INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE COV VOLTAGE CONTROLLED OVERCURRENT RELAY

CAUTION Before putting protective 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

The type COV relay is applicable where it is desired that an overcurrent element be set to operate on less than full load current when the voltage falls below a predetermined value. Furthermore, 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.

CONSTRUCTION

The relay consists of an overcurrent element, a voltage element, an operation indicator, and a contactor switch.

Overcurrent Element

This element is an induction-disc type element operating on overcurrent. The induction disc is a thin four-inch diameter aluminum disc mounted on a vertical shaft. The shaft is supported on the lower end by a steel ball bearing riding between concave, sapphire jewel surfaces, and on the upper end by a stainless steel pin.

The moving contact is a small silver hemisphere fastened on the end of an arm. The other end of this arm is clamped to an insulated section of the disc shaft in the non-geared type relays, or to an auxiliary shaft geared to the disc shaft in the geared type relays. The electrical connection is made from the moving contact thru the arm and spiral spring. One end of the spring is fastened to the arm, and the other to a slotted spring adjuster disc which in turn fastens to the element frame.

The stationary contact assembly consists of a silver contact attached to the free end of a leaf spring. This spring is fastened to a Micarta block and mounted on the element frame. A small set screw permits the adjustment of contact follow. When double trip is required, another leaf spring is mounted on the Micarta block and a double contact is mounted on the rigid arm. Then the stationary contact set screws permit adjustment so that both circuits will be made simultaneously.

The moving disc is rotated by an electromagnet in the rear and damped by a permanent magnet in the front.

Voltage Element

The type SV element operates on the solenoid principle. A U-shaped iron frame, mounted on the moulded base, supports the coil and serves as the external magnetic path for the coil. The coil surrounds a core and flux shunt. The upper end of the core is threaded and projects through the upper side of the frame, to which it is fastened by a nut. A tube threaded on the outside at its lower end is assembled in the core, and the threaded end extends below the core. The lower bearing for the plunger shaft is inserted in the lower end of this threaded tube, and is held in place by a set screw. This bearing consists of a graphite bushing in a brass holder. The bearing for the upper end of the plunger shaft is a graphite bushing which is pressed in the upper

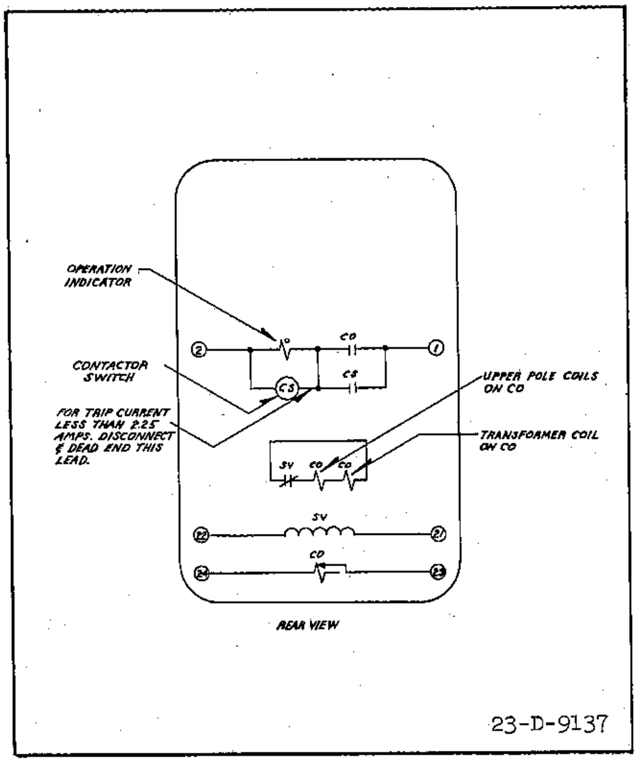

Fig. 1—Internal Schematic of the Type COV Relay in the Standard Case.

