

HIGH-SPEED RELAYS

“3/411” and “3/412” Types

[Maintenance Adjustment Instruction (M.A.I.) No. 78]

1. General.—These are standard high-speed relays and are known as Relays, High-speed, Nos. 3/411A, B, C, etc., and Nos. 3/412A, B, C, etc. A general view of a “3/412...” relay is shown in Fig. 1.

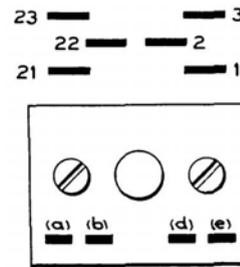
(a) Relays, High-speed, Nos. 3/411A, B, C, etc., are single-bobbin relays, whereas Nos. 3/412A, B, C, etc., are two-bobbin relays. Both types have two change-over contact units with platinum contacts and the relays are designed for fitting on 3000-type relay mountings.

(b) Each change-over unit, with its associated armature, is detachable as a complete unit. The tension of the lever spring is varied by an adjustable buffer spring, which bears on the lever spring at a point between the rear pole-piece and the spring mounting.

(c) The bowed springs mounted on the front of the relay are used to locate the break and make contacts.

(d) The springs are numbered in the same way as 3000-type relays; it should be noted that when the armature releases the lever spring rests against the higher-numbered contact.

(e) The lettering of the coil tags is the same as that for 3000-type relays. The winding of a single-bobbin relay is connected to tags (a) and (e). On a double-bobbin relay, the winding of the front bobbin is connected to tags (a) and (b) and the winding of the rear bobbin to tags (d) and (e) (see Fig. 2).



AFACE

FIG. 2

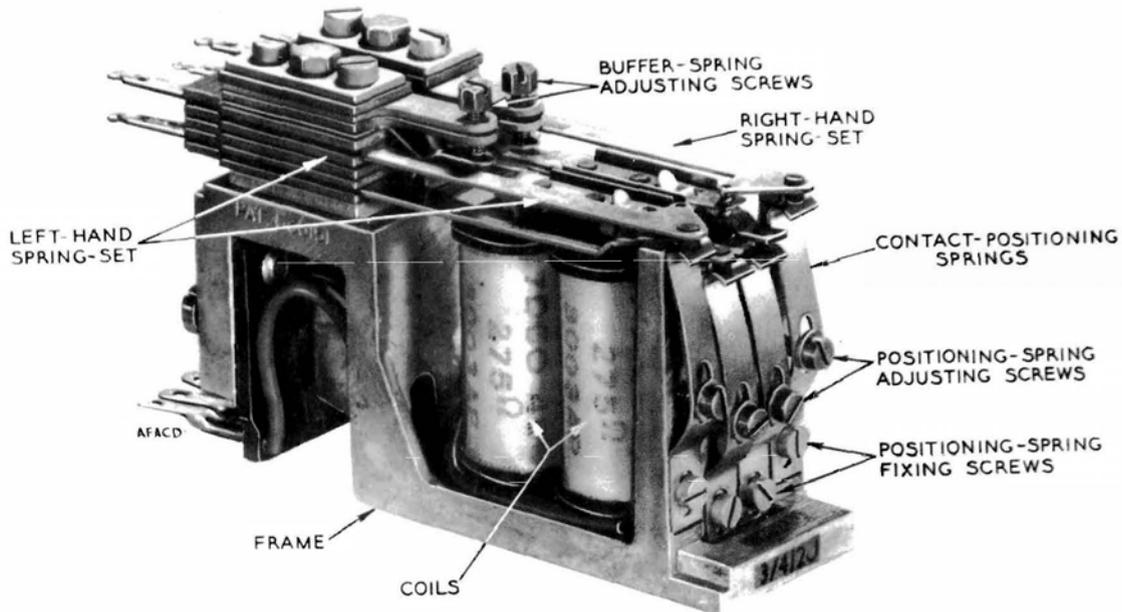


FIG. 1

2. Terms and definitions.

(a) *Armature*.—The soft-iron plates riveted to, and insulated from, the lever springs.

(b) *Core*.—The rectangular U-shaped piece of soft iron on which the coil assemblies are mounted.

(c) *Break springs*.—The outer contact springs of each spring-set.

(d) *Make springs*.—The inner contact springs of each spring-set.

