

RELAYS
AL- AND AM- TYPES
(MAGNETIC LATCHING WIRE-SPRING)

TIMING AND LATCHING FORCE TESTS USING J94735A TEST SET

1. GENERAL

1.01 This section covers timing and latching force tests of wire-spring magnetic latching relays coded AL-1, AM-1, and AM-2, AM-3, and AM-4 when used in circuits having circuit requirements tables specifying that this section applies.

1.02 Magnetic latching relays differ from other wire-spring types in the core material used. The magnetic latching relay remains magnetized after the operate voltage is removed and will hold the relay in an operate condition until the application of a release voltage.

1.03 The AL-type relay, Fig. 1, has one coil and one set of contacts. The AM-type relay has two coils and two sets of contacts (Fig. 2). When testing AM-type relays, each coil and its associated set of contacts must meet the timing requirements

of this section, while the other coil and its associated contacts are in a latched condition.

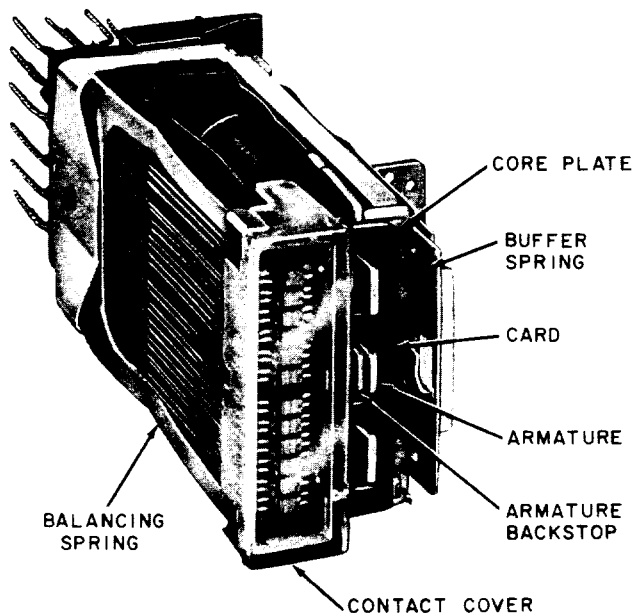


Fig. 1—AL-Type Relay, General View

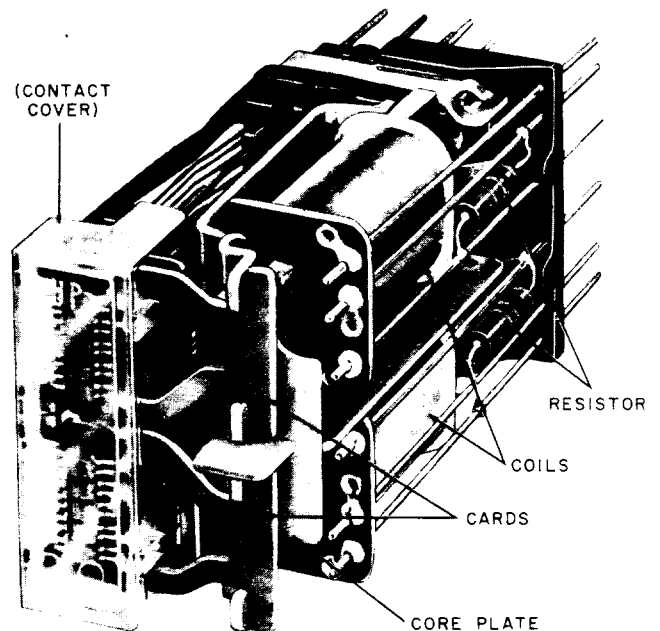


Fig. 2—AM-Type Relay, General View

1.04 The plastic dust cover over the contacts of wire-spring relays should not be removed unless the test being made requires its removal. If the cover is removed, it should be replaced as soon as practicable. Make sure that the letters UP on the plastic surface are on top and that the cover does not interfere with the card or contact springs.

Note 1: Do not attempt to interchange the covers of the AL-type relays with those of the AM-type.

Note 2: Reference should be made to the J drawing covering the equipment being tested. If a vibration damper assembly is specified, it must be in place during these tests.

