P.O. 3000-TYPE RELAYS—THERMAL TYPE

Maintenance Adjustment Instruction

★[*NOTE:—As this Instruction has been completely revised, individual paragraphs have not been 'starred'. The introduction of a new type of thermal spring-set has necessitated complete revision.*]

GENERAL

1. Introduction.—This Instruction describes the maintenance of the P.O. 3000-type thermal relay which is a device that provides longer timing limits than those given by a 'slugged' 3000-type relay.

2. Description.—It is designed for mounting on a 3000-type relay drilling and consists of a 3000-type relay yoke, 3/4 step buffer block and a thermal spring-set fitted in the right-hand position when viewed from the front.

If a normal 3000-type spring-set is fitted in the left-hand position, necessitating a relay armature and coil, the whole is termed a 'composite' relay. With such a relay the actions of the thermal and normal 3000-type spring-sets are quite independent of each other; the dimensions of the various parts ensure that with the armature operated, a clearance exists between the armature and the lowest spring of the thermal spring-set.

3. Marks 1 and 1A.—An improved thermal spring-set is now available and is known as the 'Mark 1A', the earlier spring-set design being referred to hereafter as 'Mark 1'. Figs. 1 and 2 show Marks 1 and 1A respectively, and Fig. 3 shows a composite relay with a Mark 1A thermal spring-set.

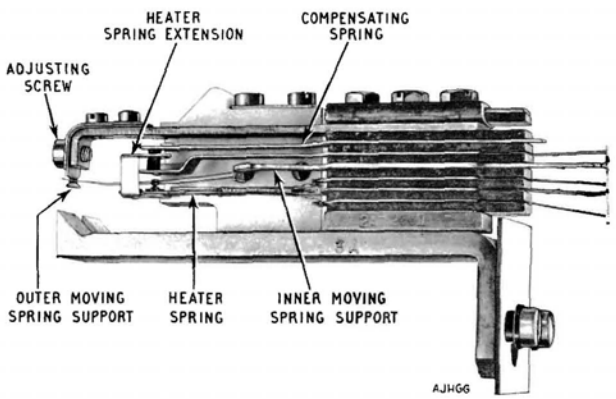

FIG. 1.—MARK 1 THERMAL SPRING-SET

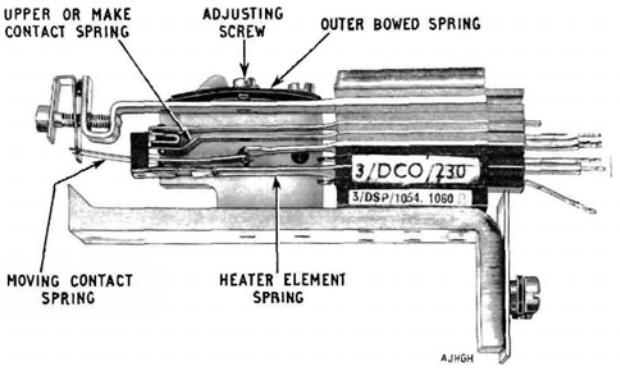

FIG. 2.—MARK 1A THERMAL SPRING-SET

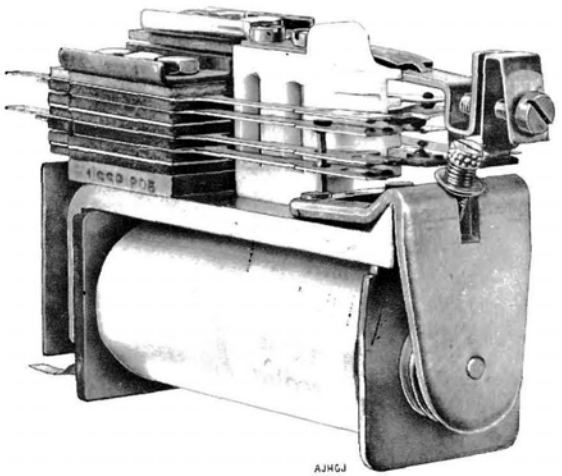

FIG. 3.—COMPOSITE RELAY WITH MARK 1A THERMAL SPRING-SET

The Mark 1A spring-set differs from the Mark 1 in the following ways:—

(*a*) Improved method of tensioning the moving-contact spring.

(*b*) Introduction of the outer bowed spring.

