BSP #857B

RELAYS
271, 282 AND 310 TYPES
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers the 271-, 282- and 310-type relays.

1.02 This section is reissued to add requirements and adjusting procedures for 310-type relays, and to revise the List of Tools. 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 proper application of the requirements listed herein.

1.04 The 271-, 282- and 310-type relays consist of U-, Y- and UA-type relays, respectively, having standard contact springs in the top spring combination, combined with a thermal unit which consists of a heater unit and associated bimetallic contact springs in the bottom spring combinations.

1.05 *Operate*

(a) The U-, UA- or Y-type portion of the relay is said to ***operate*** if, when current is connected to its winding, the armature moves sufficiently to meet the following conditions.

All Relays: All normally open contacts close and all normally closed contacts open.

271- and 310-Type Relays: At least one stop disc of the armature rests against the core.

282-Type Relays: The embossed surface of the armature rests against the core.

(b) The thermal unit of the relay is said to operate if, when current is connected to the heater unit winding, the bimetallic contact spring adjacent to the winding, or the contact spring on which the winding is mounted, moves sufficiently to break contact with the opposing bimetallic contact spring in the case of normally closed contacts, or to make contact in the case of normally open contacts.

1.06 ***Release:*** A relay is said to ***release*** if, when the current is reduced abruptly to the release value or current is removed, the armature moves from the core to its unoperated position in which the armature is resting against the

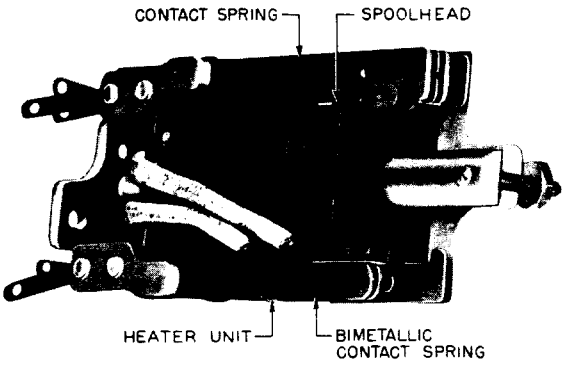


Fig. A – 271-Type Relay — General View Showing Thermal Unit

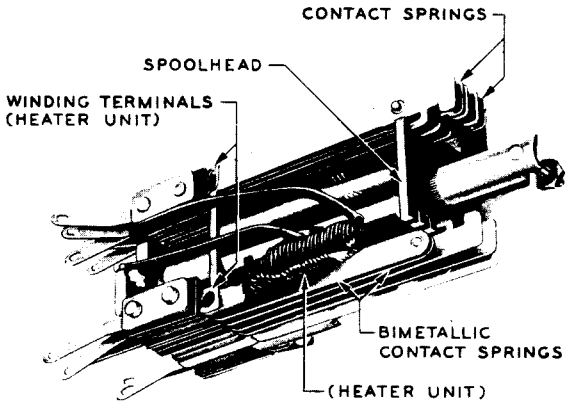


Fig. B – 282-Type Relay — General View Showing Thermal Unit

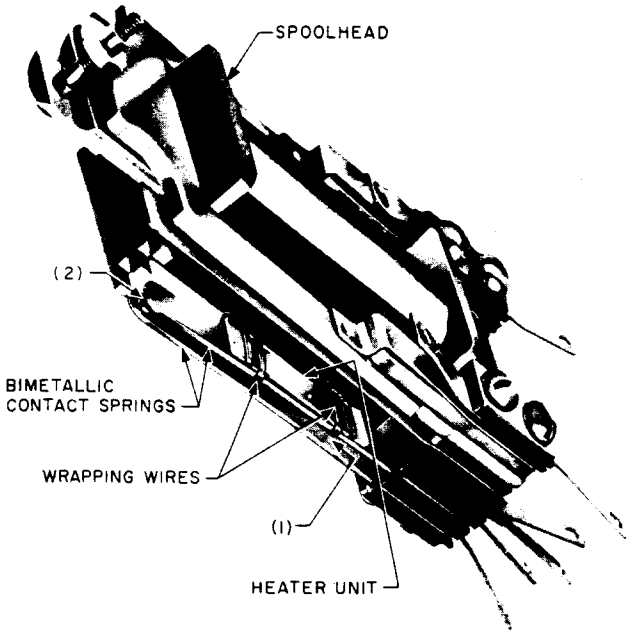


Fig. C – 310-Type Relay — Bottom View Showing Thermal Unit

adjusting nut and all normally open contacts are open and all normally closed contacts are closed.

1.07 ***Hold:*** A relay is said to ***hold*** if, after the current is reduced abruptly from the soak or operate value to the hold value, the armature does not move from the operated position.

1.08 ***Armature gap*** is the gap between the core and the nearer stop disc, or the embossing on the armature in any position the armature may assume between the unoperated and operated positions of the U-, UA- or Y-type portion of the relay.

1.09 ***Armature travel*** is the armature gap when the armature is resting against the adjusting nut.

1.10 The term ***contact spring,*** when used in this section, includes, unless otherwise specified, the contact bars welded to the end of the spring. The front end of the spring may or may not be bifurcated.

1.11 ***A pretensioned spring*** is a spring which has been tensioned during manufacture. Such a spring may be recognized by one or more distinct bends between the insulators and the contact end of the spring. Since the bends in pretensioned springs are formed during manufacture to provide the necessary tensions, these bends should not be disturbed during adjustment.

1.12 ***A pair of contacts,*** as referred to in this section, consists of a single-contact bar on one contact spring and the corresponding contact bar on the opposing contact spring.

1.13 The terms ***contact make*** or ***break*** apply to the electrical circuit between the two springs. Contact make may involve the closing of only one pair of two pairs of contacts. Contact break involves the opening of both pairs of contacts.

1.14 The year of manufacture is stamped on the spoolhead preceded by dashes, three to indicate the first quarter, two the second quarter, one the third quarter, or none the last quarter.

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. After cleaning any contacts on springs of the top spring combination, a check shall be made to see that both contacts on the bifurcated spring involved close as specified in requirement 2.19(c).

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

Gauge by feel by grasping the core and armature between the thumb and forefinger and attempting to move the relay.

2.03 ***Vertical Clearance***

(a) The clearance between the 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) Springs and thermal unit winding shall not touch the relay cover.

Gauge by eye.

2.04 ***Cover Spring and Cover Guide Pressure and Cover Cap Tightness***

(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. D(1) — The cover spring shall bear on the front spoolhead when the cover is off.

