RELAYS
A AND AB TYPES
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers A- and AB-type relays.

1.02 The section is reissued primarily to revise the information for the KS-7743 separator, to add information for the KS-7246 separator and D-159461 backstop nut, and to revise a contact pressure requirement. Detailed reasons for reissue will be found at the end of the section.

1.03 Reference shall be made to Section 020-010-711 for additional information necessary for the proper application of the requirements listed herein.

1.04 Operate: A relay is said to operate if, when current is connected to its winding, the armature moves sufficiently to cause all normally closed contacts to break and all normally open contacts to make. On the A2, A3, A26, A43, A46, A48, A54, A61, AB2, and AB4 relays, the armature shall touch the core unless stop pins are provided, in which case at least one of the stop pins shall touch the core.

1.05 Nonoperate: A relay is said to nonoperate if, when current is connected to its winding, the armature does not move sufficiently to close normally open contacts or to reduce the contact pressure of normally closed contacts enough to cause an unreliable contact.

1.06 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.

1.07 Release: A relay is said to release if the armature moves from the core sufficiently to break contacts that have been closed and to make contacts that have been broken.

1.08 Armature Travel: The armature travel is the gap between the core and the nearest stop pin (or nearest point on the armature itself when stop pins are not provided), when the armature is resting against the adjusting nut.

2. REQUIREMENTS

2.01 Cleaning: The contacts and other parts shall be cleaned when necessary in accordance with Section 069-306-801.

2.02 Relay Mounting: Relays shall be fastened securely to the mounting plate.

Gauge by feel.

2.03 Tightness of Spring Assembly: Fig. 1(A) - All springs in an assembly shall be held in their relative positions to one another and to the relay core by being securely fastened to the relay core at their bases. If it is found necessary to measure tightness of assembly, such tightness shall be considered as satisfactory if the springs in an assembly do not move in their mounting when a pressure of 680 grams (24 ounces) is applied in a vertical direction at the contact end of all springs in the same assembly taken together.

Gauge by feel.

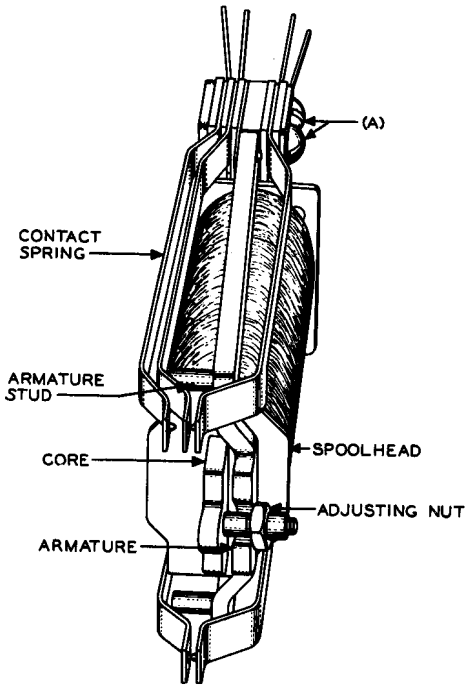


Fig. 1 - A-type Relay

2.04 Application of KS-7246 Separator: Fig. 2(A) - When difficulty is experienced in meeting the specified release requirements due to sticking conditions between the armature and the core, the KS-7246 separator may be applied in accordance with Section 040-014-811 covering the list of relays on which removable paper armature stops and separators

may be applied. The KS-7246 separator shall be mounted so that a single layer of paper is on the side of the core near the armature and so that the inner edge of the strip is approximately 1/16 inch away from the spoolhead. The separator shall rest snugly against the face of the core. The part of the separator between the armature and the core shall not be dirty, torn, or damaged in any way.

Gauge by eye.

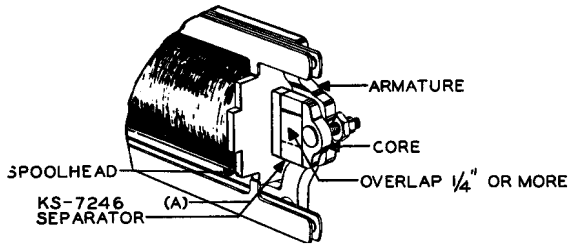


Fig. 2 - Position of KS-7246 Separator on Core

2.05 Application of Means for Relieving Sticking That May Develop Between Armature and Adjusting Nut: Where sticking is experienced between the armature and adjusting nut, either the KS-7743 separator or the D-159461 backstop nut may be used as follows to relieve the condition.

(a) Fig. 3(A) - The KS-7743 separator when applied shall lie flat against the surface of the armature and the adjusting nut. The front edge of the separator shall not, however, touch the adjusting stud. That part of the separator which is between the armature and the adjusting nut shall not be cemented to the armature.

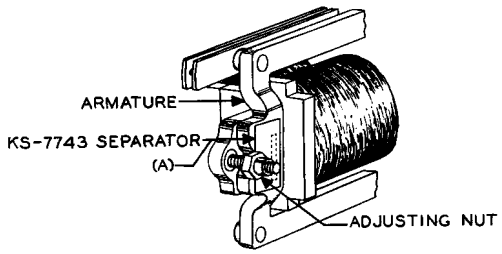


Fig. 3 - Position of KS-7743 Separator on Armature

(b) Fig. 4(A) - The D-159461 backstop nut, which has a loose captive washer on the face of the nut toward the armature, shall replace the existing adjusting nut.

