

**RELAYS**  
**B AND G TYPES**  
**REQUIREMENTS AND ADJUSTING PROCEDURES**  
**(FOR CONDENSED SECTION SEE SECTION 040-932-701)**

**1. GENERAL**

**1.01** This section covers B- and G-type relays.

**1.02** This section has been reissued to change the term core support bracket to motion limiting bracket and to delete reference to relays having motion limiting bracket in Requirement 2.06.

**1.03** Reference shall be made to Section 020-010-711 covering General Requirements and Definitions for additional information.

**\*1.04** 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):** A relay is said to operate if, when current is connected to its winding, the armature moves sufficiently to cause the back contact, if one is used, to break and all front contacts to make reliably.

**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 back contact, if one is used, to break and all front contacts to make sufficiently to lock-up or cause the associated relay to operate reliably.

**1.07 Nonoperate:** A relay is said to nonoperate if, when current is connected to its winding, the armature does not move from the unoperated position sufficiently to reduce the back contact pressure enough to cause an unreliable contact or reduce the front contact separation below 0.005 inch.

**1.08 Release:** A relay is said to release if, when the current is reduced to the release value or the current is removed, the armature moves from the operated position sufficiently to break contacts that have been made and to make reliably contacts that have been opened. On relays having no back contact or a back contact that is used for armature stop purposes, the armature need not touch the backstop or back contact.

**1.09 Hold:** A relay is said to hold if, after the relay has operated and the current is reduced abruptly to the hold value, the armature does not move from its operated position sufficiently to break contacts which have been made or to make contacts which have been opened.

**1.10** A list of coded B- and G-type relays together with their armature travel requirements is covered in Table A. This list covers the relays which were coded prior to the adoption of armature travel requirements and which may not have the armature travel requirements covered by existing circuit requirement tables. Relays with a higher code number will have the armature travel requirements given in the Arm. Trvl column of the circuit requirement tables.

**1.11** In B- and G-type relays of the initial design the cover was mounted on the relay structure and the relay structure on the mounting plate. An improved design has been introduced in which the relay structure is mounted in the cover and the cover on the mounting plate. Fig. 1 and 2 show front and rear views of the improved relay. As shown in Fig. 1, the relay has a motion limiting bracket positioned near the front of the core and secured to the bottom of the relay cover by screws. Nylon bushings in the adjusting plate are used to mount the adjusting screws which in the previous design were threaded into slotted holes in the adjusting plate. These changes improve the adjustment stability of the relay.

TABLE A

CODE	FIG. NO.	MAX ARM. TRVL (IN INCHES)	CODE	FIG. NO.	MAX ARM. TRVL (IN INCHES)	CODE	FIG. NO.	MAX ARM. TRVL (IN INCHES)	CODE	FIG. NO.	MAX ARM. TRVL (IN INCHES)	CODE	FIG. NO.	MAX ARM. TRVL (IN INCHES)
B1	1	0.030	B51	1	0.030	B101	7	0.035	B151	5	0.040	B201	1	0.030
B2	2	0.030	B52	7	0.035	B102	1	0.030	B152	1	0.030	B202	1	0.050
B3	3	0.030	B53	2	0.030	B103	3	0.030	#B153	3	0.030	B203	3	0.030
B4	3	0.030	B54	1	0.030	B104	6	0.030	B154	7	0.035	B204	1	0.030
B5	2	0.030	B55	3	0.030	B105	6	0.030	B155	4	0.030	B205	1	0.030
B6	1	0.030	B56	1	0.030	B106	2	0.030	B156	4	0.030	B206	1	0.030
B7	3	0.050	B57	3	0.030	B107	3	0.030	B157	1	0.030	B207	6	0.030
B8	4	0.030	B58	1	0.030	B108	1	0.030	B158	7	0.050	B208	1	0.030
B9	1	0.030	B59	1	0.030	B109	3	0.030	B159	1	0.030	B209	6	0.050
B10	1	0.030	B60	8	0.030	B110	1	0.030	B160	1	0.030	B210	7	0.035
B11	5	0.040	B61	3	0.030	B111	3	0.030	B161	2	0.030	B211	1	0.030
B12	3	0.030	B62	1	0.030	B112	2	0.030	B162	7	0.035	B212	1	0.030
B13	4	0.030	B63	1	0.030	B113	5	0.040	B163	1	0.030	B213	1	0.030
B14	3	0.030	B64	3	0.030	B114	1	0.040	B164	3	0.030	B214	1	0.050
B15	1	0.030	B65	3	0.030	B115	5	0.040	B165	3	0.030	B215	3	0.030
B16	1	0.030	B66	6	0.030	B116	2	0.030	B166	1	0.050	B216	2	0.030
B17	1	0.030	B67	3	0.030	B117	1	0.030	B167	1	0.030	B217	1	0.030
B18	1	0.030	B68	3	0.030	B118	7	0.035	B168	3	0.040	B218	1	0.050
B19	3	0.030	B69	4	0.030	B119	7	0.035	B169	1	0.050	B219	1	0.050
B20	3	0.030	B70	1	0.030	B120	1	0.030	B170	1	0.030	B220	3	0.030
B21	1	0.030	B71	1	0.030	B121	2	0.030	B171	3	0.030	B221	1	0.060
B22	3	0.040	B72	1	0.030	B122	6	0.030	B172	7	0.035	B222	3	0.050
B23	3	0.030	B73	6	0.030	B123	9	0.030	B173	5	0.040	B223	2	0.050
B24	1	0.030	B74	1	0.030	B124	1	0.050	B174	2	0.030	B224	1	0.030
B25	5	0.040	*B75	1	0.030	B125	7	0.035	B175	2	0.030	B225	1	0.030
B26	1	0.030	B76	1	0.030	B126	2	0.050	B176	7	0.035	B226	1	0.040
B27	3	0.030	B77	8	0.030	B127	1	0.030	B177	1	0.060	B227	1	0.030
B28	3	0.030	B78	3	0.030	*B128	3	0.030	B178	1	0.030	B228	1	0.050
B29	1	0.030	B79	1	0.030	B129	3	0.030	B179	3	0.030	B229	1	0.030
B30	Recorded	G1	B80	3	0.030	B130	7	0.035	B180	6	0.030	B230	1	0.060
B31	6	0.030	B81	1	0.030	B131	1	0.030	B181	4	0.030	B231	1	0.030
B32	1	0.030	B82	3	0.030	B132	1	0.040	B182	2	0.030	B232	1	0.030
B33	2	0.030	B83	1	0.030	B133	7	0.035	B183	1	0.060	B233	1	0.050
B34	1	0.030	B84	3	0.030	B134	Not Used		B184	Not Used		B234	2	0.030
B35	5	0.040	B85	2	0.030	B135	1	0.030	B185	8	0.030	B235	7	0.050
B36	1	0.030	B86	6	0.030	B136	7	0.060	B186	1	0.050	B236	1	0.030
B37	7	0.035	B87	6	0.030	B137	Not Used		B187	4	0.040	B237	3	0.050
B38	1	0.030	B88	1	0.030	B138	1	0.030	B188	3	0.030	B238	7	0.035
B39	8	0.030	B89	1	0.030	B139	1	0.030	B189	3	0.030	B239	6	0.030
B40	4	0.030	B90	1	0.030	B140	1	0.050	B190	1	0.030	B240	1	0.030
B41	7	0.035	B91	6	0.030	B141	1	0.030	B191	6	0.030	B241	1	0.030
B42	3	0.030	B92	1	0.030	B142	1	0.030	B192	7	0.035	B242	1	0.040
B43	1	0.030	B93	3	0.030	B143	1	0.030	B193	7	0.035	B243	1	0.050
B44	3	0.030	B94	1	0.030	B144	6	0.030	B194	1	0.030	B244	1	0.030
B45	3	0.030	B95	5	0.040	B145	1	0.030	B195	3	0.030	B245	6	0.030
B46	3	0.030	B96	1	0.030	B146	4	0.030	B196	4	0.030	B246	Not Used	
B47	2	0.030	B97	3	0.040	B147	8	0.030	B197	3	0.030	B247	Not Used	
B48	Recorded	G2	B98	7	0.035	B148	1	0.030	B198	1	0.030	B248	7	0.035
B49	6	0.030	B99	1	0.050	B149	2	0.050	B199	1	0.030	B249	7	0.060
B50	5	0.040	B100	3	0.030	B150	3	0.040	B200	2	0.030	B250	7	0.035

\*These relays have two stop pins. #This relay was formerly equipped with two stop pins.

The above data is for use on relays where the Arm. Trvl requirement is not given in the Arm. Trvl column of circuit requirement tables. All higher coded relays will have this requirement given on the circuit requirement tables.

TABLE A (Cont)