Gauge by feel.

(c) Fig. D(2) — The free end of the cover guide shall bear on the core when the cover is removed.

Gauge by feel.

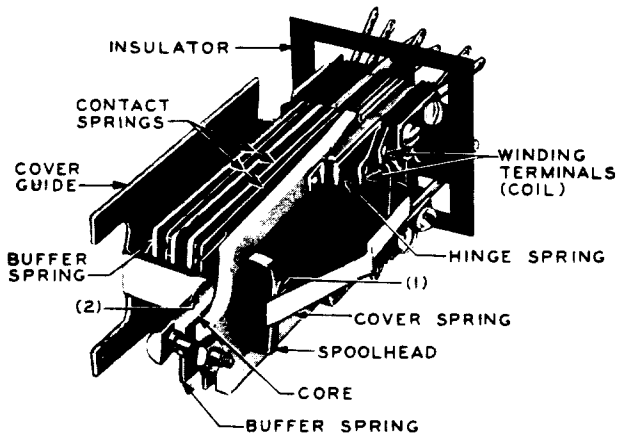


Fig. D – Relay Arranged for Mounting Individual Cover — 282-Type Relay Shown

2.05 ***Contact Alignment***

(a) Fig. E(1) — The contact alignment on springs of the top spring combination shall be within the limits indicated in Fig. E.

Gauge by eye.

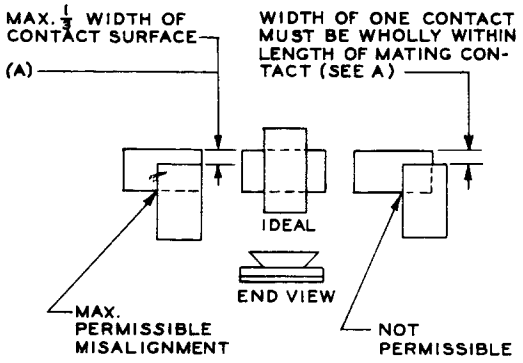


Fig. E – Alignment of Heavy Contacts — Plan View of Contact Surfaces

(b) Fig. F(1) — The contacts on the bimetallic springs shall line up so that the point of contact falls wholly within the boundary of the opposing contact.

Gauge by eye.

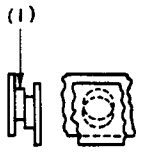


Fig. F – Alignment of Contacts on Bimetallic Springs

2.06 ***Spring Tang Position:*** Fig. G

(a) The spring tang shall not rub on the spoolhead when moved from its normal position of rest on the spoolhead in the direction of travel of the spring.

Gauge by eye.

(b) The spring tang shall overlap the spoolhead as shown in Fig. G(1) and:

(1) On 271-type relays manufactured prior to the second quarter of 1948, the full width of the spring tang shall lie within the projection of the top and bottom edges of the slots in the spoolhead.

(2) On all 282- and 310-type relays and 271-type relays manufactured during the second quarter of 1948 and subsequently,

the spring tang may project 1/3 its width above the top edge of the slot in the spoolhead as shown in Fig. G(2).

Gauge by eye.

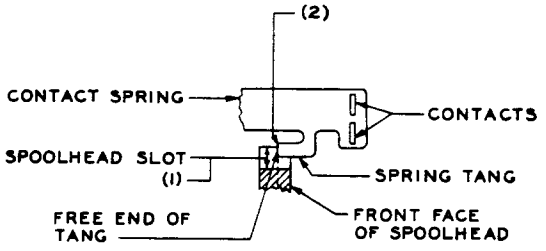


Fig. G – Spring Tang Position

2.07 ***Adjusting Stud Clearance:*** Fig. H(1) — There shall be a clearance between the armature and the adjusting stud in all positions of the armature travel.

Gauge by eye.

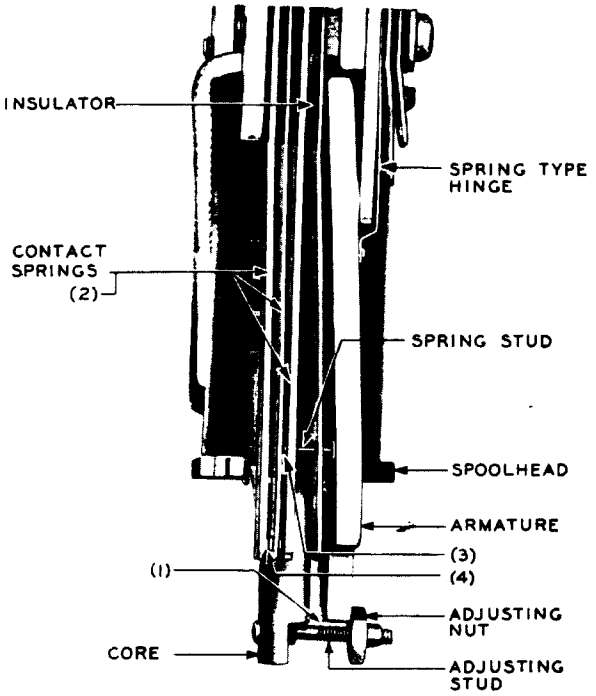


Fig. H – Top View — 271-Type Relay Shown

2.08 ***Adjusting Nut Tightness:*** The adjusting nut shall be sufficiently tight on the stud to prevent its being turned with a torque of 3 ounce-inches.

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 70D 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 40 grams is applied at right angles to the wrench in a clockwise direction as shown in Fig. I.

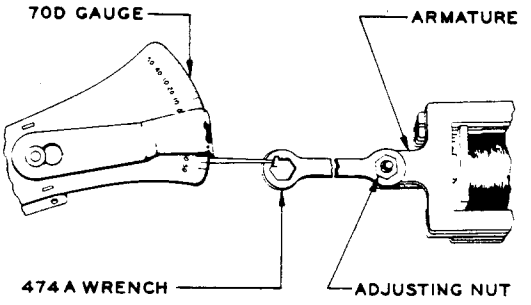


Fig. I – Method of Checking Tightness of Adjusting Nut

2.09 ***Armature Position:*** Fig. J(1) — Both legs of the armature shall bear against the →hinge bracket with the U, UA, or Y portion of the relay in the operated position, and shall also bear against the hinge bracket after the relay has released.

Operate the relay electrically and gauge by eye.

2.10 ***Armature Travel:*** The armature travel shall be in accordance with the value specified for the relay in the armature travel column of the circuit requirement table. The armature travel tolerance shall be

+0.003 inch

Use the 131A gauge.

