POST OFFICE 3000-TYPE RELAYS

(Maintenance Adjustment Instruction (M.A.I.) No. 44)

★[*Note.—As this Instruction has been completely revised, individual paragraphs have not been "starred"*]

1. Contents.

GENERAL

2. Introduction.—This Instruction describes the adjustment of the 3000-type relay. For information concerning its design, construction and use, and details of its mechanical and electrical characteristics, reference should be made to General, Q 1005 and Q 1010. This Instruction does not apply to advance supplies of this relay as installed at Sutton Coldfield Exchange and on certain U.A.X. No. 5 and No. 6 equipments manufactured by Messrs. Siemens Bros. The adjustment data for these relays are given in Maintenance Adjustment Instruction (M.A.I.) No. 38.

3. Principles of adjustments.—Adjustment of all 3000-type relays may be divided into four stages, as follows:—

(*a*) Adjust residual (if adjustable) or check residual stud

(*b*) Adjust armature travel

(*c*) Adjust each buffered spring against the block step

(*d*) Adjust each lever spring, in turn.

When this has been done correctly, with due regard to the straightness of springs, it is not necessary to make current tests or any further adjustments, except for the special relays marked with a red label.

4. Adjustment tolerances.—'Test' and 're-adjust' values are used for checking and re-adjustment purposes, respectively. These values may be defined as follows:—

(*a*) '*Test*' *Values.*—These values represent the limits of adjustment within which reliable working of a relay is ensured. A relay requires to be re-adjusted if any of its adjustments are proved to be outside the range of these values.

(*b*) '*Re-adjust*' *Values.*—These values represent a closer limit of adjustment than those provided by the 'test' values. A relay adjusted to these values will thus have a greater factor of safety and should not need attention so frequently as would be the case if the limits of the 'test' values were used for re-adjustment. When a relay requires re-adjustment, the 're-adjust' values should be applied.

5. Retardation coils.—Retardation coils of the '3000' type are provided for association with 3000-type relays and consist of yoke, armature, and coil of the standard pattern, but spring-sets are omitted. Adjustment of residual and other maintenance operations follow the standard practice for 3000-type relays as specified in this Instruction. If an adjustable residual screw is fitted to a 3000-type retardation coil, the nominal value for adjustment is quoted on the code label as for the 3000-type relay (see par. 7). When changing the coil of a 3000-type retardation coil, it is not necessary to change the coil of its associated relay, or vice versa, unless it is specified that the two are to be considered as a balanced combination.

The code numbering of retardation coils is confined to the block of numbers 3400 to 3499. To avoid confusion, this series of numbers is not used for relays.

6. Code labels.—A guide to the adjustments of a relay is indicated by the colour of the P.O. code label and by the figures and letters that are printed on it (see Fig. 1 and pars. 7 and 8). In certain circumstances it may be necessary to replace a code label locally and the procedure to be adopted is given in General, B 5902.

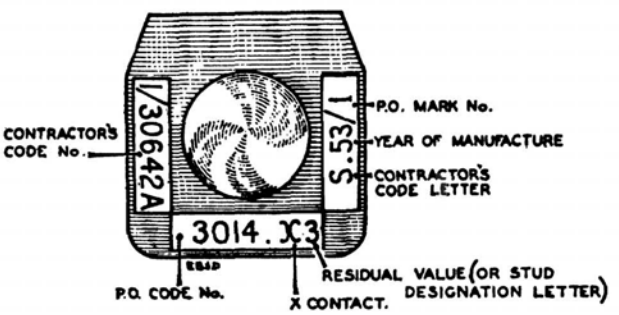

FIG. 1. CODE LABELS, SHOWING ADJUSTMENT INFORMATION

7. *White and Green labels.*—For the majority of 3000-type relays all adjustments are made to the standard values specified in this Instruction. Such relays are identified by the P.O. code number being printed on a white or green label. The springs of a white label relay are 14 mils in thickness and those of a green label relay are 12 mils in thickness. Apart from the difference in spring tensions of white to green label relays due to the difference in spring thickness, all other adjustments are made to the standard values. Current tests are not required for these relays.

The residual value or stud designation A, B or C is always shown following the P.O. code number. X or Y operation is also indicated by the letter X or Y following the P.O. code number.

8. *Red labels.*—All relays bearing red code labels are special in some respect and reference to a relay-adjustment card is necessary before any re-adjustments are made. Any special adjustments shown on an adjustment card supersede the standard adjustments given in this Instruction (see par. 56).

Residual values for certain relays are shown on the code label and the designations X or Y are also shown, if necessary.

RESIDUAL AIR-GAP

9. Residual studs (fixed).—The stud should be firmly secured in the armature. There are three sizes of residual studs, all of phosphor bronze, 4, 12 and 20 mils high. This dimension refers to the actual projection of the stud but, for maintenance purposes, it is not necessary to measure the actual projection, but merely to know the minimum gap between armature and core when the relay is operated. For this purpose, a holed feeler-gauge is used in the same manner as for residual screws (see par. 13), and the figures given in Table 1 show the minimum permissible gaps. If a residual stud has worn down so far that difficulty is experienced in obtaining any one of these gaps, the armature should be changed.

TABLE 1

Designation letter on white or green P.O. code label	Nominal stud size	Minimum residual gap ('test' values)
A	4 mils	2 mils
B	12 ,,	5 ,,
C	20 ,,	9 ,,

A residual stud in service will seldom be found too long but, if this is found to be the cause of incorrect operation, the armature should be changed.

10. Residual screws (adjustable).—Residual screws are fitted on armatures of relays requiring accurate release times or release currents. The nominal value of the residual air-gap is normally specified on the P.O. code label of the relay, and the maximum and minimum measurements are shown in Table 2. The figures quoted are not the projection of the residual-screw, but refer to residual air-gaps obtained by the method of measurement described in par. 13.

TABLE 2

Nominal value	'Test'	'Re-adjust'
3 mils	+2, — 1 mils	± 1 mil
4 to 5 mils	± 2 mils	± 1 „
6 to 11 „	± 3 „	± 2 mils
12 to 19 „	± 4 „	± 2 „
20 mils and over	± 5 „	± 2 „
Any value (except 3 mils) with restricted tolerances. See also par. 11	± 2 mils	± 1 mil
3 mils with restricted tolerances	+ 2, — 1 mil	± 1 „

11. Restricted residual tolerances (or closer limits of tolerance).—When these are required on the specified nominal residual value, the fact is indicated by the inclusion of brackets on the P.O. code label and the following are examples of markings where restricted tolerances apply:—

Red labels:—(3) or ( )
White or green labels:—(3).

Reference to Table 3 will show that when restricted tolerances apply to residual values they also apply to the 're-adjust' values of armature travel.

Owing to variations in materials and manufacture, it is not always possible for the manufacturer to use the design value of residual to meet the current and/or timing tests specified for certain relays with low factors of safety. In such cases, the manufacturer has authority to finally determine the 'nominal' residual value to meet the best conditions of adjustment of a relay, and this value will be shown enclosed in brackets on the label [see sub.-par. 12 (*c*)]. When checking and adjusting a relay of this kind, the 'marked' value on the label should always be used as the 'nominal' value. The relay-adjustment card will, in addition, cross-refer to the 'marked' value on the label.

12. Methods of indicating adjustable residuals.—Prior to about 1938, residual values for red label relays were always shown on the code labels but since that date residual values have been omitted from the labels, except on relays to which restricted tolerances apply (see par. 11).

Residual values of white and green label relays are always shown on their respective code labels.

The following differences in markings on relays with respect to adjustable residuals apply. (The code number used is for illustration purposes only):—

(*a*) *Nominal residual value quoted* = 3000 12
White, green and red label relays.
Standard residual tolerances apply.

(*b*) *Residual value not quoted* = 3000
Red label relays only. Refer to relay-adjustment card for nominal residual value. Standard residual tolerances apply, unless otherwise indicated on the relay-adjustment card.

(*c*) *'Marked' residual value (within brackets)* = 3000 (12)
White, green and red label relays.
Restricted residual tolerances apply.

(*d*) *Empty brackets* = 3000 ( )
Red label relays only. Refer to relay-adjustment card for nominal residual value. Restricted residual tolerances apply.

13. Measurement of residual gap (Fig. 2.)—The residual gap is measured by inserting the holed end of the appropriate Gauges, Feeler, No. 1 between the armature and the core face, and allowing the residual stud or screw to penetrate the hole. The armature should then be operated by hand. The degree of freedom of movement of the gauge over the core face will show whether the residual stud or screw projects too far or too little.

The gauge should cover the point at which the residual value is at a minimum; this is normally at the edge of the core face nearest the yoke. Gauges, Feeler, No. 1 have a double bend in their length, and their width is such that a minimum gap will be measured when a gauge is used at various positions around the core face.

