

## RELAYS L, N AND S TYPES REQUIREMENTS AND ADJUSTING PROCEDURES

### 1. GENERAL

- 1.01 This section covers L-, N-, and S-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 dismantling of apparatus, or would affect the adjusting 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 the back contact to break and the front contact to make. The stop pins, or the armature when no stop pins are provided, need not touch the core.
- 1.06 Nonoperate: 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 reduced abruptly, the armature does not move sufficiently to cause the contact that has made to become unreliable or to make the contact that has been broken.
- 1.08 Release: A relay is said to release if the armature moves from the core sufficiently to break the contact that has been closed and to make the contact that has been broken.

1.09 Armature Travel: The armature travel is the gap between the core and the nearer stop pin, or nearest point on the armature when the stop pins are omitted, when the contact spring is resting against the back contact or back stop screw.

### 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.

To check this requirement, remove the cover cap and attempt to move the relay by pressing against the side and bottom edges of the spoolhead with a KS-6320 orange stick.

#### 2.03 Cover and Cover Cap Tightness

(a) The cover springs shall have sufficient pressure against the cover to hold it firmly in place.

Gauge by feel.

(b) The cover spring shall rest on the front spoolhead when the cover is off.

Gauge by eye.

(c) The cover cap shall fit snugly but shall not be so tight as to prevent placing or removing with the fingers.

Gauge by feel.

(d) The cover shall remain in place when the cover cap is being removed.

Gauge by eye.

2.04 Cover Guide Position: The cover guide shall rest in the bottom of the slot in the front spoolhead when the cover is off.

Gauge by eye

#### 2.05 Clearance Between Cover and Contact

Bracket Spreader: With the cover in place and the play in the cover taken up in a downward direction, the clearance between the top of the spreader and the inside of the cover shall be

Min 1/64 in.

Gauge by eye.

Note: On relays where the cover guide is not slotted to provide for adjusting to meet this requirement, the requirement may

be waived if the cover is insulated from the spreader by means of a single layer of cellulose tape attached to the cover directly above the spreader.

2.06 Contact Alignment:

(a) Fig. 1(A) - The point of contact shall fall wholly within the circumference of the opposing contact disc except for opposing contacts having the same diameter, in which case, the centers shall not be out of alignment more than 25 per cent of the diameter of the contact points. This requirement shall be met with the horizontal play of the armature taken up in both directions.

Gauge by eye.

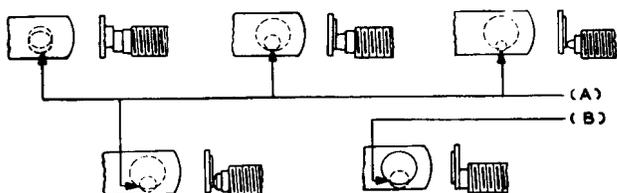


Fig. 1 - Contact Alignment

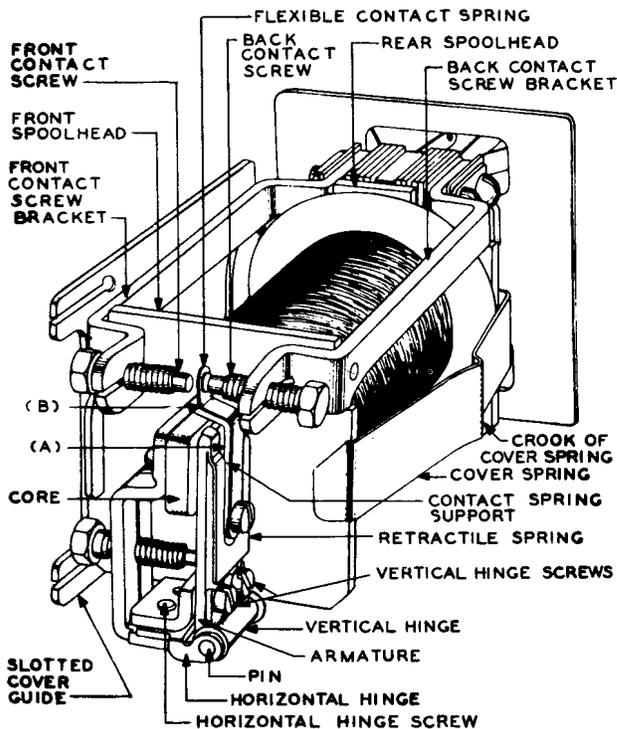


Fig. 2 - Relay Shown Equipped with Slotted Cover Guide and Cover Spring (Cover Guide and Spring Used Only on N- and S-type Relays)

(b) Fig. 1(B) - On screws not having a contact, the point of contact of the stop screw shall rest wholly within the surface of the contact spring. This shall be checked with the horizontal play of the armature taken up in both directions.

Gauge by eye.

