

RELAYS
111 (PART OF 163), 121, 122, 125, 149, 162, 178, AND 179 TYPES
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

- 1.01 This section covers 111 (part of 163), 121, 122, 125, 149, 162, 178 and 179 type relays.
- 1.02 This section has been reissued to provide correct references to other Plant Series sections. In this process marginal arrows have been omitted.
- 1.03 Reference shall be made to Section 020-010-711 covering General Requirements and Definitions for additional information necessary for the proper application of the requirements listed herein.
- *1.04 Asterisk requirements are marked with an asterisk (*) when to check for them would necessitate the dismantling or dismounting of apparatus, or would affect the adjustment involved or other adjustments. No check need be made for these requirements unless the apparatus or part is made accessible for other reasons or its performance indicates that such a check is advisable.

1.05 Operate A relay is said to operate if, when current is connected to its winding, the armature moves sufficiently to cause all back contacts to break and all front contacts to make and, unless otherwise specified on the circuit requirement table, causes at least one of the stop pins or the armature itself when no stop pin is provided to touch the pole-piece or the separator.

1.06 Non-Operate A relay is said to non-operate if, when current is connected to its winding, the armature does not move sufficiently to close any front contact or to reduce the back contact pressure enough to cause an unreliable contact.

1.07 Hold A relay is said to hold, if after the relay has operated and the current is either reduced abruptly or is interrupted momentarily, the armature does not move sufficiently to cause contacts that have been made to become unreliable or to make contacts that have been broken.

1.08 Release A relay is said to release if the armature moves from the pole-piece sufficiently to break contacts that have been closed and to make contacts that have been broken.

1.09 Armature Travel The armature travel is the gap between the pole-piece or the separator and the nearer stop pin (or nearest point on the armature itself when stop pins are not provided) when the armature is resting against the adjusting screw.

2. REQUIREMENTS

2.01 Cleaning The contacts and other parts shall be cleaned when necessary in accordance with the section covering cleaning of relay contacts and parts.

2.02 Relay Mounting - Fig. 1 (A) - The core and rear pole-piece shall be securely fastened to the brass base plate and the base plate shall be securely fastened to the mounting plate. Gauge by feel.

2.03 Tightness of Cover Nut - Fig. 1 (B) - It shall be possible to turn the cover nut with the thumb and forefinger. Gauge by feel.

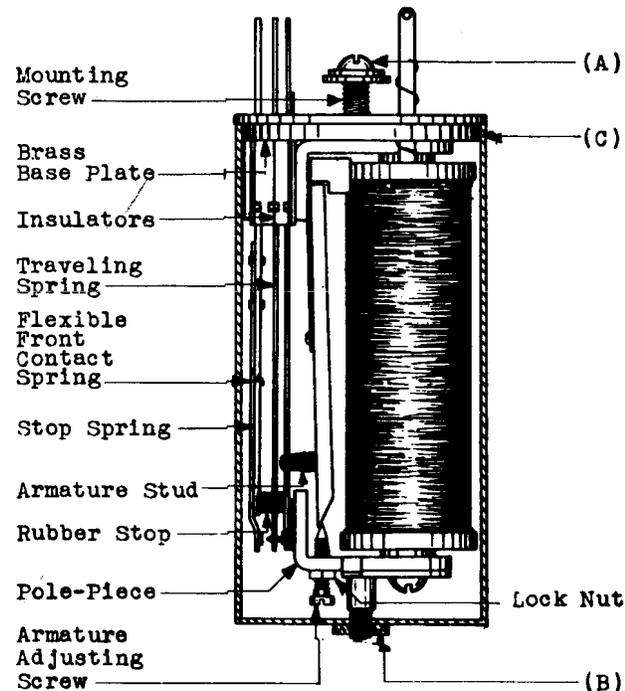


Fig. 1 - Cover Fit

SECTION 040-219-701

2.04 Cover Fit - Fig. 1 (C) - The cover shall go on without forcing. Gauge by feel.

2.05 Application of KS-7246 Separator:

Fig. 2 (A) - When difficulty is experienced in meeting specified release requirements due to sticking conditions between the armature and pole piece, the KS-7246 separator may be applied in accordance with Section 040-014-811 covering the list of relays on which separators may be applied. The KS-7246 separator shall be mounted so that a single layer of paper is on the side of the pole piece near the armature and so that the rear of the strip does not extend beyond the rear edge of the pole piece. The separator shall rest snugly against the face of the pole piece and shall not be dirty, torn, or damaged in any way. Gauge by eye.

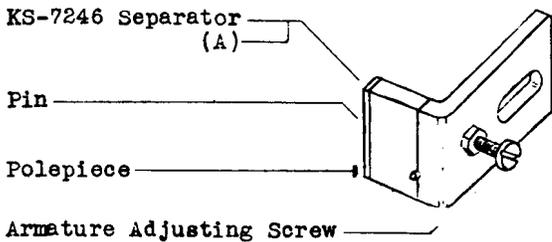


Fig. 2 - Location of KS-7246 Separator

***2.06 Tightness of Spring Assembly - Fig. 4**

(A) - The assembly screws shall be sufficiently tight to hold all springs in their relative position to one another and to the relay core. Gauge by feel.

