RELAYS

89, 101, AND 172 TYPES

REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers 89-, 101-, and 172-type relays. 101-type relays, except Nos. 101H and 101K relays, are part of 163-type relays.

1.02 This section is reissued to revise and amplify the electrical requirements and to revise the list of test apparatus. 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 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 Operate (DC) means that when the operate current is applied, the armature shall move sufficiently to make the front contact reliably.

1.06 Nonoperate (DC) means that when the specified nonoperate current is applied, the armature shall not move from the unoperated position sufficiently to make the front contact.

1.07 Hold (DC) 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 the contact which has been made.

1.08 Release (DC) 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 the contact which has been made.

1.09 Operate (AC) means that when the operate current is applied for one second, the armature shall move sufficiently to cause the associated apparatus to function.

1.10 Nonoperate (AC) means that when the nonoperate current is applied for one second, the armature shall not move sufficiently to cause the associated apparatus to function.

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 mounted securely and approximately level.

Gauge by eye and feel.

Check for tightness by applying a vertical and a horizontal pressure to the relay and not by attempting to turn the relay.

2.03 Tightness of Relay Cover: The cover shall be easily removable with the fingers.

Gauge by feel.

2.04 Front Contact Spring Position: Fig. 1(A) - The front contact spring shall rest firmly against the spoolhead at least near the contact end.

Gauge by feel.

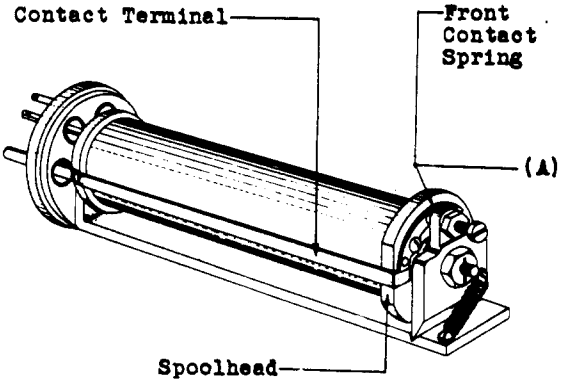


Fig. 1

2.05 Tightness of Front Contact Spring Screw: Fig. 2(A) - The front contact spring screw shall be sufficiently tight to hold the front contact spring in the adjusted position.

Gauge by feel.

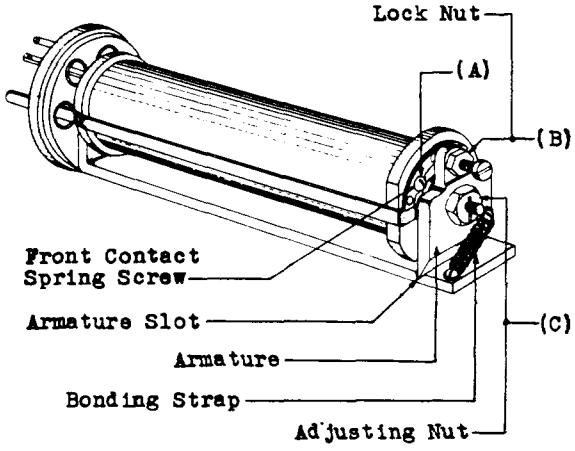


Fig. 2

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

Gauge by eye.

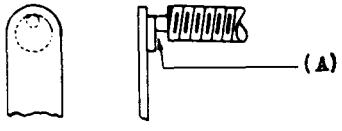


Fig. 3

2.07 Armature Movement: The armature shall not bind or ride on the top of the pin in the armature slot and shall clear the adjusting stud.

Gauge by feel.

*2.08 Tightness of Locknut: Fig. 2(B) - The locknut shall be sufficiently tight to hold the front contact screw in the adjusted position.

Gauge by feel.

*2.09 Tightness of Adjusting Nut: Fig. 2(C) - The adjusting nut shall be sufficiently tight to hold the armature in any adjusted position.

Gauge by feel.

2.10 Contact Separation: Fig. 4(A) - The separation between any pair of contacts normally open shall be

Min - 0.005 in.

Gauge by eye.

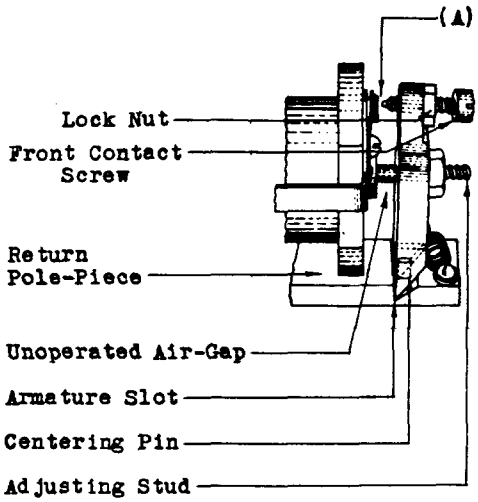


Fig. 4

2.11 Feather Contact Spring Position: Fig. 5(A) - The feather contact spring shall rest against the turned-over portion of the front contact spring when it is not engaged by the front contact screw.

Gauge by eye.