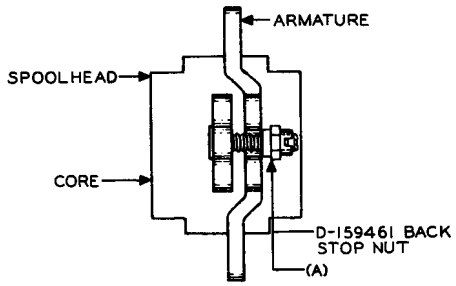


Fig. 4 - Position of D-159461 Backstop Nut

2.06 Contact and Spring Alignment

(a) Point and Disc Contacts: Fig. 5(A) - The point of contact shall fall wholly within the boundary of the opposing contact except for contacts having the same diameter, in which case their centers shall not be out of alignment more than 25 per cent of the diameter of the contact points.

Gauge by eye.

(b) Bar Contacts: Fig. 5(B) - The width of the contacting surface of each contact shall fall wholly within the length of the contacting surface of the opposing contact bar.

Gauge by eye.

(c) Springs shall not touch the relay cover.

Gauge by eye.

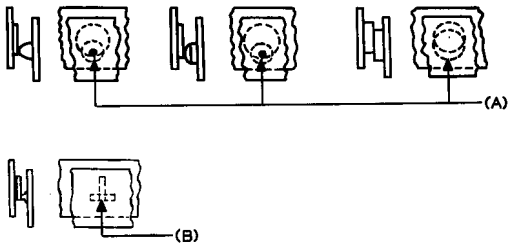


Fig. 5 - Contact Alignment

2.07 Armature Stud Clearance: Armature studs shall not rub on the springs through which they pass when the armature is moved.

Gauge by eye and feel.

2.08 Spring Tang Position

(a) Fig. 6(A) - Spring tangs shall rest on the spoolhead so that the ends of the tangs are below or above the projection of the top or bottom edges, respectively, of the spoolhead

Min 1/32 inch

Gauge by eye.

(b) Fig. 6(B) - The tang shall not rub on the spoolhead when moved slightly in the direction of travel of the spring from its normal position of rest on the spoolhead.

Gauge by eye.

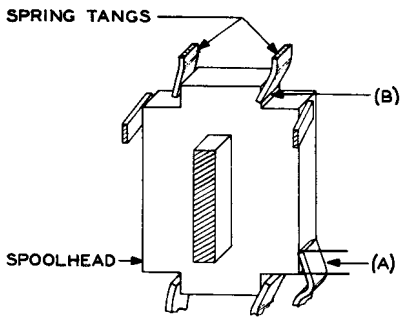


Fig. 6 - Spring Tang Position

2.09 Adjusting Stud Clearance: Fig. 7(A) - The armature shall not rub against the adjusting stud.

Gauge by eye and feel.

2.10 Adjusting Nut Tightness: Fig. 7(B) - The adjusting nut shall be sufficiently tight on the stud to prevent its being turned with the thumb and forefinger. This requirement is considered as having been met if the nut does not turn under a turning pressure of one inch-ounce. In case of doubt this may be checked by the use of the No. 349 or No. 474A wrench and No. 70D gauge. With the wrench on the nut the gauge shall be applied to the wrench at the top or bottom side of the hole in the free end and the nut shall not turn with a pressure of 22 grams if the No. 349 wrench is used or a pressure of 13 grams if the No. 474A wrench is used.

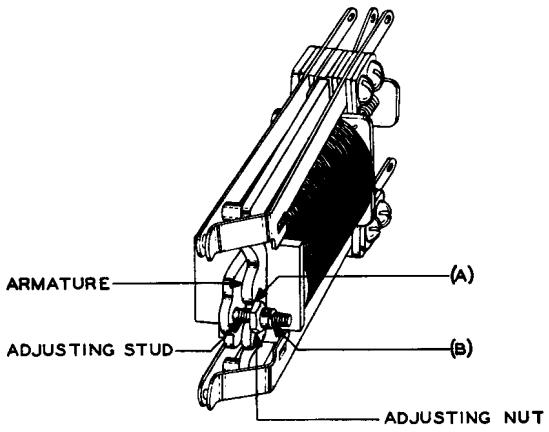


Fig. 7 - AB-type Relay

2.11 Armature Travel - Fig. 8(A)

(a) Unless otherwise specified on the circuit requirement table no definite limits are required for armature travel on these relays with the following exceptions:

(b) On the A1, A2, A25, A26, A43, A46, A47, A48, A54, A55, A58, A59, A60, A61, A62, AB1, AB2, AB3, AB4, AB5, and AB6 relays, the armature travel shall be 0.020 inch.

Use the No. 66D gauge.

(c) Unless otherwise specified the tolerance shall be:

Test	+0.005 inch,	−0.0025 inch
Readjust	+0.0025 inch,	−0.0025 inch.

