190-TYPE RELAYS

REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers 190-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 Part 1, "General" and Part 2, "Requirements" form part of the Western Electric Co. Inc. Installation Department Handbook.

1.05 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.

1.06 ***Operate (DC)*** means that when the operate current is applied the armature shall move sufficiently to break the back contact and make the front contact reliably.

1.07 ***Non-operate (DC)*** means that when the non-operate current is applied, the armature shall not break the back contact or move from the unoperated position sufficiently to make the front contact.

1.08 ***Hold (DC)*** means that when the current is reduced abruptly from the operate to the hold value, the armature shall not move from its operated position sufficiently to break the contact which has been made or to make the contact which has been broken.

1.09 ***Release (DC)*** means that when the current is reduced from the soak, operate or hold value to the release value, the armature shall move from the operated position sufficiently to break the contact that has been made, and reliably make the contact that has been broken.

1.10 ***Operate (AC)*** means that when the operate current is applied for approximately one second the armature shall move sufficiently to cause the associated relay or relays to function.

1.11 ***Non-operate (AC)*** means that when the non-operate current is applied for approximately one second, the armature shall not move sufficiently to cause the associated relay or relays to function.

2. REQUIREMENTS

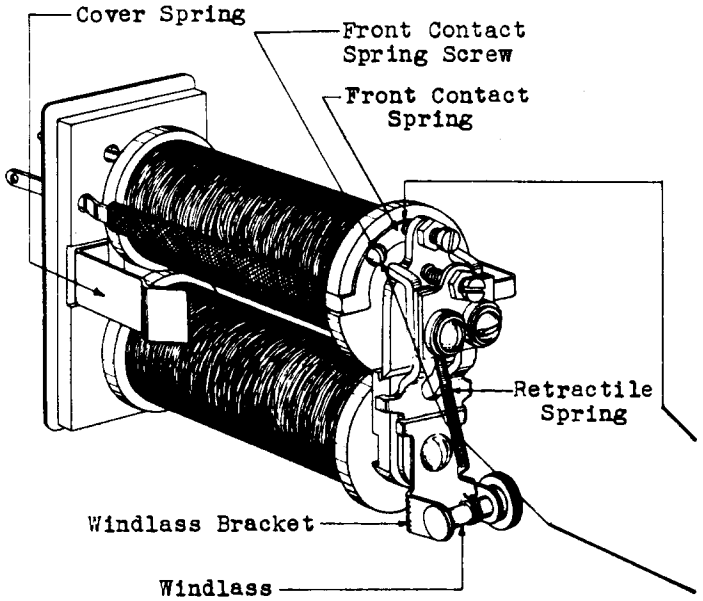


Fig. 1

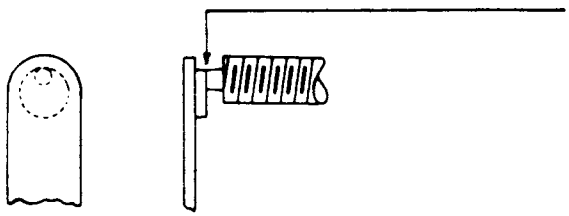


Fig. 2

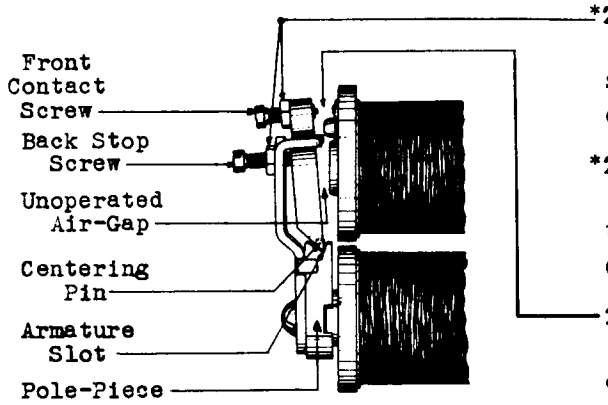


Fig. 3

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

2.02 ***Relay Mounting:*** Relays shall be mounted securely and approximately level. This shall be checked for by applying a vertical and a horizontal pressure to the relay and not by attempting 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 ***Front Contact Spring Position:*** The front contact spring shall rest firmly against the spoolhead at least near the contact end.

