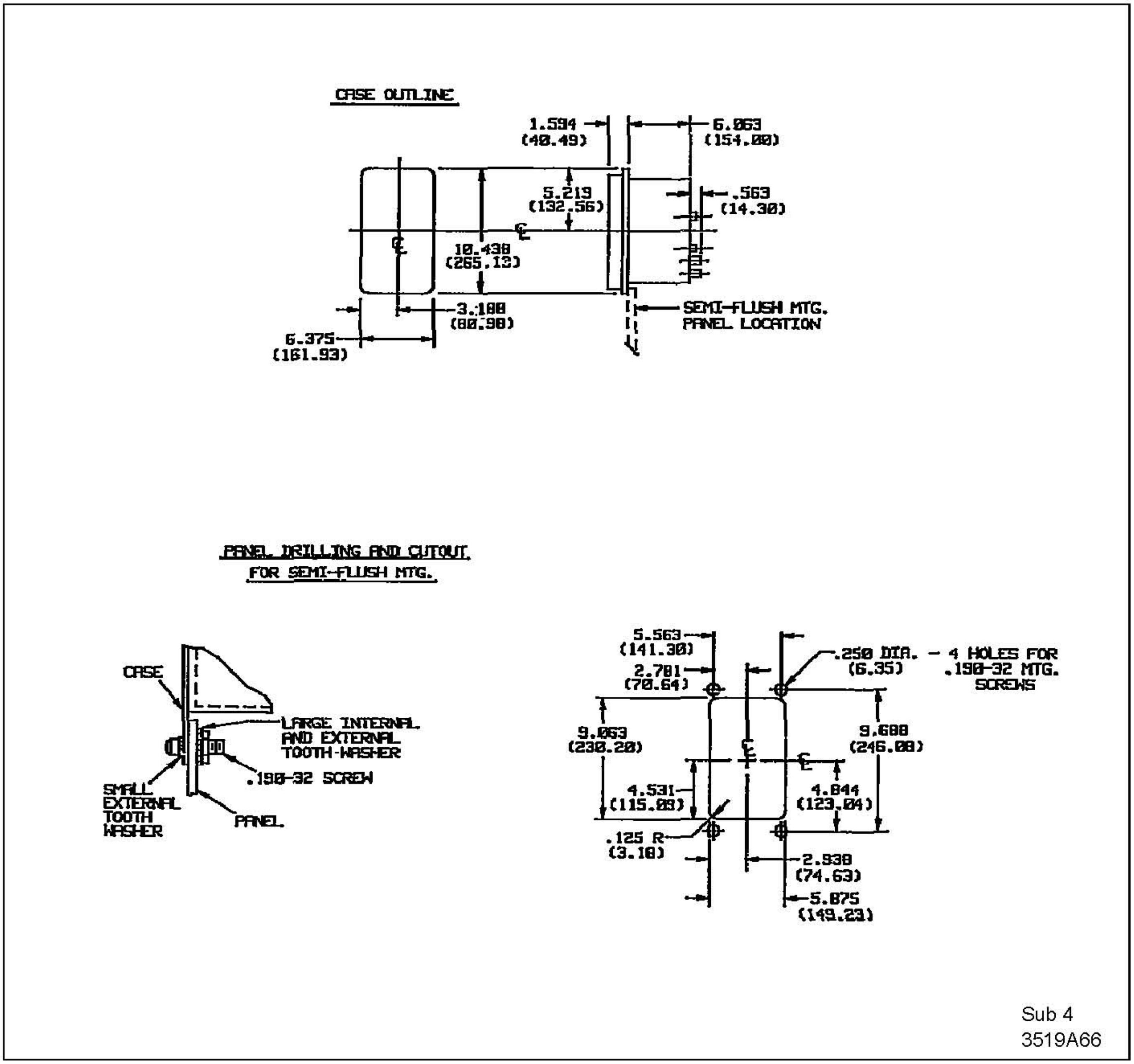

Figure 11: Outline and Drilling Plan for the Type COV Relay in Type FT21 Case (For Class 1E Application)

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