B.S.M. 881B

266-TYPE RELAYS

REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers 266-type relays.

1.02 This section is reissued to add requirements for the 266E relay and to add contact alignment requirements for heavy bar-type contacts. Detailed reasons for reissue will be found at the end of this section.

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 ***Operating Principle:*** Figure 101 illustrates the principle of operation of the 266-type relay. The relay consists of two R-type relays mounted so that their armatures are on opposite sides of their respective cores, with their cores adjacent. The cores are mechanically and magnetically connected at the front ends by a permanent magnet. The cores are joined at the rear by a bracket which completes the magnetic circuit. The action is as follows.

(a) ***Normal Position:*** With no current connected to the relay, a magnetic flux is maintained in the two cores by the permanent magnet, as illustrated by the dotted arrow line in Fig. 101. This flux saturates the two cores but, since its path is closed, with no air gaps, there is insufficient flux leakage to operate either armature.

(b) ***Operation of Right Armature:*** When negative battery is connected to the outer end of the right coil winding and ground to the inner end of the left coil winding, a flux is set up by the windings which will be in the same direction in the two cores, as illustrated by the solid arrow lines. The flux will be in the same direction as the flux from the permanent magnet in the left core and in the opposite direction in the right core. Since the cores are already saturated from the permanent magnet, there will be no appreciable change in the left core, in which the flux produced by the winding is in the same direction as the flux from the permanent magnet. The left armature will not operate. The flux produced by the winding in the right core will oppose the flux from the permanent magnet and sufficient flux will be forced across the armature air gap to operate the right armature.

Note: Various circuit combinations for connecting battery and ground to the relay windings may be used as long as the direction of current through the windings is maintained for operating the right or left armature as required.

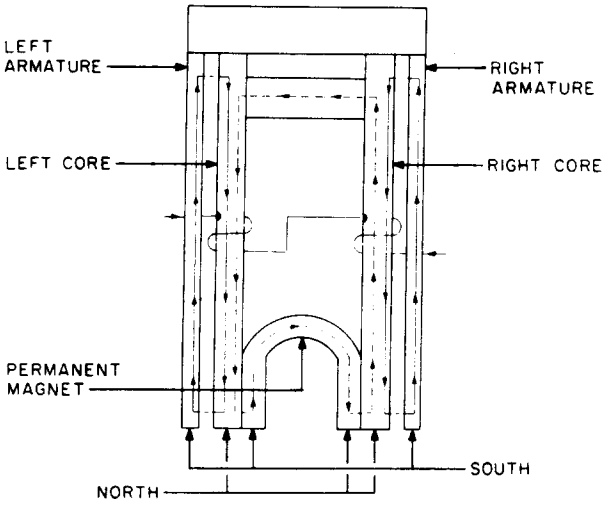


Fig. 101 – Operating Principle of 266-Type Relay

(c) ***Operation of Left Armature:*** When positive battery is connected to the outer end of the right coil winding and ground is connected to the inner end of the left coil winding, the flux set up by the windings is in the opposite direction to the flux produced by the negative battery. This flux will cause the right armature to nonoperate and the left armature to operate in the same manner as covered in (b) for the operation of the right armature. See note of (b).

1.06 ***Operate:*** A relay is said to operate if, when current is connected to its winding, one armature, depending on the direction of the current, moves sufficiently to meet the following conditions.

(a) All normally open contacts close and all normally closed contacts open.

(b) At least one stop pin touches the core.

1.07 ***Nonoperate:*** A relay is said to nonoperate if, when current is connected to its winding, neither armature moves sufficiently to close any normally open contact or to lower the contact pressure of any normally closed contact enough to cause unreliable contact.

1.08 ***Armature Travel:*** The armature travel on either the right or left armature is the gap between the associated core and the nearest stop pin when the armature is resting against the adjusting nut.

2. REQUIREMENTS

2.01 ***Cleaning:*** The contacts and other parts of the relay shall be cleaned when necessary in accordance with Section 069-306-801 covering cleaning of relay contacts and parts.

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

Gauge by feel by attempting to turn the screws in a clockwise direction with the 4-inch E screwdriver.

2.03 ***Vertical Clearance***

(a) The clearance between the contact springs of the relay and apparatus mounted directly above or below shall be

Min 1/4 inch

Gauge by eye.

Note: This clearance is satisfactory if it can be obtained by removing the covers of the apparatus directly above or below, provided such covers are readily removable.

(b) Contact springs shall not touch the relay cover.

Gauge by eye.

2.04 ***Cover Cap Tightness, Cover Guide Pressure, and Cover Guide Position***

(a) The cover cap shall fit snugly. The cover shall remain in place when the cover cap is being removed from the relay.

Gauge by feel.

(b) ***Fig. 102(A):*** The tangs on the cover guides shall bear on the spoolhead when the cover is removed.

Gauge by feel.