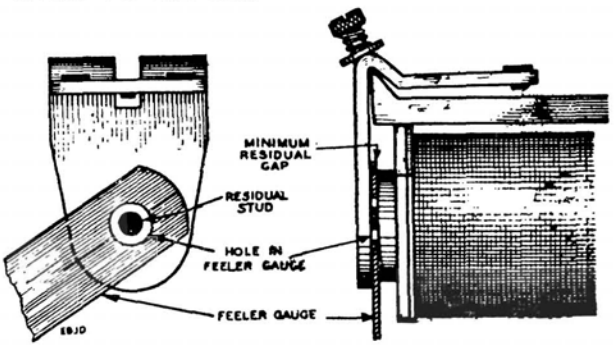

FIG. 2. MEASUREMENT OF RESIDUAL GAP

On shunt-field relays, the gauge will not quite reach the inner edge of the core face, but the method described above should be used.

14. Adjustment of residual gap.—The method of adjustment is as follows:—

(*a*) Loosen the locking nut and reduce the residual to zero

(*b*) Insert a feeler-gauge of the appropriate minimum 're-adjust' value, and operate the armature by hand

(*c*) Turn the residual screw until the feeler-gauge is felt to be loose

(*d*) A feeler-gauge of the appropriate maximum 're-adjust' value should then be substituted, and it should be felt to bind when the armature is operated by hand

(*e*) Tighten the locking nut

(*f*) Re-check the residual adjustments after tightening the locking nut.

ARMATURE ADJUSTMENTS

15. 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. This requirement is particularly important on a relay having a single contact unit, and on a relay on which the spring-set load is unbalanced, and it should be verified that there is no tendency for the armature to leave the knife-edge on the side of least spring pressure during operation or release. If the spring is found to be 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, but care should be taken not to overturn the screw.

16. Armature travel.—This is the distance between the striking face of the residual stud or screw, and the core (Fig. 3). The standard travel is 31 mils but, when X or Y contact units are fitted, the travel should be 43 mils. The tolerances permitted are shown in Table 3.

TABLE 3

Nominal values of travel	'Test'	'Re-adjust'
31 mils or 43 mils	± 3 mils	± 2 mils
Ditto, but with restricted residual tolerances, unless other travel tolerances are stated on adjustment card	± 3 mils	± 1 mil
Travel less than 31 mils	± 2 mils	± 1 mil

17. *When measuring an armature travel*, a feeler-gauge of the minimum value (normally 28 mils 'test' or 29 mils 're-adjust') should be inserted between the striking face of the residual stud or screw, and the core. A slight movement of the armature should be felt in the direction of the core, when an attempt is made to operate the armature by hand. When the gauge of the maximum value (normally 34 mils 'test' or 33 mils 're-adjust') is inserted in the manner indicated above, movement should not be felt. When making these tests, the gauge should not be inserted so far that it reaches the minimum gap where residual measurements are made. This gap, i.e. at the edge of the core face nearest to the yoke, will usually be less than the distance from core face to residual stud or screw, so that a false measurement of the armature travel will be obtained if the gauge is inserted too far.

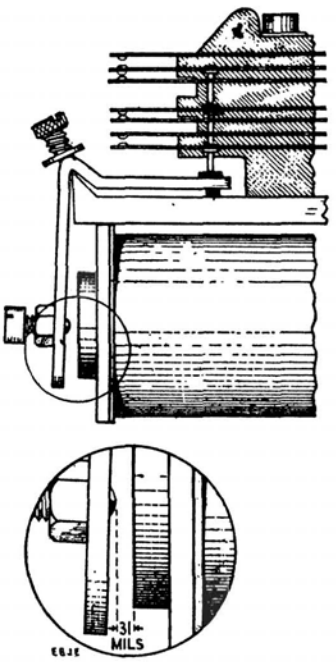

FIG. 3. ARMATURE TRAVEL

18. Adjustment of armature travel.—To adjust the armature travel, the armature should be removed from the relay and the armature bent inwards, reducing its angle to decrease the travel, or outwards to increase the travel. Adjuster, Armature, No. 2 should be used for this purpose (see Fig. 4). The armature should be placed over the tool knife-edge and clamped firmly, by tightening the clamping screw. By operating the tool lever, the armature can then be bent in either direction, without altering the angle of the V-groove which accommodates the knife-edge. An allowance must be made, however, in the movement of the tool lever for the elasticity of the armature material.

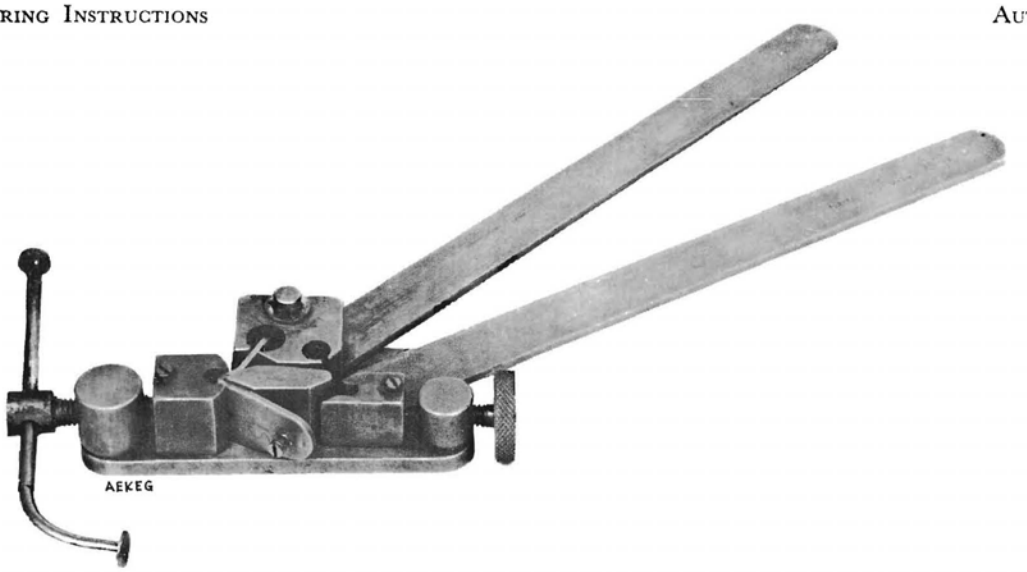

FIG. 4. ADJUSTMENT OF ARMATURE TRAVEL, USING ADJUSTER, ARMATURE, No. 2

ADJUSTMENT OF CONTACT UNITS

19. Order of spring adjustments.—If a spring-set is found to be out of adjustment, it is advisable to re-adjust in all respects, otherwise, while rectifying the adjustment of one detail, some other detail may be accidentally displaced, and further adjustments will have to be made later. If the apparatus to be adjusted is in an awkward position or in a bad light, a more accurate adjustment is likely to be obtained if the switch or relay-set is jacked-out and taken to a repair bench.

20. When re-adjusting a spring-set, each contact unit (' make,' ' break,' etc.) should be treated as an entirely independent unit, commencing with the one nearest to the yoke, and working successively to the outer contact unit in the spring-set. Each spring-set should be adjusted separately. The spring adjustments required for each type of contact unit are given in the paragraphs which follow.

21. ' Make ' contact unit adjustment (abbreviation—M).

(*a*) Straighten springs, if necessary (pars. 26 to 28)

(*b*) Tension the ' make ' spring against the block (pars. 29 and 30)

(*c*) Tension the lever spring against the lifting pin or stud below it (pars. 33 to 37)

(*d*) Check the contact clearance and spring lift, and correct where necessary (pars. 41 to 45).

22. ' Break ' contact unit adjustment (abbreviation—B).

(*a*) Straighten springs, if necessary (pars. 26 to 28)

(*b*) Operate the armature, and tension the ' break ' spring against the block step (pars. 29 and 30)

(*c*) Release the armature, and tension the lever spring so that the ' break ' spring leaves the block step, and, in addition, is tensioned against the lifting pin or stud below it (pars. 33 to 37)

(*d*) Check the contact clearance and spring lift, and correct where necessary (pars. 41 to 45).

23. ' Change-over ' contact unit adjustment (abbreviation—C).

(*a*) Straighten springs, if necessary (pars. 26 to 28)

(*b*) Tension the 'make' spring against the block step (pars. 29 and 30)

(*c*) Operate the armature and tension the ' break ' spring against the block step (pars. 30 and 31)

(*d*) Release the armature and tension the lever spring so that the 'break' spring leaves the block step, and, in addition, is tensioned against the lifting pin or stud below it (pars. 33 to 37)

(*e*) Check the contact clearances, sequence of break and make, and the spring lift, and correct where necessary (pars. 41 to 45).

24. Standard ' make-before-break ' contact unit adjustment (abbreviation—X).—This adjustment is the standard adjustment for all ' make-before-break ' contact units with the exception of certain X operated relays (for which see par. 25).

