196-TYPE RELAY
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers 196-type relays.

1.02 This section is reissued to incorporate material from the addendum in its proper location. In this process marginal arrows have been omitted.

1.03 Reference shall be made to Section 020-010-711 covering General Requirements and Definitions for additional information necessary for the proper application of the requirements listed herein.

1.04 Operate (DC): A relay is said to operate, if when current is connected to its winding the armature moves sufficiently to break the back contact and make the front contact reliably.

1.05 Release (DC): A relay is said to release, if the armature moves from the operated position sufficiently to break the contact that has been made and to close reliably the contact that has been broken.

1.06 Operate (AC): A relay is said to operate, if when current is connected to its winding the armature moves sufficiently to cause the associated relay or relays to function.

1.07 Non-Operate (AC): A relay is said to non-operate, if when current is connected to its winding, the armature does not move sufficiently to cause the associated relay or relays to function.

2. REQUIREMENTS

2.01 Cleaning: The contacts shall be cleaned when necessary in accordance with the section covering cleaning of relay contacts and parts.

2.02 Relay Mounting: Relays shall be fastened securely to the mounting plate. This shall be checked for by grasping the relay firmly at the points marked X in Fig. 2 and applying a vertical and a horizontal pressure to the relay. Do not attempt to turn the relay. Gauge by feel.

2.03 Cover Spring Pressure: The cover springs shall have sufficient pressure against the cover to hold the cover securely in place. Gauge by feel.

2.04 Contact Alignment - Fig. 1 (A): Contacts shall line up so that the point of contact falls wholly within the boundary of the opposing contact. Gauge by eye.

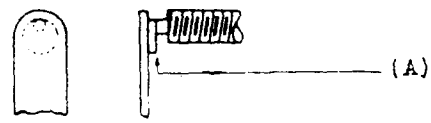


Fig. 1 - Contact Alignment

2.05 Tightness of Front Contact Screw - Fig. 2 (A): The front contact (or stop) screw shall be sufficiently tight in the front contact screw bracket to hold any adjusted position. Gauge by feel.

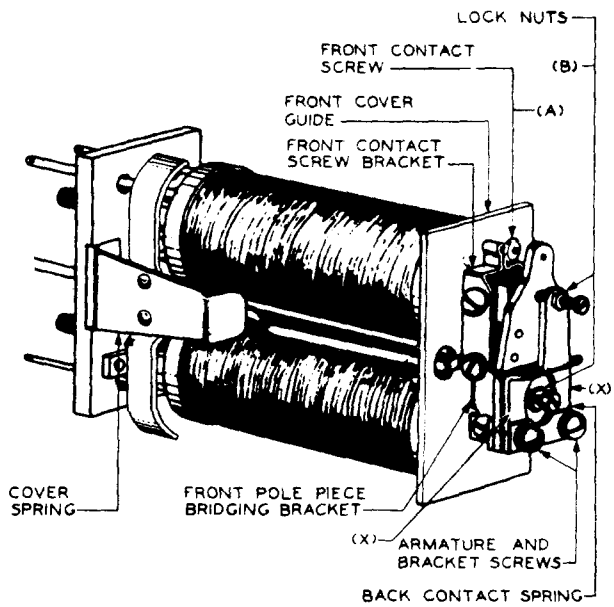


Fig. 2 - 196-Type Relay

2.06 Tightness of Locknuts

(a) Fig. 2(B) - Locknuts shall be sufficiently tight to hold the screws in their adjusted position.

Gauge by feel.

(b) Fig. 3(A) - The locknut and screw on the front pole-piece bridging bracket, which is located behind the relay armature assembly, should be checked for tightness by feeling the tightness of the coils and front cover guide.

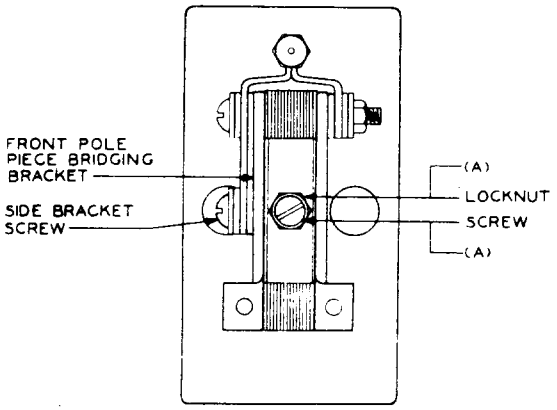


Fig. 3 - Locknut and Screw Located Behind the Armature

2.07 Unoperated Armature Air-Gap - Fig. 4(A): There shall be a gap between the core of the upper coil and the armature measured at the nearest point when the back contact (or stop) screw is touching the armature, of:

Min. .006"
Max. .009"

Use the No. 74D gauge.

2.08 Armature Travel: There shall be a separation between the back contact (or stop) screw and the armature when the front contact (or stop) screw is touching the armature of:

Min. .003"
Max. .005"

Use the No. 74D gauge.

2.09 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

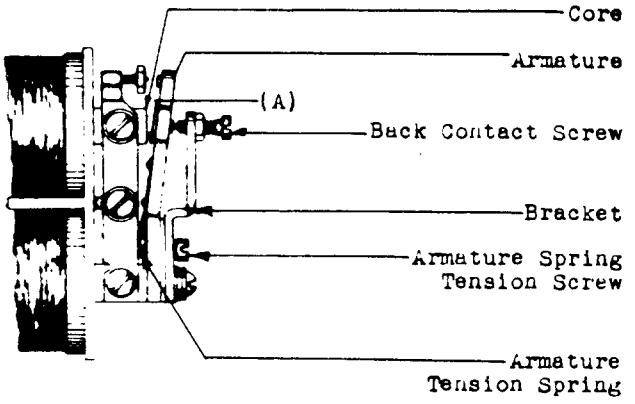


Fig. 4 - Unoperated Armature Air-Gap

in the tables on pages 3 to 10 inclusive, 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 practicable.

(b) When the relay is used in a toll circuit in a toll office and (1) an AC voltage test set is to be used and (2) AC voltage requirements are not shown in the circuit requirement table the AC voltage requirements specified in the tables on pages 9, 10, 12 and 13 shall be used.

(c) When an AC voltage test set is not to be used and the Circuit Requirement Table specifies the electrical test and readjust requirements to be in accordance with the B.S.P., R.A.P. or "X" specification, the requirements given on pages 3 to 8 and 10 to 13 of the section shall apply. The particular requirements that are to be applied shall be determined by the item number or the type of testing and adjusting equipment, the code of the relay, type of switchboard and circuit, connection of windings, type of adjustment and ringing frequency and voltage involved.

(d) The cover of the relay may be either on or off when applying the electrical requirements.

