

REQUIREMENTS AND ADJUSTING PROCEDURES
FOR
CENTRAL OFFICE AND PBX APPARATUS

Issue No.	Date of Issue	Approved	
		B.T.L.	D. & R.
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A. T. & T. CO. STANDARD			

"A" AND "AB" TYPE RELAYS

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
Department of Development and Research
Bell Telephone Laboratories, Inc.

REASON FOR REISSUE

These Requirements and Adjusting Procedures (R.A.P.) are issued to replace specification X-70077-01, issue 1 for the following reasons:

- | | |
|---|--|
| <p><u>1.</u> To include requirements and adjusting procedures for "AB" type relays.</p> | <p><u>2.</u> To add requirements as covered on Sheet 1 attached hereto.</p> |
| <p><u>3.</u> To illustrate the adjusting procedures.</p> | <p><u>4.</u> To bring the information up to date and to issue it as an R.A.P..</p> |

CHANGES IN ADJUSTING PROCEDURES FROM X-70077-01, ISSUE 1

<u>Paragraph No.</u>	<u>Change</u>	<u>Paragraph No.</u>	<u>Change</u>
1.001	Changed to agree with latest standard paragraph.	-	1.3, 1.4, 2.01 and 3.0 (X-70077-01, Issue 1) omitted.
1.002	Added.	2.01 to)	Were 3.1 to 3.17 inclusive.
1.003	Was 1.5. Reworded. No. 70 gauge replaced by No. 70-D. Added reference to A.T. & T. Co. drawings in the case of the Bell Systems tools.	2.17 Incl.)	Added illustrations.
		2.07	Was 3.07. Added M-2.
		2.14	Was 3.14. Added method for relays not required to touch the core in the operated position.

CHANGES IN REQUIREMENTS FROM X-70077-01, ISSUE 1

<u>Paragraph No.</u>	<u>Change</u>	<u>Paragraph No.</u>	<u>Change</u>
3.001 to) 3.004 Incl.)	Were 2.001 to 2.004 incl. Added A-61 Relay in 3.001. Added reference to soak in 3.003.	3.01 to 3.13) Incl.)	Were 2.01 to 2.13. Added methods of gauging.
	2.005 and 2.007 to 2.010 incl. (X-70077-01, Issue 1) omitted.	3.08	Added A-58 to A-62 and AB-1 to AB-6 relays.
3.005	Was 2.006.	3.113	Added A-61, AB-2 and AB-4 relays.
3.006	Added.	3.14	Was 2.14.
		3.15 to 3.17) Incl.)	Were 2.15 to 2.17 incl. Added method of gauging for 3.15.

SECTION 1 - GENERAL

1.001 The Requirements and Adjusting Procedures specified herein cover "A" and "AB" type relays and replace specification X-70077-01, issue 1.

1.002 Reference shall be made to R.A.P. X-70000-01, covering General Requirements, Definitions and Information for additional information necessary for the proper application of this R.A.P..

1.003 List of Tools, Gauges and Test Apparatus required for the apparatus covered by this R.A.P..

<u>Code No.</u>	<u>Description</u>
206	Screw-driver - 30° Offset

Tools (Cont.)

<u>Code No.</u>	<u>Description</u>
207	Screw-driver - 90° Offset
259	Spring Adjuster
349 (or the replaced 231)	Wrench - 3/16" and 7/32" Hex. Closed - Double-end Offset Wrench - 3/16" Flat Hex. Open-end
	Bell System Cabinet Screw-driver - 3-1/2" per A.T. & T. Co. Drawing 46-X-40

Tools (Cont.)

<u>Code No.</u>	<u>Description</u>
	Bell System - P-Long Nose Pliers - 6-1/2" per A.T. & T. Co. Drawing 46-X-56

Gauges (Cont.)

<u>Code No.</u>	<u>Description</u>
70-D (or the replaced 70)	50-0-50 Gram Gauge
74-D (or the replaced 74-C)	Thickness Gauge Nest Thickness Gauge Nest

Gauges

66-C (or the replaced 66-B)	Thickness Gauge Nest Thickness Gauge Nest
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Test Apparatus

35-C	Current Flow Test Set
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SECTION 2 - ADJUSTING PROCEDURES

2.01 RELAY MOUNTING (Rq.3.01)

M-1 To tighten loose mounting screws, use the 3-1/2" cabinet screw-driver.