(e) *Lever springs*.—The centre contact springs carrying the armature.

(f) *Buffer springs*.—The springs by which the pressure is applied to the lever springs to give the necessary break contact pressure.

(g) *Contact-positioning springs*.—The four bowed springs which are used to locate the make and break contacts.

3. Adjustments.— General.

(a) The relays are all 'red label' type and the relevant adjustment card should be consulted before maintenance work is commenced. Relay-adjustment cards should be requisitioned, on form A 2095, in accordance with B 5099. The back of the card should be used for recording test points (i.e. points in a particular circuit to which a relay current tester should be connected when making current tests) to enable tests to be made without disconnecting the relay wiring. For guidance in the selection of test points, see B 5144.

(b) Certain adjustments may be made with the relay *in situ*, but it will be necessary to remove the spring-sets when re-setting the lever springs.

(c) When it is stated that the armature should be *operated electrically*, the specified saturate value should be used. This value should not be exceeded.

(d) These relays should be adjusted in accordance with the methods described in pars. 5 to 11, the operations being performed in the sequence in which they are described.

4. Inspection of spring-sets.

The following conditions and adjustments are necessary to ensure that the relay is in good mechanical adjustment:—

(a) *Contact alignment*.—Contacts must not be out of alignment by more than one-third the diameter of a contact (see Fig. 3).

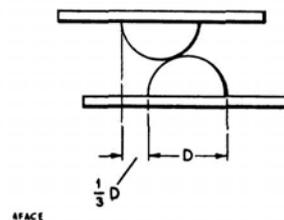


FIG. 3

(b) *Buffer-spring adjusting screws*.—The buffer-spring adjusting screws should be friction tight.

(c) *Alignment of buffer*.—The centre of the 'V' notch of the buffer spring must rest centrally on its lever spring (see Fig. 4).

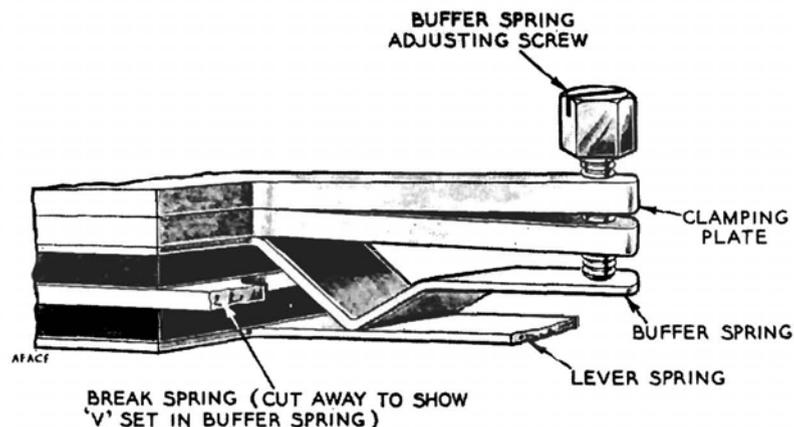


FIG. 4

(d) *Armature alignment.*—The armature must rest flat along the rear edge of the rear pole-face (see Fig. 5). The core must also lie within the outer sides of the two armatures (see Fig. 6) and within the length of the armatures (see Fig. 7).