2.07 Contact Alignment - Fig. 3 (A) -

The point of contact shall fall wholly within the boundary of the opposing contact, except for opposing contacts having the same diameter in which case their centers shall not be out of alignment more than 25% of the diameter of the contact points. Gauge by eye.

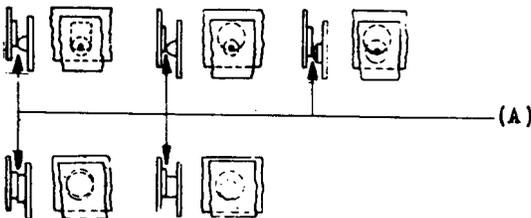


Fig. 3 - Contact Alignment

2.08 Armature Stud Clearance - Fig. 4 (B) -

Armature studs shall not rub on the springs through which they pass when the armature is moved. Gauge by eye and feel.

2.09 Traveling Spring Position - Fig. 4 (C) -

The traveling springs shall not rub on the rubber stops. Gauge by eye and feel.

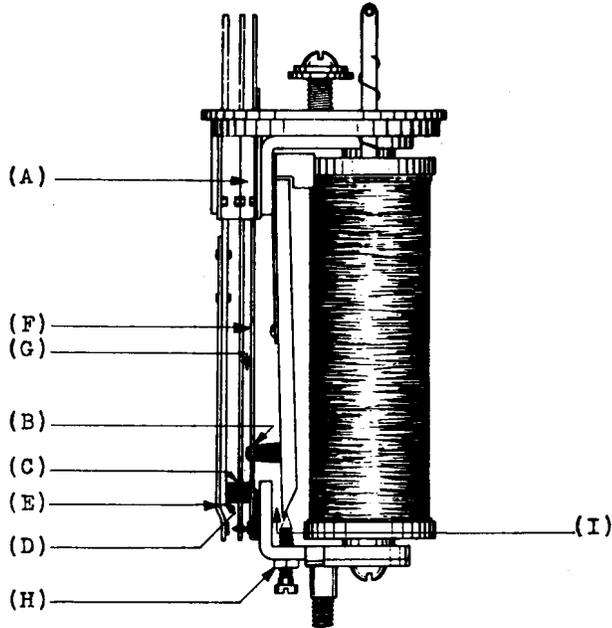


Fig. 4 - 162-Type Relay - Top View

2.10 Stop Spring Position - Fig. 4 (D) -

The stop springs shall rest on the rubber stops provided for their support. Gauge by eye.

2.11 Flexible Front Contact Spring Position

Fig. 4 (E) - The flexible front contact spring shall rest against the stop spring, at least at the end of the stop spring that is nearest the contact, when the relay is unoperated. Gauge by feel.

2.12 Straightness of Springs - Fig. 4 (F) -

All springs shall be free of sharp bends or kinks due to adjustment. A gradual bow in a spring is permissible. Gauge by eye.

Note: A slight kink due to adjustment is permissible in flexible springs near the point where they are riveted to the stop springs.

2.13 Separation Between Springs - Fig. 4 (G) -

There shall be a clearance between adjacent springs whether in the operated or unoperated position of the relay of:

Min. .008"
Gauge by eye.

2.14 Tightness of Lock Nut - Fig. 4 (H) -

The lock nut shall be sufficiently tight to hold the armature adjusting screw in the adjusted position. Gauge by feel.

2.15 Armature Alignment

When the relay is electrically operated on its specified operate "test" or "readjust" current, if one of the stop pins, or one side of the armature,

in case no stop pins are provided, does not touch the pole-piece, the clearance between that stop pin or that side of the armature and the pole-piece shall be

Max. .005"

Gauge by eye.

2.16 Armature Travel: - Fig. 4 (I) - The armature travel shall be as specified on the circuit requirement table or in Table 2. Where no armature travel is specified, the values in Table 1 shall be used as a guide in readjusting the armature travel. However, deviations from these values are permissible if difficulty is experienced in meeting the electrical requirements.

TABLE 1			
Figures	Armature Travel		
	Test	Readjust	
		Min	Max
A,B,C,D,S, and X	No Req	0.025 in.	0.030 in.
E,F,G,H, and K	No Req	0.020 in.	0.025 in.
L and M	No Req	0.015 in.	0.020 in.

TABLE 2		
For the following relays, the armature travel (Test and Readjust) shall be		
Relay	Armature Travel	
	Min	Max
149ED	0.015 in.	0.030 in.
162A	0.020 in.	0.050 in.
162Y	0.020 in.	0.040 in.
162AP	0.020 in.	0.040 in.
178AC	0.025 in.	0.045 in.
178AK	0.020 in.	0.030 in.
178AL	0.015 in.	0.030 in.
178AS	0.020 in.	0.035 in.
178BC	0.020 in.	0.045 in.
178CA	0.020 in.	0.030 in.
178CN	0.020 in.	0.040 in.
178DA	0.020 in.	0.030 in.
178DC	0.020 in.	0.035 in.
178DG	0.020 in.	0.035 in.
178DN	0.020 in.	0.045 in.
178EB	0.020 in.	0.045 in.
178EH	-	0.025 in.
178EL	0.020 in.	0.030 in.

