

## TECHNICAL MANUAL

### OVERHAUL INSTRUCTIONS

# ELECTROMECHANICAL LINEAR ACTUATOR

**PART NO.**

**R1527-5**

**(Airborne Accessories)**

Basic publication and all changes have been collated to make this a complete publication.

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SECTION I

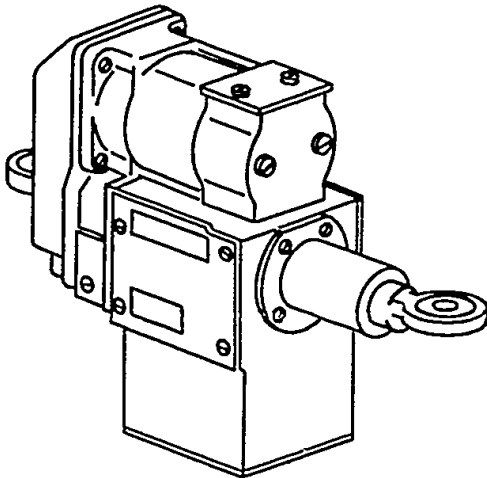
INTRODUCTION

1-1. IDENTIFICATION..

1-2. This technical manual provides overhaul and test instructions for Electromechanical Linear Actuator, Part No. R1527-5, manufactured by Airborne Accessories Corporation, Hillside, New Jersey. The actuator is shown in figure 1-1.

1-3. PURPOSE.

1-4. The actuator converts electrical energy into mechanically controlled linear movement.



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Figure 1-1. Electromechanical Linear Actuator,  
Part No. R1527-5

1-5. LEADING PARTICULARS.

1-6. Leading particulars for the actuator are listed in table 1.

1-7. DIFFERENCE DATA SHEETS.

1-8. Sections I, II, and III of this technical manual contain overhaul and test instructions for Electromechanical Linear Actuator, Part No. R1527-5. Overhaul and test instructions for additional models will be provided in Section IV by the use of Difference Data Sheets. The additional models included in Section IV will be listed in Section IV.

1-9. PARTS KITS.

1-10. Many parts for equipment covered in this publication are provided in the form of kits. (Refer to applicable Illustrated Parts Breakdown for details.) However, cleaning, inspection, testing, and repair information is included for all parts which can be repaired in order to cover any emergencies caused by shortages in supply.

TABLE 1.  
LEADING PARTICULARS

Operating Voltage .....	115 volts ac, 400 Hz
Operating Voltage Range .....	102 to 124 volts ac, 380 to 420 Hz
Operating Altitude Range .....	Sea level to 60,000 ft
Normal Operating Load .....	200 lb
Operating Speed .....	0.575 in/sec +20% at 6.0 amperes max
Maximum Operating Load .....	650 lb at 5.8 amperes max
Maximum Static Load .....	2000 lb (tension or compression)
Duty Cycle (Normal Load) .....	10.0 sec on; 2.0 min off
Operating Temperature Range .....	-54° to + 93° C (-65° to + 200° F)
Gear Ratio .....	21.02 / 1
Weight .....	3.19 lb

## CAUTION

Do not use cleaning solvent to clean parts specified in step a.

b. Clean all other metal parts, using an ultrasonic cleaner or liquid vapor degreaser with spray attachment. Use approved cleaning solvents which conform to Federal Specification P-S-661.

c. Dry all parts with dry, filtered, low pressure compressed air or a clean, dry, lint-free cloth.

### 2-9. INSPECTION.

#### Note

Many parts for equipment covered in this publication are provided in the form of kits. (See applicable Illustrated Parts Breakdown for details.) However, inspection is included for all parts which can be repaired to cover any emergencies caused by shortages in supply.

2-10. Inspect all parts as follows:

a. Visually inspect all parts for corrosion and damage.

b. Inspect all gears and pinions for tooth deformation, stress cracks, and scored conditions.

c. Inspect non-kitted threaded parts for stripped or crossed threads.

d. Inspect insulation of all lead wires for breaks and damage.

e. Check all terminal connections on motor and brake assembly for cracks or breaks.

f. Visually inspect motor rotor (20, figure 2-2) for charred, frayed, or broken wires or laminations.

