BASIC ADJUSTMENTS OF 3000 TYPE RELAYS

INTRODUCTION

The purpose of this note is to introduce the "A" Course student to the relevant paragraphs in EIs that are required for reference when carrying out basic adjustments on 3000 type relays.

Further information will be found in TI E6 H5144.

(For use in conjunction with TAs 1105, 1106, 1107).

1 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 level 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.

2 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 readjustment, the 're-adjust' values should be applied.

3 CODE LABELS

A guide to the adjustments of a relay is indicated by the colour of the PO code label and by the figures and letters that are printed on it (see TA 1105).

4 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 PO 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 PO code number. X or Y operation is also indicated by the letter X or Y following the PO code number.

5 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.

6 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 PO code label of the relay, and the maximum and minimum measurements are shown in Table 1. The figures quoted are not the projection of the residual-screw, but refer to residual air-gaps obtained by the method of measurements described in paragraph 8.

TABLE 1

Nominal Value	'Test'	'Re-adjust'
3 mils	+2, - 1 mils	± 1 mil
4 to 5 mils	± 2 mils	± 1 mil
6 to 11 "	± 3 mils	± 2 mils
12 to 19"	± 4 mils	± 2 mils
20 mils and Over	± 5 mils	± 2 mils
Any value (except 3 mils) with restricted tolerances.	± 2 mils	± 1 mils
3 mils with restricted tolerances	+ 2, - 1 mil	± 1 mil

7 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.

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
White, green and red label relays.
Standard residual tolerances apply. = 3000 12

b. Residual value not quoted
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. = 3000

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

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

8 MEASUREMENT OF RESIDUAL GAP

The residual gap is measure 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 measuredwhen a gauge is used at various positions around the core face. (see TA 1106)

9 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-guage 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.

10 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.

11 ARMATURE TRAVEL

This is the distance between the striking face of the residual stud or screw, and the core. (see TA 1106). 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 2.

TABLE 2

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

12 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, ie 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 guage is inserted too far. (see TA 1106).

13 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. 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.

14 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.

15 'MAKE' CONTACT UNIT ADJUSTMENT (ABBREVIATION - M)

a. Straighten springs, if necessary (paragraph 16)

b. Tension the 'make' spring against the block (paragraph 19)

c. Tension the lever spring against the lifting pin or stud below it (paragraph 20)

d. Check the contact clearance and spring lift, and correct where necessary (paragraphs 24, 25).

16 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. 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 (ie in front of the lifting pin or stud) is permissible if the clearances specified are not obtained.

17 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.

18 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 TA 1107). This can be judged by eye. If faulty, the spring-set should be changed.

19 BLOCK PRESSURES

The contact springs should resist a pressure of the appropriate minimum value. The springs should leave the steps of the block at the appropriate maximum value. The gauge detail should be applied to the tip of the spring, and not to the lug.

TABLE 3

	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	-	-	-	-

20 LEVER SPRING PRESSURE

The lever spring is tensioned against the armature pad. The pressure of the lever spring towards the armature should be within the limits indicated in Table 4.

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

21 ALTERNATIVE TOOLS

Springs should be tensioned either with Adjuster, Spring No 1 or with Pliers, Adjusting No 2. It is important, when using pliers, that the spring be gripped lightly, otherwise the required tension will not be obtained.

22 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.

23 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. (see TA 1107).

24 CONTACT CLEARANCES

The clearance between 'make' contacts when the armature is normal should not be less than 10 mils, ie 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.

25 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.

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.

26 LIFTING-PIN CLEARANCES

Clerances between lifting pins and studs are not permitted, except in special circumstances.

NOTE:- Remember this is only a Guide to you when adjusting 3000 Type Relays, the full instruction is contained in TI E6 H5144
Please note that "course handouts are issued as aids to students and in no way replace current standard instructions".

END OF NOTE

LONDON TELECOMMUNICATIONS REGION
ENGINEERING TRAINING CENTRE

P.O. 3000-TYPE RELAY ADJUSTMENTS.

TA 1106		SX	Sheet No. ... of ... Sheets
Approved CEI	S.E.E. (H)		Date 4-5-55
Originated by E.C.T.			Date. 10-3-55
Drn	Trd. WB		Ckd.