2.07 Clearance Between Contact Spring and Retractable Spring: Fig. 2(A) - Neither the contact spring nor contact spring support shall touch the sides of the slot in the retractile spring in the operated or unoperated position of the armature.

Gauge by eye.

To check this requirement, place the P-220366 dental mirror, tilted at a slight angle, directly beside the retractile spring and observe the position of the springs.

2.08 Tightness of Screws

\*(a) The front and back contact screws and the retractile spring screw shall be sufficiently tight in their brackets to hold any adjusted position.

Gauge by feel.

(b) The horizontal and vertical hinge screws shall be sufficiently tight to hold the armature in its adjusted position and the pin securely in its bearings.

Gauge by feel.

2.09 Armature Movement: The armature shall move freely in its bearings.

Gauge by eye.

This requirement does not apply to reed-type relays.

\*2.10 Contact Screw Bracket Pressure: The pressure of the contact screw brackets against the front spoolhead, or against the nuts of the contact bracket spreader when the relay is so equipped, measured at the front end of the bracket shall be

Min 285 grams

Use the No. 62B gauge.

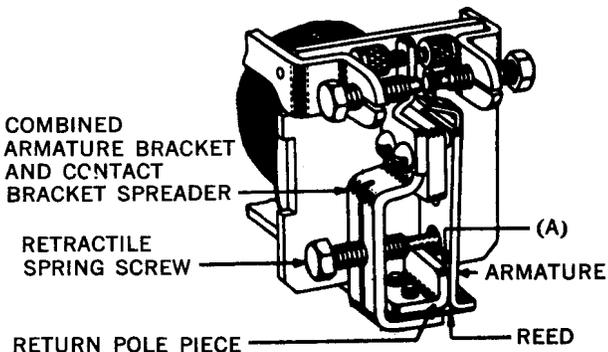


Fig. 3 - Relay Equipped with Reed-type Armature

### 2.11 Contact Screw Bracket Position

(a) All Relays: The studs on the contact screw brackets shall fall within the slots in the front spoolhead.

Gauge by eye, using the P-220366 dental mirror.

To check this requirement place the dental mirror, tilted at a slight downward angle, directly behind the front spoolhead.

(b) Relays Equipped With Contact Bracket Spreader: Fig. 4(A) - The clearance between each contact screw bracket and the front spoolhead shall be

Min. 0.006 in.

but the studs on the contact screw brackets may touch the sides of the slots in the spoolhead.

Gauge by eye using the P-220366 dental mirror.

Check the requirement at both the top and bottom edges of the bracket with the brackets resting against the nuts of the contact bracket spreader using the dental mirror.

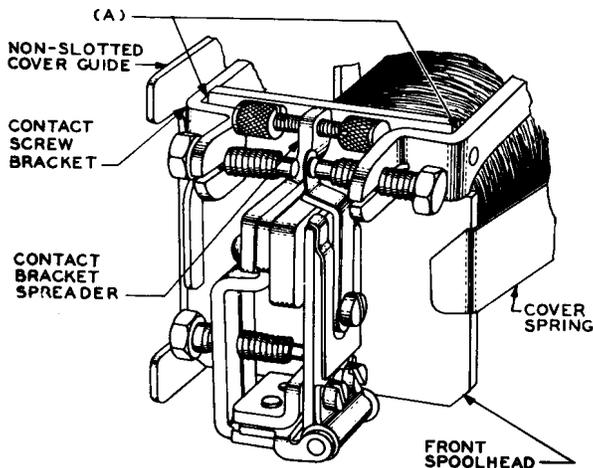


Fig. 4 - Relay Equipped with Contact Bracket Spreader, Nonslotted Cover Guide and Cover Spring.

2.12 Base Gap (Readjust Only): Fig. 3(A) and 5(A) - The gap between the armature and return pole piece, measured at the closest point, shall be

Min - 0.009 in.

Max - 0.011 in.

Use the No. 74D gauge.

Check this requirement with the armature stop pins (or armature if stop pins are not provided) resting against the core and the bottom of the armature held as close as possible to the return pole piece. When checking the base gap on reed type armatures, back off the retractile spring screw to permit insertion of the gauge.

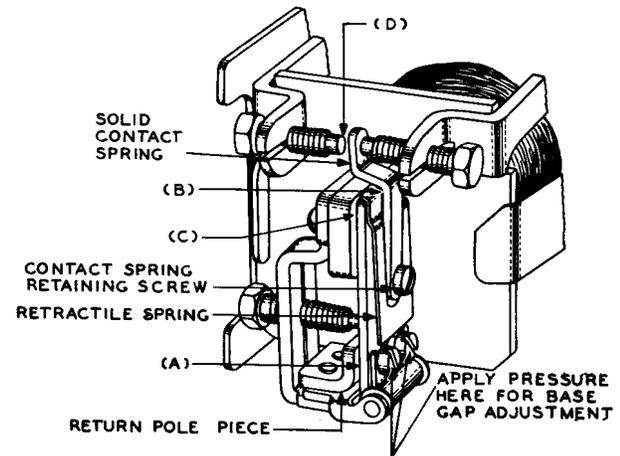


Fig. 5 - Relay Equipped With Solid Contact Spring

**Note:** Any special base gap specified on the circuit requirement table shall also be considered as a readjust requirement only.