Gauge by feel.

2.05 ***Tightness of Front Contact Spring Screw:*** The front contact spring screw shall be sufficiently tight to hold the front contact spring in the adjusted position.

Gauge by feel.

2.06 ***Contact Alignment:*** Contacts shall line up so that the point of contact falls wholly within the circumference of the opposing contact disc.

Gauge by eye.

2.07 ***Armature Movement:*** The armature shall not bind or ride on the top of the pin in the armature slot and shall clear the tangs of the armature back stop bracket.

Gauge by feel and by eye.

2.08** ***Tightness of Lock Nuts: The lock nuts shall be sufficiently tight to hold the screws in the adjusted position.

Gauge by feel.

2.09** ***Tightness of Windlass: The windlass shall be sufficiently tight in the bracket to hold the adjusted position.

Gauge by feel.

2.10 ***Contact Separation:*** The separation between any pair of contacts normally open or between any pair of contacts that are opened when the relay is operated shall be

Min. .005"

Use the No. 74-D gauge.

2.11 ***Electrical Requirements***

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

(b) ***The 190F Relay*** in toll cord circuits shall meet requirement 2.14.

(c) ***190E Relay in Toll Cord Circuit***

(1) When an a-c voltage test set is available and a-c voltage requirements are not shown in the circuit requirement table, the following a-c voltage requirements shall be used.

(2) When an a-c voltage test set is not used, the relay shall meet the requirements specified in Table A on page 5. The requirements given on the circuit requirement table for this relay shall be disregarded. The particular requirements that are to be applied shall be determined by the connection of winding, type of adjustment and ringing frequency involved, or as specified by item number. In offices where no low shunt testing and adjusting equipment is provided, the relay shall be considered satisfactory for turnover if it meets its mechanical requirements and functions satisfactorily in the circuit.

2.12 ***Feather Contact Spring Position:*** The feather contact spring shall rest against the turned over portion of the front contact spring when it is not engaged by the front contact screw.

Gauge by eye.

A-C VOLTAGE REQUIREMENTS

RELAY CODE	TYPE OF SWBD.	TYPE OF CIRCUIT	CONN. OF WDG.	SERIES CONN.	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.
190E	No. 1 Toll	Cord	Series	Ret. Coil and 1 Mf.	16⅔	[illegible]0	12.5	8.0	225
					20	18.0	14.0	9.0	
			Parallel	Ret. Coil and 4 Mf.	16⅔	5.5	4.0	2.9	225
					20	7.5	6.0	3.5	

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

						METER SETTINGS VOLTS ACROSS RELAY WDG. — TEST OPR.	READJ. OPR.	READJ. N.O.	
190E	No. 1 Toll	Cord	Series	Wdg. Alone	16⅔	[illegible]0.0	15.0	9.0	225
					20	[illegible]2.5	17.0	10.5	
			Parallel	Wdg. Alone	16⅔	9.5	7.0	4.5	225
					20	10.5	8.0	5.0	

*2.13 ***Flexible Stop Spring Position (190-F Relay Only):*** There shall be a clearance between the tip of the flexible stop spring and the armature when the tip is not touching the back stop screw of

Min. .025"
Max. .035"

Gauge by eye.