(c) With the inside of the cover touching the front ends of the cover guides on one side of the relay, the clearance between the cover and the front ends of the cover guides on the opposite side shall be

Max 3/64 inch

Gauge by eye.

Caution: After checking or adjusting, make sure the cover is fully seated and that the position of the cover and cover guides is such as to insure that the cover operated contacts which control the message registers are fully closed.

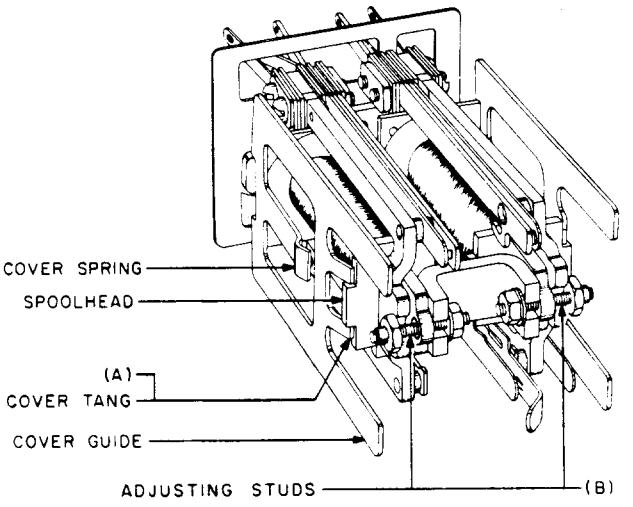


Fig. 102 – Cover Guide Position

2.05 ***Contact Alignment***

(a) ***Fig. 103(A):*** On all relays equipped with standard contacts, the contacts shall line up so that the width of the contact surface of each contact bar falls wholly within the length of its mating bar.

Gauge by eye.

(b) ***Fig. 104(A):*** On relays equipped with heavy contacts, the contact alignment shall be within the limits indicated in Fig. 104.

Gauge by eye.

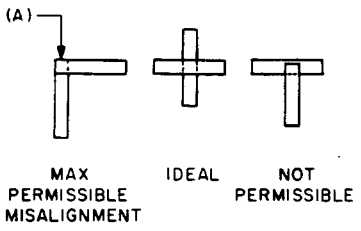


Fig. 103 – Alignment of Standard Bar-Type Contacts — Plan View of Contact Surfaces

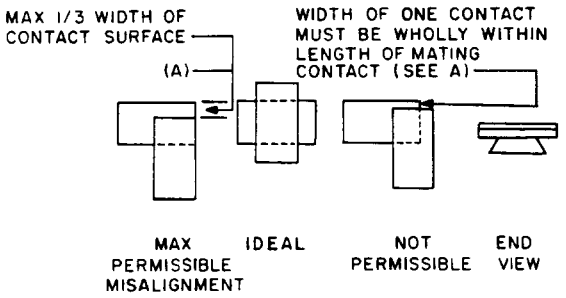


Fig. 104 – Alignment of Heavy Bar-Type Contacts — Plan View of Contact Surfaces

2.06 ***Armature Stud Clearance:*** The armature studs shall not rub on springs through which they pass in all positions of the armature travel.

Gauge by eye.

2.07 ***Spring Tang Position***

(a) ***Fig. 105(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. 105(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.

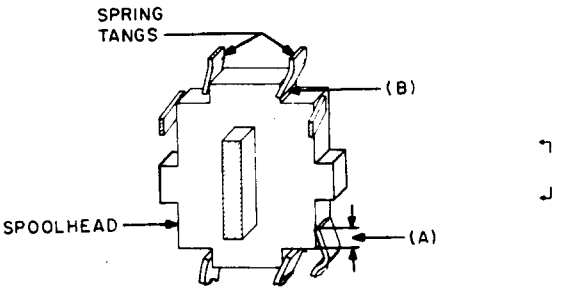


Fig. 105 – Spring Tang Position

2.08 ***Adjusting Stud Clearance:*** Fig. 102(B) — There shall be a clearance between each armature and its associated adjusting stud in all positions of the armature travel.

Gauge by eye.

2.09** ***Permanent Magnet Mounting Nut Tightness: Fig. 106(A) — The two nuts which mount the permanent magnet shall be tight.

Gauge by feel by attempting to turn the nuts in a clockwise direction with the 74 wrench. ←

2.10 ***Adjusting Nut Tightness:*** The adjusting nut shall be sufficiently tight on the stud to prevent its being turned with a torque of 1 ounce-inch.

Use the 70H gauge.

To check this requirement, attempt to turn the adjusting nut with the thumb and forefinger. In case of doubt, this may be checked by the use of the 474A wrench and the 70H gauge. With the wrench on the nut, the gauge shall be applied in the hole in the free end of the wrench, and the nut shall not turn when a pressure of 13 grams is applied at right angles to the wrench in the clockwise direction as shown in Fig. 106.