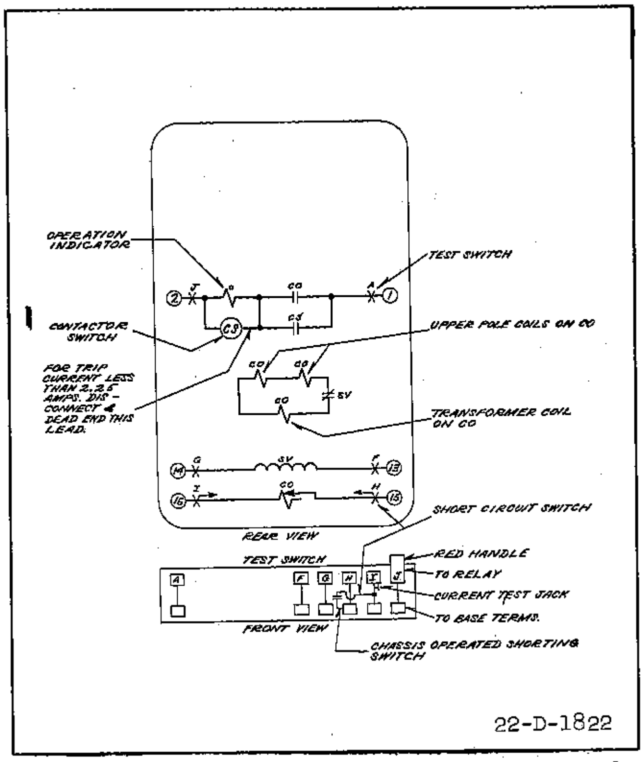

Fig. 2—Internal Schematic of the Type COV Relay in the Type FT Case.

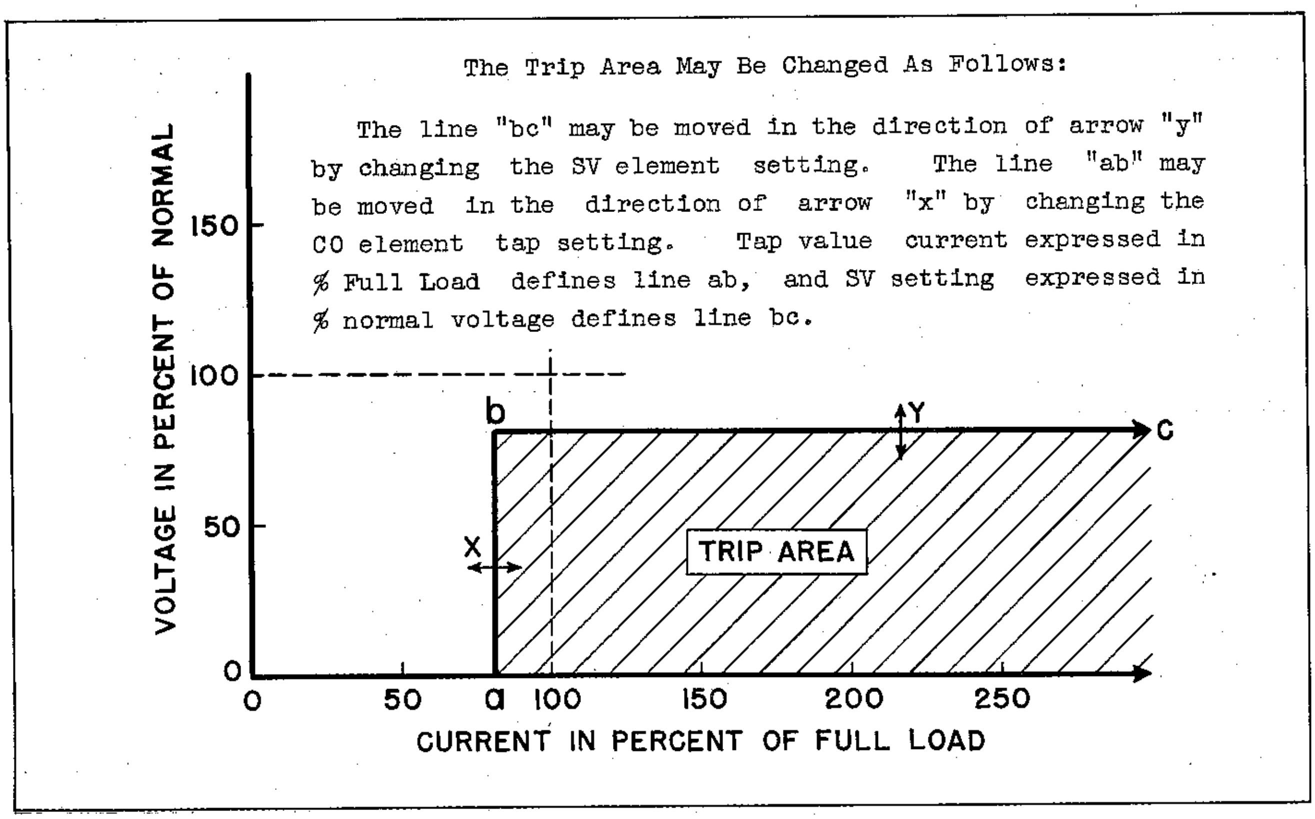

Fig. 3—Typical Tripping Characteristics of Type COV Relay.

end of the core. This bearing is visible when the plunger is in the energized position. The plunger itself does not touch the walls of the tube in which it moves.