2.02 TIGHTNESS OF ASSEMBLY (Rq.3.02)

M-1 To tighten loose spring assembly mounting screws, dismount the relay and use the 3-1/2" cabinet screw-driver or, if mounting centers permit, use the Nos. 206 and 207 screw-drivers without dismounting the relay. Care should be taken not to destroy the adjustments made under 2.03, 2.04 and 2.05.

2.03 CONTACT AND SPRING ALIGNMENT (Rq.3.03)

2.04 ARMATURE STUD CLEARANCE (Rq.3.04)

2.05 SPRING TANG POSITION (Rq.3.05)

M-1 If the contacts do not line up properly, or if the tang does not overlap the spoolhead sufficiently, or the stud rubs on the spring, an attempt should be made to correct the trouble by applying pressure to the end of the spring using the No. 259 spring adjuster as shown in Fig. T exercising care not to distort or otherwise damage the spring.

If the spring cannot be shifted, remove the relay from the mounting plate and loosen the spring assembly mounting screws sufficiently to shift the springs so as to correct the fault. Tighten the spring assembly mounting screws securely if loosened. Tighten the mounting screws securely when mounting the relay.

M-2 Use the 3-1/2" cabinet screw-driver in loosening and tightening the screws.

2.06 ADJUSTING STUD CLEARANCE (Rq.3.06)

M-1 If the armature rubs against the adjusting stud correct as follows:

M-2 If due to a bent adjusting stud, the stud should be straightened by grasping the nut with the long nose pliers, and adjusting the stud as required. Care should be exercised not to damage the threads on the stud or to loosen the stud.

M-3 If due to an improper manner in which the armature is hinged to the core, the relay should be changed.

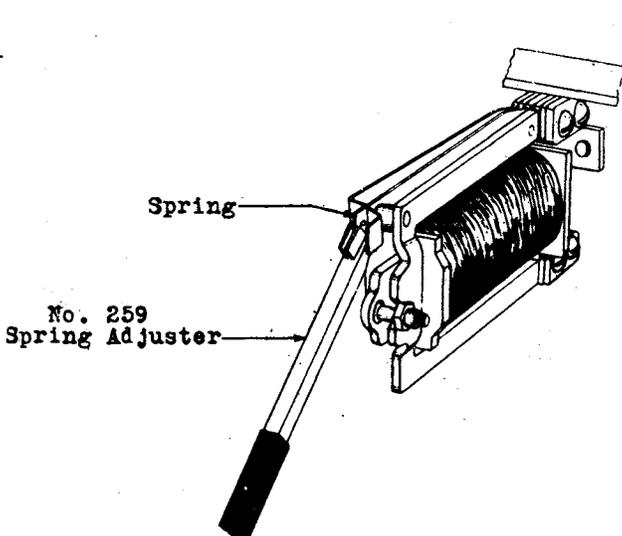


Fig. T - Method of Adjusting Spring Alignment

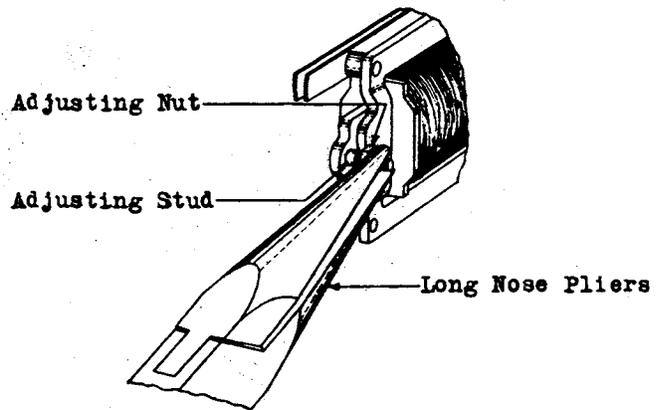


Fig. U - Method of Tightening Adjusting Nut on Stud

2.07 ADJUSTING NUT TIGHTNESS (Rq.3.07)

M-1 To tighten loose nuts back off the nut from the stud until its slotted portion is free of the stud and then force the slotted parts closer together with the long nose pliers as shown in Fig. U. Use the No. 349 wrench to turn the nut.