CONNECTION OF WINDINGS	TYPE OF ADJUST-MENT	AC TEST AND READJUST CURRENT FLOW REQUIREMENTS	FRE-QUENCY IN CYCLES	VOLTAGE AT BUS-BAR	EQUIVALENT AC N.I. RESISTANCE REQUIREMENTS				ITEM NO.
					TEST		READY.		
					NOS. 8-C or 6-B LAMP	W-L RES.	W-L RES.		
					R	R	K	L	
Windings in Series	Standard	Test Opr. - .0012 Amp. Readj. Opr. - .0011 Amp. Readj. N.O. - .00085 Amp.	16 2/3	75-80	595	690	185	390	1.01
				80-85	555	630	170	370	1.02
				85-90	515	590	160	350	1.03
				90-95	485	560	145	330	1.04
				95-100	460	530	132	310	1.05
				100-105	435	500	128	287	1.06
				105-110	410	470	125	270	1.07
				110-115	390	450	120	255	1.08
				115-120	370	430	110	245	1.09
			20	75-80	850	930	235	540	1.10
				80-85	765	880	225	510	1.11
				85-90	715	810	205	480	1.12
				90-95	670	740	187	450	1.13
				95-100	625	700	170	420	1.14
				100-105	590	660	158	392	1.15
				105-110	555	620	150	370	1.16
				110-115	530	590	142	350	1.17
				115-120	505	560	135	330	1.18
	Special	Test Opr. - .0007 Amp. Readj. Opr. - .0006 Amp. Readj. N.O. - .0004 Amp.	16 2/3	75-80	280	340	132	143	1.19
				80-85	260	310	120	135	1.20
				85-90	245	290	111	126	1.21
				90-95	235	270	105	120	1.22
				95-100	220	255	98	112	1.23
				100-105	210	240	93	107	1.24
				105-110	200	220	88	102	1.25
				110-115	190	210	83	97	1.26
				115-120	180	200	78	92	1.27
			20	75-80	375	400	140	170	1.28
				80-85	345	360	132	158	1.29
				85-90	325	330	123	147	1.30
				90-95	305	300	118	137	1.31
				95-100	285	280	110	130	1.32
				100-105	270	260	100	125	1.33
				105-110	260	240	97	118	1.34
				110-115	250	230	93	112	1.35
				115-120	240	220	90	105	1.36
Windings in Parallel	Standard	Test Opr. - .0025 Amp. Readj. Opr. - .0022 Amp. Readj. N.O. - .0017 Amp.	16 2/3	75-80	530	670	170	380	1.37
				80-85	490	610	150	350	1.38
				85-90	455	570	150	320	1.39
				90-95	430	530	140	300	1.40
				95-100	400	500	130	280	1.41
				100-105	380	470	120	270	1.42
				105-110	360	440	110	260	1.43
				110-115	340	420	100	250	1.44
				115-120	325	400	100	240	1.45
			20	75-80	600	780	180	420	1.46
				80-85	560	710	170	390	1.47
				85-90	515	650	160	360	1.48
				90-95	485	600	150	330	1.49
				95-100	455	560	150	300	1.50
				100-105	430	530	135	285	1.51
				105-110	410	500	130	270	1.52
				110-115	390	480	120	260	1.53
				115-120	370	460	110	250	1.54
	Special	Test Opr. - .0014 Amp. Readj. Opr. - .0012 Amp. Readj. N.O. - .0008 Amp.	16 2/3	75-80	240	310	90	150	1.55
				80-85	225	295	80	140	1.56
				85-90	212	270	75	130	1.57
				90-95	200	255	70	120	1.58
				95-100	190	240	70	110	1.59
				100-105	180	230	70	100	1.60
				105-110	170	215	70	90	1.61
				110-115	162	205	70	80	1.62
				115-120	155	195	70	70	1.63
			80	75-80	280	350	90	160	1.64
				80-85	265	320	80	150	1.65
				85-90	245	290	80	140	1.66
				90-95	230	270	80	130	1.67
				95-100	220	260	80	120	1.68
				100-105	210	250	80	110	1.69
				105-110	200	240	80	100	1.70
				110-115	190	230	80	90	1.71
				115-120	180	220	80	80	1.72

Notes 1, 2, 6, 9, 14 and 15 on Pages 10 and 11 apply to the above table.

Standard Adjustment was formerly Average Adjustment.
Special Adjustment was formerly Minimum Adjustment.

ELECTRICAL REQUIREMENTS FOR NOS. 196-A AND 196-B RELAYS
IN THRU TOLL CORD CIRCUITS - TOLL SWITCHBOARD NO. 1 AND REPEATER CORD CIRCUITS
WHEN RESISTANCE NETWORK METHOD OF TESTING AND ADJUSTING IS USED

CONNECTION OF WINDINGS	TYPE OF ADJUST-MENT	AC TEST AND READJUST CURRENT FLOW REQUIREMENTS	FRE-QUENCY IN CYCLES	VOLTAGE AT BUS-BAR	EQUIVALENT AC N.I. RESISTANCE REQUIREMENTS				ITEM NO.
					TEST		READJ.		
					NOS. 8-C or 6-B LAMP R	W-L RES. R	W-L RES. K	W-L RES. L	
Windings in Series	Standard	Test Opr. - .0012 Amp. Readj. Opr. - .0011 Amp. Readj. N.O. - .00085 Amp.	16 2/3	75-80	2160	2560	750	1140	2.01
				80-85	1920	2170	640	1020	2.02
				85-90	1710	1910	550	930	2.03
				90-95	1540	1710	470	860	2.04
				95-100	1380	1550	420	790	2.05
				100-105	1250	1400	380	740	2.06
				105-110	1140	1290	340	690	2.07
				110-115	1050	1200	320	640	2.08
				115-120	980	1110	300	600	2.09
			20	75-80	3080	4000	990	1700	2.10
				80-85	2710	3340	780	1500	2.11
				85-90	2400	2850	650	1350	2.12
				90-95	2120	2460	560	1220	2.13
				95-100	1860	2180	510	1110	2.14
				100-105	1660	1960	450	1020	2.15
				105-110	1500	1780	410	930	2.16
				110-115	1380	1620	370	870	2.17
				115-120	1280	1500	330	820	2.18
	Special	Test Opr. - .0007 Amp. Readj. Opr. - .0006 Amp. Readj. N.O. - .0004 Amp.	16 2/3	75-80	790	1000	330	360	2.19
				80-85	725	900	305	325	2.20
				85-90	670	810	280	300	2.21
				90-95	620	750	260	280	2.22
				95-100	580	690	235	265	2.23
				100-105	545	640	220	250	2.24
				105-110	510	600	205	235	2.25
				110-115	480	560	185	225	2.26
				115-120	450	530	175	215	2.27
			20	75-80	1000	1110	410	440	2.28
				80-85	910	1000	375	405	2.29
				85-90	835	920	340	375	2.30
				90-95	775	840	310	350	2.31
				95-100	720	780	285	325	2.32
				100-105	670	720	260	305	2.33
				105-110	625	670	240	290	2.34
				110-115	585	630	225	275	2.35
				115-120	555	590	210	260	2.36
Windings in Parallel	Standard	Test Opr. - .0025 Amp. Readj. Opr. - .0022 Amp. Readj. N.O. - .0017 Amp.	16 2/3	75-80	1100	1440	330	700	2.37
				80-85	975	1270	290	640	2.38
				85-90	875	1150	270	580	2.39
				90-95	780	1050	240	540	2.40
				95-100	710	970	210	500	2.41
				100-105	650	900	190	470	2.42
				105-110	605	830	170	440	2.43
				110-115	570	770	170	410	2.44
				115-120	545	720	160	390	2.45
			20	75-80	1340	1990	550	900	2.46
				80-85	1200	1720	470	790	2.47
				85-90	1090	1530	400	730	2.48
				90-95	1000	1370	340	680	2.49
				95-100	920	1250	310	630	2.50
				100-105	850	1150	280	590	2.51
				105-110	790	1060	260	550	2.52
				110-115	745	980	240	520	2.53
				115-120	700	910	230	490	2.54
	Special	Test Opr. - .0014 Amp. Readj. Opr. - .0012 Amp. Readj. N.O. - .0008 Amp.	16 2/3	75-80	435	550	205	190	2.55
				80-85	400	510	180	175	2.56
				85-90	375	475	165	160	2.57
				90-95	347	445	155	150	2.58
				95-100	323	420	150	140	2.59
				100-105	302	395	140	135	2.60
				105-110	285	370	130	130	2.61
				110-115	270	350	120	125	2.62
				115-120	260	330	110	120	2.63
			20	75-80	540	690	230	250	2.64
				80-85	495	630	210	230	2.65
				85-90	460	585	195	210	2.66
				90-95	430	540	180	200	2.67
				95-100	410	500	165	190	2.68
				100-105	390	470	155	180	2.69
				105-110	370	440	145	170	2.70
				110-115	350	415	140	160	2.71
				115-120	330	395	135	150	2.72

Notes 1, 2, 10, 14 and 15 on Pages 10 and 11 apply to the above table.