A flux shunt which surrounds the core is screwed on the tube, and its lower end projects below the relay frame. The position of this shunt determines the drop-out setting of the relay. The lower end of the shunt is beveled and knurled, so that it can be grasped by the fingers and turned to change the setting. A calibrated scale plate is mounted adjacent to the shunt. A groove just above the knurl in the lower end of the shunt serves as an index mark, and the relay drop-out setting is indicated by the calibration scale marking which is adjacent to the groove.

The construction of the plunger, core and flux shunt causes the plunger to float in its energized position, without being held against a stop, even when energized much above the pick-up value. Consequently, there is negligible noise and the contacts are free from chatter.

The core, shunt and plunger construction also provides the high ratio of drop-out to pick-up. This ratio is above 90% for any drop-out setting.

The shunt is held in any desired position by means of a locking mechanism in which a spring, through the medium of a lever, presses a pin against the shunt. The pressure is removed by pushing the free end of the lever to the left. Only a small amount of movement is necessary to remove the pressure on the locking pin entirely. The limit of the lever movement is readily apparent on inspection of the assembly, and this should not be exceeded since the lever may be bent. The shunt is made a fairly snug fit in the frame and on the coil core tube, but when the pressure on the locking pin is released, it can be readily turned by the fingers alone. By applying greater force, it will be possible to turn the shunt without moving the lever fully to the left, but the pressure of the locking pin will prevent any creeping of the shunt or undesired change of setting.

The stationary contacts are assembled on slotted brackets. These are held in position on the base by filister-head screws which are threaded into the terminal inserts. The moving contacts are mounted on a Micarta insulation plate which is secured to the threaded end of the plunger shaft by a nut. The rear portion of the plate is slotted and a post screwed to the frame passes through this slot to prevent the plate from rotating. The moving contacts are connected to the base terminals by flexible leads. All contacts are pure silver.

Contactor Switch and Operation Indicator

The contactor switch is a small solenoid type d.c. switch, the coil of which is connected in the trip circuit. A cylindrical plunger with a silver disc mounted on its lower end moves in the core of the solenoid. As the plunger travels upward, the disc bridges three silver stationary contacts. In the single-trip relay, two of these contacts seal around the main relay contact.

The operation indicator coil is connected in the trip circuit to show a white target when the trip circuit is completed.

CHARACTERISTICS

To prevent the relay from operating for currents above the overcurrent element setting when the voltage is above the setting of the voltage element, the normally closed SV contacts are connected in the upper pole circuit of the overcurrent element. This means that the overcurrent element cannot operate unless the voltage drops to such a value as to close the SV contacts. This construction results in a tripping characteristic as shown in Fig. 3.

The time VS current curves for the overcurrent element with the SV contacts closed are shown in Fig. 4, 5 and 6.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free

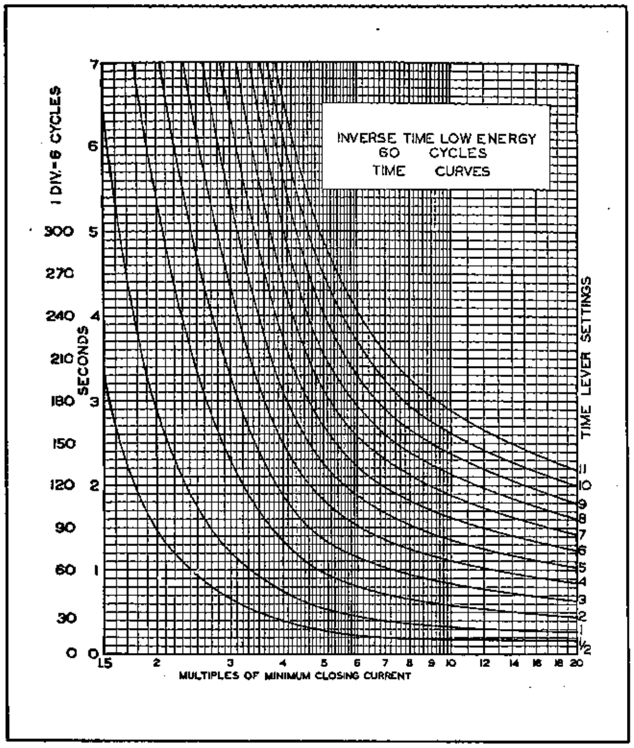

Fig. 4—Typical Inverse Time Curves of the Overcurrent Element of the Low Energy 60 Cycle Relays.

