M-TYPE RELAYS
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers apparatus requirements and adjusting procedures for M-type relays.

1.02 This section has been reissued to provide correct references to other Plant Series sections. In this process marginal arrows have been omitted.

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

1.04 ***Operate*** means that when the operate current is applied to the operating or restoring unit the armature of that unit shall move all the way up to the core except when stop pins are provided, in which case at least one of the stop pins shall touch the core. In the case of the operating unit, the latch shall lock the armature in the operated position and in the case of the restoring unit the latch shall release the armature of the operating unit.

1.05 ***Nonoperate*** of the restoring unit means that with the relay in the latched position the restoring armature shall not leave the adjusting nut.

1.06 ***Armature Travel:*** The armature travel is the gap between the core and the nearest stop pin (or nearest point on the armature itself when stop pins are not provided) when the armature is resting against the adjusing nut.

2. REQUIREMENTS

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

2.02 ***Relay Mounting:*** Relays shall be fastened securely to the mounting plate.

Gauge by feel.

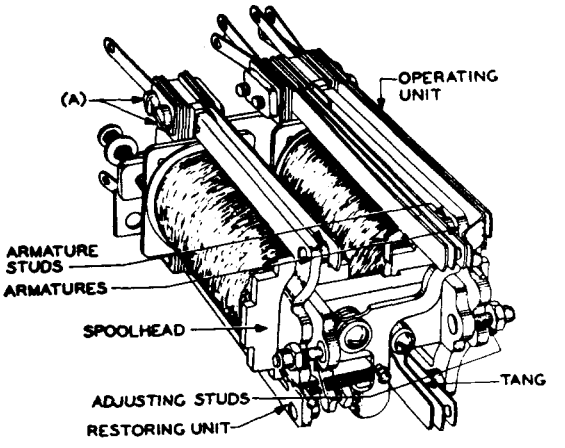


Fig. 101

2.03 ***Tightness of Assembly:*** Fig. 101(A) — All springs in a given assembly shall be held in their respective positions to one another and to the relay core by being securely fastened to the relay core at their bases. If it is found necessary to measure the tightness of assembly, such tightness shall be considered as satisfactory if the springs in a given assembly do not move in their mounting when a pressure of 680 grams (24 ounces) is applied in a vertical direction at the contact end of all springs in the same assembly taken together.

Gauge by feel.

Fig. 102

2.04 ***Contact and Spring Alignment*** — Fig. 102(A)

(a) The point of contact shall fall wholly within the circumference of the opposing contact disc.

Gauge by eye.

(b) Springs shall not touch the relay cover.

Gauge by eye.

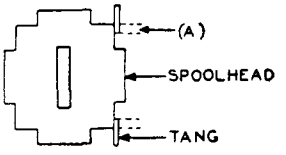


Fig. 103

2.05 ***Spring Tang Position*** [Fig. 103(A)]

(a) Spring tangs shall rest on the spoolhead so that the ends of the tangs are below or above the projection at the top or bottom edges respectively of the spoolhead by

Min — 1/32 inch

Gauge by eye.

(b) The tang shall not rub on the spoolhead when moved slightly in the direction of travel of the spring from its normal position of rest on the spoolhead.

Gauge by eye.

2.06 ***Armature Stud Clearance:*** The armature studs shall not rub on springs through which they pass when the armature is moved.

Gauge by eye and feel.

2.07 ***Adjusting Stud Clearance:*** Fig. 104(A) — The armature shall not rub against the adjusting stud.

Gauge by eye and feel.

2.08 ***Adjusting Nut Tightness:*** Fig. 104(B) — The adjusting nuts shall be sufficiently tight on the studs to prevent their being turned with the thumb and forefinger. This requirement is considered as having been met if the nut does not turn under a turning pressure of one inch-ounce. In case of doubt this may be checked by the use of the No. 388A wrench and No. 70D gauge. With the wrench on the nut and approximately horizontal, the gauge shall be applied to the wrench at the top or bottom side of the hole in the free end and the nut shall not turn with a pressure of 8 grams.