To check the armature travel requirement, attempt to insert a 131A gauge, 0.003 inch larger than the specified gap, into the gap with the long axis of the gauge in a horizontal position as shown in Fig. K. If the gauge enters, it should enter with a tight fit. Do not force the gauge.

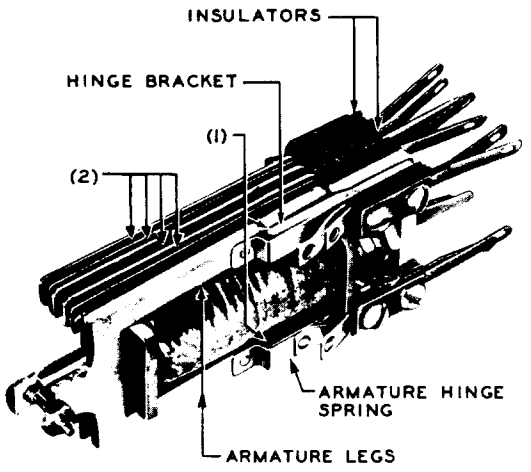


Fig. J – Position of Armature — 282-Type Relay Shown

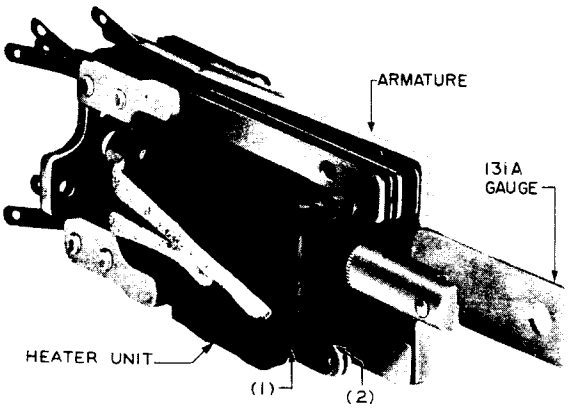


Fig. K – Position of Gauge When Checking Armature Travel — 271-Type Relay Shown

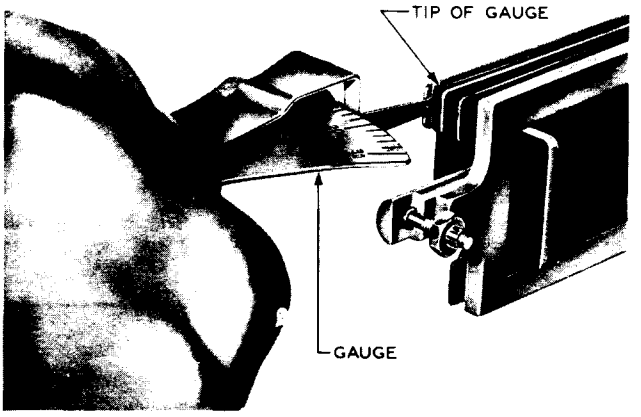


Fig. L – Method of Checking Spring Tension

2.11 *Spring Tension*

(a) *General*

(1) The tension of each spring measured in grams shall be in accordance with the information given in the particular figures on page 6, which are referred to in the Fig. No. column of the circuit requirement table.

(2) The springs shall be tensioned toward the armature, unless otherwise specified. 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 the armature through a stud shall register the required tension just as the stud leaves the armature. Use the 70H or 70J gauge to check the tension. Apply the gauge so that the tip of the gauge engages both prongs of the bifurcated springs as indicated in Fig. L. When gauging tensions on solid springs, apply the tip of the gauge near the front end of the spring just in front of the contacts.

(b) *A Springs*

(1) Where the letter A appears associated with a particular spring, it means that this spring need have no definite tension, but shall be tensioned toward the armature. The combined tension of all A springs on the relay shall be sufficient to hold the armature against the adjusting nut with sufficient pressure to insure that requirement 2.13 is met.

(2) Where the relay is equipped with a pin-type hinge, in no case shall the tension in one spring combination be more than 2-1/2 times that in the other spring combination.

To check this, block the armature unoperated, using the 508A armature blocking tool. Check the pressure of the stud against the armature by applying the tip of the 70H gauge to the A spring just in front of the stud.

(c) *E Springs (bimetallic springs)*

(1) *271- and 282-Type Relays:* The E spring adjacent to the thermal unit winding shall be tensioned against the opposing E spring to meet the following requirements.

Relays Manufactured Prior to Second Quarter of 1955

RELAY	TEST	READJUST
†271-type	No reqt	Min 25 grams Max 30 grams
††282-type	Min 20 grams Max 27 grams	Min 21 grams Max 26 grams

† Use the 70D gauge (see below).
†† Use the 70H gauge (see below).

Relays Manufactured During Second Quarter of 1955 and Subsequently

RELAY	TEST	READJUST
271-type	Min 20 grams Max 27 grams	Min 21 grams Max 26 grams
282-type	Min 20 grams Max 27 grams	Min 21 grams Max 26 grams

Use the 70H gauge

To check 271- and 282-type relays, apply the tip of the 70D or 70H gauge, whichever is specified, in front of the contact of the E spring adjacent to the thermal unit winding.

→ (2) *310-Type Relays:* Normally open E
→ springs have no tension requirement.

