

280-TYPE RELAYS REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

- 1.01 This section covers 280-type relays.
- 1.02 This section is reissued to revise the procedure covering contact travel, to reword the procedures covering electrical requirements, contact make, and pulse repeating requirements in order to refer to the circuit conditions instead of the operation of the REV key of the test set. Detailed reasons for reissue are shown at the end of the section.
- 1.03 Reference shall be made to Section 020-010-711 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 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 The letters A and B shown in the "BSP Fig." column on the circuit requirement tables indicate the particular adjustment to apply to the relay. Adjustment A applies to relays without biasing springs and adjustment B applies to relays equipped with biasing springs.
- 1.06 When applying the A or B adjustment, the magnetic balance is obtained electrically by using the operate and nonoperate readjust current flow values shown in the first two lines of the electrical requirements or the corresponding values in the case of parallel requirements.
- 1.07 Application of adjustments A and B will be facilitated by use of the J94724A contact closure test set as covered in Section A702.019. This test set includes the No. 587A contact closure indicator which provides a positive means of indicating opened or closed contacts. However, the adjustments can be applied without the use of the test set, in which case observation of the contacts when applying these adjustments may be facilitated by use of the No. 510C test lamp.
- 1.08 The 280-type relay supersedes the 206- and 239-type relays. However, in some cases, the circuit requirement tables have not been reissued to specify the superseding 280-type relay. In these cases where a 206- or 239-type relay is ordered as a replacement relay and a 280-type relay is received in its place, see Section 040-267-711 for the necessary information for installing and adjusting the 280-type relay.
- 1.09 Operated Position of Armature: On a relay not equipped with a biasing spring or on a relay equipped with a biasing spring, the tension of which has been released from the armature, the armature may rest against either the right- or left-hand contact in the operated position. When positive battery is connected to the inner end of the winding, the armature is held against the right-hand contact, and when negative battery is connected to the inner end of the winding, the armature is held against the left-hand contact. On a relay equipped with a biasing spring which is tensioned against the armature, the operated position is that position in which the armature rests against the left-hand contact.
- 1.10 Unoperated Position of Armature: The unoperated position is the reverse of the operated position. Where used, the biasing spring positions the armature against the right-hand contact.
- 1.11 Operate: A relay is said to operate if, when current is connected to its winding, the armature moves from its unoperated position and makes reliably with the contact toward which it moves.
- 1.12 Nonoperate: A relay is said to nonoperate, if the armature does not move from the unoperated position sufficiently to cause the closed contact to become unreliable.
- 1.13 Hold: A relay is said to hold if, after the relay is operated and the current is reduced abruptly, the armature does not move from its operated position sufficiently to open the contact which has been closed.
- 1.14 Release: A relay is said to release if, when the current in the winding is reduced, the armature returns to the unoperated position.
- 1.15 Dust and dirt on the contacts or pole-piece screws will seriously affect the operation of these relays. In view of this the cover or cover cap should not be removed unnecessarily, and care should be exercised to see that requirement 2.04(b) is met in order to insure a dustproof joint at the back end of the plate on the cover cap.

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2. REQUIREMENTS

2.01 Cleaning: The contacts and other parts shall be cleaned when necessary in accordance with Section O22-100-811.

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

Gauge by feel by grasping the base of the relay with the thumb and forefinger.

2.03 Cover Clearance

(a) There shall be a clearance between the cover of the relay (including the cover cap) and any adjacent apparatus including relay covers.

Gauge by eye.

(b) When the relay is mounted on a channel-type mounting plate, there shall be a clearance between the relay cover and the flanges of the mounting plate of

Min 1/64 inch

Gauge by eye.

2.04 Cover Cap: Fig. 1

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

Gauge by eye and feel.

(b) The tension of the cover cap prongs shall hold the cover cap snugly against the cover in such a position that the cover cap overlaps each side of the cover by approximately equal amounts.

Gauge by eye.