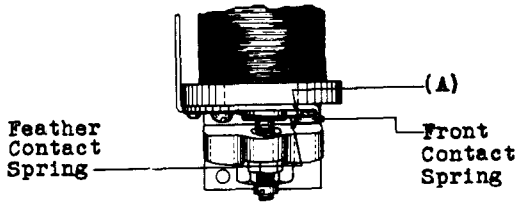


Fig. 5

2.12 Electrical Requirements

(a) Except as specified in (b) and (c), all relays shall meet the electrical requirements specified on the circuit requirement tables.

Note: The requirements designated "Special" in the "Type of Adjustment" column in this section and on the circuit requirement tables are the minimum currents for which the relays should be adjusted and should not be used unless they are necessary to meet the service conditions. If these values are used it is likely to result in unstable relay performance and increased maintenance effort will be required to maintain the adjustments. In general, the standard adjustment requirements should be used whenever practical.

(b) When the relay is used in a toll or telegraph circuit in a toll office and (1) an ac voltage test set is used and (2) ac voltage requirements are not shown in the circuit requirement table, the ac voltage requirements in Table D shall be used.

(c) When the circuit requirement table specifies the electrical test and readjust requirements to be in accordance with the BSP, RAP, or X specification, the requirements given in Tables A, B, and C shall apply. The particular requirements that are to be applied shall be determined by the item number or by the type of testing and adjusting equipment, the code of the relay, type of circuit, type of adjustment, and ringing frequency and voltage required.

Table A - Electrical Test Requirements for 89B Relay in Toll Cord Circuits When Resistance Network Method of Testing and Adjusting Is Used

FREQUENCY IN CYCLES	NOTES	VOLTAGE AT BUS BAR	NONINDUCTIVE RESISTANCE "X"	ITEM NO.
16-2/3	1-3-9-11-16-21	75-80	760	1.01
		80-85	700	1.02
		85-90	650	1.03
		90-95	580	1.04
		95-100	470	1.05
		100-105	440	1.06
		105-110	420	1.07
		110-115	395	1.08
		115-120	375	1.09
	1-2-9-12-16-21	75-80	2290	1.10
		80-85	1910	1.11
		85-90	1660	1.12
		90-95	1450	1.13
		95-100	1320	1.14
		100-105	1250	1.15
		105-110	1130	1.16
		110-115	1080	1.17
		115-120	960	1.18
20	1-5-9-11-16-21	75-80	970	1.19
		80-85	870	1.20
		85-90	780	1.21
		90-95	690	1.22
		95-100	650	1.23
		100-105	630	1.24
		105-110	595	1.25
		110-115	580	1.26
		115-120	540	1.27
	1-4-9-12-16-21	75-80	3010	1.28
		80-85	2530	1.29
		85-90	2080	1.30
		90-95	1930	1.31
		95-100	1790	1.32
		100-105	1500	1.33
		105-110	1400	1.34
		110-115	1270	1.35
		115-120	1160	1.36

See Pages 6, 7, and 8 for the notes referred to in the above table.

Table B - Electrical Requirements for 89-type, 101H, 101K, 172A, and 172B Relays in Toll Line Circuits When Resistance Network Method of Testing and Adjusting Is Used

RELAY CODE	TYPE OF ADJUST-MENT	AC TEST AND READJUST CURRENT FLOW REQUIREMENTS (AMPERES)	FREQUENCY IN CYCLES	VOLTAGE AT BUS BAR	EQUIVALENT AC N.I. RESISTANCE REQUIREMENTS			ITEM NO.
					TEST	READJUST		
					R	K	L	
89 TYPE 101H 101K (LINE) (WDG)		Test Opr - 0.008 Readj Opr - 0.0072 Readj N.O. - 0.004	16-2/3	75-80	1450	570	600	2.01
				80-85	1270	500	550	2.02
				85-90	1120	430	510	2.03
				90-95	1000	370	480	2.04
				95-100	920	320	450	2.05
				100-105	845	300	420	2.06
				105-110	780	280	390	2.07
				110-115	725	260	370	2.08
				115-120	680	230	350	2.09
			20	75-80	1630	660	650	2.10
				80-85	1410	540	600	2.11
				85-90	1250	450	560	2.12
				90-95	1130	400	520	2.13
				95-100	1025	350	490	2.14
				100-105	937	310	460	2.15
				105-110	860	280	430	2.16
				110-115	805	260	400	2.17
				115-120	745	250	370	2.18
172A		Test Opr - 0.0046 Readj Opr - 0.0042 Readj N.O. - 0.0025	16-2/3	75-80	765	355	315	3.01
				80-85	690	318	292	3.02
				85-90	630	290	270	3.03
				90-95	585	267	253	3.04
				95-100	542	247	238	3.05
				100-105	505	227	223	3.06
				105-110	475	215	210	3.07
				110-115	445	200	200	3.08
				115-120	423	187	190	3.09
			20	75-80	880	410	355	3.10
				80-85	800	370	325	3.11
				85-90	725	335	300	3.12
				90-95	670	310	280	3.13
				95-100	620	285	260	3.14
				100-105	575	260	245	3.15
				105-110	540	240	235	3.16
				110-115	508	238	222	3.17
				115-120	478	214	210	3.18
172B	Standard	Test Opr - 0.0103 Readj Opr - 0.00935 Readj N.O. - 0.0049	16-2/3 or 20	75-80	2220	1210	540	4.01
				80-85	1900	1030	490	4.02
				85-90	1600	880	450	4.03
				90-95	1450	785	415	4.04
				95-100	1300	680	390	4.05
				100-105	1170	615	365	4.06
				105-110	1060	570	340	4.07
				110-115	980	510	325	4.08
				115-120	910	475	305	4.09
	Special	Test Opr - 0.0088 Readj Opr - 0.008 Readj N.O. - 0.0045		75-80	1530	780	470	4.10
				80-85	1330	665	435	4.11
				85-90	1180	580	400	4.12
				90-95	1050	520	370	4.13
				95-100	950	470	350	4.14
				100-105	870	432	328	4.15
				105-110	800	392	308	4.16
				110-115	740	360	290	4.17
				115-120	690	335	275	4.18