1.05 In addition to this section, the following sections will be required for the tests covered in this practice:

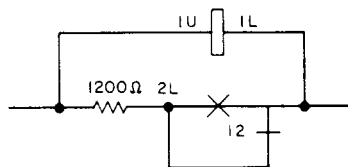
Section 100-136-701, Calibration of the J94735A Magnetic Latching Relay Timing Test Set

Section 100-136-301, Operation of the Magnetic Latching Relay Timing Test Set

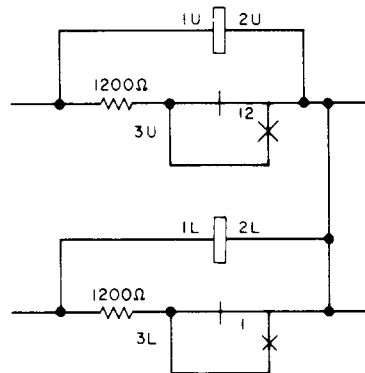
Section 040-505-701, Relays AL- and AM-types (Magnetic Latching Types) Requirements and Adjusting Procedures.

2. PRETEST ADJUSTMENTS

2.01 The magnetic latching relay is normally checked in the system in which it is being used. Prior to timing tests of the AL- or AM-type relay, the trunk frame, the junctor frame, or other frame using the relay must be taken out of service. If the relay being tested is on a No. 1 ESS trunk or junctor frame, the portion of the frame on which the relay is mounted can be removed from service by the maintenance teletypewriter (TTY). Section 231-130-301 outlines this method. If the relay is not in a system, it must be wired to return the operate and nonoperate pulses. Fig. 3 illustrates this method.



AL-TYPE RELAY



AM-TYPE RELAY

Fig. 3—Winding, Resistor, and Contact Arrangement of AL-Type Relay and AM-Type Relay

3. METHOD OF CONNECTING THE J94735A TEST SET

3.01 The Timing Test Set is designed to operate from $+25.5 \pm 0.8 - 1.20$ and -51 ± 1.75 volts provided on central office frames. The W3BC cord (furnished with the test set) is used to connect the test set to the power source. Safety features are provided in the test set to prevent damage in case of an accidental wrong connection. The test set provides a means to check these voltages. For further information on the J94735A test set, see CD-99348-01.

3.02 The W3BD cord (furnished with the test set) is used to connect both AL- and AM-type relays to the J94735A test set.

3.03 The operate time, release time, and latching force are affected by armature back tension and buffer spring adjustment. If it is found necessary to adjust a relay to meet timing requirements, the requirements for armature back tension and latching force must be rechecked. For this reason it is necessary to follow the steps outlined in this section and shown schematically on the flow diagrams Fig. 4 (AL-type) and Fig. 5 (AM-type) to test and adjust these relays.