CODE	FIG. NO.	MAX ARM. TRVL (IN INCHES)	CODE	FIG. NO.	MAX ARM. TRVL (IN INCHES)	CODE	FIG. NO.	MAX ARM. TRVL (IN INCHES)	CODE	FIG. NO.	MAX ARM. TRVL (IN INCHES)	CODE	FIG. NO.	MAX ARM. TRVL (IN INCHES)
B251	3	0.030	B301	5	0.040	B351	2	0.030	B401	1	0.030	B451	6	0.040
B252	1	0.030	B302	1	0.030	B352	2	0.030	B402	6	0.030	B452	2	0.060
B253	7	0.035	B303	1	0.030	B353	6	0.050	B403	6	0.030	B453	3	0.030
B254	1	0.030	B304	1	0.030	B354	7	0.035	B404	6	0.030	B454	1	0.030
B255	3	0.050	B305	7	0.035	B355	6	0.050	B405	6	0.050	B455	12	0.030
B256	2	0.030	B306	3	0.030	B356	8	0.030	B406	6	0.030	B456	6	0.030
B257	1	0.030	B307	3	0.030	B357	Not Used		*B407	6	0.030	B457	10	0.030
B258	1	0.030	B308	7	0.035	B358	6	0.030	B408	6	0.050	B458	6	0.030
B259	1	0.060	B309	1	0.030	B359	8	0.030	B409	8	0.030	B459	6	0.030
B260	1	0.030	B310	1	0.030	B360	6	0.050	B410	3	0.030	B460	Cancelled	
B261	1	0.030	B311	1	0.030	B361	6	0.030	B411	2	0.030	B461	6	0.050
B262	1	0.050	B312	3	0.040	B362	6	0.030	B412	6	0.030	B462	1	0.030
B263	6	0.030	B313	3	0.050	B363	6	0.050	B413	6	0.030	B463	6	0.030
B264	1	0.030	B314	3	0.050	B364	3	0.030	B414	9	0.030	B464	6	0.030
B265	7	0.035	B315	3	0.050	B365	7	0.035	B415	6	0.030	*B465	6	0.020
B266	2	0.030	B316	1	0.030	B366	2	0.050	B416	8	0.030	B466	6	0.050
B267	7	0.050	B317	1	0.030	B367	6	0.030	B417	6	0.050	B467	7	0.035
B268	3	0.030	B318	2	0.050	B368	7	0.050	B418	6	0.030	B468	7	0.035
B269	2	0.030	B319	6	0.050	B369	2	0.030	B419	6	0.030	*B469	6	0.020
B270	1	0.030	B320	1	0.030	B370	6	0.040	B420	6	0.030	*B470	6	0.020
B271	1	0.040	B321	3	0.030	B371	6	0.030	B421	6	0.030	B471	1	0.050
B272	1	0.030	B322	2	0.030	B372	6	0.030	B422	6	0.030	*B472	6	0.020
B273	1	0.030	B323	1	0.030	B373	1	0.030	B423	13	0.030	*B473	6	0.020
B274	7	0.035	B324	10	0.050	B374	1	0.030	B424	6	0.030	*B474	7	0.025
B275	7	0.050	B325	6	0.030	B375	2	0.030	B425	7	0.035	*B475	6	0.020
B276	1	0.030	B326	6	0.050	B376	6	0.030	B426	6	0.030	B476	7	0.035
B277	3	0.030	B327	6	0.050	B377	3	0.040	B427	7	0.035	*B477	6	0.020
B278	7	0.035	B328	8	0.030	B378	3	0.030	B428	1	0.030	*B478	7	0.025
B279	5	0.040	B329	1	0.030	B379	1	0.030	B429	6	0.050	*B479	7	0.025
B280	5	0.040	B330	5	0.040	B380	3	0.030	B430	7	0.035	*B480	6	0.020
B281	3	0.030	B331	6	0.030	B381	1	0.030	B431	8	0.030	*B481	6	0.020
B282	1	0.030	B332	6	0.030	B382	1	0.030	B432	4	0.030	*B482	6	0.020
B283	1	0.050	B333	6	0.030	B383	6	0.030	B433	1	0.030	*B483	11	0.020
B284	2	0.030	B334	6	0.030	B384	7	0.050	B434	3	0.030	B484	7	0.060
B285	7	0.060	B335	6	0.030	B385	3	0.030	B435	6	0.030	B485	3	0.030
B286	1	0.030	B336	7	0.035	B386	2	0.030	B436	6	0.030	B486	6	0.050
B287	6	0.030	B337	11	0.050	B387	1	0.050	B437	7	0.035	B487	6	0.030
B288	1	0.030	B338	2	0.030	B388	1	0.050	B438	1	0.050	B488	1	0.060
B289	7	0.035	B339	Not Used		B389	1	0.050	B439	6	0.030	B489	7	0.035
B290	Not Used		B340	6	0.030	B390	1	0.050	B440	4	0.030	B490	6	0.030
B291	Not Used		B341	6	0.050	B391	1	0.050	B441	8	0.030	B491	7	0.035
B292	1	0.040	B342	6	0.030	B392	6	0.030	B442	3	0.030	B492	2	0.030
B293	1	0.030	B343	6	0.030	B393	1	0.050	B443	3	0.030	B493	6	0.030
B294	7	0.035	B344	6	0.030	B394	1	0.030	B444	6	0.030	B494	3	0.030
B295	6	0.030	B345	6	0.030	B395	3	0.060	B445	6	0.030	B495	4	0.030
B296	2	0.050	B346	6	0.030	B396	1	0.030	B446	6	0.030	B496	2	0.030
B297	1	0.030	B347	7	0.035	B397	3	0.030	B347	6	0.030	B497	1	0.030
B298	1	0.030	B348	6	0.030	B398	7	0.035	B448	3	0.030	B498	7	0.035
B299	3	0.030	B349	3	0.030	B399	6	0.030	B449	9	0.030	B499	6	0.030
B300	3	0.030	B350	5	0.040	B400	7	0.035	B450	12	0.030	B500	1	0.030

\*These relays have two stop pins.

The above data is for use on relays where the Arm. Trvl requirement is not given in the Arm. Trvl column of circuit requirement tables. All higher coded relays will have this requirement given on the circuit requirement tables.

TABLE A (Cont)

CODE	FIG. NO.	MAX. ARM. TRVL (IN INCHES)	CODE	FIG. NO.	MAX. ARM. TRVL (IN INCHES)	CODE	FIG. NO.	MAX. ARM. TRVL (IN INCHES)	CODE	FIG. NO.	MAX. ARM. TRVL (IN INCHES)	CODE	FIG. NO.	MAX. ARM. TRVL (IN INCHES)
B501	6	0.030	B541	1	0.030	B1015	3	0.040	G6	2	0.030	G46	6	0.030
B502	6	0.030	B542	1	0.030	B1016	11	0.030	G7	1	0.030	G47	11	0.030
B503	7	0.035	B543	3	0.030	B1017	3	0.060	G8	8	0.040	G48	6	0.030
B504	6	0.030	B544	1	0.040	B1018	3	0.030	G9	4	0.030	G49	6	0.050
B505	6	0.040	B545	1	0.030	B1019	6	0.030	G10	2	0.040	G50	7	0.030
B506	5	0.040	B546	1	0.030	B1020	7	0.060	G11	6	0.030	G51	7	0.040
B507	2	0.030	B547	6	0.030	B1021	2	0.050	G12	7	0.050	G52	6	0.030
B508	6	0.030	B548	11	0.030	B1022	1	0.050	G13	7	0.050	G53	8	0.040
B509	3	0.030	B549	6	0.030	B1023	6	0.030	G14	7	0.060	*G54	6	0.020
B510	1	0.030	B550	7	0.035	B1024	7	0.035	G15	6	0.040	G55	2	0.030
B511	6	0.050	B551	7	0.035	B1025	7	0.035	G16	4	0.050	G56	11	0.040
B512	1	0.050	B552	6	0.030	B1026	8	0.030	G17	3	0.040	G57	4	0.030
B513	3	0.030	B553	12	0.030	B1027	11	0.030	G18	7	0.060	G58	6	0.030
B514	6	0.030	B554	4	0.050	B1028	1	0.030	G19	1	0.040	G59	7	0.035
B515	1	0.030	B555	6	0.030	B1029	7	0.035	G20	7	0.060	G60	7	0.050
B516	7	0.035	B556	6	0.030	B1030	3	0.030	G21	9	0.040	G61	7	0.030
B517	1	0.030	B557	7	0.060	B1031	7	0.035	G22	6	0.040	G62	7	0.035
B518	1	0.050	B558	4	0.030	B1032	1	0.040	G23	7	0.040	G63	7	0.035
B519	4	0.030	B559	2	0.030	B1033	1	0.040	G24	7	0.040	G64	6	0.030
B520	3	0.030			B1034	5	0.030	G25	6	0.040	G65	7	0.030	
*B521	9	0.020			B1035	7	0.030	G26	3	0.030	G66	4	0.030	
B522	8	0.030			B1036	1	0.030	G27	7	0.040	G67	9	0.030	
B523	4	0.030			B1037	11	0.030	G28	2	0.040	G68	6	0.040	
B524	1	0.030			B1038	7	0.050	G29	6	0.030	G69	5	0.040	
B525	3	0.030			B1039	6	0.050	G30	2	0.040	G70	6	0.030	
B526	7	0.050	B1000	6	0.050	B1040	6	0.050	G31	2	0.040	G71	1	0.050
B527	6	0.030	B1001	Cancelled	B1041	1	0.040	G32	2	0.040	G72	7	0.040	
B528	1	0.030	*B1002	7	0.025	B1042	6	0.030	G33	2	0.040	G73	7	0.035
B529	6	0.030	B1003	1	0.030			G34	7	0.030				
B530	11	0.030	B1004	6	0.050			G35	6	0.040				
B531	7	0.035	B1005	11	0.050			G36	7	0.040				
B532	6	0.030	B1006	6	0.030			G37	7	0.040				
B533	1	0.030	B1007	1	0.030			G38	7	0.040				
B534	1	0.030	B1008	7	0.030			G39	6	0.040				
B535	9	0.030	B1009	7	0.030			G40	7	0.030				
B536	6	0.030	B1010	6	0.040	G1	3	0.040	G41	12	0.040			
B537	6	0.040	B1011	1	0.030	G2	3	0.030	G42	1	0.060			
B538	2	0.030	B1012	6	0.030	G3	2	0.040	G43	2	0.040			
B539	6	0.030	B1013	6	0.030	G4	3	0.060	G44	4	0.050			
B540	1	0.030	B1014	3	0.050	G5	1	0.030	G45	1	0.040			

\*These relays have two stop pins.

The above data is for use on relays where the Arm. Trvl requirement is not given in the Arm. Trvl column of circuit requirement tables. All higher coded relays will have this requirement given on the circuit requirement tables.

## 2. REQUIREMENTS

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

**2.02 Relay Mounting:** The relay shall be mounted approximately level and fastened securely to the mounting plate.

Gauge by eye and by feel.

**2.03 Cover Clearance:** The clearance between the relay cover and any adjacent apparatus including relay covers, shall be

Min 1/64 inch

Gauge by eye.

**2.04 Cover Cap:** The cover cap shall fit snugly but shall not be so tight as to prevent placing or removing it with the fingers.

Gauge by feel.

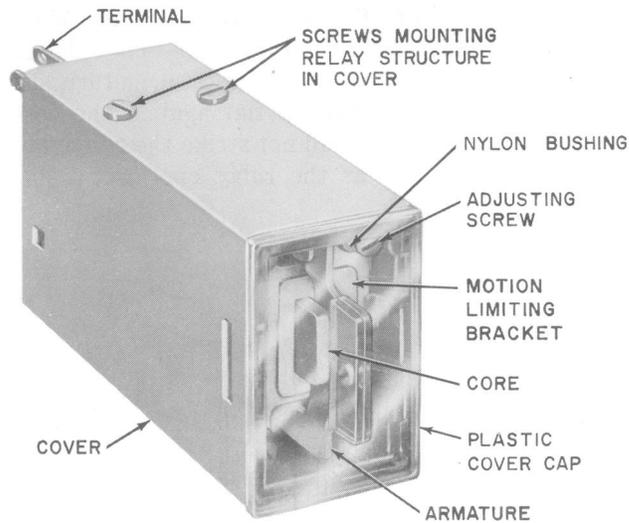


Fig. 1—B-Type Relay of Improved Design Front View

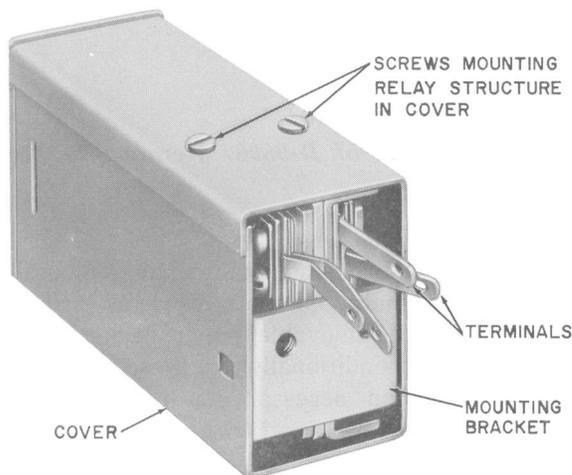


Fig. 2—B-Type Relay of Improved Design Rear View

**2.05 Contact Alignment:** Fig. 3(A)—Contacts shall line up so that the point of contact falls wholly within the boundary of the opposing contact.