Standard Adjustment was formerly Average Adjustment.
Special Adjustment was formerly Minimum Adjustment.

ELECTRICAL REQUIREMENTS FOR NOS. 196-A AND 196-B RELAYS
IN TERMINATING OR THRU AND TERMINATING CORD CIRCUITS - TOLL SWITCHBOARD NO. 1
WHEN RESISTANCE NETWORK METHOD OF TESTING AND ADJUSTING IS USED

CONNECTION OF WINDINGS	TYPE OF ADJUST-MENT	AC TEST AND READJUST CURRENT FLOW REQUIREMENTS	FRE-QUENCY IN CYCLES	VOLTAGE AT BUS-BAR	EQUIVALENT AC N.I. RESISTANCE REQUIREMENTS				ITEM NO.
					TEST		READJ.		
					NOS. 8-C or 6-B LAMP	W-L RES.	W-L RES.		
					R	R	K	L	
Windings in Series	Standard	Test Opr. - .0012 Amp. Readj. Opr. - .0011 Amp. Readj. N.O. - .00085 Amp.	16 2/3	75-80	850	1105	285	590	3.01
				80-85	785	1000	255	540	3.02
				85-90	725	920	235	500	3.03
				90-95	665	845	220	460	3.04
				95-100	625	780	200	430	3.05
				100-105	585	725	195	400	3.06
				105-110	550	675	175	380	3.07
				110-115	520	635	160	365	3.08
				115-120	495	600	145	350	3.09
			20	75-80	1885	2775	830	1040	3.10
				80-85	1640	2360	680	950	3.11
				85-90	1470	2070	590	870	3.12
				90-95	1330	1820	525	790	3.13
				95-100	1220	1630	470	730	3.14
				100-105	1120	1480	420	680	3.15
				105-110	1040	1360	370	640	3.16
				110-115	960	1260	340	600	3.17
				115-120	910	1160	320	560	3.18
	Special	Test Opr. - .0007 Amp. Readj. Opr. - .0006 Amp. Readj. N.O. - .0004 Amp.	16 2/3	75-80	365	460	150	165	3.19
				80-85	340	425	140	170	3.20
				85-90	320	395	130	160	3.21
				90-95	300	370	125	150	3.22
				95-100	285	350	120	140	3.23
				100-105	270	330	110	135	3.24
				105-110	255	310	100	130	3.25
				110-115	240	290	95	120	3.26
				115-120	230	275	90	115	3.27
			20	75-80	565	705	270	250	3.28
				80-85	520	645	235	235	3.29
				85-90	485	595	215	225	3.30
				90-95	450	550	200	210	3.31
				95-100	425	515	190	195	3.32
				100-105	400	480	180	185	3.33
				105-110	375	450	170	175	3.34
				110-115	355	430	160	165	3.35
				115-120	340	410	150	160	3.36
Windings in Parallel	Standard	Test Opr. - .0025 Amp. Readj. Opr. - .0022 Amp. Readj. N.O. - .0017 Amp.	16 2/3	75-80	485	615	140	380	3.37
				80-85	450	560	120	350	3.38
				85-90	420	520	110	325	3.39
				90-95	394	485	105	305	3.40
				95-100	370	455	100	285	3.41
				100-105	350	430	90	270	3.42
				105-110	334	400	85	255	3.43
				110-115	318	380	80	240	3.44
				115-120	304	360	75	230	3.45
			20	75-80	554	690	155	395	3.46
				80-85	512	635	140	365	3.47
				85-90	477	590	130	340	3.48
				90-95	447	550	115	320	3.49
				95-100	420	510	110	300	3.50
				100-105	396	475	100	285	3.51
				105-110	375	450	90	270	3.52
				110-115	356	425	85	255	3.53
				115-120	340	405	85	240	3.54
	Special	Test Opr. - .0014 Amp. Readj. Opr. - .0012 Amp. Readj. N.O. - .0008 Amp.	16 2/3	75-80	245	300	85	165	3.55
				80-85	230	280	85	150	3.56
				85-90	215	265	80	140	3.57
				90-95	200	250	75	130	3.58
				95-100	190	235	70	125	3.59
				100-105	180	220	65	120	3.60
				105-110	170	205	60	115	3.61
				110-115	165	195	55	110	3.62
				115-120	160	185	50	105	3.63
			20	75-80	260	325	105	145	3.64
				80-85	245	300	95	135	3.65
				85-90	230	280	90	125	3.66
				90-95	215	260	86	115	3.67
				95-100	205	245	80	110	3.68
				100-105	195	230	75	105	3.69
				105-110	185	220	70	100	3.70
				110-115	175	210	65	95	3.71
				115-120	170	200	65	90	3.72

Notes 1, 2, 11, 14 and 15 on Pages 10 and 11 apply to the above table.

Standard Adjustment was formerly Average Adjustment.
Special Adjustment was formerly Minimum Adjustment.

ELECTRICAL REQUIREMENTS FOR NOS. 196-A AND 196-B RELAYS
IN TOLL CORD CIRCUITS - SWITCHBOARDS NO. 1-D, NO. 2, AND NO. 11
WHEN RESISTANCE NETWORK METHOD OF TESTING AND ADJUSTING IS USED

NOS. 196-A AND 196-B RELAYS IN TOLL SWITCHBOARD NO. 3 WINDINGS IN PARALLEL							
TYPE OF ADJUST-MENT	AC TEST AND READJUST CURRENT FLOW REQUIREMENTS	FREQUENCY IN CYCLES	VOLTAGE AT BUS-BAR	EQUIVALENT AC N.I. RESISTANCE REQUIREMENTS A	B	C	ITEM NO.
Standard	Test Opr. - .0025 Amp. Readj. Opr. - .0022 Amp. Readj. N.O. - .0017 Amp.	20	75-80	1170	690	760	4.01
			80-85	1060	570	620	4.02
			85-90	960	490	520	4.03
			90-95	870	440	430	4.04
			95-100	810	380	370	4.05
			100-105	750	350	320	4.06
			105-110	700	310	290	4.07
			110-115	655	285	250	4.08
			115-120	615	255	230	4.09
Special	Test Opr. - .0014 Amp. Readj. Opr. - .0012 Amp. Readj. N.O. - .0008 Amp.	20	75-80	405	295	220	4.10
			80-85	375	265	195	4.11
			85-90	345	245	170	4.12
			90-95	325	220	155	4.13
			95-100	305	205	140	4.14
			100-105	285	190	130	4.15
			105-110	270	175	125	4.16
			110-115	255	165	115	4.17
			115-120	240	160	100	4.18

Notes 1, 5 and 16 on Pages 10 and 11 apply to the above table.

Standard Adjustment was formerly Average Adjustment.
Special Adjustment was formerly Minimum Adjustment.