### 2-11. TESTING.

2-12. Test capacitor (8, figure 2-1) as follows:

#### Note

Presence of a new part in the applicable kit eliminates the necessity for testing the equivalent used part removed from the assembly being repaired. Testing instructions for kitted parts are included in the following paragraphs, but these instructions are applicable only

under conditions of emergency, when kits are not available from supply.

a. Using Dielectric Test AN/PSM-2 or equivalent, apply 600 volts dc for one second between case and each terminal of capacitor. There shall be no evidence of insulation breakdown.

b. Using resistance-capacitance-inductance bridge AN/VPM-90 or equivalent, measure capacitance and dissipation factor of capacitor. Capacitance shall be between 6.65 and 7.35 microfarads. Dissipation factor shall not exceed 0.006.

## WARNING

To avoid electrical shock, discharge capacitor immediately after test.

2-13. Using Setting Fixture AT2543, test and adjust switch assemblies (22 and 25, figure 2-1) as follows:

a. Apply controlled force to switch actuator and measure difference to deflection distance required to actuate four sensitive switches. Three sensitive switches furthest from swaged ends of mounting rivets shall actuate at points 0.004 to 0.006 inch before nearest sensitive switch actuates.

b. If any sensitive switch does not actuate within the limits specified in step a, loosen locknut on associated setscrew and adjust setscrew to bring switch actuation within specified limits.

c. When all switches are actuating within specified limits, secure setscrew by tightening associated locknuts.

2-14. Temporarily connect all threads of motor stator (21, figure 2-2). Using insulation tester 13700-1-A or equivalent, apply 1500 volts, rms, between connected leads and core for one second. There shall be no evidence of insulation breakdown.

### 2-15. REPAIR OR REPLACEMENT.

#### Note

Many parts for equipment covered in this publication are provided in the form of kits. (See applicable Illustrated Parts Breakdown for details.) However, repair information is included for all parts which can be repaired to cover any emergencies caused by shortages in supply.

a. Replace all parts that do not meet inspection requirements and any other parts when there is doubt as to serviceability.

b. For all soldering operations, use 5132 or SN40 solder, Federal Specification QQ-A-571. Solder

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connections in accordance with Specification MIL-S-6872.

### 2-16. LUBRICATION.

2-17. Lubricate parts of actuator prior to assembly as follows:

a. Coat gears, all steel parts, and all working parts with grease, Specification MIL-G-21164.

b. Coat screw assembly (94, figure 2-1) and Acme nut, (93) lightly with Moly-Disulphide Type "Z" grease, Specification MIL-M-7866, and Aero Lubriplate, or equivalent, manufactured by Fiske Brothers Refining Company, Newark, N.J., in equal parts by volume.

c. Coat packing (14) with light film of grease, Versilube G-300, manufactured by General Electric Company, Silicone Products Department, Waterford, N.Y.

d. Apply anti-seize compound, Specification MIL-G-5544, to all aluminum screws and steel screws that anchor into aluminum.

e. Coat all ball bearings with grease, Specification MIL-G-23827. This lubrication shall fill 25 to 40 percent of available volume. Bearings (11 and 19, figure 2-2) shall be lubricated with Minapure (MIL-G-81937) grease.

### 2-18. REASSEMBLY.

2-19. AC MOTOR. Reassemble the ac motor in the reverse order of the index numbers given in figure 2-2. Note the following special instructions:

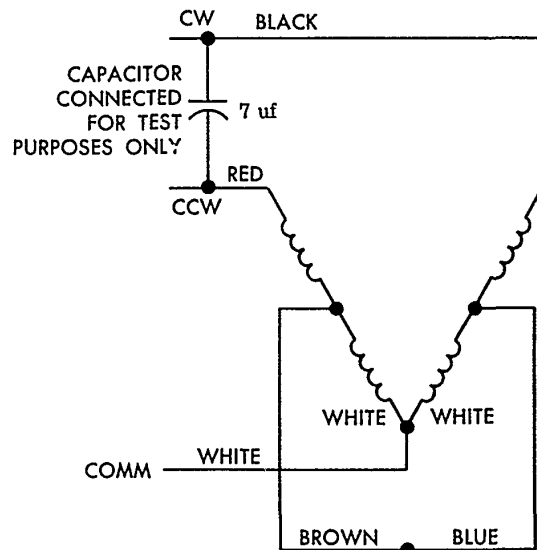
a. See figure 2-3 when making electrical connections. Use number E-24 extruded Teflon wire, Specification MIL-W-16878, for all wiring.