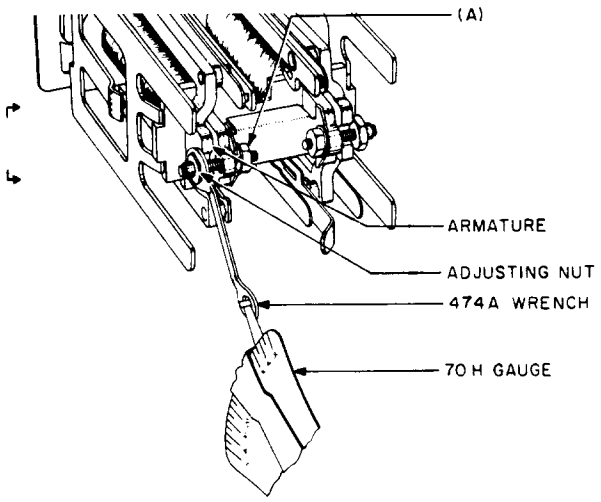


Fig. 106 – Method of Checking Tightness of Adjusting Nut

2.11 ***Armature Travel:*** Fig. 107(A)

(a) The armature travel shall be in accordance with the value specified for the relay in the armature travel column on the circuit requirements table.

Use the 66D gauge.

Note: The armature travel for the right and left armatures is not necessarily the same.

(b) The armature travel tolerance shall be as follows:

RELAY CODE	TEST	READJUST
266A	+0.015 inch −0.005 inch	+0.015 inch −0.005 inch
All except 266A	+0.005 inch −0.0025 inch	+0.0025 inch −0.0025 inch

2.12 ***Straightness of Springs:*** Fig. 107(B) — All springs shall be free of sharp bends or kinks due to adjustment. A gradual bow in a spring is permissible.

Gauge by eye.

2.13 ***Separation Between Springs:*** Fig. 107(C) — The clearance between adjacent springs whether in the unoperated or the electrically operated position of the relay shall be

Min 0.008 inch

Gauge by eye.

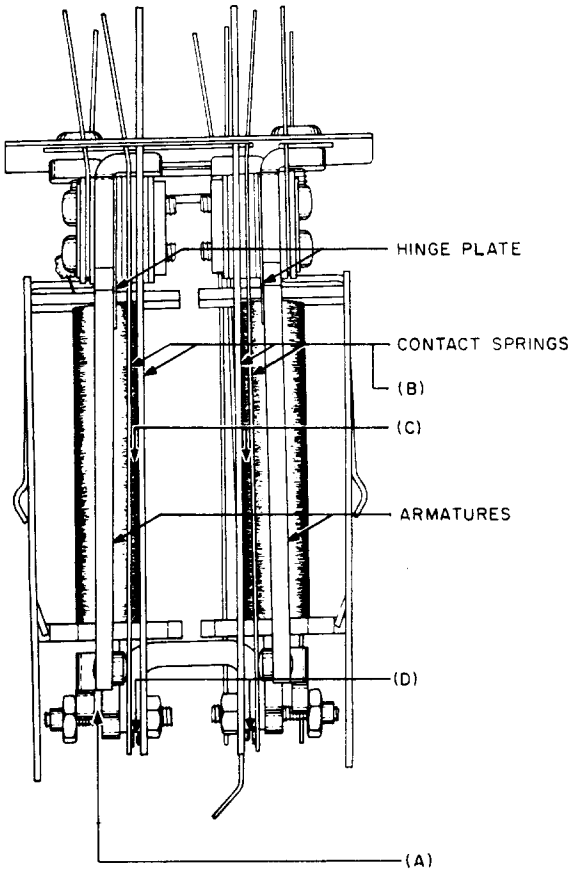


Fig. 107 – Relay — Top View (266A relay)

2.14 ***Spring Tension***

(a) The tension of each spring measured in grams shall be in accordance with the information given in the particular figure on Page 5, which is referred to in the Fig. No. column of the circuit requirements table.

(b) The springs shall be tensioned toward their associated armature. Unless the abbreviation Arm. Opr is shown associated with an arrow mark leading to a spring, the tension shall be measured with the armature in the unoperated position. A spring tensioned against the spoolhead shall register the required tension just as the tang of the spring leaves the spoolhead. A spring whose contacts are tensioned against the contacts of an opposing spring shall register the required tension just as the contacts break. A spring tensioned against a stud shall register the required tension just as it leaves the stud.

Use the 70H or 70J gauge applied to the tip of the spring.