### 2.13 Contact Spring Pressure

#### Relays with Flexible Contact Springs

(a) Test: Fig. 2(B) - The flexible contact spring shall rest on the spring support at least within 1/16 inch of the extreme end of the support.

Gauge by eye.

To check this requirement, move the armature sufficiently with a KS-6320 orange stick so that the flexible contact spring just leaves its back contact and then observe that the contact spring rests against the contact spring support within 1/16 inch of its extreme end.

(b) Readjust: The pressure of the flexible contact spring on the spring support shall be

Min 3 grams

Max 7 grams

Use the No. 70F gauge.

To check this requirement insert a toothpick between the front contact screw bracket and the front spoolhead so that when the armature is fully operated the front contacts do not make. Then place a small piece of paper to be used as a background, between the contact brackets just in front of the front spoolhead and, with the armature held in the operated position, apply the No. 70F gauge at the center of the contact and note the reading of the gauge just as the spring breaks from its support.

**Note:** The contact spring pressure should be kept near the minimum value specified consistent with meeting the electrical requirement.

Relays with Solid Contact Springs

(c) Test: Fig. 5(B) - The contact spring shall rest against the top edge of the retractile spring or armature. Where the contact spring rests against the retractile spring, that portion of the top edge of the retractile spring underneath the contact spring shall rest against the armature.

Gauge by eye using the No. 510C test lamp as shown in Fig. 6.

(d) Readjust: The contact spring shall rest against the top edge of the retractile spring or armature with a pressure of

Min 400 grams

Use the No. 62B gauge.

To check remove the armature from the relay and use the gauge as shown in Fig. 7.

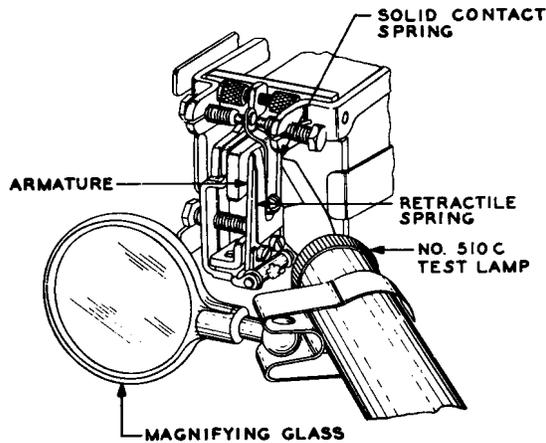


Fig. 6 - Gauging Position of Solid Contact Spring

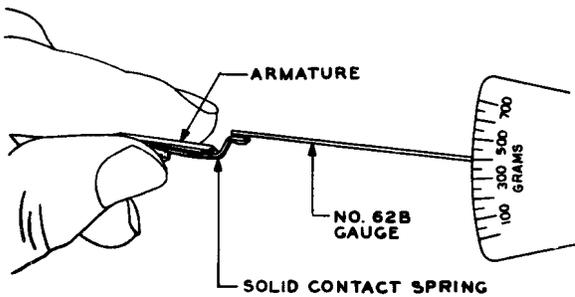


Fig. 7 - Gauging Solid Contact Spring Pressure

2.14 Armature Travel: Fig. 5(C) - The armature travel shall be

Min 0.009 in.  
Max 0.011 in.

Use the No. 74D gauge.

2.15 Contact Separation: Fig. 5(D) - The separation between contacts normally open or between contacts that are opened when the relay is operated shall be

Min 0.003 in.  
Max 0.005 in.

Use the No. 74D gauge.

Note: On relays having transfer combinations, if there is a difference in contact separation between the back and front contacts, it is an indication that there is a build-up on a contact of the pair having the smaller contact separation. On single make contacts, inspect for build-up. In both cases, if build-up exists, clean the contacts in accordance with Section 069-306-801 in order to meet the requirement.

2.16 Electrical Requirements

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

(b) On relays equipped with individual covers, the electrical test and readjust requirements specified on the circuit requirement table shall be met with the cover on. The cover cap may be either on or off.

