

280-TYPE RELAYS

REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers the two types of 280-type relays. The older type has clamping screws to lock the pole-pieces. The new type uses plastic pellets under the two upper mounting screws to lock the pole-pieces.

1.02 This section is reissued to revise List of Tools, Gauges, and Test Apparatus and the adjusting procedures in 3.11 and 3.14.

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 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 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 100-138-101. This test set includes the 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 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- and 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. If 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 sufficiently to break contact in one position and to reliably make contact in the opposite position.

1.12 *Nonoperate*: A relay is said to nonoperate if, when current is connected through its winding, 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 to the hold value, 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 ensure a dustproof joint at the back end of the plate on the cover cap.

1.16 Index: The following index lists the items covered in Part 2 of this section. Part 3 is not covered in the index as these items are the procedures corresponding to the individual requirements of Part 2.

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2. REQUIREMENTS

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

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

Gauge by feel 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 and 2

(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 lugs 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. If the point of contact is at the front edges of the springs, the gap at every point across the front edges shall not exceed 0.002 inch. If the point of contact is behind the front edges, the gap at the front edges shall not exceed 0.012 inch.

Gauge by eye.

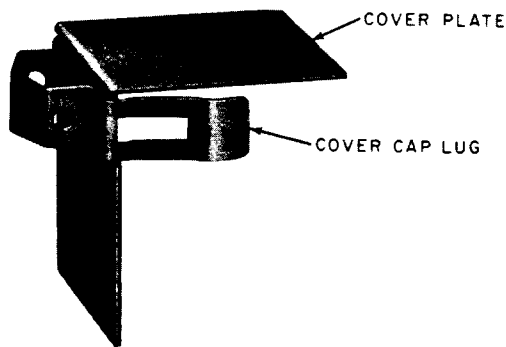


Fig. 1—Metal Cover Cap (No longer furnished)

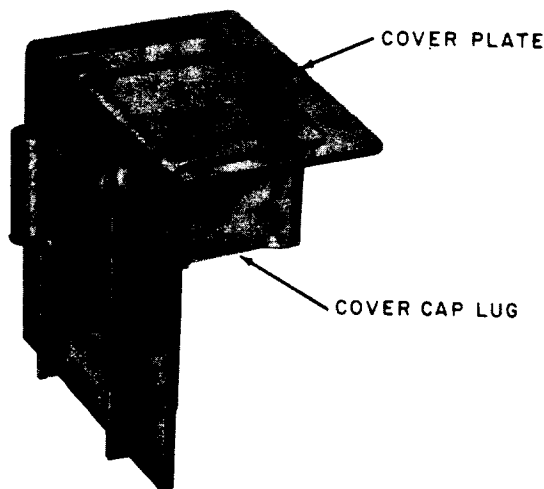


Fig. 2—Plastic Cover Cap

2.06 Biasing Spring Position

- (a) **Fig. 3(A):** There shall be a clearance between the armature and the coil portion of the biasing spring.

Gauge by eye.

- (b) **Fig. 3(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 biasing spring does not exceed 0.020 inch.

Gauge by eye.

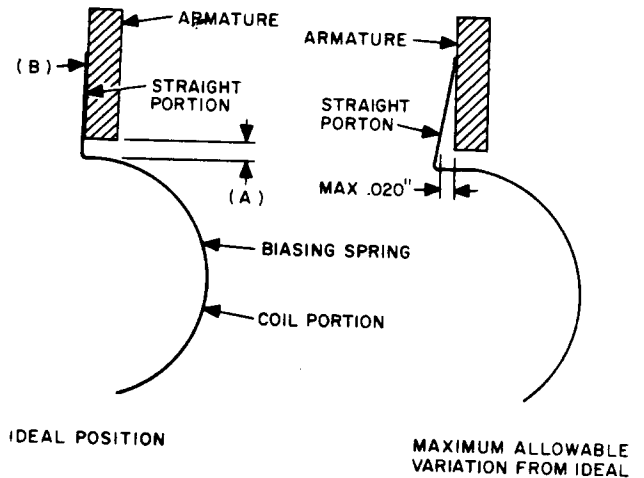


Fig. 3—Allowable Variation in Biasing Spring Position

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. 4(A)—Contacts shall line up so the point of contact falls wholly within the boundary of the opposing contact.

Gauge by eye.

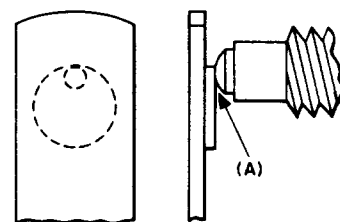


Fig. 4—Contact Alignment

***2.09 Tightness of Contact Screws and Biasing Stud:** Fig. 5(a) and Fig. 6(a)—Contact screws and biasing stud shall be sufficiently tight

in their brackets and biasing spring supports, respectively, to hold any adjusted position.