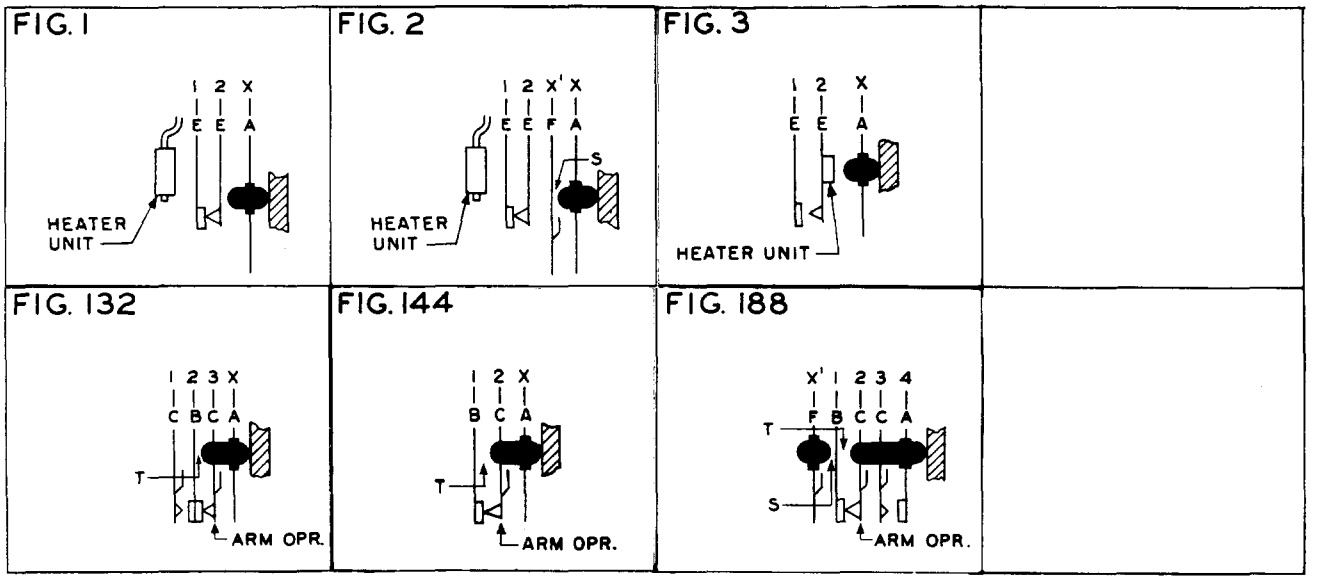
(d) *Buffer Springs*

(1) Buffer springs designated X′ (in association with the letter F) are provided on the 282-type relays to aid in meeting the electrical requirements. The buffer spring shall be used only if spring tension, in addition to that provided by the other springs, is required to meet the specified release current flow requirements. Either or both buffer springs shall be used as required for the individual relay.

(2) The tension of each X′ buffer spring designated F used shall be

Test — Min 20 grams, Max 125 grams
Readjust — Min 25 grams, Max 125 grams

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



All Springs Except E Springs Tensioned Toward Armature

SPRING	MIN TENSION IN GRAMS TEST	READJ	H CONT PRESSURE
A =	—	—	See Reqt 2.11(b)
B =	18	20	
C =	25	30	
E =	—	—	See Reqt 2.11(c)
F =	—	—	See Reqt 2.11(d)

T — Stud Gap — See Reqt 2.18(a)
S — Stud Gap — See Reqt 2.18(c)
γ — Spoolhead Springs
X — Balancing Spring
X′— Buffer Spring

2.12 ***Position of X' Buffer Springs Designated F***

(a) Each buffer spring used in meeting the release electrical requirement shall meet the following requirements.

(1) ***Readjust Only:*** When the relay is electrically energized against a 0.013-inch gauge inserted in the armature gap as shown in Fig. K, there shall be a perceptible stud gap at the stud which operates the buffer spring.

Use the 131A gauge.

(2) When the relay is electrically energized against a

Test — 0.004-inch
Readjust — 0.006-inch

gauge inserted in the armature gap as shown in Fig. K, there shall be no stud gap at the stud which operates the buffer spring.

Use the 131A gauge.

(b) If an X' buffer spring designated F is not used, there shall be a stud gap at the stud which operates the buffer spring when the relay is electrically operated.

Gauge by eye.

2.13 ***Armature Back Tension:*** Fig. M(1)—The armature shall be held against the adjusting nut with a pressure of

RELAY	TEST	READJUST
271- and 282-type	Min 18 grams	22 grams
310-type	Min 5 grams	9 grams

Use the 70H or 70J gauge.

To check this requirement, apply the gauge to the back of the armature, as indicated in Fig. M, at a point approximately midway between the points where the stop discs are normally located on the 271- or 310-type relay, or at a point opposite the center of the embossed surface on the 282-type relay.

2.14 ***Spring Stud Clearance:*** The spring studs shall clear the springs through which they pass in all positions of the armature travel.

Gauge by eye.

2.15 ***Straightness of Springs:*** Fig. H(2) — All springs other than pretensioned springs shall be free of sharp bends or kinks due to adjustment, except that in the case of thin (0.013 or 0.018 inch) springs, a kink is permitted provided it is within 1/4 inch from where the spring leaves the insulators. A gradual bow in a spring is permissible.

Note: Relays with pretensioned springs were not manufactured prior to the third quarter of 1949.

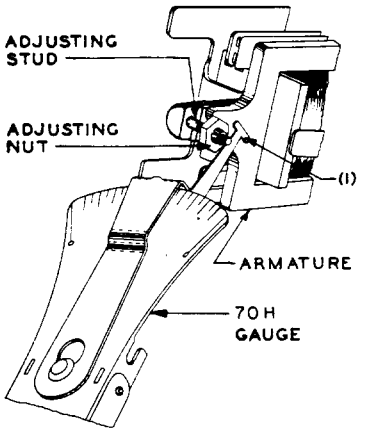


Fig. M – Method of Checking Armature Back Tension

2.16 ***Separation Between Springs:*** Fig. J(2) — 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.

2.17 ***Bimetallic Contact Spring Clearance***

(a) ***271- and 282-Type Relays:*** Fig. K(1) — There shall be a clearance between the nearest point on the thermal unit winding and the adjacent bimetallic spring, with the spring in the unoperated position, of

Relays Manufactured Prior to Second Quarter of 1955

271-type Min 0.040 inch
282-type Min 0.062 inch

Relays Manufactured During Second Quarter of 1955 and Subsequently

271- and 282-type Min 0.062 inch

Gauge by eye.

The thickness of each bimetallic spring is 0.030 inch.

(b) *310-Type Relay:* Fig. C(1) — There shall be a clearance between the heater unit wrapping wire and the adjacent bimetallic spring, with the spring in the unoperated position, of

Min 0.032 inch

Gauge by eye.

The thickness of each bimetallic spring is 0.030 inch.

(c) Fig. K(2) — The clearance between the edge of the bimetallic springs and the spoolhead shall be

Min 0.016 inch

Gauge by eye.

The thickness of the top combination spring nearest the armature is 0.013 inch.

2.18 *Stud Gap:* Fig. H(3)

(a) ***Stud Gap Designated T:*** With the relay unoperated, the clearance between the stud and the spring at the points designated T in the figures on page 6 shall be

Min 0.006 inch

This requirement is met if there is a clearance between the spring and the stud with the 133A gauge inserted between the armature and the end of the stud which rests against the armature.

Gauge by eye.

(b) The use of the 510C test lamp equipped with the 561A straight tip to illuminate the stud gap will facilitate gauging this requirement. Do not attempt to check the stud gaps by moving the armature toward the core manually since, when the armature is released, it may not restore to its position against the front ends of the yoke, thus causing false contact operation. To check the stud gaps, place the 510C test lamp so that the gap is illuminated on the side away from the eye and sight through the stud gap toward the light as shown in Fig. N.