3. ADJUSTING PROCEDURES

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

Code or Spec No.	Description
<u>Tools</u>	
43	3/16 in. and 1/4 in. Hex. Open Double-end Flat Wrench
259	Spring Adjuster
303	Spring Adjuster
325B	Adjuster
326B	Adjuster
363	Spring Adjuster
485A	Smooth-jaw Pliers

<u>Code or Spec No.</u>	<u>Description</u>
<u>Tools Cont'd</u>	
510C	Test Lamp (Equipped with a No. 561A Straight or No. 562B curved tip)
KS-6320	Orange Stick
KS-6854	Screwdriver
R-2739	Offset Screwdriver
P-220366	Dental Mirror
-	3 in. Cabinet Screwdriver
-	4 in. Regular Screwdriver
-	Flat Tweezers "Piano", Hamma-cher Schlemmer and Co. No. 56, 6 inches or Equivalent

Gauges

62B	0-700 Gram Gauge
70F	10-0-10 Gram Gauge
74D	Thickness Gauge Nest

Materials

-	Gem Clip
-	Cellulose Tape (Scotch brand or equivalent. Obtainable in local stationery store)
-	Hardwood Toothpicks - Flat at one end and pointed at the other

Test Apparatus

35 Type	Test Set
W2BL	Cord

3.002 In some cases, the proximity of adjacent apparatus may make it necessary to loosen the relay mounting screws and move the relay forward to perform maintenance operations.

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) If the relay is not fastened securely to the mounting plate, tighten the mounting screws with the 4-inch regular screwdriver.

3.03 Cover and Cover Cap Tightness (Rq 2.03)  
3.04 Cover Guide Position (Rq 2.04)

- (1) If the cover cap does not fit properly, adjust the cover cap prongs as required using the No. 485A pliers.
- (2) If the cover does not remain in place when the cover cap is being removed, the tension of the cover spring against the cover is insufficient or the tension of the cover cap prongs is too great. To correct this, either reduce the tension of the cover cap prongs using the No. 485A pliers or increase the tension of the cover spring against the cover by bowing it outward at the crook of the spring with the pliers if the spring is accessible. If the spring is not accessible, proceed as covered in (4).
- (3) If the cover spring does not rest on the spoolhead, adjust the spring with the No. 259 spring adjuster applying it near the crook in the spring. If impossible to correct in this way, proceed as covered in (4).
- (4) Remove the relay from the mounting plate with the 4-inch regular screwdriver and then remove the screw that holds the cover guide and cover spring in place with the 3 in. cabinet screwdriver. Adjust the cover spring manually by bowing it outward at the crook in the spring. To adjust the cover guide after it is removed, bend inward the part that is secured by the screw using the No. 485A pliers.

3.05 Clearance Between Cover and Contact Bracket Spreader (Rq 2.05)

- (1) If the clearance between the top of the spreader and the inside of the cover is not satisfactory, proceed as follows. Where the cover guide is slotted, insert the blade of the KS-6854 screwdriver into the slot and adjust the prong upward as required to obtain a satisfactory clearance. If the slot has been spread so that the cover cannot be mounted, reduce the width of the slot using the No. 485A pliers. Where the cover guide is not slotted, remove the cover from the relay. Attach a piece of cellulose tape approximately 1 inch long and 3/4 inch wide to the inside of the cover directly above the spreader. Remount the cover.

3.06 Contact Alignment (Rq 2.06)3.07 Clearance Between Contact Spring and Retractable Spring (Rq 2.07)

- (1) If the contacts are out of alignment, vertically, check whether the studs on the contact screw brackets rest in the slots in the spoolhead. This can be done by inserting the P-220366 dental mirror, tilted at a slight downward angle, directly behind the front spoolhead and examining each stud. In general, if the studs do not rest in the slots, they can be repositioned manually.

(2) If the studs are in the slots and the contacts are out of alignment, loosen the contact spring retaining screw with the R-2739 offset screwdriver. Move the contact spring up or down or in or out as required, and tighten the contact spring retaining screw. On relays with flexible contact springs, while tightening the screw, hold the contact spring and contact spring support in alignment with a gem clip as shown in Fig. 8 in order to prevent the spring from twisting in such a way that it will not rest against its support and the contacts be misaligned. On hinge-type relays, if a slight additional movement is necessary to align the contacts vertically or horizontally, loosen the vertical hinge screws slightly with the R-2739 screwdriver and shift the armature as required. While holding the armature firmly in position, tighten the hinge screws.

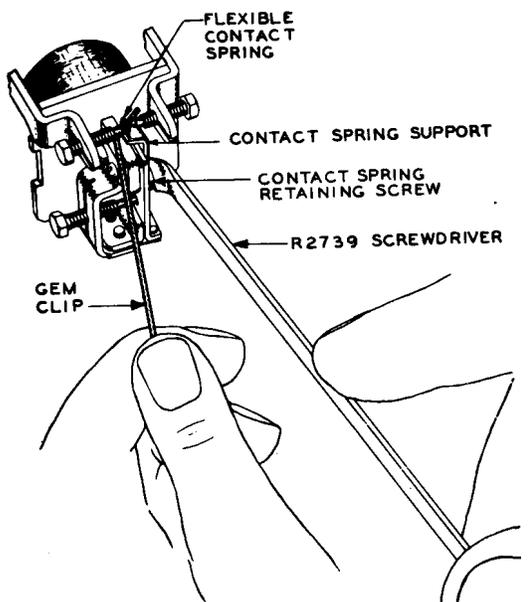


Fig. 8 - Method of Aligning the Contact Spring and Contact Spring Support

#### .08 Tightness of Screws (Rq. 2.08)

(1) If the contact screws are too loose, remove the ones at fault with the No. 43 wrench and then reduce the slot opening in the contact screw bracket using the No. 485A pliers so that with the contact screws in place, they will be held sufficiently tight to prevent the relay from changing its adjustment. However, do not reduce the slot to such an extent that the threads of the screw will be damaged when the screw is turned.