*2.05 Flexible Contact Spring Alignment: The contact springs shall bear against each other on at least one point and shall not have more than a 0.002-inch gap at any point across the front edges.

Gauge by eye.

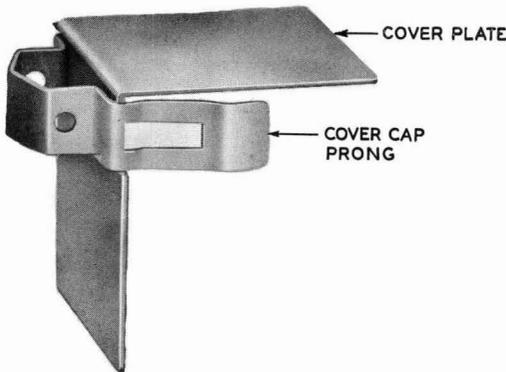


Fig. 1 - Cover Cap

2.06 Biasing Spring Position

(a) Fig. 2(A) - There shall be a clearance between the armature and the coil portion of the biasing spring.

Gauge by eye.

(b) Fig. 2(B) - With the relay in the final adjustment, the straight portion of the biasing spring shall rest approximately flat against the armature. This shall be considered satisfactory if the top end of the straight portion rests against the armature, and the clearance, if any, between the bottom edge of the armature and the straight portion of the biasing spring does not exceed 0.020 inch.

Gauge by eye.

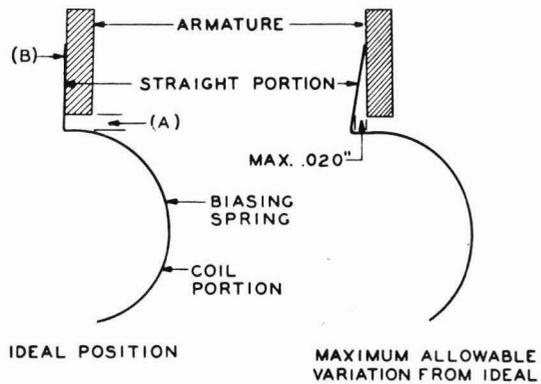


Fig. 2 - Allowable Variation in Biasing Spring Position

2.07 Armature and Spool Clearance: The armature shall not touch the inside of the spool in any position which the armature may assume with the relay either operated or unoperated.

Gauge by eye.

2.08 Contact Alignment: Fig. 3(A) - Contacts shall line up so that the point of contact falls wholly within the boundary of the opposing contact.

Gauge by eye.

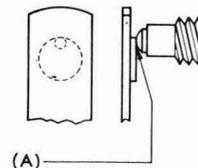


Fig. 3 - Contact Alignment

***2.09 Tightness of Contact and Biasing Screws:**

Fig. 4(A) - Contact and biasing screws shall be sufficiently tight in their brackets and biasing spring supports respectively, to hold any adjusted position.

Gauge by feel.

