

## RELAYS

### 207 AND 213 TYPES

### REQUIREMENTS AND ADJUSTING PROCEDURES

#### 1. GENERAL

- 1.01 This section covers 207- and 213-type relays.
- 1.02 This section is reissued to amplify the electrical requirement procedures. Detailed reasons for reissue will be found at the end of the section.
- 1.03 Reference shall be made to Section 020-010-711 for additional information necessary for the proper application of the requirements listed herein.
- \*1.04 Asterisk: Requirements are marked with an asterisk (\*) when to check for them would necessitate the dismantling or dismantling of apparatus or would affect the 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 When adjusting a relay, replace the retractile spring if it is of the close wound type by an open wound type spring. Also if the relay is equipped with a red fiber insulator at the mounting plate or red fiber mounting screw washers, replace them with black ones. Make these replacements as covered in Section 040-229-801 covering replacement of parts for 207- and 213-type relays.
- 1.06 Operate: A relay is said to operate if, when current is connected to its winding, the armature moves from the backstop screw and makes the front contact.
- 1.07 Nonoperate: A relay is said to non-operate if, when current is connected to its winding, the armature does not move sufficiently to make the front contact.
- 1.08 Release: A relay is said to release if the armature moves from the cores sufficiently to break the front contact.

#### 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: The cores, post (wiring terminal), and rear pole piece shall be securely fastened to the relay frame and the relay frame shall be securely fastened to the mounting plate.
- Gauge by feel, by grasping the spoolheads.

- 2.03 Cover Tightness (213-type Relays Only): The cover shall fit snugly but shall not fit so tight as to prevent placing or removing with the fingers.
- Gauge by feel.
- 2.04 Tightness of Locknuts: Fig. 1(A) - The locknuts shall be sufficiently tight to hold the respective screws in their adjusted positions.
- Gauge by feel.
- 2.05 Bonding Strap Position: Fig. 1(E) - The bonding strap shall be free from any kinks or knots and shall be drawn out to the right (looking at the relay from the front) in as long a loop as possible.
- Gauge by eye.

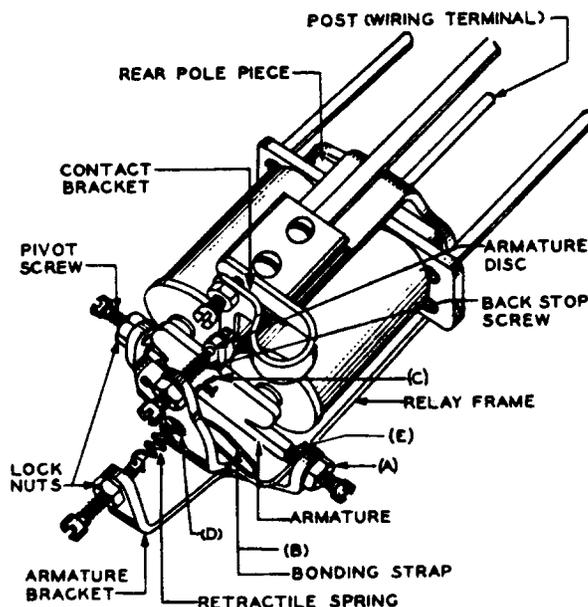


Fig. 1 - 207- and 213-type Relays  
(207 Illustrated)

- \*2.06 Hook Movement: Fig. 1(C) - The hook holding the retractile spring to the armature shall not bind in the armature.
- Gauge by feel.

SECTION 040-229-701

2.07 Retractable Spring and Frame Clearance:  
 Fig. 1(D) - There shall be sufficient clearance between the retractile spring and the relay frame, where the spring passes through the hole in the frame, to insure that the spring will not touch the frame when the relay is in final adjustment.  
 Gauge by eye.

2.08 Contact and Backstop Screw Alignment

(a) Contacts shall line up so that the point of contact falls wholly within the boundary of the opposing contact as shown in Fig. 2(A).  
 Gauge by eye.

(b) The point of the backstop screw shall fall wholly within the boundary of the armature disc.  
 Gauge by eye.

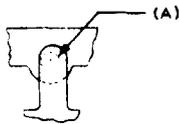


Fig. 2 - Contact Alignment

2.09 Armature Movement: Fig. 1(E) - The armature shall move freely in its bearings without excessive sideplay. Excessive shall be interpreted to mean more than 0.003 inch. The sideplay shall be checked by moving the armature from side to side in line with the axis of the pivot screws.  
 Gauge by eye and feel.