NO. 196-E RELAY							
TYPE OF ADJUST-MENT	AC TEST AND READJUST CURRENT FLOW REQUIREMENTS	FREQUENCY IN CYCLES	VOLTAGE AT BUS-BAR	EQUIVALENT AC N.I. RESISTANCE REQUIREMENTS A	B	C	ITEM NO.
Standard	Test Opr. - .0025 Amp. Readj. Opr. - .0022 Amp. Readj. N.O. - .0017 Amp.	16 2/3 or 20	75-80	1530	360	1055	5.01
			80-85	1740	377	1122	5.02
			85-90	1940	405	1188	5.03
			90-95	2150	422	1255	5.04
			95-100	2360	439	1322	5.05
			100-105	2570	456	1388	5.06
			105-110	2780	474	1455	5.07
			110-115	2990	491	1522	5.08
			115-120	3190	518	1588	5.09
Special	Test Opr. - .0017 Amp. Readj. Opr. - .0015 Amp. Readj. N.O. - .0012 Amp.	16 2/3 or 20	75-80	3240	495	1110	5.10
			80-85	3560	520	1181	5.11
			85-90	3880	545	1252	5.12
			90-95	4180	590	1323	5.13
			95-100	4500	615	1394	5.14
			100-105	4810	640	1465	5.15
			105-110	5130	665	1536	5.16
			110-115	5450	690	1607	5.17
			115-120	5760	725	1678	5.18

Notes 1, 7, 17 and 24 on Pages 10, 11 and 12 apply to the above table.

Standard Adjustment was formerly Average Adjustment.
Special Adjustment was formerly Minimum Adjustment.

ELECTRICAL REQUIREMENTS FOR
NOS. 196-A AND 196-B RELAYS IN TOLL SWITCHBOARD NO. 3
AND
NO. 196-E RELAY IN INTERMEDIATE RINGERS
WHEN RESISTANCE NETWORK METHOD OR TESTING AND ADJUSTING IS USED

RELAY CODE	CONN. OF WINDING	SERIES CONN.	TYPE OF SWBD.	TYPE OF CIRCUIT	TYPE OF ADJUST-MENT	FRE-QUENCY IN CYCLES	AC TEST AND READJUST CURRENT FLOW REQUIREMENTS CURRENT IN RELAY Test Oper.	Readjust Oper.	Readjust N.O.	METER SETTING Test Oper.	Readjust Oper.	Readjust N.O.	SHUNT RESIS-TANCE #	NOTES	ITEM NO.
196A, 196B	Series	1 MF	No. 1 Toll	Cord	Standard	16 2/3	.0012	.0011	.00085	.108	.096	.062	125ω		6.01
						20				.142	.126	.088			6.02
					Special	16 2/3	.0007	.0006	.0004	.094	.078	.048	60ω		6.03
						20				.134	.114	.070			6.04
196A, 196B	Parallel	3 MF	No. 1 Toll	Cord	Standard	16 2/3	.0025	.0022	.0017	.074	.062	.044	80ω	1,4,12,19	6.05
						20				.098	.082	.058	60ω		6.051
196F, 196G	Series									.068	.060	.040	125ω		6.06
										.140	.122	.080	60ω		6.061
					Special	16 2/3	.0014	.0012	.0008	.086	.068	.040	30ω		6.07
						20				.122	.098	.056			6.08
196A, 196B	Parallel	No Series Condenser	No. 1 Toll	Line	Standard	16 2/3	.0025	.0022	.0017	.112	.098	.072	90ω		6.09
						20				.084	.072	.050	125ω		6.091
196F, 196G	Series									.130	.116	.084	90ω	1,4,8,19	6.10
										.090	.085	.062	125ω		6.101
					Special	16 2/3	.0014	.0012	.0008	.088	.070	.040	60ω		6.11
						20				.102	.086	.048			6.12
196A 196B	Series	1 MF	No. 1D, 2 and 10	Cord	Standard	16 2/3	.0012	.0011	.00085	.106	.096	.068	100ω		7.01
						20				.086	.078	.056	125ω		7.011
										.096	.086	.064	150ω		7.02
										.116	.104	.078	125ω		7.021
					Special	16 2/3	.0007	.0006	.0004	.106	.090	.050	50ω		7.03
						20				.088	.074	.040	60ω	1,4,11,19	7.031
										.126	.104	.060	60ω		7.04
196A 196B	Parallel	3 MF	No. 1D, 2 and 10	Cord	Standard	16 2/3	.0025	.0022	.0017	.076	.066	.050	60ω		7.05
						20				.092	.078	.058	75ω		7.06
196F, 196G	Series									.116	.096	.072	60ω		7.061
					Special	16 2/3	.0014	.0012	.0008	.082	.068	.044	30ω		7.07
						20				.112	.090	.056			7.08
196A, 196B	Series	1 MF	No. 11	Cord and Position	Standard	16 2/3	.0012	.0011	.00085	.106	.096	.068	100ω		8.01
						20				.086	.078	.056	125ω		8.011
										.096	.086	.064	150ω		8.02
										.116	.104	.078	125ω		8.021
					Special	16 2/3	.0007	.0006	.0004	.106	.090	.050	50ω		8.03
						20				.088	.074	.040	60ω	1,4,13,19	8.031
										.126	.104	.060	60ω		8.04
196A, 196B	Parallel	3 MF	No. 11	Cord and Position	Standard	16 2/3	.0025	.0022	.0017	.076	.066	.050	60ω		8.05
						20				.092	.078	.058	75ω		8.06
196F, 196G	Series									.116	.096	.072	60ω		8.061
					Special	16 2/3	.0014	.0012	.0008	.082	.068	.044	30ω		8.07
						20				.112	.090	.056			8.08
196A, 196B	Parallel	3 MF	No. 11	Line	Standard	20	.0025	.0022	.0017	.122	.100	.075	60.5ω		8.09
										.122	.100	.074	60ω		8.091
196F, 196G	Series				Special		.0014	.0012	.0008	.112	.082	.050	28.5ω	1,4,8,18	8.10
										.106	.078	.048	30ω		8.101
196A, 196B	Parallel	3 MF	No. 3 Toll	Line	Standard	20	.0025	.0022	.0017	.122	.100	.075	60.5ω		9.01
										.122	.100	.074	60ω	1,4,8,18	9.011
196F, 196G	Series				Special		.0014	.0012	.0008	.112	.082	.050	28.5ω		9.02
										.106	.078	.048	30ω		9.021

See Pages 10, 11, and 12 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.