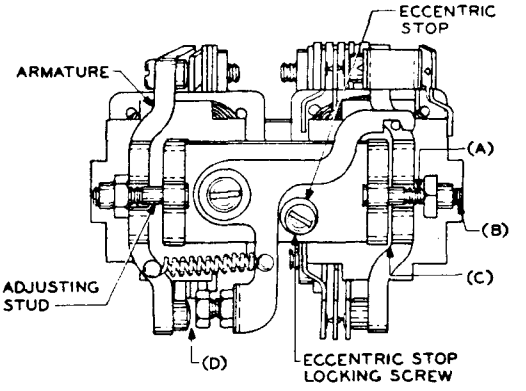


Fig. 104

2.09 ***Armature Travel:*** Fig. 105(A) — The armature travel shall be in accordance with the value specified for the relay in the "Arm. Trvl." column of the circuit requirement table. The tolerance for test shall be +0.005 inch, −0.0025 inch and for readjust +0.0025 inch, −0.0025 inch.

Use the No. 66D gauge.

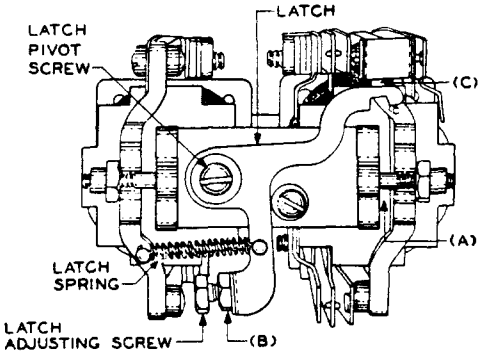


Fig. 105

2.10 ***Operated Armature Airgap:*** Fig. 104(C) — There shall be a clearance between the armature of the operating unit and the core when the armature is locked in the operated position of

Max — 0.005 inch

Use the No. 66D gauge.

2.11 ***Latch and Armature Stud Gap:*** Fig. 104(D) — There shall be a clearance between the latch adjusting screw and the armature stud when the restoring unit is in the unoperated position and the operating unit is mechanically locked in the operated position of

Max — 0.010 inch

Use the No. 66D gauge.

2.12 ***Locknut Tightness:*** Fig. 105(B) — The locknut on the latch adjusting screw shall be sufficiently tight to hold the screw in its adjusted position.

Gauge by feel.

2.13 ***Latch and Contact Spring Clearance:*** Fig. 105(C) — When the latch is pressed against the eccentric stop there shall be a clearance between the top of the latch and the nearest contact spring of

Min — 0.005 inch

Gauge by eye.

2.14 ***Eccentric Stop Locking Screw Tightness:*** The eccentric stop locking screw shall be sufficiently tight to hold the eccentric stop in its adjusted position.

Gauge by feel.

2.15 ***Straightness of Springs:*** All springs, from the point where they leave the assembly clamping plates and insulators to the ends of the springs, shall be free of sharp bends or kinks due to adjustment, but a gradual bow in the springs is permissible.

Gauge by eye.

2.16 ***Separation Between Springs:*** There shall be a clearance between adjacent springs whether in the operated or unoperated positions of the relay of

Min — 0.008 inch

Gauge by eye.

2.17 ***Contact Pressure***

(a) The contact pressure shall be in accordance with the information given in the "Cont. Press." and "Fig. No." columns of the circuit requirement table. The particular figure in this section to be used is indicated in the "Fig. No." column and the particular set of tensions to be used is given in the "Cont. Press." column.

(b) The arrows in Figs. 4, 36, and 44 indicate the direction in which the springs are tensioned. In measuring the tensions specified, apply the gauge to the tip of the spring in proximity to the contact. Where the contacts are located inside of the line of the front spoolhead, apply the gauge at the tip of the springs. The gauge should be held in such a position that the reed and the spring whose tensions are being measured are practically in a straight line. Unless the notation "Arm. Opr." (Armature Operated) is shown associated with the arrow mark leading to a spring, the tension shall be measured when the armature is in the normal position of rest. Springs tensioned against the spoolheads shall register the required tension when the tang of the spring is lifted slightly off the spoolhead. The T (test) and R (readjust) tensions given are the minimum allowable.

Use the No. 70D gauge to check the tensions.

