TECHNICAL MANUAL

# DIRECT AND GENERAL SUPPORT MAINTENANCE MANUAL

# TANK, COMBAT, FULL-TRACKED: 105-MM GUN, M48A5 NSN (2350-00-582-5595) TURRET



This copy is a reprint which includes current pages from Changes 1 and 2.

HEADQUARTERS, DEPARTMENT OF THE ARM
APRIL 19

# WARNING

## CARBON MONOXIDE POISONING CAN BE DEADLY

**Carbon monoxide is a colorless, odorless, deadly poisonous gas which, when breathed, deprives the body of oxygen and causes suffocation. Exposure to carbon monoxide produces symptoms of headache, dizziness, loss of muscular control, and drowsiness. Permanent brain damage or death can result from severe exposure. It occurs in the exhaust fumes of fuel-burning heaters and internal-combustion engines and becomes dangerously concentrated under conditions of inadequate ventilation. The following precautions must be observed whenever the personnel heater, main engine, or auxiliary engine of any vehicle is operated.**

1. **DO NOT operate heater or engine or vehicle in an enclosed area without ventilation.**
2. **DO NOT idle engine for long periods without ADEQUATE VENTILATION.**
3. **Operate vehicle with inspection plates, cover plates, and engine compartment doors removed only for maintenance purposes.**
4. **If symptoms are present, IMMEDIATELY VENTILATE personnel compartments. If symptoms persist, remove affected personnel from vehicle and treat as follows: expose to fresh air, keep warm; DO NOT PERMIT PHYSICAL EXERCISE. If necessary, administer artificial respiration.**

**THE BEST DEFENSE AGAINST CARBON MONOXIDE POISONING IS ADEQUATE VENTILATION.**

CHANGE

No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 30 September 1986

Direct and General Support
Maintenance Manual

TANK, COMBAT, FULL-TRACKED:
105-MM GUN, M48A5
(2350-00-582-5595)
TURRET

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| i and ii | i and ii |
| 2-83 through 2-88 | 2-83 through 2-88 |
| 3-215 through 3-218 | 3-215 through 3-218 |
| 3-223 and 3-224 | 3-223 and 3-224 |

File this change sheet in the back of the publication for reference purposes.

**By Order of the Secretary of the Army:**

**JOHN A. WICKHAM, JR.**
*General, United States Army*
*Chief of Staff*

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**R. L. DILWORTH**
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*The Adjutant General*

**DISTRIBUTION:**

To be distributed in accordance with DA Form 12-37, Direct and General support maintenance requirements for Tank, Combat, Full Tracked, 105-MM, M48A5.

CHANGE

No. 2

HEADQUARTERS
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DIRECT AND GENERAL SUPPORT MAINTENANCE MANUAL
TANK, COMBAT, FULL-TRACKED: 105-MM GUN, M48A5
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TURRET

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| Remove Pages | Insert Pages |
|---|---|
| i and ii | i and ii |
| ix and x | ix and x |
| 2-53 through 2-58 | 2-53 through 2-58 |
| 2-63 and 2-64 | 2-63 and 2-64 |
| 2-91 and 2-92 | 2-91 and 2-92 |
| 3-53 and 3-54 | 3-53 and 3-54 |
| 3-63 and 3-64 | 3-63 and 3-64 |
| 3-69 and 3-70 | 3-69 and 3-70 |
| 3-89 and 3-90 | 3-89 and 3-90 |
| 3-93 and 3-94 | 3-93 and 3-94 |
| 3-97 through 3-100 | 3-97 through 3-100 |
| 3-109 through 3-112 | 3-109 through 3-112 |
| 3-117 and 3-118 | 3-117 and 3-118 |
| 3-121 and 3-122 | 3-121 and 3-122 |
| 3-149 through 3-152 | 3-149 through 3-152 |
| 3-187 through 3-190 | 3-187 through 3-190 |
| 3-223 and 3-224 | 3-223 and 3-224 |
| 3-227 and 3-228 | 3-227 and 3-228 |
| 3-233 and 3-234 | 3-233 and 3-234 |
| None | 3-234.1/(3-234.2 blank) |
| A-1 and A-2 | A-1 and A-2 |
| I-1 through I-4 | I-1 through I-4 |

File this sheet in the back of the publication for reference purposes.

**By Order of the Secretary of the Army:**

**CARL E. VUONO**
*General, United States Army*
*Chief of Staff*

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**R. L. DILWORTH**
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HEADQUARTERS
DEPARTMENT OF THE ARMY
*Washington, D.C. 24 April 1978*

# DIRECT AND GENERAL SUPPORT MAINTENANCE MANUAL TANK, COMBAT, FULL-TRACKED: 105-MM GUN, M48A5 (2350-00-582-5595) TURRET

**Reporting Errors and Recommending Improvements.** You can help improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publication and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Armament Munitions and Chemical Command, ATTN: AMSMC-MAS, Rock Island, IL 61299-6000. A reply will be furnished to you.

# LIST OF ILLUSTRATIONS

# LIST OF ILLUSTRATIONS - Continued

# LIST OF ILLUSTRATIONS - Continued

# LIST OF ILLUSTRATIONS - Continued

# LIST OF ILLUSTRATIONS - Continued

# LIST OF ILLUSTRATIONS - Continued

# LIST OF ILLUSTRATIONS - Continued

# LIST OF TABLES

# CHAPTER 1
# INTRODUCTION

## Section I. GENERAL

**1-1. Scope.** This manual contains maintenance procedures for direct and general support maintenance of turret and turret components of the 105-mm gun, full-tracked, combat tank M48A5. The procedures include troubleshooting, description, removal, disassembly, cleaning, inspection, repair, testing, assembly, and installation instructions.

**1-2. Forms and Records.** Maintenance forms, records, and reports to be used are prescribed and listed in TM 38-750.

**1-3. Use of English and Metric System Units.** To facilitate conversion from the English to the metric system of measurement, torque values, when required, have been expressed in pound feet (lb-ft) or pound inches (lb-in.) and also in Newton meters (N-m) throughout this manual.

**1-4. Difference Between Vehicles.** M48A5 tanks are identified with two blocks of serial numbers, one from A1001 through A1999 and one from A3001 through A3999. For the differences between vehicle series refer to TM 9-2350-258-10 and TM 9-2350-258-20-2.

## Section II. DESCRIPTION AND DATA

### 1-5. Description.

*a. Hydraulic System.*

(1) *General.* Refer to TM 9-2350-258-20-2 for description of hydraulic system components and modes of operation.

(2) *Power mode and static condition (FO-1 and FO-2 foldout illustrations at back of manual).*

*(a)* With the MASTER BATTERY AND TURRET POWER switches in the ON position, hydraulic pressure is available for operation in power mode. Hydraulic pressure is generated by an electric motor-driven hydraulic pump in the power pack control reservoir (FO-1). The motor receives electrical power via the turret power relay when the TURRET POWER switch is in the ON position and pressure is below 925-975 psi. When the pump operates, fluid is forced from the reservoir, through a check valve and filter, into the power pack control hydraulic riser, and to the hydraulic (main) accumulator. The main accumulator contains a floating piston, one side of which is precharged with dry nitrogen gas to 500-550 psi. Fluid pumped into other side of the accumulator compresses the gas until hydraulic pressure reaches 1175-1275 psi. At this point, the accumulator pressure switch opens and breaks the turret power relay electrical circuit, turning off the electric motor. Accumulator pressure is indicated by a pressure gage connected to the main accumulator and pressure switch hydraulic tubes.

*(b)* The system contains a pressure relief valve connected between the hydraulic riser and the reservoir (FO-1). The valve opens if pressure exceeds 2000-2400 psi and closes when pressure drops to 1700-1820 psi, venting excessive pressure into the reservoir.

*(c)* The fluid from the main accumulator is applied to the high pressure regulating valve in the hydraulic riser, which regulates the pressure to 900-950 psi (FO-1). This is the main operating pressure of the system. The fluid then passes to the power shutoff spool in the gunner's control valve. When the TURRET POWER switch is in the ON position, the gunner's control valve solenoid is energized and the power shutoff valve spool permits fluid to flow to the spools of the traversing, elevating, auxiliary (low) pressure regulating, and override valves. Fluid is also applied through the shutoff needle valve to the superelevation actuator and deck clearance valve. Drilled passages between the valves of the gunner's control valve assembly, power back control hydraulic riser, and reservoir allow drain fluid to return to the reservoir.

*(d)* With fluid applied, the traversing valve is blocked from the remainder of the system since the spool is in the neutral position (FO-1).

*(e)* Fluid applied to the spool of the low-pressure regulating valve is regulated to 100-150 psi. and directed to the traversing gearbox hydraulic (pin) lock and to the traversing check valves of the gunner's control valves assembly (FO-1). The low-pressure fluid retracts the pin lock shaft, permitting power mode operation of the traversing gearbox. The fluid at the seat of the traversing check valves pressurizes both hydraulic motor tubes to 100-150 psi and replaces any fluid lost by leakage.

*(f)* The high-pressure fluid applied to the spool of the override valve is blocked until the override solenoid is energized by the palm switch in the commander's handle (FO-1).

*(g)* Fluid applied to the elevating valve is blocked from the remainder of the system since the elevating spool is in the neutral position (FO-1).

*(h)* Fluid applied through the shutoff needle valve to the deck clearance valve is blocked at port A1 since the valve is deenergized (FO-2). The solenoid energizes only when the gun is in the rear deck sector and the gun is below zero mils (FO-1). When energized, ports EE and ED are closed. Regulated pressure fluid at port A1 is directed through port CE to port P2 of the lock valve assembly. The gun is then elevated to greater than zero mils (para 1-5 *a.* (4) ).

*(i)* Fluid applied to the superelevation actuator is blocked until a mechanical input is received from the ballistics computer (FO-1).

*(j)* Fluid in the elevation shutoff valve is at a static pressure below 900 psi since the valve is energized and blocked to external fluid pressures (FO-1).

(3) *Power mode traversing (FO-2).*

*(a) General.* Positioning of the traversing valve spool for left or right traversing is accomplished with the gunner's or commander's control handle (TM 9-2350-258-20-2).

*(b) Right traversing.* With high pressure fluid available at the spool of the traversing valve (para 1-5 *a.* (2) ) and the spool positioned for right traversing, fluid is directed to the power shutoff spool of the gunner's control valve. With the value solenoid energized, fluid is applied to the right traverse hydraulic tube of the traversing gearbox hydraulic motor. The fluid seats the right traversing check valve, preventing low-pressure fluid from entering the tube. Fluid entering port M2 of the hydraulic motor valve plate enters half of the cylinder bores and forces the pistons up the cylinder bore causing the cylinder block to rotate. The angular rotation of the output shaft allows the piston to travel from a point of minimum fluid volume to a point of maximum fluid volume. Return pressure fluid discharged from the cylinder bore flows out the motor valve plate port M1 to the gunner's control valve. Return pressure is maintained to at least 100-125 psi by low-pressure fluid passing through the left traversing check valve.

*1.* A plunger-type relief valve in the traversing gearbox hydraulic motor limits the pressure between the motor and the traversing spool of the gunner's control valve. When the flow of hydraulic fluid is stopped by returning the traverse spool to neutral, the hydraulic motor pressure rises immediately to the pressure level established by the relief valve. During this period, the motor is braking the turret to a stop. Fluid passing through the relief valve recirculates through the motor and again through the valve.

*2.* The return pressure fluid from port M2 of the traversing hydraulic motor is directed through the gunner's control valve, and then to the traversing spool. The fluid then passes the metering shoulder of the traversing spool and to the spring chamber. The pressure of the fluid drops from return pressure to drain pressure as it passes the metering shoulder since the spring chamber is connected to the drain.

*(c) Left traversing.* Left traversing is identical to right traversing except that fluid flows are reversed.

(4) *Power mode elevation and depression (FO-1 and FO-2).*

*(a) General.* Positioning of the elevating valve spool to elevate or depress the main gun is accomplished with the gunner's or commander's control handles (TM 9-2350-258-20-2).

*(b) Elevation.* With high-pressure fluid available at the spool of the elevating valve (para 1-5 *a.* (2) ) and the spool positioned for elevation, fluid is directed through the deck clearance valve to locking valve port P2 on the elevating mechanism (FO-1). The operating pressure fluid moves the lock valve spool by entering the hole in the spool and acting on the end of the spool. The pressure moves the spool against the centering spring at the opposite end of the spool. After shifting the spool, fluid flows past a check valve and to the crossover relief valve. Fluid passes around the spring on one side of the crossover relief valve to the rear chamber of the elevating cylinder. Pressure in the cylinder causes the cylinder piston rod to retract and elevate the gun tube.

*1.* The fluid under pressure on the opposite side of the piston in the elevating mechanism is forced back through the manifold, past the spring on the opposite side of the crossover relief valve, and into the locking valve (FO-1). The fluid is directed past the spring of the check valve to the power lock spool. From the locking valve, the fluid passes through the deck clearance and elevation shutoff valves to the elevating spool. (The elevation shutoff valve is not present in all vehicles. See FO-1.) It then passes through the elevating spool bore and spring chamber to the reservoir. The return pressure drops to drain pressure as it flows through the metering grooves on the elevating spool.

*2.* In normal operation, superelevation is also applied when elevating or depressing the main gun (TM 9-2350-258-20-2). To increase gun elevation, an adjusting nut in the actuator is mechanically turned clockwise (FO-2). The adjusting nut moves a spool so that the regulated pressure which enters the super-elevation actuator at port A2 from port A of the gunner's control valve, is directed to port S4 where it emerges as operating pressure. The operating pressure then goes to port S2 of the lock valve assembly, through the crossover relief valve, and on to the elevating mechanism. This causes the piston to retract and elevate the gun. The return pressure from the elevating mechanism passes through the crossover relief valve and enters the lock valve assembly emerging at port S1. It then enters the superelevation actuator at port S3. The return pressure moves the piston and sleeve until the pressure and drain ports in the sleeve are covered by the lands of a spring-loaded spool. At this point, ports S4 and D2 have no flow of fluid. Prior to blocking the ports in the sleeve, the return pressure leaves the superelevation actuator through port D2 as drain and reservoir pressure. It passes through the drain port in the spring cover of the elevating valve and returns through the hydraulic riser to the reservoir.

3. The elevation shutoff valve (not present in vehicles) prevents accidental gun elevation or depression in power mode by preventing fluid flow in the power depression circuit of the elevating system (FO-1 and FO-2). With the depression circuit blocked, pressure caused by accidental movement of a control handle can only create equal pressures on both sides of the piston in the elevating mechanism. Hence, the piston cannot move and the gun tube cannot elevate or depress. The elevation shutoff valve solenoid remains energized, blocking fluid flow until a gunner's palm switch or the commander's override/palm switch is actuated. Any switch will deenergize the solenoid since the switches are series connected and gun tube movement is then possible.

*(c) Depression (FO-1 and FO-2).* Depression of the main gun is identical to elevation except that fluid flow is reversed.

(5) *Manual mode elevation and depression (FO-1).*

*(a) Elevation.*

1. Rotating the handle of the hand (manual) elevating pump clock-wise (as viewed from the left) pumps fluid under pressure through the hydraulic riser accumulator where it emerges at port ME. It is directed to the lock valve assembly where it enters port M2, passes through the crossover relief valve and on to the elevating mechanism, causing the piston to retract and thereby elevate the gun. The return pressure from the elevating mechanism passes through the crossover relief valve and enters the locking valve assembly, emerging at port M1. It then enters the hydraulic riser accumulator through port MD and passes on to the inlet side of the manual elevating pump.

2. The operating pressure leaving the hydraulic riser accumulator at the shuttle valve spool causes the spool to shift to the left, allowing return pressure to enter the pump case. This pressure in the case reduces the effort required to rotate the handle.

*(b) Depression.* Depressing the main gun using the manual elevating pump is identical to elevation except that fluid flow is reversed.

*b. Additional Component and System Description.* Refer to TM 9-2350-258-10, TM 9-2350-258-20-2 and to applicable sections within this manual.

**1-6. Data.** Refer to TM 9-2350-258-20-2.

# CHAPTER 2
# DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

## Section I. SERVICE UPON RECEIPT OF MATERIEL

**2-1. General.** This section contains information covering services performed upon receipt of a tank that has been prepared for shipment. Whenever practicable, the crew and organizational maintenance personnel assist in performance of the services described in this section.

**2-2. Inspecting, Servicing, Installation, and Stowage.**

*a. Installation and Stowage.* Refer to TM 9-2350-258-10 for the installation and stowage of basic issue items and components of the end items.

*b. Servicing and Inspecting.* Perform preventive maintenance checks and services (TM 9-2350-258-10 and TM 9-2350-258-20-2).

**2-3. Modification Work Orders.** Modification Work Orders (MWOs) are normally applied by depot or contractor teams. However, support organizations may be required to incorporate MWOs by the orders of the Commander of the Theater of Operation. No modification will be made unless authorized. Inspect vehicle log (DA 2804) for application of MWOs, check DA PAM 310-7 for the liy of applicable MWOs, and report those MWOs not incorporated. Perform applicable preventative maintenance services and checks (TM 9-2350-258-20-2) after incorporation of any MWO.

## Section II. REPAIR PARTS AND SPECIAL TOOLS, TEST, AND SUPPORT EQUIPMENT

**2-4. Repair Parts.** Repair parts are listed and illustrated in TM 9-2350-258-34P-2.

**2-5. Tools and Equipment.**

*a. Common Tools.* Standard and common tools having general application to this equipmft are listed in Tables of Allowances and Tables of Organizational Equipment.

*b. Special Tools, Test, and Support Equipment.* Special tools, test, and support equipment are listed in table 2-1. Fabricated items are illustrated in figures 2-1 through 2-30. Special tools and equipment are listed in TM 9-2350-258-34P-2, which is the authority for requisitioning replacements.