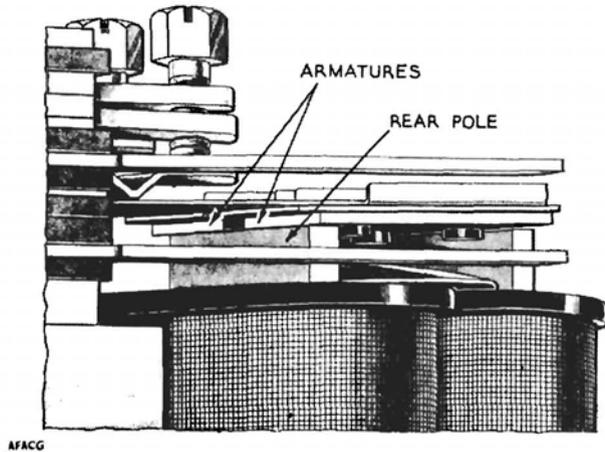


FIG. 5

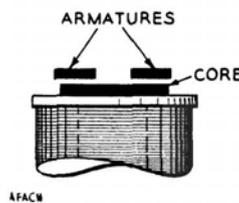


FIG. 6

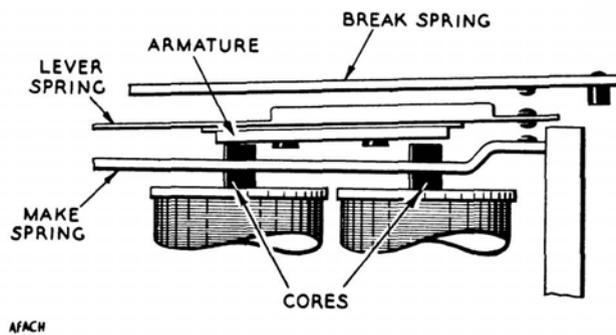


FIG. 7

(e) *Alignment of spring-sets.*—The spring-sets must be parallel to each other and there must be a clearance between the projecting insulation of both armatures, as shown in Fig. 8. The keramot studs on the front of the make and break springs must be clear of the frame, as shown in Fig. 9.

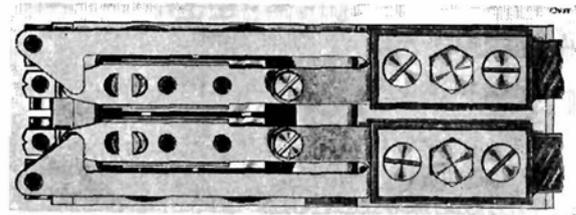


FIG. 8

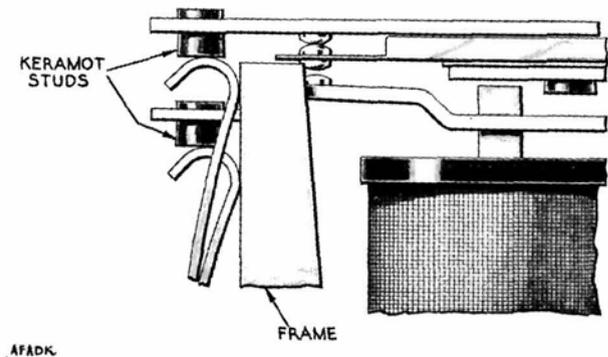


FIG. 9

(f) *Tensions of break and make springs.*—The inward tension of the break and make springs must be such that they exert a pressure of 100 ± 25 gm. on their respective positioning springs.

(g) *Contact clearance (travel)*—measured between the make contacts, with the armature normal—must be within the limits of 4 mils min., 5 mils max.

(h) *Pressure of break contact*, i.e. lever-spring contact against break spring, must be within the limits of 10 gm. min., 24 gm. max.

ADJUSTMENTS

5. Buffer-spring adjusting screws.—If it is necessary to tighten the friction locking of a buffer-spring adjusting screw, the screw should be withdrawn until its thread is free of its lower clamping plate. The ends of the two clamping plates should then be gently sprung open and held in this position until the screw is re-inserted. At least one thread of the screw should be visible between the two clamping plates (see Fig. 10). The inward tension of the clamping plates should secure the screw so that it is difficult to turn it with the fingers.

6. Contact-positioning springs.—Each contact-positioning spring must be bowed so that, when the fixing screw is tightened and the adjusting screw is unscrewed, the tip of the spring will rest lightly against the relay frame. The position of the spring can be adjusted by loosening its fixing screw, and by moving it about its elongated hole. The spring should be so located that the keramot spring-lifting studs rest fully within the width of the tip of the positioning spring. The positioning springs should be approximately parallel with each other and, as a

preliminary adjustment, they should be located so that the break springs are in their extreme outer position and the make springs are in their extreme inner position.

7. Lever springs.—The lever springs should be adjusted so that the following conditions apply. Withdraw the buffer-spring adjusting screw until there is a clearance between the 'V' notch of the buffer spring and the lever spring. Gently move the break spring outwards and check:—

(a) that the armature plate is resting lightly and evenly along the rear pole-piece

(b) that the lever spring is straight between its root and the armature plate

(c) that there is an outward set in the lever spring (approximately 2°) from a point immediately behind the armature plate (see Fig. 11).