Notes 6, 7, 8, 17, and 18 on Pages 6 and 7 apply to the above table.

Standard adjustment was formerly average adjustment.
Special adjustment was formerly minimum adjustment.

Table C - Electrical Requirements When Low Shunt Method of Testing and Adjusting Is Used

RELAY CODE	TYPE OF SWITCH-BOARD	TYPE OF CIRCUIT	TYPE OF ADJUST-MENT	FRE-QUENCY IN CYCLES	AC TEST AND READJUST CURRENT FLOW REQUIREMENTS								SHUNT RESIS-TANCE (OHMS)*	NOTES	ITEM NO.
					CURRENT IN RELAY AMPERES				METER SETTING AMPERES						
					TEST		READJ.		TEST		READJ.				
					OPR	N.O.	OPR	N.O.	OPR	N.O.	OPR	N.O.			
89-B (LINE) (WDG)	NO. 1 TOLL	CONDENSER CORD		16-2/3	0.0085		0.008		0.118		0.112		150	6,9,11,14 19,21	5.01
				20					0.080		0.076		225		5.011
				16-2/3					0.132		0.124		150		5.02
				20					0.088		0.084		225		5.021
				16-2/3					0.110		0.100		400	6,9,12,14 19,21	5.03
				20					0.130		0.114				5.04
				16-2/3					0.108		0.100		200	6,9,13,14 19,21	5.05
				20					0.092		0.088		225		5.051
									0.120		0.112		200		5.06
									0.102		0.098		225		5.061
89 TYPE (LINE) (WDG)	NO. 1-D NO. 2 NO. 11 NO. 10	CORD		16-2/3	0.0085		0.008		0.116		0.110		150	6,10,15,20	9.01
				20					0.082		0.076		225		9.011
									0.126		0.118		150		9.02
									0.088		0.082		225		9.021
89 TYPE 101H 101K (LINE) (WDG)	NO. 1-D, 2,10,11, NO. 1 TOLL	LINE		16-2/3	0.008		0.0072	0.004	0.130		0.114	0.056	120	6,15,20	6.01
				20					0.130		0.118	0.064	125		6.011
									0.146		0.130	0.064	120		6.02
									0.144		0.132	0.070	125		6.021
172A	NO. 1-D, 2,10,11, NO. 1 TOLL	LINE		16-2/3	0.0046		0.0042	0.0025	0.118		0.106	0.056	115	6,15,20	7.01
				20					0.108		0.098	0.050	125		7.011
									0.136		0.120	0.064	115		7.02
									0.126		0.110	0.058	125		7.021
	NO. 2	CORD		16-2/3					0.114		0.102	0.050	125	6,10,15,20	7.031
				20					0.120		0.108	0.054			7.041
172B	NO. 1-D, 2,10,11, NO. 1 TOLL	LINE	STANDARD	16-2/3	0.0103	0.0044	0.00935	0.0049	0.128	0.050	0.116	0.058	115	6,15,20	8.01
				20					0.120	0.046	0.108	0.054	125		8.011
									0.138	0.054	0.124	0.060	115		8.02
									0.128	0.050	0.114	0.056	125		8.021
			SPECIAL	16-2/3	0.0088	0.004	0.008	0.0045	0.110	0.046	0.100	0.052	115		8.03
				20					0.102	0.042	0.092	0.048	125		8.031
									0.116	0.048	0.106	0.056	115		8.04
									0.108	0.044	0.096	0.052	125		8.041

See Pages 6, 7, and 8 for the notes referred to on the above table.

Standard adjustment was formerly average adjustment.
Special adjustment was formerly minimum adjustment.

*Meter setting values shall be chosen to conform to the particular value of shunt resistance in the testing or adjusting circuit.