(c) ***Stud Gaps Designated S:*** With the relay unoperated, there shall be a perceptible clearance between the spring studs and the spring at the points designated S in the figures on page 6.

Gauge by eye. See requirement 2.18(b).

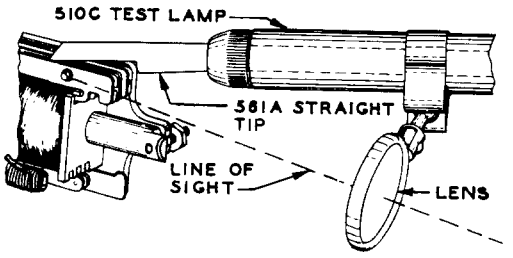


Fig. N — Method of Gauging Stud Gap Using 510C Test Lamp With 561A Straight Tip

→**2.19** ***Contact Make (U- UA- or Y-type relay portion)***

(a) Both contacts on the bifurcated spring shall make with their associated contacts with the relay in the electrically operated position for normally open contacts and in the unoperated position for normally closed contacts.

Gauge by eye and feel.

(b) With the relay electrically energized against a gauge of the thickness indicated below inserted into the armature gap, normally open contacts shall meet the following conditions.

CONTACTS SHALL NOT MAKE	AT LEAST ONE PAIR OF CONTACTS SHALL MAKE
Test — 0.018 inch	***Test*** — 0.008 inch
Readj — 0.015 inch	***Readj*** — 0.010 inch

Use the 131A gauge.

(1) To check that the requirement is met, operate the relay electrically. Release the relay and insert a 131A gauge of the proper thickness in the armature gap, taking care that the long axis of the gauge is horizontal as shown in Fig. K. Energize the relay and note whether the contacts close. In case of doubt as to whether a contact is closed, apply the KS-6320 orange stick to the tip of the solid spring and attempt to move the spring ***toward*** its associated contact spring as indicated in Fig. O. A perceptible movement of the solid spring without a corresponding movement of the bifurcated spring indicates that the contact is not closed. In case of doubt as to whether

the requirement is met, release and reoperate the relay with gauge in place and recheck for contact closure as covered above.

(2) When the circuit requirement table specifies insulating individual contacts on the relay being tested or adjusted, it will be satisfactory when checking for contact make to remove the insulating paper when checking the individual contacts. In this case, it may be necessary to open the contact manually, using the KS-6320 orange stick to release this relay.

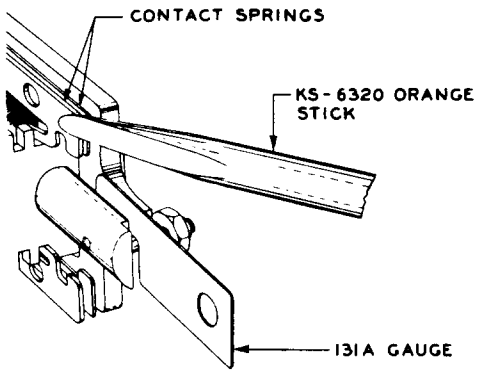


Fig. O – Method of Checking Contact Make

(c) ***Readjust Only (after turnover):*** Whenever a particular contact requires cleaning or build-up removal or when readjustments are made on a contact spring, the following requirements shall be met, in addition to (b), on the contacts affected by the cleaning or the adjustment.

(1) ***Normally Open Contacts:*** Both contacts on the bifurcated spring shall make when the relay is energized against a 0.004-inch gauge inserted as covered in (b).

Use the 131A gauge.

(2) ***Normally Closed Contacts:*** Both contacts on the bifurcated spring shall break from their associated contacts at approximately the same time.

Operate the relay manually and gauge by eye.

2.20 ***Contact Separation (except normally closed contacts of bimetallic springs):*** Fig. H(4) and C(2) — The separation between each pair of contacts normally open, or between each pair of contacts that are opened when the relay is electrically operated, shall be

Min 0.005 inch

Gauge by eye.

On normally closed contacts the requirement is met if the contacts break when the relay is electrically energized against a 0.004-inch blade of the 131A gauge inserted into the armature gap. To check contact separation on relays on which the contacts are pitted, manually move the spoolhead spring toward its associated spring. A perceptible movement of the spring (at least 0.005 inch) before the contacts make indicates a satisfactory minimum contact separation.

2.21 ***Contact Sequence:*** The normally closed contacts of the break-make unit shall break before the normally open contacts of such a unit make.

Gauge by eye.

2.22 ***Electrical Requirements:*** The relay shall meet the electrical requirements specified in the circuit requirement table.

3. ADJUSTING PROCEDURES

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

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
300	Spring Adjuster
363	Spring Adjuster
474A	3/16- by 1/4-Inch Closed Double-End Offset Wrench
505A	Spring Adjuster (for 0.013-inch springs)
506A	Spring Adjuster (for 0.018-inch springs)
507A (2 reqd)	Spring Adjuster (for 0.030-inch springs)
508A	Armature Blocking Tool

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
510C	Test Lamp [must be equipped with No. 561A straight tip and W2CB (24V) or W2BL (48V) cord]
582A	Spring Adjuster (for 0.030-inch spring tangs next to core — 310-type relays)
KS-6320	Orange Stick
—	3-Inch Cabinet Screwdriver
—	4-Inch Regular Screwdriver
—	6-1/2-Inch P-Long-Nose Pliers
GAUGES	
70D	50-0-50 Gram Gauge
70H	0-30 Gram Gauge
70J	0-150 Gram Gauge
131A	Thickness Gauge Nest
133A	Stud Gap Gauge
TEST APPARATUS	
35 Type	Test Set

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

(1) Clean the contacts and other parts of the relay in accordance with Section 069-306-801. After cleaning, check that requirement 2.19(c) is met, and if necessary, adjust as covered in 3.19.

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

(1) To tighten mounting screws, use the 4-inch regular screwdriver. To position the relay on the mounting plate, slightly loosen the mounting screws of the relay affected with the 4-inch regular screwdriver, and shift the relay as required. Retighten the mounting screws securely, taking care that the relay is in proper alignment and that there is the specified clearance both above and below the relay.

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

(1) If the cover spring does not rest on the spoolhead or if the cover is not held securely on the relay, adjust the spring with the 300 spring adjuster, applying it near the crook in the spring as shown in Fig. P. If it is not possible to correct the condition in this manner, proceed as covered under (2).