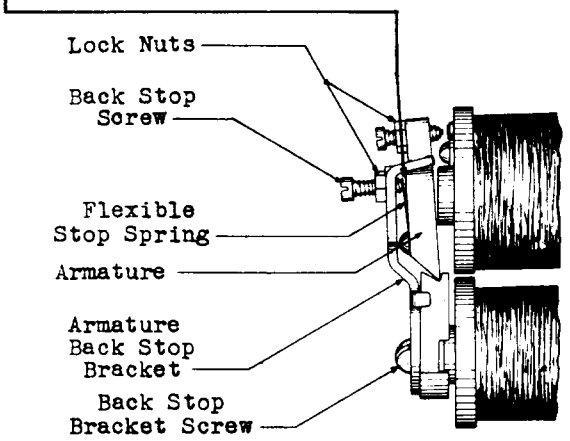


Fig. 4 – 190-F Relay Equipped With Phosphor Bronze Stop Spring per P-215437

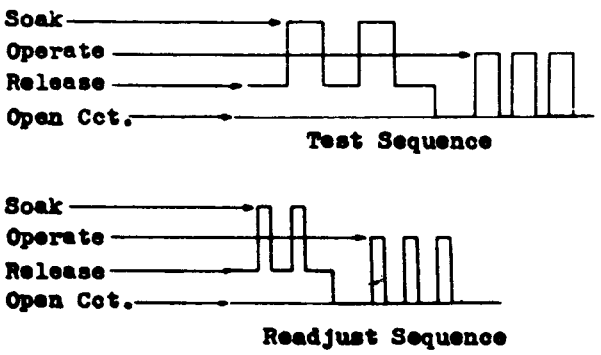


Fig. 5

2.14 ***Flashing Requirement "B"*** (Intended for use on 190-F Supervisory Relays in toll cord circuits when this relay is equipped with a phosphor bronze stop spring per P-215437).

(a) The relay shall cause the associated supervisory lamp or equivalent signal to respond to a rate of flashing as specified below for test and readjust as applied by means of the test and readjust circuits provided for the office. In offices not equipped with the testing and adjusting circuits these requirements shall be simulated manually. The current flow values to be used shall be

	TEST	READJUST
Soak	.014 amp.	.014 amp.
Release	.002 amp.	.0025 amp.
Operate	.0085 amp.	.0075 amp.

These current flow requirements replace the requirements specified on the circuit requirement table.

(b) ***Test Only:*** The current flow values specified above 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 "Soak" and "Release" currents are disconnected, connect and interrupt the "Operate" current at least three times at the rate of two interruptions per second (120 per minute) and with a ratio of make to break of 3 to 2.

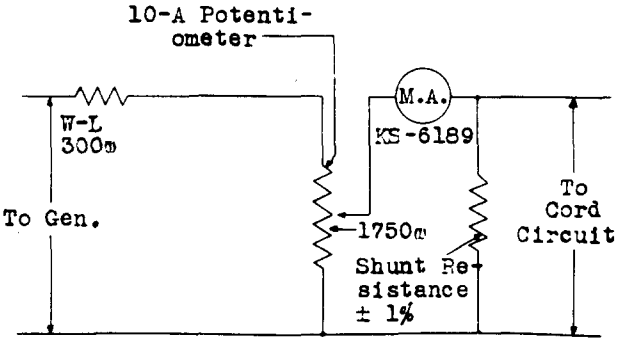
(c) ***Readjust Only:*** The current flow values specified above shall be applied in the following order in readjusting. With the "Release" current connected continuously, connect and interrupt the "Soak" current two times at the rate of two interruptions per second (120 per minute) and with a ratio of make to break of 2 to 3. Approximately 1/2 second after the "Soak" and "Release" currents are disconnected, connect and interrupt the "Operate" current at least three times at the rate of two interruptions per second (120 per minute) with a ratio of make to break of 2 to 3.