Gauge by eye.

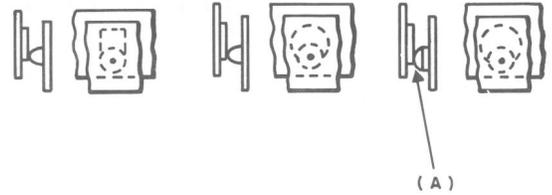


Fig. 3—Contact Alignment

**\*2.06 Tightness of Adjusting Screws for Relays not having Motion Limiting Brackets:** Fig. 5.

(a) The adjusting screws shall be sufficiently tight to prevent the relay changing its adjustment.

Gauge by eye.

To check the requirement lift the spring controlled by the adjusting screw away from the screw with the KS-6320 orange stick. If no movement of the screw can be observed by eye, the requirement is considered met.

(b) **Relays Having Slotted Adjusting Plate Only:** The adjusting screws shall not be so tight that undue force is required to turn them.

Gauge by feel.

**2.07 Application of D-93568 Removable Paper Armature Stop**

(a) If necessary to relieve sticking conditions D-93568 removable paper armature stops may be applied to B- and G-type relays listed in Section 040-014-811.

(b) The removable paper armature stop shall be mounted so that the single layer of paper is on the side of the core next to the armature. The paper shall be held snugly against the core.

(c) The removable paper armature stop shall not be dirty, torn, or otherwise damaged.

(d) **Relays Having Motion Limiting Bracket:**

Fig. 4(A)—The rear edge of the removable paper armature stop shall touch or be close to the motion limiting bracket.

Gauge by eye.

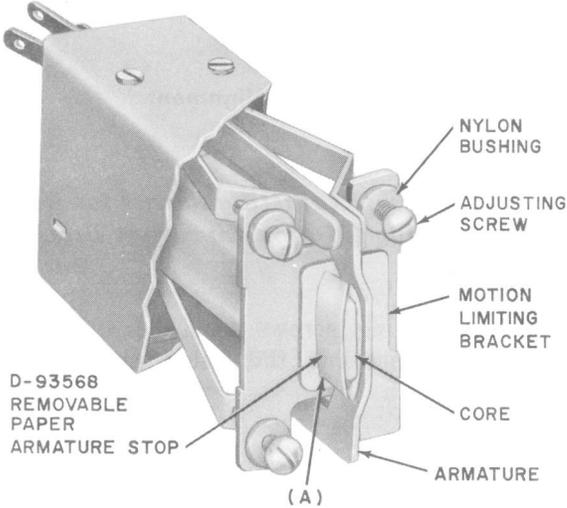


Fig. 4—Position of Removable Paper Armature Stop on Core (Relays Having Motion Limiting Bracket)

(e) **Relays Not Having Motion Limiting Bracket:**

Fig. 5(A)—The front edge of the removable paper armature stop shall be approximately flush with the end of the core.

Gauge by eye.

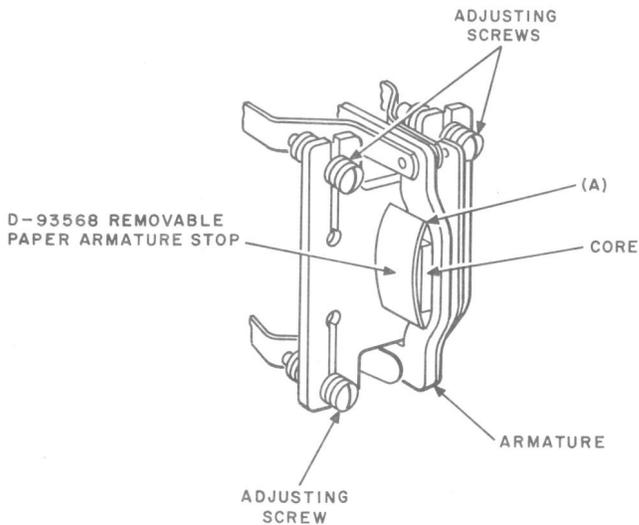


Fig. 5—Position of Removable Paper Armature Stop on Core (Relays not Having Motion Limiting Bracket)

2.08 **Position of P-231534 Removable Metal Armature Stop:**

Fig. 6(A)—The flanges on each side of the removable metal armature stop facing the armature shall be flat against the core. The armature stop pin shall not strike the removable metal armature stop as the relay operates.

Gauge by eye.

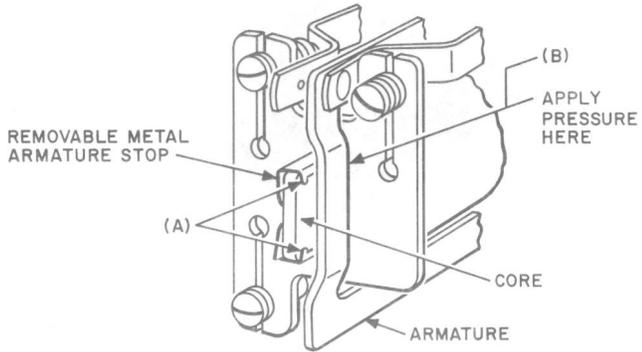


Fig. 6—Position of Removable Metal Armature Stop on Core

2.09 **Application of D-95367 Removable Paper Backstop:**

Fig. 7

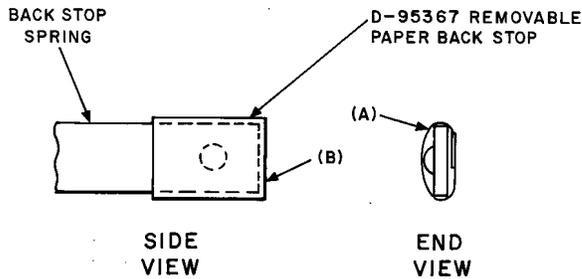
(a) If front or backstop springs have embossings or base metal contacts used as armature stops, D-95367 removable paper backstops may be applied unconditionally to these springs on all relays, when necessary to relieve sticking conditions.

(b) Before the paper backstop is mounted it shall be flattened so the lap joint is wholly between the two creases.

(c) Fig. 7(A)—The paper backstop shall be placed over the stop spring so the single layer of paper is between the stop spring and the armature.

(d) Fig. 7(B)—The end of the paper backstop shall be approximately flush with the end of the stop spring.

Gauge by eye.



**Fig. 7—Position of Removable Paper Backstop on Spring**

**2.10 Contact Follow:** Fig. 8(A)—(Relays having spring combinations per Fig. 13, 14, and 15 only and Table B)

- (a) There shall be a follow at the tip of the flexible front contact spring before the spring strikes the stop spring at the point opposite the contact of

Min 0.005 inch

Gauge by eye.

This requirement is considered met if, with the relay in the unoperated position, the clearance between the flexible spring and the stop spring measured at the point opposite the contact does not exceed 0.010 inch and there is movement of the flexible contact spring when the relay is operated manually.

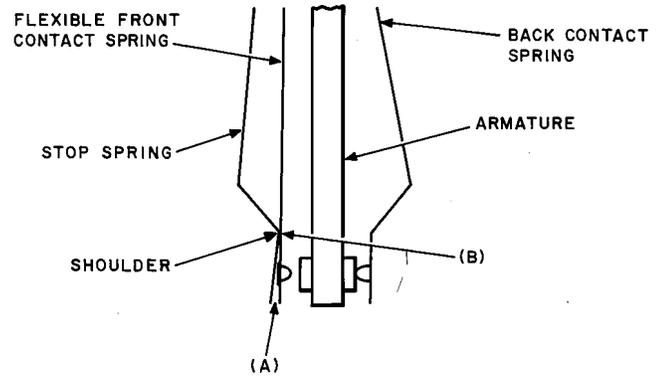
- (b) When the relay is operated manually by applying pressure to the armature at a point opposite the center of the core, the flexible front contact spring shall touch the stop spring at a point opposite the contact before the armature stop pin (or the armature itself if no stop pin is provided) touches the core (or paper armature stop, if equipped).

Gauge by eye.

**2.11 Flexible Front Contact Spring Position:**

Fig. 8(B)—(Relays equipped with spring combinations per Fig. 13, 14, and 15 and Table B). The flexible front contact spring shall rest against the shoulder of the stop spring with the relay in the unoperated position.

Gauge by eye.



**Fig. 8—Contact Follow**

**2.12 Minimum Front Contact Make:** Fig. 9(A)

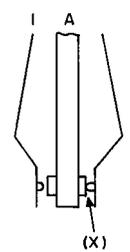
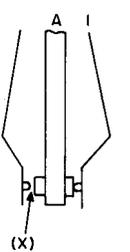
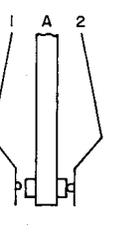
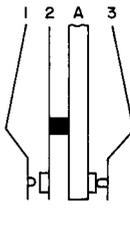
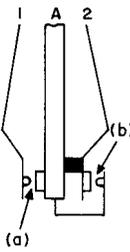
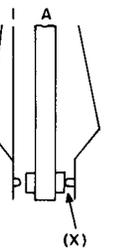
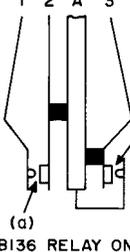
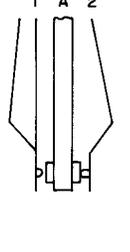
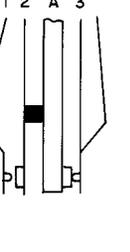
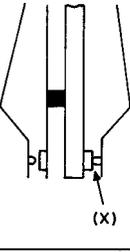
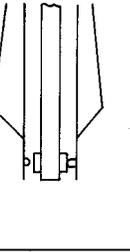
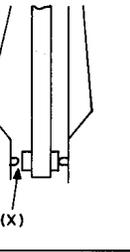
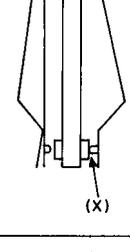
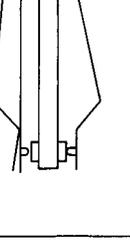
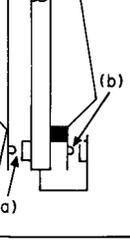
(see also Fig. 10 and 11.)—The minimum front contact make shall be as specified under Front Contact Make in the spring combination figures shown in Table B. The value of front contact make to be used shall be that corresponding to the armature travel specified in the circuit requirement table and shown on the spring combination figure.

Use the gauge specified and check the requirement as covered in (a) through (d).

- (a) **Relays Not Equipped With Removable Armature Stops:** Insert the 100 gauge of the 99A gauge nest having the thickness specified under Front Contact Make between the stop pin (or pins) and the core (or between the armature and core if no stop pin is provided). Apply sufficient pressure to the armature directly opposite the lower part of the core to hold it against the gauge but not enough to distort the armature. The armature or movable front contact spring should touch the front contact or stop.