*Table 2-1. Special Tools, Test, and Support Equipment (Including Fabricated Items)*

| Item | NSN or reference no. | Reference Fig no. | Reference Para no. | Use | Fig |
|---|---|---|---|---|---|
| | | TURRET | | | |
| 1. SLING, TURRET LIFTING | 4933-00-938-3008 (11615469) | 2-31 2-23a. | 2-22a. during removal | Lifting turret or installation. | |
| 2. STAND, TURRET | — | | 2-22a. 2-23a. | Support turret after removal. | 2-1 |
| | | TURRET RACE | | | |
| 3. EYEBOLT (3) TURRET RACE LIFTING | 5306-00-699-1282 (8708807) | 2-32 3-88 | 2-23a. 3-274a. | Provide lifting points during turret race replacement. | |
| | | POWER PACK | | | |
| 4. FIXTURE, POWER PACK FILTER | — | 3-43 3-44 | 3-108a. 2-19a. | Hold filter during test and adjustment. | 2-2 |
| 5. MANIFOLD, MANUAL ELEVATION PUMP TESTING | — | 3-16 | 3-49b. | Adapt manual elevation pump for testing. | 2-3 |
| 6. MANIFOLD, SHUTTLE VALVE TESTING | — | 3-22 | 3-64a. | Adapt manual elevation shuttle valve for testing. | 2-4 |
| 7. KEY, SOCKET | — | | 2-31b. | Tighten power pack pump dc motor coupling screw. | 2-5 |
| 8. ALINEMENT TOOL | — | | 2-31b. | To aline power pack pump dc motor to pump coupling. | 2-6 |
| 9. INSTALLATION TOOL | — | 2-40 | 2-31b. | Install power pack pump dc motor. | 2-7 |
| 10. MANIFOLD, RISER TESTING: TOP | — | 3-41 | 3-100a. | Adapt riser top for testing. | 2-8 |
| 11. MANIFOLD, RISER TESTING: BOTTOM | — | 3-41 | 3-100a. | Adapt riser bottom for testing. | 2-9 |
| 12. WRENCH, SPANNER: MANUAL ELEVATING PUMP BEARING RETAINER | 5120-00-555-9031 (7010376) | 3-14 | 3-45g. | Replace manual elevation pump bearing retainer. | |
| | | ELECTRICAL | | | |
| 13. GUN, HEAT | 4940-00-561-1002 (8031088) | | 2-36 | Shrink heat-shrinkable tubing. | |
| | | GUNNER'S CONTROL ASSEMBLY | | | |
| 14. MANIFOLD, HYDRAULIC CONTROL VALVE TESTING | — | 3-36 | 3-92b. | For hydraulic control valve testing. | 2-10 |

*Table 2-1. Special Tools, Test, and Support Equipment (Including Fabricated Items)*

| Item | NSN or reference no | Reference Fig no | Reference Para no | Use | Fig |
|---|---|---|---|---|---|
| | | GUNNER'S CONTROL ASSEMBLY — CONTINUED | | | |
| 15. FIXTURE, HYDRAULIC VALVE TESTING | — | 3-36 | 3-92*b*. | Adapter for hydraulic control valve testing. | 2-11 |
| 16. SPRING COMPRESSING TOOL, GUNNER'S CONTROL | — | | 3-39*t*. 3-84*aa*. | To compress spring during installation. | 2-13 |
| 17. ADAPTER, HYDRAULIC VALVE TESTING | — | 3-37 | 3-92*b*. | Test gunners control hydraulic valve. | 2-12 |
| | | MAIN ACCUMULATOR | | | |
| 18. WRENCH, SPANNER | 5120-00-902-5536 (10952096) | | 3-113*a*. | Remove and install main accumulator end rings. | |
| | | TRAVERSING GEARBOX | | | |
| 19. SLING, TRAVERSING MECHANISM LIFTING | 4910-00-708-3778 (7083778) | | 2-33*a*. | Lifting traversing mechanism during removal or installation. | |
| 20. | | | | | |
| 21. SOCKET, NO-BAK TESTING | 5120-00-627-8018 (7383534) | | 3-147*a*. | Apply torque during no-bak testing. | |
| 22. TOOL ASSEMBLY, CLUTCH TESTING | 1015-00-891-7847 (10952243) | 3-66 | 3-154*i*. | Lock traversing mechanism clutch for slippage test. | |
| 23. SOCKET, CLUTCH TESTING | 5120-00-627-8019 (7383535) | | 3-154*j*. | To apply torque during clutch slippage test. | |
| 24. ADAPTER, TRAVERSING GEARBOX ASSEMBLY (2) | 5120-00-588-1966 (8708442) | 3-56 | 3-140*c*. | Adapt pinion shafts during assembly of upper and lower cases. | |
| 25. ADAPTER, TORQUE WRENCH | — | | 3-140*d*. | Adapt torque wrench to magnetic brake for slippage test. | 2-17 |
| | | ARMAMENT | | | |
| 26. | | | | | |
| 27. FIXTURE, TEST, RECOIL MECHANISM | 4933-00-830-5637 (10893684) | 3-86 | 3-243*a*. | Support recoil mechanism during testing. | |

*Table 2-1. Special Tools, Test, and Support Equipment (Including Fabricated Items)*

| Item | NSN or reference no | Reference Fig no. | Reference Para no. | Use | Fig |
|---|---|---|---|---|---|
| | | ARMAMENT — CONTINUED | | | |
| 28. HOIST, CHAIN 1/2-TON | 3950-00-092-9064 Model (MP-10) | 2-64 | 2-41*a*. | Balance gun during removal or installation in vehicle. | |
| 29. PLIERS, RING RETAINING | 5120-00-595-9552 (GGG-P-430A) (7083704) | 3-84 | 3-233*q*. | Remove or install recoil mechanism retaining ring. | |
| 30. WRENCH, SPANNER ADAPTER NUT | 4933-00-986-3129 (10924472) | 3-85 | 3-241*h*. | Tighten gun tube collar. | |
| 31. CLAMP, PULLER AND LIFTING | 4933-00-039-5025 (8390439) | 3-84 | 3-233*e*. | Hold recoil mechanism piston assembly during removal. | |
| 32. TOOL ASSEMBLY, BREECH LIFTING | 4933-00-775-3742 (10870404) | 3-87 | 3-266*b*. | Lift breech during removal. | |
| 33. FIXTURE ASSEMBLY, RECOIL SRPING COMPRESSION | 4933-00-393-0240 (8390072) | 3-84 | 3-233*i*. | Compress recoil spring during assembly and disassembly. | |
| 34. PROTECTOR, ASSEMBLING, CONCENTRIC | 4933-00-039-5028 (8708628) | 3-84 | 3-233*m*. | Protect recoil piston threads during replacement. | |
| 35. ADAPTER, TORQUE WRENCH | 5120-00-348-8409 (8449228) | | 3-241*h*. | Adapter torque wrench during installation of breech block-to-gun mount collar. | |
| 36. WRENCH, ALLEN, CUPOLA AND PIPE PLUG REMOVAL | — | | 3-241*c*. | Remove expansion plug from gun shield mount. | 2-14 |
| | | CUPOLA | | | |
| 37. SLING, CUPOLA LIFTING | 4933-00-480-5662 (11658914) | 2-62<br>2-63<br>3-76 | 2-38*a*.<br>2-39*a*.<br>3-183*e*.<br>3-218*c*. | Hold cupola during replacement. | <br><br><br>a |
| 38. STAND, CUPOLA | — | 2-62<br>2-63<br>3-75 | 2-38*a*.<br>2-39*a*.<br>3-183*e*. | Support cupola, after removal. | 2-15 |
| 39. CLEVIS (3) | — | 2-62 | 2-38*a*. | Allow sling to be used to lift cupola. | |
| 40. WRENCH, ALLEN, CUPOLA AND PIPE PLUG REMOVAL | — | | 2-38*a*. | To remove socket head screws above rangefinder. | 2-14 |

*Table 2-1. Special Tools, Test, and Support Equipment (Including Fabricated Items)*

| Item | NSN or reference no. | Reference Fig no. | Reference Para no. | Use | Fig |
|---|---|---|---|---|---|
| | | ELECTRICAL TEST SUPPORT EQUIPMENT | | | |
| 41. CABLE, ELECTRICAL TEST (TYPE 1) | | 3-6 | 3-16 | Used to test vent blower motor. | 2-21 |
| 42. CABLE, ELECTRICAL TEST (TYPE 7) (2) | | 3-3<br>3-6 | 3-6*b*.<br>3-24 | Used to test slip ring, turret power relay and searchlight relay. | 2-27 |
| 43. CABLE, ELECTRICAL TET (TYPE 3) | | 3-6 | 3-24 | Used to test turret power relay and searchlight relay. | 2-23 |
| 44. CABLE, ELECTRICAL TEST (TYPE 8) | | 3-6 | 3-24 | Used to test turret power relay and searchlight relay pins. | 2-24 |
| 45. CABLE, ELECTRICAL TEST (TYPE 2) (2) | | 3-6<br>3-54 | 3-16<br>2-133 | Used to test vent blower and electric drive motor. | 2-22 |
| 45. CABLE, ELECTRICAL TEST (TYPE 6) (2) | | 3-3 | 3-6*b*. | Used to test slipring. | 2-26 |
| 47. CABLE, ELECTRICAL TEST (TYPE 5) | | 3-6 | 3-24 | Used to test turret power relay and searchlight relay. | 2-25 |
| 48. CABLE, ELECTRICAL TEST (TYPE 4) | | 3-6 | 3-24 | Used to test turret power and searchlight relay. | 2-28 |
| 49. BOX, TEST CABLE ATTACHMENT | | | | Used as attachment to test cable pigtails of electrical test cables (types 1, 3, 7, and 8). | 2-29 |
| 50. ITEM 50 NOT USED | | | | | |
| 51. SHUNT, 100-AMP AT 100 MV | | | | Electrical tests to measure input current to motors. | |
| 52. MILLIVOLT METER | | | | Electrical tests used with shunt to measure input current to motors. | |

*Table 2-1. Special Tools, Test, and Support Equipment (Including Fabricated Items)*

| Item | NSN or reference no. | Reference Fig no. | Reference Para no. | Use | Fig * |
|---|---|---|---|---|---|
| | | ELECTRICAL TEST SUPPORT EQUIPMENT — (CONTINUED) | | | |
| 53. STAND, PORTABLE TEST OR EQUIVALENT | | | 3-16*b*.<br>3-133*a*. | Test stand with vise to hold electrical components during tests. | 2-18 |
| 54. FIXTURE, ELEVATING CYLINDER TEST | | 3-72 | 3-166*a*. | Used to check operation of hydraulic elevating cylinder. | 2-19 |
| 55. MANIFOLD, ELEVATING CYLINDER TEST | | 3-71 | 3-168*b*. | Used to check operation of hydraulic elevating cylinder. | 2-20 |
| 56. PUSH ROD | | 3-83<br>3-83 | 3-226<br>3-229 | Used during disassembly or assembly of replenisher components. | 2-30 |

*Table 2-1. Special Tools, Test, and Support Equipment (Including Fabricated Items)*

| Item | NSN or reference no. | Reference Fig no. | Reference Para no. | Use | Fig * |
|---|---|---|---|---|---|
| | HYDRAULIC TEST SUPPORT EQUIPMENT. (COMPOSED OF:) | | | Used to test the following components: | |
| GAGE (0-2000 PSI) (1) | MS28063-1 | | | (1) Elevation cylinder | |
| GAGE (0-25 PSI) (1) | MS20861-T1 | | | (2) Gunner's control valve | |
| GAGE (0-5000 PSI) (1) | MS28063-2 | | | (3) Commander's control valve | |
| GAGE (0-200 PSI) (1) | MS28063-3 | | | (4) Superelevation actuator | |
| PLUG 3/8 (6) | MS21916-3 | | | (5) Power pack riser | |
| PLUG 5/8 (6) | MS21913-10 | | | (6) Manual elevation pump | |
| CAP 1/4 (12) | MS21914-4 | | | | |
| CAP 5/16 (6) | MS21914-5 | | | (7) Manual elevation pump | |
| CAP 3/8 (6) | MS21914-6 | | | (8) Power pack filter | |
| CAP 1/2 (12) | MS21914-8 | | | (9) Gearbox pump assembly | |
| CAP 5/8 (12) | MS21914-10 | | | (10) Manual elevation actuator | |
| CAP 3/4 (6) | MS21914-12 | | | (11) Main accumulator | |
| REDUCER 5/16-1/4 (6) | MS21916-5-4 | | | | |
| REDUCER 3/8-1/4 (6) | MS21916-6-4 | | | | |
| REDUCER 1/2-1/4 (6) | MS21916-8-4 | | | | |
| REDUCER 5/8-1/4 (6) | MS21916-10-4 | | | | |
| REDUCER 3/4-1/4 (6) | MS21916-12-4 | | | | |
| UNION 1/4 (6) | MS51814-23 | | | | |
| ADAPTER 1/8 (FEMALE PIPE) TO 1/4 TUBE (6) | MS51816-23 | | | | |
| ADAPTER 1/8 (MALE PIPE) TO 1/4 TUBE (24) | MS51819-33 | | | | |

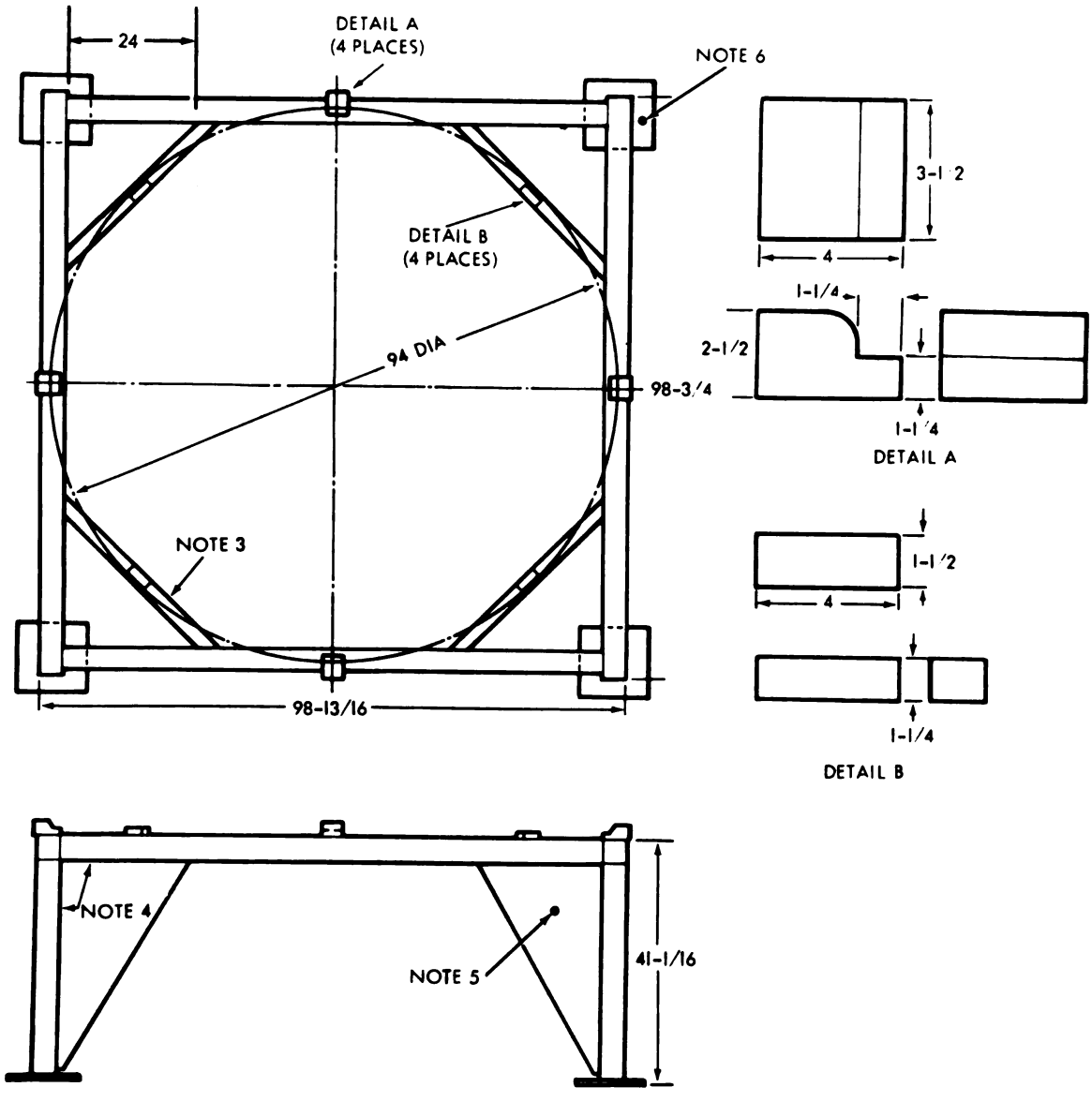
*Table 2-1. Special Tools, Test, and Support Equipment (Including Fabricated Items)*

| Item | NSN or reference no | Reference Fig no. | Reference Para no. | Use | Fig * |
|---|---|---|---|---|---|
| | HYDRAULIC TEST SUPPORT EQUIPMENT (COMPOSED OF:) — (CONTINUED) | | | | |
| ADAPTER 1/4 (MALE PIPE) TO 1/4 TUBE (6) | MS51819-32 | | | | |
| NUT 1/4 TUBE (12) | MS51823-3 | | | | |
| NUT 3/8 TUBE (6) | MS51823-5 | | | | |
| NUT 1/2 TUBE (6) | MS51823-6 | | | | |
| NUT 5/8 TUBE (6) | MS51823-7 | | | | |
| NUT 3/4 TUBE (6) | MS51823-8 | | | | |
| TEE (6) | 4730-00-708-1491 | | | | |
| TEE, 1/4 TUBE TO 1/8 PIPE ON RUN (6) | MS51824-23 | | | | |
| SLEEVE 1/4 TUBE (6) | MS51825-3 | | | | |
| SLEEVE 3/8 TUBE (6) | MS51825-5 | | | | |
| SLEEVE 1/2 TUBE (6) | MS51825-6 | | | | |
| SLEEVE 5/8 TUBE (6) | MS51825-7 | | | | |
| SLEEVE 3/4 TUBE (6) | MS51825-8 | | | | |
| TEE 1/4 TUBE, SWIVEL ON RUN (6) | MS51854-6 | | | | |
| MISCELLANEOUS ITEMS | | | | | |
| FLEX. HOSE 1/4-18 IN. LONG (4) | MS27389E0180 | | | | |
| FLEX. HOSE 1/4-54 IN. LONG | MS27369EO540 | | | | |
| GRADUATED CYLINDER 25 ML (2) | MS35943-4 | | | | |
| MISCELLANEOUS ITEMS — CONTINUED | | | | | |
| SQUEEZE BOTTLE 500 ML (2) | MS36070-2 | | | | |
| FUNNEL, POLYSTYRENE (2) | MS36577-5 | | | | |
| VALVE, SHUTOFF (1) | 7358551 | | | | |
| BLEED VALVE, SUPERELEVATION ACTUATOR (2) | 10924277 | | | | |
| BLEED VALVE, ELEVEATING MECHANISM (2) | 10924279 | | | | |
| STEEL TUBING 1/4 IN. 2 FEET | | | | | |
| STEEL TUBING 3/8 IN. 1 FOOT | | | | | |
| STEEL TUBING 1/2 IN. 1 FOOT | | | | | |
| STEEL TUBING 5/8 IN. 1 FOOT | | | | | |
| STEEL TUBING 3/4 IN. 1 FOOT | | | | | |

*Table 2-1. Special Tools, Test, and Support Equipment (Including Fabricated Items)*

| Item | NSN or reference no. | Reference Fig no. | Reference Para no. | Use | Fig |
|---|---|---|---|---|---|
| DRILL NO. 78-1 PKG. | | | | | |
| PLASTIC TUBING 1/4 IN. ID-10 FEET | | | | | |
| PLASTIC TUBING 3/8 IN. ID-10 FEET | | | | | |
| M3 HYDRAULIC PUMP (1) | 7550132 | | | Used for hydraulic tests of components. | |
| FILTER (3000 PSI) (1) | MS28720-4 | | | Used with M3 hydraulic pump. | |
| FILTER ELEMENT (1/2 GPM) (1) | AN6235-1A | | | Used with M3 hydraulic pump. | |
| FILTER O-RING (1) | | | | Used with M3 hydraulic pump. | |
| PIPE 1/4 IN. 18 NPT 4 IN. LONG (1) | | | | Used to adapt filter to hydraulic pump. | |

*Fabricated drawings in this manual.