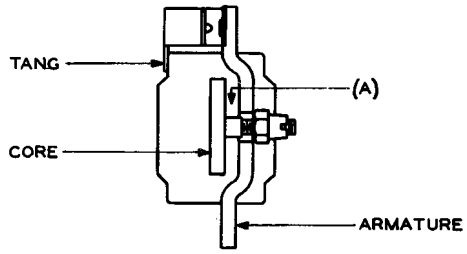


Fig. 8 - Armature Travel

2.12 Straightness of Springs: Fig. 9(A) - All springs, from the point where they leave the assembly clamping plates and insulators, to the ends of the springs, shall be free of sharp bends or kinks due to adjustment, but a gradual bow in the springs is permissible.

Gauge by eye.

2.13 Separation Between Springs: Fig. 9(B) - There shall be a clearance between adjacent springs whether in the operated or unoperated positions of the relay of:

Min 0.008 inch

Gauge by eye.

2.14 Contact Pressure

(a) The contact pressure shall be in accordance with the spring tension requirements as given in the particular figure in Table B which is referred to in the figure number column of the circuit requirement table, or in accordance with the table of special requirements for particular codes outlined on the following page.

(b) Exception to requirement (a) shall be made in the case of relays A2, A6, A7, A26, A43, A46, A48, A54, A61, AB2, and AB4 whose springs shall have the tensions given in Table A which shall be used instead of the tensions covered by the spring combination figures in Table B. The letters A, B, C, etc., listed in the contact pressure

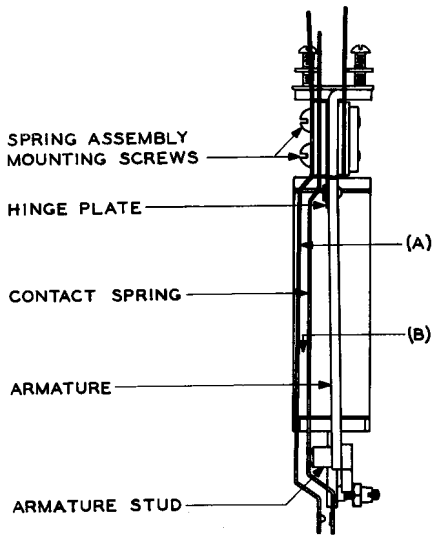


Fig. 9 - A-type Relay - Top View

columns of Table A refer to the notes A, B, C, etc., associated with the figures in Table B.

(c) The springs shall be tensioned toward the armature except spring 3 of Figs. K and L of Table B which shall be tensioned away from the armature. Unless the abbreviation Arm. Opr is shown associated with the arrow mark leading to a spring, the tension shall be measured when the armature is in the unoperated position. Springs tensioned against spoolheads shall register the required tension when the tang of the spring is lifted slightly off the spoolhead. Springs whose contacts are tensioned against the contact of opposing springs shall register the required tension when contact between the springs is broken. Use the No. 70D gauge to check definite tensions.

Table A

A2, A26, A43, A46, A48, A61, AB2, AB4							A6						
CONT PRESS.	SPRINGS						CONT PRESS.	SPRINGS					
	TOP		BOTTOM					TOP			BOTTOM		
	1	2		1	2			1	2	3	1	2	
TEST	15 C			15 C			TEST	20 A	C		20 A		
READJ	17 C			17 C			READJ	22 A	C		22 A		
A7							A54						
CONT PRESS.	SPRINGS						CONT PRESS.	SPRINGS					
	TOP			BOTTOM				TOP			BOTTOM		
	1	2	3	4	1	2	3	1	2	3	1	2	
TEST	15 B	15 D		15	15	C	TEST	15	15	C	15	C	
READJ	17 B	17 D		17	17	C	READJ	17	17	C	17	C	

2.15 Stud Gap: Fig. 10(A) - There shall be a slight clearance between the armature stud or bushing and the springs indicated in the figures listed below when the armature is resting against the adjusting nut.

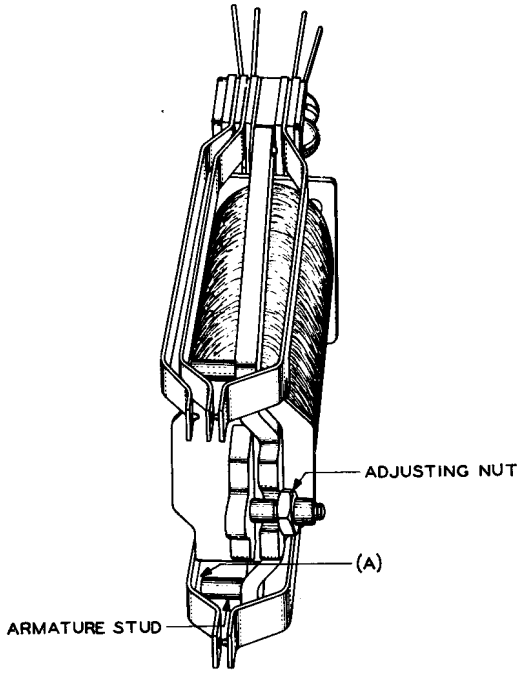
Gauge by eye.

When the springs actually have a contact pressure of 25 grams or more, regardless of the minimum tension specified, this clearance is regarded as having been met if the normally closed contacts of which they form a part do not break when a gauge of the thickness specified below is inserted between adjusting nut and armature.