2.15 ***Stud Gap***

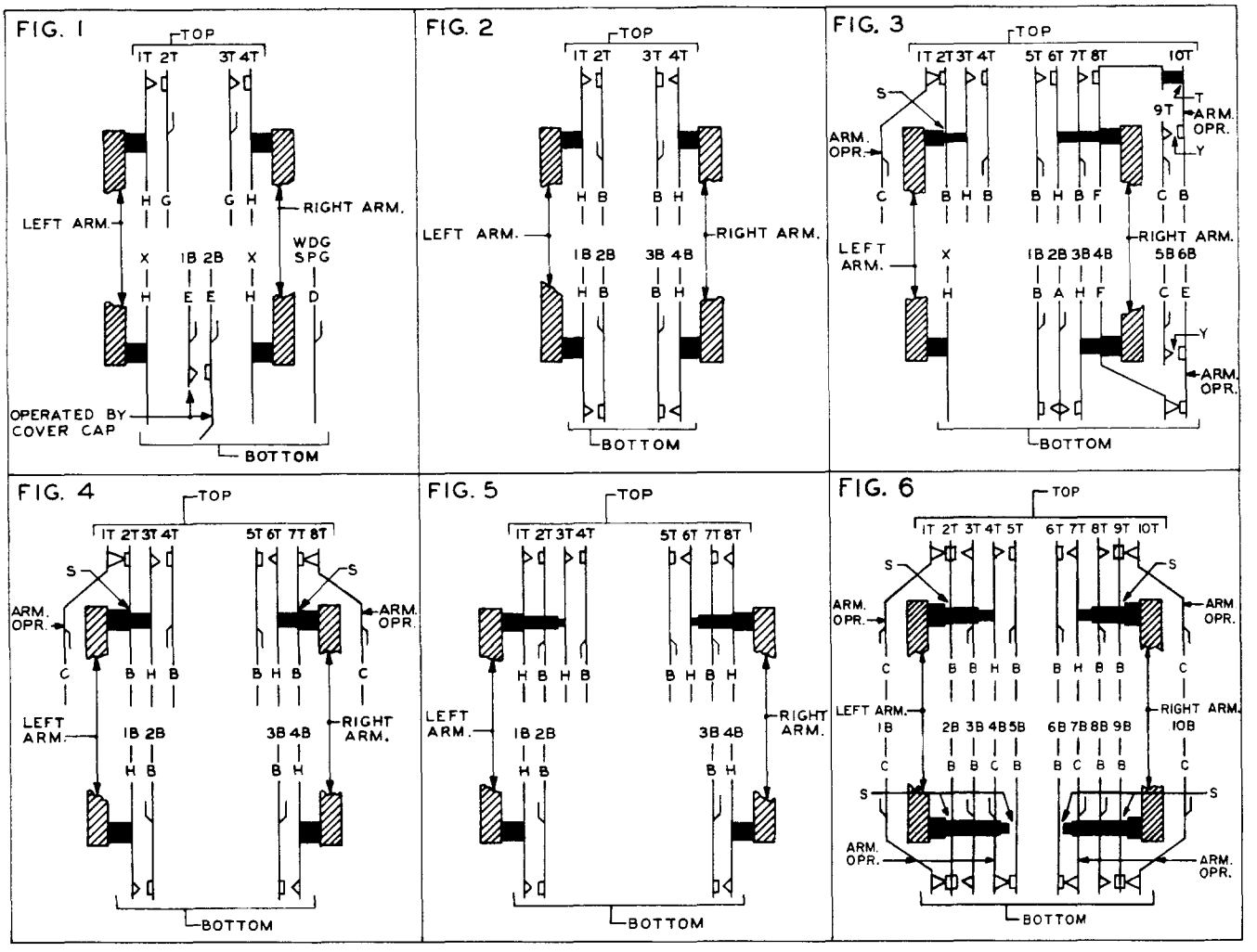
(a) ***Stud Gaps Designated S:*** With the relay unoperated, there shall be a slight clearance between the stud and the spring at the points designated S in the figures below.

Gauge by eye.

Check this requirement with the associated armature resting against the adjusting nut.

(b) ***Stud Gaps Designated T:*** With the relay electrically operated, there shall be a slight clearance between the stud and the spring at points designated T in the figures below.

Gauge by eye.



All Springs Tensioned Toward Their Associated Armature

Min Tension in Grams

CONT PRESS		SPRING DESIGNATIONS							
		A	B	C	D	E	F	G	H
L	T	5	8	25	Note D	20	Y	100	Note H
	R	6	9	27	Note D	22	Y	105	Note H
H	T	5	15	25	Note D	20	Y	100	Note H
	R	6	17	27	Note D	22	Y	105	Note H

Note D: Tension to rest firmly against spoolhead

Note H: Tension to hold armature against adjusting nut

S & T — Stud Gap — See Reqt. 2.15

X — Balancing Spring

Y — Tension of F spring shall be sufficient to insure .005 inch separation at Y contacts

⊢ — Spoolhead Spring

2.16 ***Contact Make:*** With the relay electrically energized, against a gauge of the thickness indicated below inserted between the stop pins and core, all normally open contacts associated with the armature which is operated shall make.

RELAY	TEST	READJUST
266A	0.008 inch	0.010 inch
All except 266A	0.003 inch	0.004 inch

Use the 66D gauge.