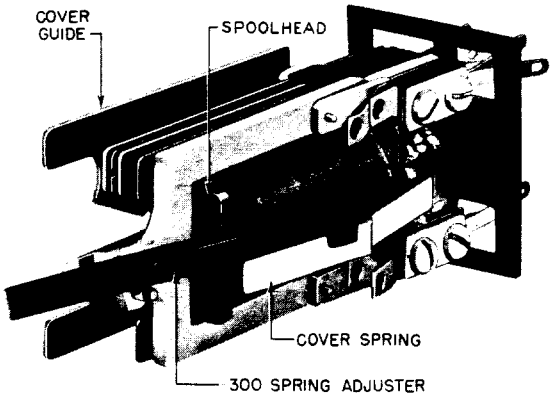


Fig. P — Method of Adjusting Cover Spring Pressure — 271-Type Relay Shown

(2) Remove the relay from the mounting plate, and remove the screws which hold the cover guide and cover spring in position, using the 3-inch cabinet screwdriver. Adjust the cover spring manually by bowing it at the crook in the spring. To adjust the cover guide after it has been removed, bend the part that is secured by the screws, as required, using the P-long-nose pliers. Remount the cover guide and the cover spring, and tighten the mounting screws securely. Remount the relay and position it to meet requirement 2.02.

(3) If the cover cap does not fit properly, adjust the cover cap prongs, as required, using the P-long-nose pliers.

3.05 ***Contact Alignment*** (Reqt 2.05)
3.06 ***Spring Tang Position*** (Reqt 2.06)

(1) If the contacts do not line up properly or if the tang does not overlap the spoolhead sufficiently, it is probably due to the springs having shifted in the assembly. In this case, refer the matter to the supervisor.

3.07 ***Adjusting Stud Clearance*** (Reqt 2.07)

(1) If the armature rubs against the adjusting stud, grasp the adjusting nut with the P-long-nose pliers, and bend the adjusting stud as required. In this operation, exercise care not to damage the threads on the stud or to loosen the stud. If the stud cannot be adjusted to provide the proper clearance in this manner or if the stud is loose in the core, refer the matter to the supervisor.

3.08 ***Adjusting Nut Tightness*** (Reqt 2.08)

(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 P-long-nose pliers as shown in Fig. Q.

3.09 ***Armature Position*** (Reqt 2.09)

(1) If the armature does not rest against the front ends of the hinge bracket after the relay has been electrically operated and released, check that the tension of the balancing springs in the top and bottom spring combinations are approximately equal. If they are not approximately equal, adjust as covered in 3.11 to 3.17. If, after making this adjustment, the requirement is still not met in both the operated and unoperated positions of the relay, it is an indication that the hinge bracket is not properly positioned or the armature hinge pins are bent. In this case, refer the matter to the supervisor.

3.10 ***Armature Travel*** (Reqt 2.10)

(1) To adjust the armature travel, insert into the armature gap, as shown in Fig. R, the 131A gauge corresponding to the armature travel specified on the circuit requirement table. Take care that the long axis of the gauge is parallel to the horizontal center line of the core. Turn the adjusting nut with the 474A wrench until friction is felt against the gauge. Remove the gauge and check that requirement 2.08 is met.

3.11 ***Spring Tension*** (Reqt 2.11)
3.12 ***Position of X' Buffer Springs Designated F*** (Reqt 2.12)
3.13 ***Armature Back Tension*** (Reqt 2.13)
3.14 ***Spring Stud Clearance*** (Reqt 2.14)
3.15 ***Straightness of Springs*** (Reqt 2.15)
3.16 ***Separation Between Springs*** (Reqt 2.16)
3.17 ***Bimetallic Contact Spring Clearance*** (Reqt 2.17)

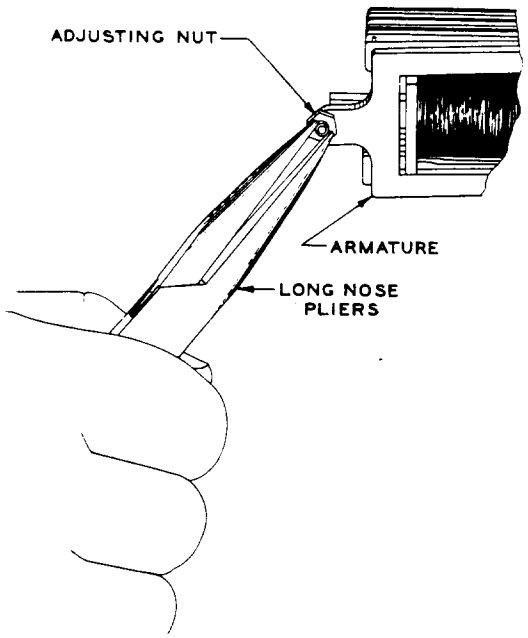


Fig. Q – Method of Tightening Adjusting Nut on Stud

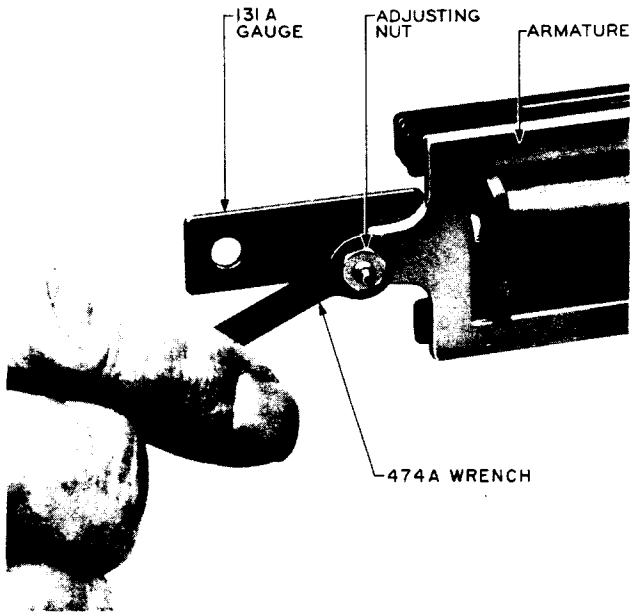


Fig. R – Method of Adjusting Armature Travel

Spring Tension

(1) 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 its electrical requirements, in which case it will be necessary to reduce the tensions. Attempt to distribute the tensions of the moving springs proportionately between the top and bottom spring combinations.