b. Assemble items (8 through 21, figure 2-2), except do not install helical spring (17) at this time. Press ball bearing (19) onto shaft of motor rotor (20). Press ball bearing (11) onto shaft of motor rotor.

c. Mount assembled parts in End Play Checking Fixture AT2037.

d. Measure air gap between flange assembly (16) and brake flange (13). Apply a 5-pound axial load to shaft of motor rotor (20) and measure shaft end play.

e. Adjust thickness of shim set (10) as required in order to obtain a shaft end play of 0.002 to 0.004 inch. Adjust shim set (15) as required to obtain an air gap of 0.003 to 0.010 inch.



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Figure 2-3. AC Motor Wiring Diagram

### CAUTION

When establishing specified brake air gap, use minimum number of shims (15) to maximum of four.

f. After establishing brake air gap and end play as specified in step e, disassembly item (8 through 10). Install helical spring (17) and reassemble items (1 through 16).

### Note

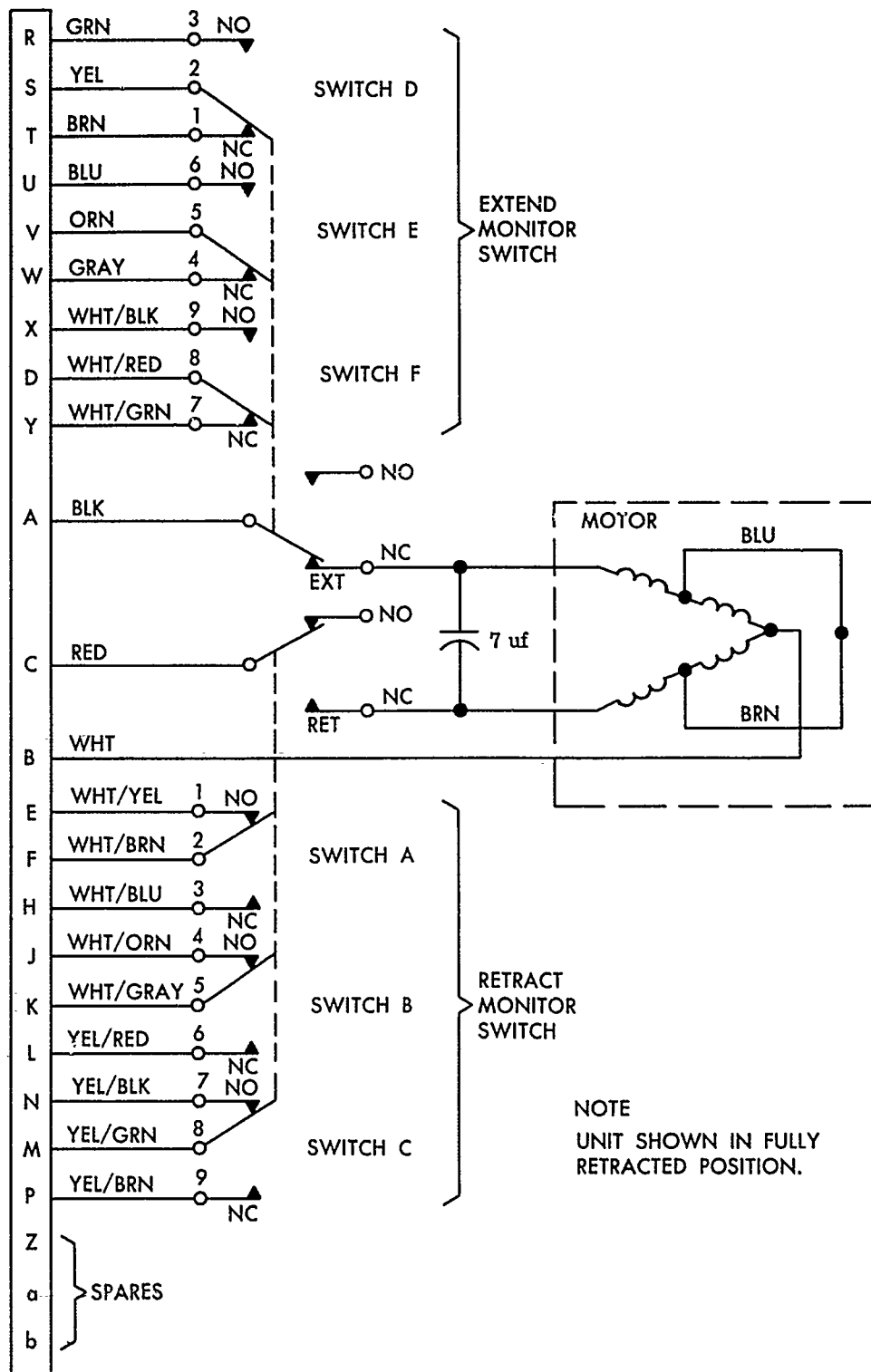
When installing ball bearing (11) in end housing (9), pack cavity in end housing with ETR "H" grease, manufactured by Shell Oil Company, New York, N.Y., or equivalent. Install ball bearing so that shield faces brake flange (13).