Table D - AC Voltage Requirements

RELAY CODE	TYPE OF SWBD	TYPE OF CIRCUIT	SERIES CONN.	TYPE OF ADJ	FREQ IN CYCLES	AC TEST AND READJUST REQUIREMENTS METER SETTINGS VOLTS ACROSS T AND R LEADS TEST OPR	TEST N.O.	READJ OPR	READJ N.O.	SHUNT RES (SEE NOTES 22,23,24)
89 Type 101H (Line Wdg)	No.1D,9D, 10,& No.2 Toll	Cord	Rep.Coil Wdgs		16-2/3	17.0		16.0		225
					20	18.0		17.0		
89 Type (Line) (Wdg)	No.1 Toll	Cond Cord	1/2 44B Wdgs Series		16-2/3	45.0		37.5		None
					20	50.0		42.5		
			1/2 44B Wdgs Parallel		16-2/3	19.0		18.0		None
					20	22.5		20.0		
172A	No.2 Toll	Cord	Rep.Coil Wdgs		16-2/3	16.0		14.5	7.0	225
					20	17.5		15.5	7.5	

The following requirements shall be used when the circuit does not show the series connections covered above or for locating trouble.

						Meter Settings Volts Across Relay Wdg Test Opr	Test N.O.	Readj Opr	Readj N.O.	
89 Type (Line) (Wdg)	No.1D,9D, 10,& No. 1 & 2 Toll	Cord	Wdg Alone		16-2/3	17.0		16.0		225
					20	18.5		17.5		
89 Type 101H 101K (Line) (Wdg)	No.1D,10, 11, No. 1 & 2 Toll	Intertoll Trunk	Line Wdg Alone (LU Wdg) (In) (Closed) (Circuit)		16-2/3	16.0		14.5	8.0	225
					20	17.5		16.0	8.5	
172A	No.1D,10, 11, No.1 & 2 Toll	Intertoll Trunk or Cord	Wdg Alone		16-2/3	17.0		13.5	6.5	225
					20	19.0		15.0	7.5	
172B	No.1D,10, 11, No.1 & 2 Toll	Intertoll Trunk	Wdg Alone	Std	16-2/3 20	14.0	6.0	13.0	6.5	225
				Spl	16-2/3 20	12.0	5.5	11.0	6.0	225

Notes

1. Testing shall be done with the standard testing circuit or network if installed; otherwise the relay shall be tested in accordance with note 6 or with the X resistance values specified in the table on Page 3 in connection with the network shown in note 16. The relay shall be readjusted in accordance with the mechanical requirements given on Pages 1 and 2.

2. These requirements provide an adjustment for ringing over lines equal to 300 miles of No. 12 N.B.S. copper wire.

3. These requirements provide an adjustment for ringing over lines equal to 600 miles of No. 12 N.B.S. copper wire.

4. These requirements provide an adjustment for ringing over lines equal to 100 miles of No. 12 N.B.S. copper wire.

5. These requirements provide an adjustment for ringing over lines equal to 400 miles of No. 12 N.B.S. copper wire.

6. Testing and readjusting shall be done with the standard testing and adjusting circuits, networks, or ac milliammeter circuit, if installed; if not, the current values, meter settings, or resistance values specified in the Tables B and C shall be used in connection with the testing and adjusting networks shown in notes 17 to 20.

7. Testing and readjusting shall be done when the relay is isolated from the toll line.

8. Testing and readjusting shall be done only when a 1000-ohm Ward-Leonard resistance is in the ringing lead.

9. The cord circuit is prepared for testing and readjusting the relay when the sleeve of the (front or back) end of the cord circuit in which the relay is located is connected to ground through 60 ohms and the tip and ring of the other cord (back or front respectively) is short-circuited.

10. The cord circuit is prepared for testing and readjusting the relay under the following conditions:

    A. Cord circuits arranged to leave the repeating coil in on all connections shall have the sleeve of the TOLL & SUBS or CALL cord connected to ground through 500 ohms when testing the relay in this cord and the sleeve of the TOLL or ANS cord connected to ground through 500 ohms when testing the relay in this cord.

    B. Cord circuits arranged to cut the repeating coil out on through magneto connections shall have the sleeve of the TOLL & SUBS or CALL cord connected to ground through 34 ohms with the tip and ring open and the testing or adjusting circuit connected to the tip and ring of the TOLL or ANS cord with the sleeve connected to ground through 500 ohms.

11. These requirements apply when the relay is NOT used in series with one-half of a 44B retardation coil.

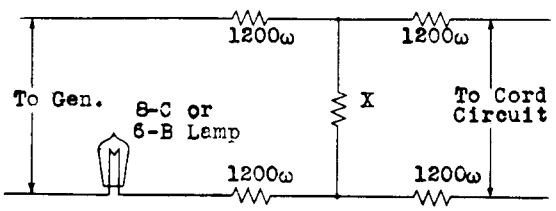
12. These requirements apply when the relay is used in series with one-half of a 44B retardation coil having its windings connected in series.

13. These requirements apply when the relay is used in series with one-half of a 44B retardation coil having its windings connected in parallel.

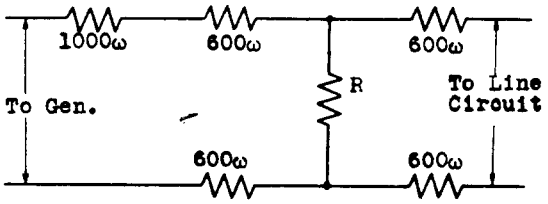
14. Testing and readjusting shall be done only when a 150-ohm Ward-Leonard resistance is in the ringing lead.