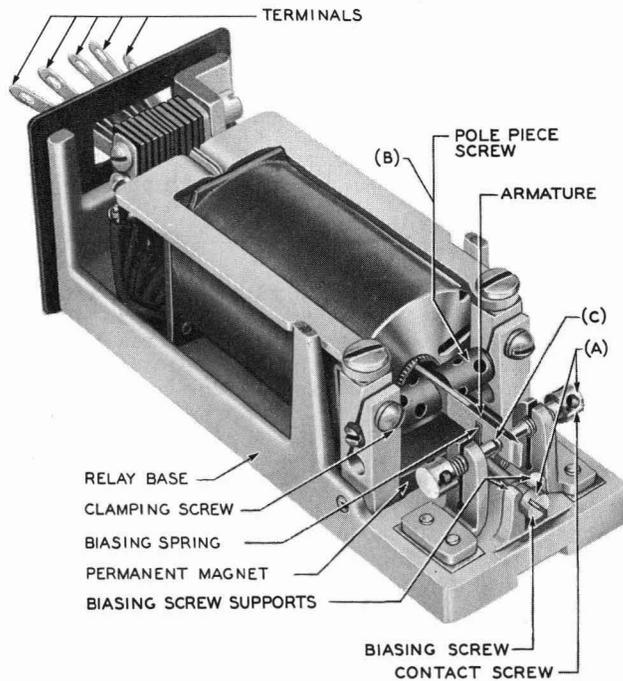


Fig. 4 - 280-type Relay

***2.10 Tightness of Pole-piece Screws:**

Fig. 4(B) - Pole-piece screws shall be held sufficiently tight in the pole piece by the clamping screws to hold them in any adjusted position and still permit the pole-piece screws to be turned.

Gauge by feel using the No. 340 adjusting key.

2.11 Contact Travel: Fig. 4(C) - The contact travel shall be

Min 0.004 inch
Max 0.006 inch

Use the No. 74D gauge, applied between the armature and either contact. On relays equipped with a biasing spring, measure the contact travel on the left side with the armature in the unoperated position and on the right side with the relay operated on the test operate current. To measure the contact travel on relays not equipped with a biasing spring, operate the relay on the test operate current to position the armature on one side and then reverse the current so that the armature moves to the other side.

If there is a difference between the measured travel on opposite sides of the armature, it is an indication that the contact on the side

of the armature having the smaller travel has a buildup. In this case, recondition the contacts in accordance with Section 022-100-811 in order to meet the requirement on both sides.

2.12 Electrical Requirements

(a) The relay shall meet the electrical requirements specified on the circuit requirement table. These requirements are defined as follows:

(1) **Test Requirements:** Relays for which an A adjustment is specified shall meet the test operate current flow requirement and the test nonoperate of open circuit (OC) in both directions. The test requirement of open circuit (OC) means that the armature shall remain on the contact to which it was operated by the soak current, after the soak current has been removed. Relays for which a B adjustment is specified are only required to meet the test current flow requirements with the biasing spring tensioned against the armature. These test values are shown subsequent to the first two lines on the circuit requirement table. For the B adjustment, no test requirements are specified in the first two lines of the Test column.

(2) **Readjust Requirements:** Relays for which an A adjustment is specified shall meet the readjust current flow requirements of operate and nonoperate in both directions. Relays for which a B adjustment is specified shall meet the readjust current flow requirements of operate and nonoperate in both directions with the tension of the biasing spring released from the armature. The requirements for this part of the adjustment are shown on the first two lines of the circuit requirement table. These relays shall also meet the additional readjust current flow requirement shown subsequent to the first two lines with the biasing spring tensioned against the armature.

Note: Where the circuit requirement table specifies an adjusting network, check the electrical requirements with the adjusting network connected.

(b) Where no release current flow value or (OC) is specified on the circuit requirement table, relays having biasing springs shall release on open circuit.

2.13 Contact Make: With a 0.003-inch gauge inserted between the pole-piece screw and the associated armature stop pin on the side to which the armature is operated and the relay electrically operated on the soak current, the contacts shall make. This requirement shall also be met with the armature operated in the opposite direction.

Use the No. 92P gauge.

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2.14 Pulse Repeating Requirements: When specified on the circuit requirement table, the relay shall meet the pulse repeating requirement covered in Sections A490.813 and A492.708.

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, and Test Apparatus

<u>Code or Spec No.</u>	<u>Description</u>
<u>Tools</u>	
340	Adjusting Key
363	Spring Adjuster
485A	Smooth-jaw Pliers
510C	Test Lamp [Must be equipped with No. 561A Tool (straight tip) and W2CB (24V) or W2BL (48V) cord]
KS-6320	Orange Stick
KS-6854	3-1/2-inch Screwdriver
-	6-1/2-inch P-long-nose Pliers
-	3-inch Cabinet Screwdriver
-	4-inch Regular Screwdriver
<u>Gauges</u>	
70D	0-50 Gram Gauge
74D	Thickness Gauge Nest
92P	0.003-inch Nonmagnetic Offset Thickness Gauge
<u>Test Apparatus</u>	
35 Type	Test Set
J94724A	Contact Closure Test Set (SD-95365-01) (includes No. 587A contact closure indicator)
R-2717 (Not reqd when J94724A test set is used)	Filter

3.01 Cleaning (Rq 2.01)

- (1) Clean the contacts and other parts when necessary in accordance with Section 022-100-811.