g. Perform test procedures, Section III, on ac motor prior to installation on actuator.

2-20. ACTUATOR. Reassemble the actuator in the reverse order of the index numbers given in figure 2-1. Note the following special instructions:

### Note

See figure 2-4, when making electrical connections. Use number E-22 extruded Teflon wire, Specification MIL-W-16787, for all wiring.



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Figure 2-4. Electromechanical Linear Actuator, Wiring Diagram

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a. Install ball bearings (76, figure 2-1) in intermediate housing (73) separated by thrust washer (77) with outer races of bearings face to face. Use sufficient thickness of shim washers (96) to remove all end play between outer race of bearings and stop washer (97).

b. Fill void between screw assembly (94) and Acme nut (93) with molybdenum disulphide, Specification MIL-M-7866, and Aero Lubriplate, manufactured by Fiske Brothers Refining Company, Newark, N. J. or equivalent, mixed in equal parts by volume.

c. Use a sufficient thickness of shim set (89) to fill void between guide collar (86) and washer (90). (Void shall not exceed 0.003 inch.)

d. Tighten screws (87) to a torque of between 3.0 and 3.5 pound-inches for screws anchored in aluminum and between 7.2 and 9.0 pound-inches for screws anchored in steel.

e. Use shim (81) as required to eliminate gap between end fitting (80) and Acme nut (93) and to place threads of end fitting under tension.

f. Use pressing and Staking Fixture AT1732 to press and stake ball bearings (79) in end fitting (80) and ball bearing (38) in end housing (39).

as specified in step g, using hole in end fitting (80) as a guide. If end fitting (80) requires replacement, replace plug (82) and drill a second rivet hole through Acme nut (93) displaced 90° to existing hole. Drill hole as specified in step g.

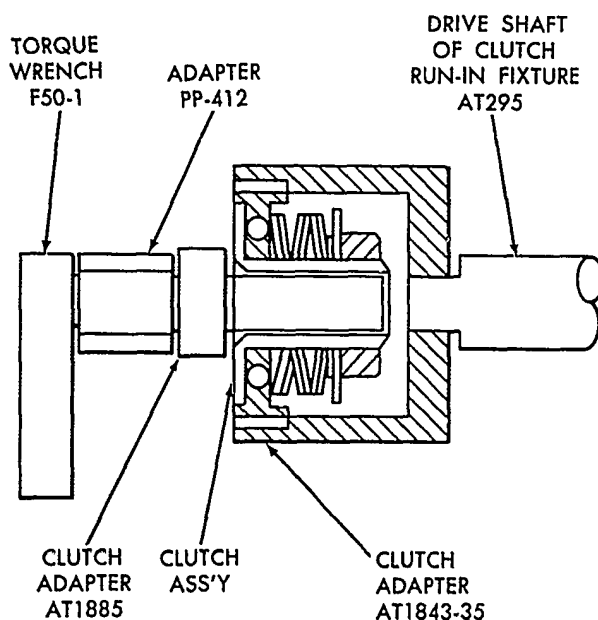
g. Assemble plug (82), Acme nut (93) and end fitting (80) in Drilling Fixture AT1894, using two bushings AT1894-3, pin AT1894-13, and drill bushing AT1894-25 (part of Drilling Fixture AT1894). Drill 0.01285 inch diameter hole through the parts parallel with axis of bearing bore in end fitting.