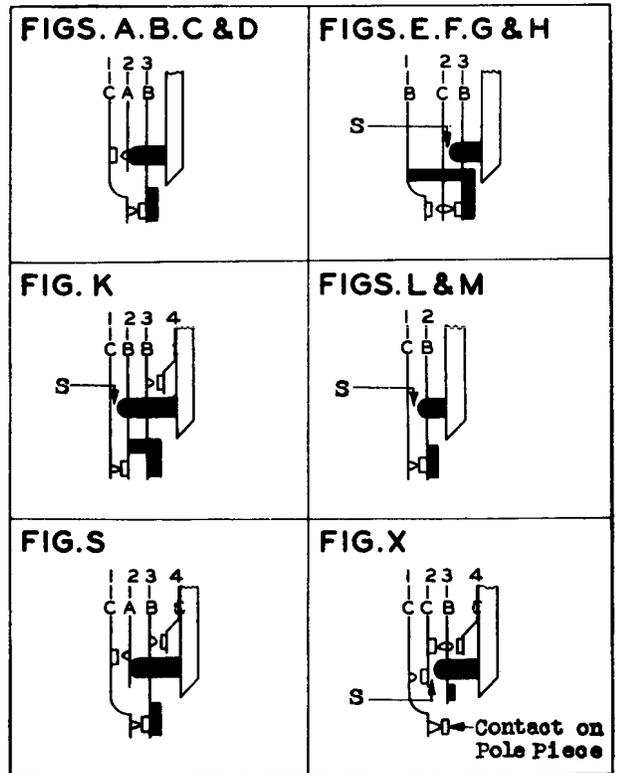
Use the 92-type gauges.

2.17 Contact Pressure

(a) Where no definite limits for contact pressure are specified herein or on the circuit requirement table, spring tensions shall conform to the requirements as given in the particular figure on page 3 of the section, which is referred to in the Fig. No. Column of the circuit requirement table, or be in accordance with the table of special requirements for particular codes as covered in (b).

(b) Exception: In the case of 111A, B, C, E, F and G relays, spring 2 of each spring combination shall have sufficient tension to rest firmly against the rubber stop and the tension of spring 1 (Test and Readjust) shall be Min. 30 grams Use the No. 70D gauge.

(c) The springs shall be tensioned toward the armature. Springs tensioned against rubber stops shall register the required tension when the spring is lifted slightly off the rubber stop. Springs whose contacts are tensioned against the contacts of opposing springs shall register the required tension when contact between the springs is broken.



SECTION 040-219-701

A - This spring shall be tensioned against the armature stud and the tension of the spring together with the sum of the tensions of all other springs that rest against the armature stud or studs shall hold the armature against the adjusting screw. Gauge by feel.

B - This spring shall have sufficient tension to rest firmly against the rubber stop. This requirement applies to spring 1 of Figs. E, F, G and H when the relay is unoperated. Gauge by feel.

C - This spring shall have sufficient tension to insure a reliable contact. (Re-adjust only) Spring 1 of Figs. A, B, C, D, S and X shall have as much tension as possible against the back contact consistent with meeting the electrical requirements.

S - Stud Gap - See Req. 2.18.

Figs. A, B, C and D differ in the thickness of the contact springs. The same is true of Figs. E, F, G and H and Figs. L and M.

2.18 Stud Gap - Fig. 5 (A)

(a) Figs. E, F, G, H and X (except No. 149W relay) There shall be a slight clearance between spring 2 and the end of the armature stud when the armature is resting against the armature adjusting screw. Gauge by eye.

Note: There need be no stud gap between spring 2 and the armature stud for the No. 149W relay.

(b) Figs. K, L and M There shall be a slight clearance between spring 1 and the end of the armature stud when the armature is resting against the armature adjusting screw. Gauge by eye.

(c) Where springs have a tension of 25 grams or more the requirement is met if the contacts do not break when a .003" gauge (Test) or a .005" gauge (Readj.) is inserted between the spring and the armature stud. Use the No. 74D gauge.

2.19 Contact Separation - Fig. 6 (A)

(a) The separation between any pair of contacts normally open or between any pair of contacts that are opened when the relay is operated, shall be:

Min. .005"

Use the No. 74D gauge.

(b) For the No. 149W Relay - (Fig. X)

The contact separation between springs 2 and 3 when the relay is operated shall be:

Min. .006"

The separation between all other contacts shall be:

Min. .006"

Max. .010"

Use the No. 74D gauge.