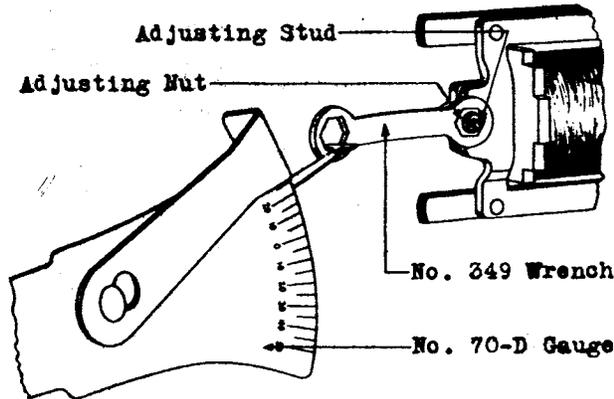


Fig. V - Method of Checking for Adjusting Nut Tightness

M-2 If in doubt as to whether or not the adjusting nut is tight enough, the tightness may be checked with the No. 70-D gauge and No. 349 wrench as shown in Fig. V. The nut should not turn when a pressure of 22 grams or less is applied.

2.08 ARMATURE TRAVEL (Rq.3.08)

M-1 To adjust the armature travel, insert the proper blade of the 66-C gauge and turn the adjusting nut with the No. 349 wrench until the gauge fits snugly. See Fig. W.

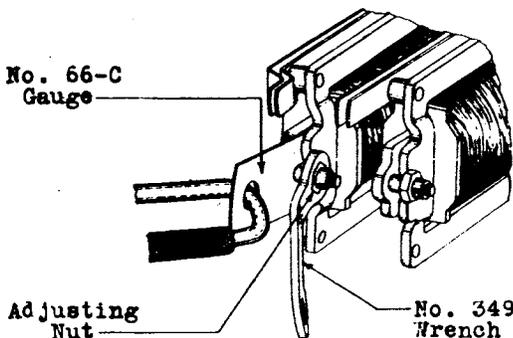


Fig. W - Method of Adjusting for Armature Travel

M-2 Where no definite armature travel is specified, it should be kept as small as possible consistent with meeting the other requirements.

2.09 STRAIGHTNESS OF SPRINGS (Rq.3.09)
2.10 SEPARATION BETWEEN SPRINGS (Rq.3.10)

M-1 If the springs are not straight or there is insufficient clearance between the springs these conditions may be corrected by adjusting the springs where they are bent or where the clearance is insufficient. Use the No. 259 spring adjuster.

2.11 CONTACT PRESSURE (Rq.3.11)
2.12 STUD GAP (Rq.3.12)

M-1 Use the No. 259 spring adjuster to adjust the springs for these requirements. The adjuster should be placed on the front end of the spring, but back of the contacts and armature stud, and then slid back to a point about 1/4" from where the spring leaves the spring assembly. See Fig. X. The adjustment of the spring should be made at this point with a slight twist to the left or right as required, exercising care not to disturb adjacent springs.

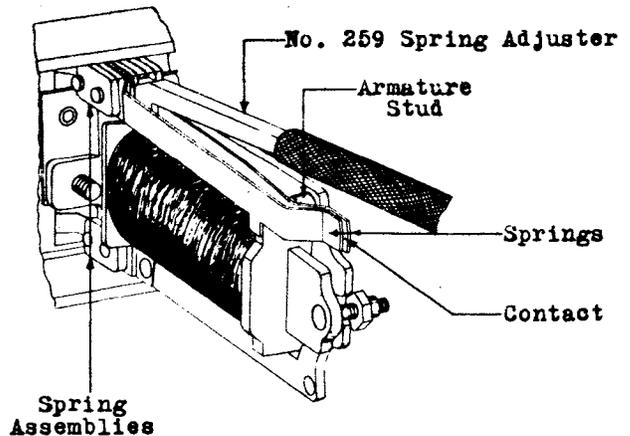


Fig. X - Method of Adjusting for Spring Tension

M-2 Normally straight springs that have been adjusted should have no sharp bends due to adjustment. A gradual bow is permissible.

M-3 In tensioning springs care should be exercised not to deform the armature hinge plate.

M-4 Contact Pressure In connection with those cases where spring tensions are specified to obtain contact pressure it should

2.11-2.12 (Continued)

be noted that they are specified on a minimum basis. They have, however, a direct bearing on a relay's electrical requirements, and, if they are greatly in excess of their minimum tension, the relay may fail to meet its electrical requirements in which case the tensions may have to be reduced slightly toward their specified minimum. In readjusting, however, it is desirable to have as much tension as possible on the various springs, consistent with meeting the other requirements. An attempt should be made to distribute the tensions proportionately between the top and bottom spring combinations and between the light and heavy springs of each combination.