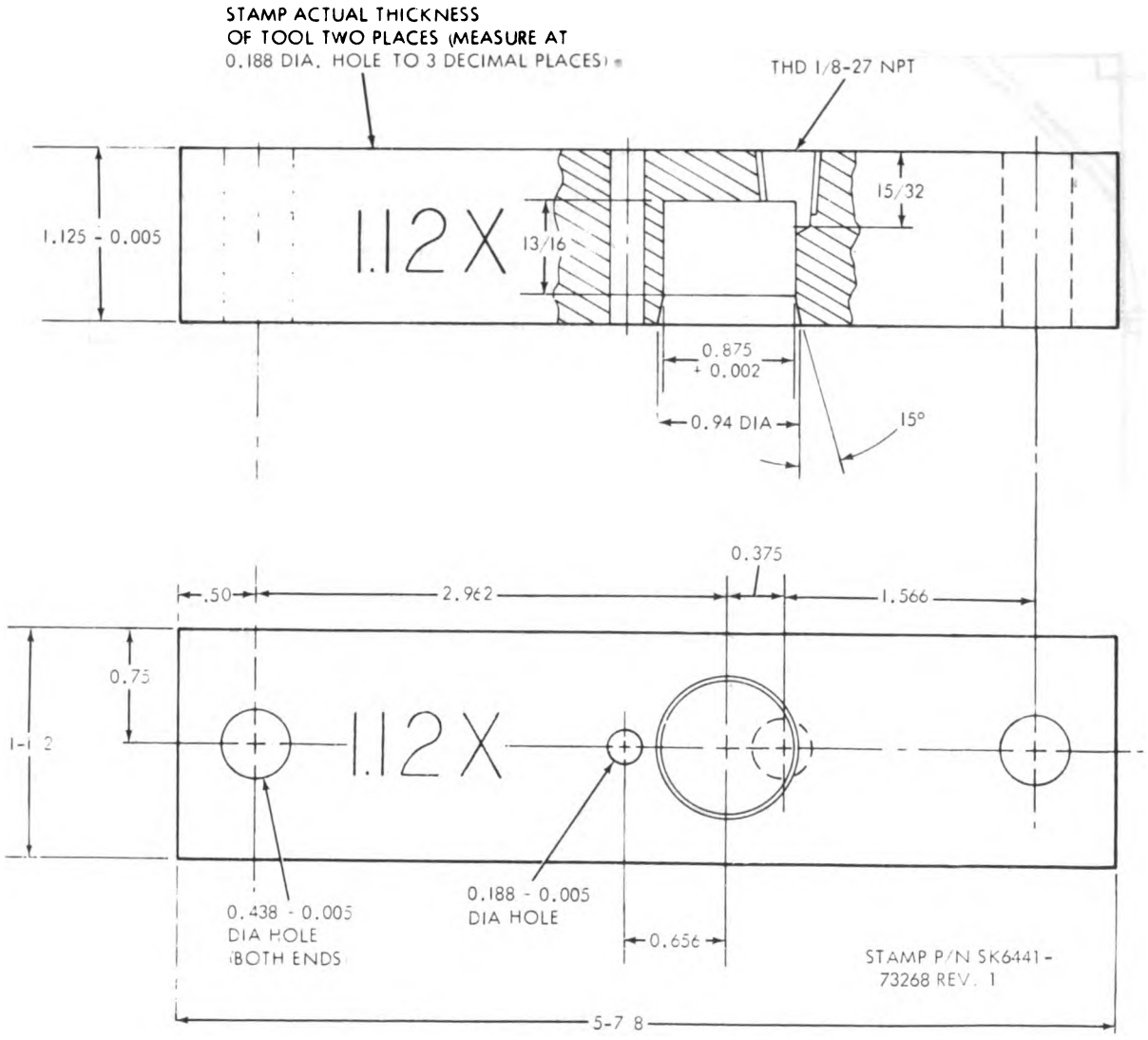



NOTE:

1. ALL DIMENSIONS ARE IN INCHES.
2. MATERIAL: 1015/1025 STEEL.
3. CHANNEL BRACES.
4. MAKE FROM CHANNELS WELDED IN BOX SECTION.
5. TOL: FRACTIONS ± 1/16 INCH
6. BREAK SHARP EDGES.

AR905961

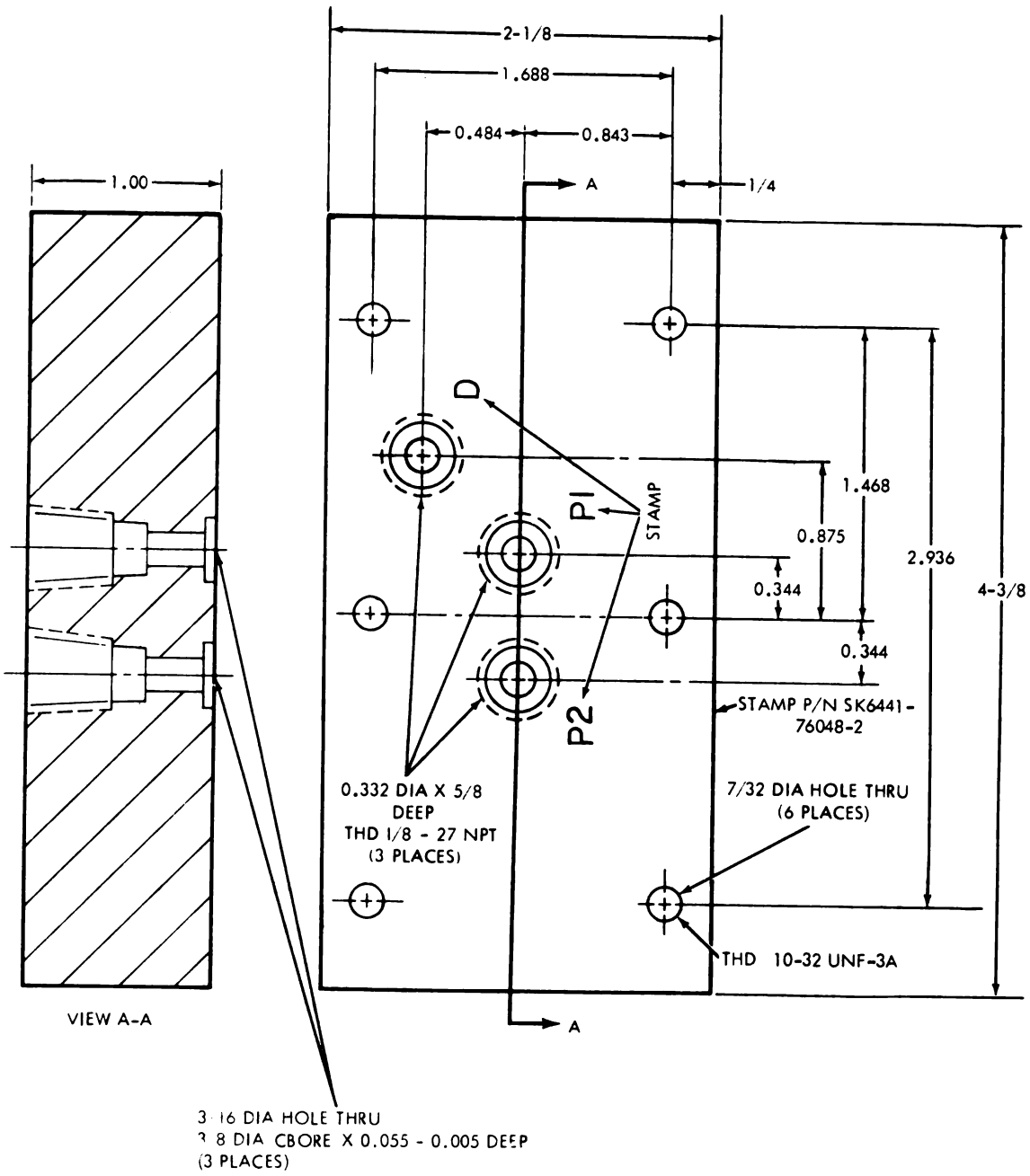
*Figure 2-1. Stand, turret.*




NOTE
1. ALL DIMENSIONS ARE IN INCHES.
2. MATERIAL: 1020/1030 STEEL.
3. TOL: 3 PC DEC ± 0.005, 2 PC DEC ± 0.02 FRACTIONS ± 1/32.
4. SURFACE FINISH: 125 RMS
5. BREAK SHARP EDGES AND REMOVE BURS.

AR905962

*Figure 2-2. Fixture, power pack filter test and adjustment.*




NOTE:

1. ALL DIMENSIONS ARE IN INCHES.
2. MATERIAL: 1020/1030 STEEL.
3. TOL: 3 PL DEC ± 0.005, 2 PL DEC ± 0.02, FRACTIONS ± 1/32.
4. SURFACE FINISH: 125 RMS.
5. BREAK SHARP EDGES AND REMOVE BURS.

AR905963

*Figure 2-3. Manifold, manual elevation pump test.*

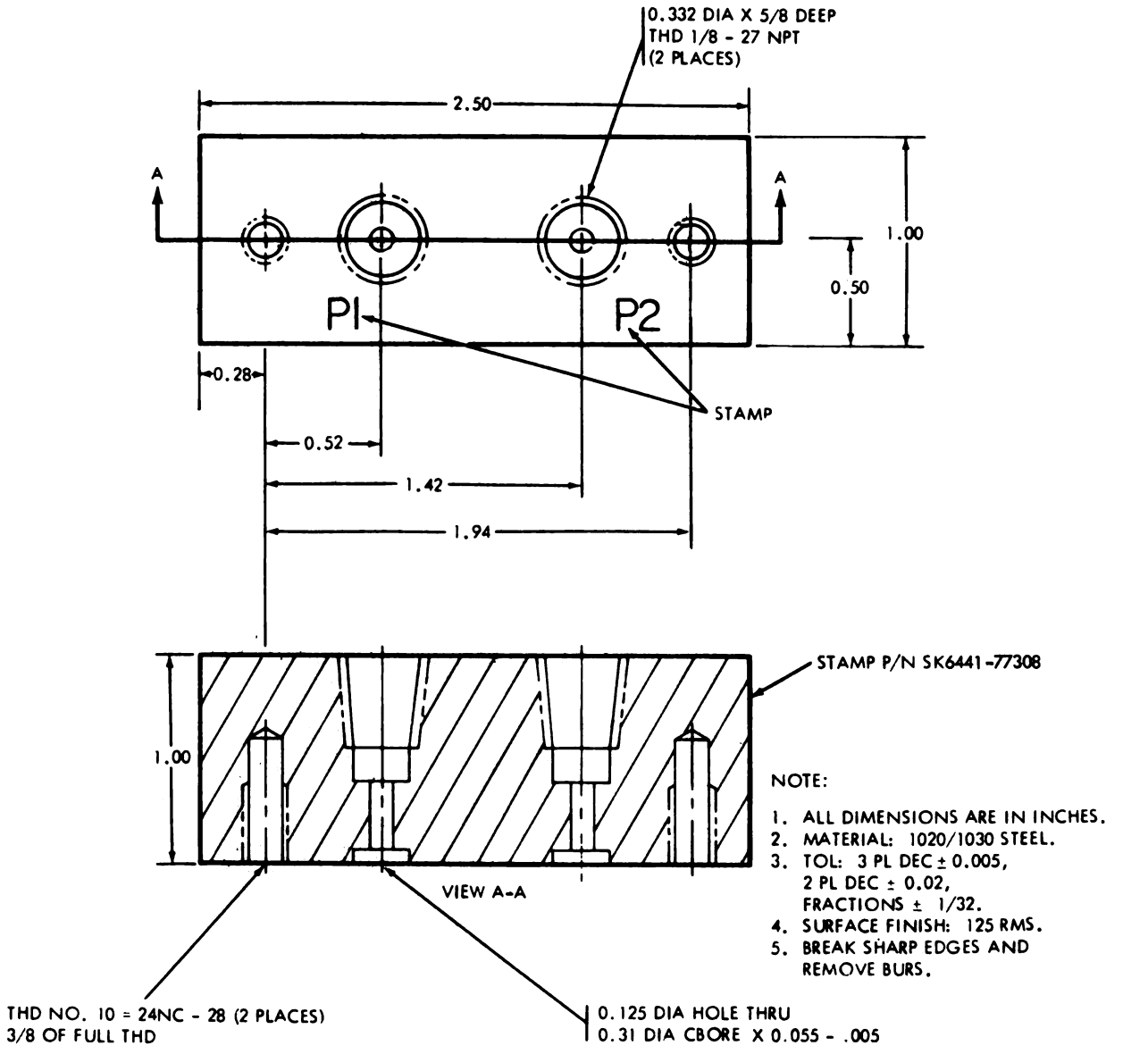



*Figure 2-4. Manifold, manual elevation pump shuttle valve test.*

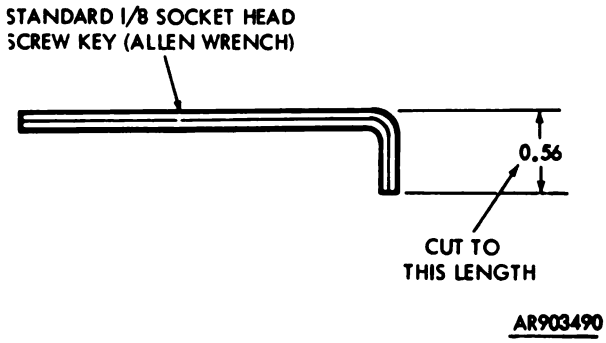
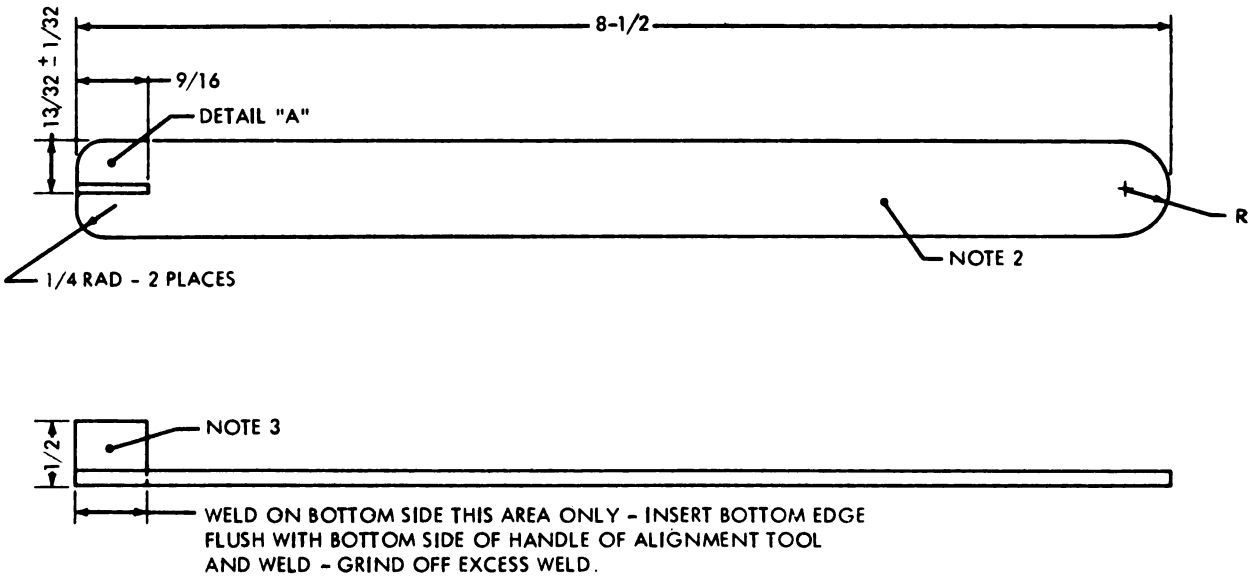
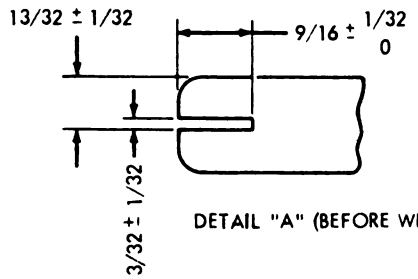



*Figure 2-5. Screw key (allen wrench) modified socket head.*




1. ALL DIMENSIONS ARE IN INCHES
2. MATERIAL: 1015/1025 STEEL, U.S. STANDARD SHEET METAL GAGE NO. 13 (.0937 INCH THICK), 3/4 INCH WIDE
3. MATERIAL: 4140 STEEL, U.S. STANDARD SHEET METAL GAGE NO. 16 (.0625 INCH THICK)
4. TOLERANCE: ± 1/16 INCH (IF NOT NOTED OTHERWISE)
5. BREAK ALL SHARP EDGES