Gauge by feel.

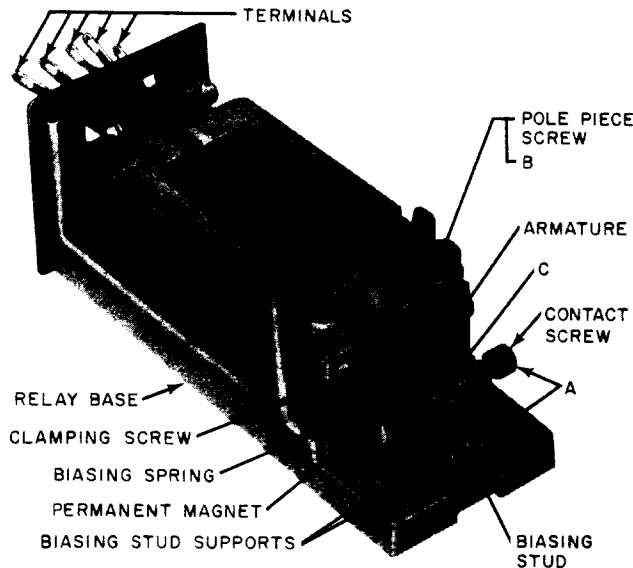


Fig. 5—280-Type Relay (Old Type)

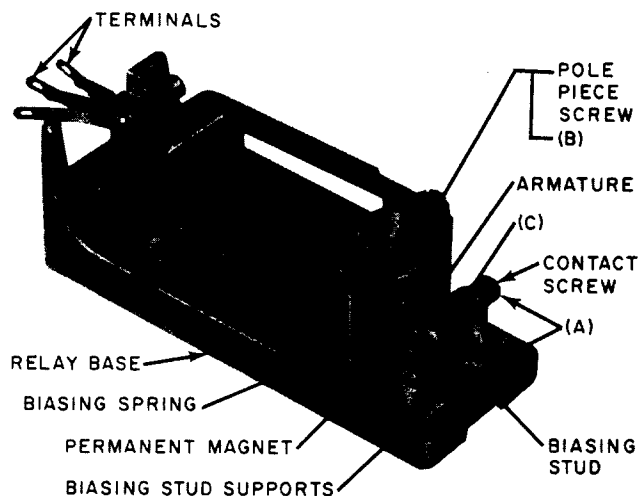


Fig. 6—280-Type Relay (New Type)

***2.10 Tightness of Pole-Piece Screws:** Fig. 5(B)—Pole-piece screws shall be held sufficiently tight in the pole piece to hold them in

any adjusted position and still permit the pole-piece screws to be turned.

Gauge by feel using the 340 adjusting key.

2.11 Contact Travel: Fig. 5(C) and Fig. 6(A)—The contact travel shall be

Min 0.004 inch

Max 0.006 inch.

Use the 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 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 069-306-801 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, 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 92P gauge.

2.14 Pulse Repeating Requirements: When specified on the circuit requirement table, the relay shall meet the pulse repeating requirement covered in Sections 040-011-711 and 040-012-711.

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, and Test Apparatus

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
340	Adjusting key
363	Spring adjuster

485A	Smooth-jaw pliers
510C	Test lamp [must be equipped with 561A tool (straight tip) and W2CB (24V) or W2BL (48V) cord]
KS-6320	Orange stick
KS-6854	3-1/2-Inch screwdriver
—	3-Inch C screwdriver
—	4-Inch E screwdriver
AT-7860	B Long-nose pliers

MATERIALS

—	Glyptal® (General Electric Co., Schenectady, New York)
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GAUGES

70D	0-50 Gram gauge
74D	Thickness gauge nest
92P	0.003-Inch nonmagnetic offset thickness gauge

TEST APPARATUS

35-type	Test set
J94724A	Contact closure test set (SD-95365-01) (includes 587A contact closure indicator)
R-2717	Filter (not required when J94724A test set is used)

3.01 Cleaning (Req't 2.01)

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

3.02 Relay Mounting (Req't 2.02)

- (1) If the relay is not fastened securely to the mounting plate, tighten the mounting screws with the 4-inch E screwdriver, taking care that the cover clearance requirement is met.

3.03 Cover Clearance (Reqt 2.03)

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

3.04 Cover Cap (Reqt 2.04)

- (1) If a metal cover cap does not meet the requirement, adjust the cover cap lugs as required with the fingers.
- (2) If the coverplate of a metal 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) If a plastic cover cap does not meet the requirement, replace the cap.