(2) If the contact screws are too tight, widen the slot in the contact screw bracket using the KS-6854 screwdriver.

(3) If the retractile spring screw is either too tight or too loose, first loosen the relay mounting screws and move the relay forward. Then proceed as covered in (1) and (2) to adjust the retractile spring bracket.

(4) Tighten the vertical hinge screws with the R-2739 screwdriver so that the armature is held securely in position and the pin is held securely in its bearings.

(5) If the shape of the vertical hinge piece is such that the vertical hinge screws cannot be made to hold the armature securely in position, proceed as follows. Unsolder the leads from the relay and remove it from the mounting plate with the 4-inch regular screwdriver. Loosen the vertical and horizontal hinge screws with the R-2739 screwdriver or the KS-6854 screwdriver and remove the armature and the vertical horizontal hinges from the relay. When doing this, take care not to disturb the position of the armature pin and washers. Flatten the curved portion of the vertical hinge slightly by compressing it with a pair of No. 485A pliers. Exercise care to flatten the hinge only enough to hold the pin securely in its bearings when the vertical hinge screws are tightened. Also exercise care not to damage the connecting wire on the vertical hinge while it is being adjusted. Reassemble the parts and tighten the horizontal and vertical hinge screws securely. Check the base gap and contact alignment. Mount the relay, tighten the mounting screws securely, and resolder the leads on the relay.

(6) If the horizontal hinge screws are loose, tighten them with the R-2739 screwdriver so that the armature is held securely in position. Before tightening the hinge screws, check the base gap to insure that it is within proper limits and, if necessary, readjust as covered in 3.11.

#### 3.09 Armature Movement (Rq 2.09)

(1) If the side play is excessive or there is binding of the armature, carefully adjust the horizontal hinge toward or away from the armature as required with the No. 303 spring adjuster as shown in Fig. 9.

#### 3.10 Contact Screw Bracket Pressure (Rq 2.10)

(1) To increase the pressure of the contact screw bracket against the spoolhead, or against the contact bracket spreader when the relay is equipped with a spreader, proceed as follows. Place the No. 325B adjuster on the rear of the long straight portion of the contact screw bracket. Apply

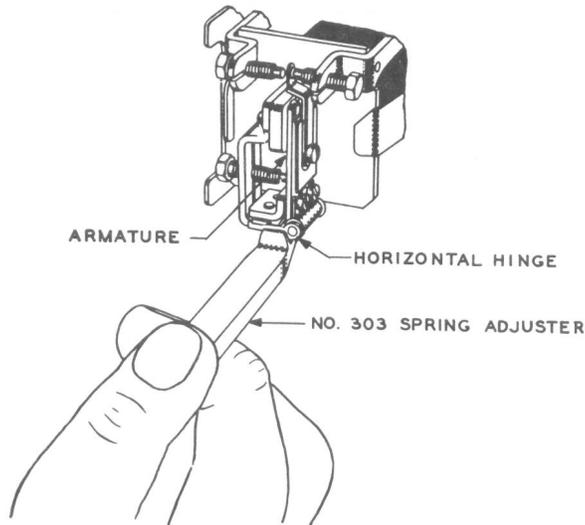


Fig. 9 - Method of Adjusting the Horizontal Hinge

the No. 326B adjuster to the bracket as close as possible to and in front of the No. 325B adjuster. Then, while holding the No. 325B adjuster with the left hand, adjust the bracket as required with the No. 326B adjuster.

Note: In some cases it may be necessary to shift or remove adjacent apparatus in order to apply the adjusters to the bracket.

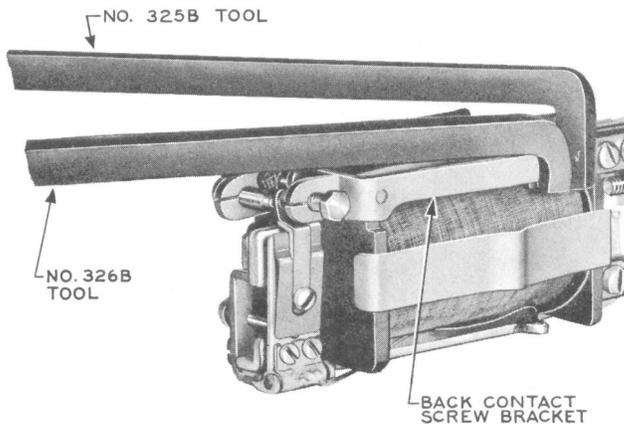


Fig. 10 - Method of Adjusting Contact Screw Bracket

### 3.11 Contact Screw Bracket Position (Rq 2.11)

(1) All Relays: Where a contact screw bracket stud does not rest in the slot in the spoolhead, position the bracket with the fingers.