M-5 Check the tensions with the No. 70-D gauge. In using the gauge the tip of the reed should engage the tip of the spring whose tension is to be measured. The gauge should be held in such a position that the reed and spring being measured are practically in a straight line. See Fig. Y.

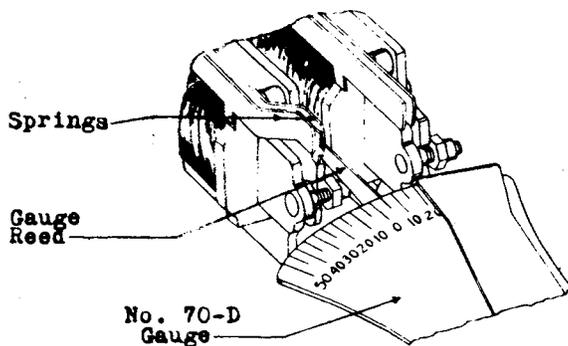


Fig. Y - Method of Gauging Spring Tension

M-6 Where no definite contact pressure is specified, tension the springs so that the relay will meet its electrical requirements. The spoolhead springs should be tensioned so that they rest firmly against the spoolhead.

M-7 Stud Gap The stud gap requirement should also be met at the same time springs are adjusted to meet the contact pressure requirements. If it is difficult to meet this requirement by a readjustment of the springs, it will be satisfactory to bend the tang a slight amount. Use the long nose pliers to bend the tangs holding the spring with the No. 259 spring adjuster as shown in Fig. Z.

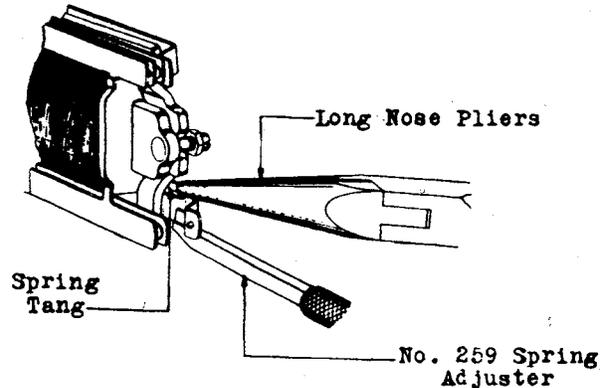


Fig. Z - Method of Adjusting Spring Tang

2.13 CONTACT SEPARATION (Rq.3.1)

M-1 To correct the separation, adjust the spring with the No. 259 spring adjuster or the spring tang with long nose pliers. See 2.12, M-7 regarding the bending of spring tangs.

2.14 CONTACT FOLLOW (Rq.3.14)

M-1 To correct the follow, reduce the contact separation towards the minimum.

M-2 On relays where the armature need not come all the way up to the core on the specified operate current, adjust the springs so that all make contacts close at approximately the same time.

2.15 SPRING SEQUENCE (Rq.3.15)

M-1 To adjust for spring sequence, modify the contact pressure, stud gap, contact separation and contact follow requirements.

2.16 ELECTRICAL REQUIREMENTS (Rq.3.16)

M-1 If the relay fails to meet the operate or hold requirement decrease the spring tension towards the minimum, reduce the contact follow towards the minimum or increase the stud gap.

M-2 If the relay fails to meet the non-operate or release requirement, increase the spring tension or the follow or decrease the stud gap.

2.17 CLEANING (Rq.3.17)

M-1 Clean the contacts and other parts in accordance with the "X" specification covering cleaning of relay contacts and parts.

Attached:

R.A.P. X-70077-01, Sheets 1 to 5, Inclusive,
Issue 2-D

SECTION 3 - REQUIREMENTS

REASON FOR REISSUE

This section is reissued to replace the requirements section of specification X-70077-01, Issue 1 for the following reasons:

1. To specify definite armature travel values for the A-58, 59, 60, 61 and 62 relays. (3.08).
2. To specify definite spring tensions for the A-61 relay. (3.113).
3. To include in the definition of release the statement that the armature shall release from its operated position when the current is reduced from the soak to the release value (3.003).