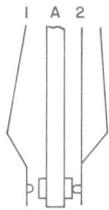
- (b) **Relays Equipped With Removable Metal Armature Stops:** Insert the blade of the No. 74D gauge having the thickness specified under Front Contact Make between the armature and the upper flange of the removable metal armature stop. Apply sufficient pressure to the armature directly opposite the upper flange of the metal armature stop [Fig. 6(B)] to hold the armature against the gauge but not enough to distort the armature. The armature or movable contact spring should touch the front contact or stop.

TABLE B — SPRING COMBINATION FIGURES

<p>FIG. 1</p> 		<p>FIG. 2</p> 		<p>FIG. 3</p> 																																																		
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0.060	0.035	0.035																																																				

Contacts marked (x) are used for armature stop purposes only and do not form part of the electrical circuit.

TABLE B (Cont)

FIG. 16			
ARM. TRVL	FRONT CONT MAKE		
0.020	0.005		
0.030	0.005		
0.035	0.010		
0.040	0.015		
0.050	0.025		
0.060	0.035		

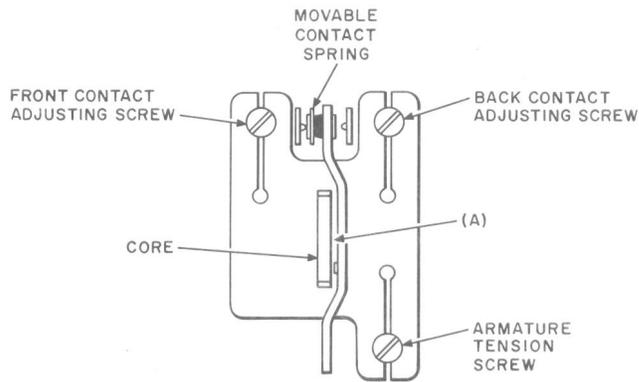


Fig. 9—Illustrating the Location of the Adjusting Screws for Spring Combinations (Fig. 4, 7, 9, and 19 Table B)

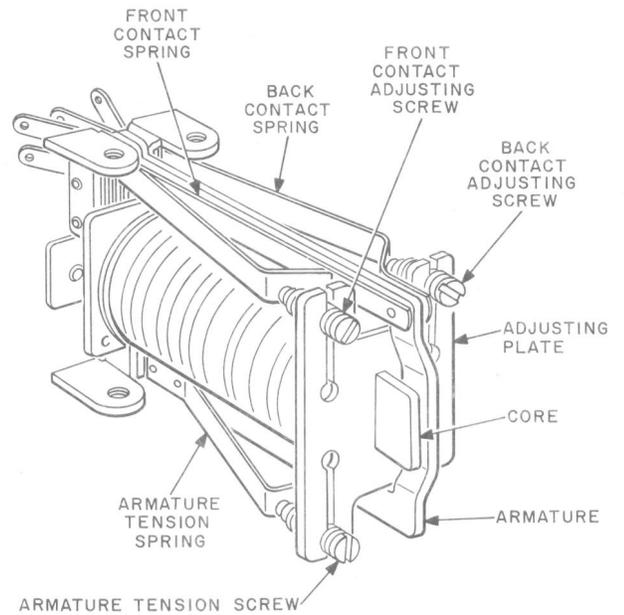


Fig. 11—B-Type Relay-Initial Design

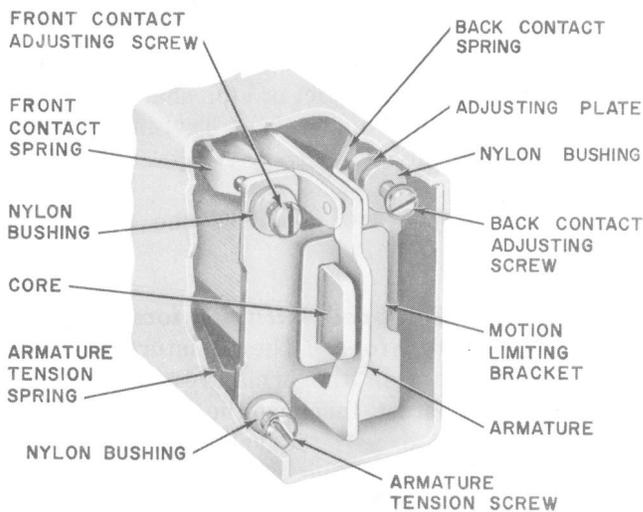


Fig. 10—B-Type Relay-Improved Design

(c) *Relays Equipped With Removable Paper Armature Stops*

*Relays Having Values of 0.005 Inch Specified under Front Contact Make*

- (1) Manually operate the relay by applying pressure to the armature opposite the lower part of the core. The movement of the armature after the armature or movable contact spring touches the front contact spring or stop, but before the stop pin or pins (or the armature when no stop pin is provided) strikes the paper stop should be minimum 0.005 inch as gauged by eye.

(2) This requirement is considered met if the armature or movable contact spring touches the front contact or stop with the 0.007-inch blade of the 74D gauge inserted between the armature stop pin or pins (or the armature where no stop pin is provided) and the core with the paper armature stop removed from the relay. In making this check take care that the bottom edge of the gauge lines up with the bottom of the core. Apply sufficient pressure to the armature directly opposite the lower part of the core to hold the armature against the gauge but not enough to distort the armature.

**Relays Having Values Greater Than 0.005 Inch Specified Under Front Contact Make**

(3) Remove the paper armature stop from the relay and check the requirement as described under (a) covering relays not equipped with removable armature stops.

(d) **Relays Equipped With Separator:** (Consisting of a strip of paper wound directly on the core.)

Use the 100 gauge of the 99A gauge nest having the thickness specified under Front Contact Make with the clip swung to one side. If the clip is fastened to the gauge with two rivets, bend the clip back sufficiently to clear the separator. Insert the gauge between the stop pin (or pins) and the separator and check the requirement as described under (a) covering relays not equipped with removable armature stops.

**2.13 Contact Separation:** Fig. 12(A)—The separation between contacts normally open or between contacts that are opened when the relay is operated shall be

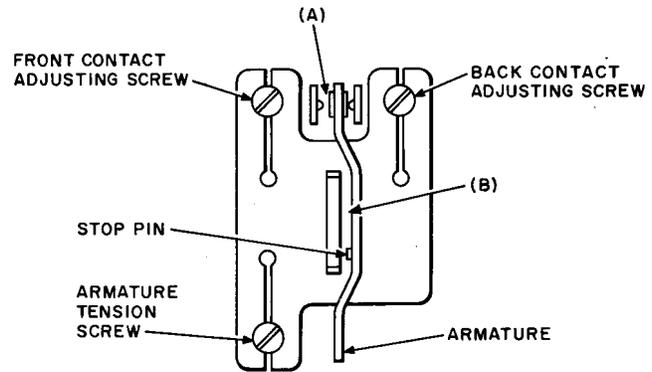
(a) For all spring combinations except Fig. 5 Table B contact (a) and Fig. 7 Table B contact (a), for B-136 relay

Min 0.005 inch .

(b) For spring combinations Fig. 5 Table B contact (a), and for Fig. 7 Table B. Contact (a), for B-136 relay

Min 0.010 inch

Use the 74D gauge.



**Fig. 12—Illustrating the Location of the Adjusting Screws for Spring Combinations (Fig. 1, 2, 3, 5, 6, 8, 11, 12, 13, 14, 15 and 16 Table B)**

**2.14 Maximum Armature Travel:** Fig. 12(B)

(a) **Relays Having One or No Stop Pin:** The armature travel (unoperated air gap) as measured between the armature and the core with the armature touching the back contact or stop shall not exceed the value specified under Arm. Trvl in the circuit requirement table.

Use the proper 101 gauge of the 99A gauge nest except where no stop pin is provided. In the latter case use the proper 100 gauge of the nest.

(b) **Relays Having Two Stop Pins:** The armature travel as measured between the nearer stop pin and the core with the armature touching the back contact or stop shall not exceed the value specified under Arm. Trvl in the circuit requirement table.

Use the proper 100 gauge of the 99A gauge nest.

(c) **Relays Equipped With Removable Metal Armature Stops:** The armature travel as measured between the armature and the core with the armature touching the back contact or stop shall not exceed the value specified under Arm. Trvl in the circuit requirement table.

Use the proper 101 gauge of the 99A gauge nest with the clip swung to one side. If the

clip is fastened to the gauge with two rivets, bend the clip back.

When inserting the gauge make sure that it does not touch the flanges of the removable metal armature stop or the stop pin on the armature.

(d) **Relays Equipped With D-93568 Removable Paper Armature Stops:** With the armature stop removed from the relay the relay shall meet the requirements covered in (a) or (b).

Check this requirement as covered in (a) or (b).

(e) **Relays Equipped With Separator:** (Consisting of a strip of paper wound directly on the core)—Relays equipped with a separator shall meet the requirements covered in (a) or (b).

Use the proper 100 gauge or 101 gauge [See (a) and (b)] of the 99A nest with the clip swung to one side. If the clip is fastened to the gauge with two rivets bend the clip back. Insert the gauge between the armature (or stop pins) and the separator instead of between the armature and the core.

**2.15 Contact Sequence:** Where different values of Front Contact Make are specified for the front contacts (a) and (b), contact (b) shall make before contact (a) makes.

Gauge by eye.

**2.16 Clearance Between Armature and No. 2 Contact Spring:** (Spring Combinations per Fig. 4, 7, 9, and 10 Table B)—With the relay electrically operated on its soak current, if a soak current is specified, or on its test operate current if no soak current is specified, there shall be a clearance between the front end of the No. 2 spring and the armature of

Min 0.005 inch

Gauge by eye.

**2.17 Clearance Between Armature and Motion Limiting Bracket:** Fig. 13(A) (Relays having motion limiting bracket only)

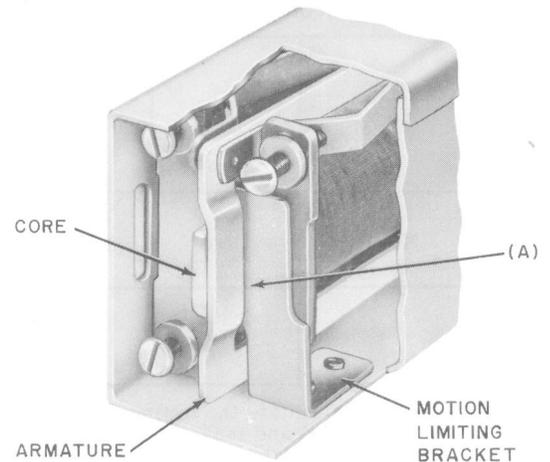
(a) **Test:** There shall be a clearance between the motion limiting bracket and the armature in both the operated and unoperated position of the relay.

Gauge by eye using the 376A dental mirror.

(b) **Readjust:** The motion limiting bracket shall clear the armature in the unoperated position of the relay by

Min 0.008 inch

Gauge by eye using the 376A dental mirror.