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, taking care that the cover clearance requirement is met.

3.03 Cover Clearance (Rq 2.03)

- (1) If the cover clearance requirement is not met, loosen the relay mounting screws with the 4-inch regular screwdriver and shift the relay as required.

3.04 Cover Cap (Rq 2.04)

- (1) If the cover cap does not fit properly, adjust the cover cap prongs as required with the fingers.
- (2) If the coverplate of the cover cap does not fit snugly against the outside of the cover, adjust the position of the coverplate by bending as required with the fingers.

3.05 Flexible Contact Spring Alignment (Rq 2.05)

- (1) If the tips of the flexible contact springs do not rest against each other properly, proceed as follows. Back off the contact screws with the No. 340 adjusting key and adjust the tips of the springs as required, using the No. 363 spring adjuster. Check that the flexible springs rest against each other in line with the armature with a pressure of 20 to 50 grams measured on one spring at the contact, with the other spring held so that it cannot follow its mate. Use the No. 70D gauge to measure the tension and hold the other spring with the flat end of the KS-6320 orange stick. If necessary, adjust the tension by applying the No. 363 spring adjuster to the spring as close as practicable to the point where it is joined to the armature. Adjust the spring toward or away from the other contact spring as required, at the same time keeping the contact springs in good alignment with the armature and with each other. Reset the contact screws and adjust for contact travel as covered in 3.11(2), (3), or (4).

3.06 Biasing Spring Position (Rq 2.06)

- (1) If there is no clearance between the armature and the coil portion of the biasing spring, remove the biasing spring screw by pulling it out while turning it slightly back and forth. Use the P-long-nose pliers to grasp the head of the screw. Exercise care in this operation not to damage the biasing spring as a forcible removal of the screw will damage the spring. Then reduce the size of the outer coil of the spring by grasping the spring between the thumb and forefinger and turn the biasing screw in a direction which will tighten the spring on the biasing screw. Exercise care not to wind the spring more than necessary to reduce the diameter of the coil the required amount. Remount the biasing screw.
- (2) If the biasing spring does not rest flat against the armature with the relay in adjustment, remove the biasing screw from the relay as covered in (1) and adjust the flat portion of the biasing spring with the No. 485A smooth-jaw pliers.

(3) If the biasing spring is distorted to the extent that it cannot be satisfactorily adjusted, as covered in (1) and (2), replace it with a new biasing spring assembly.

3.07 Armature and Spool Clearance (Rq 2.07)

3.08 Contact Alignment (Rq 2.08)

(1) If the armature does not clear the inside of the spool, remove the relay from the frame and remove the cover. Slightly loosen the screws holding the armature to its support, using the 3-inch cabinet screwdriver. Then move the armature up or down as required to bring it into an approximate central position with respect to the coil, noting that the contacts are in alignment.

(2) To align the contacts from front to rear proceed as outlined in (1), shifting the armature in or out as required. If satisfactory alignment cannot be obtained in this manner, loosen the screws holding the contact screw brackets to the base of the relay and then move the brackets until the contacts line up properly. It is desirable to set the contact screw brackets so that the contact screws strike the contacts on the armature as near the center as possible. Tighten the screws securely and remount the relay.

3.09 Tightness of Contact and Biasing Screws (Rq 2.09)

(1) If the contact screws are not sufficiently tight in the bracket, remove the screw from the bracket and force the two parts of the bracket closer together with the P-long-nose pliers. Use the No. 340 adjusting key to remove and replace the contact screws.