(c) Where the letter A appears in the spring tension column, it means that this spring shall be tensioned against the armature stud and that the tension of this spring together with the sum of the tensions of all other springs on the relay that rest against the armature stud or studs shall be sufficient to hold the armature against the adjusting nut.

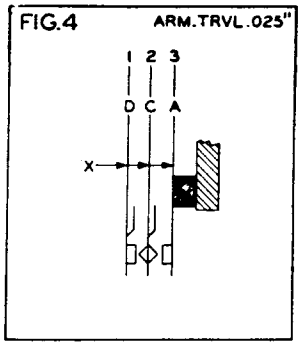
2.18 ***Stud Gap:*** Fig. 106(B) — There shall be a clearance between the armature stud and the springs as indicated by S in Fig. 44. This clearance is regarded as having been met when the springs actually have a contact pressure of 25 grams or more regardless of the minimum tension specified, and if the normally

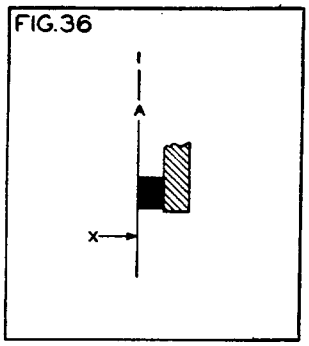
closed contacts, of which they form a part, do not break with a

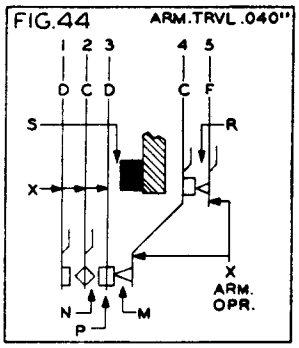
Test — 0.003 inch
Readjust — 0.005 inch

gauge inserted between the adjusting nut and the armature.

Use the No. 66D gauge.







CONT. PRESS.		SPRING DESIGNATIONS		
		C	D	F
L OR 10	T	5	8	25
	R	6	9	27
H OR 20	T	5	15	25
	R	6	17	27

Explanation of Designations Used in Figs. 4, 36, and 44.

A — Tension sufficient to hold armature against adjusting nut [see Reqt 2.17(C)].

M and N — M shall break before N makes.

P and R — Gauge tension of P as R breaks.

S — Stud gap (see Reqt 2.18).

X — Arrows indicate direction of tension.

ψ — Spoolhead springs.

Notes

1. When checking the tension of spring 3 of Fig. 4 (when definite tensions are given on the circuit requirement table) the armature should be held against the adjusting nut. The spring shall register the required tension when it breaks from the stud.
2. When a relay has two spring combinations which have different values of armature travel, use the larger of the two values.

2.19 ***Contact Separation:*** Fig. 106(A) — 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 — 0.005 inch

Use the No. 74D gauge.

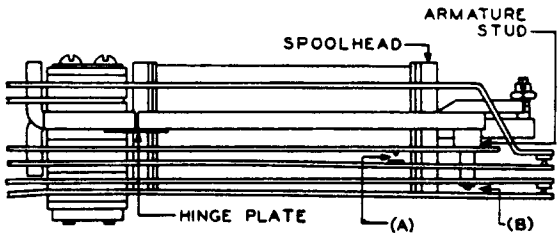


Fig. 106

2.20 ***Contact Follow:*** On all normally open contacts the follow shall be

Test — Min 0.010 inch
Readjust — Min 0.012 inch

This is considered satisfactory if the contacts make with a 0.008 inch gauge (test) or 0.010 inch gauge (readjust) inserted between the stop pins (nonfreezing discs) and the core or between the armature itself and the core when stop pins are not provided. This should be checked when the relay is electrically operated on its specified operate test or readjust current.

Use the No. 66D gauge.

2.21 ***Spring Sequence:*** The relay shall meet the spring sequence requirement shown on Fig. 44 or any other spring sequence specified on the circuit requirement table.

2.22 ***Electrical Requirements:*** The relay shall meet the electrical requirements specified on the circuit requirement table.

2.23 ***Latch Spring Tension:*** The tension of the latch spring measured against the head of the latch adjusting screw with the armature of the operating unit held against the core shall be

Min — 10 grams

Use the No. 70F gauge.