ELECTRICAL REQUIREMENTS FOR NOS. 196A, 196B, 196F AND 196G RELAYS IN SWITCHBOARD CIRCUITS WHEN LOW SHUNT METHOD OF TESTING AND ADJUSTING IS USED

RELAY CODE	CONN. OF WINDING	SERIES CONN.	TYPE OF SWBD.	TYPE OF CIRCUIT	TYPE OF ADJUST-MENT	FRE-QUENCY IN CYCLES	AC TEST AND READJUST CURRENT FLOW REQUIREMENTS: CURRENT IN RELAY AMPERES Test Oper	Readjust Oper.	Readjust N.O.	METER SETTING AMPERES Test Oper.	Readjust Oper.	Readjust N.O.	SHUNT RESIS-TANCE #	NOTES	ITEM NO.
196A	Parallel	3 MF		Relaying, Intermediate or Terminal Ringers and Signalling Circuits	Standard	16 2/3	.0025	.0022	.0017	.025	.022	.017	903Ω	1,3,20,24	10.01
196F	Series					20				.080	.068	.048	60Ω	1,4,19,23	10.011
										.025	.022	.017	903Ω	1,3,20,24	10.01
										.122	.100	.074	60Ω	1,4,19,23	10.012
					Special	16 2/3	.0014	.0012	.0008	.014	.012	.008	903Ω	1,3,20,24	10.02
										.074	.060	.040	30Ω	1,4,19,23	10.021
						20				.014	.012	.008	903Ω	1,3,20,24	10.02
										.106	.078	.048	30Ω	1,4,19,23	10.022
					Standard	16 2/3	.0025	.0022	.0017	.136	.124	.090	225Ω	1,4,19,22	10.031
					Special	or 20	.0014	.0012	.0008	.070	.058	.040			10.041
196E	Series	4 MF		Intermediate Ringer	Standard	16 2/3	.0025	.0022	.0017	.025	.022	.017	1330Ω	1,21,24	11.01
										.086	.074	.056	30Ω	1,19,23	11.011
						20				.025	.022	.017	1330Ω	1,21,24	11.01
										.118	.080	.058	30Ω	1,19,23	11.012
					Special	16 2/3	.0017	.0015	.0012	.017	.015	.012	1330Ω	1,21,24	11.02
										.060	.050	.040	30Ω	1,19,23	11.021
						20				.017	.015	.012	1330Ω	1,21,24	11.02
										.066	.052	.042	30Ω	1,19,23	11.022
					Standard	16 2/3	.0025	.0022	.0017	.128	.112	.086	225Ω	1,4,19,22	11.031
					Special	or 20	.0017	.0015	.0012	.088	.066	.052			11.041
196B	Parallel	3 MF		Relaying Ringer	Standard	16 2/3	.0065	.0055	.0025	.058	.046	.025	225Ω	1,4,19	12.011
						20				.088	.070	.032			12.021
196G	Series				Special	16 2/3	.00475	.0043	.0010	.046	.040	.008			12.031
						20				.068	.058	.010			12.041

See Pages 10, and 12 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.

ELECTRICAL REQUIREMENTS FOR NOS. 196A, 196B, 196E, 196F AND 196G RELAYS IN RINGER CIRCUITS WHEN LOW SHUNT METHOD OF TESTING AND ADJUSTING IS USED

Relay Code	Conn. of Wdg.	Series Conn.	Type of Swbd.	Type of Circuit	Type of Adj.	Freq. in Cycles	A-C Test and Readjust Requirements Meter Settings Volts Across T & R Leads Test Opr.	Readj. Opr.	Readj. N.O.	Shunt Res. See Notes 25,26, 27
196A	Parallel	3 M.F.		Relaying Ringers, Full Period Talking Signalling Circuits, 1000-20~ Int. Ringers or 20~ D-C Signalling Circuits	Std.	16-2/3	5.0	4.0	2.8	30
						20	7.0	5.5	3.5	
196F	Series				Spl.	16-2/3	2.3	1.8	1.0	
						20	3.2	2.4	1.4	
196A	Parallel	10000ω and 3 M.F.		1000-20~ Int. Ringers	Std.	16-2/3	35.0	30.0	20.0	225
						20				
196F	Series									
196A, 196B Front Cont. not in Use	Series	1 M.F.	No. 1 Toll	Cord or Intertoll Trunk	Std.	16-2/3	10.0	8.5	6.0	225
						20	15.0	12.0	8.5	
					Spl.	16-2/3	5.5	4.0	2.3	
						20	7.5	6.0	3.2	
196A, 196B Front Cont. not in Use	Parallel	3 M.F.	No. 1 Toll	Cord or Intertoll Trunk	Std.	16-2/3	5.0	4.0	2.8	30
						20	7.0	5.5	3.5	
196F, 196G Front Cont. not in Use	Series				Spl.	16-2/3	2.3	1.8	1.1	
						20	3.2	2.4	1.4	
196A, 196B Front Cont. not in Use	Series	Rep. Coil Wdgs.	Nos. 1D, 10, 11, and No. 2 Toll	Cord or Cord and Position	Std.	16-2/3	9.5	8.0	5.5	225
						20	13.0	11.0	7.5	
					Spl.	16-2/3	4.5	3.4	2.0	30
						20	7.0	5.0	2.9	
196A, 196B Front Cont. not in Use	Parallel	Rep. Coil Wdgs.	Nos. 1D, 10, 11 and No. 2 Toll	Cord or Cord and Position	Std.	16-2/3	4.5	3.5	2.5	30
						20	6.0	5.0	3.5	
196F, 196G Front Cont. not in Use	Series				Spl.	16-2/3	2.2	1.7	1.0	
						20	3.0	2.5	1.3	
196A, 196B Front Cont. not in Use	Parallel	3 M.F.	* Nos. 11 and No. 3 Toll	Intertoll Trunk	Std.	20	7.0	5.5	3.5	30
196F, 196G Front Cont. not in Use	Series				Spl.	20	3.2	2.4	1.4	
196B Front Cont. in Use	Parallel	3 M.F.		Relaying Ringer and Misc.	Std.	16-2/3	12.0	9.5	4.0	225
						20	16.0	13.5	6.0	
196G Front Cont. in Use	Series				Spl.	16-2/3	8.5	7.0	1.5	
						20	12.0	10.5	1.8	
196E	Series	4 M.F.		Intermediate Ringers	Std.	16-2/3	2.4	2.1	1.5	30
						20	3.1	2.4	1.6	
					Spl.	16-2/3	1.6	1.4	1.1	
						20	1.8	1.5	1.2	
196E	Series	10000ω & 4 M.F.		Intermediate Ringers	Std.	16-2/3	27.0	23.5	19.0	225
						20				

*In circuits not equipped with test jacks, the 20-cycle supply shall be furnished through a 77A or 67C repeating coil, or its equivalent.

A-C VOLTAGE REQUIREMENTS

FOR RELAYS IN COMBINATION WITH OTHER APPARATUS

Relay Code	Conn. of Wdg.	Type of Circuit	Type of Adj.	Freq. in Cycles	A-C Test and Readj. Req. Meter Setting Volts Across Relay Wdg. Test Oper.	Readj. Oper.	Readj. N.O.	Shunt Res. See Notes 25,26, 27
196A, 196B Front Cont. not in Use	Series	Ringer and Signalling Circuits, Intertoll Trunks, Cord and Cord and Position Circuits	Std.	16-2/3	18.5	16.5	11.0	225
				20	22.5	18.5	13.5	
			Spl.	16-2/3	10.0	7.5	4.5	
				20	11.5	9.0	5.5	
196A, 196B Front Cont. not in Use	Parallel	Ringer and Signalling Circuits, Intertoll Trunks, Cord and Cord and Position Circuits	Std.	16-2/3	10.5	8.5	6.5	225
				20	11.5	9.5	7.0	
196F, 196G Front Cont. not in Use	Series		Spl.	16-2/3	5.0	4.0	2.5	30
				20	6.0	5.0	2.8	
196B Front Cont. in Use	Parallel	Relaying, Ringer and Misc.	Std.	16-2/3	27.5	22.5	9.0	225
				20	30.0	25.0	10.5	
196G Front Cont. in Use	Series		Spl.	16-2/3	19.0	16.0	3.2	
				20	22.5	19.5	3.8	
196E	Series	Intermediate Ringers	Std.	16-2/3	5.5	4.5	3.2	30
				20	6.5	5.5	3.8	
			Spl.	16-2/3	3.5	2.8	2.2	
				20	4.0	3.3	2.5	

The above requirements shall be used when the circuit does not show the series connections (particular circuit connections) covered in the preceding table, or for locating trouble.