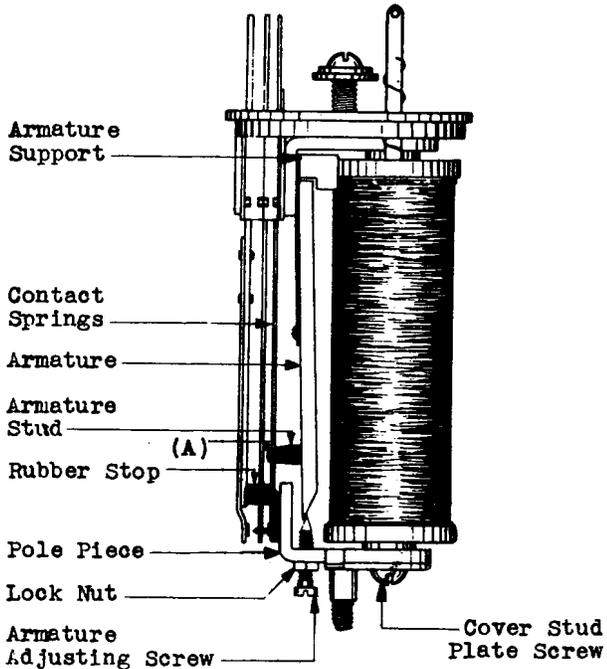


Fig. 5 - 162 Type Relay

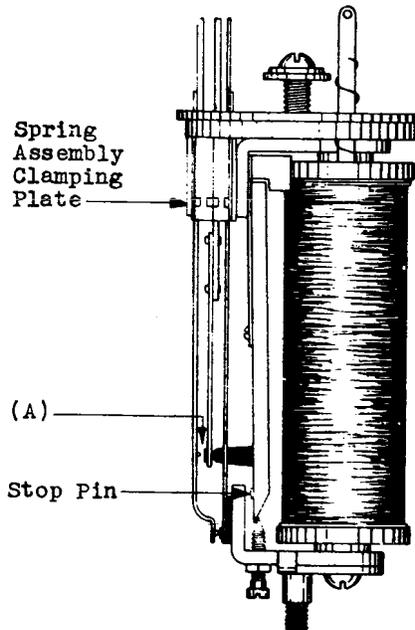


Fig. 6 - Contact Separation

- 2.20 Contact Follow shall be perceptible (approximately .005"). Gauge by eye.
- 2.21 Spring Sequence The relay shall meet any requirement for spring sequence specified on the circuit requirement table.
- 2.22 Electrical Requirements
 - (a) The relay shall meet the electrical requirements specified on the circuit requirement table.
 - (b) Unless otherwise specified the cover shall be off when applying the electrical requirements.
 - (c) When applying the electrical requirements the covers of adjacent relays equipped with cross talk proof covers shall be on.

2.23 Timing Requirements

- (a) The relay shall meet the timing requirements specified on the circuit requirement table or in Section 040-013-711 covering timing requirements. When the circuit requirement table refers to timing adjustments 1 to 7 per "X" specification, R.A.P., or BSP, the following timing adjustments are referred to. To check timing requirements, use the 35-type test set in conjunction with the test equipment provided at the office for this purpose. Where no testing equipment is available, the timing requirements shall be considered as having been met if the relay functions satisfactorily in the circuit in which it is used.
- (b) Unless otherwise specified the cover shall be off when applying the timing requirements.
- (c) When applying the timing requirements the cover of adjacent relays equipped with crosstalk proof covers shall be on.

Timing Adjustments No. 1 and No. 5

Operate and Hold when a current flow of .018 ampere is interrupted on .333 second make and .333 second break intervals.

Operate and Release when a current flow of .018 ampere is interrupted on .500 second make and .500 second break intervals after being operated on .018 ampere for 3 seconds.

Timing Adjustment No. 2

Operate on a current flow of .030 ampere.

Hold for min. 5 seconds when the current flow of .030 ampere is reduced to .002 ampere.

Release within 3 seconds on open circuit after operating on .030 ampere.

Timing Adjustment No. 3

Release within 3 seconds on .0005 ampere after a soak of .095 ampere.

Operate on a current flow of .029 ampere.

Hold for min. 5 seconds when the current flow of .029 ampere is reduced to .003 ampere.

Timing Adjustment No. 4

Operate and Hold when a current flow of .027 ampere is interrupted on .333 second make and .333 second break intervals.

Operate and Release when a current flow of .027 ampere is interrupted on .500 second make and .500 second break intervals after being operated on .027 ampere for 3 seconds.

Timing Adjustment No. 6

Operate and Hold when a current flow of .025 ampere is interrupted on .333 second make and .333 second break intervals.

Operate and Release when a current flow of .025 ampere is interrupted on .500 second make and .500 second break intervals after being operated on .025 ampere for 3 seconds.

Timing Adjustment No. 7

Operate and Hold when a current flow of .036 ampere is interrupted on .333 second make and .333 second break intervals.

Operate and Release when a current flow of .036 ampere is interrupted on .500 second make and .500 second break intervals after being operated on .036 ampere for 3 seconds.