TABLE A

CONNECTION OF WINDING	TYPE OF ADJUSTMENT	FREQUENCY IN CYCLES	AC TEST AND READJUST CURRENT FLOW REQUIREMENTS						SHUNT RESISTANCE	NOTES	ITEM NO.
			CURRENT IN RELAY AMPERES			METER SETTING AMPERES					
			TEST OPER.	READJ.		TEST OPER.	READJ.				
				OPER.	N.O.		OPER.	N.O.			
Series	Average	16⅔	.0016	.0013	.0009	.116	.088	.054	125ω	1, 2, 3, 4	1.01
		20				.146	.106	.068			1.02
Parallel		16⅔	.0032	.0026	.0018	.104	.082	.058	60ω		1.03
		20				.130	.098	.058			1.04

Notes

1. Testing and readjusting may be done with the standard AC milliammeter circuit, if installed; if not, the current values or the meter settings specified in the table on this page shall be used in connection with the testing and adjusting circuit as shown in Note 4.
2. Testing and readjusting shall be done only when a 300ω Ward-Leonard resistance is in the ringing lead.
3. The cord circuit is prepared for testing and readjusting the relay when the toll end of the cord is connected to the Testing and Adjusting Circuit and the sleeve of this cord is connected to ground through 60ω.
4. *Testing and Adjusting Circuit*



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.

3. ADJUSTING PROCEDURES

CODE NO.	DESCRIPTION
TOOLS	
35 (Part of Combination Tool 221)	Screwdriver — 3-1/2"
102	Wrench — 3/8" Hex. Socket
220 (Part of Combination Tool 221)	Wrench — 3/16" Hex. Socket
350	Spring Adjuster
KS-2348	Cord Repair Screwdriver
—	Bell System P-Long Nose Pliers — 6-1/2" per A.T.&T.Co. Drawing 46-X-56
—	Bell System Cabinet Screwdriver — 3-1/2" per A.T.&T.Co. Drawing 46-X-40
GAUGES	
74-D (or the replaced 74-C)	Thickness Gauge Nest
TEST APPARATUS	
35-C	Test Set
—	163 Type Interrupter and Associated Circuit or Equivalent for Use in Making "Flashing" Tests When Equipped in the Office
MATERIALS	
—	Toothpicks — Hardwood — Flat at One End and Pointed at Other

3.01 *Cleaning* (Reqt 2.01)

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

3.02 *Relay Mounting* (Reqt 2.02)

M-1 If the relay is loose on the mounting plate tighten the mounting nuts securely with the No. 102 wrench. Do not fasten the mounting nuts too tightly as otherwise undue pressure will be exerted on the fibre insulator and the threads of the mounting studs may be stripped. It is particularly important that these relays be mounted approximately level (as regards the armature knife edge). Therefore, when tightening the mounting nuts, note that the relay is mounted approximately level.

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

3.03 *Cover Spring Pressure* (Reqt 2.03)

M-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 3-1/2" cabinet screwdriver inserted between the spring and coils.

M-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 3-1/2" cabinet screwdriver inserted outside the spring.

M-3 Care should be taken not to injure the protective serving on the coils.

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

M-1 ***Front Contact Spring:*** To position the front contact spring against the spoolhead, first tighten the contact spring screw, if loose, with the No. 35 screwdriver. If this does not correct the trouble loosen the screw sufficiently to place the No. 350 spring adjuster between the spring and the spoolhead so that its forked end spans the screw. Turn the screw in and then force the front contact spring towards the spoolhead by applying pressure to the contact end with the No. 35 screwdriver. See Fig. 6. Exercise care to place the screwdriver on the tip of the spring and not on the contact so as to prevent marring the contact. On relays equipped with a flexible contact spring exercise care not to bend the turned over portion of the front contact spring toward the spoolhead during this operation since this will tend to destroy the purpose for which the feather spring is used.

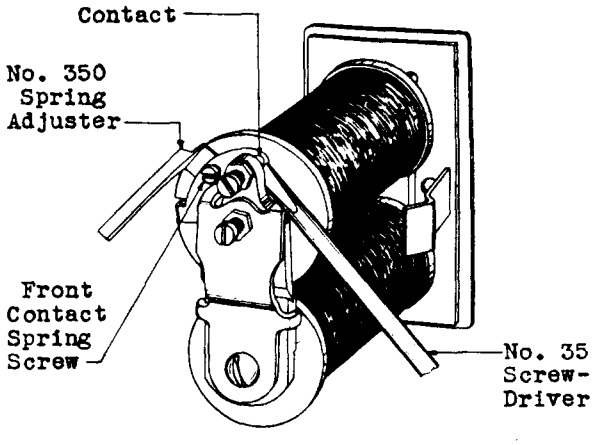


Fig. 6 – Method of Adjusting Front Contact Spring

M-2 . Loosen the screw, remove the spring adjuster and then tighten the screw securely. In tightening this screw press the front contact spring against the spoolhead adjacent to the head of the screw, in order to relieve the tension against the screw head while tightening and to prevent stripping of the threads in the spoolhead.