DEFINITIONS AND GENERAL INFORMATION

- | | |
|--|--|
| <p>3.001 <u>Operate</u> means that when the operating current is applied the armature shall move sufficiently to break the back contacts and make the front contacts reliably. On the A-2, 3, 26, 43, 46, 48, 54 and 61 relays the armature shall touch the core on the operate current unless stop pins are provided, in which case at least one of the stop pins shall touch the core.</p> | <p>3.004 <u>Hold</u> means that when the current is reduced abruptly from the operate to the hold value, the armature shall not move from its operated position sufficiently to break contacts which have been made or to make contacts which have been broken.</p> |
| <p>3.002 <u>Non-operate</u> means that when the non-operate current is applied the armature shall not move from the unoperated position sufficiently to reduce the contact separation below .005" or reduce the back contact pressure enough to cause an unreliable contact.</p> | <p>3.005 <u>Armature Travel</u> The armature travel is the gap between the core and the nearest stop pin, or nearest point on the armature itself when stop pins are not provided when the armature is resting against the adjusting nut.</p> |
| <p>3.003 <u>Release</u> means that when the current is reduced from the soak, operate or hold value to the release value, the armature shall move from the operated position sufficiently to break contacts that have been made and to make reliably contacts that have been broken.</p> | <p>3.006 <u>Additional General Information Reference</u> shall be made to R.A.P. X-70000-01 covering General Requirements, Definitions and Information for additional information necessary for the proper application of the requirements listed on these sheets.</p> |

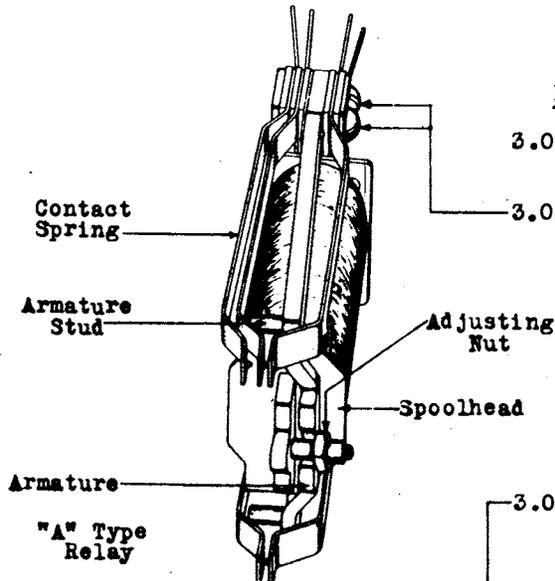


Fig. 1



Fig. 2

REQUIREMENTS

- 3.01 Relay Mounting Relays shall be fastened securely to the mounting plate. Gauge by feel.
- 3.02 Tightness of Assembly All springs in a given assembly shall be held in their relative positions to one another and to the relay core by being securely fastened to the relay core at their bases. If it is found necessary to measure the tightness of assembly, such tightness shall be considered as satisfactory if the springs in a given assembly do not move in their mounting when a pressure of 680 grams (24 oz.) is applied in a vertical direction at the contact end of all springs in the same assembly taken together. Gauge by feel.
- 3.03 Contact and Spring Alignment
 - (a) The point of contact shall fall wholly within the circumference of the opposing contact disc except for opposing contacts having the same diameter, in which case their centers shall not be out of alignment more than 25% of the diameter of the contact points. Gauge by eye.
 - (b) Springs shall not touch the relay cover. Gauge by eye.

REQUIREMENTS

FOR
"A" AND "AB" TYPE RELAYS

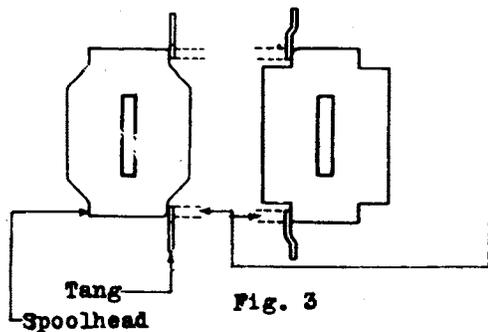


Fig. 3

3.04 Armature Stud Clearance Armature studs shall not rub on the springs through which they pass when the armature is moved. Gauge by eye and feel.

3.05 Spring Tang Position

- (a) Spring tangs shall rest on the spoolhead so that the ends of the tangs are at least 1/32" below or above the projection of the top or bottom edges, respectively, of the spoolhead. Gauge by eye.
- (b) The tang shall not rub on the spoolhead when moved slightly in the direction of travel from its normal position of rest on the spoolhead. Gauge by eye and feel.