(*a*) Straighten the springs, if necessary (pars. 26 to 28)

(*b*) Operate the armature and tension the ' break ' spring (i.e. the lowest of the three springs)

against the block step (pars. 29 and 30)

(*c*) Release the armature and tension the ' make ' spring (i.e. the top spring) against the ' break ' spring [pars. 29 to 31 (*a*)]

(*d*) Tension the lever spring (i.e. the middle spring) against the lifting pin or stud below it (pars. 33 to 37)

(*e*) Check the contact clearances and correct, if necessary, by adjusting the tips of the lever spring (pars. 41 to 45).

25. Non-standard ' make-before-break ' contact unit adjustment.—The adjustments for 'make-before-break ' contact units (described in par. 24) do not apply to certain ' make-before-break ' units on relays with X contacts, when the lever spring of a ' make-before-break ' unit is unsupported by the lever spring of a preceding ' break ' or ' change-over ' unit (Fig. 11). Application of the standard adjustment to such a ' make-before-break ' unit may result in its lever spring fouling its ' break ' spring when the armature is normal. The ' make-before-break ' unit should, therefore, be adjusted so that there is a gap of approximately 2 mils between the block step and the ' break ' spring, when the armature is normal. The adjustment procedure is as follows:—

(*a*) Straighten the springs, if necessary (pars. 26 to 28)

(*b*) Operate the armature and tension the ' break ' spring (i.e. the lowest of the three springs) against the block step (pars. 29 and 30)

(*c*) Release the armature and tension the ' make ' spring (i.e. the top spring) so that the ' break ' spring leaves the block step [par. 31 (*b*)]

(*d*) Tension the lever spring (i.e. the middle spring) against the lifting pin or stud below it (pars. 33 to 37)

(*e*) Check the contact clearances and spring lift and correct, if necessary, by adjusting the tips of the lever spring (pars. 41 to 45).

ALIGNMENT OF SPRING-SETS

26. Straightness of springs.—It is a fundamental requirement of this type of relay that every spring, including the lug that rests on the buffer block, shall appear straight and flat when the relay is midway between the operated and unoperated position—that is to say, when all buffered springs are in contact with the buffer block, and all lever springs are midway between ' break ' and ' make ' springs. The buffer block and lifting pins are manufactured to such dimensions that, with straight springs, all clearances, including the spring lift from the buffer block, are obtained automatically, or at least with a minimum of adjustment. It is difficult to judge exact straightness of springs when assembled on a relay and, therefore, slight bending of the front end of the springs (i.e. in front of the lifting pin or stud) is permissible if the clearances specified in pars. 41 to 45 are not obtained. A spring lug should never be bent to obtain a particular sequence of contact operation, e.g. X or Y operation. Long and short lifting pins are provided for this purpose (see pars. 46 to 55). Buffer blocks should never be filed to obtain contact clearances or for any other reason.

27. Twin-contact tongues.—Twin-contact points should make or break approximately at the same time, as far as can be judged by the eye. The springs are provided with independent tongues for each contact point. The tongues of the lever springs should first be adjusted to lie parallel with each other and with the yoke when viewed from the front. The tongues of each buffered spring should then be adjusted, using the spring tongue adjusting tool, so that the twin-contact points make or break approximately at the same time (see Fig. 5).

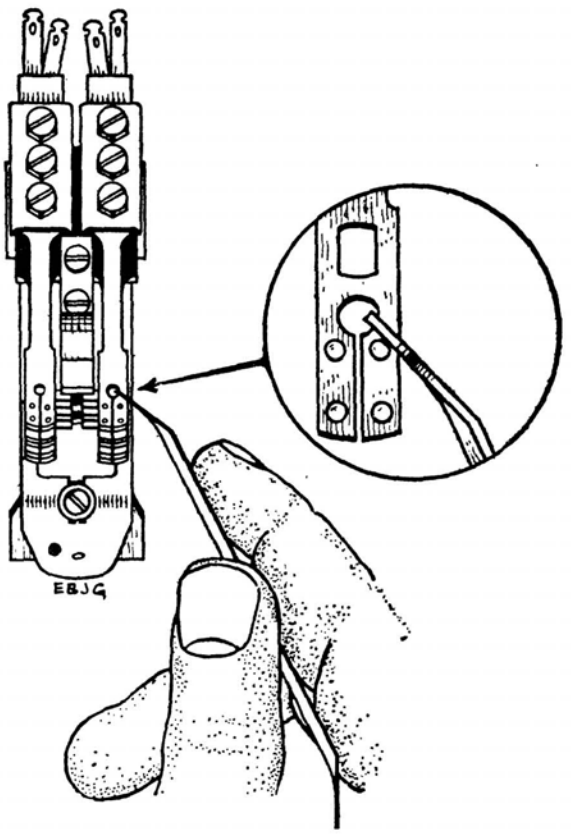

FIG. 5. ADJUSTMENT OF TWIN-CONTACT TONGUES

28. Alignment of contact points.—Pairs of contact points which make electrical contact one with the other (one in one spring and the other in the adjacent spring) should not be out of alignment by more than one-third of the diameter of a contact (see Fig. 6). This can be judged by eye. If faulty, the spring-set should be changed.

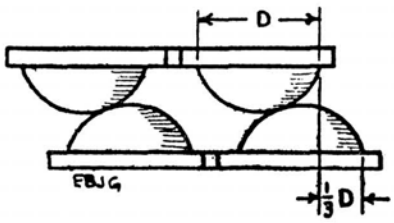

FIG. 6. MAXIMUM MISALIGNMENT OF CONTACT POINTS

SPRING TENSIONS

29. Contact pressures and block pressures.—Contact pressure is the pressure of one contact against another. The only contact pressure measured, except with certain special relays, is the ' make ' spring against the ' break ' spring of a standard ' make-before-break ' contact unit. Block pressure is the pressure of a lug of a ' break ' or ' make ' contact spring resting against a buffer block and is measured by applying a tension gauge to the tip of the spring, as shown in Figs. 7 and 8. Block pressures and contact pressures vary with the thickness of the springs, and the appropriate ' test ' and ' re-adjust ' values are given in Table 4.

30. *Block pressures.*—The contact springs should resist a pressure of the appropriate minimum value, as shown in Fig. 7. The springs should leave the steps of the block at the appropriate maximum value, as shown in Fig. 8. The gauge detail should be applied to the tip of the spring and not to the lug. Block pressures of ' break ' contacts should be measured with the armature operated; block pressures of ' make ' contacts should be measured with the armature unoperated. On both *standard* and *non-standard* ' make-before-break ' contact units, the tension of the ' break ' spring (i.e. the innermost of the three springs) against the block should also be measured with the armature operated as shown in Fig. 9.

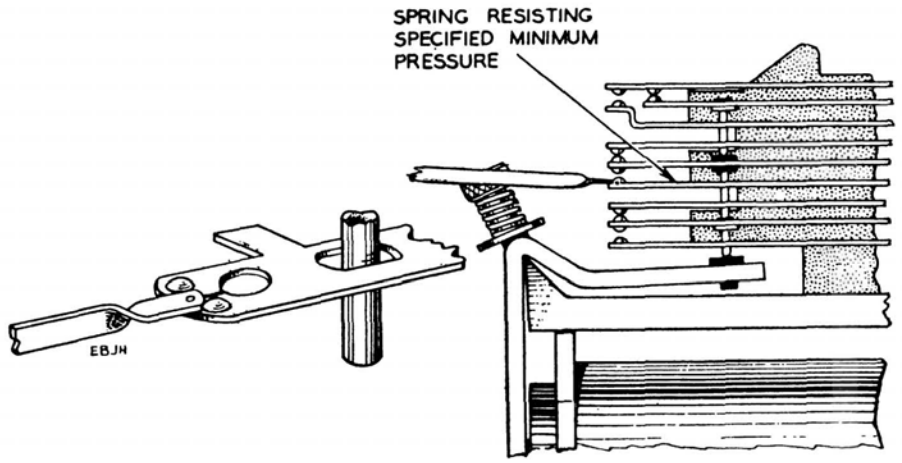

FIG. 7. CHECKING MINIMUM BLOCK PRESSURE

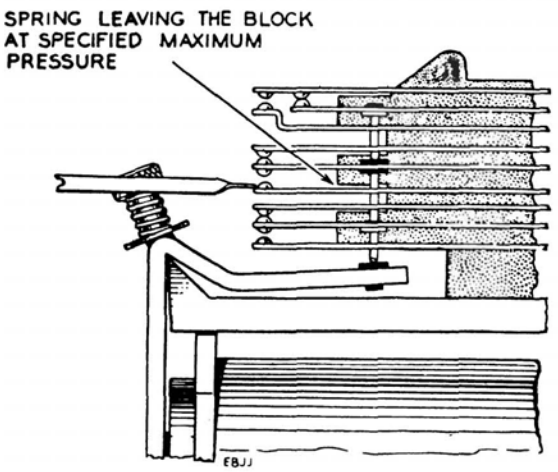

FIG. 8. CHECKING MAXIMUM BLOCK PRESSURE

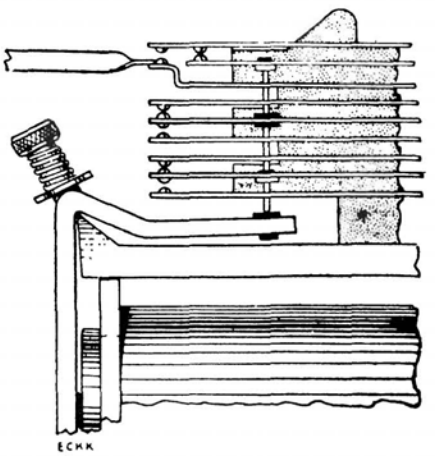

FIG. 9. CHECKING BLOCK PRESSURE OF ' BREAK ' SPRING OF STANDARD OR NON-STANDARD ' MAKE-BEFORE-BREAK ' UNIT (ARMATURE OPERATED)

