INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CO-10 OVERCURRENT 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.

APPLICATION

These induction-overcurrent relays are used to disconnect circuits or apparatus when the current in them exceeds a given value for a specific length of time.

The type CO-10 relay current vs time characteristic make it particularly suitable for applications that require the coordination between fuses and relays, also as an overcurrent relay for distribution circuits.

CONSTRUCTION AND OPERATION

The type CO-10 relay consists of an overcurrent element, and operation indicator, a contactor switch, and an instantaneous trip attachment where required.

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 contacts 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.

The electrical connection is made from the moving contact through 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.

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

Contactor Switch

The d-c contactor switch in the relay is a small solenoid type switch. 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. The coil is in series with the main contacts of the relay and with the trip coil of the breaker. When the relay contacts close, the coil becomes energized and closes the switch contacts. This shunts the main relay contacts, thereby relieving them of the duty of carrying tripping current. These contacts remain closed until the trip circuit is opened by the auxiliary switch on the breaker.

Operation Indicator

The operation indicator is a small solenoid

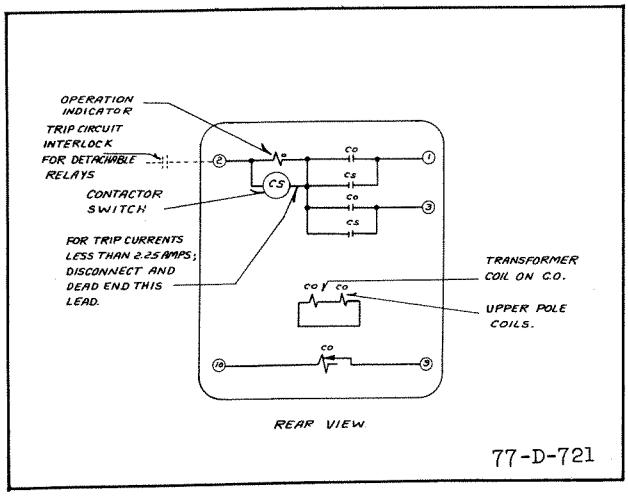

Fig. 1—Internal Schematic Of The Double Trip Circuit Closing Type CO-10 Relays In The Standard Case. The Single Trip Relays Have Terminal 3 And Associated Circuits Omitted.

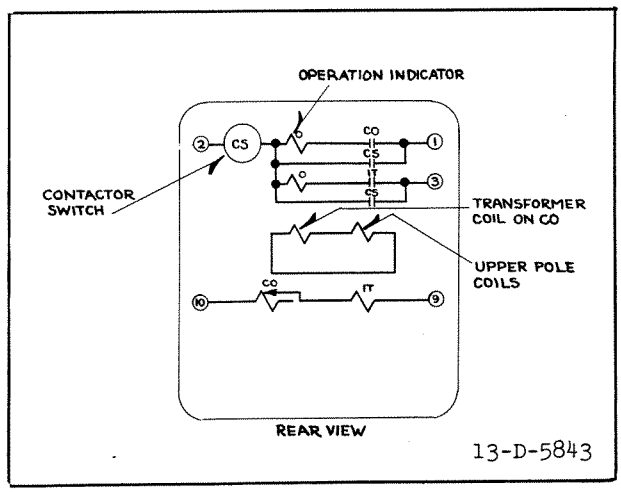

Fig. 2—Internal Schematic Of The Single Trip Circuit Closing Type CO-10 Relays With Instantaneous Trip Attachment In The Standard Case.

coil connected in the trip circuit. When the coil is energized, a spring-restrained armature releases the white target which falls by gravity to indicate completion of the trip circuit. The indicator is reset from outside of the case by a push rod in the cover or cover stud.

Instantaneous Trip (When Supplied)

The instantaneous trip attachment is a small solenoid switch whose coil is connected in the main current circuit. It functions to energize the breaker trip coil instantaneously and independently of power direction when the fault current is exceptionally heavy.