**Fig. 13—Clearance Between Motion Limiting Bracket and Armature**

**2.18 Position of Adjusting Screws:** (Relays equipped with slotted adjusting plate only)—At the time of turnover to the telephone company, the adjusting screws as finally adjusted shall extend beyond the front of the adjusting plate

Min 2 threads

Gauge by eye.

**2.19 Electrical Requirements**

(a) The relay shall meet the electrical requirements specified on the circuit requirement table.

(b) If the relay is used as an ac operated relay 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 given in Table C shall be used.

(c) The cover shall be on but the cover cap may be either on or off when applying the electrical requirements.

TABLE C — AC VOLTAGE REQUIREMENTS

RELAY CODE	TYPE OF SWDB	TYPE OF CIRCUIT	SERIES CONN	HERTZ IN CYCLES	AC TEST AND READJUST REQUIREMENTS METER SETTINGS VOLTS ACROSS T & R LEADS		SHUNT RES. (SEE NOTE)
					TEST OPR	READJ OPR	
B49	No. 1D	Cord	Rep Coil Wdgs	16 2/3	13.5	11.5	225
				20	14.0	12.0	
The following requirements for the B49 relay shall be used only when the circuit does not show the series connections covered above, or for locating trouble.							
					METER SETTINGS VOLTS ACROSS RELAY WDG		
					TEST OPR	READJ OPR	
B49	No. 1D	Cord	Wdg Alone	16 2/3	10.0	9.0	225
				20	10.5	9.5	
G29 G61		Misc	Sec Wdg Alone	16 2/3	23.0	21.0	225
				20	25.0	22.0	

**Note:** These shunts facilitate the testing or readjusting of a group of relays by stabilizing the test circuit output when the J68602AJ test set is used and makes it unnecessary to reestablish the test circuit output voltage for each relay. When the J68602AH test set is used which is not equipped with the shunt resistance specified, the voltage value must be reestablished for each relay tested or readjusted.

## 2.20 Armature Tension Spring Position:

Fig. 14(A)—On relays equipped with the type of armature tension spring shown in Fig. 14, the clearance between the armature and the spring with the relay in its operated position and between the spring and the adjusting plate with the relay in its unoperated position shall be

Min 0.005 inch

Gauge by eye.

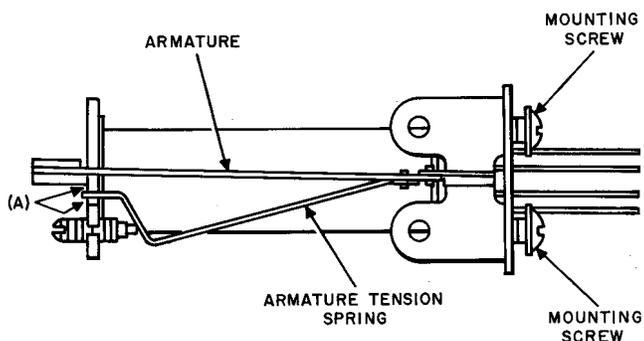


Fig. 14—Armature Tension Spring

**2.21 Flashing Requirement A:** Fig. 15—Supervisory relays in core circuits of No. 1 and 1C manual switchboards, and B1, B15, B36, and B76 supervisory relays in incoming trunk circuits in manual offices, or when flashing requirement "A" is specified on any circuit requirement table, shall follow interruptions at the rate of three times per second (180 per minute). The ratio of MAKE to BREAK or ON to OFF periods of the interrupter or the manual interruption of current shall be 2 to 1. The operation of core circuit supervisory relays shall be gauged by the flashing of the associated supervisory lamp or equivalent signal but it will be satisfactory to gauge the operation of incoming trunk supervisory relays by observing the relay itself.

**Test Only:** The current values specified on the circuit requirement table shall be applied in the following order in testing: With the release current applied continuously connect both the soak and operate currents. After one second disconnect the soak current and follow immediately by interrupting the operate current at the above speed and ratio of make to break for 3 interruptions.

The foregoing cycle of tests, when repeated, shall always proceed in the same sequence starting with the application of the combined soak and operate currents.

**Readjust Only:** The current values specified on the circuit requirement table shall be applied in the following order in readjusting: With the release current applied continuously connect the soak current. After one second disconnect the soak current and note that the relay releases promptly (approximately 1/2 second). Immediately after the relay releases follow by applying and interrupting the operate current at the above speed and ratio of make to break for 3 interruptions. The foregoing cycle of tests, when repeated, shall always proceed in the same sequence starting with the application of the soak current.

**Note:** It is desirable to have maximum back tension consistent with meeting the above readjust requirements.

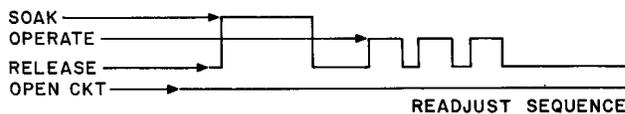
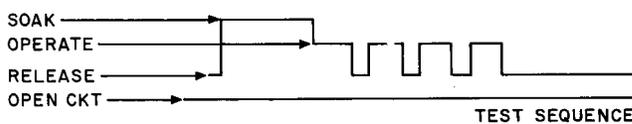


Fig. 15—Flashing Requirement A

**2.22 Flashing Requirement B:** Fig. 16—(Intended for use on supervisory relays in toll cord. toll line, toll trunk or other circuits when specified on the circuit requirement tables.) 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.

**Test Only:** The current values specified on the circuit requirement table shall be applied in the following order in testing: With the release current connected continuously, 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 1 to 1. Approximately 1/2 second after the second application of the soak current, disconnect the release current and approximately 1/2 second later connect and interrupt the operate current at least three times at the rate of 2 interruptions per second (120 per minute) and with a ratio of make to break of 3 to 2.

**Readjust Only:** The current values specified on the circuit requirement table shall be applied in the following order in readjusting: With the release current connected continuously, connect and interrupt the soak current two times at the rate of two interruptions per second (120 per minute) and with a ratio of make to break of 2 to 3. Approximately 1/2 second after the second application of the soak current disconnect the release current and approximately 1/2 second later connect and interrupt the operate current at least 3 times at the rate of 2 interruptions per second (120 per minute) and with a ratio of make to break of 2 to 3.

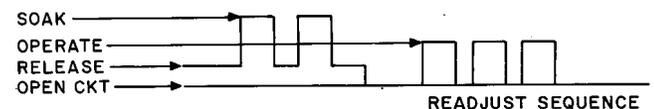
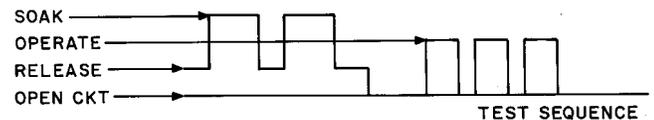
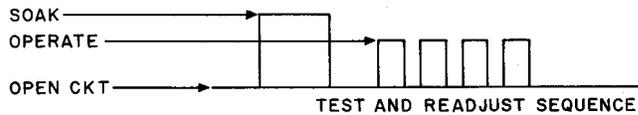


Fig. 16—Flashing Requirement B

**2.23 Flashing Requirement C:** Fig. 17—Supervisory relays in cord circuits of No. 1D, 10, and 11 manual switchboards, or when flashing requirement C is specified on the circuit requirement table, shall follow interruptions at the rate of 2 times per second (120 per minute) with a ratio of make to break or on to off of 3 to 12. For test, the operation of the cord circuit supervisory relays shall be gauged by the flashing of the associated supervisory lamp. For readjust, the operation of cord circuit supervisory relays shall be gauged by observing the relay itself.

**SECTION 040-506-701**

The current values specified on the circuit requirement table shall be applied in the following order in testing and readjusting. With the release current disconnected connect the soak current and disconnect it after approximately one second. Approximately 1/2 second thereafter apply and interrupt the operate current at the above speed and ratio of make to break for four interruptions. The foregoing cycle of tests when repeated shall always proceed in the same sequence starting with the application of the soak current.



**Fig. 17—Flashing Requirement C**

**3. ADJUSTING PROCEDURES**

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

CODE OR SPEC NO.	DESCRIPTION
<b>TOOLS</b>	
259	Spring Adjuster
300	Spring Adjuster
319B	Lamp Cap and Number Plate Extractor
363	Spring Adjuster
376A	Dental Mirror
553A	Lamp Extractor
KS-6015	Duck-bill Pliers
KS-6320	Orange Stick
KS-6854	3-1/2-inch Screwdriver
—	4-inch Regular Screwdriver
—	3-inch C Screwdriver
—	P Long-nose Pliers
<b>GAUGES</b>	
74D	Thickness Gauge Nest
99A	Thickness Gauge Nest Consisting of 100- and 101-Type Gauges

CODE OR SPEC NO.	DESCRIPTION
<b>TEST APPARATUS</b>	
35 Type	Test Set
J68602AH	Test Set
J68602AJ	Test Set
—	163-Type Interrupter and Associated Circuit or Equivalent for Use in Making "Flashing" Tests When Equipped in the Office
<b>MATERIALS</b>	
D-93568	Removable Paper Armature Stop
D-95367	Removable Paper Backstop

**3.002** Do not remove adjusting screws mounted in nylon bushings. These screws have cut their own thread in the bushings, and if removed and remounted the thread may be damaged thereby necessitating replacement of the relay.

**3.01 Cleaning** (Reqt 2.01)

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

**3.02 Relay Mounting** (Reqt 2.02)

**3.03 Cover Clearance** (Reqt 2.03)

- (1) To align the relay so that it is approximately level and also to obtain the necessary clearance between the relay cover and adjacent apparatus, loosen the mounting screws with the 4-inch regular screwdriver and shift the relay as required. Tighten the mounting screws securely.

**Relays Not Having Motion Limiting Bracket**

- (2) If necessary, additional cover clearance can be obtained provided there is clearance between the adjusting plate and the inside of the cover. To obtain additional cover clearance proceed as follows:

(3) Tag and unsolder the leads. Remove the relay from the mounting plate using the 4-inch regular screwdriver. Loosen the cover screws with the 3-inch cabinet screwdriver, and shift the cover with respect to the relay as required. Tighten the cover screws securely, mount the relay, and tighten the mounting screws securely. Exercise care that the relay is mounted approximately level. Recheck the cover clearance requirement. Resolder the leads to the relay terminals.

### **3.04 Cover Cap** (Reqt 2.04)

- (1) If a metal cover cap does not fit properly adjust the cover prongs as required using the P long-nose pliers.
- (2) If a plastic cover cap does not fit properly, replace the cap.

### **3.05 Contact Alignment** (Reqt 2.05)

- (1) If the contacts are misaligned refer the matter to the supervisor.

### **3.06 Tightness of Adjusting Screws** (Reqt 2.06)

- (1) If a relay is equipped with nylon bushings and the adjusting screws are loose, replace the relay.
- (2) If the relay is equipped with a slotted adjusting plate and the adjusting screws are too loose or too tight proceed as follows:
  - (a) Tag and unsolder the leads and remove the relay from the mounting plate using the 4-inch regular screwdriver.
  - (b) Remove the cover screws with the 3-inch cabinet screwdriver and remove the cover.
  - (c) If the adjusting screw is too tight, widen the slot in the adjusting plate using the KS-6854 screwdriver.
  - (d) If the screw is too loose, remove the screw and then close up the slot in the adjusting plate using the P long-nose pliers. Take care not to loosen the adjusting plate in making this adjustment.