TABLE 4

Type of spring	Spring thickness	Block pressure (grammes)				Contact pressure (grammes)			
		'Test'		'Re-adjust'		'Test'		'Re-adjust'	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
'Make' and 'break' springs, other than on K contact units	14 mils (white label)	15	21	16	20	—	—	—	—
	12 mils (green label)	10	16	11	15	—	—	—	—
'Break' spring of standard K contact units (par. 24)	14 mils (white label)	30	—	30	—	—	—	—	—
	12 mils (green label)	21	—	21	—	—	—	—	—
'Break' spring of non-standard K contact units (par. 25)	14 mils (white label)	15	21	16	20	—	—	—	—
'Make' spring of standard K contact units	14 mils (white label)	—	—	—	—	15	21	16	20
	12 mils (green label)	—	—	—	—	10	16	11	15
'Make' spring of non-standard K contact units (par. 25)	14 mils (white label)	—	—	—	—	[see par. 31 (*b*)]			

31. *Contact pressures.*

(*a*) *Standard 'make-before-break' contact units.*—The tension of the 'make' spring (i.e. the outer spring) should be measured directly against the 'break' spring with the armature unoperated, the gauge detail being applied to the tip of the 'make' spring (see Fig. 10). The tolerances permitted in the adjustment of these 'make-before-break' contact units are subject to the condition that the final adjustment of the contact unit is such that the 'break' spring is tensioned against the block in both the operated and unoperated positions.

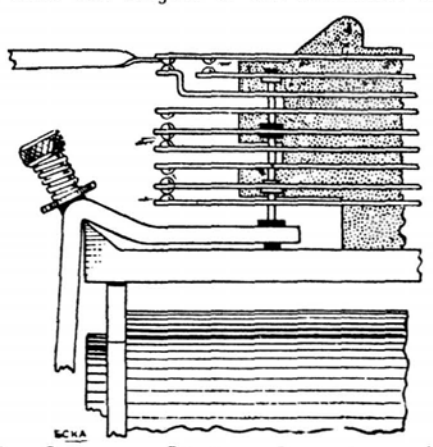

FIG. 10. CHECKING CONTACT PRESSURE OF 'MAKE' SPRING OF STANDARD 'MAKE-BEFORE-BREAK' UNIT (ARMATURE UNOPERATED)

(*b*) *Non-standard 'make-before-break' contact units.*—The tension of the 'make' spring (i.e. the outer spring) should be such that the 'break' spring leaves the block step when the armature is unoperated (see Fig. 11).

32. *Special relays*, on which the adjustments specified in pars. 29 to 31 may not apply, are indicated by red code labels, and the special adjustments concerned are given on relay-adjustment cards (see par. 57).

33. Lever-spring pressures.—*'Break' contacts.*—If a lever spring is associated with a 'break' spring, it should be tensioned so that, when the armature is unoperated, the 'break' spring leaves the block step in accordance with the general requirements of spring lift (par. 44). The pressure of the lever spring towards the armature under these conditions should be within the limits indicated in Table 5.

TABLE 5

'Test' (grammes)	'Re-adjust' (grammes)
4–9	5–8

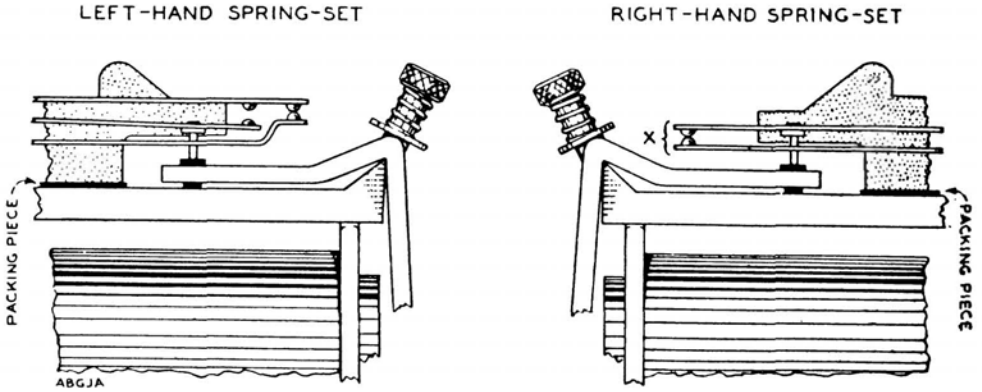

FIG. 11. X UNIT WITH ASSOCIATED NON-STANDARD ' MAKE-BEFORE-BREAK ' CONTACT UNIT

This pressure is measured by applying the gauge detail to the tip of each lever spring, any outer lever spring to the spring under test being lifted clear (see Fig. 12), using the tip of a small screwdriver applied to both of the twin-contact tongues together.

34. When applying this test to a lever spring of a ' break ' or ' change-over ' contact unit, it should be appreciated that the *resultant* tension of the lever spring and its associated ' break ' spring is actually measured; the lifting pin of the lever spring should, therefore, just lift from the armature stud when a pressure of 8 gm. is applied but should not leave the stud when a pressure of 5 gm. is applied to the tip of the lever spring (see Fig. 12).

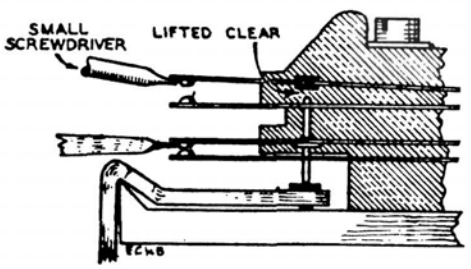

FIG. 12. MEASURING LEVER-SPRING PRESSURE (' BREAK ' CONTACT UNITS)

35. ' *Make* ' *contact units.*—The outer lever springs should be tensioned so that each one exerts pressure on an inner lever spring in accordance with Table 5. The method of measuring the lever-spring tension of the inner ' make ' contact unit is shown in Fig. 13 and is a measurement of the lever spring only resting on the armature stud.

36. *Gross lever-spring pressures.*—The measurements indicated in pars. 33–35 apply to individual lever springs when re-adjusting a relay. When testing a relay, however, it will suffice if the gross pressure is measured on the innermost lever spring (i.e. the one nearest the armature) and is within the limits of ' n ' times the ' test ' values, where ' n ' is the number of lever springs in the spring-set. Therefore, the minimum gross pressure of a spring-set having three lever springs will be 12 gm. and the maximum 27 gm. When the gross pressures are measured, the minimum inward tension of the extreme outer lever spring should be not less than 4 gm.

To verify that all other lever springs are tensioned towards the armature, the pressure due to the outer lever spring (or springs) should be relieved and, with an inner ' make ' or ' make-before-break ' contact unit, it should be noted that the lever spring does not exhibit any tendency to leave the lifting pin (or stud) of an adjacent inner lever spring, or from the armature stud. When checking the lever spring of a ' break ' or ' change-over ' contact unit in this way, it is permissible for the spring lift of the ' break ' contact

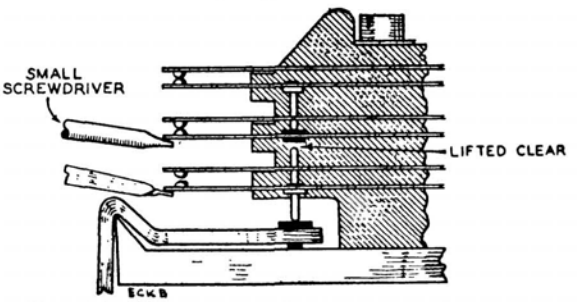

FIG. 13. MEASURING LEVER-SPRING PRESSURE (' MAKE ' CONTACT UNITS)

spring to be reduced to zero but the ' break ' contact must not break. Reduction of spring lift may cause the lifting pin (or stud) of an inner ' break ' or ' change-over ' unit to leave the stud or lifting pin of an adjacent lever spring and, if the ' break ' or ' change-over ' unit being checked is adjacent to the armature, its lifting pin may leave the armature stud.

37. For X contact relays, the lever-spring pressure of each ordinary ' make ' contact unit should be measured with the armature normal (i.e. at 43 mils travel), but the lever-spring pressure of each ordinary ' break ' or ' change-over ' contact unit should be measured with a 31-mil gauge in the armature core gap (i.e. at 31 mils travel). Further details will be found in pars. 46 to 55.