h. Install rivet (78).

i. Prior to installation, apply a thin, even coating of adhesive EC-776, manufactured by Minnesota Mining Steel Mfg. Co., Detroit, Mich. or equivalent, to both faces of gaskets (34, 21, and 5). Prepare the adhesive for use as follows: Use a sufficient quantity of adhesive to cover the three gaskets; thin with hexone. Federal Specification TT-M-268, to viscosity such that adhesive will flow through a No. 2 DOW CORNING Viscosity Cup, manufactured by Dow Corning Corp., Midland Mich. Measure viscosity by holding cup vertically and submerging it in the adhesive. Lift cup and begin timing as cup breaks the surface. Viscosity is correct if cup empties in 60 to 70 seconds.

### Note

If Acme nut (93) required replacement, replace plug (82) and drill hole for rivet (78)



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Figure 2-5. Ball Clutch Assembly Run-in Setup

**Note**

Before applying adhesive, clean surface to be sealed with a clean cloth wet with trichlorethylene, Federal Specification O-T-624a.

j. Use shim (70) as required to obtain end play of between 0.002 and 0.005 inch on spur gear (69).

k. When assembling clutch assembly, consisting of items (60) through (66), apply a light coating of grease, Specification MIL-G-21164, to spur gear (65) and clutch flange (66).

l. Prior to installing clutch assembly on screw assembly (94), mount the clutch assembly on Clutch Running Fixture AT292, as shown in figure 2-5, using Clutch Adapter AT1843-35 and Clutch Adapter AT1885. Couple torque wrench and Clutch Adapter AT1885 with Adapter PP-412; set clutch assembly to slip at a torque of 25 pound-inches by adjusting retainer nut (60, figure 2-1). Use suitable spanner wrench to adjust retainer nut.

m. With clutch assembly mounted and adjusted as specified in step m, run in clutch assembly for 10 minutes. Then readjust clutch to slip at a torque between 37 to 47 pound-inches.

n. Secure ball bearing (52) on spur gear (54) and secure ball bearing (48) on spur gear (50) by staking in four equally spaced places.

o. Use suitable crimping tool to secure lug terminal (7) to lead wires.

p. Orient connector (3) with polarizing key facing end fitting (80).

q. Using a clean camel hairbrush, apply sealant (described in step i) over all external seams and screw heads.

**WARNING**

Base compound in the following step is flammable, having a flash point of 95 °F (35 °C). Keep away from heat or open flame. Accelerator compound contains a toxic lead chemical. Avoid contact with the skin. Wash hands with soap and water after mixing and using potting compound.

r. Perform test procedure. Refer to paragraph 3-1.

s. After satisfactory completion of test procedure, Section III pot leads at switch assemblies (22 and 25) and connector (3) as outlined in steps t through v.

t. Make a temporary potting mold for connector (3) by wrapping a few turns of pressure sensitive tape around base of connector. Tape shall protrude approximately 0.5 inch. Mix 100 parts by weight of base compound Pro-Seal 727, manufactured by Coast Pro-Seal and Mfg. Co., Los Angeles, Calif, with 12 parts of accelerator, Pro-Seal 727A. Mix until a uniform, streakless consistency is obtained.

u. Using a spatula, fill cavities of potting molds with potting compound, forcing compound between the lead wires and working out all air bubbles by tapping or stirring gently. Cure, undistributed, at room temperature and humidity for 48 hours. Higher temperature and humidity will shorten the required cure time. Remove potting molds.

v. After satisfactory completion of test procedure, Section III, and potting of leads, lockwire all drilled head screws with MS20995NC32 lockwire in accordance with Military Standard MS33540.

