INSTALLATION • OPERATION • MAINTENANCE

# INSTRUCTIONS

# TYPE POQ NEGATIVE SEQUENCE 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

The type POQ relay provides a sensitive instantaneous negative sequence current relay for detecting unbalances or unbalanced faults in three phase power systems.

## CONSTRUCTION AND OPERATION

The type POQ relay consists of a transformer, a Rectox rectifying unit, a sensitive permanent magnet type polar element, a neon lamp, an auxiliary switch, a contactor switch, and an operation indicator. These elements are connected as shown in Fig. 1.

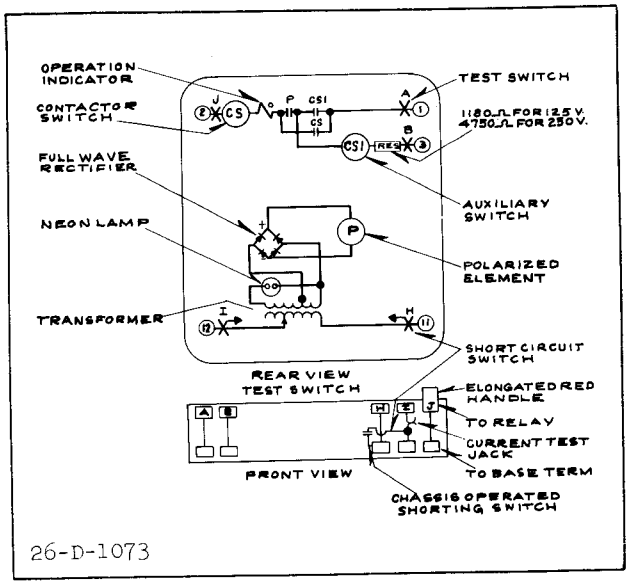


**Fig. 1 - Internal Schematic of the Type POQ Relay in Type FT Case.**

The relay is energized from a negative sequence current filter which consists of a mutual reactor and tapped resistor arranged as shown in Fig. 2.

The transformer of the relay has a tapped primary winding. These taps are provided to permit selection of the minimum negative sequence input current to the filter to cause operation of the relay. The range of selection by means of these taps is 0.5 to 2.5 amperes. A portion of the secondary voltage developed by this transformer is rectified by means of a full wave Rectox rectifier and applied to the coil of the sensitive polar element. A neon lamp is connected across the full secondary winding of the transformer. This is done to protect the Rectox unit from over voltage in the case of heavy operating currents. The transformer is a saturating device and tends to produce a peaked wave form at heavy currents. The neon lamp flashes on these peaks of voltage and effectively reduces the voltage applied to the Rectox.

The contacts of the polar elements are connected in series with the contacts of an aux-

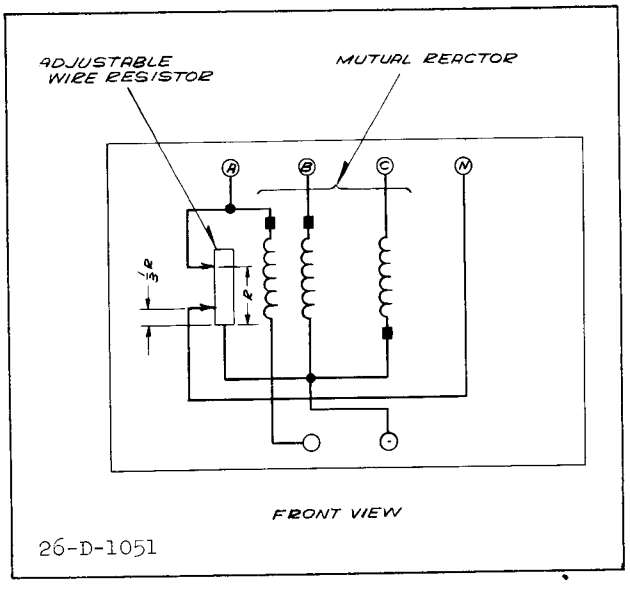


**Fig. 2 - Internal Schematic of the Negative Sequence Filter for the Type POQ Relay.**

SUPERSEDES I. L. 41-404
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iliary switch marked CS-1. When the polar element contacts, P, close, the coil of CS-1 is energized from the battery voltage connected to terminals 2 and 3 of the relay. The operation of CS-1 consumes approximately 3/4 cycles, at the end of which time the trip circuit will be completed from terminals 2 to 1 if the polar element contacts, P, remain closed. The auxiliary switch CS-1 is incorporated in the relay design to give an overall shock-proof quality not obtainable with an extremely sensitive high speed element. If the polar element contacts, P, are jarred closed momentarily due to an accidental heavy jar to the switchboard panel, they will not remain closed sufficiently long to pick up CS-1 contacts and complete the circuit.