Test - 0.003 inch
Readjust - 0.005 inch

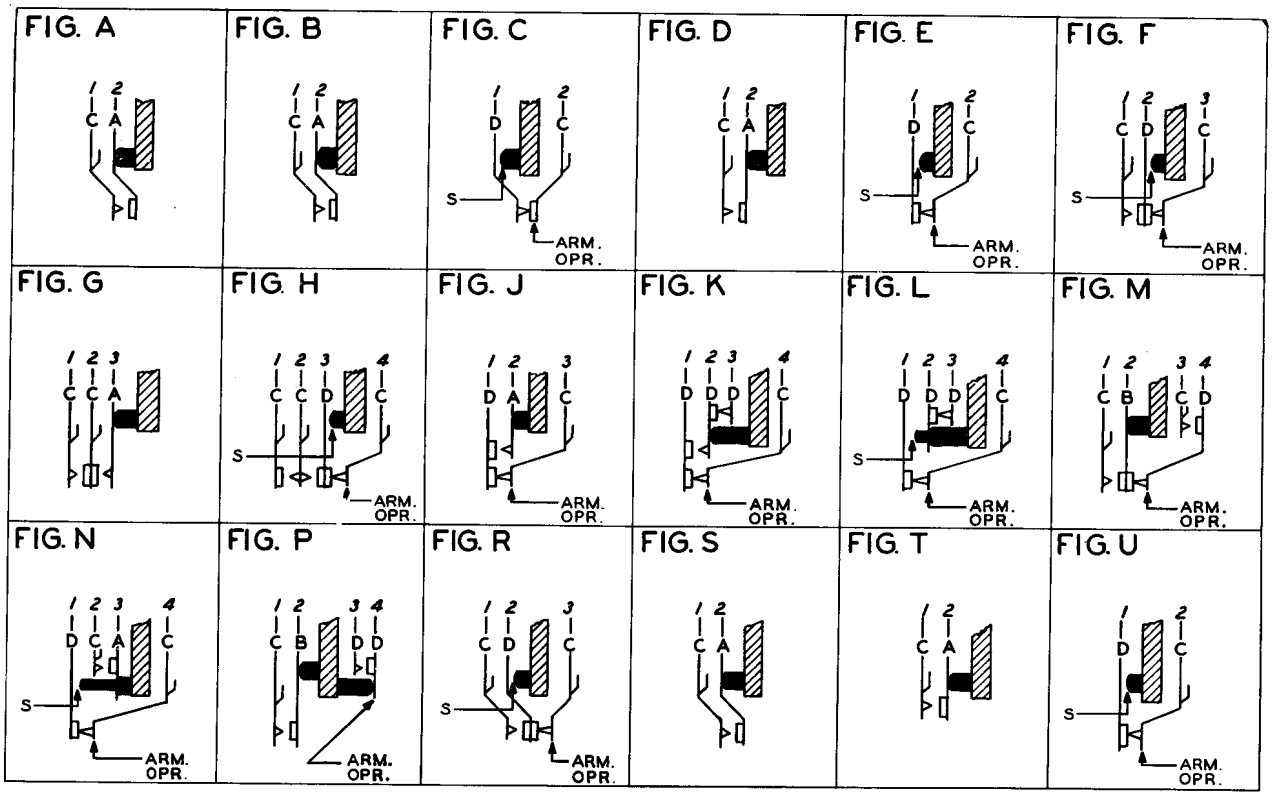
Use the No. 66D gauge.

Springs	Figs of Table B
1	C,E,L,N,U
2	F,K,L,R
3	H



ig. 10 - Stud Gap

Table B



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 nut.

Gauge by feel.

B = Spring 2 shall have sufficient tension to insure a contact separation between springs 3 and 4 of

Min 0.005 inch

Gauge by eye.

C = The tension of this spring agains the spoolhead shall be

Min 10 grams

D = This spring shall have sufficient tension to insure a reliable contact. Readjust springs 1 of Figs. J and K to have as much tension as possible against the back contact consistent with meeting the readjust electrical requirement.

S = Stud gap - See Rq 2.15.

Ψ = Indicates spoolhead springs.

Arm. Opr = Armature operated - See Rq 2.14(c).

2.16 Contact Separation: Fig. 11(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 0.005 inch

Use the No. 74D gauge.

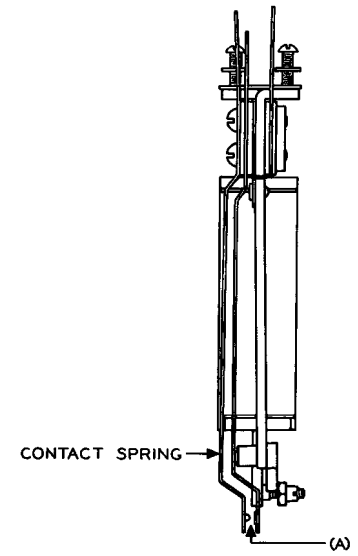


Fig. 11 - Contact Separation

2.17 Contact Follow: The contact follow on all normally open contacts shall be

Approximately 0.005 inch

Gauge by eye.

This requirement is met if the normally open contacts make when the relay is electrically energized on its specified test or readjust current with a

Test - 0.003 inch
Readjust - 0.004 inch

gauge inserted between the stop pins and the core, or between the armature and the core when no stop pins are provided.