TENSIONING OF SPRINGS

38. Alternative tools.—Springs should be tensioned either with Adjuster, Spring, No. 1 or with Pliers, Adjusting, No. 2. The instructions which follow refer to the use of Adjuster, Spring, No. 1, but the principles apply to both. It is important, when using pliers, that the spring be gripped *lightly*, otherwise the required tension will not be obtained.

39. Principles.—The tension of a spring should not be increased by merely giving a bend or ' set ' near its root. If this were done, the pressure at the lifting pin or stud (or at the buffer-block step) would be increased, but the extra pressure would cause the spring to sag and upset the contact clearances. The correct method, therefore, is first to form a uniform hump or bow in the spring by the process known as ' stroking', so that when, finally, a ' set ' is put on the root of the spring to increase the pressure at the lifting pin or stud (or at the buffer-block step), the tendency to sag is counteracted by the hump and the spring remains straight.

40. *Example.*—The following example shows the details of this method, as applied to the tensioning of a ' make ' spring on to the buffer-block step. For simplicity, the directions are given assuming that the relay is mounted with its spring-sets uppermost, but once the principle is understood there should not be any difficulty in carrying out the operation while the relay is mounted on its side, either left-hand or right-hand.

(*a*) Place the tool over the spring, with the prongs as shown, at the root of the spring (see Fig. 14A).

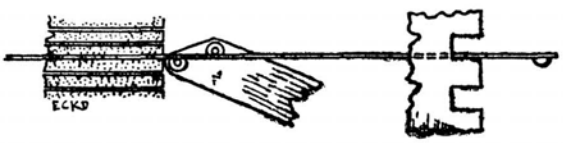

FIG. 14A. POSITION OF " ADJUSTER, SPRING, No. 1 "

(*b*) Use the tool as a lever to exert a light pressure on the spring as shown, at the same time pressing the tip of the tool upwards (see Fig. 14B).

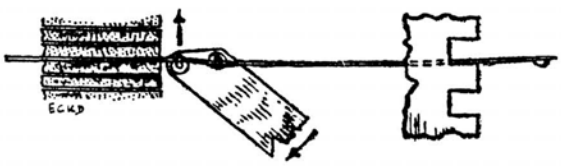

FIG. 14B. BENDING THE SPRING AND PRESSING UPWARDS

(*c*) Keeping the spring under pressure, draw the tool gently but firmly along the spring so that a bow is extended towards the buffer-block step (see Fig. 14C).

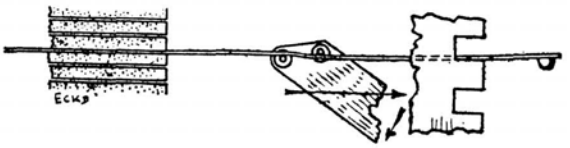

FIG. 14C. STROKING THE SPRING

(*d*) The shape of the spring after this stroking will be as shown, a uniform bow being formed along the length of the spring (see Fig. 14D).

FIG. 14D. BOW IN SPRING

(*e*) Replace the tool at the root, and give a ' set ' to the spring to increase the pressure on the buffer-block step until the spring becomes straight (see Fig. 14E).

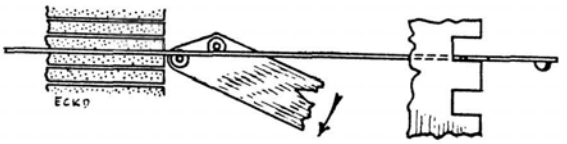

FIG. 14E. FINAL SET IN SPRING

The final setting of the spring will apply the necessary increased pressure at the buffer block, and yet the spring will be quite straight at the end of the adjustment. Once the principle of stroking and setting is understood, it can be applied to increase or decrease the tension of any spring without difficulty, the appropriate end of the tool being used (see Fig. 15).

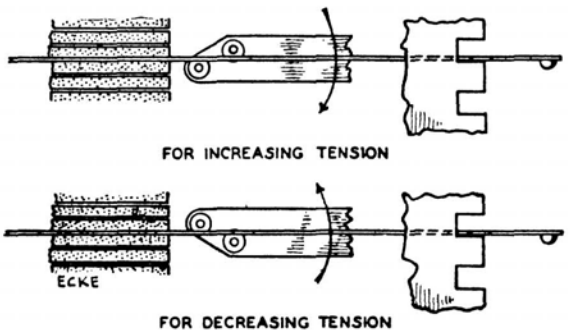

FIG. 15. INCREASING OR DECREASING TENSION

SPRING-SET CLEARANCES

41. Contact clearances.—The clearance between ' make ' contacts when the armature is normal, and between ' break ' contacts when the armature is operated, should not be less than 10 mils, i.e. half the height of a standard dome-shaped contact point when new. The clearance can usually be gauged by eye, and is normally much greater than this. If incorrect, the straightness of the springs, particularly the twin-contact tongues, should be checked and corrected where necessary.

42. *Contact clearances on pulsing relays.*—On pulsing relays, the contact clearance of the ' make-before-break ' unit is of special importance and should be adjusted to meet the following condition:—

If the armature travel is *more than 25 mils*, the ' make ' contact clearance should be adjusted to be approximately equal to the ' break ' contact clearance, as judged by eye. If the armature travel is *25 mils or less*, the ' make ' contact clearance should be adjusted to be slightly greater than the ' break ' contact clearance. After this adjustment has been made, it should be verified that the ' break ' contact clearance is not less than 10 mils, but if it is, the requirement should be met by reducing the ' make ' contact clearance slightly. If the relay carries a ' make ' contact unit in addition, the contact clearance of the ' make ' spring should be adjusted to be approximately equal to that of the ' make ' contact clearance of the ' make-before-break ' unit. See also H 5004 for the effect of contact clearances on pulsing performance.

43. Sequence of contact operation.—Apart from any X or Y contact units and ' make-before-break ' units, it should be checked that all ' break ' contact units break before any ' make ' contact unit makes. Similarly, in a change-over unit, the lever spring should leave the ' break ' spring before it makes contact with the ' make ' spring. If this requirement is not met, the straightness of the spring should be checked and corrected where necessary, as for incorrect contact clearance. For ' make-before-break ' units the make and break operations will occur in the reverse order to those of a change-over unit.

44. Spring lift.—The lift of a spring is the movement of its lug away from the buffer-block step, either away from or towards the yoke, and although the word ' lift ' suggests a movement in a vertical direction, in practice, the spring lift is horizontal because a relay is mounted on its side. Spring lift should be checked by eye, the armature being operated for ' make ' contacts, and unoperated for ' break ' contacts.

The nominal value is about 5 mils, with a minimum of about 2 mils. If the lift is judged to be insufficient, the straightness of the springs, particularly the spring lugs, should be checked, and corrected where necessary. A contributory cause may be the wearing down of the contact points, and when this wear is found to be excessive, the spring-set concerned should be changed.

For the ' break ' springs of standard ' make-before-break ' units and red label relays for which the ' break ' spring tension is specified to be greater than the associated lever spring tension, there is no spring lift.

45. Lifting-pin clearances.—Clearances between lifting pins and studs are not permitted, except for certain relays with X or Y contact units (see pars. 46 to 55) and certain special relays.

X AND Y OPERATION

46. X operation.—Early operation of a contact unit, either ' make ' or ' break ', is obtained by a shortened lifting pin immediately above the X unit, thereby delaying the action of the other contact units in the spring-set. X or Y contact units normally occupy the spring-set where the first contact spring is numbered at 21. The action of the whole of the spring-set on the opposite side is also delayed by packing up the buffer block, complete with both spring-sets, so that the armature has to travel about 10 mils before it starts to actuate the springs. To prevent this from delaying the action of the X contact unit, the lifting pin below the X contact unit is lengthened by an amount equal to the thickness of the packing. This is shown in Fig. 16B. Thus, a relay containing an X contact unit has a packing piece (metal plate) under the buffer block and spring-sets, and the X lever spring has special lifting pins, a short one above, and a long one below.

47. The adjustment of an X contact unit is exactly the same as for ordinary ' make ' and ' break ' units (pars. 21 and 22), the correct sequence of contact operation being obtained by means of the constructional design of the spring-set.

48. Associated contact units.—Since the X action is obtained by delaying the action of all other contact units (in the X spring-set and in the spring-set opposite), the adjustments of those other units may need additional attention.

49. *A normal ' break ' or ' change-over ' contact unit* on an X contact relay is adjusted, as regards lever spring pressure, when the armature is situated 31 mils from the core, i.e. corresponding to the condition that exists on a normal relay with 31 mils travel. This can be effected by inserting a 31-mil gauge between the armature and the core, and operating the armature, electrically if possible. In this way, the extra travel provided for operation of the X contact unit is taken up.