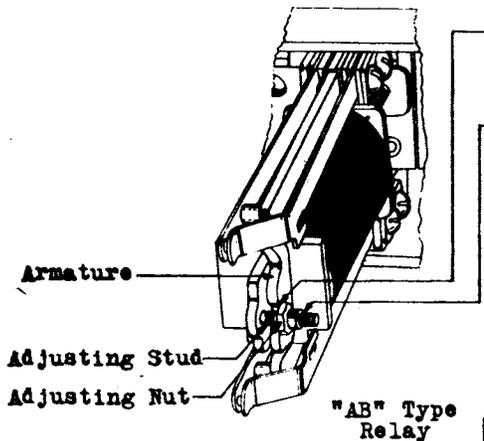


Fig. 4

"AB" Type Relay

3.06 Adjusting Stud Clearance The armature shall not rub against the adjusting stud. Gauge by eye and feel.

3.07 Adjusting Nut Tightness The adjusting nut shall be sufficiently tight on the stud to prevent its being turned with the thumb and forefinger. This requirement is considered as having been met if the nut does not turn under a turning pressure of one inch ounce. In case of doubt this may be checked by the use of the No. 349 wrench and No. 70-D gauge. With the wrench on the nut the gauge shall be applied to the wrench at the top or bottom side of the hole in the free end and the nut shall not turn with a pressure of 22 grams or less.

3.08 Armature Travel

- (a) Unless otherwise specified on the "Circuit Requirement Table" no definite limits are required for armature travel on these relays with the following exceptions:
- (b) On the A1, 2, 25, 26, 43, 46, 47, 48, 54, 55, 58, 59, 60, 61, 62, AB1, 2, 3, 4, 5 and 6 relays the armature travel shall be .020". Use the No. 66-C gauge.
- (c) Unless otherwise specified the allowance shall be:

Test	- + .005"	- .0025"
Headjust	- + .0025"	- .0025"

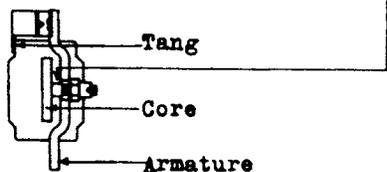


Fig. 5

3.09 Straightness of Springs All springs shall be free of sharp bends or kinks due to adjustment. A gradual bow in a spring is permissible. Gauge by eye.

3.10 Separation Between Springs There shall be a clearance of min. .008" between adjacent springs whether in the operated or unoperated positions of the relay. Gauge by eye.

3.11 Contact Pressure

3.111 Unless otherwise specified herein or on the "Circuit Requirement Table" no definite limits are required for contact pressure on "A" type relays. Spring tensions shall, however conform to the requirements covered in the following paragraphs 3.114 to 3.118 inclusive, the particular tension for each individual spring being indicated by the letters A, B, C, D or E listed in the contact pressure columns of the spring combination figures given on Sheet 3. These letters refer to paragraphs 3.114 to 3.118 respectively.