3.05 Flexible Contact Spring Alignment (Reqt 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 340 adjusting key and adjust the tips of the springs as required, using the 363 spring adjuster. Check that the flexible springs rest against each other in line with the armature with a pressure of 20 to 60 grams measured on one spring at the contact with the other spring held so that it cannot follow its mate. Use the 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 363 spring adjuster to the spring as close as is 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 (Reqt 2.06)

- (1) If there is no clearance between the armature and the coil portion of the biasing spring, remove the biasing stud by pulling it out while turning it slightly back and forth. Use the B long-nose pliers to grasp the head of the stud. Exercise care in this operation not to damage

the biasing spring, as a forcible removal of the stud 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 stud in a direction which will tighten the spring on the biasing stud. Exercise care not to wind the spring more than necessary to reduce the diameter of the coil the required amount. Remount the biasing stud.

- (2) If the biasing spring does not rest flat against the armature with the relay in adjustment, remove the biasing stud from the relay as covered in (1) and adjust the flat portion of the biasing spring with the 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 (Reqt 2.07)

3.08 Contact Alignment (Reqt 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 C 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 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 Screws and Biasing Stud (Reqt 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 B long-nose pliers. Use the 340 adjusting key to remove and replace the contact screws.

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

3.10 Tightness of Pole-Piece Screws (Reqt 2.10)

- (1) If the pole-piece screws do not meet the requirement, adjust the clamping screws, if provided, with the KS-6854 screwdriver as required. Clamping screws are provided only in the old design of 280-type relays. The new design uses plastic pellets under the two upper mounting screws which do not require further tightening.

Note: If the pole-piece screw cannot be tightened or will not remain tight; replace the relay and return the defective unit for repair.

3.11 Adjustment A

Contact Travel (Reqt 2.11)

- (1) If readjustment for contact travel is required, proceed as follows: (Fig. 7)
 - (a) Where bias spring is furnished, back it off to clear armature.
 - (b) Loosen pole-piece clamping screws (if provided) with KS-6854 screwdriver just enough to permit turning of pole-piece screws.
 - (c) Turn **left** pole-piece screw **up** as far as possible.
 - (d) Turn **right** pole-piece screw **down** as far as possible.
 - (e) Turn **left** contact screw **up** sufficiently to clear armature.
 - (f) Turn **right** contact screw **down** sufficiently to clear armature.

- (2) If necessary, remove the buildups from the contacts in accordance with Section 069-306-801.

(3) **Using the Contact Closure Test Set:**

- (a) Remove the 0.009-inch blade from the 74D gauge nest and insert between the tips of the flexible contact springs of armature.
- (b) Turn **left** contact screw **down** until lamp on **left** contact just lights.
- (c) Turn **right** contact screw **up** until lamp on **right** contact just lights.
- (d) Remove the gauge and substitute the 0.008-inch blade. Note that neither lamp lights. If adjustment of contact screws are required, recheck using 0.009 inch blade and vice versa until no further adjustments are required.

(4) **Contact Closure Test Set Not Available:**

Use same method as shown in (3) above except use lamp signal on 35-type test set to indicate contact closure. See Section 100-101-101, Fig. 9.

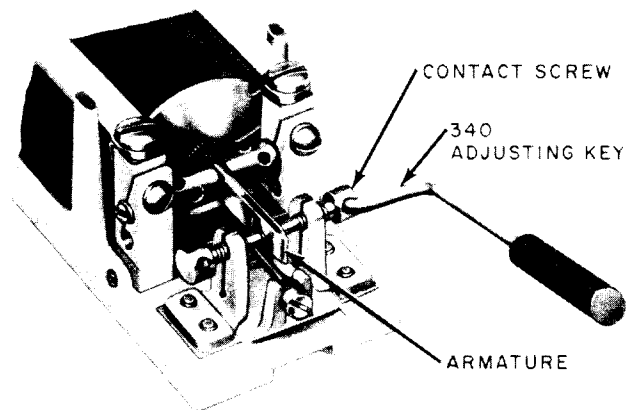


Fig. 7—Method of Aligning Contact Travel (Old Style Illustrated)

3.12 **Electrical Requirements** (Reqt 2.12)

3.13 **Contact Make** (Reqt 2.13)

3.14 **Pulse Repeating Requirements** (Reqt 2.14)

Caution: All adjustments must be made with shells in place and securely positioned by the two screws on the bottom of the relay, since the shell is actually a part of the magnetic path. For clarity, all figures show the relay with the shell removed. The two shell fastening screws are electrically connected to the armature contacts and may present a shock hazard. After tightening, they may be sealed with an insulating paint such as GLYPTAL or covered with gray insulating tape.