To check for contact closure, apply the KS-6320 orange stick to the front end of the spoolhead spring and attempt to move the spring toward the associated spring as shown in Fig. 108. Any movement of the spring without a corresponding movement of the associated spring indicates that the contact is not closed.

Note: When checking this requirement with the cover removed, the relay may require more than the specified operate current due to the cover effect.

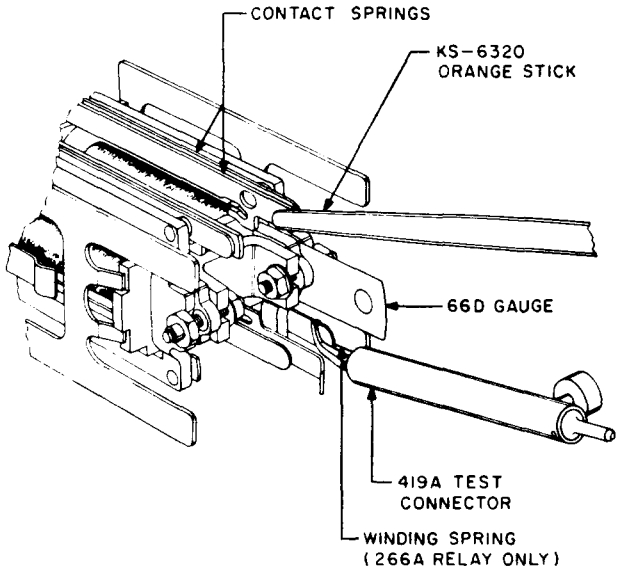


Fig. 108 – Method of Checking Contact Make (266A relay)

2.17 ***Contact Follow of Springs Actuated by Stud on Cover Cap (266A relay):*** Fig. 109 — The contact follow on springs actuated by the stud on the cover cap shall be

Min 1/32 inch

Gauge by eye.

To check this requirement, hold the cover cap horizontally in front of the cover as shown in Fig. 109. The requirement is met if the maximum contact separation between the springs is observed to be maximum 1/32 inch, and at least 1/2 the offset portion of the actuating spring is to the right of the outer surface of the stud as designated by (A) in Fig. 109.

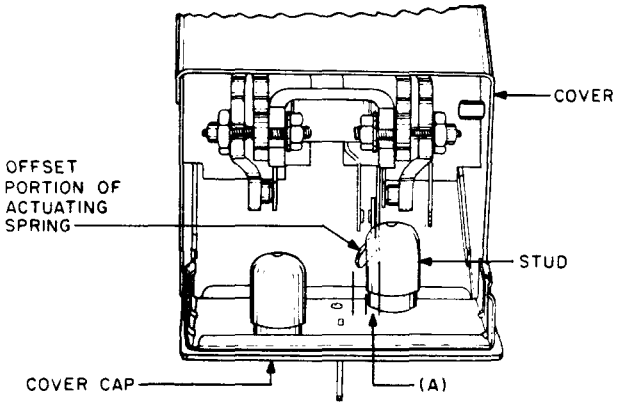


Fig. 109 – Method of Checking Contact Follow — 266A Relay Only

2.18 ***Contact Separation:*** Fig. 107(D) — 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

266A Relay	— Min .010 inch
Other 266 Relays	— Min .005 inch

Use the 74D gauge.

2.19 ***Spring Sequence:*** The relay shall meet the spring sequence requirements shown on the figures on page 5 or any other spring sequence specified on the circuit requirements table.

Gauge by eye.

2.20 ***Electrical Requirements***

(a) The relay shall meet the electrical requirements specified in the Circuit Requirements Table.

Note: (266 relay only) The message register 100 operation test shall apply only to relays where the associated line registers have been installed and cross connected to

the relay. If only one register has been installed, it shall apply only to that half of the relay to which the register is cross connected.

(b) The electrical requirements 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
TOOLS	
74	5/32- and 7/32-Inch Hex. Open Double-End Flat Wrench
206	30-Degree Offset Screwdriver
207	90-Degree Offset Screwdriver
259	Spring Adjuster
300	Spring Adjuster
419A	Test Connector
474A	3/16- and 1/4-Inch Hex. Closed Double-End Offset Wrench
485A	Smooth-Jaw Pliers
534D	Spring Adjuster
KS-6320	Orange Stick
—	3-Inch C Screwdriver (or the replaced 3-inch cabinet screwdriver)
—	4-Inch E Screwdriver (or the replaced 4-inch regular screwdriver)
GAUGES	
66D	Thickness Gauge Nest (consists of a nest of 67-type gauges)
70H	0-30 Gram Gauge
70J	0-150 Gram Gauge
74D	Thickness Gauge Nest
MATERIALS	
—	Hardwood Toothpicks, Flat at One End, Pointed at the Other
TEST APPARATUS	
35 Type	Test Set
—	Message Register Test Set SD-20173-01 (for use in battery cut-off relay offices)
—	Message Register Test Set ES-20054-01 (for use in ground cut-off relay offices)

3.01 ***Cleaning*** (Reqt 2.01)

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

3.02 ***Relay Mounting*** (Reqt 2.02)
3.03 ***Vertical Clearance*** (Reqt 2.03)

(1) To tighten mounting screws or to loosen them in order to shift the relay in meeting the requirement for alignment and clearance, use the 4-inch E screwdriver. After tightening or after making any change in the position of the mounting screws, check the electrical requirements.