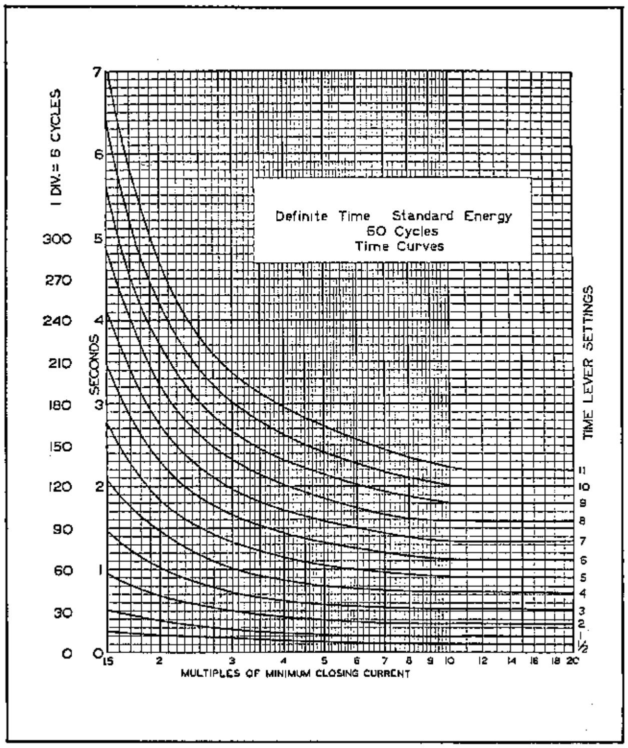

Fig. 5—Typical Inverse Definite Minimum Time Curves of the Overcurrent Element of the Standard Energy 60 Cycle Relays.

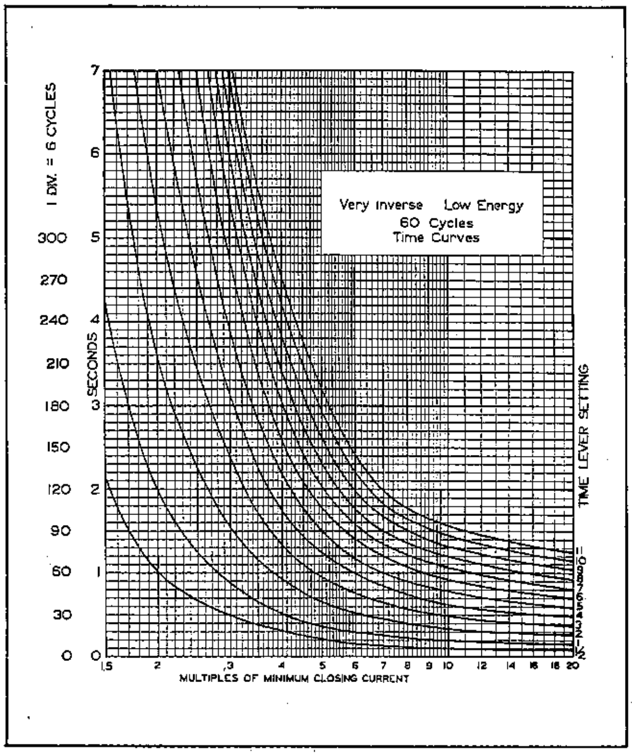

Fig. 6—Typical Very Inverse Time Curves of the Overcurrent Element of the Low Energy 60 Cycle Relays.

from dirt, moisture, excessive vibration and heat. Mount the relay vertically by means of the two mounting studs for the standard cases and the type FT projection case or by means of the four mounting holes on the flange for the semi-flush type FT case. Either of the studs or the mounting screws may be utilized for grounding the relay. The electrical connections may be made direct to the terminals by means of screws for steel panel mounting or to terminal studs furnished with the relay for ebony-asbestos or slate panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the studs and then turning the proper nut with a wrench.

SETTINGS

Current Setting

The connector screw on the terminal plate above the time scale makes connections to various turns on the operating coil. By placing this screw in the various holes, the relay will just close contacts at the corresponding current, 4-5-6-8-10-12 or 15 amperes, or as marked on the terminal plate.

The tripping value of the relay on any tap may be altered by changing the initial tension of the spiral spring. This can be accomplished by turning the spring adjuster by means of a screw driver inserted in one of the notches of the plate to which the outside convolution of the spring is fastened. An adjustment of tripping current approximately 15 per cent above or below any tap value, can be secured. By choosing the proper tap, a continous adjustment of tripping current from 3.4 amperes to 17.5 amperes may be secured.