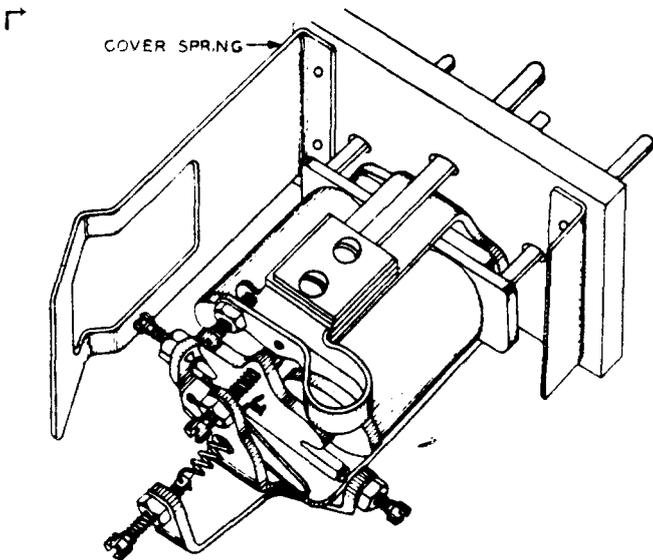


Fig. 3 - 213-type Relay

2.10 Unoperated Armature Gap: Fig. 4(A) - With the armature against the backstop screw, the gap between the surface of the armature and the cores, measured separately between the nearest point on each core and the armature shall be  
 Min 0.012 inch  
 Max 0.014 inch

Use the No. 77B gauge.  
 To check, insert the No. 77B gauge first between the armature and one core and then between the armature and the other core. If the 0.014-inch gauge enters between either core and the armature, it should do so with a snug fit.

2.11 Separation Between Armature Disc and Backstop Screw: Fig. 4(B) - With the relay electrically operated, the separation between the armature disc and the backstop screw shall be  
 Min 0.004 inch  
 Max 0.005 inch  
 Use the No. 110A gauge.

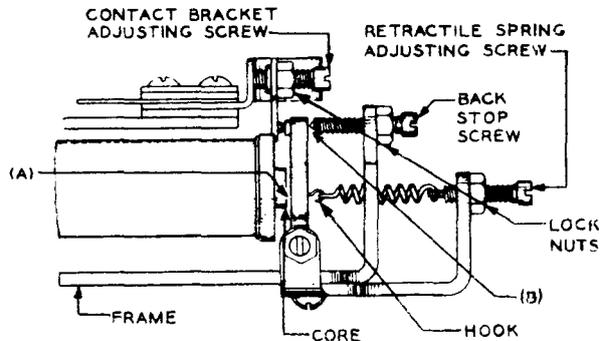


Fig. 4 - Separation Between Armature Disc and Backstop Screw - Armature Operated

2.12 Electrical Requirements: The relay shall meet the electrical requirements specified on the circuit requirements tables.

3. ADJUSTING PROCEDURES

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

Code or Spec No.	Description
<u>Tools</u>	
48	Combination 7/32-inch and 1/4-inch Hex. Double-end Socket Wrench and Screwdriver
206	30-degree Offset Screwdriver
207	90-degree Offset Screwdriver
349	3/16-inch and 7/32-inch Hex. Flanged Double-end Offset Wrench

<u>Code or Spec No.</u>	<u>Description</u>
<u>Tools</u>	
485A	Smooth Jaw Pliers
-	5-inch Diagonal Pliers
-	6-1/2-inch P-Long-nose Pliers
-	3-inch Cabinet Screwdriver
-	4-inch Regular Screwdriver
-	Small Mirror
<u>Gauges</u>	
77B	0.012-inch and 0.014-inch Thickness Gauge
110A	0.004-inch and 0.005-inch Thickness Gauge

Materials

- Hardwood Toothpicks (Flat at one end and pointed at the other)

Test Apparatus

35 Type Test Set

3.01 Cleaning (Rq 2.01)

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

3.02 Relay Mounting (Rq 2.02)

- (1) To tighten loose mounting screws, use the 4-inch regular screwdriver.
- (2) If the cores are loose, remove the relay from the mounting plate, and in the case of 213-type relays, remove the cover spring assembly. Tighten the screws in the cores with the 3-inch cabinet screwdriver.
- (3) If the post (wiring terminal) shown in Fig. 5 is loose, tighten it by grasping the round portion with the P-long-nose pliers and turning it until it is secure in the frame. Do not grasp the post at the flat portion because the sharp edge of the pliers may shear off the wire.
- (4) After mounting a relay or tightening loose mounting screws, check the unoperated armature gap and the separation between the armature disc and backstop screw and if necessary readjust as outlined in 3.08 to 3.12.