(2) To adjust the spring for tension, use the 505A spring adjuster for 0.013-inch springs, the 506A spring adjuster for 0.018-inch springs, and the 507A spring adjuster for 0.030-inch springs. It is especially important to use the 505A spring adjuster on 0.013-inch springs since the use of any adjuster having a wider slot may result in unsatisfactory adjustment and may affect the adjustment of the adjacent springs.

Pretensioned Springs

(3) When the springs have been pretensioned, do not attempt to remove the bends as the adjustment will be destroyed. Exercise care not to slide or draw the spring adjuster over a bend in a pretensioned spring.

(4) To adjust a pretensioned spring for tension, place the slotted portion of the spring adjuster against the spring to be adjusted on the side toward the mating spring just behind the contacts. Tilt the adjuster so that it rests on the mating spring, and using this spring as a guide, slide the adjuster back to the base of the spring. Roll the adjuster over the spring to be adjusted so that the spring fits into the slot in the adjuster. When adjusting a balancing spring or a buffer spring, use an adjacent spring as a guide. Adjust the spring to the right or left, as required, taking care not to tilt the spring or disturb adjacent springs. Do not adjust the spring any more than necessary since repeated adjustments may injure the spring. Take care when adjusting the springs to adjust them in line with their movement and to avoid tilting. Tilted contact springs cause unequal contact separation of the two pairs of contacts and may result in the failure of one of the contacts on the bifurcated spring to close. If the requirements cannot be met, refer the matter to the supervisor.

(5) If the studs touch the springs through which they pass, it may be due to a twist in the spring to which the stud is attached. To correct this, apply the proper spring adjuster to the spring at fault as covered in (4), except that in this case do not slide the adjuster to the base of the spring. Adjustment should be made at a point at least 1/4 inch forward from the insulators but not over a pretensioned bend. Adjust the spring so that there is the required clearance between the stud and the springs.

Nonpretensioned Springs

(6) To adjust a nonpretensioned spring for tension, place the spring adjuster on the spring just back of the operating stud and slide it back to the base of the spring as indicated in Fig. S. Adjust the spring to the right or to the left, as required, exercising care not to disturb adjacent springs. Do not adjust the spring any more than is necessary since repeated adjustment may injure the spring. Take care when adjusting the springs to adjust them in line with their movement and to avoid tilting. Tilted springs cause unequal contact separation of the two pairs of contacts and may result in the failure of one of the contacts on the bifurcated spring to close.

(7) If the spring is excessively bowed or bent or if there is not the proper clearance between springs or between the thermal unit winding and the adjacent spring, straighten the spring before adjusting to meet the spring tension requirement. To straighten the spring, apply the proper spring adjuster to the spring just back of the bow or bend, and while exerting pressure to the right or left, as required, draw the spring adjuster forward the length of the bow. Repeat this operation, as required, until the spring is approximately straight. Take care when making this adjustment to avoid tilting the springs.

Caution: On 310-type relays, do not adjust the bimetallic spring on which the heater unit winding is mounted. When adjusting the mating bimetallic contact spring, exercise care not to disturb the heater unit or the wrapping wires.

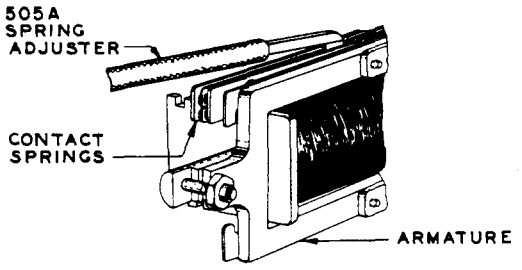


Fig. S – Method of Adjusting Spring Tension

(8) If the desired tension cannot be obtained by adjusting as outlined in (6) 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. S. 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, as indicated in Fig. T. Then move the adjuster to the base of the spring and adjust as covered in (6). 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.

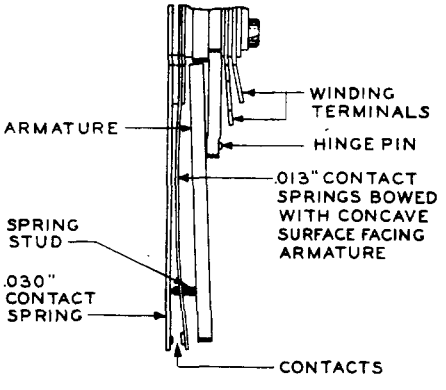


Fig. T – Position of Bowed Spring Before Final Tension Adjustment

(9) If the studs touch the springs through which they pass, it is probably due to a twist in the spring to which the stud is attached. To correct this, apply the proper spring adjuster to the spring at fault and adjust it so that there is the required clearance between the stud and the springs.

(10) ***Kinked Springs:*** Do not straighten kinked springs unless the kink interferes with proper adjustment of the spring assembly. Removing kinks tends to weaken the spring and to shorten its life. Normally straight springs that have been adjusted should have no sharp bends due to adjustment, except that a kink near the base of thin (0.013 and 0.018 inch) springs is permissible when necessary to obtain required tension. A gradual bow, however, is permissible.

Adjustment for Pressure of Armature Against the Adjusting Nut

(11) If the armature is not held against the adjusting nut with the specified pressure (or where the relay is equipped with a pin-type hinge and the portion of this pressure in one spring combination is more than 2-1/2 times that of the other spring combination), alter the tension of the A springs, as necessary, using the proper spring adjuster as covered in (4) or (6) depending on whether the relay is equipped with pretensioned or nonpretensioned springs, respectively.

To check the tension of the A spring in each spring combination, block the armature unoperated, using the 508A armature blocking tool, and apply the tip of the 70H gauge to the A spring just in front of the stud.

Buffer Spring Position (282-type relays)

(12) When it is necessary to adjust the tension of a buffer spring having F tension, check it for position in accordance with requirement 2.12 and adjust it as required in accordance with 3.18(1).

Bimetallic Contact Spring Clearance

(13) If the clearance does not meet the requirements, this may be due to a distorted spring or the wrapping wires becoming loose. If the wrapping wires are loose, refer the matter to the supervisor. If the spring is distorted, adjust it as covered in (7).

3.18 *Stud Gap* (Reqt 2.18)
3.19 *Contact Make* (Reqt 2.19)
3.20 *Contact Separation* (Reqt 2.20)
3.21 *Contact Sequence* (Reqt 2.21)

Stud Gap and Contact Make

(1) To adjust to meet these requirements, adjust the spring tangs to the right or left as required, using the 507A spring adjuster on 271- and 282-type relays and the 582A spring adjuster on 310-type relays. While adjusting the tang, hold the spring with a 507A spring adjuster as shown in Fig. U. It is satisfactory if, in making this adjustment, the spring tang does not rest flat against the spoolhead. Exercise care, however, to see that requirement 2.06, covering spring tang position, is met. If failure to meet the contact make requirement is due to misalignment of the prongs of the bifurcated spring, adjust the individual prongs with the 363 spring adjuster so that both prongs are approximately in the same vertical plane.