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, Materials and Test Apparatus

<u>Code No.</u>	<u>Description</u>
<u>Tools</u>	
50B	Spring Adjuster
72	Combination 5/32" and 3/16" Hex. Double-end Socket Wrench and Screw-driver
130	Spring Adjuster
259	Spring Adjuster
422A	90° Offset Screw-driver
423A	45° Offset Screw-driver

SECTION 040-219-701

<u>Code No.</u>	<u>Description</u>
-	KS-2663 5-3/8" Jewelers File
-	KS-6015 Duck-bill Pliers
-	KS-6320 Orange Stick
-	KS-6854 3-1/2" Screw-driver
-	3-1/2" Cabinet Screw-driver
-	4" Regular Screw-driver
-	6-1/2" P-Long Nose Pliers
-	Bell System Eraser

Gauges

70D	50-0-50 Gram Gauge
74D	Thickness Gauge Nest
92E	.015" Non-Magnetic Offset Thickness Gauge
92F	.022" Non-Magnetic Offset Thickness Gauge
92G	.020" Non-Magnetic Offset Thickness Gauge
92H	.025" Non-Magnetic Offset Thickness Gauge
92J	.030" Non-Magnetic Offset Thickness Gauge
92K	.035" Non-Magnetic Offset Thickness Gauge
92L	.040" Non-Magnetic Offset Thickness Gauge
92M	.045" Non-Magnetic Offset Thickness Gauge
92N	.050" Non-Magnetic Offset Thickness Gauge

Material

-	KS-7246 Separator
---	-------------------

Test Apparatus

35 Type	Test Set
---------	----------

3.01 Cleaning (Rq.2.01)

(1) Clean the contacts and other parts in accordance with the section covering cleaning of relay contacts and parts.

3.02 Relay Mounting (Rq.2.02)

(1) To tighten relays loose on the mounting plate, securely tighten the mounting screws using the 3-1/2" cabinet screw-driver.

(2) If the mounting screws are tight but the relay coil is loose, tighten the screw which holds the coil to the brass base plate with the 4" regular screw-driver. Since the mounting plate and insulator in recent installations are provided with a hole through which the screw-driver can be applied it is not necessary to remove the relay from the mounting plate. When the mounting plate and insulator are not provided with a hole through which to apply the screw-driver it will be necessary to remove the relay from the mounting plate to make this adjustment.

(3) If the mounting screws are tight but the armature is loose, remove the relay from the mounting plate. If the armature is loose at the front end of the hinge plate, tighten the screws which hold the hinge plate to the armature with the KS-6854 screw-driver, if the screws are accessible. If the screws at the front hinge plate are not accessible or if the armature is loose due to the hinge plate not being held securely between the rear pole-piece and armature support remove the spring assembly mounting screws with the KS-6854 screw-driver and remove the spring assembly taking care not to lose any of the springs or insulators. Tighten the screws at the front hinge plate or the screws which clamp the hinge plate between the rear pole-pieces and the armature support with the KS-6854 screw-driver. Reassemble the spring assembly on the relay making sure that requirements 2.06 and 2.07 are met. Remount the relay on the mounting plate.

3.03 Tightness of Cover Nut (Rq.2.03)

(1) To tighten removable cover nuts as shown in Fig. 7A place the beveled side of the nut so that it will be next to the cover and tighten the nut securely with the thumb and forefinger but not so tight that it cannot be removed in the same manner. Never use a wrench or pliers to tighten the nut as such tightening is liable to affect the adjustment of the relay. Do not turn the cover to tighten the cover nut.

(2) Tighten captive cover nuts as shown in Fig. 7B with the thumb and forefinger.

3.04 Cover Fit (Rq.2.04)

(1) If the cover does not go on easily loosen the cover stud plate screw

with the 4" regular screw-driver and shift the plate until the cover fits properly. In making this adjustment, take care not to change the position of the pole-piece which is held to the core by this screw. Securely tighten the screw after the adjustment is made.

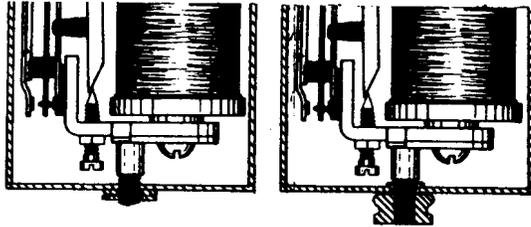


Fig. 7-A

Fig. 7-B

Fig. 7 - Removable and Captive Cover Nuts

3.05 Application of Separator per KS-7246
(Rq.2.05)

- (1) Remove the insulator from between the pole-piece and the inner contacts on the relay. Remove the cover stud plate screw with the 4" regular screw-driver and remove the cover stud plate and the pole-piece.
- (2) Withdraw a strip of the KS-7246 separator from the container and tear off a length which can be conveniently handled (approximately 3 inches or 4 inches).
- (3) Moisten the surface of the pole-piece on which the insulator rests with the finger, or the KS-6320 orange stick dipped in water. Place the gummed side of the separator against the moistened surface of the pole-piece so that the end of the separator is flush with one edge of the pole-piece and the rear edge of the separator is parallel to and approximately flush with the rear edge of the pole-piece. Press the separator firmly and smoothly against the moistened surface of the pole-piece using the finger or an eraser. Then while holding the separator firmly against the moistened surface of the pole-piece wrap the separator around the surface of the pole-piece which is nearest the armature. The separator must not extend beyond the rear edge of the pole-piece. Moisten the free end of the separator strip for a short distance adjacent to the pole-piece and wrap it evenly around the edge and over the pole-piece taking care that the separator is smooth and tight against the surface of the pole-piece adjacent to the armature. Press

the moistened portion of the separator against the part already stuck to the pole-piece. This end must overlap the end previously stuck for the full width of the pole-piece. If the pin in the pole-piece interferes with the separator press the separator into contact with the pole piece around the pin, taking care not to tear the separator more than is necessary to insure that the insulator will rest flat on the pole piece. Cut off any excess paper and remount the pole piece on the relay, taking care that the end of the armature is properly located between the pole piece and the adjusting screw. Replace the insulator taking care to see that springs are in their proper grooves.