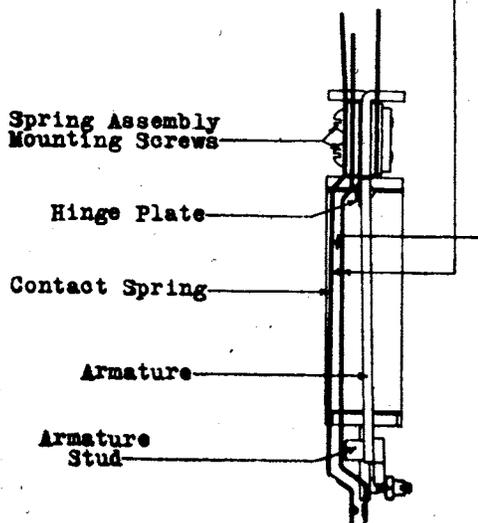


Fig. 6

REQUIREMENTS
FOR
"A" AND "AB" TYPE RELAYS

FIG.A		FIG.B		FIG.C		FIG.D		FIG.E		FIG.F	
CONT. PRESS	SPRINGS										
	1 2		1 2		1 2		1 2		1 2		1 2 3
TEST	C A	TEST	C A	TEST	E C	TEST	C A	TEST	E C	TEST	C E C
READJ.	C A	READJ.	C A	READJ.	E C	READJ.	C A	READJ.	E C	READJ.	C E C
FIG.G		FIG.H		FIG.J		FIG.K		FIG.L		FIG.M	
CONT. PRESS	SPRINGS										
	1 2 3		1 2 3 4		1 2 3		1 2 3 4		1 2 3 4		1 2 3 4
TEST	C C A	TEST	C C E C	TEST	E A C	TEST	E E E C	TEST	E E E C	TEST	C B C E
READJ.	C C A	READJ.	C C E C	READJ.	D A C	READJ.	D E E C	READJ.	E E E C	READJ.	C B C E
FIG.N		FIG.P		FIG.R		FIG.S		FIG.T		FIG.U	
CONT. PRESS	SPRINGS										
	1 2 3 4		1 2 3 4		1 2 3		1 2		1 2		1 2
TEST	E C A C	TEST	C B E E	TEST	C E C	TEST	C A	TEST	C A	TEST	E C
READJ.	E C A C	READJ.	C B E E	READJ.	C E C	READJ.	C A	READJ.	C A	READJ.	E C

A-2, A-26, A-43, A-46, A-48, A-61, AB-2, AB-4				A-6			
CONT. PRESS.	SPRINGS			CONT. PRESS.	SPRINGS		
	TOP	BOTTOM			TOP	BOTTOM	
	1 2	1 2		1 2 3	1 2		
TEST	15 C	15 C	TEST	20 A C	20 A		
READJ.	17 C	17 C	READJ.	22 A C	22 A		
A-7				A-54			
CONT. PRESS.	SPRINGS			CONT. PRESS.	SPRINGS		
	TOP	BOTTOM			TOP	BOTTOM	
	1 2 3 4	1 2 3		1 2 3	1 2		
TEST	15 B	15 E	15 C	TEST	15 C	15 C	
READJ.	17 B	17 E	17 C	READJ.	17 C	17 C	

3.112 The particular spring combination Fig. or Figs. on this sheet to be used shall be as specified in the Fig. No. column of the "Circuit Requirement Table".

3.113 Exception to requirement 3.112 shall be made in the case of relays A2, A6, A7, A26, A43, A46, A48, A54, A61, AB2 and AB4 whose springs shall have the tensions given in the adjacent tables which shall be used instead of the tables given in the spring combination figures on this sheet. The letters A, B, C etc. listed in the contact pressure columns of the adjacent tables also refer to the corresponding paragraphs 3.114, 3.115, 3.116 etc.

REQUIREMENTS FOR

"A" AND "AB" TYPE RELAYS

3.114 When the letter "A" appears in the spring tension column, it means that the spring shall have sufficient tension against the armature stud to hold the armature against the adjusting nut. When a relay has more than one spring tensioned against its armature stud or studs the tension of any one of the springs taken alone need not hold the armature against the adjusting nut but their tensions collectively shall do so.

3.115 When the letter "B" appears in the spring tension column, it means that the spring shall have the following tension.

FIG. M Spring 2 shall have sufficient tension against spring 4 to insure a separation of minimum .005" between the contacts of springs 3 and 4. Gauge by eye

FIG. P Spring 2 shall have sufficient tension against the armature stud to insure a separation of minimum .005" between the contacts of springs 3 and 4. Gauge by eye.

3.116 When the letter "C" appears in the spring tension column, it means that the spring shall have sufficient tension to hold its tang firmly against the spoolhead when the relay is unoperated.

3.117 When the letter "D" appears in the spring tension column, it means that the spring shall have as much tension as possible against the back contact consistent with meeting the readjust electrical requirement.

3.118 When the letter "E" appears in the spring tension column, it means that the spring shall have sufficient tension to insure a reliable contact.

3.119 The arrows in the spring combination Figs. indicate the direction in which the springs are tensioned. In measuring the tensions specified apply the No. 70-D gauge to the tip of the spring in proximity to the contacts. Where the contacts are located inside of the line of the front spoolhead, apply the gauge at the tip of the spring. The gauge should be held in such a position that the reed and the spring, whose tension is being measured are practically in a straight line. Unless the symbol 'A.O.' (Armature Operated) is shown associated with the arrow mark leading to a spring the tension shall be measured when the armature is in the unoperated position. Springs tensioned against spoolheads shall register the required tension when the tang of the spring is lifted slightly off the spoolhead. Springs whose contacts are tensioned against the contacts of opposing springs shall register the required tension when contact between the springs is broken.