M-3 ***Tightness of Front Contact Spring Screw:*** To tighten this screw use the No. 35 screwdriver and at the same time align the contacts in accordance with procedure 3.06.

3.06 *Contact Alignment* (Reqt 2.06)

M-1 ***Front Contacts:*** To align the front contacts loosen the front contact spring screw with the No. 35 screwdriver and shift

the spring. An attempt should be made to center the contacts. Tighten the screw securely.

M-2 If it is not possible to correct the trouble in this way loosen the armature back stop bracket screw with the 3-1/2" cabinet screwdriver and shift the armature back stop bracket. Tighten the screw securely.

M-3 ***Back Contacts:*** To align the back contacts loosen the armature back stop bracket screw with the 3-1/2" cabinet screwdriver and shift the bracket. Tighten the screw securely. Note that the front contacts are still in alignment.

3.07 ***Armature Movement*** (Reqt 2.07)

M-1 ***Tangs:*** If the armature does not clear the tangs of the armature back stop bracket adjust them with long nose pliers until the armature moves freely.

M-2 ***Centering Pin and Armature Slot:*** If the armature clears the tangs but still does not move freely, it may be due to the centering pin located in the armature slot being bent, or to burrs in the slot in the armature. Ordinarily, in the process of checking it will not be necessary to remove the armature to inspect the knife edge. If it is obviously defective proceed as follows: Disconnect the retractile spring from the windlass, if the relay is so equipped, by grasping the lower end of the hook of the spring with the long nose pliers. Remove the armature back stop bracket screw with the 3-1/2" cabinet screwdriver and remove the armature bracket, and windlass bracket if the relay is so equipped.

M-3 If the centering pin is bent, attempt to straighten it with long nose pliers. Note that the slot in the armature that clears the pin, and the knife edge of the armature is not burred. Do not remove burrs by filing or other means as this injures the finish which protects the parts from corrosion.

M-4 It is advisable at this time to thoroughly clean the armature and armature slot in accordance with procedure 3.01.

M-5 Reassemble the parts and tighten all screws securely. Align the contacts at the same time in accordance with procedure 3.06.

3.08 ***Tightness of Lock Nuts*** (Reqt 2.08)

M-1 To tighten loose lock nuts use the No. 220 wrench holding the screws in position with the No. 35 screwdriver.

3.09 ***Tightness of Windlass*** (Reqt 2.09)

M-1 If the windlass is not sufficiently tight in its bracket increase the pressure of the sides of the bracket against the windlass by adjusting the sides outward with the long nose pliers.

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

M-1 ***General:*** If the relay fails to meet the electrical requirements proceed as follows: The procedures given under M-8 to M-17 are for use on relays equipped with a retractile spring.

Relays Not Equipped with Retractile Springs

M-2 ***Operated Position of Armature:*** With the release current specified on the circuit requirement table connected continuously, apply the soak current or if no soak current is specified apply the operate current. Loosen the lock nut on the front contact screw slightly with the No. 220 wrench and turn the front contact screw in a counterclockwise direction with the No. 35 screwdriver to a point where the armature sticks when the soak or operate current is released. Again apply the soak or operate current and turn the front contact screw slightly in a clockwise direction until it has reached a point where the armature just releases when the soak or operate current is released. Then turn the front contact screw (approximately 1/16 of a turn) further in a clockwise direction and tighten the lock nut.