AR905965

*Figure 2-6. Alinement tool — power pack pump dc motor coupling.*

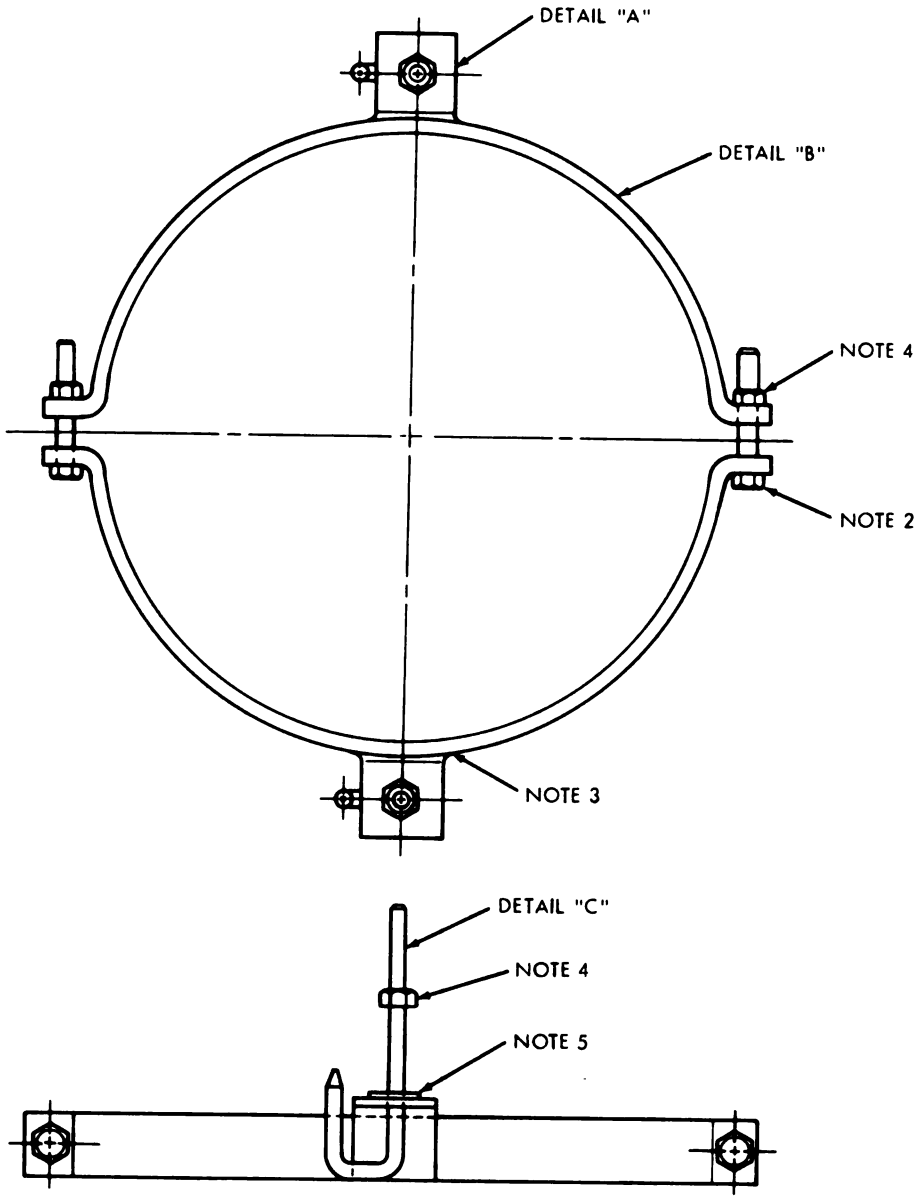
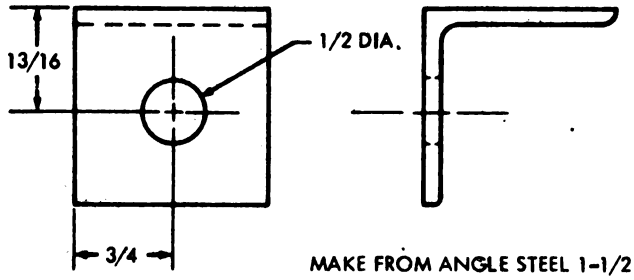
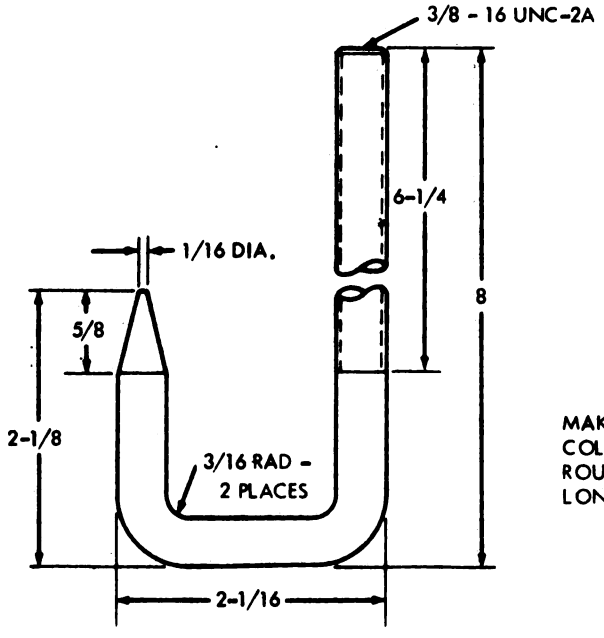



*Figure 2-7. Installation tool — power pack pump dc motor (1 of 3).*




MAKE FROM ANGLE STEEL 1-1/2 x 1-1/2 x 1/8 INCH
- 2 PIECES REQUIRED

DETAIL "A"

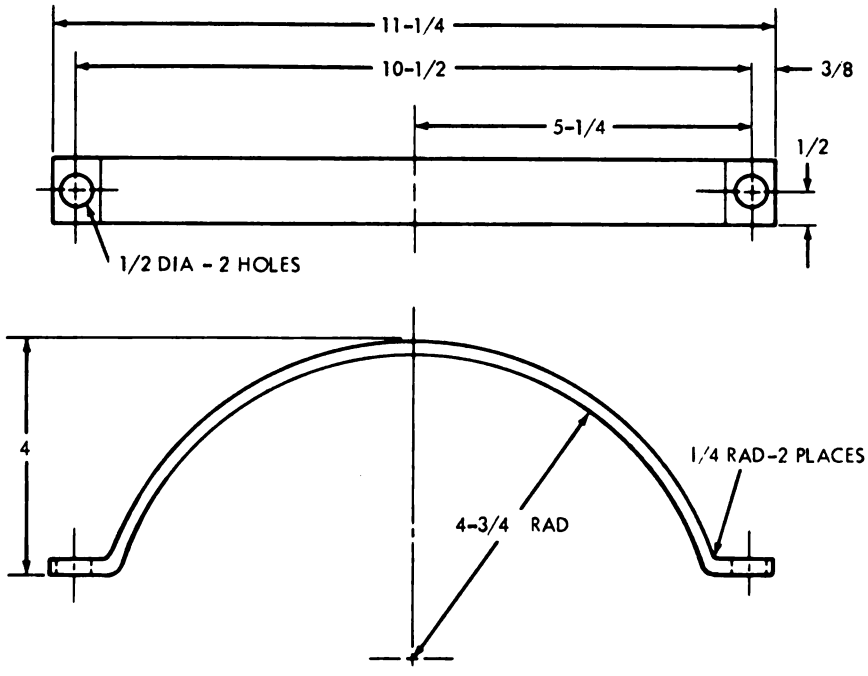



MAKE FROM MILD STEEL,
COLD ROLLED, 3/8 INCH
ROUND, APPROX. 11-1/2 INCHES
LONG - 2 REQUIRED

DETAIL "C"

AR905974

*Figure 2-7 Installation tool — power pack pump dc motor (2 of 3).*



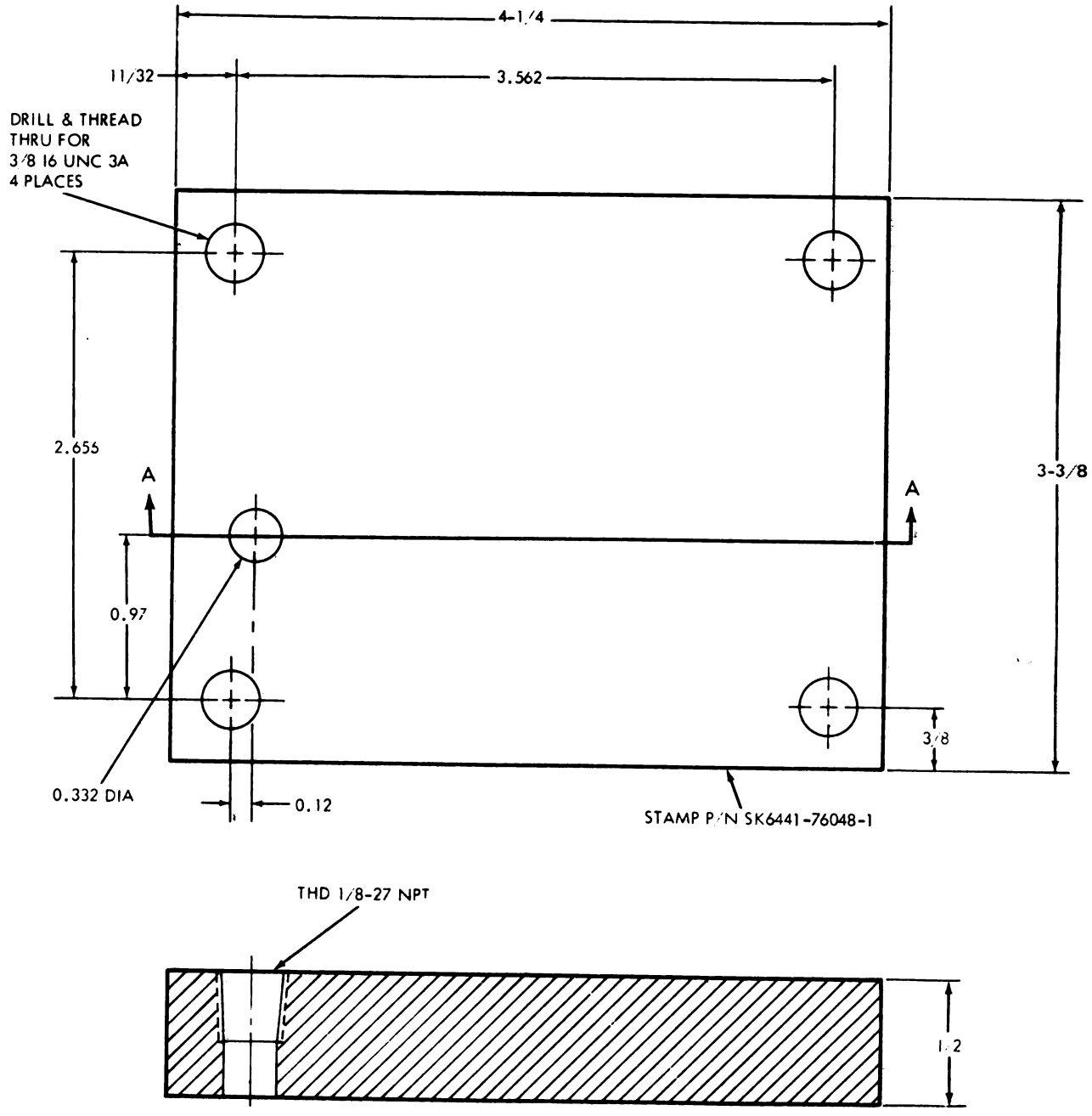

MAKE FROM MILD STEEL, HOT ROLLED FLATS, 1/4 x 1 INCH

DETAIL "B"

1. ALL DIMENSIONS ARE IN INCHES
2. SCREW, CAP, HEXAGON HEAD, MS90728-69 - 2 REQUIRED
3. WELD ON ALL FOUR (4) SIDES - 2 PLACES
4. NUT, PLAIN, HEXAGON, MS51967-8 - 4 REQUIRED
5. WASHER, FLAT, MS27183-13 - 2 REQUIRED
6. TOLERANCE: ± 1/16 INCH
7. BREAK ALL SHARP EDGES

AR905977

*Figure 2-7. Installation tool — power pack pump dc motor (3 of 3).*

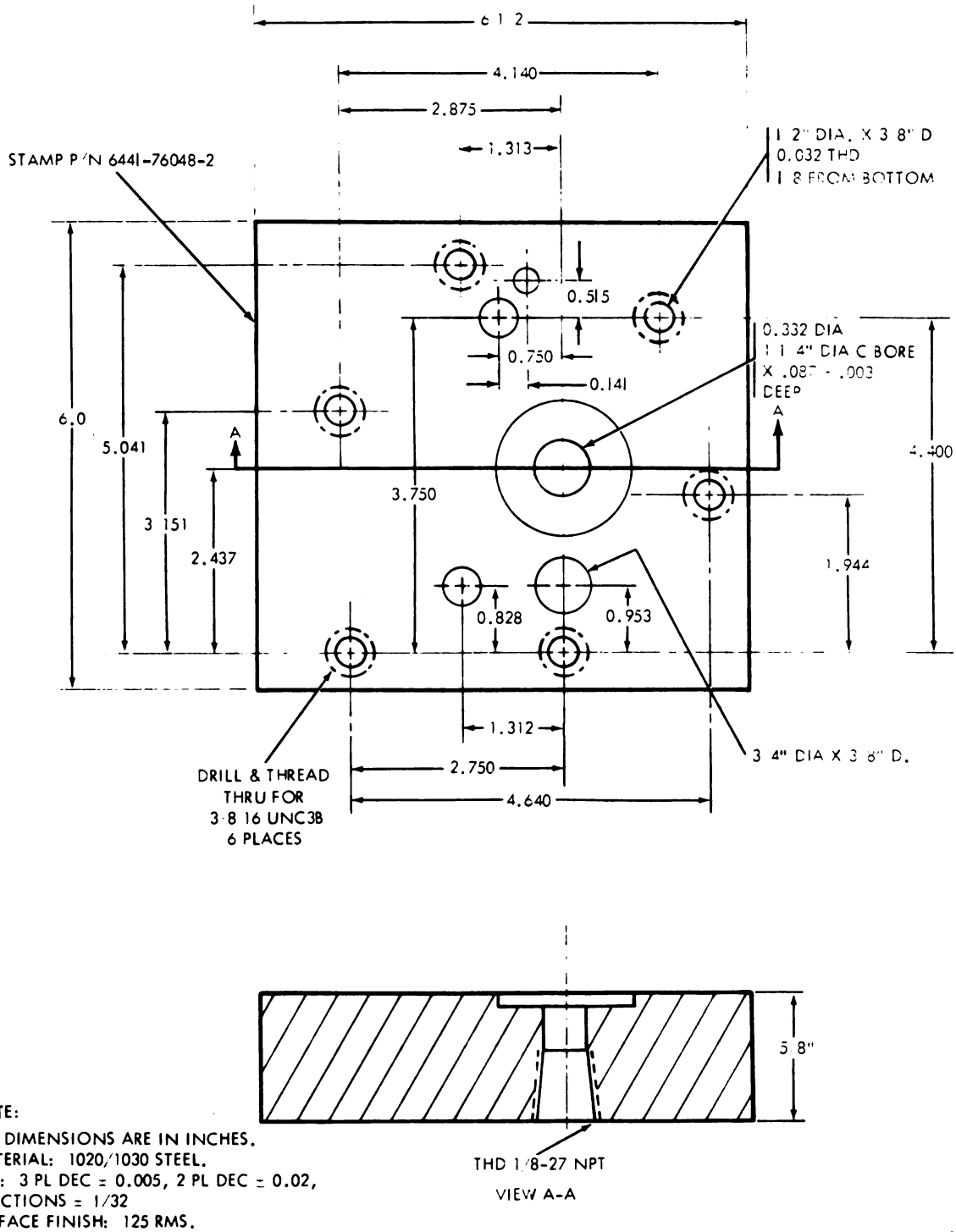



NOTE:

1. ALL DIMENSIONS ARE IN INCHES.
2. MATERIAL: 1020 1030 STEEL.
3. TOL: 3 PL DEC ± 0.005, 2 PL DEC ± 0.02, FRACTIONS ± 1/32
4. SURFACE FINISH: 125 RMS.
5. BREAK SHARP EDGES AND REMOVE BURS.

*Figure 2-8. Manifold, riser top testing.*

AR905967

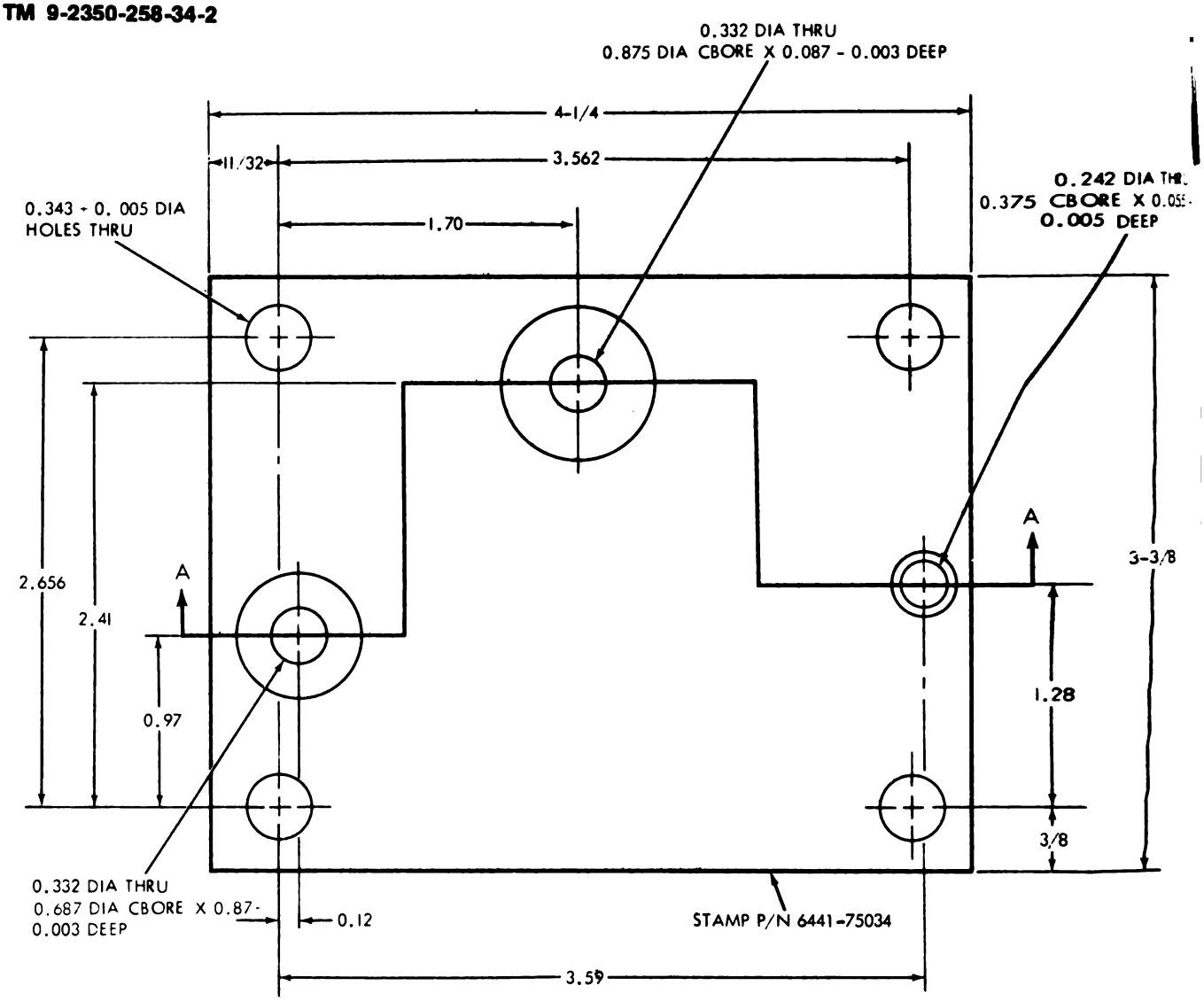


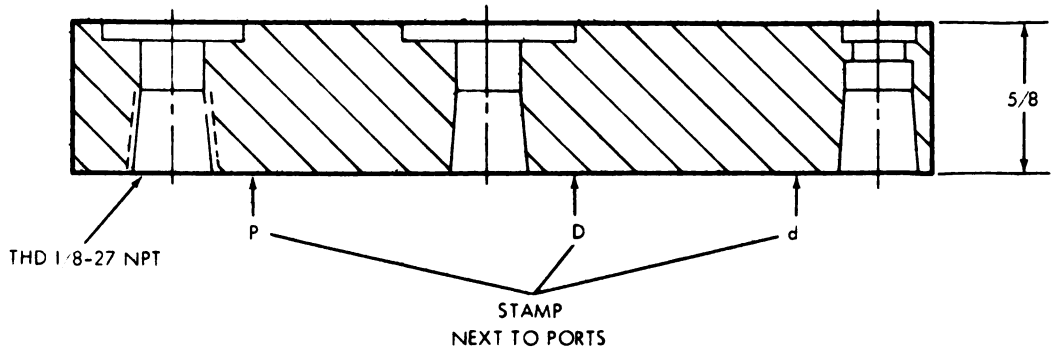

NOTE:

1. ALL DIMENSIONS ARE IN INCHES.
2. MATERIAL: 1020/1030 STEEL.
3. TOL: 3 PL DEC ± 0.005, 2 PL DEC ± 0.02, FRACTIONS ± 1/32
4. SURFACE FINISH: 125 RMS.
5. BREAK SHARP EDGES AND REMOVE BURS

AR905968

*Figure 2-9. Manifold, riser bottom testing.*



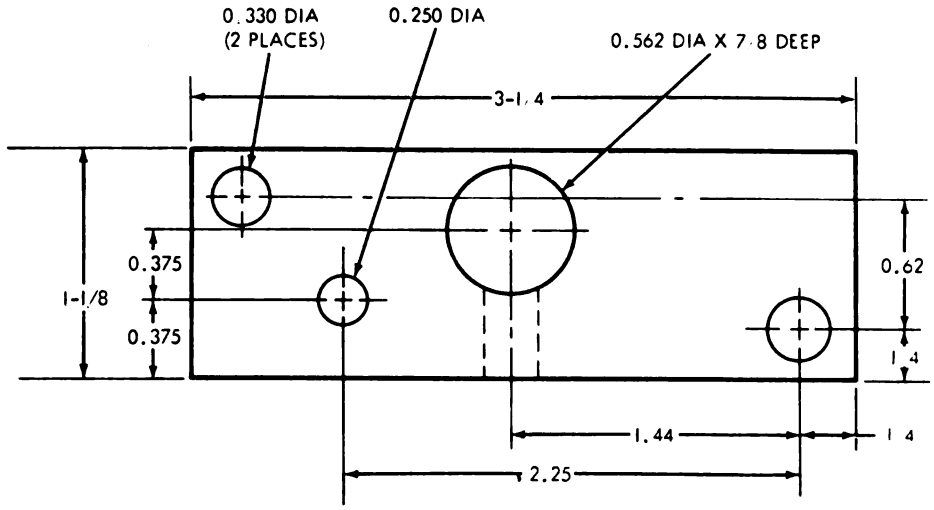

VIEW A-A

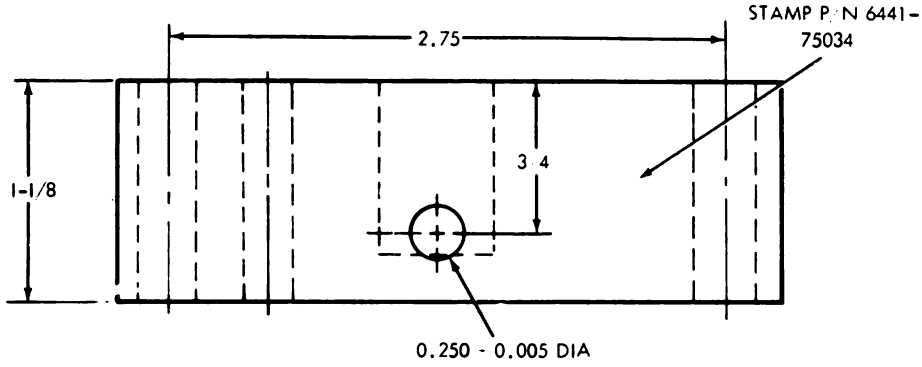
NOTE:

1. ALL DIMENSIONS ARE IN INCHES.
2. MATERIAL: 1020/1030 STEEL.
3. TOL: 3 PL DEC ± 0.005, 2 PL DEC ± 0.02, FRACTIONS ± 1/32
4. SURFACE FINISH: 125 RMS.
5. BREAK SHARP EDGES AND REMOVE BURS.

AR905969

*Figure 2-10. Manifold, hydraulic control valve testing*

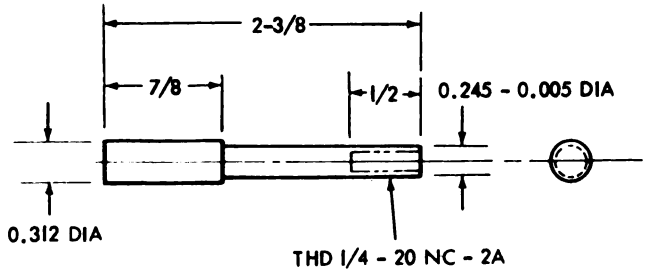



NOTE:
1. ALL DIMENSIONS ARE IN INCHES
2. MATERIAL: 2024 T4 ALUMINUM OR 1015/1030 STEEL
3. TOL: 3 PL DEC ± 0.010, 2 PL DEC ± 0.02,
   FRACTIONS ± 1/32
4. SURFACE FINISH: 250 RMS
5. BREAK SHARP EDGES AND REMOVE BURS

AR905970

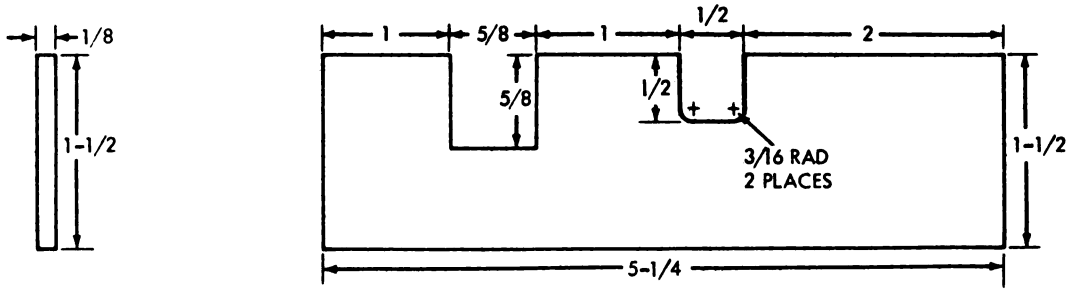
*Figure 2-11. Fixture, hydraulic control valve testing.*




NOTES:
1. ALL DIMENSIONS ARE IN INCHES
2. MATERIAL: 1015/1030 STEEL
3. TOL: 3 PL DEC ± 0.010, FRACTIONS ± 1/32 UNLESS OTHERWISE INDICATED
4. SURFACE FINISH: 125 RMS
5. BREAK SHARP EDGES AND REMOVE BURS

AR905971

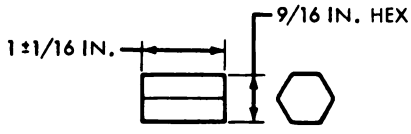
*Figure 2-12 Adapter hydraulic control valve testing*




NOTE:
1. ALL DIMENSIONS ARE IN INCHES
2. MATERIAL: 1015/1035 STEEL
3. TOLERANCES: ±1/16 INCH
4. BREAK ALL SHARP EDGES

AR905972

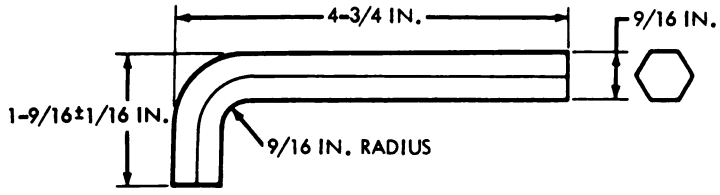
*Figure 2-13 Tool, spring compressing, gunner's control.*




9/16 IN. HEX BAR

MAKE FROM 9/16 IN. SOCKET HEAD KEY NSN 5120-00-240-5268 PROVIDED IN SC 5180-95CL-A51 AND SC 4910-95-CL-A74

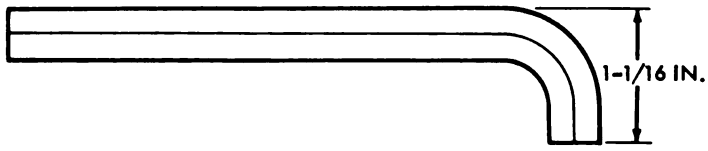
A




9/16 IN. SOCKET HEAD KEY (ALLEN WRENCH)

MAKE FROM 9/16 IN. SOCKET HEAD (ALLEN WRENCH) KEY NSN 5120-00-240-5268 PROVIDED IN SC 5180-95-CL-A51 AND SC 4910-95-CL-A74

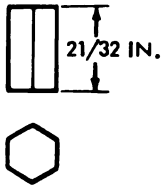
B




3/8 IN. SOCKET HEAD KEY (ALLEN WRENCH)

MAKE FROM KEY, SOCKET HEAD SCREW: HEX: 3/8 INCH NSN 5120-00-198-5390

C




NOTE:
1. TOOL "D" IS MADE FROM PIECE CUT OFF FROM TOOL "A"
2. TOLERANCE: ±1/32 INCH

3/8 IN. HEX BAR

D

AR905973

*Figure 2-14. Wrench, allen, cupola and pipe plug removal.*

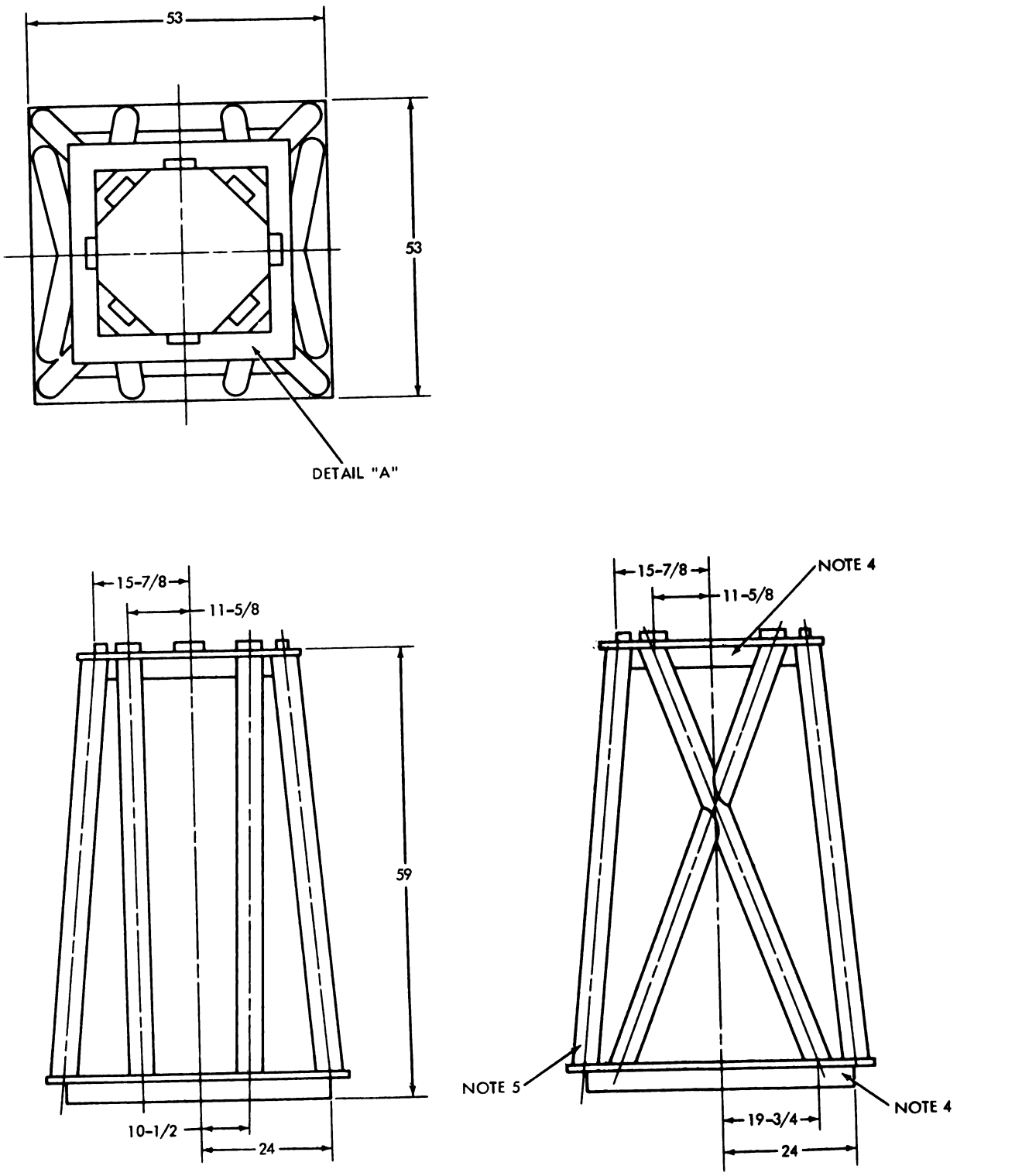
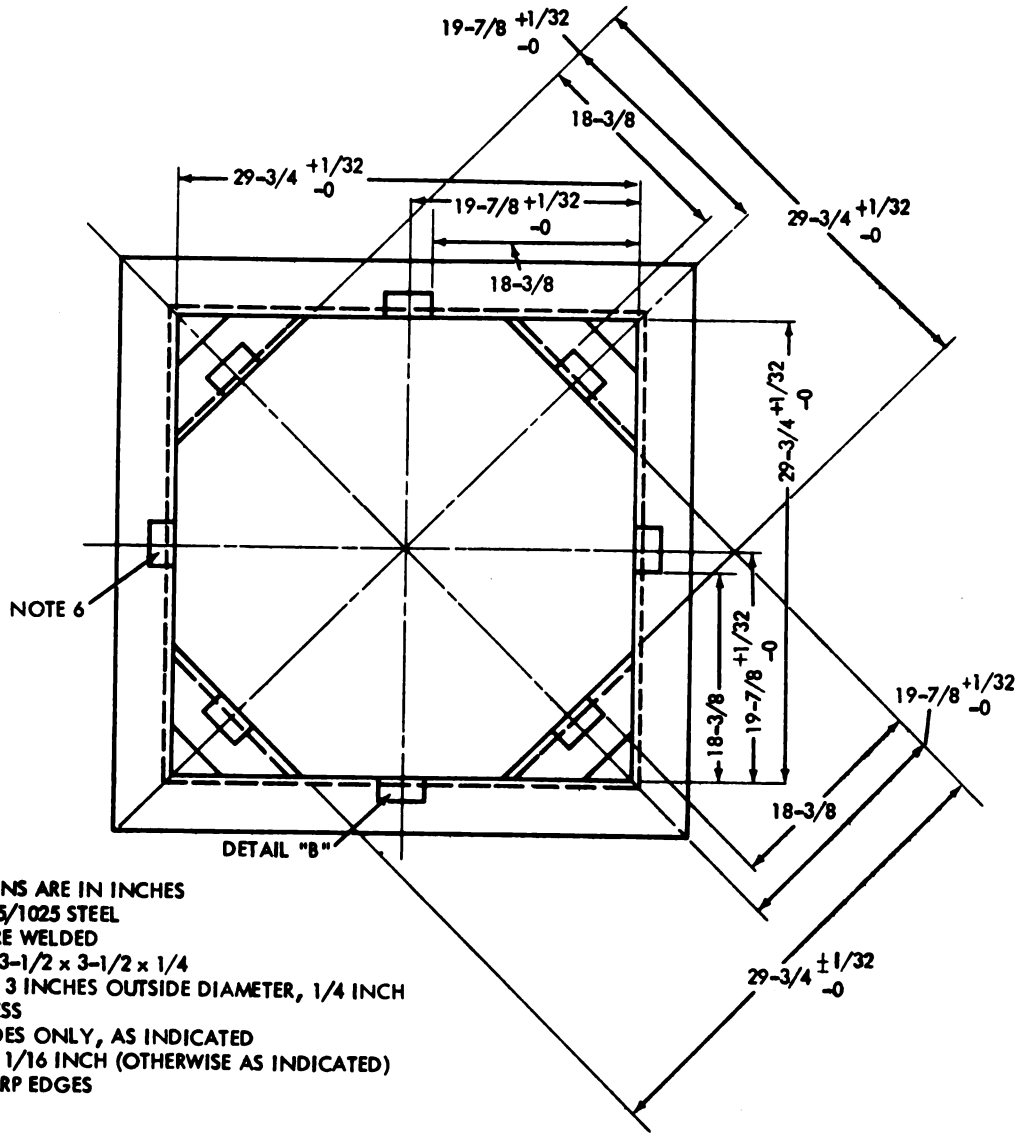


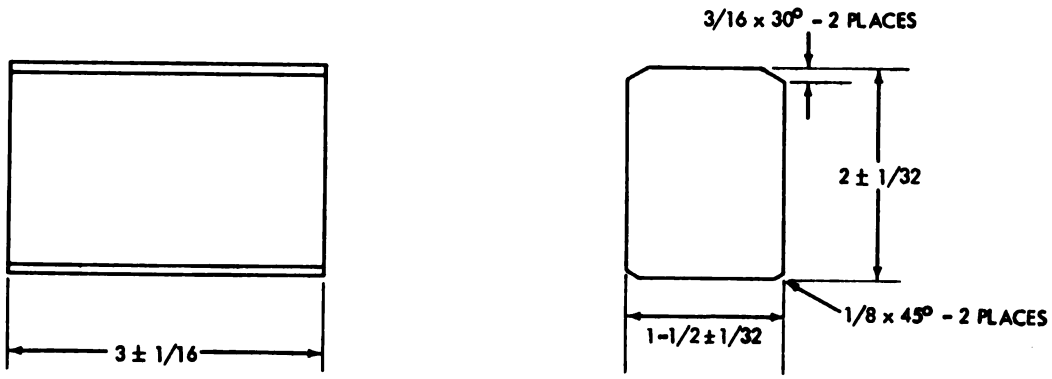

*Figure 2-15 Stand cupola (1 of 2)*




NOTE:

1. ALL DIMENSIONS ARE IN INCHES
2. MATERIAL: 1015/1025 STEEL
3. ALL JOINTS ARE WELDED
4. ANGLE STEEL: 3-1/2 x 3-1/2 x 1/4
5. STEEL TUBING: 3 INCHES OUTSIDE DIAMETER, 1/4 INCH WALL THICKNESS
6. WELD ON 3 SIDES ONLY, AS INDICATED
7. TOLERANCE: 1/16 INCH (OTHERWISE AS INDICATED)
8. BREAK ALL SHARP EDGES

DETAIL "A"




DETAIL "B"