50. When all the normal ' break ' and ' change-over ' units have been adjusted in this manner, the 31-mil gauge should be removed and the armature allowed to release fully. It is then necessary to en-

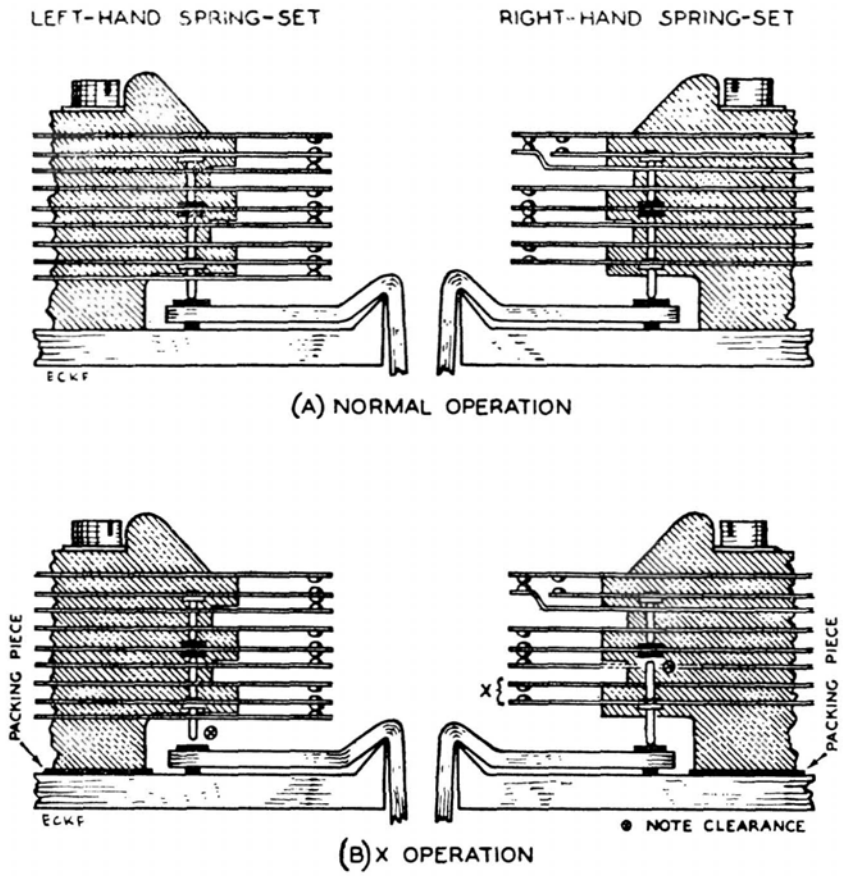

FIG. 16. X OPERATION WITH ASSOCIATED CONTACT UNITS (COMPARED WITH NORMAL OPERATION)

sure that the X unit will make or break contact before any normal ' break ' spring is moved. The lowest normal ' break ' spring in each spring-set should, therefore, be given additional upward tension until there is sufficient lifting-pin clearance (see Fig. 16B) to allow this sequence of movement. This lifting-pin clearance, however, should not be so great that the lift of the ' break ' springs away from the block is less than standard (see par. 44).

51. *A ' make ' or ' make-before-break ' contact unit on an X contact relay (Fig. 17)* is adjusted, as regards lever spring pressure, when the armature is fully released, i.e. at 43 mils travel. Except for the adjustment of

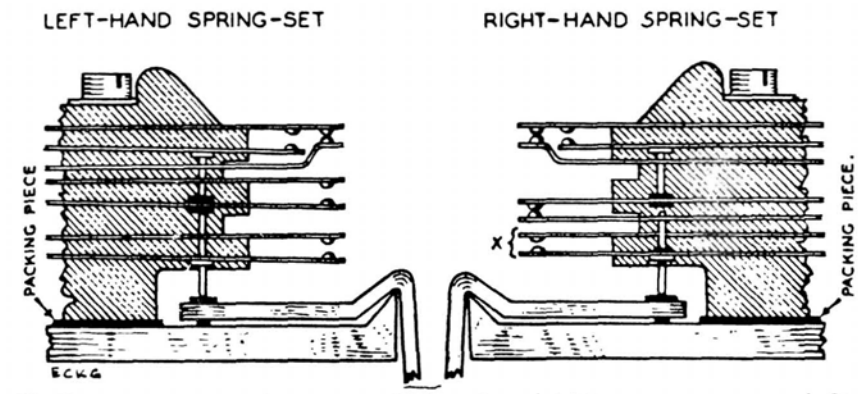

FIG. 17. X OPERATION WITH ASSOCIATED ' MAKE ' and ' MAKE-BEFORE-BREAK ' CONTACT UNITS

block clearance on the ' break ' spring of a non-standard ' make-before-break ' unit (see par. 25), departures from the standard procedure are not necessary. Also, with an X contact relay, when a ' make-before-break ' unit is fitted on the outer side of a normal ' break ' or ' change-over ' unit, it is classified as a standard ' make-before-break ' unit, and should be adjusted as specified in par. 24.

52. The order of adjustment of the spring-sets on an X contact relay may, therefore, be summarized as follows:—

(*a*) Adjust the X contact unit in the standard manner (pars. 21 and 22)

(*b*) Adjust each of the remaining ' make ' and ' make-before-break ' contact units in the standard manner, with the armature at 43 mils during lever-spring adjustments

(*c*) Adjust each of the remaining ' break ' and ' change-over ' contact units, in the standard manner, with the armature at 31 mils during lever-spring adjustments

(*d*) Increase the tension of the lowest normal ' break ' spring in each spring-set until the required lifting-pin clearance is obtained.

If it is desired to check the lever-spring pressures during adjustment operations, this should be done before the final increase in tension of the lowest ' break ' spring is made; otherwise the extra tension of that spring will cause it to follow the lever springs when the pressure gauge is applied.

53. Y operation.—Late operation of a contact unit, either ' break ' or ' make ', is obtained by a shortened lifting pin on the Y lever spring which delays its action (see Fig. 18). A packing piece under the buffer block is not required.

54. Adjustments of Y contact units.—A Y contact unit is adjusted in exactly the same way as an ordinary ' make ' or ' break ' contact unit, except that when the Y unit is a ' break ' unit (as shown in Fig. 18) the Y lever spring is not tensioned to meet the values specified in par. 33. The lever spring should be tensioned down until the Y ' break ' spring leaves the block step to the extent of the normal spring lift (see par. 44), but a clearance should be left below the Y lever spring (as shown in Fig. 18) to ensure that the Y contact unit is the last to be operated.

55. On a Y ' make ' contact unit, the lifting-pin clearance is taken up as a result of the Y lever spring moving towards the yoke. The contact opening of a Y ' make ' unit is, therefore, slightly greater than normal.

CURRENT AND TIMING TESTS

56. General.—Relays requiring special adjustments for current tests are identified by a red P.O. code label on the coil cheek (see Fig. 1) and the special adjustment details and current values are given on individual relay-adjustment cards.

Information regarding the timing of relays having operate and/or release lags is obtainable on request from the Eng. Dept. (Tp 2/8). When relay current or timing tests are made on a bench, it is important that the relay mounting should not be tilted at an angle to its normal position. If individual relays are to be tested on a bench, they should be mounted on Stands, Testing, No. 8A in the same position that they would normally occupy *in situ*.

57. Relay-adjustment cards should be requisitioned in accordance with B 5099. A typical relay-adjustment card P.O. Code No. 4172 (Mark No. 1) is shown in Fig. 19, from which will be seen the nature of the special information that may be quoted.

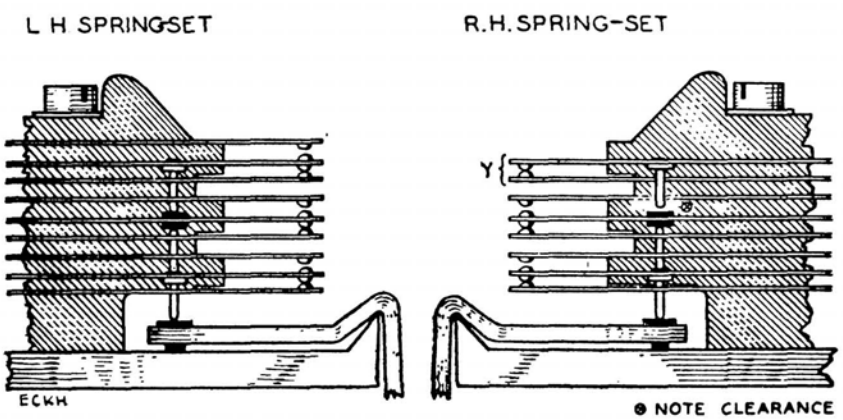

FIG. 18. Y BREAK CONTACT UNIT

Relay Adjustment Card
Special (Red Label) 3000-Type Relay

P.O. Code No. 4172
Mark No. 1

Circuit	Relay	Test Points	Remarks

Current Values

Condition	'Test' Values		'Re-adjust' Values	
Coil	a–b	d–e	a–b	d–e
Saturate	110	76	110	76
Hold	—	—	—	—
Release	—	—	—	—
Non-op.*	12	—	13	—
Operate*	26	—	25	—
Operate	—	30	—	28.5

* Relates to X contact

Special Mechanical Adjustments
Residual: 4 mils
Travel: 43 mils
Spring thickness: 12 mils
Springs 1, 4, 7, 22, 24, 27, 29: adjust tensions to meet current tests

Tolerances and other adjustments to E.I. TELEPHONES, Automatic, B 5144

Issue	Amendment	Date
A		20.3.36
B	Current values altered	24.6.43

FIG. 19. SPECIMEN RELAY-ADJUSTMENT CARD

58. Test points.—Test points represent the points in a particular circuit to which testing equipment should be connected to make current tests, and they should be inserted by the maintenance officer concerned, together with any relative information, in the appropriate columns of the relay-adjustment card, on the first occasion that the card is used. When these columns have been filled-up, additional test points should be inserted on the back of the card. Some relay-adjustment cards which are issued may list the test points required for certain circuits, but the practice of specifying the test points before the distribution of the cards has now ceased.