4. AL-TYPE RELAY TESTS

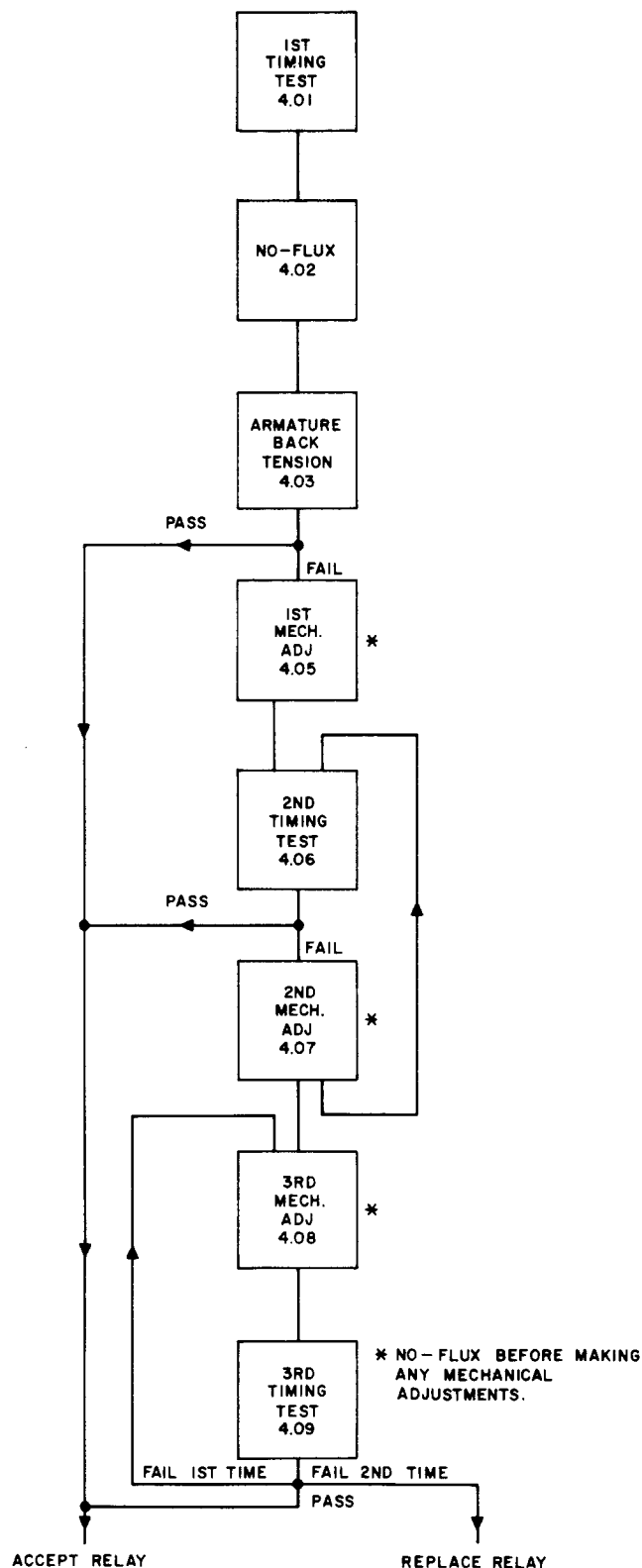


Fig. 4—Flow Diagram AL-Type Relay Timing Test Sequence

4.01 AL-Type Relay, First Timing Test

- (a) Connect the W3BD cord as follows:
 - (1) The GRD lead to terminal 1L of the relay under test.
 - (2) The UPPER lead to terminal 1U.
 - (3) Do not connect LOWER lead.
- (b) Set TEST switch to AL.
- (c) Set VOLT CHECK switch to NOR.
- (d) Set LATCH/CYCLE switch to CYCLE.
- (e) Rotate the TEST ADV switch in one-position steps.
- (f) Read time on the meter located on the control panel. The limits for each test are given in Table A.
- (g) Repeat Steps (e) and (f) until all four tests are completed.
- (h) Set LATCH/CYCLE switch to OFF.

4.02 AL-Type Relay, No-Fluxing the Relay:

Before any measurements or mechanical adjustments can be made on the armature back spring, the relay core must be placed in a no-flux condition. With the relay connected as in 4.01, proceed as follows:

- (a) Set TEST switch to AL.
- (b) Set VOLT CHECK switch to NOR.
- (c) Set LATCH/CYCLE switch to OFF.
- (d) Depress the AL/NO FLUX button momentarily but no longer than 5 seconds.

4.03 AL-Type Relay, Armature Back Tension Test:

After no-fluxing the relay, measure the armature back tension by applying the 70D gauge to the tip of the armature as described in Section 040-505-701. The armature shall bear against the armature backstop with a force of approximately 100 grams.♦

TABLE A
TIMING LIMITS
AL-TYPE RELAYS
A AND B (UPPER AND LOWER) AM-TYPE RELAYS

CHECKS	TEST ADV SW POSITION	INDICATOR	TOLERANCE	
			TEST	READJUST
OPERATE	RIGHT	LAMP NO.1	Max operate time 11.0 Milliseconds	Max operate time 10.5 Milliseconds
	LEFT	LAMP NO. 2	Min operate time 4.5 Milliseconds	Min operate time 5.0 Milliseconds
RELEASE	RIGHT	LAMP NO. 3	Max release time 9.0 Milliseconds	Max release time 8.5 Milliseconds
	LEFT	LAMP NO. 4	Min release time 4.0 Milliseconds	Min release time 4.5 Milliseconds

If the AL-type relay passed the first timing test and the armature back tension is within limits, it is considered acceptable. No further tests are necessary.

4.04 AL-Type Relay Latching Force Test: Not required.

4.05 AL-Type Relay, First Mechanical Adjustment: This adjustment shall be performed if the relay fails either the first timing test or the armature back tension is out of requirements. To make it possible for the relay to meet these requirements the armature back tension is corrected using tools and methods described in Section 040-505-701. Generally, an increase in armature back tension will increase the operate time and decrease the release time, while a decrease in armature back tension will decrease the operate time and increase the release time.

4.06 AL-Type Relay, Second Timing Test:

This test is similar to the first timing test (4.01). If the first test fails, readjust the armature back tension as described in 4.05. If the relay passes the second timing test recheck (4.05). If the relay passes both tests, it may be rated acceptable.

4.07 AL-Type Relay, Second Mechanical Adjustment: No-flux the relay as covered

in 4.03. If the armature back tension is less than the maximum allowed, increase the tension slightly. If the armature back tension is more than the minimum allowed decrease the tension slightly. Proceed to third timing test, if the tension is at the maximum value allowed and the relay fails the second timing test proceed to the third mechanical adjustment, (4.08).