3.04 ***Cover Cap Tightness, Cover Guide Pressure, and Cover Guide Position*** (Reqt 2.04)

(1) If the cover cap does not fit properly, adjust the cover cap prongs, as required, using the 485A pliers.

(2) If the cover is not held on the relay securely, adjust the cover spring, as required, with the 534D spring adjuster. If the cover spring cannot be adjusted sufficiently by adjusting at the base of the cover spring with the 534D spring adjuster, use the 534D spring adjuster as a lever or bar to push or move the end of the spring in or out sufficiently to insure a good cover fit.

(3) If the cover guides do not rest against the spoolhead, adjust the cover guide tangs with the 534D spring adjuster.

(4) If the clearance between the cover and the ends of the cover guides is excessive, straighten the cover guides, if necessary, with the 534D spring adjuster. If the clearance is

still excessive, adjust the cover guide tangs, as required, with the 534D spring adjuster until the clearance requirement is met. In general, the cover guides will be properly positioned if the tangs are adjusted so that the inside of each cover guide is in line with the outer edge of the associated spoolhead.

Caution: After checking or adjusting, make sure the cover is fully seated and that the position of the cover and cover guides is such as to insure that the cover-operated contacts which control the message registers are fully closed.

3.05 ***Contact Alignment*** (Reqt 2.05)
3.06 ***Armature Stud Clearance*** (Reqt 2.06)
3.07 ***Spring Tang Position*** (Reqt 2.07)

(1) If the contacts do not line up properly, if the tang does not overlap the spoolhead sufficiently, or if stud clearance is not met, attempt to correct the trouble by applying pressure to the end of the springs using the 259 or 300 spring adjuster as shown in Fig. 110, exercising care not to distort or otherwise damage the springs. If the springs cannot be shifted, remove the relay from the mounting plate and loosen the spring assembly clamping screws, with the 3-inch C screwdriver, sufficiently to shift the springs so as to correct the fault. Tighten the spring assembly clamping screws securely if loosened. Before mounting the relay, make the adjustments covered in 3.04 and 3.05 if necessary. Tighten the mounting screws securely when mounting the relay.

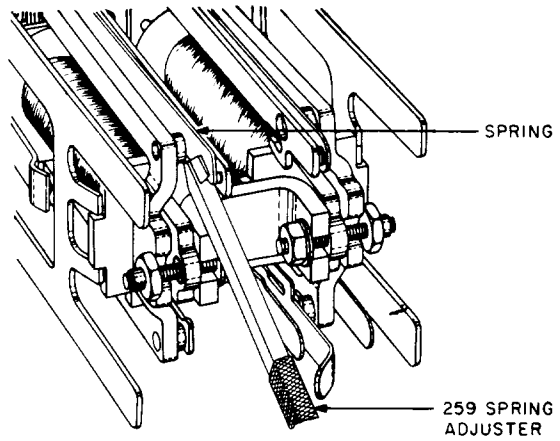


Fig. 110 – Method of Adjusting for Spring Alignment

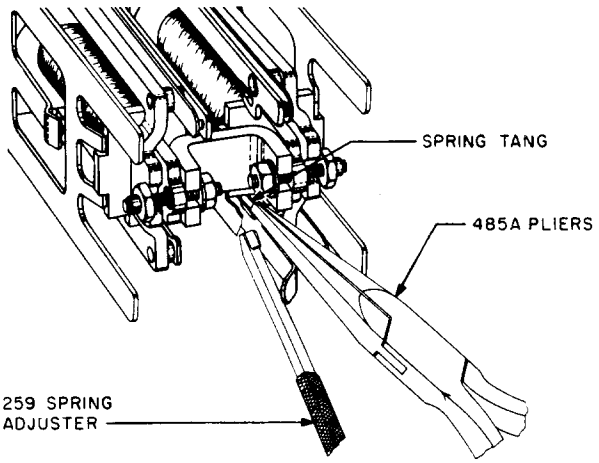


Fig. 111 – Method of Adjusting Spring Tang

3.08 ***Adjusting Stud Clearance*** (Reqt 2.08)

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

(a) If due to a bent adjusting stud, straighten the stud by grasping the nut with the 485A pliers and bending the stud as required. Exercise care not to damage the threads on the stud or loosen the stud.