15. Testing and readjusting shall be done only when a 300-ohm Ward-Leonard resistance is in the ringing lead.

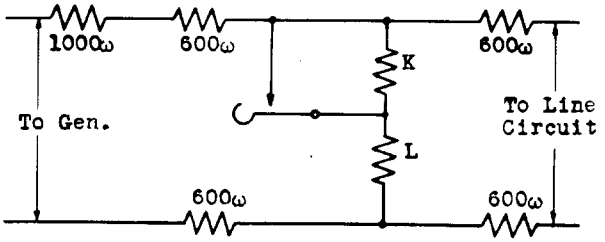
16. Testing Network



17. Testing Network

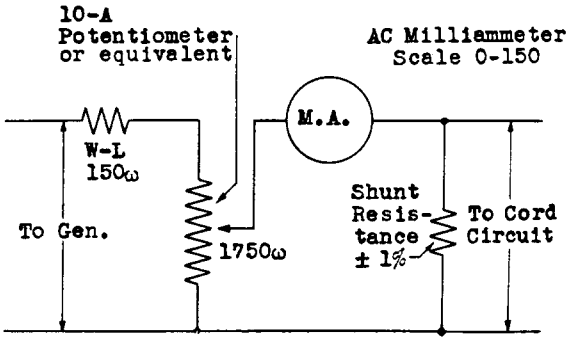


18. Adjusting Network



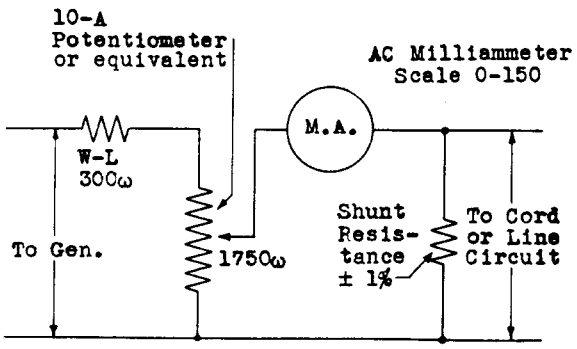
For readjust operate, the key which short-circuits resistance K shall be normal so that resistances K and L are in the circuit. For readjust nonoperate, the key which short-circuits resistance K shall be operated.

19. Testing and Adjusting Network



Vary the potentiometer arm to get specified meter setting. This shall be done before the testing and adjusting circuit is connected to the circuit under test.

20. Testing and Adjusting Network



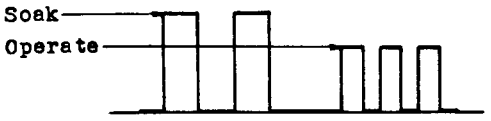
Vary the potentiometer arm to get specified meter setting. This shall be done before the testing and adjusting circuit is connected to the circuit under test.

21. In addition to meeting the ac requirements specified, the relay shall cause the associated supervisory lamp or equivalent signal to respond to a rate of flashing as specified below for test and readjust as applied by means of the test and readjust circuits provided for the office. In offices not equipped with an interrupter, the interruptions shall be simulated manually. The dc requirements to be used shall be

	Test (Amp)	Readjust (Amp)
Soak	0.010	0.010
Operate	0.0064	0.006

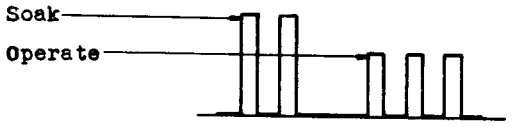
These current flow requirements replace the requirements specified on the circuit requirement table for the line winding of this relay.

Test: The current values specified above shall be applied in the following order in testing. Connect and interrupt the soak current two times at the rate of one interruption per second (60 per minute) and with a ratio of make to break of one to one. Approximately one second after the soak current is disconnected, connect and interrupt the operate current at least three times at the rate of two interruptions per second (120 per minute) and with a ratio of make to break of three to two.



Test Sequence

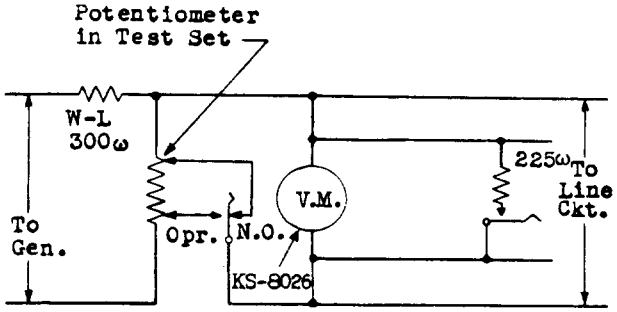
Readjust: The current values specified above shall be applied in the following order in readjusting. Connect and interrupt the soak current two times at the rate of two interruptions per second (120 per minte) and with a ratio of make to break of two to three. Approximately one second after the soak current is disconnected, connect and interrupt the operate current at least three times at the rate of two interruptions per second (120 per minute) with a ratio of make to break of two to three.