- (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, 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:** (Fig. 8)

- (a) Apply soak current to relay winding continuously in a direction to move armature to **left** contact (Soak key locked). If the armature does not move to **left**, move left pole piece screw **down** until armature does move to **left**. If the armature does not

move to **right**, move right pole piece screw **up** until armature does move to **right**.

- (b) Move **left** pole-piece screw **down** until it engages armature and puts lamp out on **left** contact.
- (c) Move **left** pole-piece screw **up** until lamp just lights on **left** contact.
- (d) Operate REV. key.
- (e) Move **right** pole-piece screw **up** until lamp lights on right contact and continue to move **right** pole-piece screw **up** until it engages armature and puts lamp out on **right** contact.
- (f) Move **right** pole-piece screw **down** until lamp just lights on **right** contact.
- (g) Release REV. key and remove soak (unlock soak key).
- (h) Tighten the pole-piece clamping screws, (if provided) sufficiently to hold their adjusted position but still permit changes in adjustment.

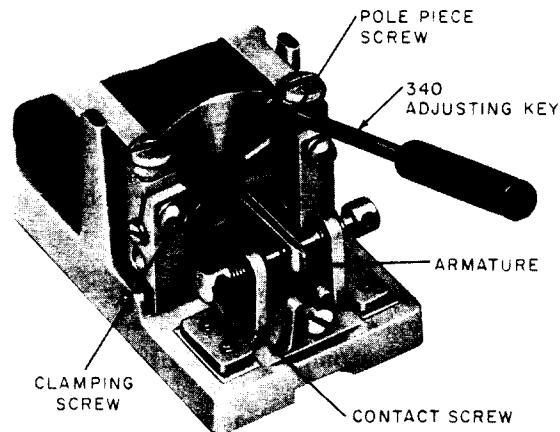


Fig. 8—Method of Adjusting Pole Piece Screws (Old Style Illustrated)

- (6) **Application of Operate Requirement:** (Check operate to right)
 - (a) Apply operate current continuously (operate key locked).
 - (b) Momentarily operate soak key.

- (c) Operate REV. key, armature should move to **right** (lamp lights).
 - (d) If armature does not move to **right**, turn **left** pole-piece screw **up** until armature moves to **right** (lamp lights).
- (7) **Application of Operate Requirements:**
(Check operate to left)
- (a) Momentarily operate soak key.
 - (b) Restore REV. key to normal, armature should move to **left** (lamp lights.)
 - (c) If armature does not move to **left** turn **right** pole-piece screw **down** until armature moves to **left** (lamp lights).
 - (d) Recheck operate to **right** and if adjustment of pole-piece screw is required, recheck operate to **left** and vice versa.
 - (e) Release operate key.
- (8) **Application of Nonoperate Requirement:**
(Check nonoperate to right)
- (a) Apply nonoperate current continuously (nonoperate key locked).
 - (b) Momentarily operate soak key.
 - (c) Operate REV. key. Armature should not move to **right**.
 - (d) If armature does move to **right**, turn **left** pole-piece screw **down** until armature does not move to **right**.
- (9) **Application of Nonoperate Requirement:**
(Check nonoperate to left.)
- (a) Momentarily operate soak key.
 - (b) Restore REV. key to normal. Armature should not move to **left**.
 - (c) If armature does move to left, turn **right** pole-piece screw **up** until armature does not move to **left**.
 - (d) Recheck nonoperate to **right** and, if adjustment of pole-piece screw is required, recheck nonoperate to **left** and vice versa.
- (e) Tighten pole-piece clamping screws (if provided).
 - (f) Recheck operate to **left** and **right** and nonoperate to **left** and **right** until no further adjustment of the pole-piece screws is required.
 - (g) Release nonoperate key.
- (10) **Check contact make**
- (a) Insert a .003 gauge (92P gauge) between **left** pole-piece screw and armature stop pin. Apply soak current in a direction to hold gauge. **Left** contact shall make (lamp lights).
 - (b) Remove soak current and gauge.
 - (c) Insert gauge between **right** pole-piece screw and armature stop pin.
 - (d) Operate REV. key.
 - (e) Apply soak current to hold gauge. **Right** contact shall make (lamp lights).
- Adjustment B—Relays Equipped with Biasing Springs**
- (11) 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 (10), inclusive. The second part is applied as covered in (12) using the remaining current flow values specified on the circuit requirement table.
- (12) **Application of Operate, Nonoperate, Hold, and Release Electrical Requirements With the Biasing Spring Engaged.** Use the 3-inch C screwdriver to adjust the biasing spring stud and proceed as follows:
- (a) Tension biasing spring until armature remains on **right** contact after manually operating armature to **left**.
 - (b) Apply electrical requirements. Tension or remove tension from biasing spring until requirements are met.