59. *Selection of test points.*—The following notes are given for guidance in the selection of test points:—

(*a*) The testing equipment should be connected so as to indicate the current flowing through the relay coil; particular attention should be paid to this point when there is normally a circuit in parallel with the relay to be tested.

(*b*) The connexion of battery or earth to any point of the circuit for the purpose of the test should not cause a damaging current to flow through a resistor, rectifier, low-voltage lamp, etc., connected to the same point. If a doubt exists the item should be disconnected.

(*c*) Where possible, care should be taken to avoid magnetic interference from any adjacent relays with the relay under test. Relays having slugged or short-circuited coils which are adjacent to the relay under test and are operated during the test should, if possible, be disconnected by insulating appropriate contacts. Contacts of the relay under test should not be insulated for this purpose, as this may affect its operate or release performance. Also, if magnetic interference is caused by an adjacent relay, the relay causing the interference may be screened, by placing over it a screen such as that used on pulsing relays.

(*d*) The prevention of other relays from operating whilst testing can sometimes be accomplished by the removal of the armature of a particular relay

in the circuit. The same purpose may also be served by operating an armature by hand and inserting a small wedge between its back stop and yoke.

(*e*) The disconnexion of soldered connexions should be avoided if possible.

60. Current values.—The values of operate current, etc., quoted on the relay adjustment card are expressed in milliamperes, and should be read as follows:—

(*a*) '*Saturate*'.—This is the minimum value which must be applied to the relay prior to making the individual current tests which follow. Where not quoted or the word 'full' appears, the full potential of the exchange battery must be connected across the relay.

(*b*) '*Hold*'.—This is the value at which the relay must remain operated when the current is reduced in one step from the 'saturate' value, e.g. if 12 mA. is quoted as the 'hold' value, then the relay must hold at this value when the current is reduced from the 'saturate' value; the relay may, however, hold at a lower value, but the other values, 'release', 'non-operate', etc., given on the card must also be met.

(*c*) '*Release*'.—This is the value of current in a relay which will permit the armature to release so that all contacts are restored to normal, when the current is reduced in one step from the 'saturate' or the 'hold' value when this latter value is specified. If, for example, 10 mA. is quoted as the 'release' current, the relay must release at that value. A relay may, however, release at a higher value than that which is stated on its relay-adjustment card, but other current tests, as specified, must also be met.

Unless otherwise specified on a relay-adjustment card, all 'break' springs of 'break' or 'change-over' contact units must leave the buffer-block steps during the release test, but there may be further slight movement of the armature on disconnexion, after the release test.

When the block pressures of the 'break' springs of contact units are specified to exceed 30 gm. (for 14-mil springs) and 20 gm. (for 12-mil springs), movement of 'break' springs from the block step is not required with release.

When a relay is fitted with 'make' and/or 'make-before-break' contact units only, the armature must restore fully to normal during the release test.

(*d*) '*Non-operate*'.—This is the value at which the relay must not operate, e.g. if 8 mA. is quoted, then, when 8 mA. is applied, the relay must not operate; the relay may, however, fail to operate at a higher value, but the other current tests given on the card must also be met. (See also par. 61.)

(*e*) '*Operate*'.—This is the value at which the relay must fully operate, e.g. if 16 mA. is quoted, then, when 16 mA. is applied, the relay must fully operate; it may, however, operate with less current, but the other current tests given on the card must also be met.

61. *Order of current tests.*—The current tests should be made under the correct magnetic conditions, i.e. after saturation, and the order of tests should be as follows:—

'*Saturate*': '*Hold*': '*Release*': '*Non-operate*' and then '*Operate*' current tests.

It is, normally, unnecessary to apply the 'saturate' current more than once for any series of tests. In the definition of 'non-operate' current, it is stated that all 'break' springs must be free of the buffer-block steps and, from this it follows, when the non-operate current is applied, there must not be any appreciable reduction of 'make' contact clearance even when 'break' springs are not fitted. *This requirement should be rigidly observed.*

62. Adjustment to meet current tests.—The following notes are given for guidance when re-adjusting a relay to meet its current tests:—

(*a*) The armature should be removed and the pole-face, knife-edge and the armature back-stop cleaned with chamois leather, with special attention given to every part where friction takes place.

(*b*) The residual, armature travel and block pressures should be adjusted within the 're-adjust' tolerances and the specified current tests then applied.

(*c*) The lever spring tensions should then be varied within the specified limits so that the current tests are met. When it is stated on the relay-adjustment card that certain lever springs are to be "adjusted to meet current tests" and limits are not quoted, then

(i) the lever-spring pressure must not be reduced to such an extent that spring lift is below the standard requirements (see par. 44).

(ii) the lever-spring pressure may exceed the limit of 8 gm. quoted in pars. 33 and 34. The maximum lever spring tension for 12- and 14-mil springs that can be obtained is as follows:—

Spring thickness	*B or C contact unit*	*M or K contact unit*
12 mils	10 gm.	25 gm.
14 mils	10 gm.	30 gm.
12 mils with thick 'break' contact spring	25 gm.	
14 mils with thick 'break' contact spring	30 gm.	

(*d*) When adjusting a relay having a residual value indicated on the label enclosed in brackets [see par. 12 (*c*)] to meet its specified current values, it may be found that the release value cannot be met with all mechanical adjustments within tolerances or without applying excessive tensions to the lever springs [see sub-par. (*c*)]. In such circumstances, it may be necessary (due to residual magnetism) to determine a new nominal residual value for the relay, as follows:—

All mechanical adjustments should be within the specified ' re-adjust ' values and, when it is specified that lever springs should be adjusted to meet current tests, the lever springs of ' break ' and ' change-over ' contact units should be tensioned within the limits of 5 to 8 gm. Lever spring tensions of ' make ' or ' make-before-break ' contact units should be between 6 to 12 gm. If, however, specified limits of tension are quoted on the adjustment card for certain lever springs, e.g. 11 to 15 gm., the lever springs indicated should conform to those values.

The residual screw should then be advanced, 1 mil at a time, until the specified ' re-adjust release ' value is met. The armature travel should be checked and corrected after each residual adjustment. The specified 're-adjust' operate current should next be applied and, if the relay fails to operate, it indicates that the relay is unreliable and may have excessive residual magnetism in its magnetic circuit. Where excessive residual magnetism exists in a relay, improvement may sometimes be obtained by fitting a new armature but, if difficulty is still experienced in adjusting the relay to function correctly, either the coil and yoke or the complete relay should be changed.

When a new residual value has been determined in the above manner, the new value should be marked on the label, replacing the old value.

63. Shielded relays.—When a shield is fitted to a relay, the ' test ' current values should be applied with the shield on. When re-adjusting a relay, however, mechanical adjustments and ' re-adjust ' current tests should be applied with the shield removed.

64. Current testers.—Testers AT 4557 and AT 4569, which are described in TESTS & INSPECTIONS, General, B 1520 and B 1522, respectively, are available for making current tests.

65. Timing tests.—Timing testers described in TESTS & INSPECTIONS, General, B 1523, are necessary for making timing tests. If general difficulty is experienced in adjusting a particular code of relay to meet its timing requirements, the Eng. Dept. (Tp 2/8) should be notified of details of the relay and the diagram number of the circuit concerned.

66. *Operate lag.* — If the operate lag of a relay is found to be outside the range permitted, the relay should be re-adjusted so that its lag lies between the maximum and the mean value of the range. To meet such values, it should first be checked that the block tension, lever tension, armature travel and residual (if adjustable) are within the tolerances. The lever-spring tensions and armature travel should then be varied within their tolerances to meet the required lag. Unless otherwise stated on adjustment cards, lever-spring tensions of red label relays may be increased to the values indicated in par. 62 (*c*) (ii).

If a relay cannot be adjusted to meet a required operate lag by variation of lever-spring pressures, the residual screw should be varied within test limits, with a corresponding re-adjustment to the armature travel.