- (4) The application of the separator reduces the armature travel approximately .002" and brings the inner spring outward .004". Check, and if necessary, readjust for contact separation, armature travel and electrical requirements.

- 3.06 Tightness of Assembly (Rq.2.06)
- 3.07 Contact Alignment (Rq.2.07)
- 3.08 Armature Stud Clearance (Rq.2.08)
- 3.09 Traveling Spring Position (Rq.2.09)

- (1) In case of only a loose assembly, tighten the screw or screws which hold the spring assembly in place, using the Nos. 422A and 423A offset screw-drivers. At the same time exercise care not to shift the springs so as to introduce any other fault.

- (2) In the case of misaligned contacts, armature studs rubbing on the springs or the traveling spring rubbing on the rubber stop, shift the springs as required with the fingers. If it is not possible to shift the springs with the fingers loosen the spring assembly mounting screw or screws, using the Nos. 422A and 423A offset screw-drivers, and shift the springs as required. Tighten the assembly mounting screws securely after the adjustment has been made.

3.10 Stop Spring Position (Rq.2.10)

- (1) If the stop spring does not rest on the stud, tension the spring until it does using the No. 50B spring adjuster as shown in Fig. 8. Apply the adjuster to the spring about 1/4" from where the spring leaves the spring assembly insulators.

3.11 Flexible Front Contact Spring Position (Rq.2.11)

- (1) If the flexible front contact spring does not rest on the stop spring at its contact end adjust as follows: Insert the offset portion of a piece of No. 22 bare tinned copper wire, bent at right angles, between the flexible spring

and the stop spring and slide it back as far as possible toward the point where they are riveted together. Place the No. 50B spring adjuster over the stop spring and the flexible spring and then slide it back close to the wire as shown in Fig. 9. Remove the wire and spring adjuster.

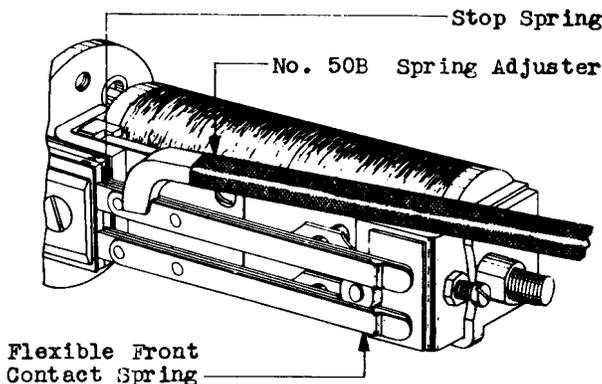


Fig. 8 - Method of Adjusting for Stop Spring Position and Contact Pressure

3.12 Straightness of Springs (Rq.2.12)

(1) To straighten springs, use the Nos. 50B, 130 and 259 spring adjusters applying them to the springs near the points at fault. Give the adjuster a slight twist towards or away from the armature as required. The No.130 spring adjuster is for use on the middle bank of springs on 125 and 179 type relays and on 111 (part of 163) type relays. It will be satisfactory to have a slight kink in the flexible front contact springs, at the point near where they are riveted to the stop springs. This kink may be introduced in making the adjustment outlined in procedure 3.11.

3.13 Separation Between Springs (Rq.2.13)

(1) If the clearance between the springs is insufficient, adjust the springs with the Nos. 50B, 130 and 259 spring adjusters. If the lack of clearance is due to the springs being bent or kinked, correct this in accordance with procedure 3.12.

3.14 Tightness of Lock Nut (Rq.2.14)

(1) To tighten loose nuts use the wrench portion of the No. 72 combination wrench and screw-driver, holding the armature adjusting screw in position with the screw-driver portion.

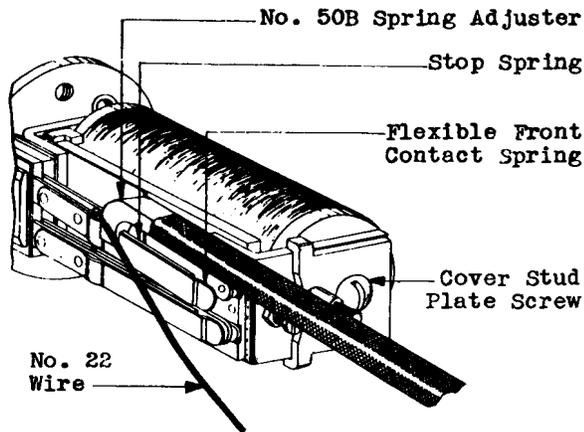


Fig. 9 - Method of Positioning Flexible Front Contact Spring

3.15 Armature Alignment (Rq 2.15)

(1) If the armature does not line up with the pole-piece, loosen the cover stud plate screw with the 4" regular screw-driver and shift the pole-piece as required to line it up with the armature. Take care not to shift the cover stud plate so that the cover fit requirement cannot be met. If it is not possible to line the pole-piece up with the armature, line the armature up with the pole-piece as outlined in procedure 3.02 (3).