(2) If the biasing screw does not fit tightly in the biasing screw supports, refer the matter to the supervisor. Do not attempt to tighten by applying pressure to the biasing screw supports. To remove the biasing screw, proceed as outlined in 3.06(1).

3.10 Tightness of Pole-piece Screws (Rq 2.10)

(1) If the pole-piece screws do not meet the requirement, adjust the clamping screws with the KS-6854 screwdriver as required.

3.11 Contact Travel (Rq 2.11)

(1) If necessary, remove the buildups from the contacts in accordance with Section 022-100-811.

(2) If complete readjustment for contact travel is required, proceed as follows. Where a biasing spring is furnished, back it off and loosen the pole-piece clamping screws with the KS-6854 screwdriver. Back off the pole-piece screws as far as possible and the contact screws sufficiently to permit the armature to assume its free position.

When the contact closure test set is available, adjust the contact travel as covered in (3) except where the circuit requirement table specifies special contact travel, in which case proceed as in (4). Where the contact closure test set is not available, adjust for contact travel as covered in (4).

(3) Using the Contact Closure Test Set:

Remove the 0.009-inch blade from the No. 74D gauge nest and insert it between the tips of the flexible contact spring. Allow the gauge to be held in position by the tension of the springs. Turn in one contact screw with the No. 340 adjusting key as shown in Fig. 5 until the lamp just lights. Repeat the operation with the other contact screw. Remove this gauge and substitute the 0.008-inch blade. Note that neither lamp lights.

(4) Contact Closure Test Set Not Available:

Advance one contact screw as shown in Fig. 4 until it just touches the armature, and then back it off one half the specified contact travel. One twelfth (1/12) of a turn of the contact screw (approximately 1/3 the distance between hole centers in the head of the contact screw) corresponds to approximately a 0.002-inch change in contact travel. Repeat this operation with the other contact screw. Check that the armature does not make contact with either contact screw but stands approximately midway between the contact points. With the No. 74D gauge, check that the contact travel measured at the contacts is within the specified limits.

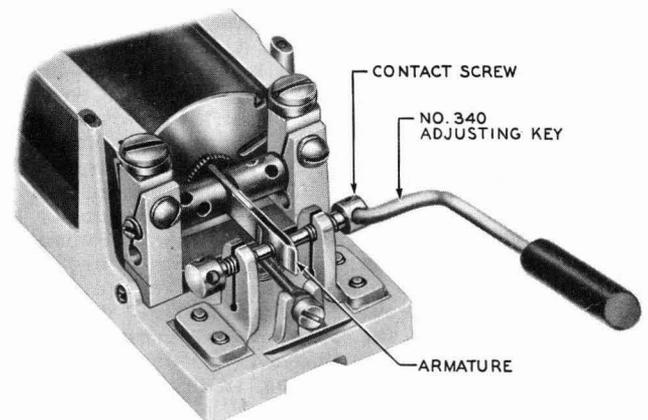


Fig. 5 - Method of Adjusting for Contact Travel

3.12 Electrical Requirements (Rq 2.12)

3.13 Contact Make (Rq 2.13)

3.14 Pulse Repeating Requirements (Rq 2.14)

(1) Use the 35-type test set for application of current values. When adjusting relays which have soak requirements as part of the adjustment, apply the soak current associated with the operate, nonoperate, hold,

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or release requirement before applying the requirement itself. On adjustments where the biasing spring is not involved, apply the requirements in both directions. For relays bridged by a condenser and where the circuit requirement table specifies an adjusting network, use the J94724A contact closure test set or the R-2717 filter. The contact closure test set and the filter provide a capacitor of 4.28 to 4.36 microfarads in series with 4600 ohms ± 1 per cent and also a resistor of 500 ohms ± 1 per cent.

(2) The particular adjusting procedure to be followed depends upon the adjustment letter specified in the "BSP Fig." column of the circuit requirement table. These adjustments are designated A and B and are covered in the following paragraphs.