A-C VOLTAGE REQUIREMENTS
FOR RELAY WINDINGS ALONE

NOTES

1. Testing and readjusting shall be done with the standard testing and adjusting circuits, networks or AC milliammeter circuits, if installed; if not, the current values, meter settings or resistance values, specified in the tables on pages 3, 4, 5, 6, 7, 8, 9, and 10 shall be used in connection with the testing and adjusting circuits shown in Notes 14 tc 27.

2. Readjusting shall be done only when a 1000 ohm Ward-Leonard resistance is in the ringing lead.

3. Testing and readjusting shall be done only when a 500 ohm Ward-Leonard resistance is in the ringing lead.

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

5. Testing and readjusting shall be done when the relay is isolated from the toll line. The line circuit relay equipment shall be left in the circuit, that is, disconnect the toll line at the drop jack.

6. In repeater cord circuits, testing and readjusting shall be done with the relay isolated from its circuit.

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

8. Testing and readjusting may be done when the relay is either connected to or isolated from the toll line.

9. With the tip and ring of either cord connected to the testing circuit and the sleeve of this cord connected to ground through 60 ohms the cord circuit is prepared for testing and readjusting the relay. Where repeater cord circuits of the through and terminating type are involved the sleeve of the TRK & TOLL cord shall be connected to ground through 60 ohms.

10. With the tip and ring of the TOLL cord connected to the testing circuit and the sleeve of that cord connected to ground through 60 ohms the cord circuit is prepared for testing and readjusting the relay.

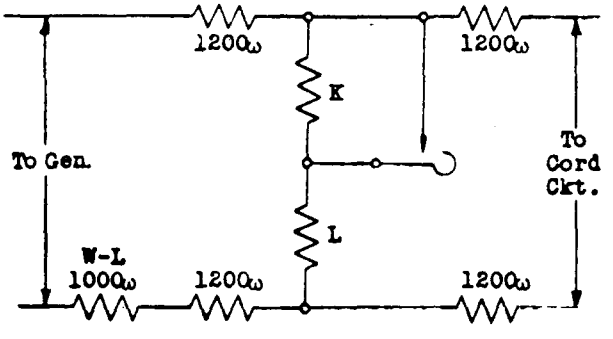
11. The cord circuit is prepared for testing and readjusting the relay under the following conditions:
Cord circuits arranged to leave the repeating coil in on all connections shall have the sleeve of the TOLL & SUBS or CALL cord connected to ground through 500 ohms when testing the relay in this cord and of the TOLL or ANS cord connected to ground through

500 ohms when testing the relay in this cord. 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.

12. With the tip and ring of either cord, in the case of through toll cord circuits, connected to the testing circuit and the sleeve of that cord connected to ground through 60 ohms, or with the tip and ring of the TOLL cord, in the case of terminating or through and terminating toll cord circuits, connected to the testing circuit and the sleeve of that cord connected to ground through 60 ohms, the cord circuit is prepared for testing and readjusting the relay.

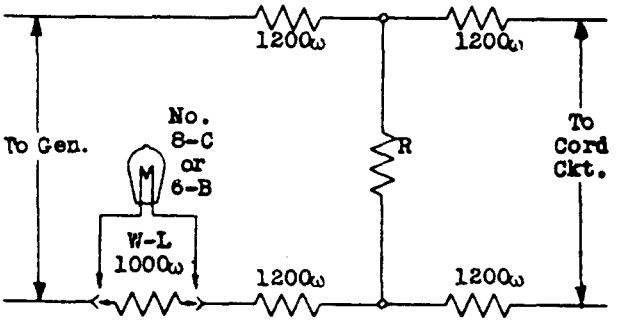
13. The cord circuit is prepared for testing and readjusting the relay in the cord circuit under the following conditions:
Cord circuits arranged to leave the repeating coil in on all connections shall have the sleeve of the TOLL & SUBS or CALL cord connected to ground through 500 ohms when testing the relay in this cord and of the TOLL or ANS cord connected to ground through 500 ohms when testing the relay in this cord.
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.
The cord and position circuits are prepared for testing and readjusting the relay in the position circuit under the following conditions:
The testing or adjusting circuit shall be connected to the tip and ring of the TOLL or ANS cord of any cord in the position with the sleeve connected to ground through 500 ohms, the cord circuit talking key operated and the position circuit splitting key operated to talk on the TOLL & SUBS end of the cord.

14. Adjusting Network

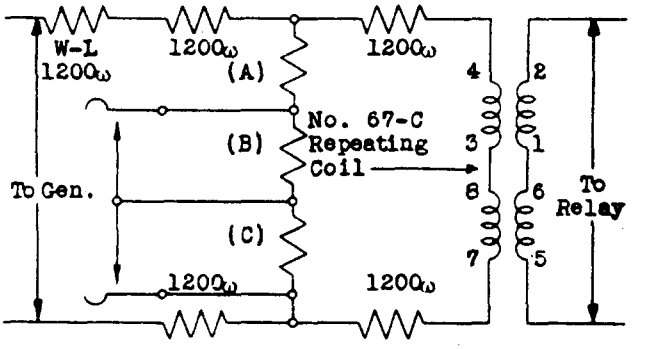


For readjust operate, the key which short circuits resistance K shall be normal so that resistances K and L are in the circuit.
For readjust non-operate, the key which short circuits resistance K shall be operated.

15. Testing Network

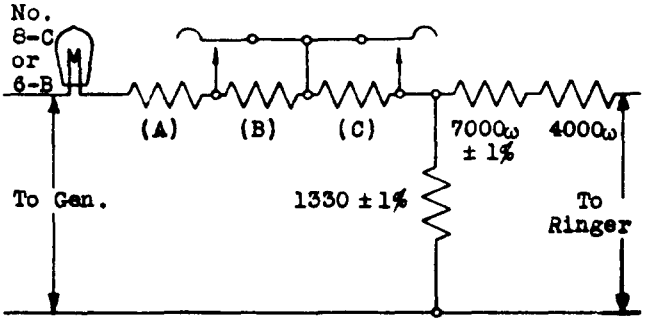


16. Testing and Adjusting Network



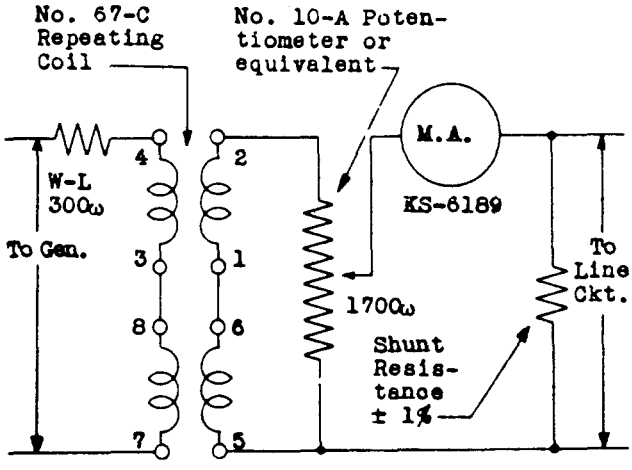
For test operate, the keys shall be normal so that resistances "A", "B" and "C" are in the circuit.
For readjust operate, the key which short circuits resistance "C" shall be operated.
For readjust non-operate, the keys which short circuit resistances "B" and "C" respectively shall be operated.