A cylindrical plunger rides up and down on a vertical guide rod in the center of a solenoid core, which in turn screws into the element frame. A silver disc is fastened to the moving plunger thru a helical spring. When the coil is energized, the plunger moves upward carrying the silver disc which bridges three conical-shaped stationary contacts. In this position, the helical spring is compressed and the plunger is free to move while the contacts remain stationary. Thus a-c vibrations of the plunger are prevented from causing contact bouncing. A Micarta disc screws in the bottom of the guide rod and is locked in place by a small nut. Its position determines the pick-up current of the element.

CHARACTERISTICS

The type CO-10 relay is available in the following current ranges:

.5 - .6 - .8 - 1.0 - 1.5 - 2.0 - 2.5

2.0 - 2.5 - 3.0 - 3.6 - 4.0 - 5.2 - 6.0

4.0 - 5.2 - 6.0 - 7.2 - 8 - 9 -12

The tap value is the minimum current required to just close the relay contacts. In addition to the taps, the initial position of the moving contact is adjustable around a semicircular lever scale calibrated in 11 division.

Trip Circuit

The main contacts will safely close 30 amperes at 250 v. d-c, and the switch contacts will safely carry this current long enough to trip a breaker.

The relay without the instantaneous trip attachment is shipped with the operation indicator and the contactor switch connected in parallel. This circuit is suitable for all trip currents above 2.25 amperes d-c. If the trip current is less than 2.25 amperes, there is no need for the contactor switch and it should be disconnected. To disconnect the

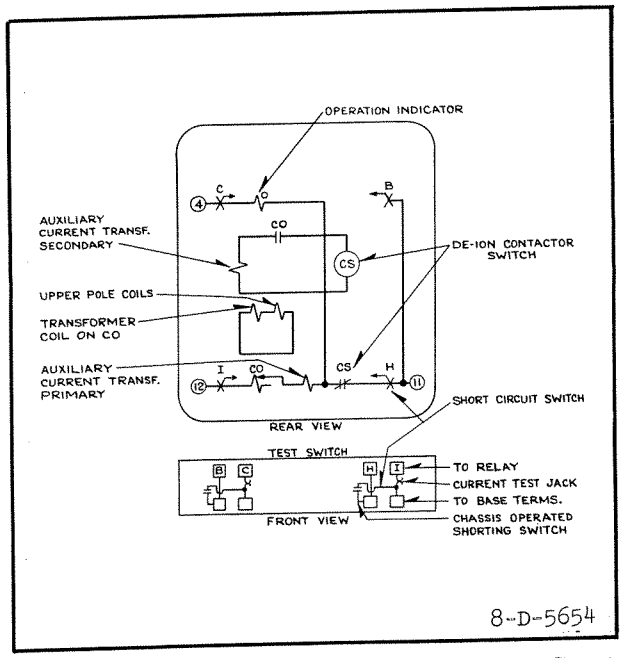

Fig. 3—Internal Schematic Of The Single Trip Circuit Opening Type CO-10 Relay In The Type FT Case.