## SECTION III

## TEST PROCEDURE

**This Section supersedes Section III with Changes  
through Change 3 dated 1 December 1981****3-1. GENERAL.**

3-2. This section contains test procedures used to adjust and check the performance of the actuator and the ac motor. If the ac motor fails to perform as specified during any test, refer to troubleshooting chart, Table 3, to determine probable fault and appropriate remedy.

**3-3. AC MOTOR TEST PROCEDURE.****Note**

Use of equivalent test equipment that meet the same specification as those called out is authorized.

a. Connect a 1.5-microfarad capacitor between the black and red leads of the motor. (See figure 2-3.)

**CAUTION**

Observe duty cycle given in table 1 when testing ac motor.

b. Mount the ac motor in Motor Holding Test Fixture AT916. Energize the motor with 115 volts rms, 400 Hz power by means of NY200 actuator test stand. Using stroboscopic light capable of measuring speed of 8,000 to 20,000 rpm, check the no-load speed. Minimum no-load speed shall be 10,000 rpm. Current draw shall not exceed 5.8 amperes.

c. Install Motor Load Test Pulley AT1901-2. Attach spring scale to pulley with cord. Operate motor at 115 volts rms, 400 Hz. Gradually tighten cord until spring scale indicates 8.0 ounce-inches. Using stroboscopic light, check motor speed. Speed shall not be less than 7,000 rpm.

d. Upon completion of step c above, gradually tighten cord until motor stalls. Spring scale shall indicate a minimum of 20.0 ounce-inches. Current draw shall not exceed 5.0 amperes.

e. De-energize motor and remove cord, spring scale and Motor Test Pulley AT1901-2. Energize motor with 88 volts rms, 400 Hz. Brake shall release and rotation shall occur.

f. Clamp Coast Adapter AT1061-2 on output shaft of motor and brake assembly. Energize motor with 115 volts rms, 400 Hz. Using stroboscopic light, count brake coast revolutions by removing power when and counting number of revolutions from time power is removed to time output shaft stops rotating. Coast shall not exceed 13 revolutions. Remove Coast Adapter AT1061-2.

g. Using Motor Test Pulley AT1901-2, and torque wrench, measure brake torque. The torque required to start and turn output shaft shall be 6.5 ounce-inches minimum.

h. Using AN/PSM-2 insulation test set, apply 1500 volts rms for one second across the joined white (common) leads and motor case. There shall be no indication of insulation breakdown or arcing.

**CAUTION**

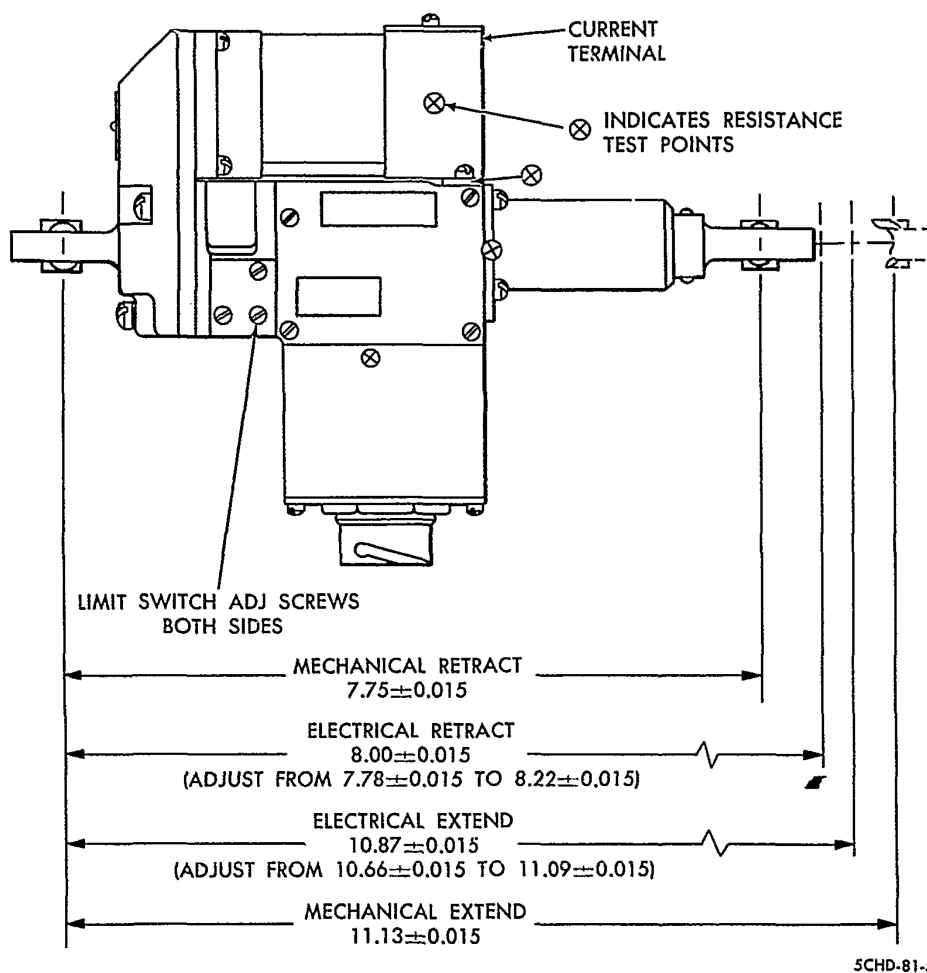
Connect a jumper between motor shaft and motor case to prevent damage to bearings if insulation breakdown occurs.