If re-setting of the lever spring is required, it will be necessary to remove the spring-set from the relay. Care must be taken when adjusting the lever spring to ensure that it is not twisted or difficulty will be experienced in positioning the armature to lie correctly on the rear pole face when the spring-set

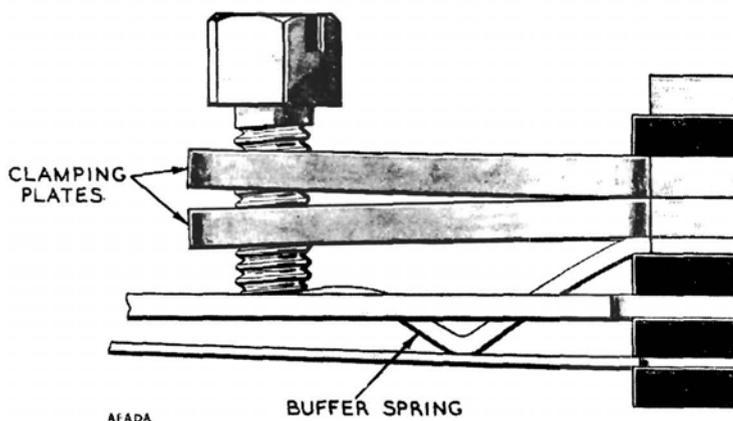


FIG. 10

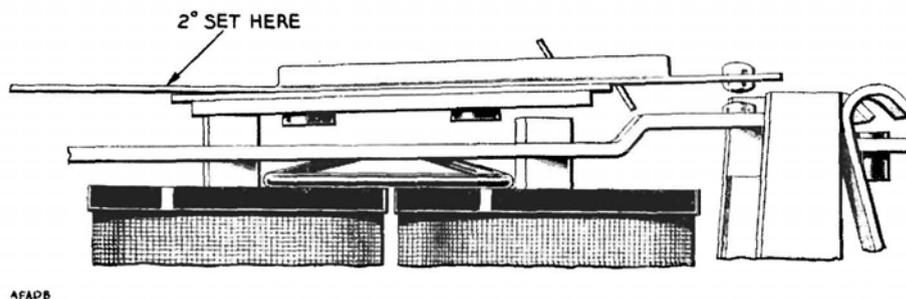


FIG. 11

is replaced. It should be checked that the spring-sets are parallel to each other and that there is a clearance between the projecting insulation of both armatures.

8. Make and break contact springs.—Before tensioning the make and break contact springs, the make contact-positioning springs must be positioned so that when the armatures are operated the make contacts are just broken. The break contact-positioning springs should be positioned so that when the armatures are normal the contact clearance between the make contacts is about 3-4 mils.

Using "Pliers, Adjusting, Nos. 1 or 2", tension each make and break contact spring so that they exert a pressure on their respective positioning springs of 100 ± 10 gm. The pressure of the break contact springs should be measured with the armature operated so that it does not include tension of the lever spring. The tensions should be checked by applying the tip of the gauge detail to the tip of each spring and in front of its insulating stud (see Fig. 12).

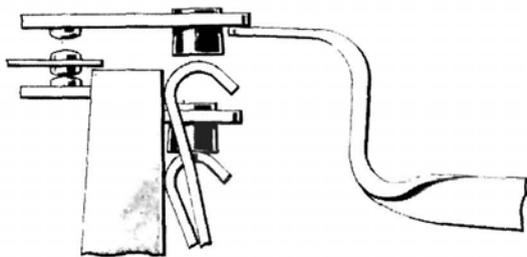


FIG. 12

9. Residual gap.—The residual gap is specified on the relay adjustment card and is determined by positioning the make contact to close before the armature strikes the front pole face. The residual gap should be adjusted as follows:—

(a) Operate the armature electrically, using the specified 'saturate' current value.

(b) Screw in the make contact-positioning spring-adjusting screws, until the make spring contacts just close with the contacts of the lever springs. This should be determined electrically by applying a "Tester No. 23A" to the contacts. Adjust the break contact-positioning springs by loosening their fixing screws and moving them until the break contacts just close with the contacts of the lever springs. Tighten the fixing screws.

(c) Release the armature.

(d) Screw in the break contact-positioning spring-adjusting screws until the make contact clearance is approximately 12 mils and tension the lever spring by means of its buffer-adjusting screw until the break contact pressure is 15-20 gm.