CAUTION

Be sure that the connector screw is turned up tight so as to make a good contact, for the operating current passes through it. Since the overload element is connected directly in the current transformer circuit, the latter should be short-circuited before changing the connector screw. This can be done conveniently by inserting the extra connector screw, in the new tap and removing the old screw from its original setting.

Time Lever Setting

The index or time lever limits the motion of the disc and thus varies the time of operation. The latter decreases with lower lever settings as shown in the typical time curves.

Voltage Setting

The position of the magnetic shunt of the SV element determines the voltage value at which the SV contacts will close. The lower end of the shunt is beveled and knurled, so that it can be grasped by the fingers and turned to change the setting. A calibrated scale plate is mounted adjacent to the shunt. A groove is above the knurl in the lower end of the shunt serves as an index mark, and the relay drop-out setting is indicated by the calibration scale marking which is adjacent to the groove.

ADJUSTMENTS AND MAINTENANCE

All relays should be inspected periodically and the time of operation should be checked at least once every six months. For this purpose, a cycle counter should be employed because of its convenience and accuracy. Phantom loads should not be used in testing induction-type relays because of the resulting distorted current wave from which produces an error in timing.

All contacts should be periodically cleaned with a fine file. S#1022110 file 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.

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be disturbed after receipt by the customer. If the adjustments have been changed or the relay taken apart for repairs, the following instructions should be followed in reassembling and setting it.

Overcurrent Element

Shift the position of the contact stop on the time lever and adjust the contacts so that they barely touch when the time lever is set on zero. Adjust the tension of the spiral spring so that the relay will close its contacts at its rated current, as shown by the position of the screw on the terminal block. Shift the position of the damping magnets so that the time characteristics of the relay, are as shown on the typical time curve.

Voltage Element

In order to remove the plunger and shaft assembly, it is necessary to loosen the set screw in the lower guide bearing and slip the bearing out of the tube. The spool-shaped bushing assembled on the upper end of the plunger shaft has a portion of its center section machined off so that the shaft is exposed at this point and can be prevented from turning by gripping shaft and bushing with a pair of long-nose pliers. The set screw and nut at the upper end of the shaft can then be removed, after which the shaft and plunger will drop out of the core assembly. The shaft and plunger assembly should be handled carefully to avoid bending the shaft or damaging the bearing surfaces. The shaft should never be gripped on its upper bearing surface, below the spool shaped bushing, when loosening the nut and set screw, as this would almost certainly damage the bearing surface. The shaft bearing surfaces should not be cleaned or polished with any abrasive material, as the abrasive particles might become imbedded in the shaft and cause difficulty later. The plunger shaft and bearings may be cleaned by wiping them carefully with a clean, lintless cloth. This may be moistened with benzene or some other cleaning solvent if necessary. Use no lubricant on the plunger shaft or bearings when reassembling the relay, since this will eventually become gummy and prevent proper operation.

The stationary contacts should be located so that they just touch the moving contacts when the latter are 1/32" above the de-energized position.

The lever of the shunt-locking device should be approximately parallel with the mounting block. A variable number of thin spacer washers are assembled on the left hand end of the locking pin in order to obtain this adjustment when the relay is assembled at the factory. If the locking device is dismantled later, these washers should be preserved and replaced.

Contactor Switch

Adjust the stationary core of the switch for a clearance between the stationary core and the moving core of 1/64" when the switch is picked up. This can be done by turning the relay up-side-down or by disconnecting the switch and turning it up-side-down. Then screw up the core screw until the moving core starts rotating. Now, back off the core screw until the moving core stops rotating. This indicates the points where the play in the assembly is taken up, and where the moving core just separates from the stationary core screw. Back off the core screw approximately one turn and lock in place. This prevents the moving core from striking and sticking to the