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

3.09 ***Permanent Magnet Mounting Nut Tightness*** (Reqt 2.09)

→ (1) Tighten loose nuts with the 74 wrench.

3.10 ***Adjusting Nut Tightness*** (Reqt 2.10)

(1) To tighten loose adjusting nuts, back off the adjusting nut from the adjusting stud using the 474A wrench until its slotted portion is free of the stud. Then force the slotted parts of the nut closer together using the 485A pliers as shown in Fig. 112.

3.11 ***Armature Travel*** (Reqt 2.11)

(1) To adjust the armature travel, insert the proper blade of the 66D gauge between the stop pins and core as shown in Fig. 113. Turn the adjusting nut using the 474A wrench until the gauge fits snugly.

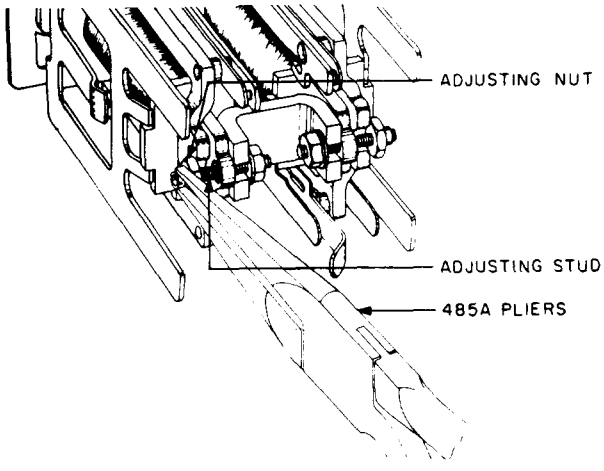


Fig. 112 – Method of Tightening Adjusting Nut on Stud

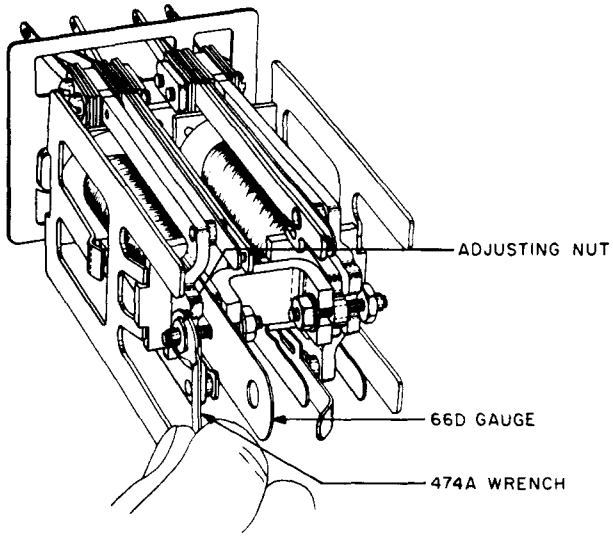


Fig. 113 – Method of Adjusting for Armature Travel

3.12 ***Straightness of Springs*** (Reqt 2.12)
3.13 ***Separation Between Springs*** (Reqt 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 with the 259 or 300 spring adjuster. After adjusting straightness of springs or separation between springs, check to see that requirements 2.14 through 2.19 are met.

3.14 ***Spring Tension*** (Reqt 2.14)
3.15 ***Stud Gap*** (Reqt 2.15)
3.16 ***Contact Make*** (Reqt 2.16)
3.17 ***Contact Follow of Springs Actuated by Stud on Cover Caps (266A relay)*** (Reqt 2.17)
3.18 ***Contact Separation*** (Reqt 2.18)
3.19 ***Spring Sequence*** (Reqt 2.19)

(1) Use the 259 or 300 spring adjuster to adjust the springs for these requirements. Place the adjuster on the front end of the spring just back of the contacts 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. 114. Adjust the spring at this point to the left or right, 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.

(4) ***Spring Tension:*** Spring tensions are specified on a minimum basis. They have, however, in the case of moving springs a direct bearing on the electrical performance of the relay and, if they are greatly in excess of the specified minimum, the relay may fail to meet

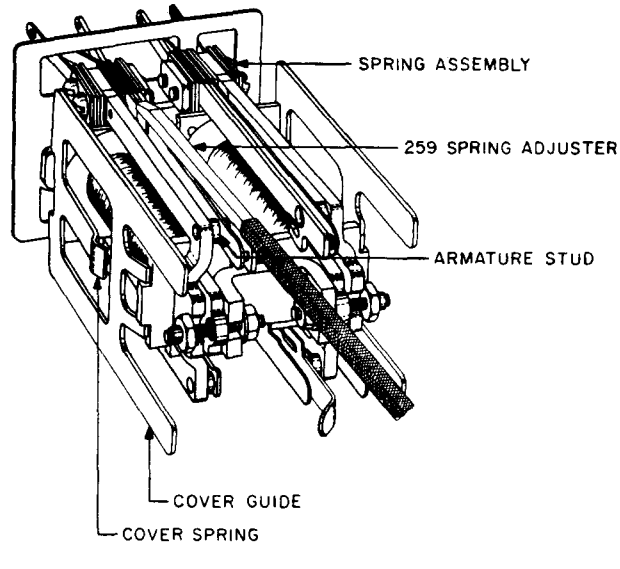


Fig. 114 – Method of Adjusting Spring Tension

its electrical requirement in which case the tensions will have to be reduced. In readjusting, however, it is desirable to have as much tension in the moving springs as is consistent with meeting the other requirements. Attempt to distribute the tensions of the moving springs proportionately between the top and bottom spring combinations.