The auxiliary and contactor switches in the relay are small solenoid type d-c switches. 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 contactor switch coil is in series with the main contacts of the relay.

The operation indicator is a small solenoid 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.

## CHARACTERISTICS

The taps available in the relay are 0.5, 0.6, 0.8, 1.0, 1.5, 2.0, and 2.5. These values represent the negative sequence current input to the filter to just close the relay contacts. The filter will carry 5 amperes positive sequence continuously and 100 amperes for one second. The operating time of the relay is approximately 1 to 2 cycles.

## 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 type FT projection case or by means of the four mounting studs 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.

## ADJUSTMENTS AND MAINTENANCE

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 desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

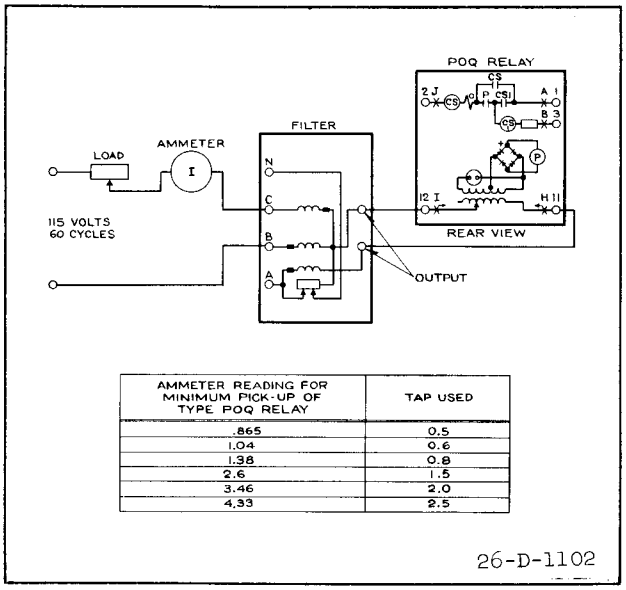
All contacts should be periodically cleaned with a fine file, S#1002110 file is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

Polar Element

The sensitivity of the polar element is adjusted by means of two screw type magnetic shunts at the rear of the assembly. Looking at the relay front view, drawing out the left hand shunt increases the amount of current required to close the relay contacts. Conversely, drawing out the right hand shunt decreases the amount of current required to trip the relay. It will usually be possible to set the relay to the desired tripping value by leaving the right hand shunt at the extreme "in" position and make all the adjustments with the left hand shunt. The shunts are held securely in position by means of a spring type clamp.

When the relay is operated electrically, the contacts should have a deflection equivalent to one-half to one turn of the stationary contact screw. This is obtained by allowing the armature rivet to strike the right hand pole face, then bringing up the stationary contact screw until the contact circuit just makes, then giving the stationary contact screw an additional one-half to one turn before locking it in place with the lock nut provided. After setting one-half to one turn contact deflection, set the contact travel for one turn of the backstop screw. With the contacts in the closed position, bring up the backstop screw until it just touches the moving contact. Then back off one turn and lock in place.

To check the taps of the relay make connection as shown in figure 3, and compare tap position with ammeter reading as shown by the table.




| AMMETER READING FOR MINIMUM PICK-UP OF TYPE POQ RELAY | TAP USED |
|---|---|
| .865 | 0.5 |
| 1.04 | 0.6 |
| 1.38 | 0.8 |
| 2.6 | 1.5 |
| 3.46 | 2.0 |
| 4.33 | 2.5 |

**Fig. 3 - Diagram of Test Connections of the Type POQ Relay.**

Auxiliary Switch

The auxiliary switch CS-1 mounted rear should have a free contact travel of 3/32" and a magnetic air gap equivalent to one turn of the stationary core screw. This magnetic air gap may be determined in one of two ways. If the relay is free of the panel, it may be turned up-side-down and the core screw turned in the right hand direction until it becomes obvious that it is in contact with the movable core or plunger. Then turn the core screw in the left hand direction until the silver disc rests on the stationary contacts and stops turning. The plunger itself will next stop turning as the play is taken up. The core screw may then be given an additional one turn before being locked in place. If the relay is mounted on a panel, the adjustment may be made in the same manner except that, since the relay will be in the normal position, it will be necessary to pick up the plunger by applying voltage to the coil of the unit, and thus the test may be performed in the same way.