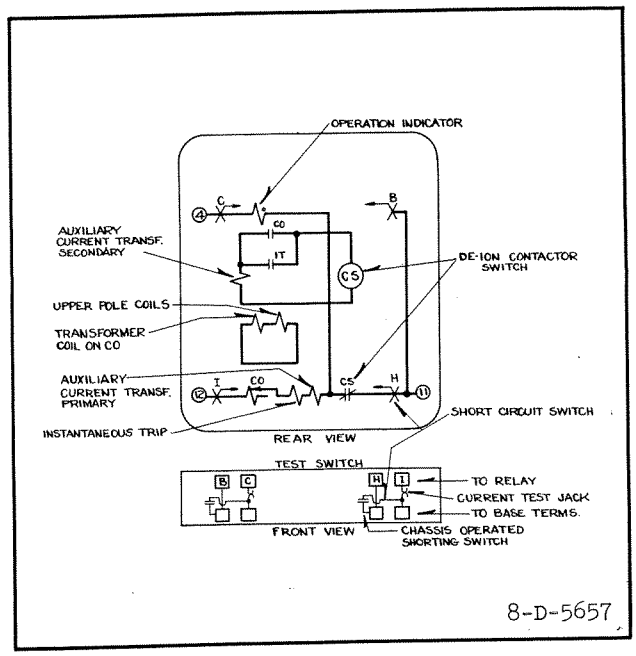

Fig. 4—Internal Schematic Of The Single Trip Circuit Opening Type CO-10 Relay With Instantaneous Trip Attachment In The Type FT Case.

coil in the standard case relays, remove the short lead to the coil on the front stationary contact of the contactor switch. This lead should be fastened (dead ended) under the small filisterhead screw located in the Micarta base of the contactor switch. For the Flexitest relays, the coil is disconnected by removing the coil lead at the spring adjuster and dead-ending it under a screw at the top of the Micarta support.

The relay with the instantaneous trip attachment has a two ampere contactor switch in series with a one ampere operation indicator in each trip path.

Relay With Quick-Opening Contacts

When the relays are used with circuit breakers that are instantaneously reclosed, it is necessary to arrange the relay contacts to be quick opening. This is done by screwing in the small set screw on the stationary contact assembly until the contact rivet rests solidly on the Micarta support. When this is done, the position of the contact stop on the time lever should be shifted so that the moving and stationary contacts barely touch when the time lever is set on zero.

CONTACT CIRCUIT CONSTANTS

Universal Trip Circuit

Resistance of 0.2 ampere target.....2.8 ohms
Resistance of 2.0 ampere Contactor Switch.....
0.25 ohm
Resistance of Target and Switch in Parallel...
0.23 ohm

Trip Circuit With Instantaneous Trip

Resistance of 1.0 ampere target.....0.16 ohm
Resistance of 2.0 ampere Contactor Switch.....
0.25 ohm
Resistance of Target and Switch in Series.....
0.41 ohm

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 two mounting studs for the standard cases and the type FT projection case or by means of

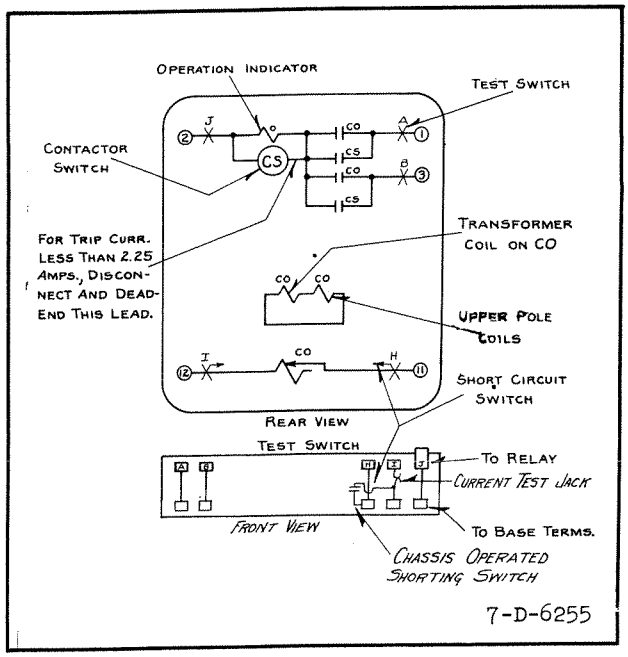

Fig. 5—Internal Schematic Of The Double Trip Circuit Closing Type CO-10 Relays In The Type FT Case. The Single Trip Relays Have Terminal 3 And Associated Circuits Omitted.