3.03 Cover Tightness (Rq 2.03)

- (1) If the cover does not fit properly, adjust the cover springs toward or away from the coils as required, using the No. 485A pliers applied near the base of the spring.

3.04 Tightness of Locknuts (Rq 2.04)

- (1) To tighten loose locknuts, except the pivot screw locknuts, use the smaller end of the wrench portion of the No. 48 combination wrench and screwdriver holding the screws in position with the screwdriver portion.
- (2) To tighten the pivot screw locknuts, use the No. 349 wrench holding the screws in position with the Nos. 206 and 207 offset screwdrivers as shown in Fig. 5.

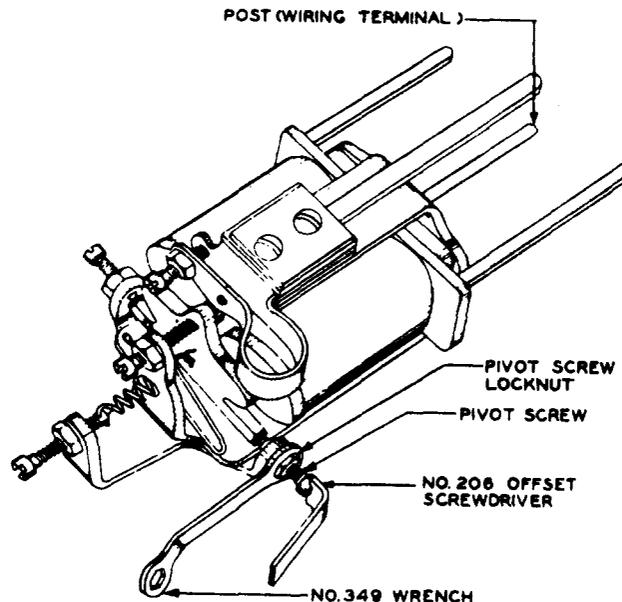


Fig. 5 - Method of Tightening Locknuts

3.05 Bonding Strap Position (Rq 2.05)

- (1) If the bonding strap is not formed properly, reform it manually by freeing it from any kinks or knots and drawing it out to the right (looking at the relay from the front) in as long a loop as possible.

3.06 Hook Movement (Rq 2.06)3.07 Retractable Spring and Frame Clearance (Rq 2.07)

- (1) If the spring touches the frame, the fault may be due to a failure of the hook in the armature to turn properly, a bent hook, an incorrect position of the armature or armature bracket, or a distorted or bent retractile spring.
- (2) If the armature or armature bracket is not properly positioned, proceed as covered in 3.08 (3) and (10).
- (3) If the retractile spring is distorted or bent, replace it with a new open wound retractile spring.

(4) The hook in the armature must be free to turn when the retractile spring adjusting screw is turned. After each adjustment of the retractile spring adjusting screw, for the purpose of stabilizing this adjustment, turn the hook in the armature with the flat end of a toothpick in the same direction in which the retractile spring adjusting screw was turned. Turn the hook until the loop in the retractile spring stops following the hook in the armature. (See Fig. 6.) Adjust hooks which bind in the armature with the No. 485A pliers. If the hook still binds after adjusting, replace the armature and pivot screws. In this case, proceed as outlined in 3.08 to 3.12.