Readjust Sequence

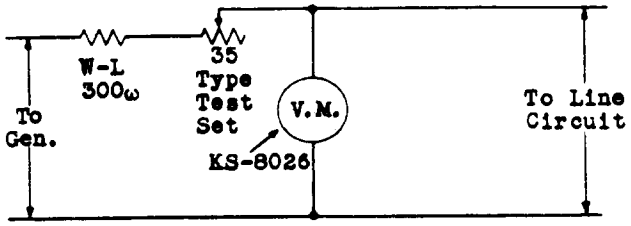
22. These shunts facilitate the testing or readjusting of a group of relays by stabilizing the test circuit output and making it unnecessary to re-establish the test circuit output voltage for each relay. When a test circuit is used that is not equipped with the shunt resistance specified, the voltage value must be re-established for each relay tested or readjusted.

23. Testing and Adjusting Network



Connect the network to the line to be tested. Operate the specified shunt key and adjust the potentiometer sliders to get the specified meter settings. (This circuit arrangement is used in the J68602AJ test set.)

24. Testing and Adjusting Network



Connect the network to the line to be tested. Operate a test key of the 35-type test set and vary the associated resistance slider to get the specified meter setting. (This circuit arrangement is used in the J68602AH test set.)

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, and Test Apparatus

Code or Spec No.	Description
Tools	
46 or 102	3/8 in. Hex. Single-end Socket Wrench
221	Consists of 3/16-in. and 5/16-in. Hex. Single-end Socket Wrenches and a Screwdriver
350	Spring Adjuster
-	P-long-nose Pliers
-	Hardwood Toothpicks (flat at one end and pointed at other)
Gauges	
66D	Thickness Gauge Nest
107A	0.065-in. Thickness Gauge
Test Apparatus	
35F	Test Set
J68602AH	Test Set
J68602AJ	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 nuts use the No. 46 or 102 wrench. Do not fasten the mounting nut too tightly as otherwise undue pressure will be exerted on the fiber insulators and the threads of the mounting stud may be stripped. It is particularly important that these relays be mounted approximately level (as regards the armature knife edge).

(2) If the mounting nut is tight but the coil is loose, remove the relay from the mounting plate. Tighten the nut on the mounting stud, which holds the pole piece to the core at the rear of the relay, with the No. 46 or 102 wrench. At the same time align the contacts by shifting the coil and pole piece.

3.03 Tightness of Relay Cover (Rq 2.03)

(1) Since failure of the relay to function properly may be due to the cover being on too tight, thereby twisting the relay structure, exercise care in replacing the cover not to put it on so tight that it cannot be easily removed with the fingers. Do not use any tool to tighten the cover.

3.04 Front Contact Spring Position (Rq 2.04)
3.05 Tightness of Front Contact Spring Screw (Rq 2.05)

(1) Front Contact Spring: To position the front contact spring against the spoolhead, first tighten the front contact spring screw if loose with the screwdriver of the No. 221 tool. If this does not correct the trouble, loosen the screw sufficiently to permit the insertion of the No. 350 spring adjuster between the spring and the spoolhead so that its forked end spans the screw. Tighten the screw and then force the front contact spring toward the spoolhead by applying pressure to the end of the spring with the screwdriver applied as shown in Fig. 6. Exercise care not to bend the turned-over portion of the spring toward the spoolhead during this operation since this will tend to destroy the purpose for which the feather contact spring is used. Loosen the screw, remove the No. 350 spring adjuster, and tighten the screw securely. In tightening the screw, press the front contact spring against the spoolhead adjacent to the head of the screw, in order to relieve the tension against the screwhead while tightening, to prevent stripping of the threads in the spoolhead.

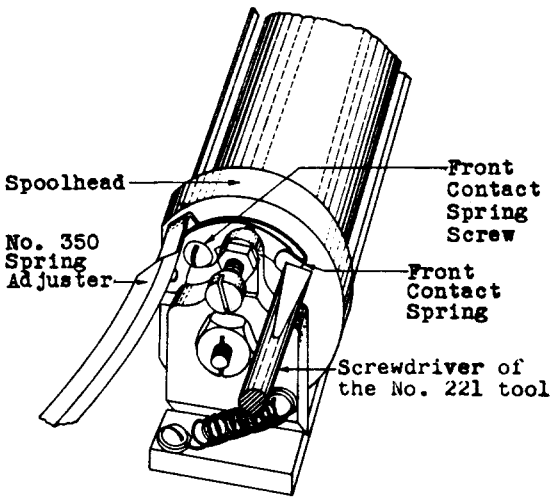


Fig. 6 - Method of Adjusting for Front Contact Spring Position

(2) Tightness of Front Contact Spring Screw: To tighten the front contact spring screw use the screwdriver of the No. 221 tool and at the same time align the front contacts in accordance with procedure 3.06.

3.06 Contact Alignment (Rq 2.06)

(1) To align the contacts, loosen the front contact spring screw with the screwdriver of the No. 221 tool and shift the spring so that the contact points rest wholly within their associated contacts and as near the center as possible. Tighten the screw securely.

3.07 Armature Movement (Rq 2.07)

(1) Centering Pin and Armature Slot: If the armature does not move freely, it may be due to the centering pin located in the armature slot being bent, or to burrs in the slot in the armature. Remove the armature to inspect the knife edge if the action of the relay indicates that such an inspection is necessary. If it is defective, proceed as follows: If the relay is equipped with a bonding strap, remove the screw which fastens it to the armature using the screwdriver of the No. 221 tool. Then remove the adjusting nut with the 5/16-in. wrench of the No. 221 tool and remove the armature.