3. ADJUSTING PROCEDURES

3.001 ***List of Tools and Gauges***

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
206	30-degree Offset Screwdriver
207	90-degree Offset Screwdriver
259	Spring Adjuster
388A (two required)	3/16-inch and 1/4-inch Hex. Open Double-end Offset Wrench
—	6-1/2-inch P-long-nose Pliers
—	3-inch Cabinet Screwdriver
—	Diagonal Pliers
GAUGES	
66D	Thickness Gauge Nest
70D	50-0-50 Gram Gauge
70F	10-0-10 Gram Gauge
74D	Thickness Gauge Nest

3.01 ***Cleaning*** (Reqt 2.01)

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

3.02 ***Relay Mounting*** (Reqt 2.02)

(1) To tighten loose mounting screws use the 3-inch cabinet screwdriver.

3.03 ***Tightness of Assembly*** (Reqt 2.03)

(1) To tighten loose spring assembly mounting screws use the Nos. 206 and 207 offset screwdrivers. Take care not to destroy the adjustments made under procedures 3.04 and 3.05.

3.04 ***Contact and Spring Alignment*** (Reqt 2.04)

3.05 ***Spring Tang Position*** (Reqt 2.05)

(1) If the contacts do not line up properly, or if the tang does not overlap the spoolhead sufficiently, attempt to correct the trouble by applying pressure to the ends of the springs using the No. 259 spring adjuster, exercising care not to distort or otherwise damage the springs.

3.06 ***Armature Stud Clearance*** (Reqt 2.06)

(1) If an armature stud touches the spring through which it passes, it is probably due to a twist in the spring as a result of adjustment. Apply the No. 259 spring adjuster to the spring at fault and adjust it so that there is the required clearance between the stud and springs.

3.07 ***Adjusting Stud Clearance*** (Reqt 2.07)

(1) If the armature rubs against the adjusting stud correct as follows:

(2) If due to a bent adjusting nut stud, straighten the stud by grasping the nut with long-nose pliers and bending the stud as required. Exercise care not to damage the threads on the stud or loosen the stud.

(3) If due to an improper manner in which the armature is hinged to the core, change the relay.

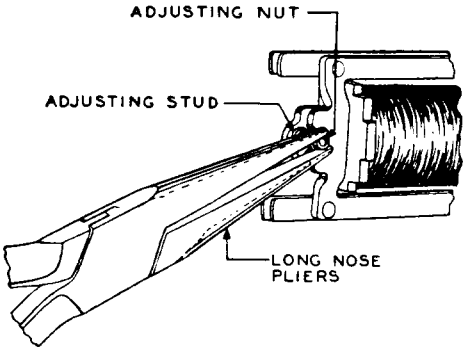


Fig. 107—Method of Tightening Adjusting Nut on Stud

3.08 ***Adjusting Nut Tightness*** (Reqt 2.08)

(1) To tighten loose nuts back off the nut from the stud until its slotted portion is free of the stud and then force the slotted parts closer together with long-nose pliers as shown in Fig. 107.

Use the No. 388A wrench to turn the nut.

(2) If in doubt as to whether or not the adjusting nut is tight enough, the tightness may be checked with the No. 70D gauge and the No. 388A wrench. The nut should not turn when a pressure of 8 grams is applied.

3.09 ***Armature Travel*** (Reqt 2.09)

(1) To adjust the armature travel, insert the proper blade of the No. 66D gauge and turn the adjusting nut with No. 388A wrench until the gauge fits snugly.

3.10 ***Operated Armature Airgap*** (Reqt 2.10)

(1) To adjust the operated armature airgap, loosen the latch pivot screw with the 3-inch cabinet screwdriver and shift the latch toward or away from the core of the restoring unit until, with the 0.003-inch blade of the No. 66D gauge inserted between the armature and the core and the armature held against the gauge, the armature of the operating unit will lock. Tighten the latch pivot screw securely.

(2) At this time it should be noted that the center line of the armature stud lies within the periphery of the latch adjusting screw. The latch may be shifted to correct for this condition.