(2) Relays Equipped With Contact Bracket Spreader: If the clearance between a contact screw bracket and the front spoolhead is not satisfactory, turn the nut on the spreader with the 6-inch flat tweezers in a direction which will move the bracket away from the spoolhead as shown in Fig. 11.

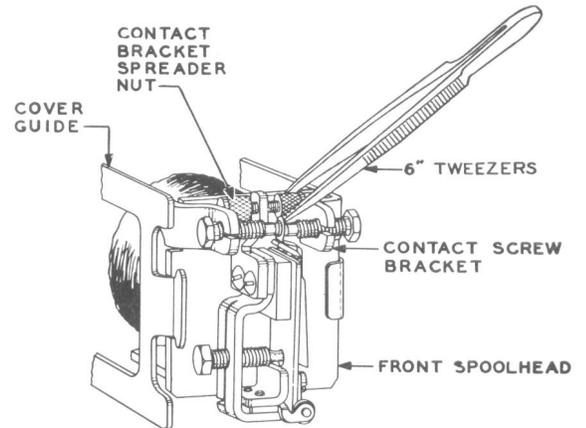


Fig. 11 - Method of Adjusting for Contact Screw Bracket Position

### 3.12 Base Gap (Rq 2.12)

(1) Relays With Solid Contact Springs: In the case of relays not having a contact spring support, insert a toothpick between the front contact screw bracket and the front spoolhead as shown in Fig. 12 when adjusting the relay.

(2) Hinge-type Relays: Check that the vertical hinge screws do not project through the armature. If they do, replace them. If the vertical hinge screws are satisfactory, proceed as covered in (4).

(3) Reed-type Relays: In the case of reed-type relays, turn the retractile spring screw in a counterclockwise direction with the No. 43 wrench in order to insert the No. 74D gauge between the armature and return pole piece. Then proceed as outlined in (4).

(4) All Relays: To correct the base gap, loosen the horizontal hinge screws with the R-2739 screwdriver. Insert the 0.010-inch blade of the No. 74D gauge (or the 0.006-inch blade when so specified on the circuit requirement table) between the armature and return pole piece at an angle sufficient to clear the retractile spring screw. Hold the armature tightly against the gauge applying pressure at the point indicated in Fig. 5. Securely tighten the screws and remove the gauge.

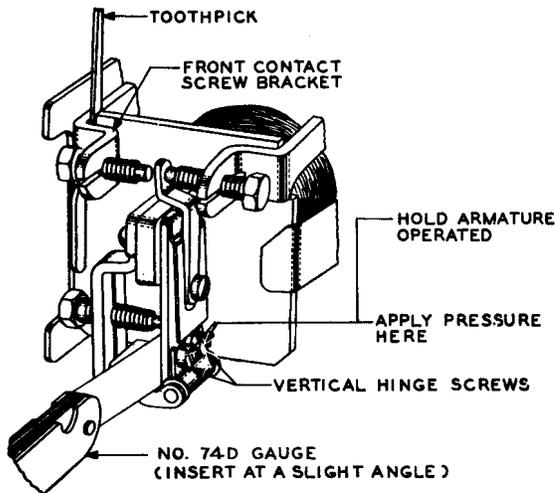


Fig. 12 - Method of Adjusting for Base Gap

armature firmly with the No. 485A pliers placing the jaw of the pliers between the vertical hinge screws and the contact spring retaining screw as shown in Fig. 15. Using the fingers, force the contact end of the