M-3 ***Unoperated Position of Armature (Contact Separation):*** Loosen the lock nut on the back contact (or stop) screw slightly with the No. 220 wrench and turn the back contact (or stop) screw in a clockwise direction with the No. 35 screwdriver until the front contact screw just touches the front contact. Then turn the back contact (or stop) screw in a counterclockwise direction approximately

1/4 of a turn which will allow a clearance between the front contact and the screw of .005" to .007". On relays having a back contact, check to see that the back contact separation is min. .005". If necessary turn the back contact screw in a counterclockwise direction until this is met. Retighten the lock nut and check to make sure the relay meets all electrical requirements. If it does not proceed as follows:

M-4 ***Operate and Non-operate:*** Failure to meet either of these current requirements is probably due to the air-gap between the armature and core when the armature is in the unoperated position, being incorrect. If the relay fails to meet the operate requirement decrease the unoperated armature air-gap. To do this loosen the lock nut on the back contact (or stop) screw with the No. 220 wrench and turn the screw in a clockwise direction with the No. 35 screwdriver, noting that the contact separation requirement is still met. Tighten the lock nut securely. If the relay fails to meet the non-operate requirement increase the unoperated air-gap. To do this turn the back contact (or stop) screw in a counterclockwise direction. If impossible to meet the operate and non-operate requirements by means of the adjustment of the unoperated air-gap and still meet the contact separation requirement, slightly change the operated air-gap, as outlined under M-5 consistent with meeting the hold and release requirements.

M-5 ***Hold and Release:*** Failure to meet either of these current requirements is probably due to the air-gap between the armature and core when the relay is in the operated position, being incorrect. If the relay fails to release, increase the operated armature air-gap. To do this loosen the lock nut on the front contact screw with the No. 220 wrench and turn this screw in a clockwise direction with the No. 35 screwdriver, noting that the contact separation requirement is still met. Tighten the lock nut securely. Failure to release may also be due to dirty contacts which should be cleaned in accordance with procedure 3.01. If the relay fails to meet the hold requirement decrease the operated armature air-gap. To do this, loosen the lock nut on the front contact screw with the No. 220 wrench and turn this screw in a counterclockwise direction with the No. 35 screwdriver. Tighten the lock nut securely.

M-6 ***Feather Contact Spring Position:*** The adjustment of the feather contact spring, on relays so equipped, also affects the operation of the relay and the tension of it against the turned over portion of the front contact spring should be considered in adjusting to meet the electrical requirements. To increase the tension insert the flat end of a toothpick between the spring and the front contact spring and slide the toothpick towards the contact spring screw until the spring will rest firmly against the inside of the turned over portion of the front contact spring. Take care not to kink the spring or give it an excessive bow. In case the spring is bowed excessively the bow may be reduced by rubbing the spring with the No. 35 screwdriver adjacent to the front contact spring screw. In its final adjusted position, the spring should curve slightly outward toward the armature rather than inward toward the front contact spring so that the front contact screw in its travel will make contact as long as possible.

M-7 ***Final Check:*** In all cases after a relay has been adjusted, the cover should be replaced and a check made to insure that the relay meets its electrical requirements. This check can generally be made by observing the operation of associated apparatus in the circuit.

Relays Equipped with Retractile Springs

M-8 It will facilitate meeting the requirements if the operated and unoperated positions of the armature on relays equipped with a retractile spring are adjusted as follows:

M-9 ***Unoperated Position of Armature:*** To establish the unoperated position of the armature proceed as follows: Loosen the lock nut on the back contact (or stop) screw with the No. 220 wrench and turn this screw in a counterclockwise direction with the No. 35 screwdriver until the .009" blade of the No. 74-D gauge can be inserted between the armature and the core of the upper coil at the nearest point. Then turn the back contact (or stop) screw in a clockwise direction until

the armature, gauge and the core of the upper coil are just touching. If necessary turn the front contact screw in a counterclockwise direction. Tighten the lock nut securely and remove the gauge.