17. Testing and Adjusting Network



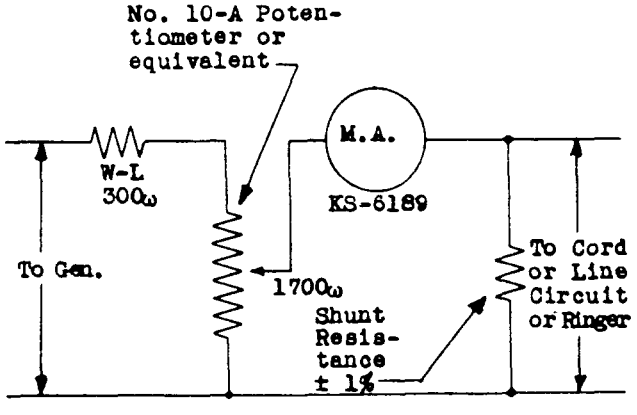
For test operate, the keys which short circuit resistances "B" and "C" respectively shall be operated.
For readjust operate, the key which short circuits resistance "C" shall be operated.
For readjust non-operate, the keys shall be normal so that resistances "A", "B" and "C" are in the circuit.

18. Testing and Adjusting Network



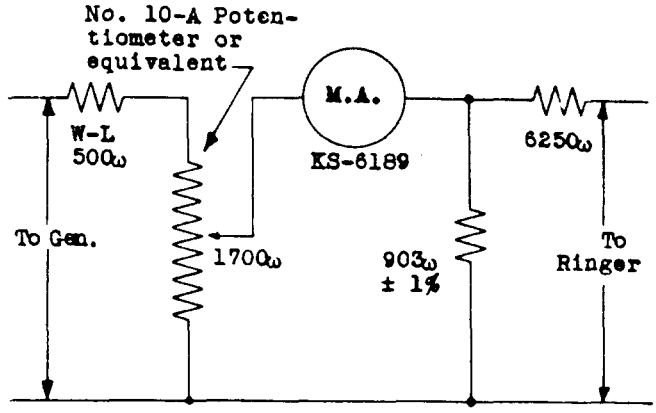
Vary the potentiometer arm to get specified meter setting. This shall be done before the testing and adjusting circuit is connected to the circuit under test.

19. Testing and Adjusting Network



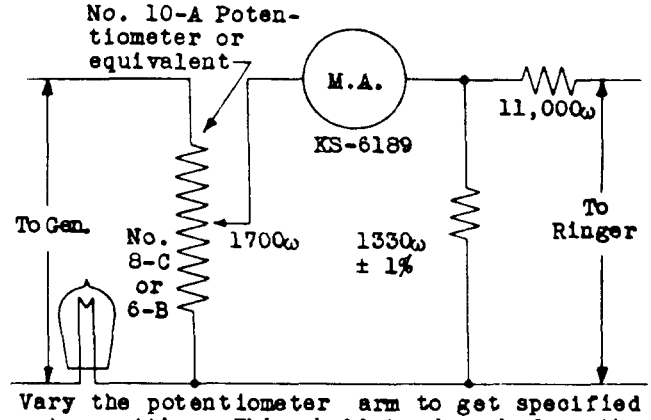
Vary the potentiometer arm to get specified meter setting. This shall be done before the testing and adjusting circuit is connected to the circuit under test.

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. 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.

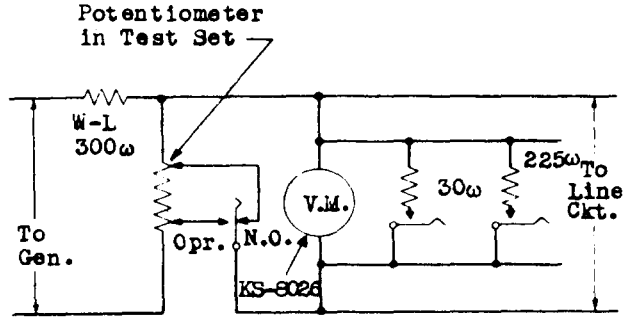
22. These values apply when the strapping around the 10,000ω resistance in series with the relay under test has been removed.

23. These values apply when the strapping around the 10,000ω resistance in series with the relay under test has not been removed.

24. If the strapping around the 10,000ω resistance in series with the relay under test has been removed, short circuit this resistance when testing or readjusting the relay.

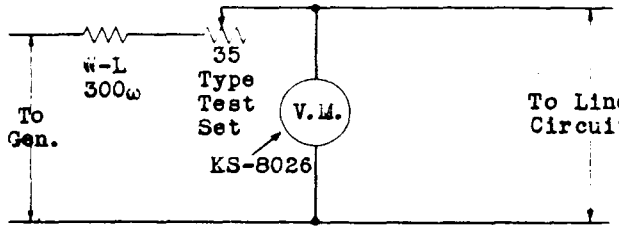
25. These shunts facilitate the testing or readjusting of a group of relays by stabilizing the test circuit output and making it unnecessary to reestablish the test circuit output voltage for each relay. When a test circuit is used that is not equipped with the shunt resistance specified, the voltage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

26. 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.)

27. 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 No.	Description
Tools	
46	3/8" Hex. Single-end Socket Wrench
72	Combination 5/32" and 3/16" Hex. Double-end Socket Wrench and Screwdriver
388A	3/16" and 1/4" Hex. Open Double-end Offset Wrench
485A	Smooth Jaw Pliers
KS-6854	3-1/2" Screwdriver
Gauges	
74D	Thickness Gauge Nest

Test Apparatus

35 Type	Test Set
J68602AH	Test Set
J68602AJ	Test Set

3.01 Cleaning (Rq.2.01)

(1) Clean the contacts in accordance with the section covering cleaning of relay contacts and parts.

3.02 Relay Mounting (Rq.2.02)

(1) To tighten loose mounting nuts use the No. 46 wrench.

3.03 Cover Spring Pressure (Rq.2.03)

(1) If the cover springs do not have sufficient tension against the cover increase the tension by adjusting the springs away from the coil, applying a lateral pressure against the springs with the KS-6854 screwdriver inserted between the spring and coils.

(2) If the cover springs have excessive tension, decrease the tension by adjusting the spring toward the coil, applying a lateral pressure against the spring with the KS-6854 screwdriver inserted outside the spring.

(3) Take care not to injure the protective serving on the coils.

3.04 Contact Alignment (Rq.2.04)

(1) To align the contacts loosen the armature and bracket screws with the KS-6854 screwdriver and shift the armature and bracket as required.

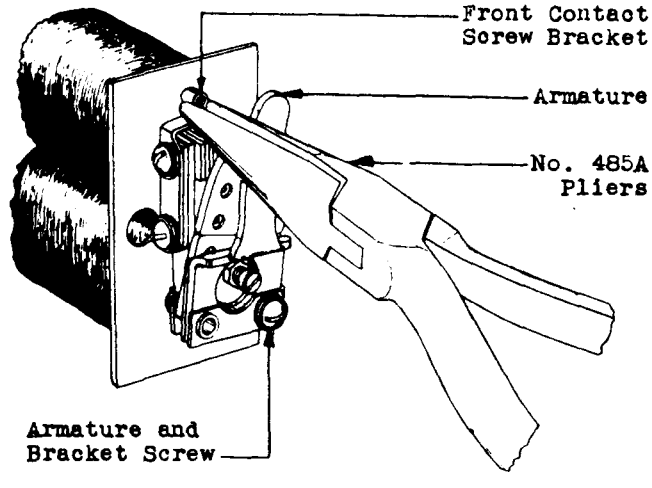


Fig. 5 - Adjusting the Front Contact Screw Bracket

3.05 Tightness of Front Contact Screw (Rq.2.05)

(1) If the front contact (or stop) screw is not sufficiently tight in its bracket to hold its adjusted position proceed as follows:

(2) Remove the left armature and bracket screw and loosen the right armature and bracket screw using the KS-6854 screwdriver. Then push the armature to the right with the No. 72 wrench until the wrench can be applied to the front contact (or stop) screw and remove the screw.