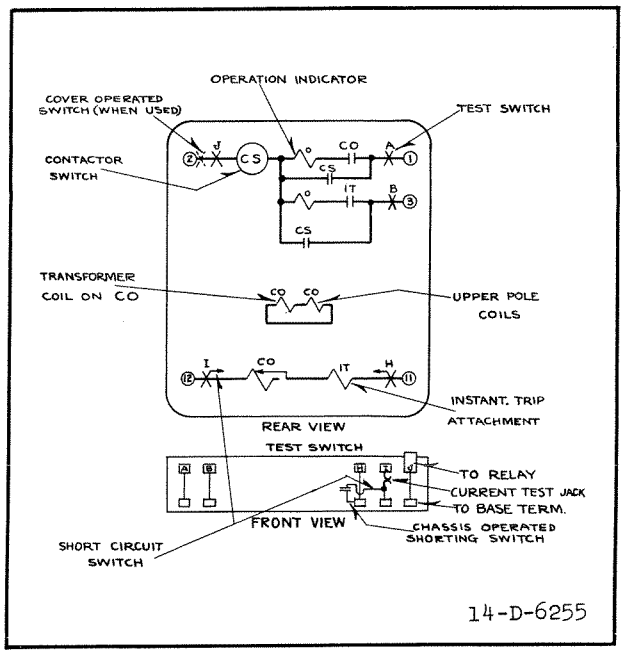

Fig. 6—Internal Schematic Of The Single Trip Circuit Closing Type CO-10 Relays With Instantaneous Trip Attachment In The Type FT Case.

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

There are two settings - namely the current value at which the relay closes its contacts and the time required to close them. When the relay is to be used to protect equipment against overload, the setting must be determined by the nature of the load, the magnitude of the peaks and the frequency of their occurrence.

For sectionalizing transmission systems the current and time setting must be determined by calculation, due consideration being given to the time required for circuit breakers to open so that proper selective action can be obtained throughout the system.

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 4.0 - 5.2 - 6.0 - 7.2 8 - 9 - 12 amperes, or as marked on the terminal plate.

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 circuits the latter should be short-circuited before changing the connector screw. This can be done conveniently by inserting the extra connector screw, located on the right-hand mounting boss, 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 of Figure.5.

ADJUSTMENTS AND MAINTENANCE

All relays should be inspected periodically and the time of operation should be checked at least once every six months. 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 cleaned periodically. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

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, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

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 tap block. Shift the position of the damping magnets so that the time characteristics of the relay, are as shown on the typical time curves. In the factory the relay is tested from the No. 10 lever position. The adjustment of spring tension has a great effect on the time curve for values, below 1.5 times minimum trip. Therefore slight changes of spring tension is an adjustment that may be used when recalibrating a type CO-10 relay. The calibration is intended to be on the basis of the cool or normal operation condition inasmuch as overloads are of short duration. When checking a number of points on the time curves, it will be necessary to cool the relay coils between points particularly after operating at high currents. An air hose may be used for this purpose.

Contactor Switch

Adjust the stationary core of the switch for a clearance between the stationary core and the moving core when the switch is picked-up. This can be most conveniently done by disconnecting the switch and turning it or the relay upside-down. 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 moving contact assembly is taken up, and where the moving core just separates from the stationary core screw. Back off the stationary core screw one turn beyond this point and lock in place. This prevents the moving core from striking and sticking to the stationary core because of residual magnetism. Adjust the contact clearance for 3/32 inch 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 or 1.0 ampere d-c as supplied gradually applied by loosening the two screws on the under side of the assembly, and moving the bracket forward or backward. Test for sticking after 10 times rated pick-up current have been applied.