- (e) Mount the adjusting screw.
- (f) Before mounting the cover on the relay and the relay on the mounting plate recheck the requirement.
- (g) Mount the cover on the relay using the 3-inch cabinet screwdriver and mount the relay on the mounting plate using the 4-inch regular screwdriver. Make sure that requirements 2.02 and 2.03 are met. Resolder the leads to the relay terminals.
- (h) Check requirements 2.10, 2.12 through 2.14, and 2.19 and adjust as required.

### **3.07 Application of D-93568 Removable Paper Armature Stop** (Reqt 2.07)

- (1) If the relay is already equipped with a removable paper armature stop and the stop is improperly positioned but is otherwise satisfactory, position the stop manually to meet the requirement. If the stop is dirty or damaged, replace the stop.
- (2) If the relay is equipped with a separator consisting of a strip of paper wound directly on the core remove the separator. Take care that no particles of paper are left on the core.
- (3) Clean the relay core and other parts as covered in 3.01.
- (4) Check requirements 2.10, 2.12, 2.13, and 2.14.
- (5) Mount the removable paper armature stop as follows: Grasp the papered edges of the stop between the thumb and forefinger and bow the bronze strip to form an opening between the single thickness of paper and the bronze strip sufficiently wide to permit slipping the stop onto the relay core. The flaps holding the removable paper stops in their shipping package may prove useful in guiding the removable stop onto the core.
- (6) With the bronze strip bowed as described in (5), slip the stop over the core as shown in Fig. 18. Release the pressure on the bronze strip and push the stop in until it touches the

adjusting plate or the motion limiting bracket. Then position the stop so that its upper and lower ends are approximately equidistant from the upper and lower edges of the core as shown in Fig. 18. Make sure that there is a clearance between the ends of the stop and the armature with the relay operated.

**Caution:** In mounting the stop, exercise care that the paper does not become moistened and that the bronze strip is not bowed excessively to cause it to take a permanent set.

(7) After mounting the stop, check requirement 2.19.

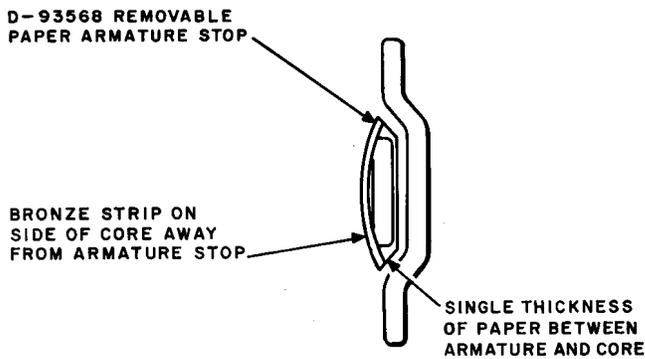


Fig. 18—Position of D-93568 Removable Paper Armature Stop

**3.08 Position of P-231534 Removable Metal Armature Stop** (Reqt 2.08)

(1) If the armature stop pin strikes the lower portion of the removable metal armature stop as the relay operates, thereby preventing the armature from striking the removable metal armature stop, reverse the position of the armature stop on the core. If this does not clear the trouble, replace the metal armature stop with a paper armature stop.

**3.09 Application of D-95367 Removable Paper Backstops** (Reqt 2.09)

(1) Before applying a D-95367 removable paper backstop, clean the relay as covered in 3.01.

(2) Mount the backstop as follows: Grasp the stop between the thumb and forefinger,

and press the stop firmly together taking care that the joint is entirely on one of the flattened sides of the stop. Slip the stop over the backstop spring so the single layer of paper is between the armature and the embossing on the stop spring. Make sure that the paper is approximately flush with the front end of the stop spring as indicated in Fig. 19.

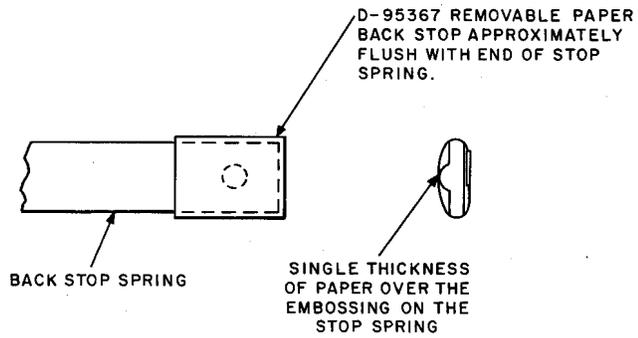


Fig. 19—Position of D-95367 Removable Paper Backstop

(3) The removable paper backstop will decrease the armature travel of the relay by the thickness of the paper (approximately 0.002 inch). After mounting the stop, check requirements 2.10, and 2.12 through 2.14.

- 3.10 *Contact Follow* (Reqt 2.10)
- 3.11 *Flexible Contact Spring Position* (Reqt 2.11)
- 3.12 *Minimum Front Contact Make* (Reqt 2.12)
- 3.13 *Contact Separation* (Reqt 2.13)
- 3.14 *Maximum Armature Travel* (Reqt 2.14)
- 3.15 *Contact Sequence* (Reqt 2.15)
- 3.16 *Clearance Between Armature and No. 2 Contact Spring* (Reqt 2.16)

**General**

(1) In making the adjustments covered below it is desirable, consistent with meeting the electrical requirements, that the Front Contact Make and Contact Separation be adjusted near

the minimum values specified. This will facilitate keeping the armature travel below the maximum specified value.

(2) Where removal of the cover is necessary in making adjustments covered below, proceed as follows: Tag and unsolder the leads to the relay terminals. Remove the relay from the mounting plate with the 4-inch regular screwdriver. Remove the cover from the relay using the 3-inch cabinet screwdriver.

(3) After completing the adjustments, reassemble the cover and relay and partially tighten all screws in the cover. Before fully tightening the screws make sure there is clearance between the adjusting plate and the cover. To facilitate obtaining this clearance insert the 0.012-inch feeler of the 74D gauge between the upper left edge of the adjusting plate and the cover and alternately tighten the screws in the top of the cover in several steps. Then insert the feeler between the upper right edge of the adjusting plate and the cover and similarly tighten the bottom screws near the rear of the cover. Then, on relays having a core support bracket, securely tighten the bracket mounting screws making sure that requirement 2.17 is met. Remount the relay on the mounting plate and resolder the leads to the relay terminals.

#### **Contact Follow**

(4) To adjust for contact follow proceed as follows: Turn the front contact adjusting screw counterclockwise approximately one complete turn using the KS-6854 screwdriver. Hold the flexible front contact spring away from the stop spring and apply the 300 spring adjuster to the stop spring just in front of the first bend from the front end of the spring. To increase the clearance between the flexible spring and the stop spring adjust the front portion of the stop spring to the left. To decrease the clearance adjust the stop spring to the right. Turn the front contact screw in a clockwise direction to its former position.

#### **Flexible Contact Spring Position**

(5) If the flexible front contact spring does not rest against the shoulder of the stop spring, apply the 259 spring adjuster to the rear of the

flexible spring and adjust the spring slightly to the left.

#### **Minimum Front Contact Make**

##### **General**

(6) In order to insure proper pressure of front contacts, if these contacts are used, and to aid the armature to release promptly, the following condition should be met: The front contact spring or stop spring should be located so the armature in moving to its operated position engages the front contact spring or stop spring before the stop pin (or pins) or the armature if no stop pin is provided touches the core (or removable paper stop if provided). In the case of relays having spring combinations per Fig. 13, 14, or 15 Table B, the front stop spring should be positioned to the right by means of the front contact adjusting screw so when the relay is manually operated as described below, the flexible front contact spring will touch the stop spring at a point opposite the contact before the armature stop pin (or armature if no stop pin is provided) touches the core. In manually operating the relay, pressure should be applied to the armature opposite the center of the core. In the case of relays having an armature spring (spring combinations per Fig. 5, 7, and 15 Table B) the other springs should be adjusted for contact make and contact separation before adjusting the armature spring as covered in (13).

##### **Relays Without Removable Armature Stops**

(7) Insert the proper gauge between the stop pin (or pins) and the core or between the armature and the core if no stop is provided. Apply sufficient pressure to the armature opposite the lower part of the core to hold it against the gauge as shown in Fig. 20. Exercise care not to distort the armature as this would result in a different gap under operating conditions. Turn the front contact adjusting screw with the KS-6854 screwdriver until the front contacts just make or the armature just touches the front stop.

##### **Relays With P231534 Removable Metal Armature Stops**

(8) Check whether the flanges on each side of the removable metal armature stop facing

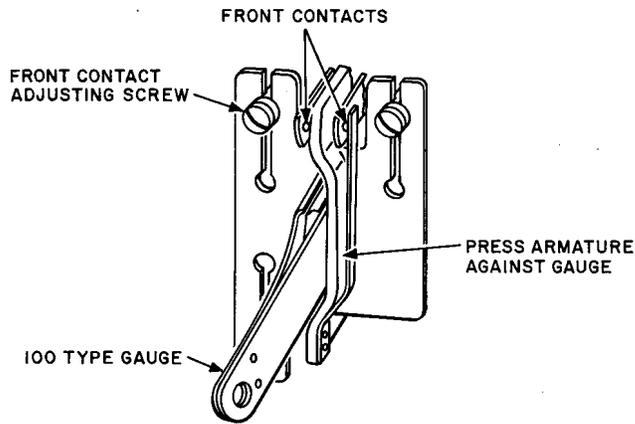


Fig. 20—Method of Adjusting for Minimum Front Contact Make

the armature are flat against the core. If they are not, remove the stop, adjust the flanges with the KS-6015 duckbill pliers and mount the stop on the relay core. Insert the proper gauge between the armature and the upper flange of the removable metal armature stop as shown in Fig. 21. Apply sufficient pressure to the armature directly opposite the upper flange of the stop to hold the armature against the gauge. Exercise care not to distort the armature as this would result in a different gap under operating conditions. Turn the front contact adjusting screw with the KS-6854 screwdriver until the front contacts just make or the armature just touches the front stop.