Adjustment A - Relays Without Biasing Springs

(3) The readjust operate and nonoperate current flow values for this adjustment appear on the first two lines shown on the circuit requirement table. Use the corresponding values in the case of parallel requirements.

(4) Adjust the relay for contact travel as covered in 3.11 and then proceed as follows.

↳ (5) Preliminary Setting of Pole-piece Screws: Apply the soak current to the relay winding continuously. The current shall be applied so that the relay is energized in a direction to move the armature toward the left contact. Then move the left pole-piece screw toward the armature until it engages the armature and has moved the armature sufficiently to break the left contact. Move the left pole-piece screw away from the armature just sufficiently so that the left contact just makes. Repeat the above procedure for the right pole-piece screw with the soak current reversed. Remove the soak current from the relay winding. Tighten the pole-piece clamping screws sufficiently to hold their adjusted position but still permit changes in adjustment.

↳ (6) Application of Operate Requirement: Apply the readjust operate current to the relay winding continuously. The current shall be applied so that the relay is energized in a direction to move the armature toward the left contact. Momentarily apply soak current to the relay winding in the same direction as the readjust operate current. If the left contact is not made prior to the application of the soak current, it will make. Reverse the readjust operate current so that the relay is energized in a direction to move the armature toward the

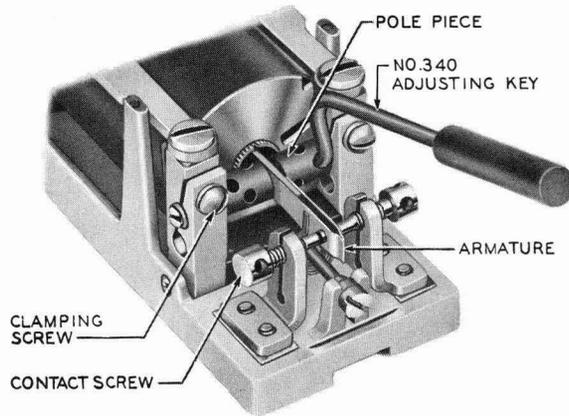


Fig. 6 - Method of Adjusting Pole-piece Screws

↳ right contact, and if the left contact remains closed, move the left pole-piece screw away from the armature until the armature operates to the right contact. Momentarily apply soak current to the relay winding in a direction to keep the armature on the right contact. Reverse the readjust operate current so that the relay is now energized in a direction to move the armature toward the left contact. If the right contacts remain closed, move the right pole-piece screw away from the armature until the armature operates to the left contact. Repeat the above procedure until the armature operates satisfactorily in both directions. Remove the operate current from the relay winding.

↳ (7) Application of Nonoperate Requirement: Apply the readjust nonoperate current continuously in the same manner as that described for the operate current. When the readjust nonoperate current is reversed after a momentary application of the soak current, the armature should not leave the contact. If the nonoperate requirement is not met, turn the pole-piece screw in until the relay meets the requirement, and then recheck (6).

↳ (8) Contact Make: With a 0.003-inch gauge inserted between the pole piece and the associated armature stop pin and with the soak current flowing in the direction tending to hold the gauge, the contacts shall make. This requirement shall be met on both contacts.

Adjustment B - Relays Equipped With Biasing Springs

(9) The adjustment consists of two parts. The first part is applied with the tension of the biasing spring released from the armature and is the same as adjustment A covered in (3) to (8), inclusive. The second part is applied as covered in (10) using

the remaining current flow values specified on the circuit requirement table.

(10) Application of Operate, Nonoperate, Hold, and Release Electrical Requirements With the Biasing Spring Engaged: Tension or remove tension from the biasing spring until the electrical requirements are met, using the 3-inch cabinet screwdriver to adjust the biasing spring screw.

REASONS FOR REISSUE

1. To revise the gauge sizes used in the contact travel procedure [3.11(3)].
2. To reword the electrical requirement procedures by describing circuit conditions instead of referring to REV key of the test set [3.12 to 3.14(1), (5), (6), and (7)].