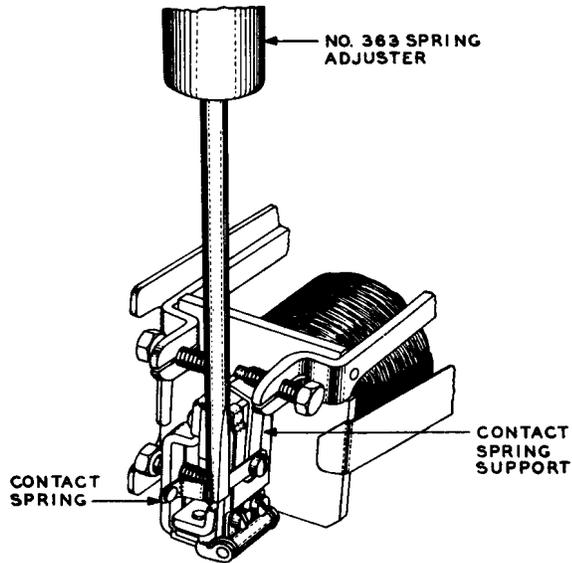


Fig. 13 - Method of Adjusting Flexible Contact Spring

3.13 Contact Spring Pressure (Rq 2.13)

(1) Flexible Contact Springs: To adjust the flexible contact spring slightly loosen the contact spring retaining screw with the R-2739 screwdriver. Swing the contact spring out toward the front until it is in a horizontal position. Adjust it with the No. 363 spring adjuster applied as shown in Fig. 13. Reposition the contact spring and tighten the retaining screw securely. Check the pressure of the spring against its support. If the pressure is found to be excessive, force the back contact screw brackets slightly away from the contact spring by inserting a toothpick between the back contact screw bracket and the front spoolhead. Then hold the armature manually operated as shown in Fig. 14 and force the contact spring back toward the back contact screw with the flat end of another toothpick. Repeat this operation until the required tension is obtained. Remove the toothpick from the contact screw bracket. After making this adjustment, adjust for contact separation and check that the contact alignment is satisfactory.

(2) Solid Contact Springs: To adjust the solid contact spring, insert a toothpick between the back contact screw bracket and the spoolhead. Back off the retractile spring screw using the No. 43 wrench until the screw is clear of the armature. Slightly loosen the vertical hinge screws with the R-2739 screwdriver. Remove the armature from the relay taking care not to disturb the position of the armature pin and washers. Loosen the contact spring retaining screw with the KS-6854 screwdriver just sufficiently to permit the contact spring to be moved to a position at right angles to its normal position. Then tighten the contact spring retaining screw. Grasp the

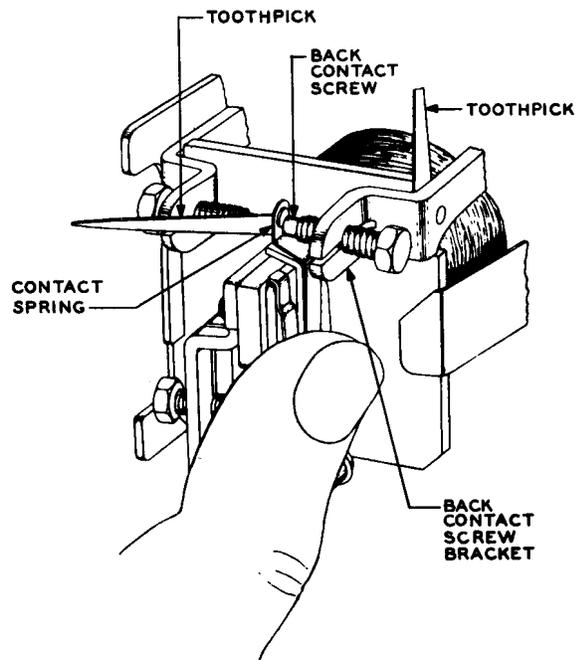


Fig. 14 - Method of Reducing Contact Spring Tension

spring over the side of the armature so that the spring is bowed slightly. Loosen the contact spring retaining screw, restore the contact spring to its normal position, and tighten the retaining screw securely. Check that the contact spring rests against the top edge of the armature with at least the minimum pressure specified. Carefully remount the armature on the relay and securely tighten the vertical hinge screws. Remove the toothpick. Check the contact alignment. If the relay does not operate satisfactorily, proceed as covered in 3.16.

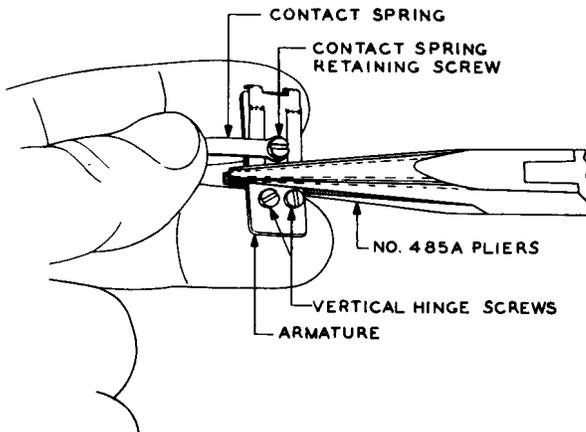


Fig. 15 - Method of Adjusting Solid Contact Spring

- 3.14 Armature Travel (Rq 2.14)  
 3.15 Contact Separation (Rq 2.15)

(1) Turn the back and front contact screws outward with the No. 43 wrench until the blade of the No. 74D gauge corresponding to the mean value can be inserted between the armature stop pins and the core. Hold the armature firmly operated against the gauge and slowly turn the back contact screw inward with the No. 43 wrench until the back contact just makes. Release the armature and if the armature moves away from the core, as indicated by the gauge becoming loose, continue turning the contact screw until the gauge fits snugly but not tight between the armature and core. See Fig. 16.