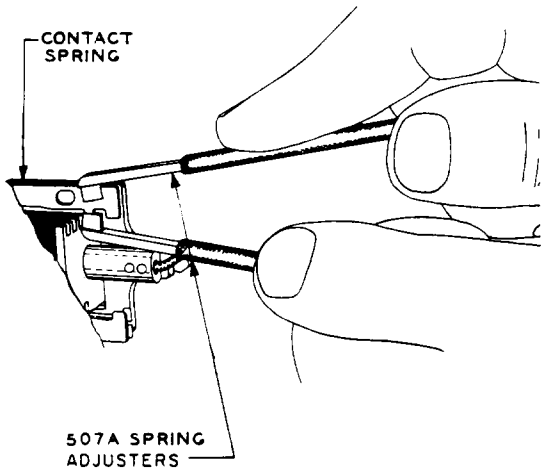


Fig. U – Method of Adjusting Spring Tang on 271- and 282-Type Relays

(2) Adjust so that there are stud gaps at the points indicated in the spring combinations figures on page 6. The use of the 510C test lamp equipped with the 561A straight tip to illuminate the stud gap will facilitate making this adjustment. Where it is necessary to check the stud gaps by moving the armature toward the core manually, operate the relay electrically two or three times after checking the stud gap to restore the armature to its position against the front ends of the yoke, thus preventing false contact operation.

Contact Separation

→ (3) *U-, UA-, and Y-Type Portion:* To correct the contact separation, adjust the spring tang on spoolhead springs as covered in (1) or adjust the moving springs with a 505A spring adjuster. In adjusting the front contact separation, adjust the spring tangs on the spoolhead spring so that the contact separation is sufficient to insure that the spring sequence requirement will be met under operating conditions. If the requirement is not met due to the misalignment of the prongs of the bifurcated spring, adjust the individual prongs with the 363 spring adjuster so that the contact separation at both prongs is approximately the same and so that the two prongs of the bifurcated spring are approximately in the same vertical plane.

(4) *Thermal Portion (310-type relay):* To correct the contact separation, place the 507A spring adjuster on the bimetallic contact spring that does not have the heater unit mounted on it. Slide the spring adjuster to the base of the spring. Adjust the spring to the right or left as required.

Caution: In making this adjustment, take care not to disturb the heater wrapping wires on the adjacent bimetallic contact spring.

Contact Sequence

(5) To adjust for contact sequence, modify the spring tensions, contact make, stud gap, and contact separation adjustments as required.

3.22 *Electrical Requirements* (Reqt 2.22)

→ **271- and 310-Type Relay (U- and UA portion)**

(1) Decrease the tension of the moving springs (including balancing springs) toward the minimum to meet the operate requirements. If the requirements cannot be met in this manner, increase the stud gap as covered in 3.18. If the requirements still cannot be met, check that the armature rests against the hinge bracket in the operated position, and if it does not, refer the matter to the supervisor.

282-Type Relay (Y-type portion)

(2) Operate the relay on the specified soak current or operate current if no soak is specified, and check for hold and release. If the relay fails to release in approximately 1-1/2 seconds, add tension to the weaker buffer spring, making repeated checks for operate, hold, and release, and observing 3.09(1) until the relay just fails to hold. Then reduce this tension just sufficiently to cause the relay to hold on its hold current.

Caution: If too much reliance is placed on the buffer springs to meet the release requirement, a slowing up of the armature movement or a complete stop of the armature may result when it picks up the buffer spring load. If this occurs, adjust the buffer spring or springs to be picked up later in the armature stroke within the limits specified in requirement 2.12(a), and if necessary, increase the tension of the moving springs of both spring assemblies.

(3) When adjusting relays to meet the release requirements, adjust the relays to release on as high a current as possible consistent with meeting the operate and hold requirements. It is desirable to obtain this higher release by using the buffer springs in conjunction with the moving springs, rather than attempting to overtension the moving springs.

(4) If a relay fails to operate on its specified operate current, note whether it fails to start or whether it operates part way and then stops. If the relay fails to start, its initial load is too great and tension must be removed from the moving springs which are tensioned directly or indirectly against armature in the normal position. Locate the moving springs having high tensions and remove the required amount of tension from them.

(5) If the armature, in operating, stops or hesitates perceptibly when the buffer spring load is picked up, check for correct buffer spring pickup as covered in requirement 2.12, and correct if necessary. Repeat the operate test, and if the armature still stops or hesitates when the buffer spring load is picked up, remove tension from the buffer spring having the higher tension or from both springs, as required.

271- and 282-Type Relay (thermal unit portion)

(6) If the relay fails to meet the thermal unit timing requirements specified on the circuit requirement table, attempt to correct this condition by adjusting the bimetallic spring tension toward the maximum, using the method specified under 3.17(6). If the relay still fails to meet its electrical requirements, refer the matter to the supervisor.

310-Type Relay (thermal unit portion)

(7) If the relay fails to meet the thermal unit timing requirements specified on the circuit requirement table, adjust the contact separation as required, using the procedure covered in 3.18-3.21(4). If the relay still fails to meet the requirements, refer the matter to the supervisor.

REASONS FOR REISSUE

1. To revise the general information to cover 310-type relays (1.01, 1.04, 1.05, and 1.08).
2. To add Fig. C.
3. To amplify the requirement covering spring tang position to cover 310-type relays (2.06).
4. To amplify the requirement covering armature position to cover 310-type relays (2.09).
5. To revise the requirement covering spring tension to cover 310-type relays (2.11).
6. To add Fig. 3 and 144.
7. To amplify the requirement covering armature back tension to cover 310-type relays (2.13).
8. To revise the requirement covering bimetallic spring clearance to cover 310-type relays (2.17).
9. To amplify the requirement covering contact make to cover 310-type relays (2.19).
10. To amplify the requirement covering contact separation to include 310-type relay (2.20).
11. To revise the List of Tools (3.001).
12. To revise adjusting procedure covering bimetallic contact spring clearance (3.17).
13. To revise the adjusting procedures covering stud gap, contact make, and contact separation (3.18, 3.19, and 3.20).
14. To revise the adjusting procedures covering the electrical requirements (3.22).