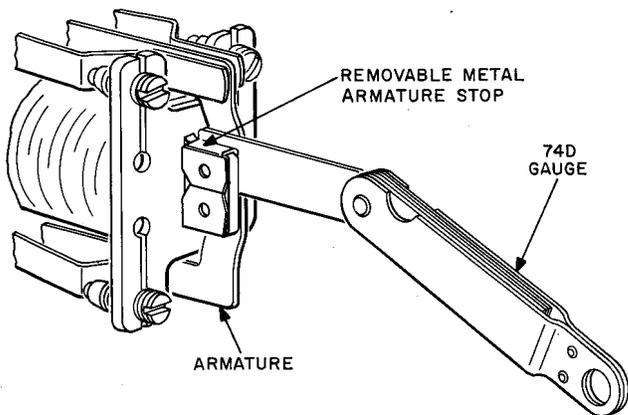


Fig. 21—Method of Adjusting for Minimum Front Contact Make on Relays Equipped with a Removable Metal Armature Stop

#### Relays With D-93568 Removable Paper Armature Stop

(9) **Relays Having Values of 0.005 Inch Specified Under Front Contact Make:** To adjust for Front Contact Make first remove the paper armature stop. Then insert the 0.007-inch blade of the 74D gauge between the armature stop pin or pins (or the armature when no stop pin is provided) and the core, taking care that the bottom edge of the blade lines up with the bottom edge of the core. Apply sufficient pressure to the armature opposite the lower part of the core to hold it against the gauge. Exercise care not to distort the armature as this would result in a different gap under operating conditions. Turn the front contact adjusting screw with the KS-6854 screwdriver until the front contacts just make or the armature just touches the front stop. Mount the paper armature stop as covered in 3.07(5), (6), and (7).

(10) **Relays Having Values Greater Than 0.005 Inch Specified Under Front Contact Make:** Remove the removable paper armature stop from the relay. Insert the proper gauge between the stop pin or pins (or armature when no stop pin is provided) and the core. Apply sufficient pressure to the armature opposite the lower part of the core to hold it against the gauge as shown in Fig. 20, but exercise care not to distort the armature, as this would result in a different gap under operating conditions. Turn the front contact adjusting screw with the KS-6854 screwdriver until the front contacts just make or the armature just touches the front stop. Mount the paper armature stop as covered in 3.07(5), (6), and (7).

#### Relays Equipped With a Separator, Consisting of a Strip of Paper Wound Directly on the Core

(11) If it is not necessary to replace the separator with a removable paper armature stop as covered in 3.07, insert the proper gauge between the stop pin or pins (or the armature if no stop pin is provided) and the paper on the core, using a 100- or 101-type gauge with the clip swung to one side. If the clip is fastened to the gauge with two rivets, bend the clip back. Apply sufficient pressure to the armature opposite the lower part of the core to hold it against the gauge, but exercise care not to distort the armature, as this would result in a different gap

under operating conditions. Turn the front contact adjusting screw with the KS-6854 screwdriver until the front contacts just make or the armature just touches the front stop. Make sure that the separator is not torn or otherwise injured by the insertion of the gauge.

#### Permissible Deviation From Minimum Front Contact Make Value Specified

(12) If upon making the armature tension adjustment as described in 3.19(1), (2), and (4), it is not possible to meet the release requirement due to the characteristics of the relay involved, adjust the front contact make to a value greater than the minimum value specified. However, the front contact gap should not be such that the contact separation requirement 2.13 and armature travel requirement 2.14 cannot be met.

#### Relays Equipped With Armature Spring (Spring Combination Fig. 5, 7, and 15 Table B)

(13) To position the armature spring for front contact make, adjust it with the 363 spring adjuster until it makes contact with the proper gauge inserted between the armature and the core of the relay. Apply the spring adjuster slightly above the bend in the spring as shown in Fig. 22.

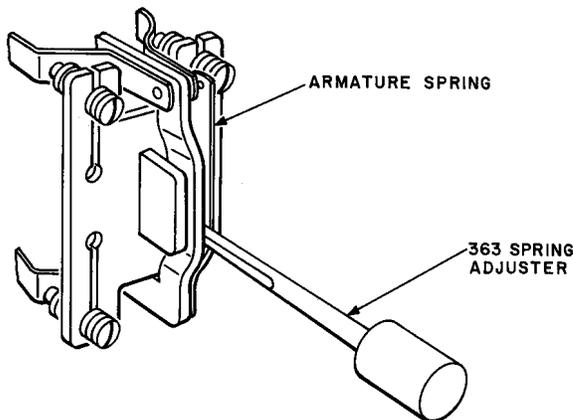


Fig. 22—Method of Adjusting Armature Spring for Minimum Front Contact Make

#### Contact Separation

(14) Position the back contact spring or stop so the contact separation is at or near the minimum value specified. Do this by turning the back contact adjusting screw with the KS-6854 screwdriver and then inserting the proper gauge to check the front contact separation as shown in Fig. 23. Do not turn the adjusting screw with the gauge inserted between the contacts. To position the armature spring for contact separation adjust it with the 363 spring adjuster as shown in Fig. 22. After making this adjustment check that the front contact make requirement is still met.

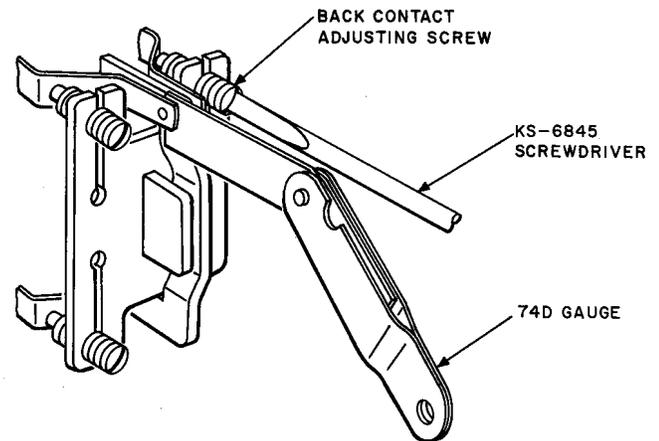


Fig. 23—Method of Adjusting Contact Separation

#### Maximum Armature Travel

(15) In adjusting for Front Contact Make and Contact Separation as described in (6) through (14) the armature travel (unoperated air gap) is also established. Check the armature travel with the proper gauge to determine whether it is within the maximum limit. To do this proceed as follows: Select the proper gauge and attempt to insert it in the gap between the armature and the core without forcing the gauge. (If a removable paper armature stop is on the relay remove it before inserting the gauge.) If the gauge does not enter the gap, the armature

travel is satisfactory. If the gauge slides freely into the gap, the armature travel is too great in which case readjust the Front Contact Make or the Contact Separation closer to the minimum values specified. Mount the paper armature stop if provided. The term "armature travel" is used instead of "unoperated air gap" in order to facilitate putting the requirement on the circuit requirement table. It will be given in the column under the heading Arm. Trvl.

### **Contact Sequence**

(16) Adjust relays on which a definite sequence of contact closure is required so the contact separation between the contacts required to make first is 0.005 inch less than that between the contacts required to make later. Use the 363 spring adjuster applying it slightly above the bend in the spring. Check the adjustment by moving the armature manually and noting that the proper sequence is obtained.

### **Clearance Between Armature and No. 2 Contact Spring (Spring Combination Fig. 4, 7, 9, and 10 Table B)**

(17) Apply the soak current if specified or the test operate current if no soak current is specified and note that sufficient clearance exists between the No. 2 spring and the armature. If this requirement is not met, reduce the Front Contact Make toward the minimum value.

(18) If reducing the Front Contact Make to the minimum value does not provide sufficient clearance between the armature and the No. 2 spring, proceed as follows:

(19) Adjust the No. 2 spring so that it is more nearly parallel to the armature in the unoperated position using the 259 spring adjuster.

### **3.17 Clearance Between Armature and Motion Limiting Bracket (Reqt 2.17)**

(1) If there is insufficient clearance between the armature and motion limiting bracket, proceed as follows: Tag and unsolder the leads and remove the relay from the mounting plate using the 4-inch screwdriver.

(2) Loosen the motion limiting bracket screws and position the core support bracket as required. If necessary to obtain the required clearance also loosen the screws which mount the relay structure in the cover, and shift the relay with respect to the cover. Obtain clearance between the adjusting plate and the cover and tighten all screws by following the procedures covered in 3.10 through 3.16(3).

(3) Fasten the relay cover securely to the mounting plate using the 4-inch screwdriver and reconnect all leads to the relay. Check requirements 2.02 and 2.03.

**3.18 Position of Adjusting Screws** (Reqt 2.18)  
No procedure.

**3.19 Electrical Requirements** (Reqt 2.19)

**3.20 Armature Tension Spring Position** (Reqt 2.20)

### **Electrical Requirements**

(1) **Operate or Hold:** If the relay fails to meet the operate or hold requirement, reduce the back tension on the armature using the KS-6854 screwdriver. On relays having adjusting screws in the positions shown in Fig. 9, turning the armature tension screw in decreases the back tension on the armature and turning it out increases the tension. On relays having adjusting screws in the position shown in Fig. 12 turning the armature tension screw out decreases the back tension on the armature.

(2) **Nonoperate or Release:** If the relay fails to meet the nonoperate or release requirements, increase the backward tension of the armature using the KS-6854 screwdriver. If it is impossible to meet the requirement or if the armature is sluggish in releasing, increase the Front Contact Make. The maximum armature travel requirement must not be exceeded. Ordinarily it will be possible to regulate the tension by the adjustment of the armature tension screw, but in the case of relays having the arrangement of adjusting screws in Fig. 9, it may be necessary to remove the relay from the mounting plate, remove the cover, and tension the No. 2 spring with the 259 spring adjuster against the armature stud sufficiently to permit a satisfactory adjustment of the armature tension.

- (3) Increasing the backward tension of the armature to meet nonoperate or release requirements will affect operate and hold of the relay. Decreasing the backward tension to meet operate and hold requirements will affect nonoperate and release of the relay.
- (4) If the relay is required to meet a flashing requirement, adjust the armature tension in accordance with the procedure given for that requirement.
- (5) Difficulty in adjusting the relay may be due to the armature tension spring being displaced from its normal position. This condition will be evident in the case of relays having the adjusting screws in the positions shown in Fig. 12 if turning the armature tension screw in does not seem to force the armature against the back contact or stop. In the case of relays having adjusting screws in the positions shown in Fig. 9 this condition will be evident if turning the armature tension screw does not affect the tension on the armature. In such cases the tension spring may be restored to its normal position by means of a small hook made from a paper clip or a piece of wire. Turn the armature tension screw out until it clears the spring, slip the hook in so as to catch the spring, move the spring toward the armature, and then turn the screw in until the armature spring rests against it.

**Caution:** *On relays having nylon bushings take care not to turn the adjusting screw out sufficiently to disengage the screw from the bushing. If the threads are disengaged, remounting the screw may damage the threads in the bushing thereby necessitating replacement of the relay.*

#### **Armature Tension Spring Position**

- (6) If the clearance between the armature tension spring and the adjusting plate or the armature is not met remove the relay from the mounting plate and remove the cover from the relay as covered in 3.10 through 3.16(2). Reduce or increase the tension of the armature tension spring as required with the 259 spring adjuster applying it at the rear of the spring. Mount the relay and check requirement 2.19.

#### **Final Check**

- (7) In all cases after a relay has been adjusted, lift the springs controlled by the three adjusting screws slightly away from the screws using the KS-6320 orange stick and allow them to return to the normal position which they will assume in service. Then mount the cover cap and check to insure that the relay meets its electrical requirements and flashing requirements (if specified). This check can generally be made by observing the operation of associated apparatus in the circuit or the lamp in the test set.