Contactor Switch and Operation Indicator

With the contactor switch and operation indicator connected in series, both should operate at 2 amperes d.c. The total resistance is approximately 0.31 ohm. The contactor switch is adjusted as described above for the auxiliary switch. The switch itself should pick up at 2 amperes d.c. Test for sticking after 30 amperes d-c have been passed through the coil. The coil resistance is approximately 0.25 ohm.

Adjust the operation indicator separately to operate at 1.0 ampere d-c gradually applied by loosening the two screws on the under side of the assembly, and moving the bracket forward or backward. The coil resistance is approximately 0.16 ohm.

## 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 nameplace data.

## ENERGY REQUIREMENTS

The 60 cycle burden of the current filter with positive sequence currents applied (no output current to the type POQ relay) is as follows:

| Phase | Continuous Rating-Amps. | One-Second Rating-Amps. | Watts at 5 Amps. | Volt-Amps. at 5 Amps. | Power Factor Angle |
|---|---|---|---|---|---|
| A | 5 | 100 | 5.3 | 5.3 | 0° |
| B | 5 | 100 | 0.0 | 0.98 | 90° lag |
| C | 5 | 100 | 4.0 | 7.25 | 56° lag |

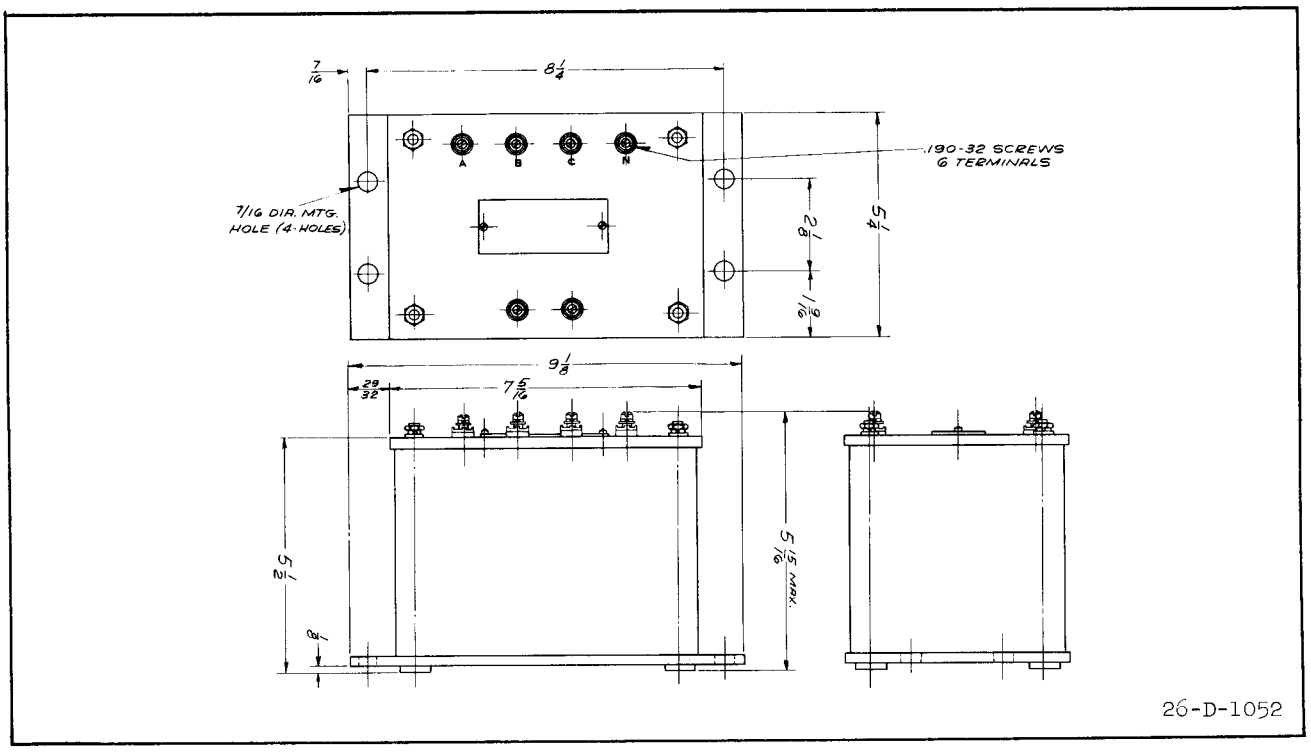



Fig. 4 - Outline and Drilling Plan for the Negative Sequence Filter. For Reference Only.

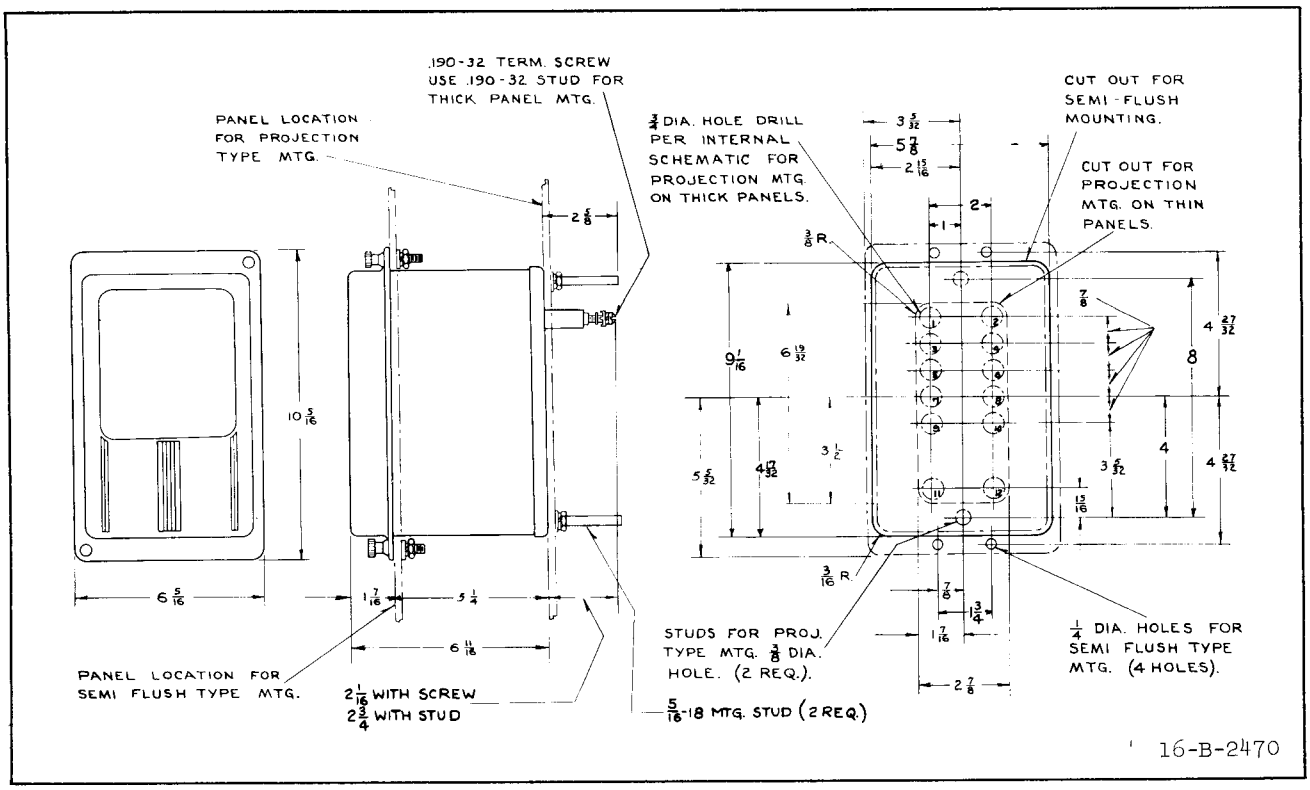



Fig. 5 - Outline and Drilling Plan for the S10 Projection or Semi-flush Type FT Flexitest Case. See the Internal Schematic for the Terminals Supplied. For Reference Only.



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