AR905976

*Figure 2-15. Stand, cupola (2 of 2).*

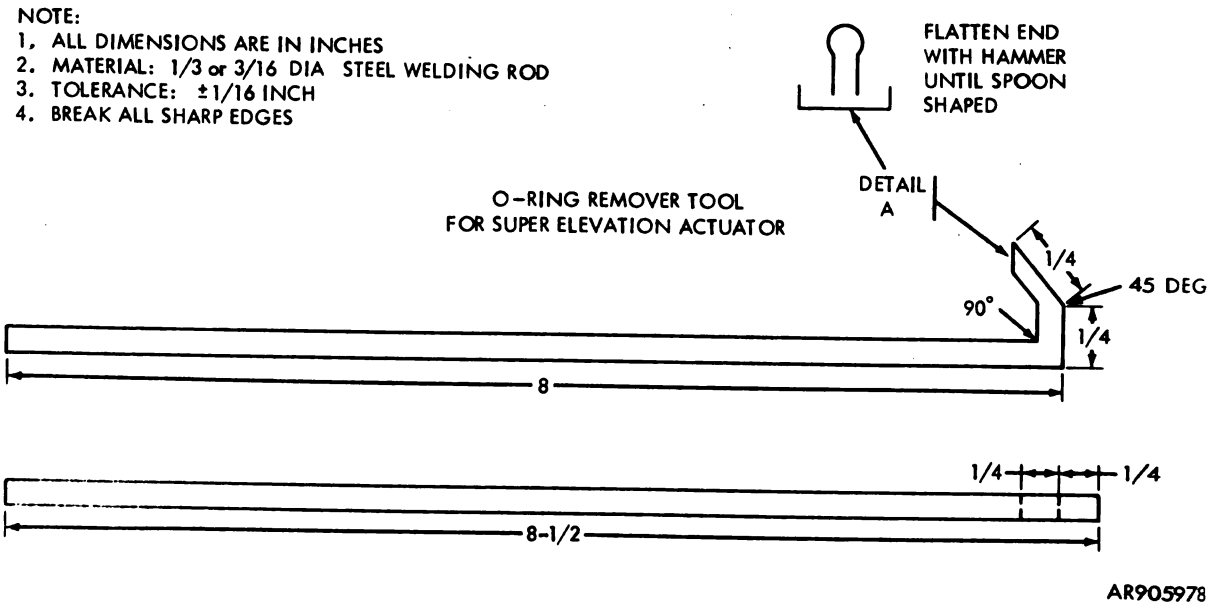



Figure 2-16. Tool, o-ring remover for superelevation actuator

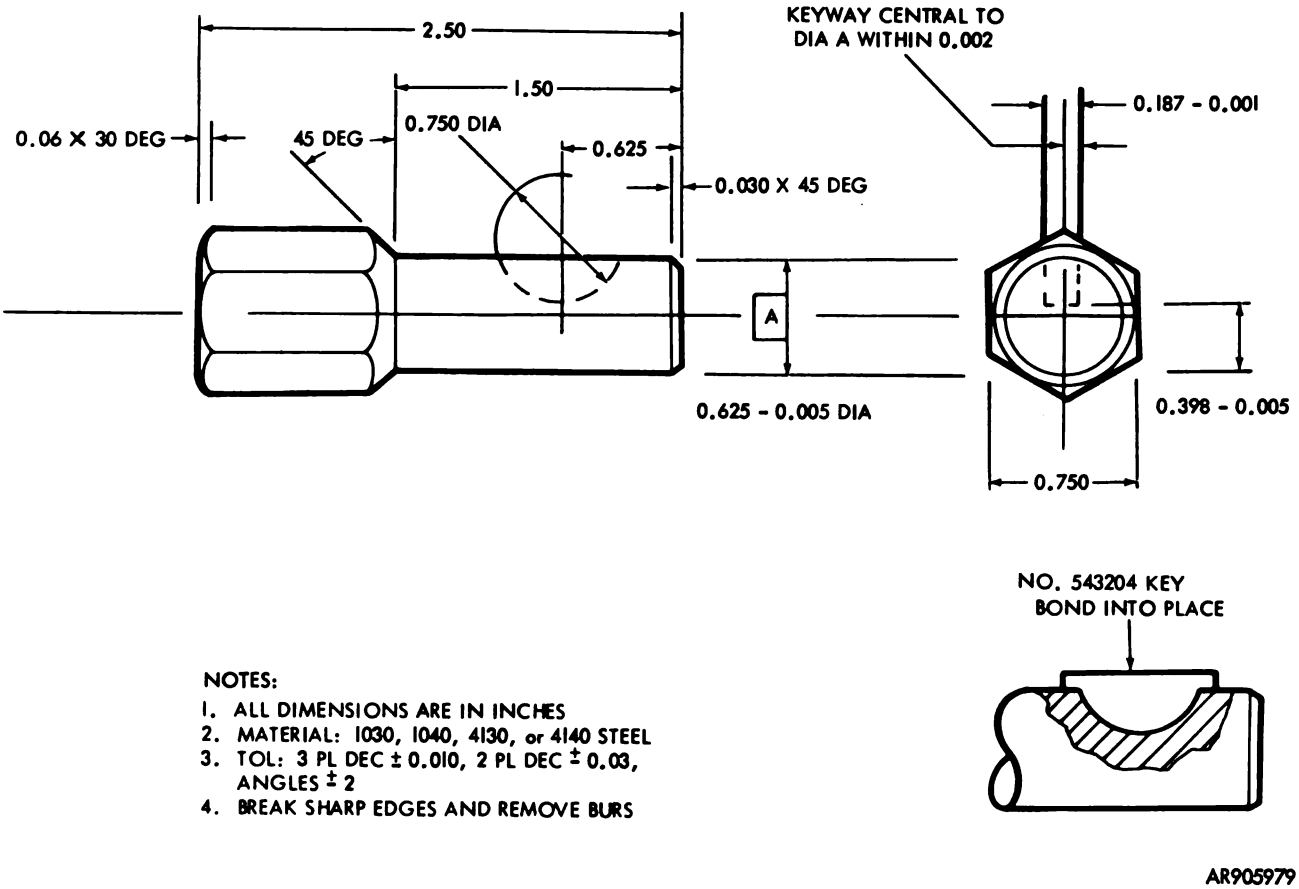



*Figure 2-17. Adapter, torque wrench, traverse gearbox magnetic brake.*

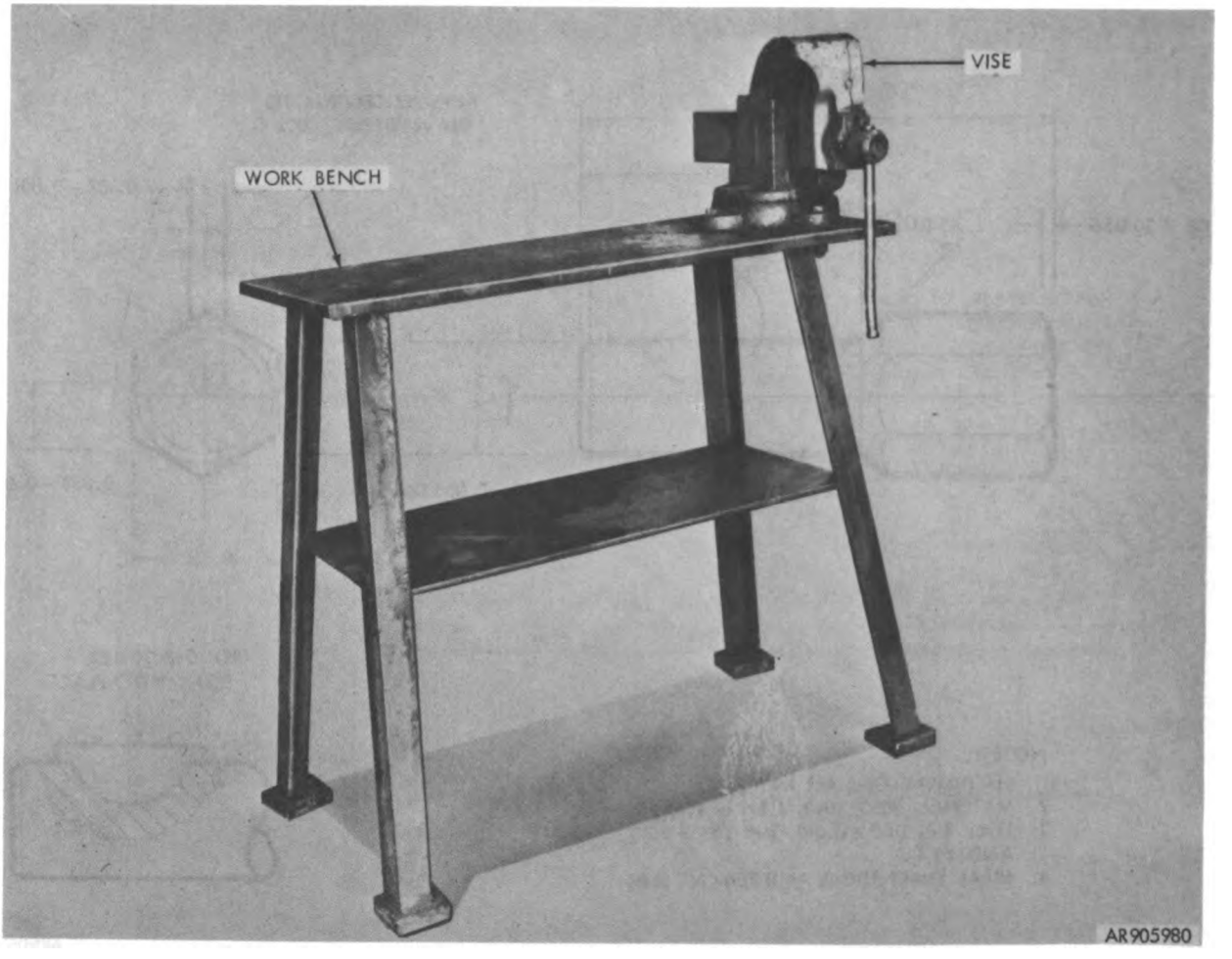



*Figure 2-18. Stand, portable, electrical test.*

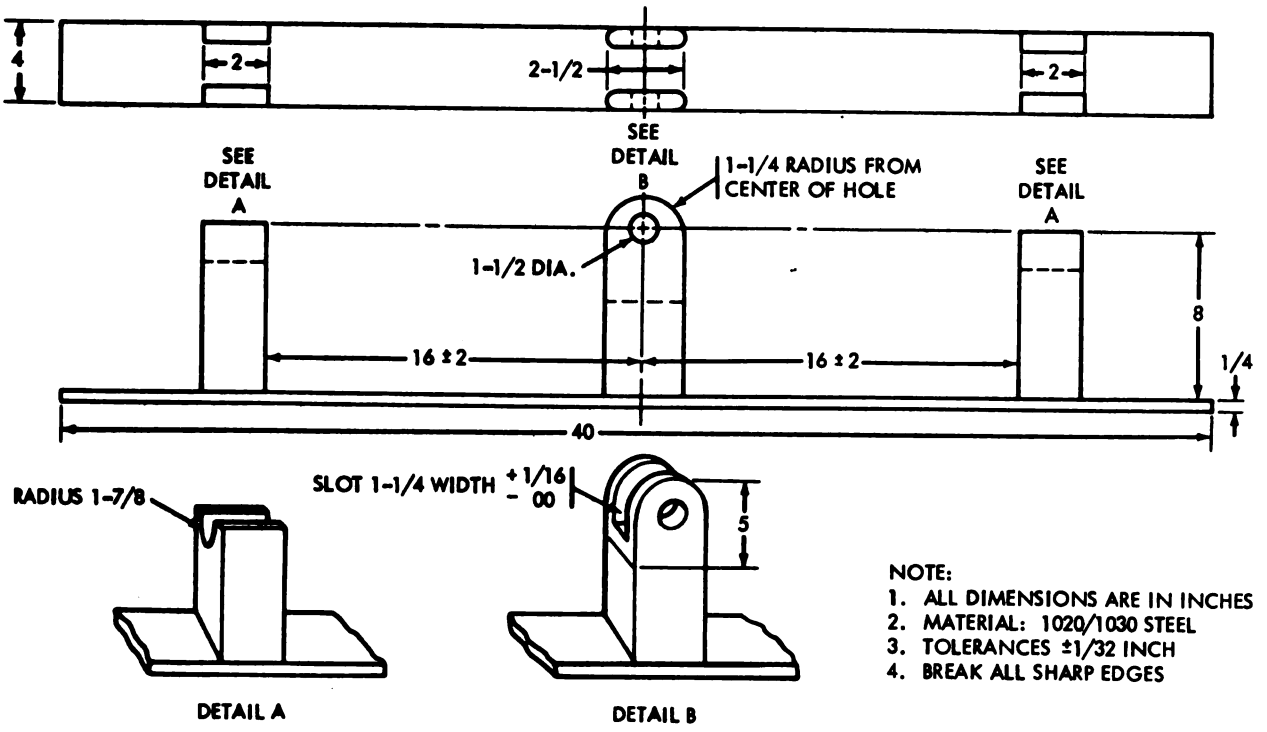
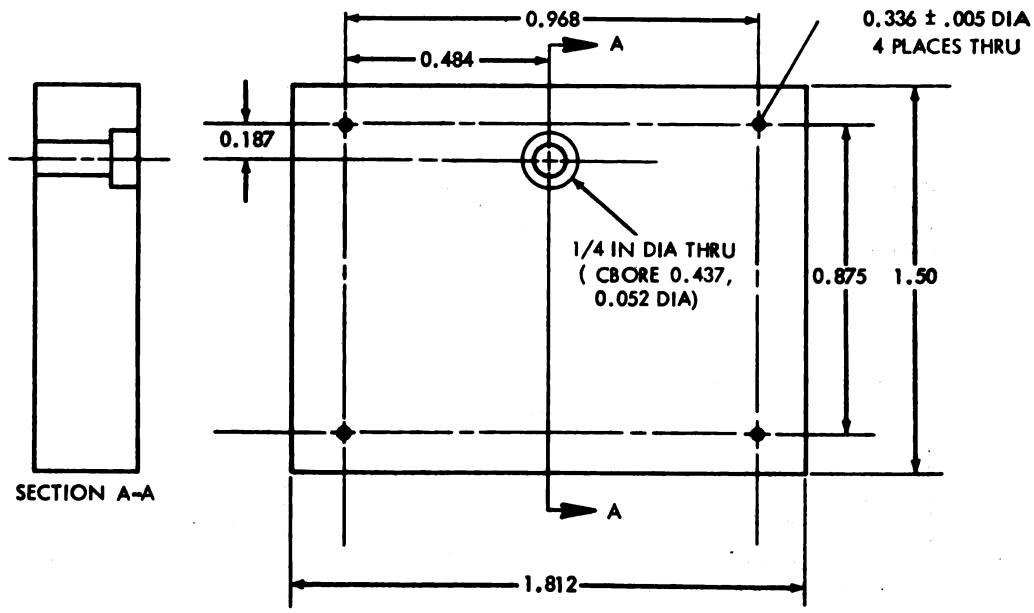



*Figure 2-19. Fixture, elevating cylinder testing*




2 EA WITH COUNTERBORE - MANIFOLD
2 EA WITHOUT COUNTERBORE - CYLINDER

NOTES:
1. ALL DIMENSIONS ARE IN INCHES.
2. MATERIAL: 1020/1030 STEEL.
3. TOL: 3 PL DEC ± 0.005, 2 PL DEC ± 0.07, FRACTIONS ±1/32
4. SURFACE FINISH: 125 RMS.
5. BREAK SHARP EDGES AND REMOVE BURS.