(2) If the centering pin is bent, straighten it with long-nose pliers. Note that the slot in the armature and the knife edge of the armature are not burred. Do not remove burrs by filing or other means as this injures the finish which protects the parts from corrosion.

(3) At this time clean the armature and armature slot thoroughly in accordance with procedure 3.01.

(4) Reassemble the parts and tighten all screws securely.

(5) Adjusting Stud: If the armature does not clear the adjusting stud, straighten it by grasping the adjusting nut with long-nose pliers and then twisting as required.

3.08 Tightness of Locknut (Rq 2.08)

(1) To tighten loose locknuts, use the 3/16-in. wrench of the No. 221 tool holding the screw in position with the screwdriver of the No. 221 tool.

3.09 Tightness of Adjusting Nut (Rq 2.09)

(1) If the adjusting nut is loose remove it, using the 5/16-in. wrench of the No. 221 tool and then close up the slot in the nut with the long-nose pliers. Replace the nut on the stud.

3.10 Contact Separation (Rq 2.10)
3.11 Feather Contact Spring Position (Rq 2.11)
3.12 Electrical Requirements (Rq 2.12)

(1) General: The method of adjusting the operated and unoperated armature airgaps as outlined under (2) and (3) are for use on all relays except the 89B, 89K, 101H, and 101K which are covered by (8) and (9), and the 172A and 172B relays which are covered by (10) and (11).

(2) Operated Position of Armature: With the release current connected continuously to the proper winding or windings of the relay as specified on the circuit requirement table, apply the soak current; or if no soak current is specified, apply the operate current. Loosen the locknut on the front contact screw slightly with the 3/16-in. wrench of the No. 221 tool and turn the front contact screw in a counterclockwise direction with the screwdriver of the No. 221 tool to a point where the armature sticks when the soak or operate current is disconnected. Again apply the soak or operate current and turn the front contact screw slightly in a clockwise direction until it has reached a point where the armature just releases when the soak or operate current is disconnected. Then turn the front contact screw a very slight amount (approximately 1/16 of a turn) further in a clockwise direction and tighten the locknut.

(3) Unoperated Position of Armature (Contact Separation): Turn the adjusting

nut in a clockwise direction with the 5/16-in. wrench of the No. 221 tool until the front contact screw just touches the front contact. Then turn the adjusting nut in a counterclockwise direction approximately 1/4 turn which allows a clearance between the front contact and the screw of minimum 0.005 in. Check the relay for its electrical requirements. If the relay fails to meet the electrical requirements after the operated and unoperated positions of the armature have been established, proceed as follows.

(4) Operate and Nonoperate: Failure to meet either of these current requirements is probably due to the airgap between the armature and core when the armature is in the unoperated position being incorrect. If the relay fails to operate, decrease the unoperated armature airgap. To do this, turn the adjusting nut in a clockwise direction with the 5/16-in. wrench of the No. 221 tool, noting that the contact separation requirement is still met. If the relay fails to meet the nonoperate requirement, increase the unoperated armature airgap. To do this turn the adjusting nut in a counterclockwise direction. If impossible to meet the operate requirement by means of the adjustment of the unoperated airgap and still meet the contact separation requirement, slightly change the operated airgap as outlined under (5) consistent with meeting the release and hold requirements.

(5) Release Hold: Failure to meet either of these current requirements is probably due to the airgap between the armature and core, when the relay is in the operated position, being incorrect. If the relay fails to release, increase the operated armature airgap slightly. To do this loosen the locknut on the front contact screw with the 3/16-in. wrench of the No. 221 tool and turn this screw in a clockwise direction with the screwdriver of the No. 221 tool, noting that the contact separation requirement is still met. Tighten the locknut securely. If the relay fails to meet the hold requirement, decrease the operated armature airgap. To do this, loosen the locknut on the front contact screw with the 3/16-in. wrench of the No. 221 tool and turn this screw in a counterclockwise direction with the screwdriver of the No. 221 tool. Tighten the locknut securely.

(6) On relays equipped with bonding straps, failure to meet the electrical requirements may be due to a defective bonding strap. Replace the bonding strap if the requirements cannot be obtained by a readjustment of the operated and unoperated airgaps.

(7) Feather Contact Spring Position: The adjustment of the feather contact spring also affects the operation of the relay, and the tension of it against the turned-over portion of the front contact spring should be considered in adjusting to meet the electrical requirements. To increase the tension insert the flat end of a toothpick between the spring and the front contact spring and slide the toothpick towards the contact spring screw until the spring will rest firmly against the inside of the front contact spring. Take care not to kink the spring or give it an excessive bow. In case the spring is bowed excessively, the bow may be reduced by rubbing the spring with the screwdriver of the No. 221 tool adjacent to the front contact spring screw. In its final adjusted position, the spring should curve slightly outward toward the armature as shown in Fig. 5, rather than inward toward the front contact spring, so that the front contact screw in its travel will make contact as long as possible.