**3-4. TROUBLESHOOTING AC MOTOR.**

3-5. Refer to table 3 for ac motor troubleshooting information.

**TABLE 3. TROUBLESHOOTING MOTOR**

TROUBLE	PROBABLE CAUSE	REMEDY
Inoperative; No Current	Open winding	Replace motor stator (21, figure 2-2).
	Open connection	Check continuity of all connections.
Inoperative; Stall Current	Mechanical interference	Disassemble and correct fault.
	Brake not releasing	Adjust air gap (step e, paragraph 2-19).
Inoperative; Excessive Current	Shorted winding	Replace motor stator (21, figure 2-2).
Low Power; High Current	Brake dragging	Adjust air gap (step e, paragraph 2-19).
	Mechanical Interference	Locate and correct fault.
Low Power; Low Current	High resistance contact	Check all connections



**Figure 3-1. Travel Limits Diagram**

## 3-6. ACTUATOR ASSEMBLY TEST PROCEDURE.

### Note

Use of equivalent test equipment that meet the same specification as those called out is authorized.

3-7. Perform test using actuator test stand (part No. NY200) to operate the actuator and to check the current applied. Applied voltage at actuator shall be 115 volts rms at a frequency of 400 Hz, unless otherwise specified.

3-8. BONDING RESISTANCE. Perform the bonding resistance test as follows:

a. Using bonding Resistance Test Panel AT3304 and Power Output Lead AT3304-2, apply 25.0 amperes dc between end housing (8, figure 2-2) and bonding jumper assembly (83, figure 2-1).

b. Using Test Probes AT3304-1, check voltage drop between X designated components (figure 3-1). Voltage drop shall not exceed 0.125 volt (125 millivolts) dc, between adjacent resistance test points.

### Note

Make certain that excellent contact is made at each test point.

c. Check voltage drop between end housing (8, figure 2-2) at current input (figure 3-1) and jumper assembly (83, figure 2-1). Voltage drop shall not exceed 0.500 volt (500 millivolts) dc.

3-9. END PLAY. Using NY200 Actuator Test Stand, apply a 5-pound reversing load and measure the end play. End play shall not exceed 0.004 inch.

3-10. CLUTCH TEST. Mount actuator in NY200 Actuator Test Stand.

a. Apply 115 volts rms and check extend and retract strokes as shown in figure 3-1. Apply a 690 pound opposing load. The clutch shall not slip.

b. Increase the opposing load. The clutch must slip or the motor must stall before a total of 1400 pounds opposing load is reached.

### CAUTION

Do not allow motor to remain in stalled position for more than 3 seconds.

3-11. MECHANICAL STOPS. Perform mechanical stop check as follows:

### CAUTION

Before performing step a, back off limit switch adjusting screws (13, figure 2-1). This back off spur gear (540 and prevents damaging switch assemblies (22 and 25). The switches are now inoperative.

a. With an actuator no-load condition, apply 115 volts rms to operate actuator, engaging each mechanical stop three times.

b. Reduce voltage to 102 volts rms and back off stops. Damage or jamming shall not occur at either stop.

c. Check mechanical extend and retract dimension with that shown in figure 3-1, by jogging the actuator into the stops.