Use the No. 66D gauge.

→ (a) On relays where the armature does not come all the way up to the core on the specified operate current, the contact follow shall be considered satisfactory if with the relay electrically energized on the specified operate test or readjust current there is a perceptible following movement of the spring as the opposing spring is moved away from it.

Gauge by eye.

2.18 Spring Sequence

(a) Figs. F, K, and R of Table B: Spring 2 shall break from 3 before it makes with 1.

Gauge by eye.

(b) Fig. H of Table B: Spring 3 shall break from 4 before it makes with 2.

Gauge by eye.

(c) Fig. M of Table B: Spring 2 shall break from 4 before it makes with 1.

Gauge by eye.

(d) A relay shall meet any other spring sequence specified on the circuit requirement table.

2.19 Electrical Requirements

(a) A relay shall meet the electrical requirements specified on the circuit requirement table.

(b) These requirements shall be met with the cover off the relay unless otherwise specified.

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, Materials, and Test Apparatus

Code or Spec No.	Description
Tools	
→136B	Relay Blocking Tool
206	30-degree Offset Screwdriver
207	90-degree Offset Screwdriver
→240	Scriber
259	Spring Adjuster
349	3/16-in. and 7/32-in. Hex. Closed Double-end Offset Wrench
	or
474A	3/16-in. and 1/4-in. Hex. Closed Double-end Offset Wrench
→KS-6320	Orange Stick
→ -	Eraser
-	6-1/2-in. P-Long-nose Pliers
→ -	3-in. Cabinet Screwdriver
→ -	4-in. Regular Screwdriver
Gauges	
66D (or the replaced 66C)	Thickness Gauge Nest
70D	50-0-50 Gram Gauge
74D	Thickness Gauge Nest
Materials	
D-159461	Backstop Nut
KS-7246	Separator
KS-7743	Separator
KS-7756	Cement
-	Hardwood Toothpicks, Flat at One End, Pointed at the Other
Test Apparatus	
35 Type	Test Set

3.002 In order to make some of the adjustments contained herein, it may be necessary to remove the relay from the frame. Use the 4-inch regular screwdriver to remove the relay mounting screws.

3.01 Cleaning (Rq 2.01)

(1) Clean the contacts and other parts in accordance with Section 069-306-801.

3.02 Relay Mounting (Rq 2.02)

(1) To tighten loose mounting screws, use the 4-inch regular screwdriver.

3.03 Tightness of Spring Assembly (Rq 2.03)

(1) To tighten loose spring assembly mounting screws, use the Nos. 206 and 207 offset screwdrivers. If the mounting centers of the relays do not permit the use of the offset screwdrivers, remove the relay from the mounting plate and tighten the spring assembly mounting screws with the 3-inch cabinet screwdriver. Take care not to destroy the adjustments made under procedures 3.06, 3.07, and 3.08.

3.04 Application of KS-7246 Separator (Rq 2.04)

(1) Before applying the separator, clean the armature and core as covered in 3.01. Check the armature travel, contact separation, and contact follow, and if necessary, readjust as covered in 3.11, 3.16, and 3.17, making any necessary corrections allowing approximately 0.002 inch for the thickness of the paper. This should minimize the adjustment outlined in (8).

(2) Withdraw a strip of KS-7246 separator from the container and tear off a length that can be conveniently handled (approximately 3 or 4 inches).

(3) Thread the separator between the armature and core with the gummed side toward the core until one end projects either at the top or bottom as convenient, for approximately 1-1/2 inch beyond the core. Moisten the projecting length of separator at the end for a distance of about 3/8 inch with the finger or with the KS-6320 orange stick dipped in water. Exercise care to thoroughly moisten the end of the strip but to avoid excessive moisture.

(4) Pull the dry end of the separator strip until only the 3/8-inch moistened end projects beyond the core. Position the strip so that it is about 1/16 inch away from the spoolhead of the relay, and then press the 3/8-inch moistened end of the strip firmly against the side of the core away from the armature with the finger or the eraser. Hold it in this position and pull on the free end of the strip in a manner that will cause it to lie smoothly and tightly against the side of the core adjacent to the armature (see Fig. 12). Best results are obtained if the end of the paper that is stuck to the pole piece is allowed to dry for at least 3 to 5 minutes before fastening to the other end.

(5) When pulling on the paper always exercise extreme care not to pull with sufficient tension to tear the paper. Replace separators if the portion between the armature and core is torn, dirty, or damaged in any way.

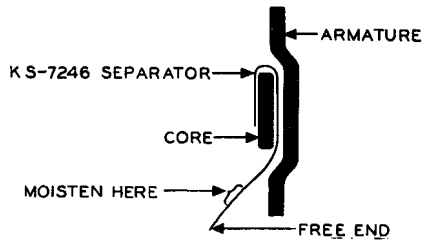


Fig. 12 - Method of Applying KS-7246 Separator

(6) Continue the pull on the separator, press the armature against the core, and hold it in this position either manually or with the No. 136B tool. Then release the pull on the separator.

(7) Moisten the free end of the separator strip for a short distance adjacent to the pole piece as indicated in Fig. 12 and wrap it evenly around the edge and over the pole piece in such a way as to overlap by at least 1/4 inch the 3/8 inch previously stuck. Cut off the excess paper. Remove the No. 136B relay blocking tool, if used.

