

P.O. STANDARD 3000-TYPE RELAY-SWITCHES (EXCHANGE TYPE)

[Maintenance Adjustment Instruction (M.A.I.) No. 52]

1. Introduction.—This Instruction specifies the maintenance adjustments of exchange-type relay-switches (Relay-switches, 3300 type). This relay-switch comprises a 3000-type relay with a mercury-tube carrier attachment, and is designed to switch exchange voltages, i.e. up to 70 V., the mercury tubes being capable of carrying currents up to 6 amp. The relay-switch mounts in the space of two 3000-type relays on a standard relay plate. A description of the components and an illustration of a typical relay-switch are given in General, Q 1010.

2. The following paragraphs are arranged in the correct sequence for assembly and adjustment of the parts of a relay-switch.

ARMATURE ADJUSTMENTS

3. Assembling the armature to the yoke.—The armature should first be placed on the knife-edge of the yoke and secured by means of the armature-retaining screw. The spring of the armature-retaining screw should have sufficient tension to ensure that the armature is securely pivoted along the knife-edge. If the spring is weak, the complete armature-retaining screw and spring should be changed. The screw should be finally tightened by using a small screwdriver and not by using the fingers, taking care not to damage the screw.

4. Residual air-gap and armature travel.—When adjusting the residual air-gap, or the armature travel, reference should be made to B 5144, which details the methods of measurement and adjustment for 3000-type relays, and

(a) The residual air-gap should be adjusted to the figure specified on the code label of the relay.

(b) The armature travel should be adjusted to the standard value of 31 ± 3 mils, by bending the armature. If an armature has an extension arm which is not detachable it is impracticable to adjust the travel by means of the standard tool, and if such an armature is out of adjustment the complete relay-switch should be changed.

5. Armature-restoring spring.—The armature-restoring spring should next be replaced, taking care that the inner portion of the spring rests flat on the armature stud. The restoring spring should exert a tension of not less than 100 gm. on the armature stud, so that the carrier will restore reliably, and also to meet electrical tests. To adjust the tension, the spring should be stroked with bent duckbill pliers.

TUBE MOUNTING AND CARRIER ASSEMBLY

6. Assembling the mercury tubes in the carrier.—Before assembling the tubes in the carrier, the setting

of the carrier limbs should be checked to ensure that the carrier will be free when mounted. This may be done by placing the carrier between the carrier-pivot brackets and verifying that there is a gap of approximately $\frac{1}{8}$ in. between one of the carrier limbs and the adjacent bracket. If the clearance is less than $\frac{1}{8}$ in., the carrier limbs should be set inwards. The tubes should next be assembled in the carrier so that their rounded ends are at the same side of the carrier as the approximately-straight side of the carrier limbs.

7. The tubes (or tube dummies) are located by a projection on the spring clip, which enters the space between the cups; the centre screw causes the clip to press the tube into the corner of the carrier. This screw should therefore be tightened until the tube is secure. If the tube cannot be secured by tightening the screw, the clip should be removed and opened out to increase the tension on the tube. When the tubes have been secured, the setting of the carrier limbs should again be checked, as the tightening of the screw causes the limbs of the carrier to spread out. It should then be just possible to slide the limbs of the carrier between the carrier-pivot brackets without it being necessary to press the limbs inwards by hand; if this is not possible, *the tubes should be removed* and the carrier limbs set further inwards. The tubes should then be re-assembled and the setting of the carrier limbs re-checked.

8. Assembling the carrier on its pivots.—The carrier should next be replaced on its pivots, taking care that the carrier is assembled so that the correct contact action is obtained. This may be checked by noting that,

(a) for 'make' actions, the top surface of the carrier moves from the tilted position to the horizontal position

(b) for 'break' actions, the top surface of the carrier moves from the horizontal to the tilted position.

'Make' or 'break' action is determined by the position of the slot which engages the armature-extension arm; by reversal of the carrier, a 'make' action may be converted into a 'break' action.

9. It is not necessary to remove the pivot screws in assembling the carrier; it can be sprung into position by gently pressing the limbs inward between the finger and thumb. When assembling the carrier, check that the armature-extension arm engages the slot in the carrier. It should also be checked that the carrier-pivot screws are tight.

TUBE LEADS

10. Method of terminating.—After the carrier has been assembled on its pivots, the tube leads should be connected to the terminal block in such a manner that, when the relay-switch is viewed from the front, the terminations are in accordance with the particulars given in Table 1.

TABLE 1

Tube	Contact numbering	Terminal block numbering
'M' or 'B,' front tube	1 and 2 (left to right)	1 and 2 (lowest pair, left to right)
'M' or 'B,' rear tube	3 and 4 (left to right)	3 and 4 (upper pair, left to right)

When only one tube is fitted, it should be mounted in the front position in the carrier, the leads being terminated on terminals 1 and 2. The tube leads should be securely connected to the terminal screws; they should also hang freely so that they do not exercise any control on the carrier.

ADJUSTMENT OF ARMATURE-EXTENSION ARM AND CARRIER-STOPS

11. When making adjustments for which it is stated that the armature should be in the operated position, hand operation of the armature should simulate the action of the equivalent electrical operation, i.e. the armature should be brought up smartly. When adjustments are made to the carrier-stops, check that they are clear of the mercury tubes but engage the carrier adequately.

12. Relay-switches with 'make' action.

(a) With the armature operated, the armature-extension arm should be adjusted by bending the cranked portion in the appropriate direction, using an "Adjuster, Armature-extension, No. 1," so that both electrodes of each tube are equally covered with mercury.

(b) With the armature operated and both electrodes equally covered with mercury, the left-hand stop should be adjusted to touch the carrier, by bending with an "Adjuster, Carrier Stop, No. 1."

(c) With the armature normal, the right-hand stop should then be adjusted to touch the carrier, by bending with an "Adjuster, Carrier Stop, No. 1."

References :—B 5144
(Tp2) General, Q 1010

13. Relay-switches with 'break' action.

(a) With the armature normal, the extension arm should be adjusted by bending the cranked portion in the appropriate direction, using an "Adjuster, Armature-extension, No. 1," so that both electrodes of each tube are equally covered with mercury.

(b) With the armature normal and both electrodes equally covered with mercury, the right-hand stop should be adjusted to touch the carrier, by bending with an "Adjuster, Carrier Stop, No. 1."

(c) With the armature operated, the left-hand stop should then be adjusted to touch the carrier, by bending with an "Adjuster, Carrier Stop, No. 1."

MISCELLANEOUS

14. Spring-sets.—If spring-sets are fitted, they should be adjusted in accordance with B 5144.

15. Replacement of parts.—If a faulty part needs to be renewed, the complete relay-switch should be changed under maintenance-exchange procedure.

16. Tools and their uses.—The tools necessary for the adjustment of exchange-type relay-switches are detailed in Table 2.

TABLE 2

Rate-book description	Use
Screwdriver, Instrument, No. 1	Armature-retaining screw and residual-screw adjustment
Spanner, Flat, No. 2 ...	For residual-screw adjustment
Screwdriver, Instrument, No. 6	Core-fixing nut
Gauges, Feeler, No. 1 ...	For general mil gauging
Pliers, Adjusting, No. 1	For tensioning the armature-restoring spring
Adjuster, Spring, No. 1	Tensioning springs
Adjuster, Carrier Stop, No. 1	Adjustment of carrier stops
Adjuster, Armature-extension, No. 1	Adjustment of armature-extension arm
Gauges, Tension, No. 3...	For measuring spring pressures
Adjuster, Armature, No. 2	For adjustment of armature travel

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