AR905982

*Figure 2-20. Manifold elevating cylinder.*

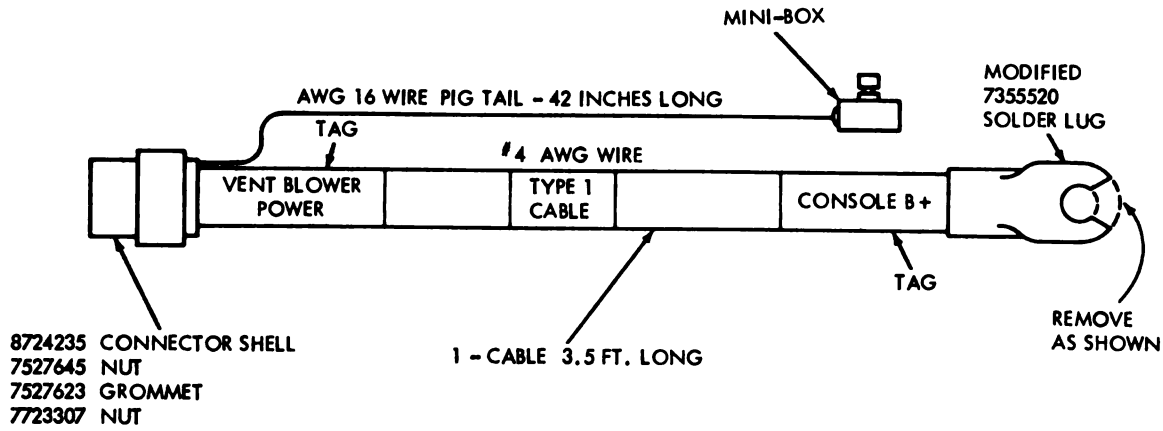



*Figure 2-21. Cable, electrical test, type no. 1.*

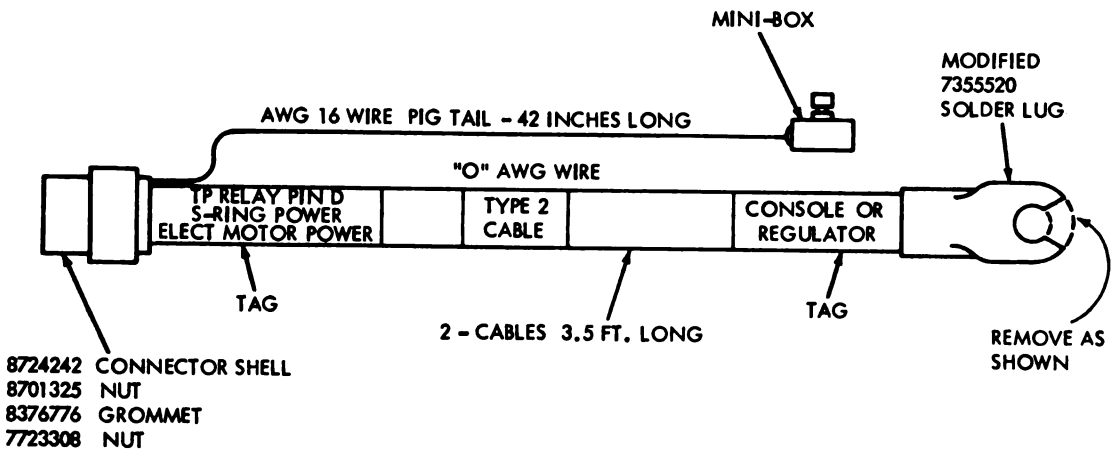



*Figure 2-22. Cable, electrical test, type no. 2.*

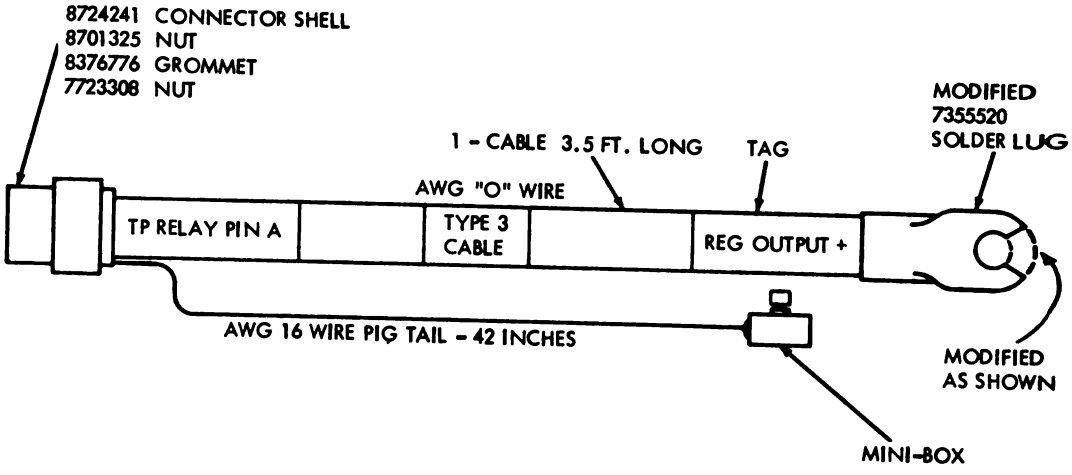



*Figure 2-23. Cable, electrical test, type no. 3.*

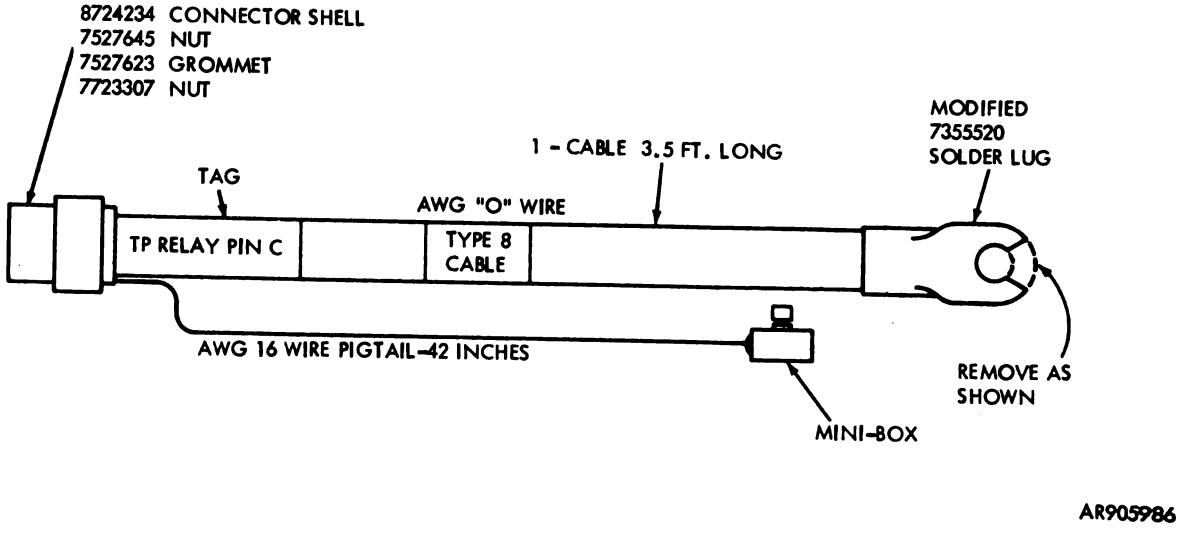



*Figure 2-24. Cable, electrical test, type no. 8.*

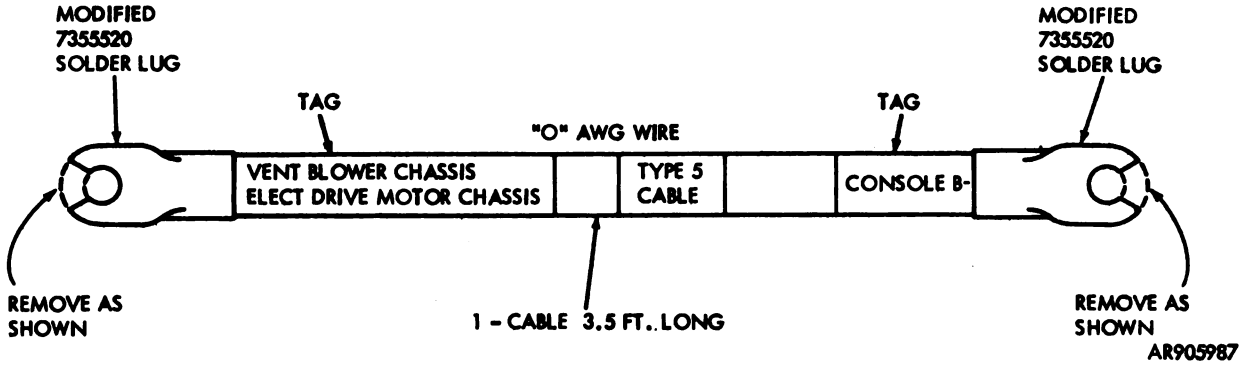



*Figure 2-25. Cable, electrical test, type no. 5.*

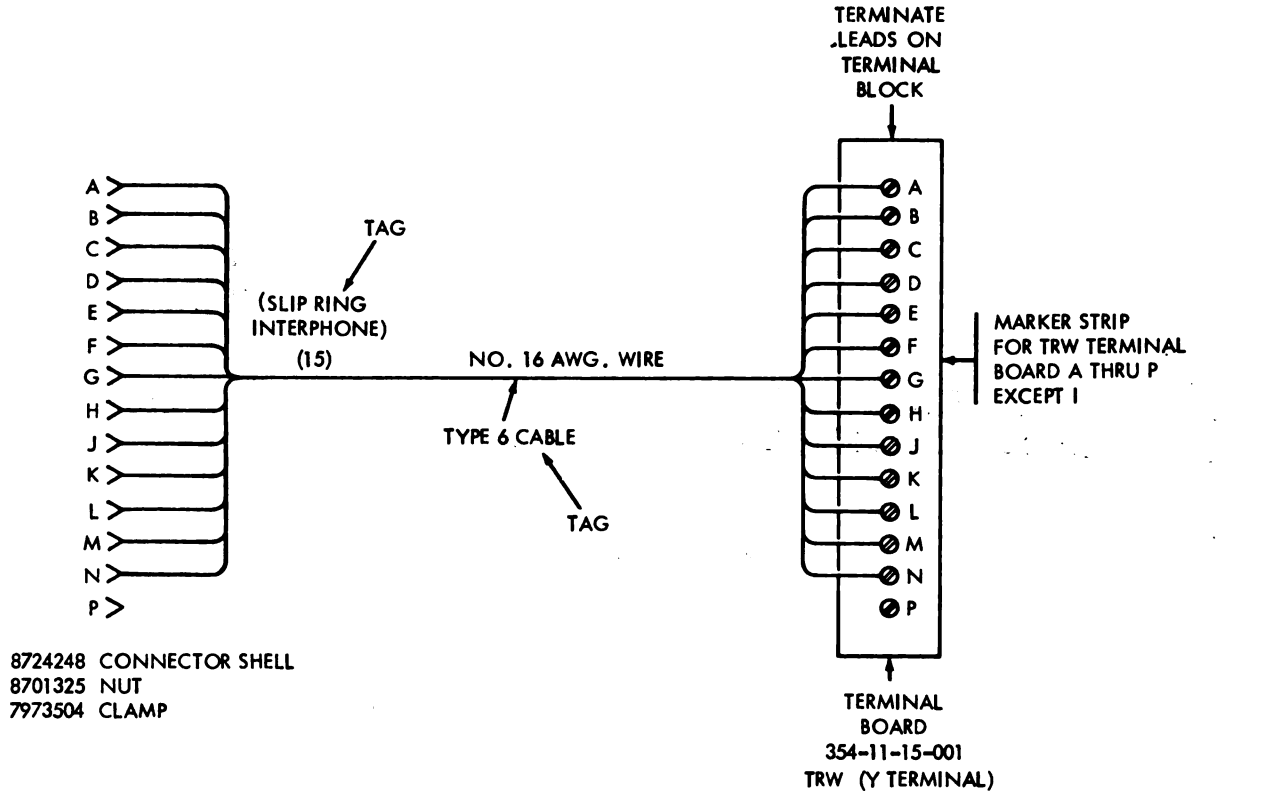
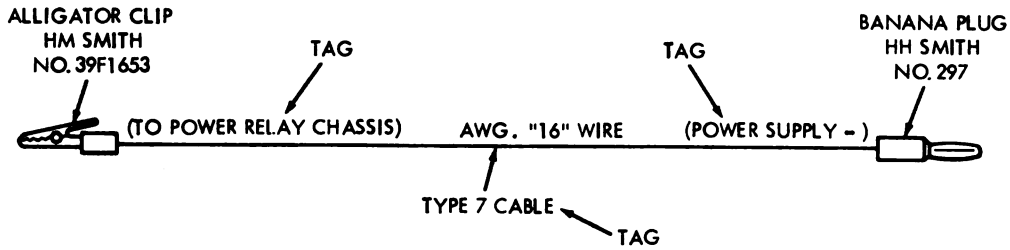


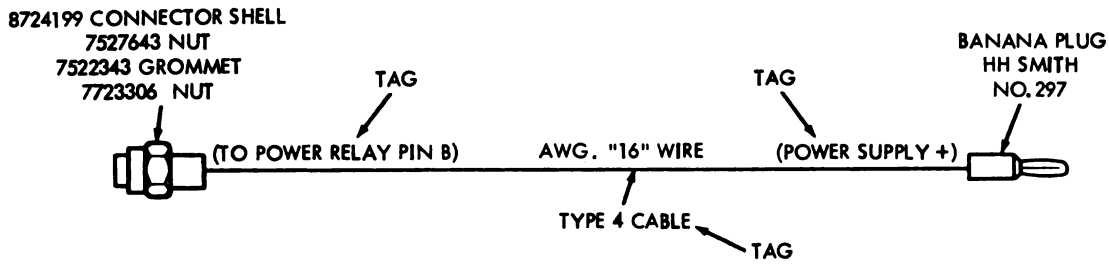

*Figure 2-26. Cable, electrical test, type no. 6.*




2 - CABLE 3.5 FT. LONG

AR905989

*Figure 2-27. Cable, electrical test, type no. 7.*




1 - CABLE 3.5 FT. LONG

AR905990

*Figure 2-28. Cable, electrical, test, type no. 4*

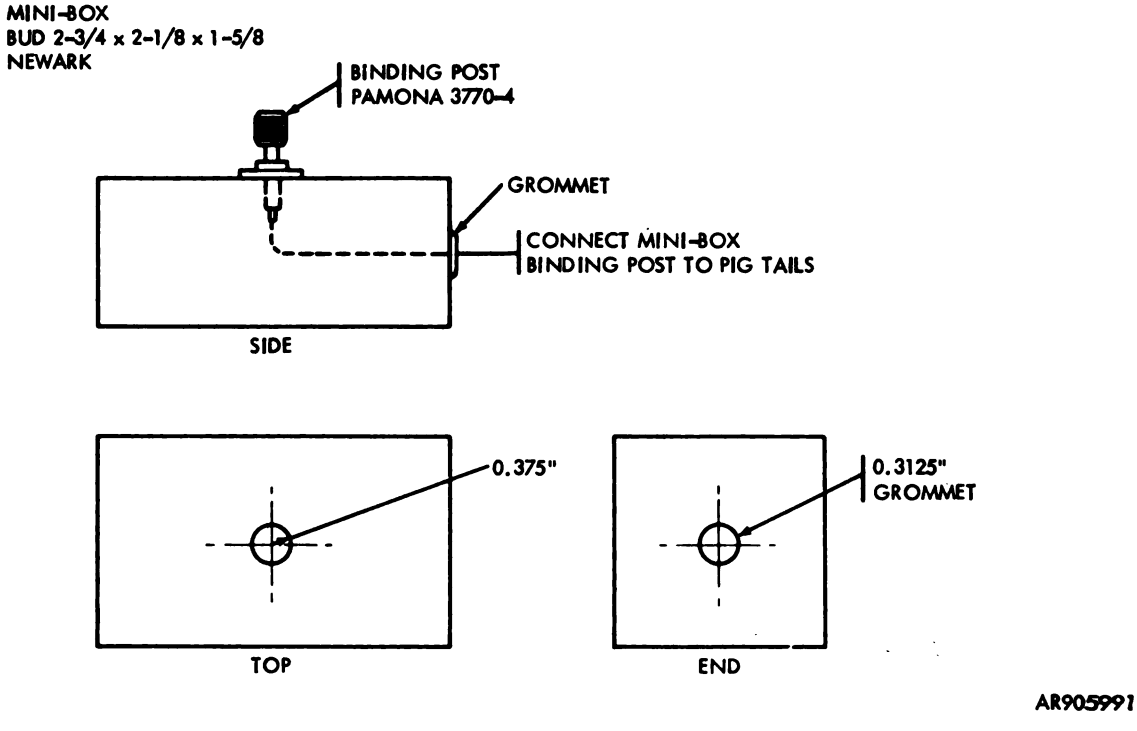



*Figure 2-29. Box, test cable attachment.*

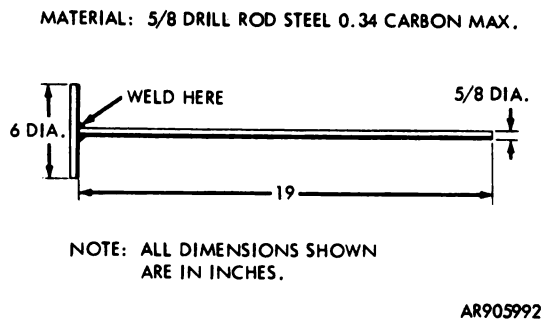



*Figure 2-30. Replenisher push rod.*

## Section III. TROUBLESHOOTING

**2-6. General.** This section contains information for locating and correcting troubles that may develop in the turret systems. If a specific trouble, test, and remedy is not covered, proceed to isolate the system in which the trouble occurs. Then locate the defective component. Standard armament procedures apply to troubleshooting weapons. Use all senses and methods to observe and locate symptoms of trouble. The more symptoms that can be evaluated and the more detailed the knowledge of conditions under which they occurred, the easier it is to isolate the defect.

**2-7. System Malfunctions List (table 2-2).** Typical system malfunctions are listed in table 2-2. Only specific malfunctions which may occur during operation or inspection of the turret are listed. Use the list to locate the page number of the malfunction in the troubleshooting table.

**2-8. Troubleshooting.** Table 2-3 contains system troubleshooting procedures. Troubleshooting procedures for the assembly or component level are included elsewhere in the manual when applicable.

**NOTE**

Be sure applicable troubleshooting procedures specified in TM 9-2350-258-20-2 have been performed prior to conducting troubleshooting procedures contained in this manual.

*Table 2-2. System Malfunctions*



*Vehicles serial numbered A3001 thru A3374
**Vehicles serial numbered A1001 thru A1999 and vehicles Serial numbered A3375 thru A3999.

*Table 2-3. Troubleshooting*

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

HYDRAULIC SYSTEM — MANUAL MODE

1. TURRET TRAVERSING DEFECTIVE.

Step 1. Using socket and torque wrench, apply torque to no-bak splined input shaft. Clutch should slip at a torque of 34-42 lb-ft (46-57 N.m).

*a.* If clutch is serviceable, proceed to step 2.

*b.* If clutch is unserviceable, repair clutch, (para 3-153).

Step 2. Remove traversing gearbox drive pinions (TM 9-2350-258-20-2) and test (para 3-139).

*a.* If turret race is defective, repair race (para 3-277).

*b.* If turret race is not defective, repair traversing gearbox (para 3-139).

. GUN ELEVATING DEFECTIVE.

Step 1. Remove manual elevation pump shuttle valve (para 2-27).
Test (para 3-64).
*a.* If shuttle valve is serviceable, reinstall valve and proceed to step 2.
*b.* If shuttle valve is unserviceable, repair valve (para 3-62).

Step 2. Test and replace manual elevation pump, if defective (para 2-26).
If malfunction is not corrected, manual elevation lock valve on elevation mechanism is defective.
Replace lock valve (para 3-174).

Step 3. Hand elevating pump handle spins when released.
Check power pack check valve.

HYDRAULIC SYSTEM — POWER MODE

3. ZERO OR LOW HYDRAULIC PRESSURE.
Hydraulic Pump or Power Pack Pump Motor Noisy.

Step 1. Remove power pack pump dc motor and inspect coupling for damage (para 2-31).
*a.* If damaged, replace coupling.
*b.* If coupling is not damaged, proceed to step 2.

Step 2. Test motor (para 3-133).
*a.* If motor functions properly replace pump (para 2-32).
*b.* If motor does not function properly, repair motor.

4. INOPERATIVE OR ERRATIC TRAVERSING.

Step 1. Disconnect hydraulic tube from port D5 of pin lock. Place finger over port and turn turret power switch ON and OFF several times.
*a.* If alternate pressure and vacuum is felt, proceed to step 2.
*b.* If alternate pressure and vacuum is not felt, remove and repair pin lock (TM 9-2350-258-20-2).

Step 2. With TURRET POWER switch in OFF position, connect a multimeter between pin A of magnetic brake electrical receptacle and ground. Place multimeter function switch to ohms and measure resistance of magnetic brake coil. Meter should indicate 37 to 39 ohms.
*a.* If reading is correct, proceed to step 3.
*b.* If reading is not correct, the magnetic brake coil is defective. Replace magnetic brake (para 3-137*h*).

Step 3. Remove no-bak (TM 9-2350-258-20-2). Using socket and torque wrench, apply torque to no-bak splined input shaft. Maximum torque required to rotate shafts should be 13-19 lb-in. (1.5-2.1 N.m).
*a.* If no-bak is serviceable, proceed to step 4.
*b.* If no-bak is unserviceable, repair no-bak (para 3-146 and TM 9-2350-258-20-2).

Step 4. Install no-bak (TM 9-2350-258-20-2). Using socket and torque wrench, apply torque to no-bak splined input shaft. Clutch should slip at a torque of 34-42 lb ft (46-57 N m).
*a.* If clutch is serviceable, proceed to step 5.
*b.* If clutch is unserviceable, repair clutch (para 3-153).

Step 5. Replace traversing mechanism motor (TM 9-2350-258-20-2).
If malfunction is not corrected, proceed to step 6.

Step 6. Remove traversing gearbox drive pinions (TM 9-2350-258-20-2) and test (para 3-139).
*a.* If turret race is defective, repair race (para 3-277).
*b.* If turret race is not defective, repair traversing gearbox (para 3-139).

SIGHTING AND FIRE CONTROL SYSTEM

5. MAIN GUN SYNCHRONIZATION AND/OR BACKLASH ERROR EXCESSIVE.
   Check ballistic drive installation and operation (TM 9-1220-220-34).

ARMAMENT SYSTEM

6. MAIN GUN DOES NOT RETURN TO BATTERY.
   Repair recoil mechanism (para 3-235).

*M1 CUPOLA

7. M1 CUPOLA AZIMUTH DRIVE DEFECTIVE.
   Remove cupola. Remove ring gear. Clean plastic balls and ring gear. Examine balls and ring gear for defects. Replace / repair as necessary. Reassemble and reinstall cupola (para 3-185 and 3-186).
8. M1 CUPOLA ELEVATION DRIVE DEFECTIVE.
   Step 1. Perform adjustment procedures (para 3-189). If drive is unserviceable, proceed to Step 2.
   Step 2. Disassemble cupola cradle assembly (para 3-187). Examine bearings for defects (para 3-188).
   Repair/replace as necessary. If bearings are not defective, reassemble cupola cradle assembly and perform adjustment.