(8) Check for contact separation and contact follow, and if necessary, readjust as covered in 3.16 and 3.17. Check the electrical requirements, and if necessary, readjust the relay.

3.05 Application of Means For Relieving Sticking That May Develop Between Armature and Adjusting Nut (Rq 2.05)

KS-7743 Separator

(1) Cut off a strip of the KS-7743 separator approximately 1-1/2 inches long. Dip the pointed end of a clean toothpick approximately 1/8 inch into the KS-7756 cement and wipe off the excess cement on the inside of the container. The cement remaining on the toothpick should not be sufficient to form a drop. Place the strip of separator on a flat surface and make a line of the cement with the toothpick approximately 3/8 inch long and 1/32 inch wide along one edge of the separator near the center as indicated in Fig. 13. Exercise care to use the cement sparingly as it spreads when the separator is applied to the armature. Excess cement will result in the spreading of the cement under the adjusting nut. Keep the container covered

at all times except when dipping the toothpick into the cement in order to prevent evaporation of the solvent. If the cement in the container becomes thick so that it will not flow freely, discard the old cement and obtain a fresh supply.

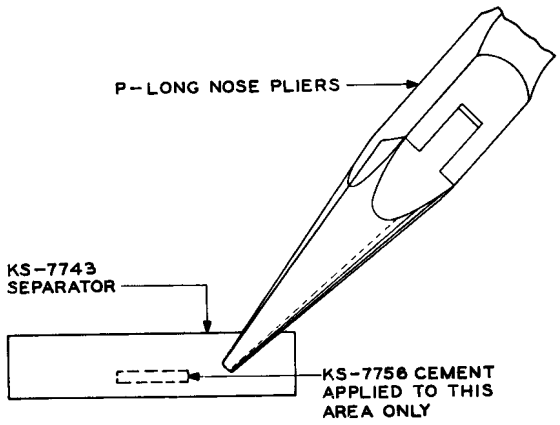


Fig. 13 - Application of Cement to KS-7743 Separator

(2) Using the P-long-nose pliers grasp one end of the separator as indicated in Fig. 13, operate the relay using the KS-6320 orange stick and while holding the relay operated place the separator in position on the back of the armature as indicated in Fig. 14 so that the surface of the separator to which the cement is applied rests against the armature near the spoolhead. Position the separator so that the front end extends well under the adjusting nut as indicated in Fig. 14 taking care that it is not so far forward that it touches the

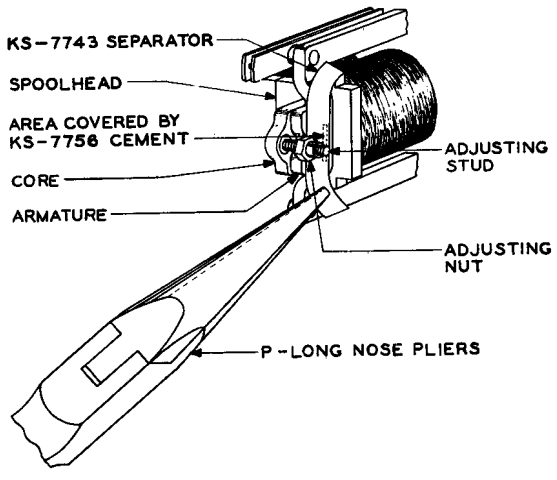


Fig. 14 - Application of KS-7743 Separator to Relay

threads on the adjusting stud, then release the relay and the pliers. Using the KS-6320 orange stick rub the cemented portion of the separator smoothly and tightly against the surface of the armature taking care that the cemented portion of the separator does not extend under the adjusting nut.

(3) Insert the No. 136B tool between the armature and the adjusting nut, exercising extreme care not to dislodge the separator or to shift its position. Then using the P-long-nose pliers tear off the excess paper from each end of the separator along the top and bottom edges of the No. 136B tool. Remove the No. 136B tool and check to be sure that the separator is in its proper position between the armature and the adjusting nut.

(4) Check for contact separation, contact follow, stud gap, and armature travel, and readjust as required. Check the electrical requirements and if necessary readjust the relay.

D-159461 Backstop Nut

(5) Remove the adjusting nut mounted on the relay using the P-long-nose pliers. If a KS-7743 paper separator has been applied previously between the armature and the adjusting nut, remove the paper and cement from the area which the backstop nut will contact by gently scraping off the paper and cement using the No. 240 scriber. Mount the D-159461 backstop nut in place using the P-long-nose pliers.

(6) Check for contact separation, contact follow, stud gap, and armature travel, and readjust as required. Check the electrical requirements and if necessary readjust the relay.

3.06 Contact and Spring Alignment (Rq 2.06)
3.07 Armature Stud Clearance (Rq 2.07)
3.08 Spring Tang Position (Rq 2.08)

(1) If the contacts do not line up properly, or if the tang does not overlap the spoolhead sufficiently, or the stud rubs on the spring, attempt to correct the trouble by applying pressure to the end of the spring using the No. 259 spring adjuster as shown in Fig. 15 exercising care not to distort or otherwise damage the spring. If the spring cannot be shifted, remove the relay from the mounting plate and loosen the spring assembly mounting screws with the 3-inch cabinet screwdriver sufficiently to shift the springs so as to correct the fault. Tighten the spring assembly mounting screws securely if loosened. Before mounting the relay make the adjustments outlined in procedure 3.03, if necessary. Tighten the mounting screws securely when mounting the relay.