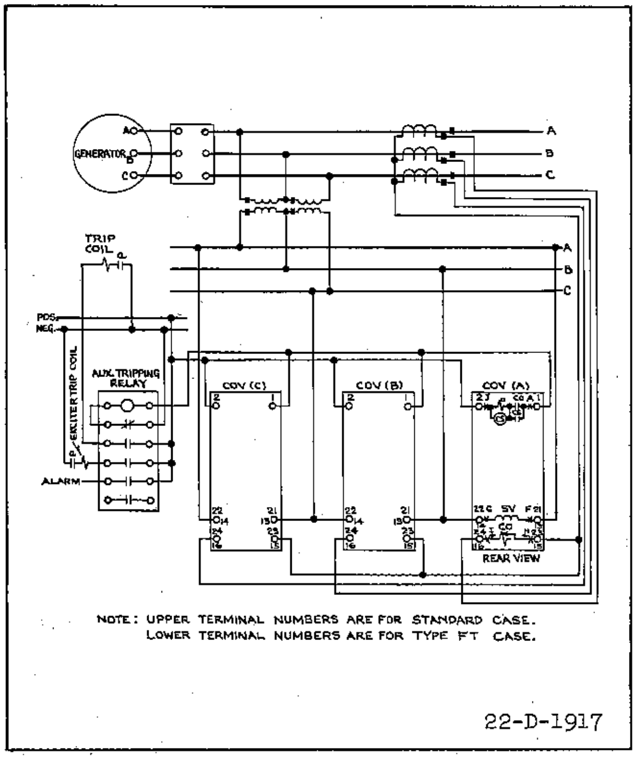

Fig. 7—External Connections of the type COV Relay.

stationary core because of residual magnetism. Adjust the contact clearance for 3/32" by means of the two small nuts on either side of the Micarta disc. The switch should pick-up at 2 amperes d.c. Test for sticking after 30 amperes d.c. have been passed through the coil.

Operation Indicator

Adjust the indicator to operate at 0.2 ampere d.c. gradually applied. Test for sticking after 5 amperes d.c. is passed.

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.

CONTACT CIRCUIT CONSTANTS

Universal Trip Circuit
Resistance of 0.2 ampere Target... 2.8 ohms
Resistance of 2.0 ampere
Contact Switch .... 0.25 ohms
Resistance of Target and Switch
in Parallel .... 0.23 ohms

ENERGY REQUIREMENTS

The burdens and thermal capacities of the various circuits of the relay are as follows:

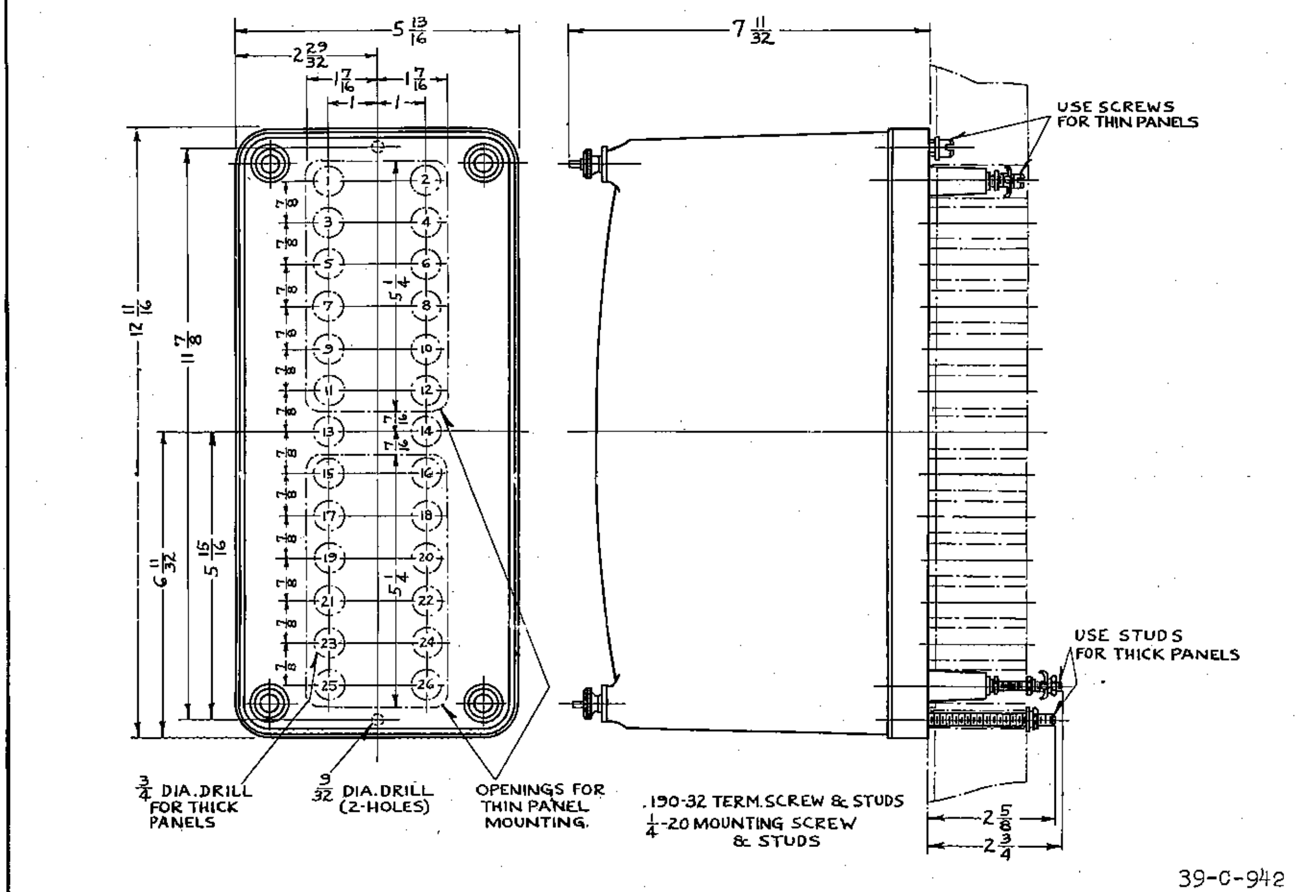

Fig. 8—Outline and Drilling Plan for the Standard Case. See the Internal Schematic for the Terminals Supplied. For Reference Only.

DEFINITE MINIMUM TIME OVERCURRENT ELEMENT AT 60 CYCLES

Ampere Range	Tap	V.A. at 5 Amperes	V.A. at Tap Current	Power Factor	Continuous Rating (Amperes)	One* Second Rating (Amperes)
2/6	2	108	17	60° lag	4	140
	2.5	68	17	60° lag	5	140
	3	47	17	60° lag	5	140
	3.5	35	17	60° lag	6	140
	4	26	17	60° lag	7	140
	5	17	17	60° lag	8	140
	6	12	17	60° lag	10	140
4/15	4	26	17	60° lag	8	250
	5	17	17	60° lag	8	250
	6	12	17	60° lag	9	250
	8	6.5	17	60° lag	10	250
	10	4.5	17	60° lag	12	250
	12	3	17	60° lag	13	250
	15	2	17	60° lag	15	250

INVERSE TIME OVERCURRENT ELEMENT AT 60 CYCLES

Ampere Range	Tap	V.A. at 5 Amperes	V.A. at Tap Current	Power Factor	Continuous Rating (Amperes)	One* Second Rating (Amperes)
0.5/2.5	0.5	200	2	66° lag	2	70
	0.6	140	2	66° lag	2	70
	0.8	78	2	66° lag	2	70
	1.0	50	2	66° lag	3	70
	1.5	22	2	66° lag	3	70
	2.0	12.5	2	66° lag	4	70
	2.5	8	2	66° lag	5	70
2/6	2	12.4	2	66.4° lag	8	250
	2.5	8	2	66.4° lag	8	250
	3	5.6	2	66.4° lag	8	250
	3.5	4.1	2	66.4° lag	8	250
	4	3.1	2	66.4° lag	9	250
	5	2	2	66.4° lag	9	250
	6	1.3	2	66.4° lag	10	250
4/15	4	3.1	2	66.4° lag	16	250
	5	2	2	66.4° lag	16	250
	6	1.4	2	66.4° lag	16	250
	8	0.8	2	66.4° lag	17	250
	10	0.5	2	66.4° lag	18	250
	12	0.3	2	66.4° lag	19	250
	15	0.2	2	66.4° lag	20	250

VERY INVERSE TIME OVERCURRENT ELEMENT AT 60 CYCLES

Ampere Range	Tap	V.A. at 5 Amperes	V.A. at Tap Current	Power Factor	Continuous Rating (Amperes)	One* Second Rating (Amperes)
0.5/2.5	0.5	125	1.25	66.4° lag	2	100
	0.6	87	1.25	66.4° lag	2	100
	0.8	49	1.25	66.4° lag	2	100
	1.0	31	1.25	66.4° lag	3	100
	1.5	14	1.25	66.4° lag	3	100
	2.0	8	1.25	66.4° lag	4	100
	2.5	5	1.25	66.4° lag	5	100
2/6	2	8	1.25	66.4° lag	8	250
	2.5	5	1.25	66.4° lag	8	250
	3	3.5	1.25	66.4° lag	8	250
	3.5	2.5	1.25	66.4° lag	8	250
	4	1.9	1.25	66.4° lag	9	250
	5	1.25	1.25	66.4° lag	9	250
	6	0.9	1.25	66.4° lag	10	250
4/15	4	1.9	1.25	66.4° lag	16	250
	5	1.25	1.25	66.4° lag	16	250
	6	0.9	1.25	66.4° lag	16	250
	8	0.5	1.25	66.4° lag	17	250
	10	0.3	1.25	66.4° lag	18	250
	12	0.2	1.25	66.4° lag	19	250
	15	0.15	1.25	66.4° lag	20	250

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

BURDENS FOR SATURATION DATA

Voltage taken with Rectox type voltmeter.