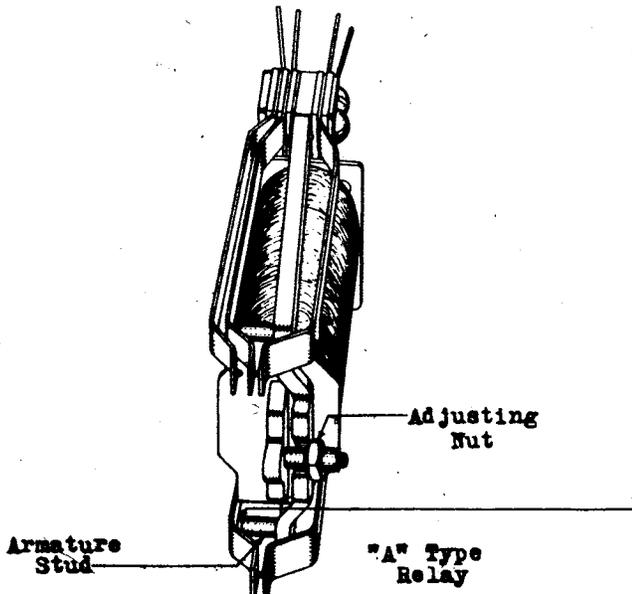


Fig. 6

3.12 **Stud Gap** There shall be a slight clearance between the armature stud or bushing and the springs indicated in the Figs. below when the armature is resting against adjusting nut. When the springs actually have a contact pressure of 25 grams or more, regardless of the minimum tension specified, this clearance is regarded as having been met if the normally closed contacts of which they form a part do not break when a gauge of the thickness specified below is inserted between adjusting nut and armature.

Test - .003"
Readjust - .005"

Use the No. 56-C gauge.

Springs	Figs.
1	C, E, L, N
2	F, K, R, L
3	H

REQUIREMENTS
FOR

"A" AND "AB" TYPE RELAYS

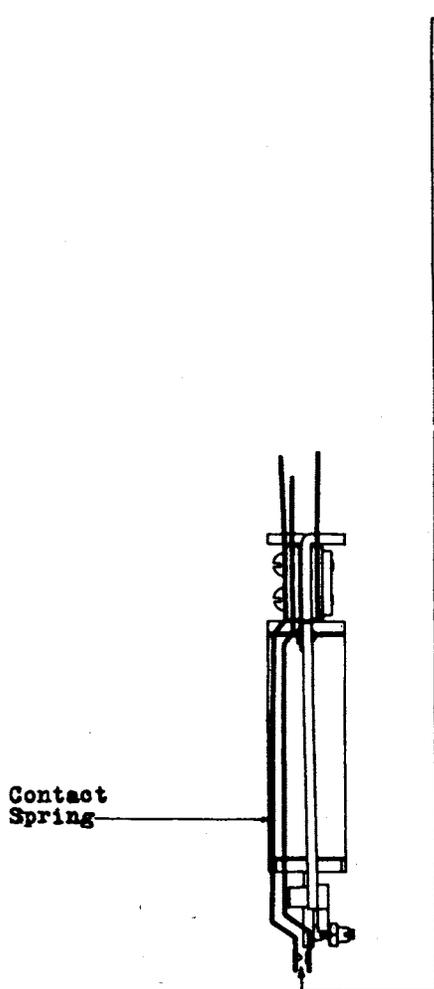


Fig. 7

3.13 Contact Separation The separation between any pair of contacts normally open or between any pair of contacts that are opened when the relay is operated shall be minimum .005". Use the No. 74-D gauge.

3.14 Contact Follow shall be perceptible (approximately .005"). This is considered satisfactory if the contacts make with a gauge of the thickness specified below inserted between the stop pins (non-freezing discs) and the core or between the armature itself and the core when stop pins are not provided.

Test - .003"

Readjust - .004"

This should be checked when the relay is electrically operated on its specified operate "Test" or "Readjust" current. Use the No. 66-C gauge.

3.15 Spring Sequence

- (a) Figs. F, K and R Spring 2 shall break from 3 before it makes with 1. Gauge by eye.
- (b) Fig. H Spring 3 shall break from 4 before it makes with 2. Gauge by eye.
- (c) Fig. M Spring 2 shall break from 4 before it makes with 1. Gauge by eye.
- (d) A relay shall meet any other spring sequence specified on the "Circuit Requirement Table".

3.16 Electrical Requirements A relay shall meet the electrical requirements specified on the "Circuit Requirement Table".

3.17 Cleaning The contacts and other parts shall be cleaned when necessary in accordance with the "X" specification covering cleaning of relay contacts and parts.