3.16 Armature Travel (Rq.2.16)

(1) To adjust for armature travel loosen the lock nut and turn the armature adjusting screw as required using the No. 72 combination wrench and screw-driver. Turning the screw in a clockwise direction decreases the travel and turning the screw in a counter-clockwise direction increases the travel. One complete turn of the head of the adjusting screw gives a movement of the armature at the stop pins of approximately .008". Tighten the lock nut securely.

3.17 Contact Pressure (Rq.2.17)

3.18 Stud Gap (Rq.2.18)

3.19 Contact Separation (Rq.2.19)

3.20 Contact Follow (Rq.2.20)

3.21 Spring Sequence (Rq.2.21)

3.22 Electrical Requirements (Rq.2.22)

(1) Contact Pressure In general no definite contact pressure requirements are specified for the relays covered by this section. However, when they are given on circuit requirement tables, tension the springs accordingly as shown in Figs. 10 and 11 using the Nos. 50B, 130 and 259 spring adjusters. Tension the springs for contact pressure by ap-

plying the adjuster at the point where the spring leaves the spring assembly insulators. In the case of springs attached to stop springs, such as the No. 2 spring in Fig. A change the tension by adjusting the stop spring. When no definite contact pressure requirements are specified, tension the springs in accordance with the other information given, to meet the readjust electrical requirements. In the case of relays having two or more similar spring combinations exercise care to adjust corresponding springs of each combination so that their tensions are approximately equal.

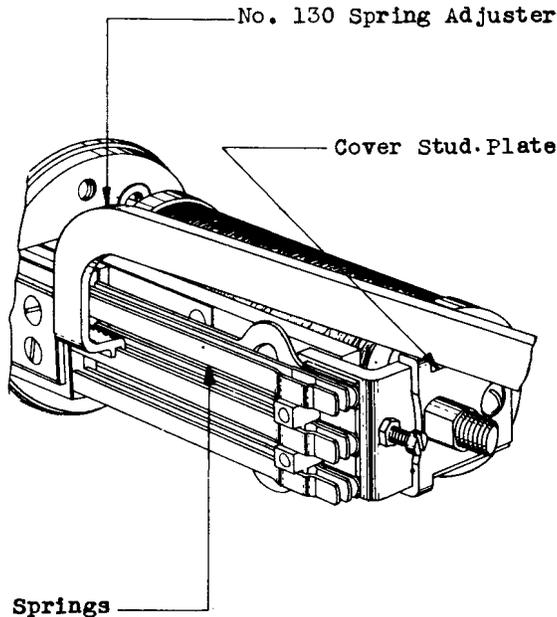


Fig. 10 - Method of Adjusting Contact Springs of 125 Type Relay

(2) If the desired tension can not be obtained by adjusting as outlined in (1) without bowing the spring beyond its permissible limit or reducing the clearance between the springs below the specified minimum, apply the proper spring adjuster to the spring just back of the operating stud and slide it back to the base of the spring, as indicated in Fig. 10. Then draw the adjuster forward the length of the spring meanwhile applying pressure as required so that the spring is formed into a slight gradual bow with the concave surface facing the armature. Then move the adjuster to the base of the spring and adjust as covered in (1). The magnitude of the bow to be formed in the spring must be learned by experience and should be such that when the final tension adjustment is made at the base the spring will be approximately straight.

(3) Stud Gap In adjusting spring 1 in Figs. K, L and M and spring 2 in Figs. E, F, H, and X (except the No. 149W relay) take care to provide a stud gap. This gap is necessary to insure contact pressure between the normally closed contacts. Adjust the springs as covered in (1) to provide this gap. It may be necessary in some cases when adjusting for stud gap to reduce the height of the armature stud to avoid excessive bowing of the contact springs. To do this insert the KS-2663 file between the top of the stud and the contact spring and file the stud as required.