M-10 ***Operated Position of Armature (Contact Separation):*** To establish the operated position of the armature proceed as follows: Loosen the lock nut on the front contact screw with the No. 220 wrench and turn this screw in a clockwise or counterclockwise direction as required until the .005" blade of the No. 74-D gauge can be inserted between the armature and the back contact (or stop) screw. Then turn the front contact screw in a clockwise direction until it touches the front contact and the armature just presses the gauge against the back contact (or stop) screw. Tighten the lock nut securely. Remove the gauge.

M-11 With the operated and unoperated positions of the armature established, as covered under M-9 and M-10 adjust to meet the electrical requirements as follows:

M-12 ***Operate:*** With the operate current applied to the relay slowly turn the windlass in a counterclockwise direction thus increasing the tension of the retractile spring until the relay just fails to operate. Then reduce the tension of the spring by slowly turning the windlass in a clockwise direction until the relay just operates. Connect and disconnect the operate current until the relay operates satisfactorily and then decrease the tension of the spring slightly.

M-13 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.

M-14 ***Non-operate:*** Now apply the non-operate current, if specified, and if the relay does not operate it may be considered in proper adjustment. If, however, the relay operates increase the tension of the retractile spring. To do this slowly turn the windlass in a counterclockwise direction until the relay does not operate. Check that the relay and the associated apparatus functions when the operate current is applied.

M-15 ***Release:*** Now apply the release current, if specified, after the soak or operate current has been applied and if the relay releases the relay may be considered in proper adjustment. If, however, the relay fails to release increase the tension of the retractile spring by turning the windlass in a counterclockwise direction. Failure to release may also be due to dirty contacts and they should be cleaned in accordance with procedure 3.01. After the relay releases satisfactorily check to see that the relay and associated apparatus functions satisfactorily when the operate current is applied. When no release current is specified the relay must release on open circuit.

M-16 If it is impossible to obtain a satisfactory adjustment by changing the tension of the retractile spring, with the positions of the armature as established under M-9 and M-10, change the positions of the armature as required, noting that the contact separation requirement is still met.

M-17 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.

3.13 ***Flexible Stop Spring Position*** (Reqt 2.13)
3.14 ***Flashing Requirement "B"*** (Reqt 2.14)

M-1 ***Flexible Stop Spring:*** To check this requirement loosen the back stop bracket screw with the 3-1/2" cabinet screwdriver and remove the armature.

M-2 If the flexible stop spring lies too close to the armature insert the flat end of a toothpick between the spring and the armature farther from the screw which holds the spring to the armature. Then slide the toothpick towards the screw, until the requirement is met.

M-3 If the clearance between the spring and the armature is too great correct as follows: First mark on the armature the position of the spring so as to facilitate reassembling; then loosen the screw which holds the spring to the armature with the 3-1/2" cabinet screwdriver or the KS-2348 cord repair screwdriver, sufficiently to permit removing the spring. Remove the spring and adjust it manually. Replace the spring and if it lies too close to the armature correct as outlined under M-2.

M-4 Reassemble the armature and bracket on the relay tightening the bracket screw securely.

M-5 With the relay adjusted in accordance with procedures 3.02 to 3.08 and M-2 to M-4, it should be adjusted to meet the flashing requirements as follows: These methods supplement the procedure 3.11 to meet the electrical requirements.

M-6 Connect the standard adjusting circuit as specified in the circuit requirement table. Where the standard adjusting circuit is not provided, the 35-C test set should be used at the position and the flashing simulated manually.

M-7 The electrical requirement should be applied in the following sequence when adjusting the operated and unoperated positions of the armature.

With Standard Adjusting Circuit Using Interrupter

M-8 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.

M-9 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. Note the operation of the relay. Release key No. 1. Then loosen the lock nut on the front contact screw with the No. 220 wrench and turn the screw in a counterclockwise direction with the No. 35 screwdriver until the armature fails to release after the interrupted "operate" current has been again applied by operating key No. 1 to the "INT" position. This condition is indicated by a steady lighted lamp in the test set. Now turn the front contact screw in a clockwise direction until the armature just releases when the "operate" current is disconnected. Then turn the screw 1/16 of a turn further in a clockwise direction and tighten the lock nut securely.