4.08 AL-Type Relay Third Mechanical Adjustment:

No-flux the relay (4.02). With the relay released, insert a 0.010-inch gauge into the armature gap. Operate the relay manually by means of a toothpick or KS-6320 orange stick taking care that the armature does not lift from the springs. Adjust the operating lug so the motion is just perceptible. Care should be exercised so the edge of the operating lug does not dig into the card. Proceed to 4.09.

4.09 AL-Type Relay, Third Timing Test:

This test is the same as the second timing test except for the action required when the relay fails the test. If a relay fails the third timing test, adjust the buffer spring using 0.013-inch gauge. The adjustment procedure is the same as in 4.08 except the gauge is different. If a relay that has been adjusted with the 0.013-inch gauge fails the third timing test, replace the relay. If the relay passes the third timing test, the relay is acceptable.

5. AM-TYPE RELAY TESTS

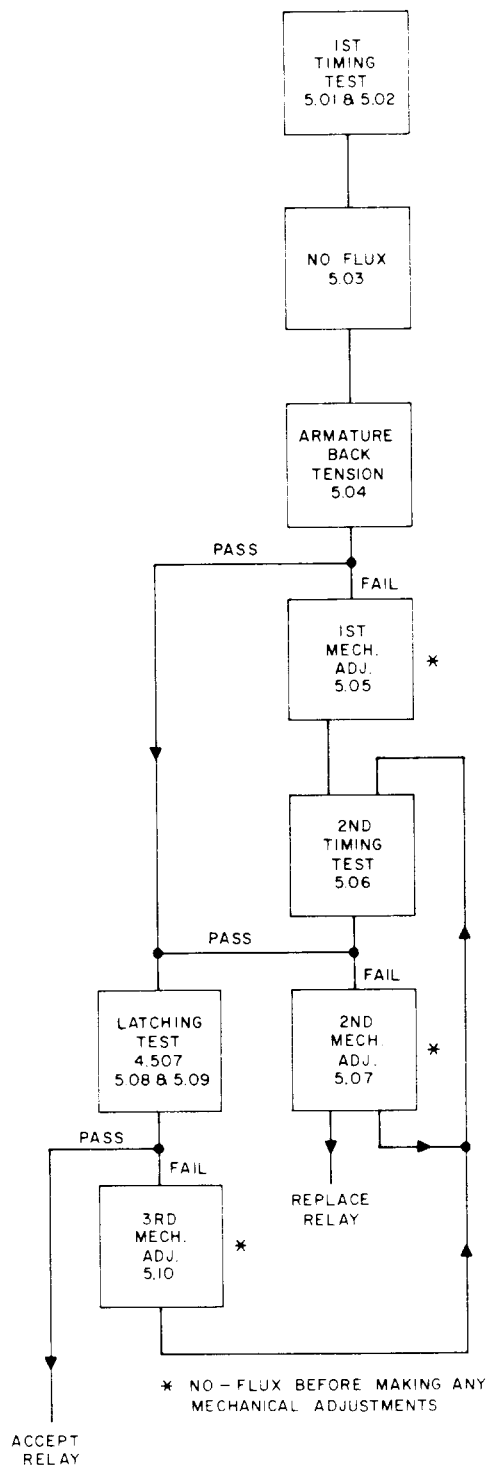


Fig. 5—Flow Diagram AM-Type Relay Timing Test Sequence

5.01 AM-Type Relay, First Timing Test Upper:

(a) Connect the W3BD cord as follows:

- (1) The GRD lead to the ground side of the relay coil to be tested at terminal 2L or 2U.
- (2) The UPPER lead to terminal 1U.
- (3) The LOWER lead to terminal 1L.

(b) Set VOLT CHECK switch to NOR.

(c) Set LATCH/CYCLE switch to OFF.

(d) Set TEST switch to LATCH LOWER (AM UPPER section).

(e) Set LATCH/CYCLE switch to LATCH momentarily to operate the lower section of the relay.

(f) Set TEST switch to TIME (AM UPPER section).

(g) Set LATCH/CYCLE switch to CYCLE.

(h) For each operation of the TEST ADV switch, read time on the meter located on the control panel until all four timing tests are completed. The limits for each test are given in Table A.

(i) Set LATCH/CYCLE switch to OFF.

5.02 AM-Type Relay, First Timing Test Lower:

(a) Leave W3BD cord connected as in 5.01 (a).

(b) Set VOLT CHECK switch to NOR.

(c) Set LATCH/CYCLE switch to OFF.

(d) Set TEST switch to LATCH UPPER (AM LOWER section).

(e) Set LATCH/CYCLE switch to LATCH momentarily to operate the upper section of the relay.

