**Signal Training Bulletin**

**COMMITTEE G: Education & Training**
**Communication & Signal Section, AAR**

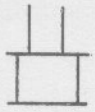
*Approved January 1974*

# C-2 Magnetic Structure Direct Current Neutral Relay

**Definition:** Relay, DC: A relay designed to respond to direct current.

Relay, Neutral: A relay which operates in response to a predetermined change of the current in the controlling circuit, irrespective of the direction of current.

**Symbol:**



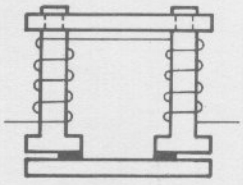


Figure 1 (a)

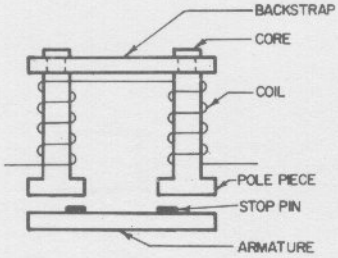



Figure 1 (b)

**Description:** The magnetic structure of a dc neutral relay consists of the backstrap, core, pole pieces and armature. The magnetic structure of a neutral relay is illustrated in Figure 1.

**Purpose and Application:** The purpose of the magnetic structure is to detect the presence or absence of direct current in the controlling circuit (coil circuit). When direct current (dc) is flowing in the coils the armature will be magnetically attracted to the pole pieces as shown in Figure 1(a). Figure 1(b) illustrates the de-energized condition when insufficient or no current is flowing. The movement of the armature is reflected into other circuits by contacts that are connected to the armature and move with the armature to open or close other circuits.

**General Information:** Maintenance of relay coils, armatures, etc. is normally a shop function but field forces should periodically inspect the coils for insulation deterioration and the armature linkage to ensure it is intact. The backstrap nuts or studs must be kept tight.

**Detailed Operation:** When direct current is passed through the coils, magnetic lines of force are produced. These lines of force will flow through the iron or steel cores of the relay and cause a magnetic attraction between the lower portion of the cores (pole pieces) and the armature. The armature is hinged and will pivot upward toward the pole pieces as shown in Figure 2(a). When electrical energy is removed the magnetic flux decays and the armature is released from the pole pieces and is forced to the down position by gravity. (See Figure 2(b).

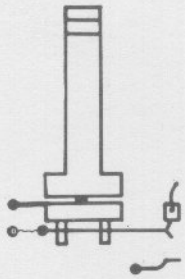


Figure 2 (a)

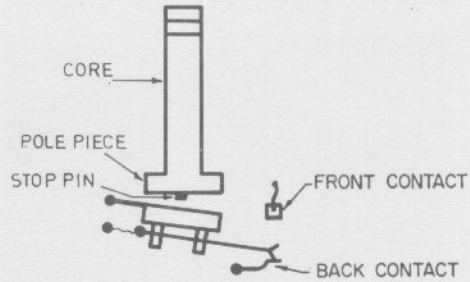



Figure 2 (b)

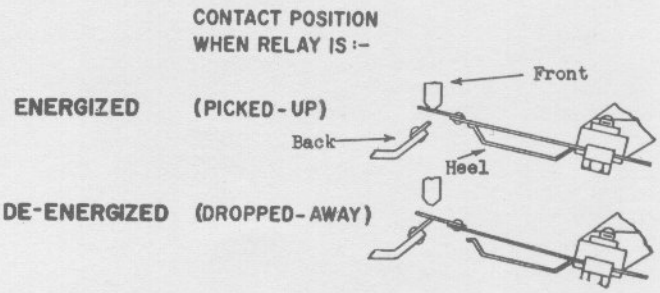



Figure 3

The armature is equipped with stop pins made of non-magnetic material to provide an air gap between the armature and pole pieces. This ensures positive drop-away of the armature when energy is removed from the coils.

Movement of the armature alone is obviously of little value. Its movement must be reflected into the control of other circuits. This is accomplished by fastening heel contacts to the armature, each being insulated from the other and the armature. See Figure 3. When the relay is de-energized a physical connection exists between the heel contact to its back contact to provide an electrical path.

Conversely, when the relay is energized the electrical path is provided from the heel contact to its front contact. The operation and application of relay contacts is covered in detail in Signal Training Bulletin C-3.

The amount of magnetic flux produced is dependent upon the magnitude of the current, the number of turns of wire in the coil, the composition and size of the core and dimensions of the airgap. In a relay, the magnetic flux produced must be strong enough to overcome the airgap between the armature and the pole pieces and the force of gravity. Therefore, the applied voltage must be large enough so that enough current flows through the resistance of the coil windings to pick up the relay.

Coils for a dc relay are designated by their resistance whose values range from less than 1 to 1000 or more ohms.