M-10 After this adjustment, loosen the lock nut on the back stop screw with the No. 220 wrench and turn the screw in a clockwise direction with the No. 35 screwdriver until the front contact screw just touches the front contact as indicated by the lighting of the test set lamp. Then turn the back stop screw in a counterclockwise direction approximately 1/4 of a turn. This will provide a clearance between the front contacts of from .005" to .007".

M-11 After this adjustment has been made, a check should be made of 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.

M-12 If the relay follows the interrupted "soak" and "operate" currents, 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, make slight readjustments of the front contact and back stop screws using the No. 220 wrench to loosen the lock nuts and the No. 35 screwdriver to turn the screws. Take care to maintain the proper "release" adjustment and that the contact separation requirement of min. .005" is still met.

M-13 Tighten the lock nut securely at each adjustment of the screw to hold the screw in the adjusted position.

M-14 If the armature seems to respond promptly but the test set lamp or equivalent signal does not follow each operation of the armature the trouble is probably due to the front contact spring not resting firmly against the spoolhead. This should be checked and corrected as outlined in procedure 3.04.

M-15 As a final check after all adjustments have been made and the cover replaced, operate key No. 1 to the "INT" position, key No. 4 to the locking position and 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. If the test set lamp does not flash uniformly refine the above adjustment until the relay functions properly.

Without Standard Adjusting Circuit

M-16 Connect up the test set (35-C) as specified on the circuit requirement table.

M-17 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.

M-18 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 loosen the lock nut on the front contact screw with the No. 220 wrench and turn the screw in a counterclockwise direction with the No. 35 screwdriver until the armature fails to release. When the "operate" key is released this condition is indicated by a steadily lighted lamp in the test set or equivalent signal. Now turn the front contact screw in a clockwise direction until the armature just releases when the "operate" key is released. Then turn the screw 1/16 of a turn further in a clockwise direction and tighten the lock nut securely.

M-19 With the front contact screw adjusted as outlined above, loosen the lock nut on the back stop screw with the No. 220 wrench and turn the screw in a clockwise direction with the No. 35 screwdriver until the front contact screw just touches the front contact as indicated by the lighting of the test set lamp. Then turn the back stop screw in a counterclockwise direction approximately 1/4 of a turn. This will provide a clearance between the front contacts of from .005" to .007".

M-20 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 or equivalent signal lamp should follow the intermittent operation of the key.

M-21 Immediately after the second flash of the test set lamp or equivalent signal restore the "release" key and operate the "operate" key a number of times at the rate of approximately two times per second, the ratio of "make" to "break" being approximately 2 to 3.

M-22 If the relay follows the interrupted "soak" and "operate" 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, turn the front contact or back stop screw in clockwise or counterclockwise directions slightly as outlined in M-12 until it does. Take care to maintain the proper "release" adjustment and that the contact separation requirement of min. .005" is still met.

M-23 Tighten the lock nut sufficiently at each adjustment of the screw to hold the screw in the adjusted position.

M-24 If the armature seems to respond promptly but the test set lamp or equivalent signal does not follow each operation of the armature the trouble is probably due to the front contact spring not resting firmly against the spoolhead. This should be checked and corrected as outlined in procedure 3.04.

M-25 As a final check after all adjustments have been made and the cover replaced, operate the key which connects the "release" current to the relay and operate the "soak" key twice at the rate of approximately two times per second, the ratio of "make" to "break" being approximately 2 to 3. Immediately after the second operation of the "soak" key restore the "release" key and operate the "operate" key three times at the rate of approximately two times per second, the ratio of "make" to "break" being approximately 2 to 3. The lamp in the test set or equivalent signal should flash at the rate of 120 flashes per minute. If the test lamp does not flash uniformly refine the above adjustment until the relay functions properly.