- (f) Set TEST switch to TIME (AM LOWER section).
- (g) Set LATCH/CYCLE switch to CYCLE.
- (h) For each operation of the TEST ADV switch read time on the meter located on the control panel until all four tests are completed for the lower relay. The limits of Table A also apply for this test.
- (i) Set LATCH/CYCLE switch to OFF.

5.03 *AM-Type Relay, No-Fluxing the Relay:*

Before any measurements or mechanical adjustments can be made on the armature back spring, the relay cores (upper and lower) must be placed in a no-flux condition. With the relay connected as in 5.01 (a) proceed as follows:

- (a) Set TEST switch to LATCH AM UPPER section.
- (b) Set VOLT CHECK switch to NOR.
- (c) Set LATCH/CYCLE switch to OFF.
- (d) Depress the AM/NO FLUX switch momentarily but no longer than 5 seconds. This will no-flux the upper winding.
- (e) Set TEST switch to LATCH AM LOWER section.
- (f) Depress AM/NO FLUX switch momentarily but no longer than 5 seconds. This will no-flux the lower winding.

5.04 *AM-Type Relay, Armature Back Tension*

Test: After no-fluxing the relay measure the armature back tension by applying the 70J gauge to the armature in front of armature back stop as described in Section 040-505-701. Make sure the gauge clears the backstop and magnetic shield. The armature should bear against its backstop with a pressure of:

Test 35 grams Min
Readjust 40 grams Min

Test 115 grams Max
Readjust 110 grams Max

If the relay passed the first timing test and its armature back tension is within limits, proceed to

latching force test (5.08). If the relay failed either the first timing test or the armature back tension test proceed to 5.05, after first no-fluxing the winding as covered in 5.03.

5.05 *AM-Type Relay, First Mechanical*

Adjustment: This adjustment is necessary because the relay failed either the first timing test or the armature back tension test. The relay is adjusted to meet these requirements by changing the armature back tension using methods described in Section 040-505-701. Generally, an increase in the armature back tension will increase the operate time and decrease the release time, while a decrease in armature back tension will decrease the operate time and increase the release time. After this adjustment is made proceed to 5.06.

5.06 *AM-Type Relay, Second Timing Test:*

This test is similar to the first timing test. (5.01 upper and 5.02 lower.) If the relay passes the second timing test proceed to the latching force test (5.08).

5.07 *AM-Type Relay, Second Mechanical*

Adjustment: No-flux the winding as covered in 5.03. If the armature back tension is less than the maximum or more than the minimum allowed, increase or decrease the tension slightly. If the tension is at the maximum or minimum value and the relay fails the second timing test, replace the relay.

5.08 *AM-Type Relay, Latching Force Test*

Upper: The purpose of this test is to determine if the one half relay under test will operate and remained latched when the other half relay is pulsed. With the relay connected as in 5.01 and the test set in test MODES 1 or 4, as indicated on the illuminated panel, proceed as follows:

- (a) Set TEST switch to LATCH (AM UPPER section.)
- (b) Set LATCH/CYCLE switch to LATCH momentarily.
- (c) Set TEST switch to CYCLE LOWER (AM UPPER section) and then operate the LATCH/CYCLE switch to the CYCLE position for 5 seconds to allow approximately 100 cycles of the lower relay.

(d) Measure the latching force of the upper section of the relay by using the 62B gauge to mechanically release the relay. The force required shall be:

Test 140 grams Min
Readjust 150 grams Min

5.09 AM-Type Relay Latching Force Test

Lower: With the relay still connected as in 5.01 and the test set in test MODES 1 or 4, as indicated on the illuminated panel, proceed as follows:

- (a) Set TEST switch to LATCH (AM LOWER section).
- (b) Set LATCH/CYCLE switch to LATCH momentarily.
- (c) Set TEST switch to CYCLE UPPER (AM LOWER section) and then operate the LATCH/CYCLE switch to the CYCLE position for 5 seconds to allow approximately 100 cycles of the upper relay.

(d) Measure the latching force of the lower section of the relay by using the 62B gauge to mechanically release the relay. The force required shall be:

Test 140 grams Min
Readjust 150 grams Min

- (e) If the relay fails the latching force test and all mechanical adjustments are correct, and the armature air gap is free of dust and foreign particles, the relay is defective and must be replaced. Paragraph 5.10 following is applicable only if the relay requires adjustment.

5.10 AM-Type Relay, Third Mechanical

Adjustment: No-flux the relay before adjusting (5.03). If the armature back tension is not less than the lower limit of 35 grams, decrease the armature back tension slightly and repeat second timing test. If the relay now passes the timing test it is satisfactory.