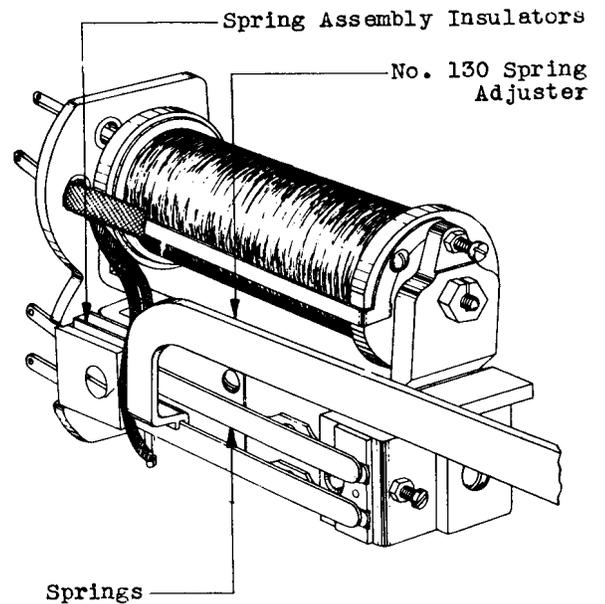


Fig. 11 - Method of Adjusting Contact Springs of 111 Type Relay

(4) Contact Separation If the separation is insufficient, reduce the tension of the spring towards the minimum specified or the minimum necessary for proper circuit operation using the Nos. 50B, 130 and 259 spring adjusters. If the tension is already at the minimum allowable, bend the tip of flexible springs slightly with duck-bill pliers, exercising care not to mar the contact or bend the spring so that it presents a poor appearance. It is permissible to slightly bow other springs near the contact. In order to meet the contact separation and other requirements on springs 1 and 2 of Figs. A, B, C, D, and S it may in some cases be necessary to reduce the height of the armature stud as covered in (3).

(5) Contact Follow If the contact follow is insufficient reduce the contact separation towards the minimum by increasing the tension of the spring or ad-

justing the tip or front portion of the spring. On Figs. A, B, C, D, S and X adjust for follow on spring 1 by adjusting it near the bent portion.

(6) Spring Sequence To adjust for spring sequence increase or decrease the contact separation and follow as required following the procedures outlined under (4) and (5).

(7) Electrical Requirements In the case of high non-operate or release electrical requirements it may be necessary to slightly increase the armature travel by loosening the lock nut and turning the armature adjusting screw in a counter-clockwise direction using the No. 72 combination wrench and screw-driver.

(8) To facilitate adjusting relays with spring combinations per Figs. A, B, C, D or S, when a release requirement is specified, proceed as follows:

(a) Adjust the contact separation near the min. of .005".

(b) Tension No. 2 spring against the armature, but only to the extent of holding the relay unoperated when the release current is applied.

(c) Tension No. 1 spring until the release requirement is met.

(9) If the relay fails to meet its electrical requirements check to see that the lock nut is tight as a loose nut may be the cause of trouble.

(10) If difficulty is experienced in adjusting No. 178AD, 178CL, or 178CW relays to meet electrical requirements, check to see if the relay is equipped with a hydrogen-annealed magnetic-iron pole piece. (Hydrogen-annealed pole pieces are stamped with an "H" which is visible from the front of the relay.) If it is not so equipped, replace the pole piece with a hydrogen-annealed pole piece. This should relieve the difficulty.

3.23 Timing Requirements (Rq. 2.23)

(1) These adjustments may be made by means of a 35 type test set or equivalent applied as follows: With the test set properly prepared for operating the relay, the relay should hold or release when the current through the relay is interrupted by means of the telegraph key.

(2) If the relay fails to hold or release in the specified period of time check to see that the lock nut is tight as a loose lock nut may be the cause of trouble.

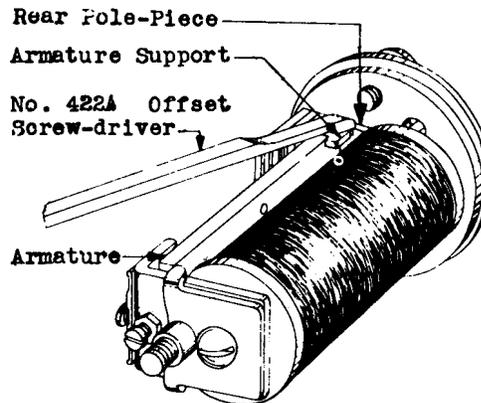


Fig. 12 - Method of Adjusting Armature Support for Timing Requirements

(3) If a loose screw did not cause the trouble change the contact pressure in accordance with procedure 3.17, (1). Decreasing the contact pressure will aid in meeting the hold and increasing the contact pressure will aid in meeting the release requirements. Check to see if the relay now meets the timing requirements.

(4) If the relay still fails to meet the requirements, change the contact follow in accordance with procedure 3.20, (4). Decreasing the contact follow will aid in meeting the hold and increasing the contact follow will aid in meeting the release requirements. Exercise care that the minimum contact follow is still met.

(5) If it is impossible to adjust the relay in accordance with (1) to (3), check to see if the armature is parallel to the pole-piece at the front end. This may be done by attempting to move the armature toward the front pole-piece at the top and bottom with the screw-driver portion of the No. 72 combination wrench and screw-driver with the relay electrically operated. If there is no rocking movement of the armature it can be considered as being parallel. If there is a movement, loosen the cover stud plate screw with the 4" regular screw-driver and shift the pole-piece if possible until the armature is approximately parallel with it. Retighten the cover stud plate screw and repeat the adjustments outlined under (1) to (3) above.

(6) In extreme cases, it may be necessary to reduce the side play of the armature slightly at the rear end by adjusting the armature support with the No. 422A offset screw-driver, applied between the support and the rear pole-piece as shown in Fig. 12. In some cases it may be necessary to remove the relay from the mounting plate to make this adjustment.