3.11 ***Latch and Armature Stud Gap*** (Reqt 2.11)
3.12 ***Locknut Tightness*** (Reqt 2.12)

(1) To adjust for the gap between the latch adjusting screw and the stud on the armature of the restoring unit, loosen the locknut on the screw with the No. 388A wrench and turn the screw in (down) or out (up) as required using the No. 388A wrench until the 0.010-inch blade of the No. 66D gauge fits snugly in the gap.

(2) Tighten the locknut securely with one No. 388A wrench while holding the screw in position with another No. 388A wrench.

3.13 ***Latch and Contact Spring Clearance*** (Reqt 2.13)
3.14 ***Eccentric Stop Locking Screw Tightness*** (Reqt 2.14)

(1) To adjust for clearance between the top of the latch and the nearest contact spring, loosen the eccentric stop locking screw with the 3-inch cabinet screwdriver and shift the eccentric stop. Tighten the locking screw securely.

3.15 ***Straightness of Springs*** (Reqt 2.15)
3.16 ***Separation Between Springs*** (Reqt 2.16)

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

3.17 ***Contact Pressure*** (Reqt 2.17)
3.18 ***Stud Gap*** (Reqt 2.18)

(1) Use the No. 259 spring adjuster to adjust the springs for these requirements. Place the adjuster on the front end of the springs but back of the contacts and armature stud, and then slide it back to a point about one-quarter inch from where the spring leaves the spring assembly. Adjust the springs at this point to the left or right as required exercising care not to disturb adjacent springs.

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

(3) In tensioning springs, exercise care not to deform the armature hinge plate.

(4) ***Contact Pressure:*** In connection with spring tensions that are specified to obtain contact pressure, note that they are specified on a minimum basis. They have, however, a direct bearing on a relay's electrical requirements and if they are greatly in excess of their minimum tension, the relay may fail to meet its electrical requirements, in which case the tensions may have to be reduced

slightly toward their specified minimum. In readjusting, however, it is desirable to have as much tension as possible on the various springs consistent with meeting the other requirements. Attempt to distribute the tensions proportionately between the top and bottom spring combinations and between the light and heavy springs of each combination.

(5) Check the tensions with the No. 70D gauge. In using the gauge, the tip of the reed should engage the tip of the spring whose tension is to be measured. Hold the gauge in such a position that the reed and spring being measured are practically in a straight line.

(6) ***Stud Gap:*** Adjust for stud gap requirements at the same time springs are adjusted to meet the contact pressure requirements. If it is difficult to meet this requirement by a readjustment of the springs, it will be satisfactory to bend the tang a slight amount. Use long-nose pliers to bend the tangs holding the springs with the spring adjuster. It is satisfactory if in making this adjustment the tang does not rest flat on the spoolhead.

3.19 ***Contact Separation*** (Reqt 2.19)

(1) To correct the separation, adjust the springs with the No. 259 spring adjuster or the spring tang with the long-nose pliers. See procedures 3.16 and 3.18(6) regarding the bending of spring tangs.

(2) In adjusting the front contact separation on break before make springs, adjust the springs so that the contact separation is sufficient to insure that spring sequence will be obtained under operating conditions.

3.20 ***Contact Follow*** (Reqt 2.20)

(1) To correct the follow reduce the contact separation towards the minimum.

3.21 ***Spring Sequence*** (Reqt 2.21)

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

3.22 ***Electrical Requirements*** (Reqt 2.22)
3.23 ***Latch Spring Tension*** (Reqt 2.23)

(1) If the relay fails to meet the electrical requirements adjust as follows:

(2) To meet the operate requirement on the operating unit, decrease the contact spring tension toward the minimum, reduce the contact follow toward the minimum, or increase the stud gap.

(3) If the armature of the operating unit apparently comes all the way up to the core but the latch fails to lock it in the operated position, the tension of the latch spring may be insufficient. To increase the tension of the latch spring, grasp the loop of the spring which is around the pin on the armature with the long-nose pliers and lift the loop off the pin. Pull the spring to the left above the pin and then lower the spring so that the pin will separate the second and third coils of the spring. Bring the portion of the spring extending to the left of the pin down so that the second coil of the spring will be hooked around the pin. Clip the excess amount of the spring with the diagonal pliers.

(4) To meet the operate requirement on the restoring unit decrease the tension of the armature restoring spring slightly.