(3) Force the threaded portion of the front contact screw bracket closer together with the No. 485A as shown in Fig. 5.

(4) Replace the front contact (or stop) screw in the front contact screw bracket with the No. 72 wrench and reassemble the armature and bracket by replacing the left armature and bracket screw and tightening the right armature and bracket screw. At the same time align the contacts in accordance with procedure 3.04.

3.06 Tightness of Locknuts (Rq.2.06)

(1) To tighten loose locknuts except the one located behind the armature assembly use the wrench of the No. 72 tool in combination with the screwdriver of the No. 72 tool exercising care that the position of the screws is not changed.

(2) To obtain access to the locknut and screw behind the armature assembly of the 196A, B, E, F, and G relays, unsolder the leads connected to the back contact spring. Remove the armature and bracket screws with the KS-6854 screwdriver. These screws free all parts necessary to obtain access to the locknut and screw. If necessary, the side bracket screw adjacent to the locknut should be loosened with the KS-6854 screwdriver so that the wrench of the No. 72 tool can be applied to the locknut. Tighten the loose locknut and screw with the wrench of the No. 72 tool in combination with the screwdriver of the No. 72 tool until the front cover guide presses firmly against the coils. Exercise care in tightening the screw to avoid excessive bending of the front cover guide. Tighten the side bracket screw. After checking to see that the insulating bushings have not fallen out of the bracket, reassemble the armature, insulators, bracket, spring, insulating washers, and washers. Replace and tighten the bracket screws with the KS-6854 screwdriver. At the same time align the contacts as covered in 3.04. Resolder any leads previously disconnected from the back contact spring.

(3) To obtain access to the locknut and screw behind the armature of the 196C and D relay, loosen one and remove the other of the armature and bracket screws with the KS-6854 screwdriver. Turn the armature assembly until the locknut and screw are exposed. If necessary, the side bracket screw adjacent to the locknut should be loosened with the KS-6854 screwdriver, so that the wrench of the No. 72 tool can be applied to the locknut. Tighten the loose locknut and screw with the wrench of the No. 72 tool in combination with the screwdriver of the No. 72 tool until the front cover guide presses firmly against the coils. Exercise care in tightening the screw to avoid excessive bending of the front cover guide. Tighten the side bracket screw. Replace and tighten the armature and bracket screw with the KS-6854 screwdriver. At the same time align the contacts as covered in 3.04.

3.07 Unoperated Armature Air-Gap (Rq.2.07)
3.08 Armature Travel (Rq.2.08)

(1) Unoperated Armature Air-Gap: To adjust for the unoperated armature air-gap proceed as follows: Loosen the lock nut on the back contact (or stop) screw with the No. 72 wrench and turn this screw in a counter-clockwise direction with the screwdriver of the No. 72 tool until the .007" blade of the No. 74D gauge can be inserted between the armature and the core of the upper coil at the nearest point. Then while holding the gauge against the core of the upper coil turn the back contact (or stop) screw in a clockwise direction until the armature just touches the gauge. If necessary turn the front contact (or stop) screw in a clockwise direction using the No. 388A wrench. Tighten the lock nut securely and remove the gauge.

(2) Armature Travel: To adjust for the armature travel proceed as follows: Turn the front contact (or stop) screw in a clockwise direction with the No. 388A

wrench until the .004" blade of the No. 74D gauge can be inserted between the armature and the back contact (or stop) screw. Then while holding the gauge against the back contact (or stop) screw turn the front contact (or stop) screw in a counter-clockwise direction until the front contact (or stop) screw just touches the armature and the armature touches the gauge. Remove the gauge.

3.09 Electrical Requirements (Rq.2.09)

(1) General Information: The presence of defects which may cause the armature to remain in an operated position after the flow of current through the relay has stopped may be detected by pushing the top of the armature lightly forward against the front contact (or stop) screw. If the relay has been readjusted as outlined below and the armature remains in an operated position, this may be due to the front contact (or stop) screw being dirty. If dirty, clean in accordance with procedure 3.01. If the relay fails to meet the non-operate requirement the trouble is probably due to a defective armature tension spring.

(2) The procedures covered in (7) to (12) inclusive are for use where testing and adjusting circuits or test panels are installed, the other procedures are for general use.

(3) After the relay has been adjusted to meet its electrical requirements replace the cover and apply the electrical requirements again to see that the relay still operates, non-operates and releases satisfactorily.

DC Adjustment (To be used only where DC requirements are specified)

(4) Operate: Failure of the relay to meet the operate requirement is probably due to the tension of the armature tension spring being too great. To decrease this tension, loosen the lock nut on the armature spring tension screw with the No. 72 wrench and turn the screw in a counter-clockwise direction with the screwdriver of the No. 72 tool until the relay just meets the operate requirement. Tighten the lock nut securely.

(5) Release: Failure of the relay to meet the release requirement is probably due to the tension of the armature tension spring being insufficient. To increase this tension, loosen the lock nut on the armature spring tension screw with the No. 72 wrench and turn the screw in a clockwise direction with the screwdriver of the No. 72 tool until the relay meets the release requirement. Tighten the lock nut securely. Failure to meet the release requirement may also be due to the front contact (or stop) being dirty. If dirty, clean in accordance with procedure 3.01.

(6) In general the armature tension should be as great as possible, consistent with meeting the operate requirement reliably.

AC Adjustment

(7) The following procedures are to be employed in conjunction with the milliammeter, low shunt or Network Adjusting circuit or with the voltmeter type a-c relay test circuit.

(8) With the relay adjusted mechanically in accordance with procedures 3.02 to 3.08 inclusive, connect the relay circuit to the adjusting circuit and adjust to meet the electrical requirements as follows:

(9) Operate: Loosen the lock nut on the armature spring tension screw with the No. 72 wrench and while intermittently applying the operate current, slowly turn the screw in a clockwise direction with the screwdriver of the No. 72 tool, thus increasing the tension on the spring until the relay just fails to operate. Then reduce the tension of the spring by slowly turning the screw in a counter-clockwise direction until the relay just operates satisfactorily and then decrease the tension slightly by turning the screw in a counter-clockwise direction approximately 1/16 of a turn. Tighten the lock nut securely.

(10) If the relay operates satisfactorily but the relays associated with the relay under adjustment do not, check to see if they are in adjustment and if they are not, readjust them.

(11) Non-operate: Now apply the non-operate current and if the relay does not operate the relay may be considered in proper adjustment. If, however, the relay operates, increase the tension of the armature tension spring. To do this, loosen the lock nut on the armature spring tension screw with the No. 72 wrench and turn the screw in a clockwise direction slowly with the screwdriver of the No. 72

tool until the relay does not operate. Check that the relay and the associated apparatus functions when the operate current is applied for approximately one second.

(12) Replace the relay cover and again check to see that the relay operates, non-operates and releases satisfactorily as indicated by the operation of the associated apparatus. Although no release requirement is specified for these relays when adjusted on AC, they should release on open circuit after the current has been disconnected. Failure to do this may be due to the front contact (or stop) screw being dirty. If dirty, correct in accordance with procedure 3.01.