89B, 89K, 101H, and 101K Relays

(8) Unoperated Position of Armature: Loosen the locknut on the front contact screw slightly with the 3/16-in. wrench of the No. 221 tool and turn the screw in a counterclockwise direction with the screwdriver of the No. 221 tool until the contact point does not protrude through the armature. Insert the No. 107A gauge between the armature and core from the left-hand side of the relay so that the slotted surface is toward the feather contact spring and the edge of the gauge (shown A-B in Fig. 7) is horizontal and rests on the adjusting stud flat against the core. Turn the adjusting nut in a counterclockwise direction, if necessary, with the 5/16-in. wrench of the No. 221 tool. With the gauge held in this position turn the adjusting nut in a clockwise direction with the 5/16-in. wrench of the No. 221 tool until, with the armature knife edge held in its normal position in the slot, the armature touches the gauge. Remove the gauge.

(9) Operated Position of Armature (Contact Separation): Hold the armature in its normal position in the slot with the fingers, and with the locknut on the front contact screw loosened as outline in (8), turn the front contact screw in a clockwise direction with the screwdriver of the

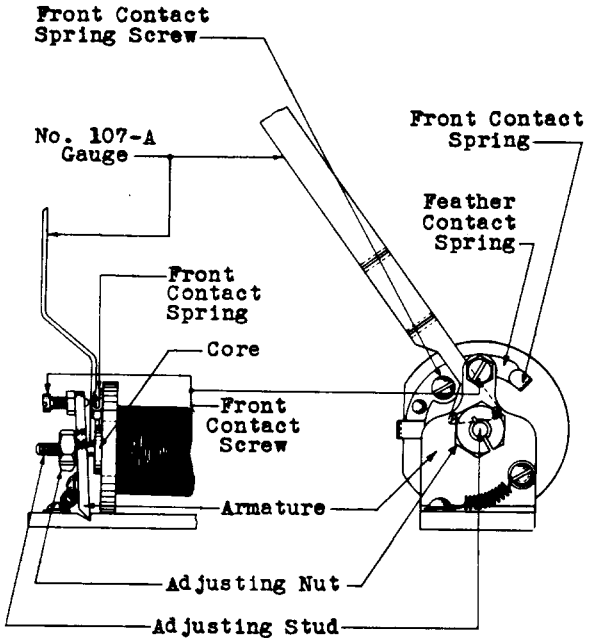


Fig. 7 - Method of Adjusting for Unoperated Airgap

No. 221 tool until it just makes contact with the feather contact spring. Then turn the contact screw in a counterclockwise direction approximately 1/3 of a turn. This establishes a contact separation of approximately 0.007 in. Tighten the locknut securely.

172A and 172B Relays

(10) Operated Position of Armature: In positioning the armature in its operated position, it is desirable to establish first a temporary unoperated position of the armature. Loosen the locknut on the front contact screw slightly with the 3/16-in. wrench of the No. 221 tool and turn the screw in a counterclockwise direction with the screwdriver of the No. 221 tool until the contact point does not protrude through the armature. With the armature knife edge in the slot and the armature held firmly against the core, turn the adjusting nut in a clockwise or counterclockwise direction as required with the 5/16-in. wrench of the No. 221 tool to position it approximately midway between the armature and the end of the adjusting stud. This establishes a temporary unoperated position of the armature. With the armature still held against the core, turn the front contact screw in a clockwise direction until the contact point presses the feather contact spring firmly against the front contact spring. In doing this, see that the armature does not leave the core since the adjustment would be changed. With the armature knife edge in the slot and the armature now held against the adjusting nut, turn the front contact screw in a clockwise direction one complete turn. Retighten the locknut securely.

(11) Unoperated Position of Armature (Contact Separation): The armature was located in a temporary unoperated position while locating it in its operated position in (10). The final unoperated position is determined by the electrical requirements and is obtained by turning the adjusting nut in a clockwise direction to meet the operate requirement, or in a counterclockwise direction to meet the nonoperate requirement.

(12) Flashing Condition: In addition to meeting the ac requirements specified, the 89B and 89K relays shall be adjusted to meet the flashing adjustment specified on Page 8 in note 21. This may be done by slightly turning the adjusting nut in a clockwise or counterclockwise direction with the 5/16-in. wrench of the No. 221 tool from the position established in (8) or (9). Make a corresponding adjustment of the the front contact screw with the screwdriver of the No. 221 tool, first loosening the locknut with the 3/16-in. wrench of the No. 221 tool, to maintain the contact separation established in (9).

(13) Electrical Check: Apply the electrical requirements and if the relay fails to meet them, slightly modify the previous adjustments by turning the adjusting nut slightly in a clockwise or counterclockwise direction as required and make a corresponding adjustment of the front contact screw to maintain the contact separation previously established. Replace the relay cover and again check to see that the relay meets its electrical requirements as observed by the functioning of the associated apparatus in the circuit.

REASONS FOR REISSUE

1. To amplify the electrical requirement to specify when the standard and special adjustments should be used (2.12).

2. To add the 101H relay to Table D.

3. To add the No. 10 switchboard to Table C.

4. To add a note referring to the shunt resistance values on Table D (note 22).

5. To add two testing and adjusting networks for voltmeter method of testing (notes 23 and 24).

6. To revise and add to the List of Tools, Gauges, and Test Apparatus (3.001).

7. To delete the paragraph referring to the No. 72 tool (3.002).