(5) ***Stud Gap:*** The stud gap requirement should also be met at the same time springs are adjusted to meet the spring tension requirements. If it is difficult to meet this requirement by a readjustment of the springs, it will be satisfactory to bend the tang a slight amount. Use the 485A pliers to bend the tangs, holding the springs with the spring adjuster as shown in Fig. 111. It is satisfactory if, in making this adjustment, the tang does not rest flat on the spoolhead.

(6) ***Contact Make, Contact Follow, and Contact Separation:*** To correct the contact make, contact follow or contact separation, adjust the spring with the 259 or 300 spring adjuster or the spring tang with the 485A pliers. Adjust the tangs as shown in Fig. 111. It is satisfactory if, in making this adjustment, the tang does not rest flat on the spoolhead. If the contact follow is not satisfactory for the springs actuated by the stud on the cover cap, check that the contact separation does not exceed 1/32 inch and readjust for separation if required. Also check requirement 2.04 and, if the clearance between the cover and cover guides is excessive, readjust the cover guides as outlined in 3.04.

Note: There shall be only one bend in the spring actuated by the cover cap and the bend shall be at an angle of approximately 45 degrees.

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

3.20 ***Electrical Requirements*** (Reqt 2.20)

(1) ***266A Relay:*** With the cover off, adjust the armature travel to .025 inch. Adjust the spring tension, contact make, stud gap, and contact separation until the electrical requirements are met. To meet the operate requirement, decrease the spring tension, contact make, and contact separation toward a minimum. To meet the nonoperate requirement, increase the spring tension. It may be found advantageous to adjust the relay stiff, that is, close to its operate readjust requirement, as the relay will operate more readily when the cover is in place. Remount the cover and check the electrical requirements. If necessary, adjust the armature travel within the specified tolerances (see 2.11) until the requirements are met. If the electrical requirements cannot be met in this manner, remove the cover and reset the armature travel and adjust the spring tensions as required, until the requirements can be met with the cover on by adjusting the armature travel.

(2) When making the message register 100 operation test, first block the contact springs which are normally operated by the stud on the cover cap, as shown in Fig. 115.

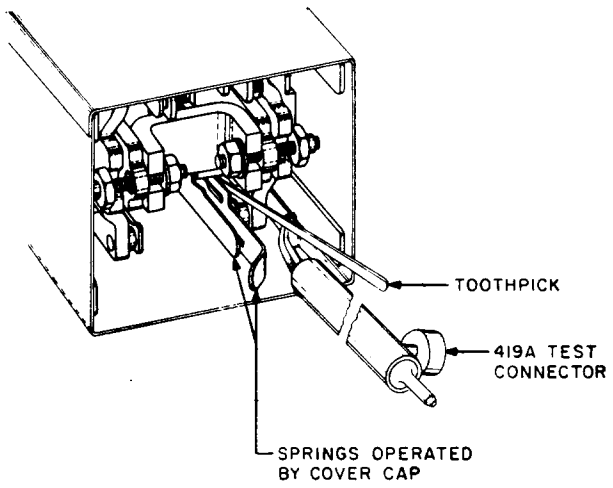


Fig. 115 – Method of Blocking Cover Cap Operated Contact Springs

(3) ***Relays Other Than 266A:*** With the cover off, adjust the armature travel to the value specified on the circuit requirement table. Adjust the spring tension, contact make, stud gap, and contact separation until the electrical requirements are met. To meet the operate or hold requirement, decrease the spring tension, contact make, and contact separation toward a minimum or increase the stud gap. To meet the nonoperate requirement, increase the spring tension. For relays having nonoperate

requirements specified, it may be found advantageous to adjust the relay stiff, that is, close to its operate readjust requirement, as the relay will operate more readily when the cover is in place. Remount the cover and check the electrical requirements. If the electrical requirements are not met, remove the cover and adjust the spring tension, contact make, contact separation, and stud gap until the requirements can be met when the cover is in place.

REASONS FOR REISSUE

1. To add requirements for heavy bar-type contacts [2.05(b)].
2. To add Fig. 104.
3. To revise Fig. 105.
4. To add Fig. 6.
5. To revise the List of Tools, Gauges, Materials, and Test Apparatus (3.001).