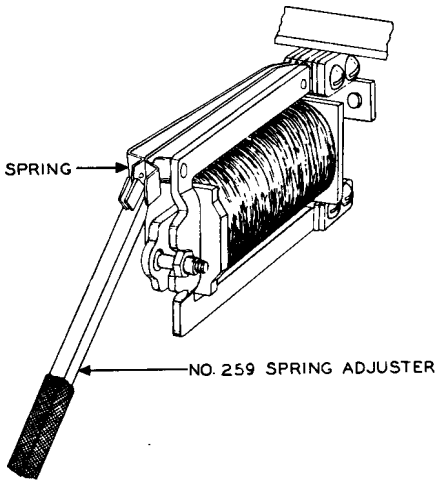


Fig. 15 - Method of Adjusting for Spring Alignment

3.09 Adjusting Stud Clearance (Rq 2.09)

(1) If the armature rubs against the adjusting stud, correct as follows:

(2) If due to a bent adjusting stud, straighten the stud by grasping the nut with the P-long-nose pliers, and adjusting the stud as required. Exercise care not to damage the threads on the stud or to loosen the stud.

(3) If due to an improper manner in which the armature is hinged to the core, change the relay.

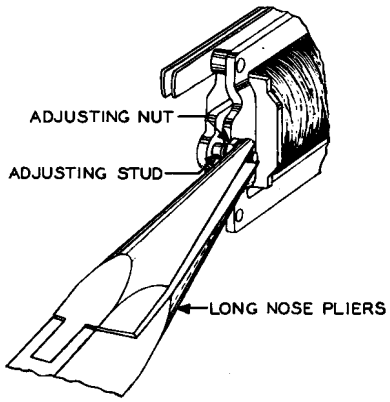


Fig. 16 - Method of Tightening Adjusting Nut on Stud

3.10 Adjusting Nut Tightness (Rq 2.10)

(1) To tighten loose nut, back off the nut from the stud until its slotted portion is free of the stud and then force the slotted parts closer together with the P-long-nose pliers as shown in Fig. 16. Use the No. 349 or No. 474A wrench to turn the nut.

(2) If in doubt as to whether or not the adjusting nut is tight enough, the tightness may be checked with the No. 70D gauge and No. 349 or No. 474A wrench as shown in Fig. 17. The nut should not turn when a pressure of 22 grams or less is applied, if the No. 349 wrench is used or with a pressure of 13 grams if the No. 474A wrench is used.

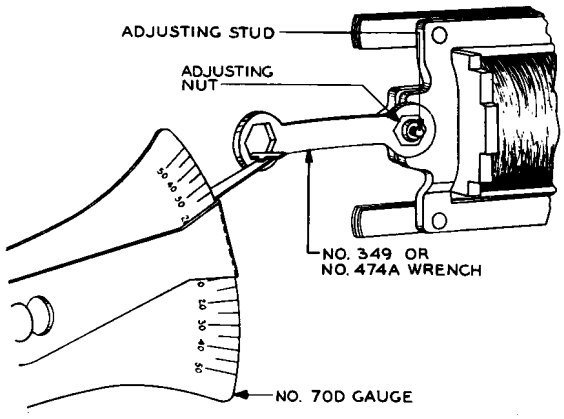


Fig. 17 - Method of Checking for Adjusting Nut Tightness

3.11 Armature Travel (Rq 2.11)

(1) To adjust the armature travel, insert the proper blade of the No. 66D gauge and turn the adjusting nut with the No. 349 or No. 474A wrench until the gauge fits snugly (see Fig. 18).

(2) Where no definite armature travel is specified, it should be kept as small as possible consistent with meeting the other requirements.

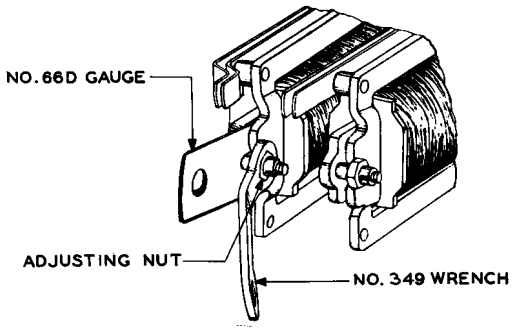


Fig. 18 - Method of Adjusting for Armature Travel

3.12 Straightness of Springs (Rq 2.12)
3.13 Separation Between Springs (Rq 2.13)

(1) If the springs are not straight or there is insufficient clearance between the springs, correct by adjusting the springs where they are bent or where the clearance is insufficient.

Use the No. 259 spring adjuster.

3.14 Contact Pressure (Rq 2.14)
3.15 Stud Gap (Rq 2.15)
3.16 Contact Separation (Rq 2.16)
3.17 Contact Follow (Rq 2.17)
3.18 Spring Sequence (Rq 2.18)

(1) Use the No. 259 spring adjuster to adjust the springs for these requirements. Place the adjuster on the front end of the spring, but back of the contact and armature stud, and then slide it back to a point about 1/4-inch from where the spring leaves the spring assembly as shown in Fig. 19. Adjust the spring at this point as required, exercising care not to disturb adjacent springs.