Instantaneous Trip Attachement

The position of the Micarta disc at the bottom of the element with reference to the calibrated guide indicates the minimum overcurrent required to operate the element. This disc should be lowered or raised to the proper position by loosening the locknut and rotating the Micarta disc. The nominal range of adjustments is 1 to 4, for example 10 to 40 amperes, and it has an accuracy within the

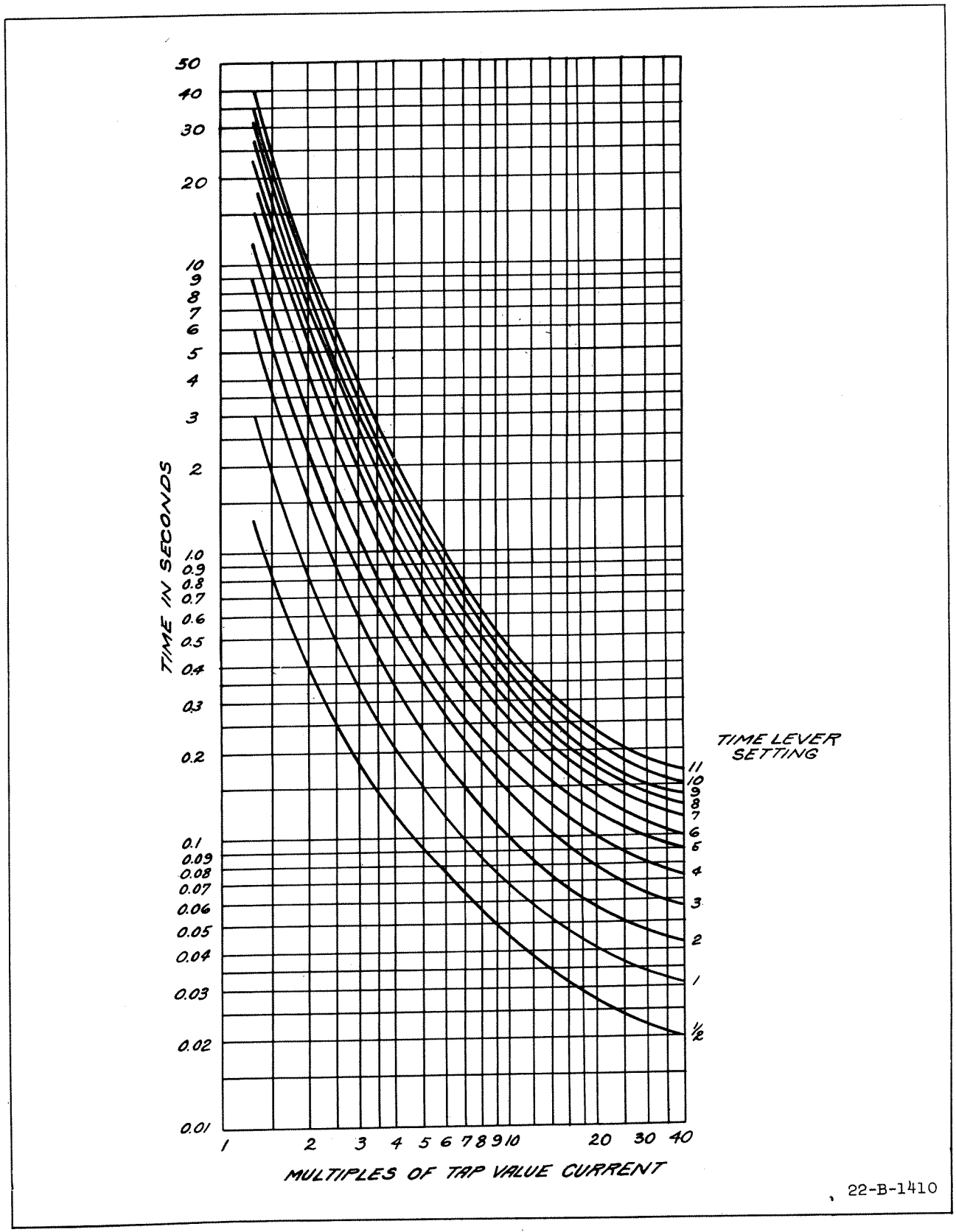

Fig. 7—Typical 60 Cycle Time Curve For The Type CO-10 Relay.

limits of approximately plus or minus 10%.

The drop-out value is varied by raising or lowering the core screw at the top of the switch and after the final adjustment is made, the core screw should be securely locked in place with the locknut. It should be adjusted for about 2/3 of the minimum pick-up.