#### **3.21 Flashing Requirement (Req't 2.21)**

- (1) Before making any adjustment to meet the flashing requirement make sure that the relay meets requirements 2.01 through 2.19. In general, if the relay meets these requirements it will also meet the flashing requirement. In cases where the flashing requirement is not met proceed as follows:
- (2) Connect the 35-type test set as specified on the circuit requirement table and connect the flashing test interrupter and circuit, if available, to the test set. If no interrupter is available simulate the flashing manually.
- (3) When the supervisory relay is in adjustment and the flash of the supervisory lamp, as observed from the front of the switchboard, is unsatisfactory, attempt to improve it as follows: Remove the lamp cap and lamp using the 319B cap remover and the 553A lamp extractor. Partially insert the lamp into the socket, place the cap over the lamp and push the cap inward until it seats in the mounting.
- (4) Adjust the relay so that the back tension against the armature is as high as practicable consistent with meeting the operate requirement to insure maximum back contact pressure where required and to aid the armature to release promptly when the current is disconnected. Regulate the tension in accordance with procedures 3.19 and 3.20(1). If it is impossible to meet the requirement or if the armature is sluggish in releasing, increase the Front Contact Make gap. However, note that the contact separation and armature travel requirements are still met.

Apply the electrical requirements in the following sequence when regulating the armature tension.

***With Interrupter Circuit***

- (5) With the RELEASE key operated continuously, depress the SOAK key and release it after one second.
- (6) With the RELEASE key still operated, depress the OPERATE key until three flashes are obtained.
- (7) After the third flash and with the OPERATE key still depressed, increase the armature back tension until the armature just fails to operate. Although applied previously, the soak current should not be applied during the tensioning operation.
- (8) After this adjustment has been made and with the release current still connected, depress the SOAK key for one second. Release the SOAK key and follow immediately (approximately 1/2 second) by depressing the OPERATE key until three flashes are obtained. See that the associated cord supervisory lamp or equivalent signal indicates the operation and release of the relay as the SOAK and OPERATE keys are depressed and released.
- (9) If the signal follows the three applications of the operate current, the relay may be considered in a satisfactory adjustment. If the relay fails, reduce the armature back tension slightly until the relay responds to the three applications of the operate current after the soak current has been applied as described above.
- (10) If the tension of the armature spring is adjusted as outlined and the armature seems sluggish when releasing after the soak current has been disconnected, it is probable that the front contact spring or stop is located in such a way that the armature strikes the core face. It is well, therefore, to make a final check for the correct position of the front contact spring or stop. If it is found necessary to change its position, note that the contact separation requirement is still met.

***Without Interrupter Circuit***

- (11) With the RELEASE key operated continuously, depress the SOAK key and release it after one second.
- (12) With the RELEASE key still operated, depress and release the OPERATE key intermittently at the rate of approximately three times per second, the relation of make to break being approximately 2 to 1.
- (13) After releasing the OPERATE key the third time and while continuing to depress and release the OPERATE key, increase the armature back tension until the armature just fails to respond as the OPERATE key is depressed. Although applied previously, the soak current should not be applied during the tensioning operation.
- (14) After this adjustment has been made and with the release current still connected, depress the SOAK key for one second. Release the SOAK key and follow immediately (approximately 1/2 second) by depressing and releasing the OPERATE key ***three times*** at the rate of three times per second, the relation of make to break being approximately 2 to 1. See that the associated cord supervisory lamp or equivalent signal indicates the operation and release of the relay as the SOAK and OPERATE keys are depressed and released.
- (15) If the signal follows the three applications of the operate current, the relay may be considered in a satisfactory adjustment. If the relay fails, reduce the armature back tension slightly until the relay responds to the three applications of the operate current after the soak current has been applied.
- (16) If the tension of the armature spring is adjusted as outlined and the armature seems sluggish when releasing after the soak current has been disconnected, it is probable that the front contact spring or stop is located in such a way that the armature strikes the core face. It is well, therefore, to make a final check for the correct position of the front contact spring or stop. If it is necessary to change its position, note that the contact separation requirement is still met.

**3.22 Flashing Requirement B** (Reqt 2.22)

- (1) Before making any adjustment to meet the flashing requirement make sure that the relay meets requirements 2.01 through 2.19. In general, if the relay meets these requirements it will also meet the flashing requirement. In cases where the flashing requirement is not met proceed as follows:
- (2) Connect the standard adjusting circuit as specified on circuit requirement table. Where the standard adjusting circuit is not provided use the 35-type test set at the position and simulate the flashing manually.
- (3) Adjust the relay so the back tension is as high as practicable consistent with meeting the operate requirement to insure maximum back contact pressure where required and to aid the armature to release promptly when the current is disconnected. Regulate the tension in accordance with procedures 3.19 and 3.20 (1). If it is impossible to meet the requirement or if the armature is sluggish in releasing, increase the front contact make gap. However, note that the contact separation and armature travel requirements are still met. Apply the electrical requirements in the following sequence when regulating the armature tension.

***With Standard Adjusting Circuit Using Interrupter***

- (4) Apply the release current to the relay by operating key No. 1 of the portable test set to the DC position. With key No. 1 still operated, apply the soak current for approximately one second by operating key No. 2 to the SAT. DC and key No. 4 to the locking position. Release the soak current by restoring key No. 2 to the normal position.
- (5) Approximately 1/2 second after key No. 2 has been restored and with key No. 4 still operated, connect the operate current intermittently by operating key No. 2 to the OP. DC position and key No. 1 to the INT position. While the operate current is being applied intermittently by the interrupter increase the armature spring tension until the armature just fails to operate; then decrease the armature spring tension until the armature just operates, as indicated by the flashing of the test set lamp. Approximately

one-eighth of a turn of the armature tension screw will generally be sufficient.

- (6) After this adjustment has been made, check the operation of the relay as follows: With key No. 1 operated to the INT position, operate key No. 4 to the locking position. Operate key No. 2 to the SAT. DC position for two flashes of the test set lamp. Immediately after the second flash of the test set lamp, operate key No. 2 to the OP. DC position.
- (7) If the relay follows the interrupted soak and operate current, as indicated by uniform flashing of the test lamp, it may be considered in satisfactory adjustment. If, however, the relay does not respond satisfactorily to the soak and operate currents either increase or decrease the armature spring tension slightly as required until the relay meets the flashing requirements.

- (8) If the tension of the armature spring is adjusted as outlined and the armature seems sluggish when releasing after the soak current has been disconnected, it is probable that the front contact spring or stop is located in such a way that the armature strikes the core face. It is well, therefore, to make a final check for the correct position of the front contact spring or stop. If it is found necessary to change its position, note that the contact separation requirement is still met.

***Without Standard Adjusting Circuit***

- (9) Connect the 35-type test set as specified on the circuit requirement tables.
- (10) Operate the key which connects the release current to the relay. With the RELEASE key operated, operate the SOAK key for approximately one second. Release the SOAK key.
- (11) Approximately 1/2 second after the SOAK key has been restored to normal, restore the RELEASE key and follow immediately by operating the OPERATE key intermittently at the rate of approximately two times per second, the ratio of make to break being approximately 2 to 3. During the intermittent operation of the OPERATE key, increase the armature back tension until the armature just fails to operate; then decrease the armature back tension until

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the armature just operates, as indicated by the flashing of the test set lamp or equivalent signal. Approximately one-eighth of a turn of the armature tension screw will generally be sufficient.

(12) After this adjustment has been made, check the operation of the relay as follows: Operate the RELEASE key and then the SOAK key twice at the rate of approximately two times per second, the ratio of make to break being approximately 2 to 3. The test set lamp or equivalent signal should follow the intermittent operation of the key.

(13) Immediately after the second flash of the test set lamp or equivalent signal, restore the RELEASE key and operate the OPERATE key three or more times at the rate of approximately two times per second, the ratio of make to break being approximately 2 to 3.

(14) If the relay follows the interrupted operate and soak currents, as indicated by the uniform flashing of the test set lamp or equivalent signal, the relay may be considered in satisfactory adjustment. If, however, the relay does not respond satisfactorily to the soak and operate currents, either increase or decrease the armature spring tension slightly as required until the relay meets the flashing requirements.

(15) If the tension of the armature spring is adjusted as outlined and the armature seems sluggish when releasing after the soak current has been disconnected, it is probable that the front contact spring or stop is located in such a way that the armature strikes the core face. It is well, therefore, to make a final check for the correct position of the front contact spring or stop. If it is found necessary to change its position, note that the contact separation requirement is still met.

### 3.23 Flashing Requirement C (Reqt 2.23)

(1) Before making any adjustment to meet the flashing requirement make sure that the relay meets requirements 2.01 through 2.19. In general, if the relay meets these requirements it will also meet the flashing requirement. In cases where the flashing requirement is not met proceed as follows:

(2) Connect the 35-type test set as specified on the circuit requirement table.

(3) Adjust the relay so that the back tension against the armature is as high as practicable consistent with meeting the operate requirement to insure maximum back contact pressure and to aid the armature to release promptly when the current is disconnected. Regulate the tension in accordance with procedures 3.19 and 3.20 (1). If it is impossible to meet the requirement or if the armature is sluggish in releasing, increase the front contact make gap. However, note that the contact separation and armature travel requirements are still met. Apply the electrical requirements in the following sequence when regulating the armature tension:

(4) With the release current disconnected depress the SOAK key and release it after one second.

(5) Immediately thereafter depress and release the OPERATE key intermittently at the rate of approximately two times per second, the relation of make to break being approximately 3 to 2.

(6) After releasing the OPERATE key the fourth time and while continuing to depress and release the OPERATE key increase the armature spring tension until the armature just fails to respond after the OPERATE key is depressed. Although applied previously do not apply the soak current during the tensioning operation.

(7) Check for the release condition as follows:  
With the release current connected continuously operate and release the SOAK key at approximately one second intervals and note that the armature releases promptly on the release of the SOAK key.

(8) After this adjustment has been made and with the release current disconnected, depress the SOAK key for one second. Release the SOAK key and follow immediately (approximately 1/2 second) by depressing and releasing the OPERATE key four times at the rate of two times per second, the relation of make to break being approximately 3 to 2.

(9) If the relay follows the four applications of the operate current gauged by observing the operation of the relay it may be considered in a satisfactory adjustment. If the relay fails, reduce the armature tension slightly until the relay will respond to the four applications of the operate current after the soak current has been applied. If it is necessary to reduce the armature back tension repeat the check for the release condition by depressing the SOAK key at intervals of approximately one second with the release current connected.

(10) If the tension of the armature spring is adjusted as outlined and the armature seems sluggish when releasing after the soak current has been disconnected, it is probable that the front contact spring or stop is located in such a way that the armature strikes the core face. It is well, therefore, to make a final check for the correct position of the front contact spring or stop. If it is found necessary to change its position note that the contact separation requirement is still met.