SX	Amendment	Orig	D/O	Approved S.E.E.	Date

FIG. 1

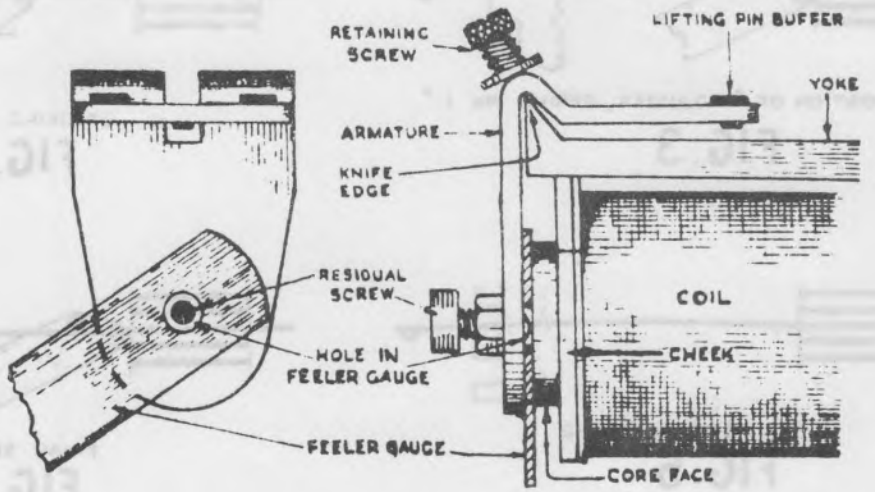
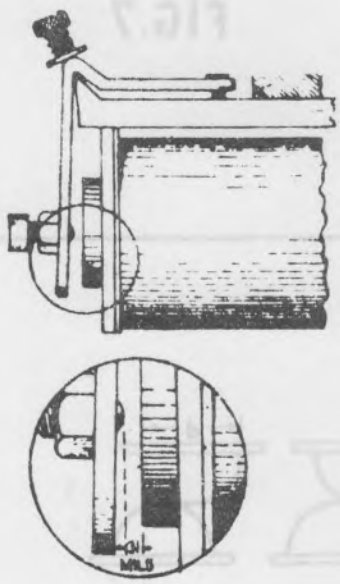


FIG. 2



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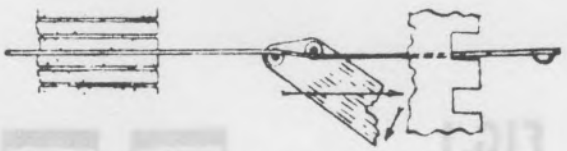
P.O. 3000 TYPE RELAY ADJUSTMENTS (CONTINUED)

POSITION OF "ADJUSTER, SPRING No. 1"