BURDEN

The burden of the type CO-10 relay is very low and ranges from 0.30 volt amps to 0.5 volt amps at 65 degrees current lagging the voltage for tap value current.

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.

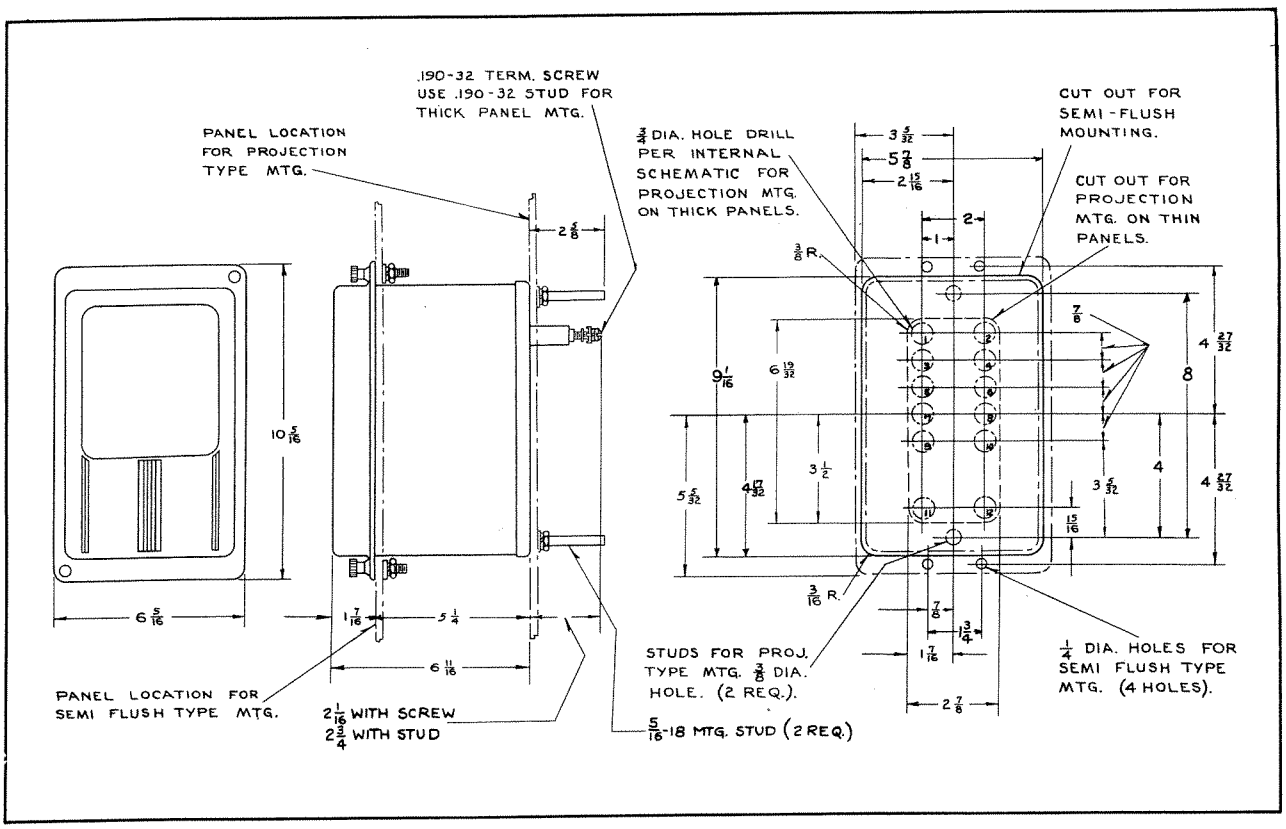

Fig. 8—Outline And Drilling Plan For The Type CO-10 Relay In The S10 Projection Or Semi-Flush Type FT Case. See The Internal Schematics For The Terminals Supplied. For Reference Only.

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