(2) Normally straight springs that have been adjusted should have no sharp bends due to adjustment. A gradual bow is permissible.

(3) In tensioning springs exercise care not to deform the armature hinge plate.

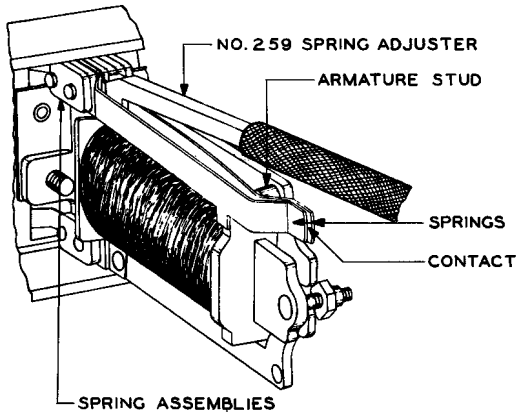


Fig. 19 - Method of Adjusting for Spring Tension

(4) Contact Pressure: In connection with those cases where spring tensions are specified to obtain contact pressure note that they are specified on a minimum basis. They have, however, a direct bearing on a relay's electrical requirements, and if they are greatly in excess of their minimum tension, the relay may fail to meet its electrical requirements in which case the tensions may have to be reduced slightly toward their specified minimum. In readjusting, however, it is desirable to have as much tension as possible on the various springs, consistent with meeting the other requirements. Attempt to distribute the tensions proportionately between the top and bottom spring combinations and between the light and heavy springs of each combination.

(5) Where no definite contact pressure is specified, tension the springs so that the relay will meet its electrical requirements. Tension the spoolhead springs so that they rest against the spoolhead.

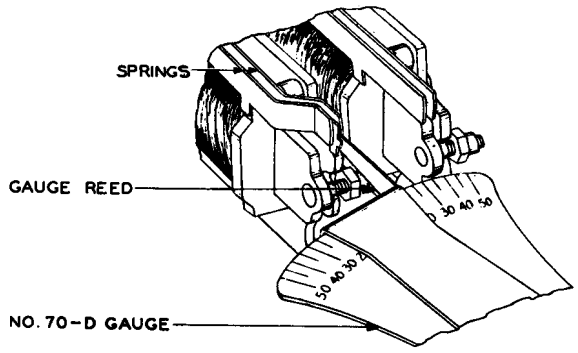


Fig. 20 - Method of Gauging Spring Tension

(6) Stud Gap: The stud gap requirement should also be met at the same time springs are adjusted to meet the contact pressure requirements. If it is difficut to meet this requirement by a readjustment of the springs, it will be satisfactory to bend the tang a slight amount. Use the P-long-nose pliers to bend the tangs holding the spring with the No. 259 spring adjuster as shown in Fig. 21. In making this adjustment, note that the spring tangs rest as nearly flat on the spoolhead as possible consistent with meeting all the other requirements.

(7) Contact Separation: To correct the separation, adjust the spring with the No. 259 spring adjuster or the spring tang with the P-long-nose pliers. See (6) regarding adjustment of spring tangs.

(8) In adjusting the front contact separation on break before make springs, adjust the springs so that the contact separation is sufficient to insure that spring sequence will be obtained under operating conditions.

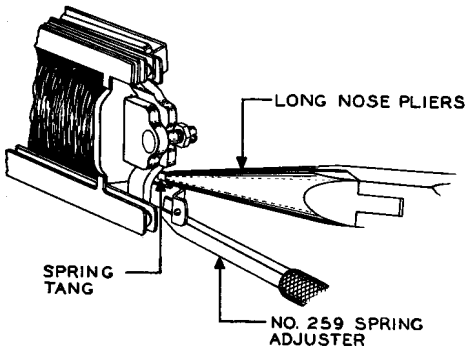


Fig. 21 - Method of Adjusting Spring Tang

(9) Contact Follow: To correct the contact follow, reduce the contact separation towards the minimum.

(10) On relays where the armature need not come all the way up to the core on the specified operate current, adjust the springs so that all make contacts close at approximately the same time.

(11) Spring Sequence: To adjust for spring sequence, modify the contact pressure, stud gap, contact separation, and contact follow requirements.

3.19 Electrical Requirements (Rq 2.19)

(1) If the relay fails to meet the operate or hold requirement, decrease the spring tension towards the minimum, reduce the contact follow towards the minimum, or increase the stud gap.

(2) If the relay fails to meet the non-operate or release requirement, increase the spring tension or the follow or decrease the stud gap.

REASONS FOR REISSUE

1. To add the AB2 and AB4 relays in the definition for Operate (1.04).

2. To amplify the information covering application of KS-7743 separator and to add information covering the application of the KS-7246 separator and the D-159461 backstop nut (2.04, 2.05, 3.04, and 3.05).

3. To revise a spring tension requirement (Table B).

4. To revise the figure for spring tang position (Fig. 6).

5. To revise the list of tools, gauges, and materials (3.001).

6. To revise contact follow requirements (2.17).