When the operate lag of a red label relay has been obtained, it should be confirmed that the current values are within tolerance.

67. *Release lag.*—If the release lag of a relay is found to be outside the range permitted, it should be re-adjusted so that its lag lies between the minimum and the mean values of the timing range. To meet such values it should first be checked that the block tensions, lever-spring tensions, armature travel and the residual are within the specified test values.

Before attempting any re-adjustment, it is important to check that the pole-face and the knife-edges are clean [see par. 62 (*a*)]. If, after cleaning, the release lag still requires correction, all mechanical adjustments should be placed within the specified ' re-adjust ' values. An increase in lever-spring tensions within the specified tolerances will decrease the release lag, but a reduction in lever-spring tensions to increase the lag is not recommended.

If, after the above, further adjustment is still required, the residual screw may then be varied and, in these circumstances, it is permitted to exceed the test tolerances for the specified residual value, provided the current values (if specified) are also met. The armature travel should be checked and re-adjusted, if necessary, after residual adjustment.

68. Clip, Test, No. 32 has been developed primarily for use in connexion with the testing of relays. A description of the clip and method of use is given in TESTS & INSPECTIONS, General, B 1501.

MISCELLANEOUS

69. Relays with special applications.—Relays LC 3/1, LC 3/2, etc., are low capacity relays of 3000-type design and are used on circuits where low capacity is required between contact springs. They are classified as " red label " relays and relay adjustment cards are therefore available for adjustment purposes with each type. Adjustment information as detailed in this Instruction regarding residual, travel and spring adjustments, etc., should be followed. The main differences between low capacity relays and standard 3000-type relays are:—

(*a*) Specially constructed spring-sets with double layers of insulation between contact springs.

(*b*) The front ends of ' make ' and ' break ' contact springs are curved towards the lever springs to counteract the double layers of insulation of the spring-set. Lifting pins associated with lever springs are longer for the same reason.

(*c*) Left-hand and right-hand spring-sets and spring tags are electrically screened from each other by two metal plates.

(*d*) Circular insulated studs are fixed at the front to each side of the screen and take the place of the block steps of buffer blocks.

70. Relay adjustment sheets for U.A.X. No. 7 (A.G.S. System).—Early installations of the U.A.X. No. 7 type were equipped with 3000-type relays not bearing P.O. codes, but later installations have been equipped with a certain number of relays to which P.O. codes have been allocated. For all installations, however, relay adjustment sheets (P.O. diagrams RA 40018 etc.) have been issued to cover the adjustments for all relays used in the equipment. Where equipment has been fitted with relays having restricted tolerances, the residual value shown in brackets on the relay should be used for checking and re-adjustment purposes but, in respect of identical uncoded relays, the residual value quoted in the relative RA diagrams should be used for this purpose.

71. Numbering of contact springs.—Fig. 20 illustrates the method of numbering the contact springs, as viewed from the front. The standard method of mounting the relay in each of the horizontal positions is shown, with the width of the springs in a vertical plane. Spring No. 1 will be the inner spring of the lower spring-set with the relay mounted in the left position on the mounting plate. When the relay is mounted in the right position, spring No. 1 will be the inner spring of the upper spring-set. The spring tags are shown in Fig. 21 and it can be seen that those of the lever springs occupy inward positions with respect to the 'make' and 'break' springs.

72. Coil tags and windings.—Coil tags are identified by the letters a - e as shown in Fig. 21 when viewed from the rear, and the number fitted will depend upon the number of windings of the coil. The windings are terminated on specific tags according to the individual requirements of a relay. It is usual, however, for single windings to be terminated on tags a - e and double windings on tags a - b for one winding and d - e for the other. When there are three windings to a coil, it is common practice to use tag c to terminate one end of a winding and to common the other end to another tag used by one of the other two windings. The inner end of a winding is connected to the lower of the two tags when mounted in a left position, as viewed from the rear, and it follows that the lower tag will become the upper tag when mounted in a right position.

All windings are wound in an anti-clockwise direction as viewed from the rear, starting from the inner end. The tag that is connected to the inner end of a winding is coloured red.

73. Tools and their uses.—The tools necessary for adjustment of 3000-type relays are indicated in Table 6. The tools specified should be used only for the purposes for which they are intended. Any tool which is in such a condition that screws, nuts or springs would be damaged by its use should be changed.

74. Replacement of parts.—Parts of any relay can be changed if found to be faulty. Reference should be made to B 5507 for the procedure to be adopted and the part numbers of the various items.

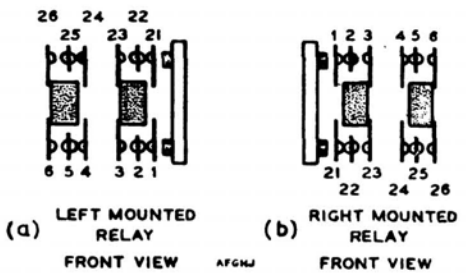

FIG. 20. NUMBERING OF SPRINGS

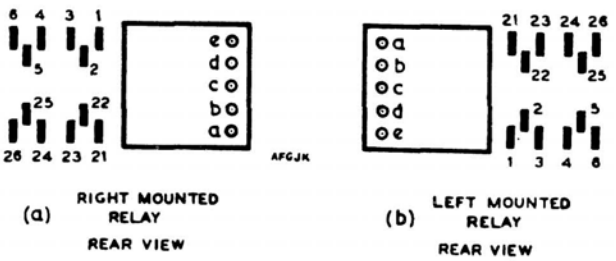

FIG. 21. NUMBERING OF SPRINGS AND LETTERING OF COIL TAGS

TABLE 6

Rate Book description	General description and use
Screwdriver, Instrument, No. 1	Screwdriver } for residual-screw adjustment
Spanner, Flat, No. 2	Spanner }
Screwdriver, Instrument, No. 2	Screwdriver for buffer-block fixing-screws
Screwdriver, Instrument, No. 6	Screwdriver for core-fixing nut
Gauges, Feeler, No. 1	Feeler gauges for general use
Gauges, Feeler, No. 9	Feeler gauges for general use
†Screwdriver, Offset, No. 1	For spring-set fixing screws
Spanner, Box, Cranked, No. 4	Box spanner for spring-set fixing-screws
Gauge, Tension, No. 1	Pressure gauges for measuring the tension of springs
Gauge, Tension, No. 2	
Cleaner, Contact, No. 1	Contact cleaner
Insulator, Contact, No. 1	Insulator for relay contacts
Guide No. 1	Armature shoe-horn for replacing armature
Adjuster, Armature, No. 2	Tool for armature bending
Pliers, Adjusting, No. 2	Bent duck-bill pliers for spring adjustments
Adjuster, Spring, No. 1	Spring adjuster
Adjuster, Spring, No. 2	Spring-tongue adjuster, for adjusting the relative positions of twin-contact points

†The spring-set fixing-screws are now hexagonal-headed and are not slotted. Screwdriver, Offset, No. 1 is retained for existing spring-set screws.

References:—B 5099, B 5507, H 5004
(Tp 2/8) General, B 5902, Q 1005, Q 1010
TESTS & INSPECTIONS, General, B 1501, B 1520, B 1522 and B 1523

END

POST OFFICE 3000-TYPE RELAYS

[Maintenance Adjustment Instruction (M.A.I.) No. 44]

[Additional paragraph 15.1]

15.1 Adjustable armature-retaining screws. The following 3000-type relays will in future be supplied with adjustable armature-retaining screws.

Codes:- 3100, 3571, 4706, 5513, 6120, 6398, 7181, 13331, 14137

Fig. 1 shows an adjustable armature-retaining screw and its parts.

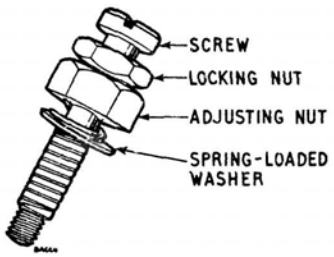

FIG. 1

In many cases the pulsing performance of these relays will be improved by fitting adjustable armature-retaining screws.

Full retrospective action will not be taken, but when a relay of one of the above codes requires maintenance attention an adjustable armature-retaining screw (Part No. 1/DSC/398) should be fitted.

It is important that when an adjustable armature-retaining screw is fitted, the adjustment of the relay should be completely checked and corrected.

Adjust the screw as follows:-

(a) Fit the adjustable armature-retaining screw, checking that the adjusting and locking nuts do not prevent the screw fully entering into the yoke.

(b) Set the adjusting nut so that when the spring-loaded washer is lifted from the armature and pushed against the adjusting nut there is a clearance of 3-7 mils between the washer and the armature.

(c) Lock the adjusting nut with the locking nut

(d) Re-check the clearance

Tools required for adjustment are:-

Screwdriver, Instrument, No. 1
Spanner, Flat, No. 2
Spanner, Box Cranked, No. 9
Gauges, Feeler, No. 10