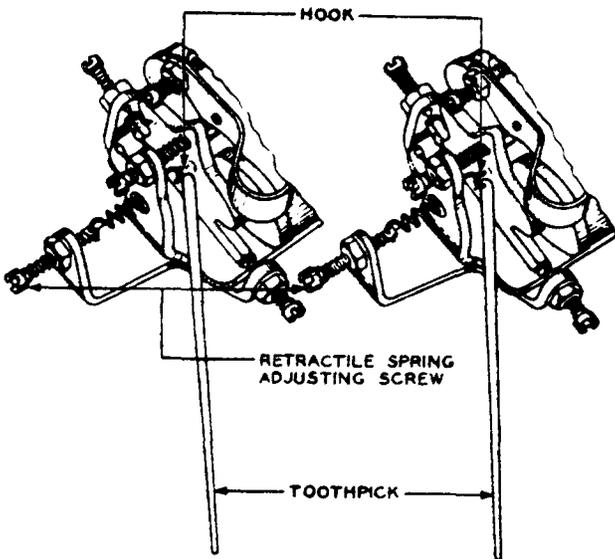


Fig. 6 - Method of Positioning the Hook

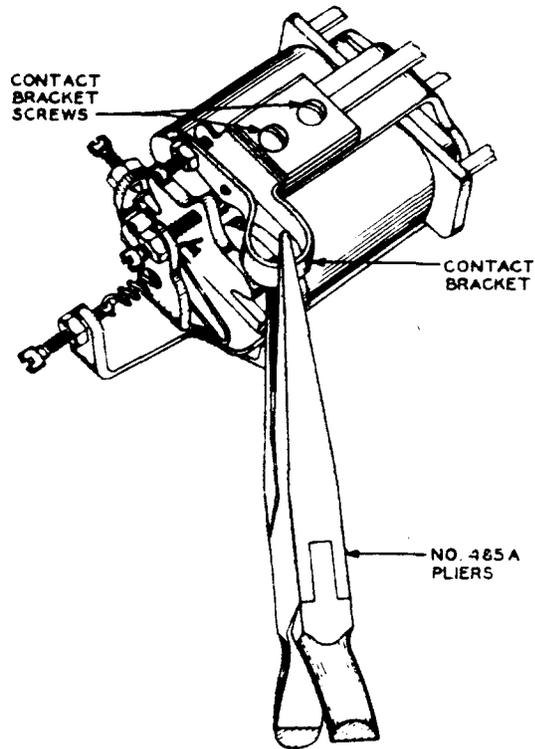


Fig. 7 - Method of Aligning Contacts Vertically

- 3.08 Contact and Backstop Screw Alignment (Rq 2.08)
- 3.09 Armature Movement (Rq 2.09)
- 3.10 Unoperated Armature Gap (Rq 2.10)
- 3.11 Separation Between Armature Disc and Backstop Screw (Rq 2.11)
- 3.12 Electrical Requirements (Rq 2.12)

(1) All the following adjustments must be made with the relay mounted.

Contact Alignment - Vertical

(2) If the contacts are out of line vertically, force the contact bracket slightly upward or downward as necessary using the No. 485A pliers as shown in Fig. 7. Then move the armature upward and downward to check that the contacts are in accordance with 2.08.

Contact and Backstop Screw Alignment - Horizontal

(3) If the contacts or backstop screw and armature disc are out of line horizontally, proceed as outlined in (10).

(4) If a satisfactory alignment of both the contacts and backstop screw still cannot be obtained, set the backstop screw in the proper alignment as outlined above and then loosen the contact bracket screws with the Nos. 206 and 207 offset screwdrivers and shift the bracket as required to obtain the proper contact alignment. Tighten the contact bracket screws securely. Recheck for requirement 2.11.

Armature Movement

(5) To facilitate meeting the electrical requirements, it is desirable that the sideplay of the armature be kept as small as possible.

(6) If it is necessary to readjust for armature movement, replace the armature and pivot screws with pivot screws having hexagon heads and proceed as outlined in (7). Then proceed as outlined in (10).

(7) Loosen the right-hand pivot screw locknut with the No. 349 wrench enough to permit turning the pivot screw with the fingers. Turn the pivot screw out until there is a noticeable sideplay of the armature. Then turn the pivot screw in with the fingers a little at a time until the sideplay is entirely eliminated, and tighten the locknut finger tight. Then while holding the screw and locknut as shown in Fig. 5, back off the pivot screw approximately 15 degrees (equivalent to 1-1/4-inch movement at the hand end of the Nos. 206 and 207 offset screwdrivers). Tighten the locknut while holding the pivot screw in place. A sideplay of approximately 0.001 inch is ideal. If the sideplay is not satisfactory, loosen the locknut with the No. 349 wrench and turn the pivot screw as required with the Nos. 206 and 207 offset screwdrivers and then tighten the locknut.

#### Unoperated Armature Gap

(8) To change the unoperated armature gap, loosen the backstop and front contact screw locknuts with the wrench portion of the No. 48 tool and back off both screws. Insert the 0.014-inch blade of the No. 77B gauge between the armature and both cores observing that the armature in the operated position does not touch the front contact. Turn the backstop screw in a clockwise direction until the gauge is held snugly. Then while holding the screw in the position with the screwdriver portion of the No. 48 tool, tighten the backstop screw locknut with the wrench portion sufficiently to insure that the backstop screw will be held in its adjusted position. Reset the contact separation as outlined in (11).