Multiples of Tap Values of Current		1	3	10	20
Definite Time	V.A. Burden	17	100	490	1300
Inverse Time	V.A. Burden	2.0	20	136	351
Very Inverse Time	V.A. Burden	1.25	10.75	97	254

CHARACTERISTICS OF SV ELEMENT

Frequency Cycles	Range of Adjustment Volts	Max. Volts Continuous	Watts at 115 V. AC 125 V. for DC	V.A. at 115 V.	Drop-out Ratio
60	70-160	160	3.4	7.3	90-98%

Values of watts and volt-amperes in the table are average for various plunger and shunt positions.

Drop-out ratio varies somewhat with drop-out adjustment but will be approximately constant for any given drop-out setting. Limits in tables include variables such as friction and other individual relay variations.

Maximum continuous volts given for the SV drop-out element is for the relay set for minimum drop-out. With the relay set for maximum drop-out the continuous voltage can be increased 10 to 20%.

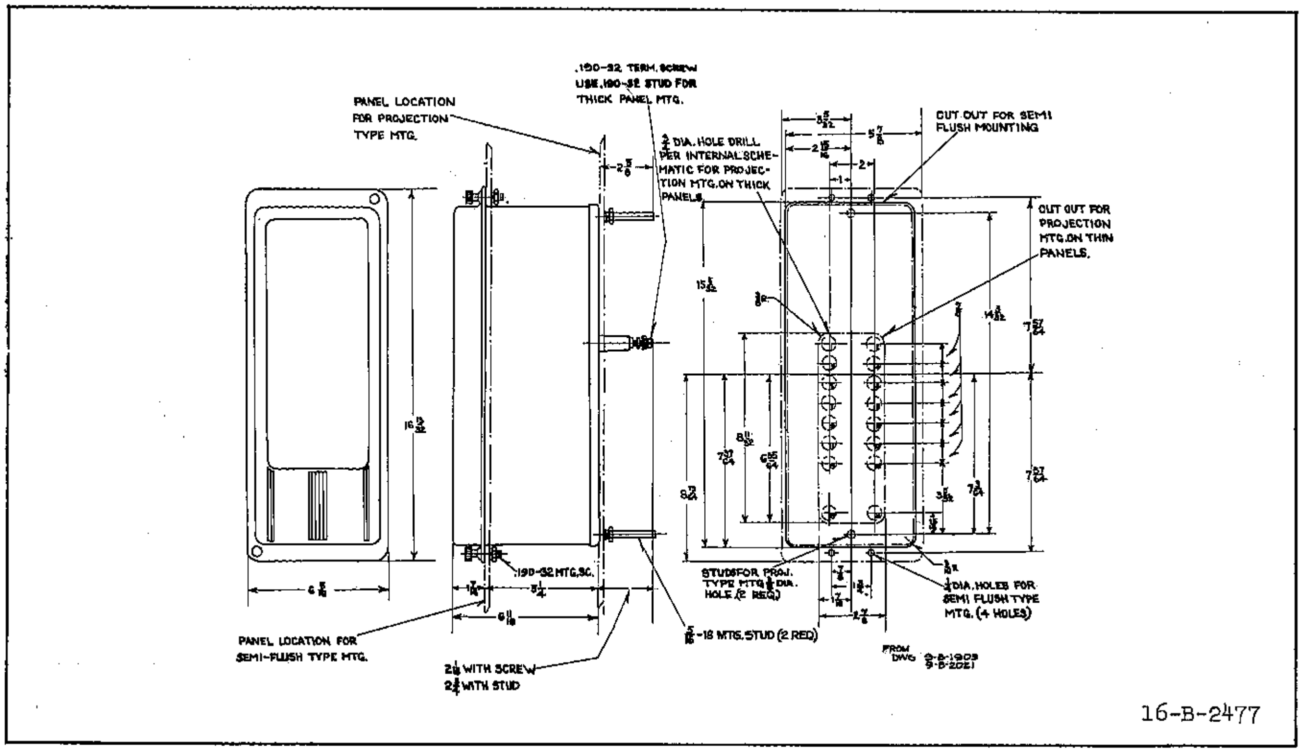

Fig. 9—Outline and Drilling Plan for the Semi-flush or Projection Type FT Case. See the Internal Schematic for the Terminals Supplied. For Reference Only.

WESTINGHOUSE ELECTRIC CORPORATION

METER DIVISION • **NEWARK, N.J.**

Printed in U.S.A.