3-12. ELECTRICAL STROKE. Use adjusting screws (13, figure 2-1) to adjust electrical stroke limits of the actuator to dimensions shown in figure 3-1. Perform this adjustment at no-load, and check electrical stroke limits three times for each switch. Check for correct direction of operation. Each check of the electrical stroke limits shall fall within 0.015 inch of the specified setting.

3-13. MONITOR SWITCHES. Connect actuator to NY200 actuator test stand. Electrically extend and retract actuator to check that monitor switches actuate at 0.100 inch maximum from ends of electrical extend and retract position. Perform this test three times for each switch at no-load speed. Each check of monitor switch actuation point shall fall within 0.015 inch.

3-14. LIMIT LOAD. Using NY200 actuator test stand, proceed as follows:

a. Operate actuator to electrical retract position. Apply a 1,465-pound static tension load. The actuator shall not reverse under load.

b. Remove 1,465-pound load and operate the actuator to the electrical extend position. Apply 1,465-pound compression load. Actuator shall not reverse under load.

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3-15. **MAXIMUM OPERATING LOAD TEST.** Using NY200 Actuator Test Stand, apply a 650-pound opposing load. Operate the actuator through one complete extend and retract cycle at 115 volts rms, 400 Hz. Check current drain for each stroke. The current drain shall not exceed 5.8 amperes.

3-16. **NORMAL OPERATING LOAD TEST.** Using NY200 Actuation Test Stand, apply a 200-pound opposing load. Operate the actuator through one complete extend and retract cycle at 115 volts rms, 400 Hz. Check actuation time and current drain for each stroke. Actuation time must fall between 4.16 and 6.24 seconds per 2.87 inch stroke. The current drain shall not exceed 6.0 amperes.

3-17. **COAST TEST.**

a. Operate the actuator to about one inch from the electrical retract limit.

b. With no load applied, run the actuator to the electrical retract limit. Measure and record electrical retract dimension. (See figure 3-1.)

c. Operate the actuator to about 1/2 inch from the electrical retract limit.

d. Jog the actuator to the electrical retract limit. Measure and record the electrical retract dimension. The difference between this value and that recorded in step b is the coast. The coast shall not exceed 0.032 inch at no-load speed.

3-18. **AIR SEAL TEST.** Apply a temporary seal at point where Acme nut (88, figure 2-1) protrudes through guide collar (81). Remove one screw (20), at lower right-hand corner of plate (19); insert Adapter AT2652-3 and attach to filtered air supply. Pressurize actuator assembly to 0.5 psi. Pressure shall remain constant for a minimum of 10.0 seconds. Remove temporary seal and air supply. Re-insert screw (20) and perform procedures of step r, paragraph 2-22, around base of screw (20).

3-19. **LOW VOLTAGE TEST.** Apply 102 volts rms, 420 Hz at no-load. The actuator shall operate through one complete cycle with no evidence of malfunction.

### 3-20. TROUBLESHOOTING ACTUATOR ASSEMBLY.

3-21. Refer to table 4 for actuator troubleshooting.

**TABLE 4. TROUBLESHOOTING ACTUATOR**

TROUBLE	PROBABLE CAUSE	REMEDY
Inoperative; No Current	Open connection	Check all connections for continuity.
	Defective limit switch	Locate and replace defective switch.
	Limit switch improperly adjusted	Check switch adjustments in accordance with paragraph 2-13.
Inoperative; Stall Current	Switches improperly adjusted and actuator at limit	Check switch adjustments in accordance with paragraph 2-13.
Inoperative; Excess Current	Short circuit	Locate and correct short circuit.
Poor performance; Low Current	High resistance connection	Check all connections.
Poor performance; High Current or Noise	Mechanical Interference	Disassemble, locate, and correct fault.
Intermittent Operation	Defective limit switch	Locate and replace defective switch.
Load Limit Switch Ineffective	Defective limit switch	Replace defective switch.