(9) If the unoperated armature gap is satisfactory at one core but unsatisfactory at the other, it is an indication that the armature is not approximately parallel with the cores. Correct this condition as covered in (10).

(10) Loosen the backstop screw locknut with the No. 48 wrench and back off the screw approximately one turn to permit better observation of the armature movement. Tighten the locknut. Also, in order to properly position the armature, loosen the front contact adjusting screw locknut with the No. 48 wrench and position the screw until the armature in the operated position does not touch the front contact. Tighten the locknut. Loosen the armature bracket screws with the Nos. 206 and 207 offset screwdrivers or with the No. 349 wrench where the screws have hexagon heads and place the 0.012-inch blade of the No. 77B gauge between both cores and the armature. Where the relay is mounted at the bottom of a unit-type sender cabinet and the armature bracket screws have slotted heads, place a small mirror beneath the relay to facilitate locating the slots in the armature bracket

screws with the Nos. 206 and 207 offset screwdrivers. On 207-type relays where a washer was not previously provided, remove the armature bracket screws and place a P-284185 washer between the head of each screw and the armature bracket. ← If the armature bracket screws have slotted round heads, replace them with the new hexagon headed screws. Electrically energize the relay in the operate direction by applying a soak of 0.035 ampere to hold the armature in the operated position. Then shift the armature bracket until the gauge is held flat against both cores and the armature, and the contacts and backstop screw are aligned horizontally. Tighten the armature bracket screws securely. Disconnect the current to the relay and remove the No. 77B gauge. Adjust for unoperated airgap as outlined in (8) and then set the contact separation as outlined in (11). Check for armature movement and if necessary proceed as in (7). Then apply a soak of 0.035 ampere in the opposite direction to the soak previously applied. In certain cases, it may be necessary to use nongrounded battery to obtain the 0.035-ampere current flow.

#### Separation Between Armature Disc and Backstop Screw

(11) Loosen the front contact screw locknut with the wrench portion of the No. 48 tool. With the screwdriver portion of the same tool, turn the front contact adjusting screw in a clockwise direction to decrease the separation or in a counterclockwise direction to increase the separation. Hold the screw in this position and tighten the locknuts securely.

#### Electrical Requirements

(12) Connect the lamp of the 35-type test set in series with the relay contact to facilitate determining when the relay operates and releases. Loosen the locknut on the retractile spring screw enough to permit the retractile spring screw to be turned with the screwdriver portion of the No. 48 tool. Apply the specified operate current following the soak current when specified. If the relay operates, turn the retractile spring screw out until the relay just fails to operate. Turn the retractile spring screw in slowly until the relay just operates and tighten the locknuts securely. Position the hook in the armature as covered in 3.06(4). Stroke the retractile spring gently with the blade of the screwdriver to cause the spring to assume a stable position. Tap the head of the retractile spring screw gently with the handle of the screwdriver to further aid in stabilizing the position of the spring. Check that the relay meets all its electrical requirements.

Note: When testing for operate or non-operate requirements, the release key of the 35-type test set should be open. ↴ ↵

SECTION 040-229-701

(13) The release requirement is more readily met if the unoperated airgap is adjusted towards the maximum and the contact separation towards the minimum.

(14) If, after adjusting as outlined above, the relay fails to meet the release requirements when specified, it is an indication that the front to rear play of the armature is excessive which may be due to imperfect or worn pivots or armature bearings. If this condition exists, replace the armature and pivot screws. Adjust for armature movement as outlined in (7) and then realign the armature as covered in (10). If the relay still fails to meet the release requirement, inspect the retractile spring and if it is a close wound type replace it with a new open wound type.

(15) Final Check: After the cover (when used) has been replaced, check that the relay meets its electrical readjust requirements.

(16) If the relay fails to meet the electrical requirements after all the mechanical requirements have been met, refer the matter to the supervisor.

REASONS FOR REISSUE

1. To revise the cleaning requirement and procedure (2.01)(3.01).
2. To revise Figs. 1 and 3.
3. To revise the List of Tools and Materials (3.001).
4. To delete the procedure for replacing the retractile spring (3.06 and 3.07).
5. To omit the procedures applying to new relays (3.08 to 3.12).
6. To delete the procedure for cleaning the armature disc and backstop screw (3.08 to 3.12).
7. To delete the procedure for replacing the armature and pivot screws (3.08 to 3.12).
8. To amplify the electrical requirement procedures [3.12(12)].