(2) After the armature travel has been set, turn the front contact screw with the No. 43 wrench until the blade of the No. 74D gauge corresponding to the mean value can be inserted between the front contact and the contact spring. With the blade held against the contact spring, turn the front contact screw inward slowly, until it just touches the blade. Check that the contact separation is met. See Fig. 17.

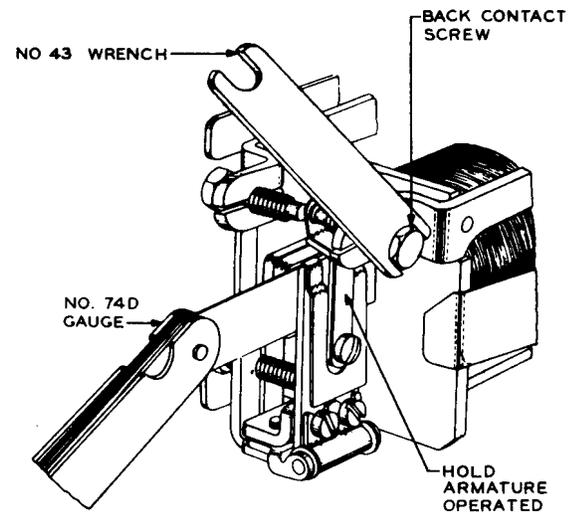


Fig. 16 - Method of Adjusting for Armature Travel

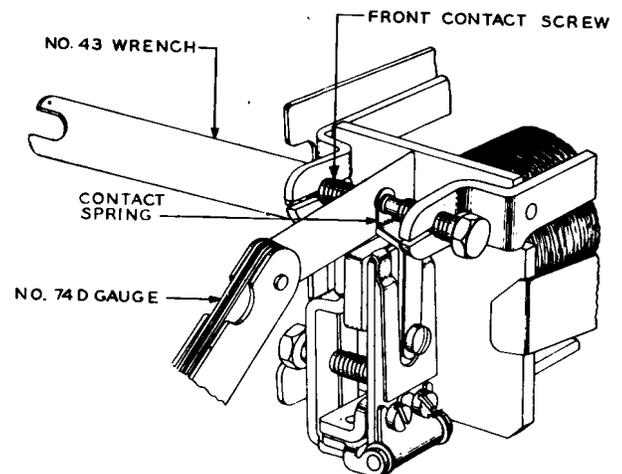


Fig. 17 - Method of Adjusting for Contact Separation

(3) If after adjusting the contact separation as covered in (2) the separation is not sufficient, it may be due to the contact disc on the contact spring contacting one of the contact screws near the bottom of the disc and the other screw near the top of the disc. To better align the contacts adjust the contact brackets at the front of the bracket with the No. 485A pliers, as shown in Fig. 18, so that adjacent points on the contacting surfaces of the disc on the contact spring will strike the approximate centers of the contacts on the front and back contact screws. After making this adjustment, check the armature travel and, if necessary, readjust. Recheck

the contact separation and, if necessary, readjust.

(4) If necessary remove the build-up from the contacts in accordance with Section 069-306-801.

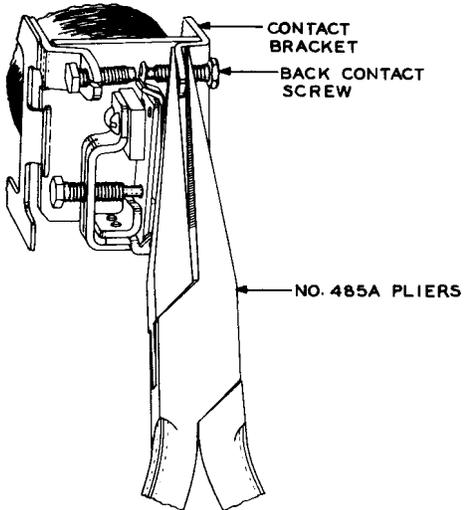


Fig. 18 - Method of Adjusting Front End of Contact Bracket

3.16 Electrical Requirements (Rq 2.16)

(1) Failure to meet an operate or hold requirement indicates that the tension of the retractile spring is excessive. Turn the retractile spring screw in a counterclockwise direction with the No. 43 wrench until the requirement is met. Failure to meet the nonoperate or release requirements indicates insufficient tension of the retractile spring. In this case, turn the retractile spring screw in a clockwise direction until the requirement is met.

(2) If a relay meets all its electrical requirements but fails to function satisfactorily in service or fails to meet the requirements imposed by the test circuit, check the contact spring pressure as covered in readjust requirement 2.13. If this requirement is satisfied and the test circuit conditions are not met, it may be necessary to further adjust the base gap, armature travel, retractile spring tension, and contact separation until the test circuit requirements are satisfied.