(e) Insert a feeler gauge of the specified maximum residual value (5, 7 or 9 mils) between the make contact and the lever spring contact and position the break contact by adjusting the break contact-positioning spring-adjusting screw until the gauge is just gripped between the make contacts.

(f) Remove the feeler gauge and check that a feeler gauge of the specified minimum residual value passes freely between the contacts.

(g) Adjust the make contact, as described in (b), until it just makes contact with the lever spring contact. This should be checked electrically, using "Tester No. 23A".

10. Contact opening (armature travel).—The contact opening should be adjusted within the limits of 4-5 mils as described below:—

(a) With the armature released, adjust the break contact by means of the positioning-spring adjusting-screw so that a 5-mil feeler gauge is just gripped between the make contact and the lever spring contact.

(b) Remove the 5-mil feeler gauge and check that a 4-mil feeler gauge passes freely between the contacts.

11. Break contact pressures.—Tension the lever spring by adjusting the buffer-spring adjusting screw until the contact pressure of the break contact is within the limits of 10-24 gm. The contact pressure should be checked by applying the tip of the gauge detail to the tip of the lever spring, and in line with the contact (see Fig. 13). The contact pressure

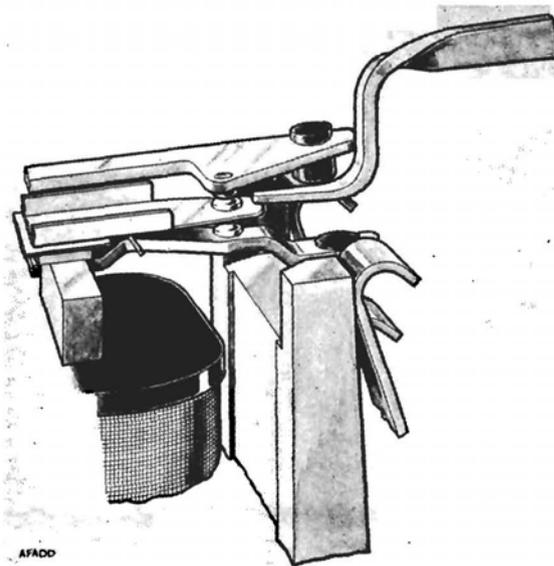


FIG. 13

may be varied within these limits so that the relay passes the specified current test. If it is found that the lever spring tension cannot be decreased sufficiently towards the minimum to meet the operate values, the set in the lever spring [par. 7 (c)] is probably too large; the spring-set should be removed and the angle re-adjusted. To ensure approximately simultaneous operation, the pressures of the break contacts should differ by not more than 3 gm.

12. Current tests.—Check the performance of the relay against the current values specified on the relay-adjustment card. The current tests should be made in the following order:—

Saturate
Hold
Release
Non-operate
Operate.

If the current values are not met, vary the break contact pressure within the limits specified on the relay-adjustment card until the required conditions are satisfied. If the limits of break contact pressure are not specified on the card, a range of 10–24 gm. should be assumed.

If the current values cannot be met within the specified range of break contact pressure, re-check the residual gap and contact opening. If, after a re-check of the mechanical adjustment, the current

values cannot be met, the relay coils should be changed.

13. “Clips, Test No. 22” (see TESTS & INSPECTIONS, Gen., B 1501) will be found useful in carrying out electrical tests.

14. Replacement of parts.—Parts of any relay can be changed if found to be faulty. Reference should be made to B 5610 for the procedure to be adopted and the part numbers of the various items.

15. Tools.—The following tools are required for adjusting these relays:—

Gauges, Feeler, No. 10, Parts Nos. 3, 4, 5, 6, 7, 8, 9 and 10

Case, Gauges, Feeler, No. 10
Gauges, Tension, No. 1
Gauges, Tension, No. 3
Pliers, Adjusting, No. 1
Pliers, Adjusting, No. 2
Pliers, Adjusting, No. 5
Screwdriver, Instrument, No. 1

The tools specified must be used only for the purpose for which they are intended. Any tool that is in such a condition that screws, nuts or springs would be damaged by its use should be changed.

References:—B 5099, B 5144, B 5610
(Tp 2/8) TESTS & INSPECTIONS, General, B 1501

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