FIG. 3



STROKING THE SPRING

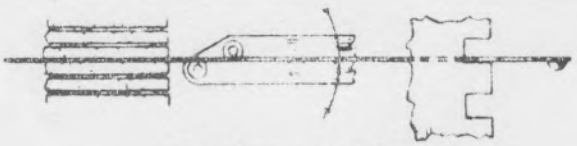
FIG. 4

BOW IN SPRING

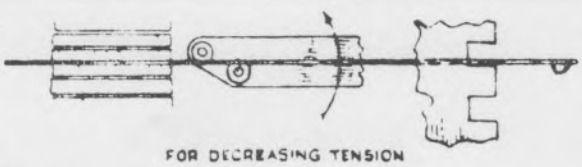
FIG. 5

FINAL SET IN SPRING

FIG. 6

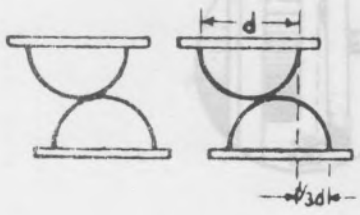


FOR INCREASING TENSION



FOR DECREASING TENSION

FIG. 7



SHOWING CONTACT OVERLAP

FIG. 8

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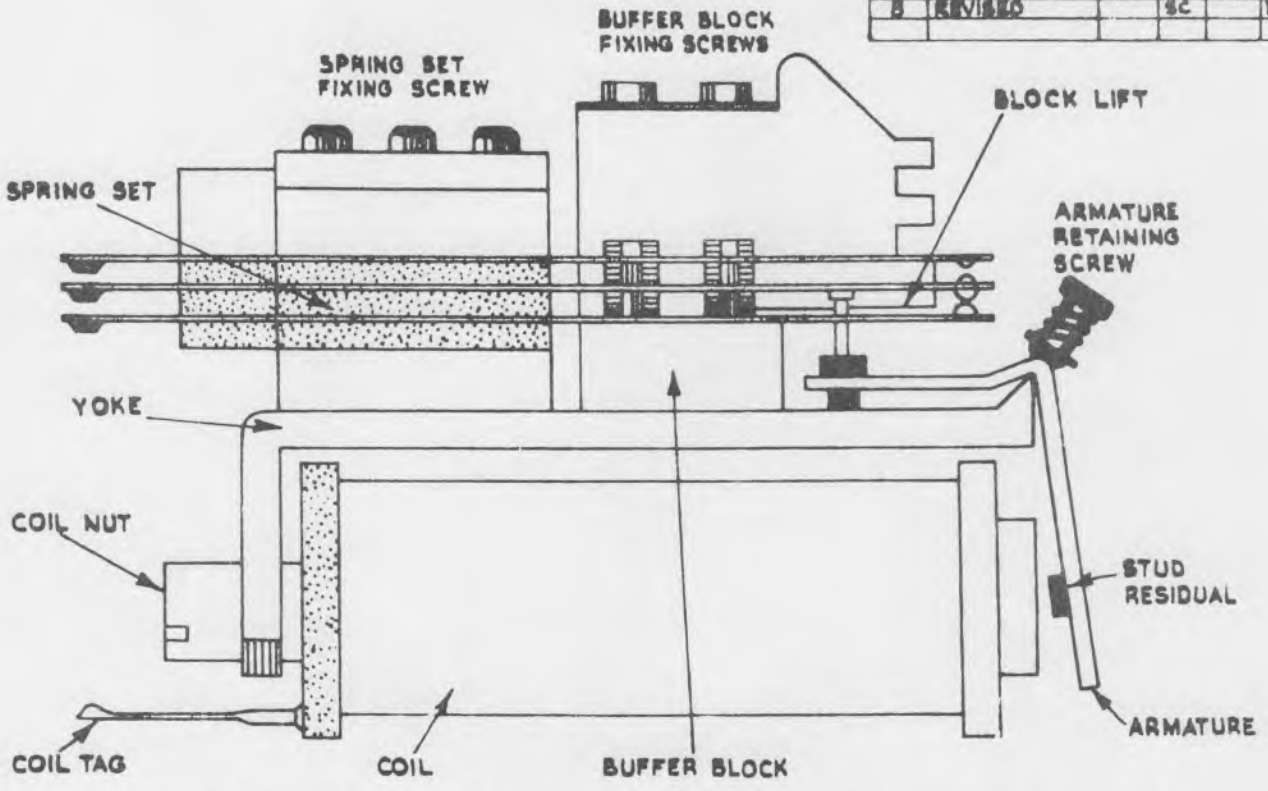
THE 3,000 TYPE RELAY

TO BE USED WITH NS. 19 & NS. 29

TA 1010		SX A	Sheet No___ of____Sheets
Approved — S.E.E.(T/T)			Date —
Originated by GWPH			Date 1952
Drn	Trd		Ckd

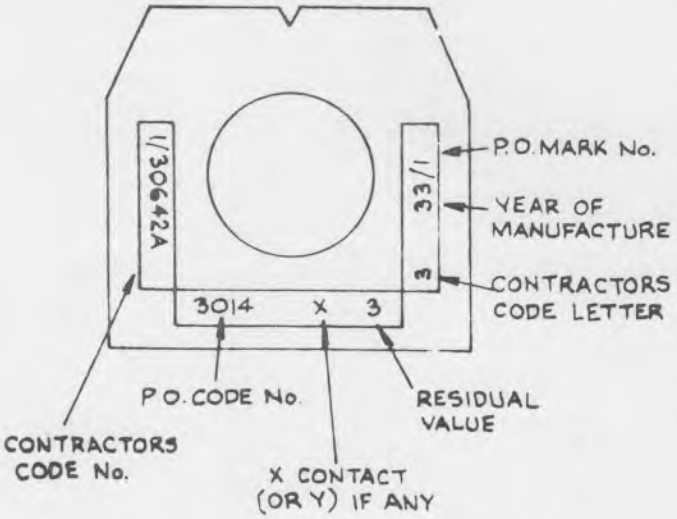
SX	Amendment	Orig.	D/O	Approved S E E	Date
A	CORRECTED	CYS	VS	CERS	11·9·54
B	REVISED		SC		15·3·72

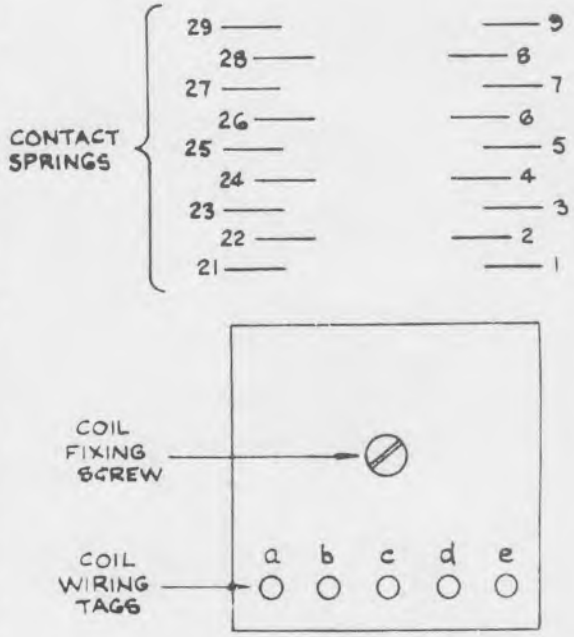


CODE LABELS

SHOWING

ADJUSTMENT INFORMATION





DIAGRAMATIC SKETCH OF REAR OF 3,000 TYPE RELAY SHOWING NUMBERING OF SPRINGS AND LETTERING OF COIL TAGS