(*c*) Modified heater spring extension.

Both types are fitted with platinum contacts.

4. Coding and labelling.—Each relay design is allocated a code in the standard 3000-type relay series. Since individual relays require special adjustment to ensure correct time operation, all designs are classified 'red-label' and reference to a relay adjustment card is necessary whenever readjustment is made. Relay adjustment cards may be obtained as described in B 5099.

When a thermal spring-set only is fitted, a label bearing the P.O. code number is fixed to the relay yoke. This is shown in Fig. 4. The code labelling of a 'composite' relay follows normal practice for a 3000-type relay. The procedure for changing a code label locally is given in B 5902.

The heater coil resistance value of a thermal spring-set is marked on its lower clamping plate as shown in Fig. 5.

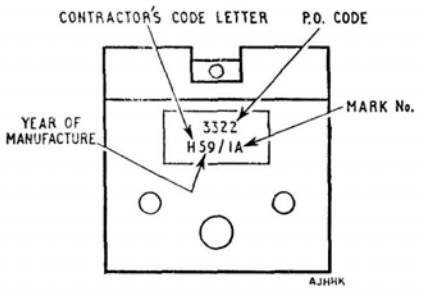

FIG. 4

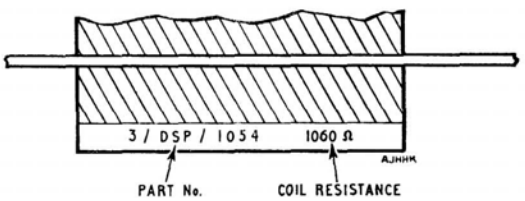

FIG. 5

5. Timing tests.—The timing characteristics of a thermal relay are determined by the heater coil resistance and applied voltage. These two factors control the rate of temperature rise of the operating spring and consequently the time taken to reach the operating temperature. This temperature however is about the same for all relay codes and therefore the cooling, or release time, is approximately constant. Relays are designed to provide either of the following time lags:—

(*a*) Operate.

(*b*) Operate and release combined.

When the appropriate voltage is applied to the relay, the timing lag should be within the limits shown on the relay adjustment card.

To test the lag, one of two methods may be used. The method illustrated in Fig. 6 includes use of a milliammeter, whilst that in Fig. 7 uses a voltmeter.

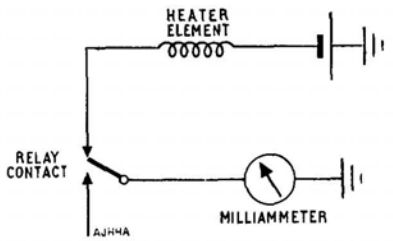

FIG. 6

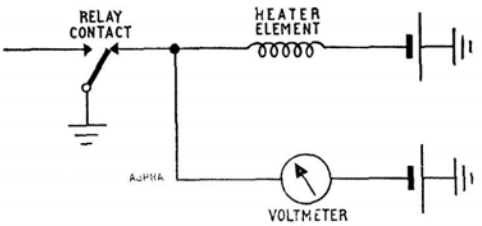

FIG. 7

6. Principles of operation and release.—The thermal spring-set includes a heater spring and a compensating spring. Both are bimetallic and arranged to work in opposition, the effect of ambient temperature on the heater spring being offset by an equal and opposite movement of the compensating spring. A metal stirrup, termed a heater spring extension, is fitted with an insulating stud and provides a mechanical connexion between the two springs, whilst insulating them electrically. When current flows through the heating wire wound on the heater spring, this spring, being bimetallic, bows, and the tip of the spring rises. The moving-contact spring, which under stress is bowed and resting on the heater spring, rises also and with a definite movement or 'toggle action', leaves the heater spring and makes contact with the upper or 'make-contact' spring.

When current in the heating element no longer flows, the heater spring in cooling restores to normal, allowing the moving-contact spring to 'toggle' back and remake contact with the heater spring.

ADJUSTMENTS

7. Spring-sets.—Adjustments for thermal spring-sets Mark 1 and 1A are detailed below. Where a normal 3000-type spring-set is also fitted (composite relay) this should be adjusted in accordance with B 5144.

The contacts of the thermal spring-set should not be out of alignment by more than one-third of their diameter, judged visually. If faulty, change the spring-set.

(*a*) *Heater spring.*—This spring is tensioned during manufacture to exert a specified downward pressure and should not require further adjustment. There should be perceptible clearance between the upright centre web of the buffer block and the lugs on both the heater spring and the heater spring extension.

When all other adjustments to the spring-set have been made, the heater spring should still rest on the buffer block. If the spring-set does not function correctly and all other adjustments appear satisfactory, change the spring-set.

(*b*) *Compensating spring.*—The compensating spring should be tensioned against the top of the heater spring extension with a pressure of 10–40 gm, measured at the spring tip.

(*c*) *Upper or 'make-contact' spring.*—This spring should be tensioned to exert a pressure against the insulating stud of the heater spring extension, measured in line with the contact:—

Mark 1 —15–20 gm

Mark 1A—10–30 gm

(*d*) *Contact clearance.*—This should not be less than 10 mils, and obtained by bending the heater spring extension, using Pliers, Adjusting, No. 5.

(*e*) *Moving-contact spring.*—The tension of the moving-contact spring should be adjusted, by means of the adjusting screw located in the moving-contact spring outer support, to exert a pressure, not less than 10 gm, on the heater spring when this is normal. The pressure should be measured opposite the contacts.

When the heater spring is moved by hand to the point where the moving-contact spring just operates, the moving-contact spring should be approximately straight throughout its length. After operation, clearance should be visible between the moving-contact spring inner support and the heater element.

After having been operated electrically, the contact pressure between the moving-contact spring and the 'make-contact' spring should not be less than 10 gm.

8. Operate and release lag adjustments for Mark 1 spring-sets.

(*a*) Small variations to the operate and release lag may be made by adjusting the tension of the compensating spring within the limits specified in par. 7(*b*).

(*b*) To increase the operate lag and decrease the release lag, set the moving-contact spring inner support slightly away from the heater element spring. After setting the inner support, check that there is a perceptible clearance between the lug on the heater spring extension and the third step of the buffer block, at the moment that the moving-contact spring 'toggles' over.

(*c*) To decrease the operate lag and increase the release lag, set the moving-contact spring inner support slightly towards the heater element spring, ensuring that there is perceptible clearance between the heater element spring and the bottom of the moving-contact spring inner support after the moving-contact spring has 'toggled' over.

(*d*) Further small adjustments to increase the operate lag and decrease the release lag or vice-versa may be achieved by bending the top portion of the heater spring extension either away from or towards the 'make-contact' spring. This increases or decreases the contact opening. Take particular care when making this adjustment and use Pliers, Adjusting, No. 3 or 5.

After any alterations to the relay timing all other adjustments should be checked.

9. Operate and release lag adjustments for Mark 1A spring-sets.

(*a*) Small variations to operate and release lags may be made as in par. 8 (*a*).

(*b*) To increase the operate lag and decrease the release lag the tension on the outer bowed spring should be reduced by withdrawing the adjusting screw.

(*c*) To decrease the operate lag and increase the release lag, the tension on the outer bowed spring should be increased.

(*d*) Further small adjustments to increase the operate lag and decrease the release lag or vice-versa should be made as described in par. 8(*d*).

After any alterations to the relay timing all other adjustments should be checked.

10. Tools.—A list of tools and their uses is given in Table 1.

TABLE 1

Rate Book title	General description and use
Adjuster, Spring, No. 3	Spring bender, for compensating spring adjustment
Gauges, Tension, No. 2	Gauge for measuring contact pressure
Pliers, Wiring, No. 2	Pliers, taper nosed, for general use
Pliers, Adjusting, No. 3	Pliers, straight, duck-bill, for spring adjustment
Pliers, Adjusting, No. 5	Pliers, fine taper-nosed, for spring adjustment
Screwdriver, Instrument, No. 1 Screwdriver, Instrument, No. 2	For general use

The tools listed are suitable for adjustment of a thermal spring-set. If a normal 3000-type spring-set is fitted and requires adjustment the tools listed in B 5144 should be used.

The tools specified should be used only for the purpose for which they are intended. A tool should not be used if it is in such a condition that the screws or springs would be damaged by its use. The tool, if damaged or faulty, should be changed.

11. Piece parts.—Details of certain piece parts, together with requisitioning procedure, are given in B 5507.

References:—B 5099, B 5144, B 5507, B 5902 (TPM2/3)

END