**LOW-PROFILE CUPOLA

9. COMMANDER'S CUPOLA IS DIFFICULT TO TRAVERSE.
   Step 1. Check for dirt, corrosion, or debris accumulation in commander's cupola race assembly
   Clean as necessary
   Step 2. Check for icing of cupola, visually inspect and remove ice.
   Step 3. Check for proper lubrication.
   Lubricate in accordance with LO 9-2350-258-12.
10. AZIMUTH HANDLE IS DIFFICULT TO TURN.
   Step 1. Check the azimuth drive gear and the azimuth driven gear for corrosion, pitting, or broken teeth.
   Repair/replace as necessary
   Step 2. Check the drive gear lower bearing for dirt or spalling.
   Correct as necessary.
   Step 3. Check for lubrication, cleanliness, defective parts.
   Correct as required.
11. WATER LEAKS INTO COMMANDER'S CUPOLA
   Check cupola race dust seal for proper sealing.
   Replace the race dust seal (para 2-24).

RANGEFINDER

12. ELEVATION BORESIGHT KNOB HAS INSUFFICIENT TRAVEL.
   Check ballistics drive installation and operations (TM 9-1220-220-34). If satisfactory, replace rangefinder (TM 9-2350-258-20-2).

GUNNER'S M32 IR PERISCOPE

13. PERISCOPE CANNOT BE BORESIGHTED.
   Check M118 periscope mount (TM 9-1240-271-35).

*Table 2-3. Troubleshooting — Continued*

| MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|
| BALLISTICS COMPUTER |
| 14. COMPUTER OSCILLATES.<br>Check ballistics drive installation and operation (TM 9-2350-258-20-2). |
| POWER PACK CONTROL |
| 15. CONTROL ASSEMBLY DEFECTIVE.<br>Remove power pack pump dc motor and inspect coupling for damage (para 2-31).<br>*a.* If damaged, replace coupling.<br>*b.* If coupling is not damaged, remove reservoir and clean and test filter (para 2-30). If filter is satisfactory, replace hydraulic pump (para 2-32). |

*Vehicles serial numbered A3001 through A3374.
**Vehicles serial numbered A1101 through A1999 and vehicles serial numbered A3375 through A3999.

*Table 2-4. General Maintenance Procedures*

| Procedure no. | Procedure | Para |
|---|---|---|
| | General | 2-9 |
| 1 | Cleaning | 2-10 |
| 2 | Inspection and repair of cast parts and machined surfaces | 2-11 |
| 3 | Inspection and repair of shafts and splines | 2-12 |
| 4 | Inspection and repair of threaded parts | 2-13 |
| 5 | Inspection of retaining rings | 2-14 |
| 6 | Inspection and removal of dowel pins | 2-15 |
| 7 | Removal of studs | 2-16 |
| 8 | Inspection and repair of welds | 2-17 |
| 9 | Inspection, care, and maintenance of anti-friction bearings | 2-18 |
| 10 | Inspection of bushing-type bearings | 2-19 |
| 11 | Inspection and replacement of cushioning material | 2-20 |
| 12 | Inspection and repair of gears | 2-21 |

## Section IV. GENERAL MAINTENANCE

**2-9. General.** This section contains cleaning, inspection, and repair instructions which are common methods and are not specific to one component or assembly. Table 2-4 lists these procedures. Supplemental instructions pertinent to a specific component are given in the appropriate section.

### 2-10. Cleaning.

**WARNING**

**Cleaning agents specified are flammable. Use only in well ventilated areas. Keep away from flames, sparks, or heat, Do not smoke while using. Prevent contact with eyes, mouth, and/or skin. Wear rubber gloves when performing cleaning procedures.**

*a. Mechanical Parts.*

(1) Remove dirt and other foreign matter from metal surfaces. Use the dip-tank method, vapor-degreaser method, or clean with a cloth or bristle brush soaked in drycleaning solvent (P-D-680). When using the dip-tank method, agitation for approximately 1 minute in each tank is sufficient. When using the vapor degreaser method, treatment for about 2 or 3 minutes is sufficient.

(2) Remove any remaining foreign matter from recessed areas using a stiff bristled brush and/or scraper.

*b. Bearings.* Remove dirt, oil, or grease from those bearings designed for cleaning (TM 9-214) using either dip-tank or vapor-degreaser method. Do not attempt to clean sealed, lubricated-for-life type bearings. Dip and agitate bearings in drycleaning solvent (P-D-680). Dry thoroughly and coat with thin film of specified lubricant. Wrap tightly in oiled paper until ready for use.

*c. Electrical Parts.*

(1) For electrical contacts:

*(a)* Remove loose dirt, corrosion, and other foreign matter from all parts with a stiff bristle brush and dry compressed air.

*(b)* Apply a liberal amount of refrigerant (type II freon, 6850-00-681-568) on surface to be cleaned.

*(c)* Wipe off surfaces with a soft lintless cloth or lens tissue.

*(d)* Apply a second coat of refrigerant and allow to air dry.

(2) For other electrical parts:

*(a)* Remove loose dirt, corrosion, and other foreign matter with a stiff bristle brush saturated in drycleaning solvent. (P-D-680).

*(b)* Allow to air dry.

### 2-11. Inspection and Repair of Cast Parts and Machined Surfaces.

*a.* Inspect cast parts for cracks or fractures. Inspect interiors for scores and burs.

*b.* Inspect machined surfaces for cracks, fractures, galling, pitting, scoring, or corrosion.

*c.* Remove minor scores and burs from machined surfaces and interiors of cast parts with a fine stone or crocus cloth that has been dipped in drycleaning solvent (P-D-680). Replace part if it is cracked, fractured, or excessively scored, worn, or burred.

### 2-12. Inspection and Repair of Shafts and Splines.

*a.* Inspect for cracks, fractures, scores and deformation. Remove minor nicks with a fine stone or crocus cloth. Replace shafts if they are cracked, fractured, scored, or deformed.

*b.* Inspect splines for chip areas, cracks, fractures, and deformation. Remove minor nicks with a fine stone or crocus cloth. Replace any splined parts for any defect or if splines do not permit proper fit.

### 2-13. Inspect and Repair of Threaded Parts.

*a.* Inspect all threaded parts for worn or damaged threads.

*b.* Repair damaged threads by chasing with a tap or die.

*c.* Inspect fit of repaired parts. Replace parts if fit is unsatisfactory.

**2-14. Inspection of Retaining Rings.** Replace retaining rings if damaged; do not attempt repair.

**2-15. Inspection and Removal of Dowel Pins.**

*a.* Inspect dowel pins for wear and proper fit. Replace if defective.

*b.* If necessary to remove dowel pins, use one of the following methods:

(1) Grip pin with self-locking pliers and pull with a twisting motion.

(2) Grind pin off flush with surface and drill out remainder of pin. Remove excess parts of pin. Drill to proper size for fitting of new dowel pin.

**2-16. Removal of Studs.** If necessary to remove studs, use one of the following methods:

*a.* Use stud remover.

*b.* Apply penetrating oil (VV-P-216) to base of stud. Thread two hex nuts on stud and jam the nuts. Sharply tap head of stud several times with hammer. Turn lower nut to remove stud.

*c.* Grind stud off flush with surface and drill out remainder of stud. Drill and tap to proper size for fitting of new stud.

**2-17. Inspection and Repair of Welds.**

*a.* Inspect welds for cracks or defects.

*b.* Repair welds in accordance with TM 9-237.

**2-18. Inspection, Care and Maintenance of Antifriction-Type Bearings.** Refer to TM 9-214.

**2-19. Inspection of Busing-Type Bearings.** - Inspect bushing-type bearing, before removal, for wear, cracks, fractures, galling, pitting, scoring, or corrosion. Replace bearings if they are damaged in any way.

**2-20. Inspection and Replacement of Cushioning Material.**

*a. Inspection.* Inspect cushioning material for wear, punctures, breaks, cracks and deterioration. Examine parts joined with adhesive for separation.

*b. Replacement* Replace damaged parts bonded with synthetic rubber adhesive (MMM-A-161), type II) as follows:

(1) Scrape damaged cushioning material, cemented seals, or gaskets from component.

(2) Remove any paint from surface of area to be bonded.

(3) Remove oil, grease, moisture, or contaminants by cleaning area with cloth soaked in naptha (MIL-N-15178, grade B, 50 percent).

*NOTE*

Cementing should be accomplished at a minimum room temperature of 65°F. Do not use tape to temporarily hold parts together during cementing operation.

(4) Using a brush, or suitable applicator, apply a thin coat of adhesive (MMM-A-1617, type II) to mating surface of each part. Allow adhesive to set for about 15 minutes before joining parts.

**2-21. Inspection and Repair of Gears.** - Inspect gears for wear, nicks, flaking, scoring, and burring. Replace gears if damaged in any way.

## Section V. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS AND AUXILIARIES

### 2-22. Turret.

*a. Removal (fig 2-31).*

(1) Place MASTER BATTERY switch in OFF position. Disconnect ground lead from batteries.

(2) Reduce hydraulic pressure to 0 psi. Refer to TM 9-2350-258-20-2, zero pressure check.

(3) Place gun travel lock in down position (TM 9-2350-258-10).

(4) Unlock turret traverse lock.

(5) Remove two turret race access hole plugs (view A).

(6) Manually traverse turret and remove 48 screws securing turret to hull (view B).

(7) Remove three screws and lockwashers securing access cover to slipring box. Remove access cover (view C).

(8) Remove four screws and lockwashers securing two slipring access covers to the turret platform (view F).

(9) Disconnect two electrical cables from slipring receptacles (view D).

(10) Disconnect two electrical wire connectors from interference switch connectors (view D).

(11) Remove three screws and lockwashers securing torque arm to turret platform and slipring box. Remove torque arm (view E).

(12) Install turret lifting sling (1, table 2-1) on the turret lifting eyes (view G).

**WARNING**

**When lifting the turret use a crane with a minimum lifting capacity of 20 tons and capable of a 20-foot lift from the ground.**

(13) Perform a trial lift to insure a direct vertical lift and that the turret will remain level when raised. Position crane and adjust sling as necessary.

(14) Lift turret clear of hull and lower turret onto turret stand (2, table 2-1).

*b. Installation (fig 2-1).*

**NOTE**

Observe through turret race access hole, after plug is removed, and manually traverse turret until portion of race stamped FRONT appears. Engage turret lock. Install race with front dowel pin holes to front of vehicle.

(1) Install turret in reverse order of the re procedure.

(2) Prior to releasing hoist, start one scre either side of turret to insure proper alineme holes.

(3) Install and tighten 48 screws securing t to hull to 300 lb-ft (407 N.m).

(4) Check hydraulic fluid and fill syste required (LO 9-2350-258-12).

(5) Check turret operation (TM 9-2350-25

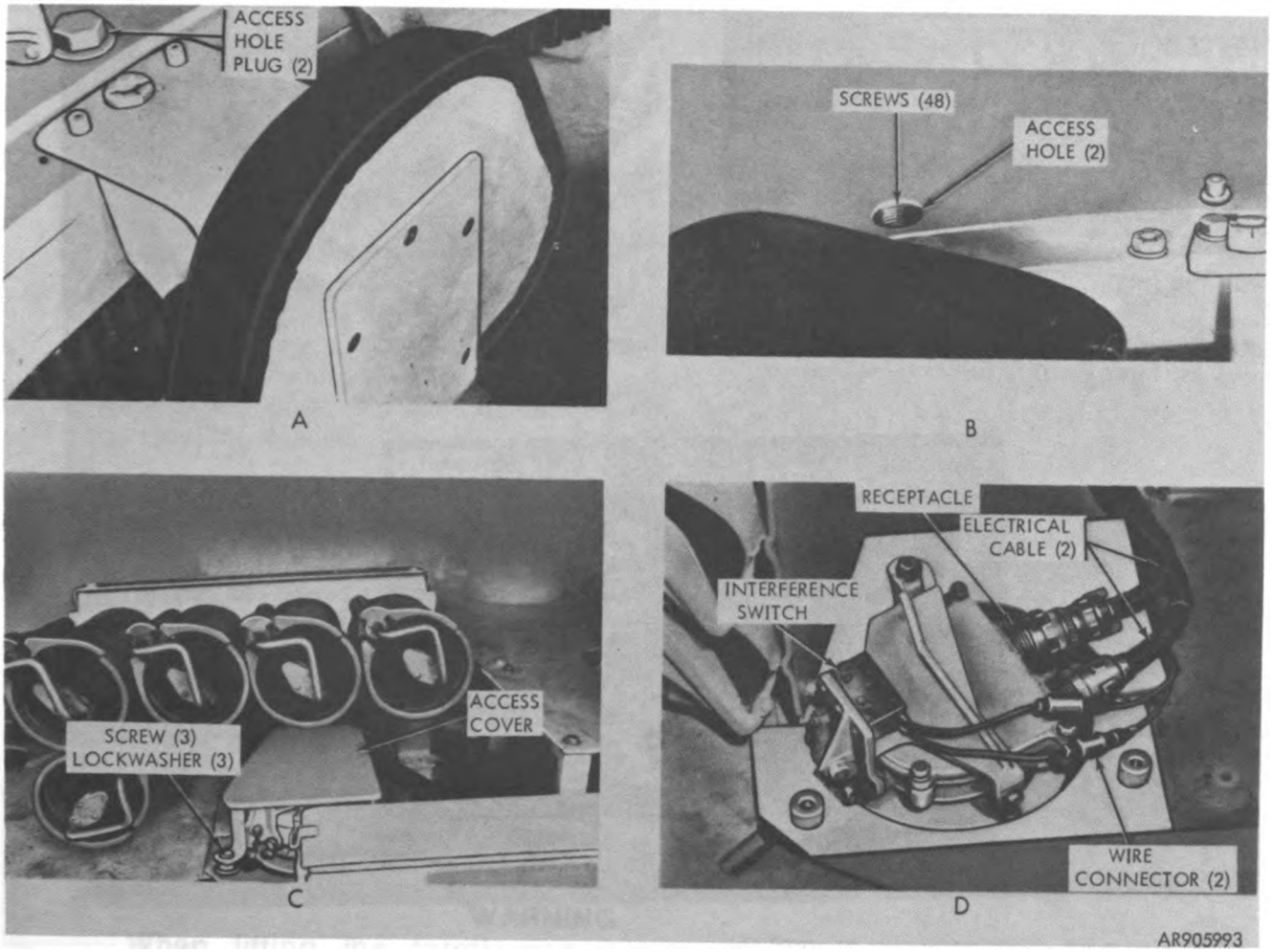



*Figure 2-31. Turret removal or installation (1 of 2).*

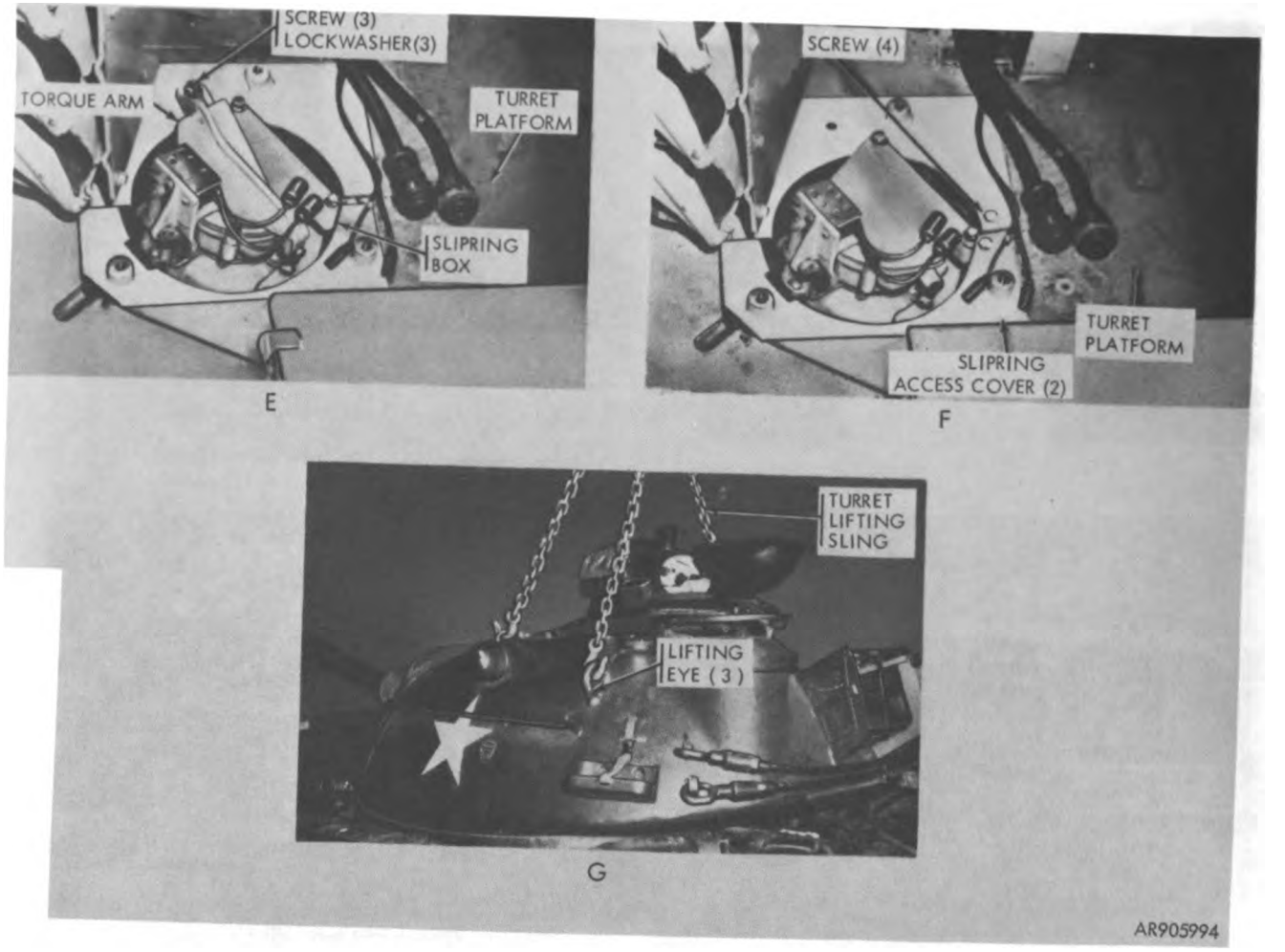



*Figure 2-31. Turret removal or installation (2 of 2).*

## 23. Turret Race.

*a. Removal (fig 2-32).*

(1) Place MASTER BATTERY switch in the OFF position. Disconnect ground leads from batteries.

(2) Refer to applicable section of TM 9-2350-258-20-2 and perform a zero pressure check before removing the following items:

*(a)* Loader's seat.
*(b)* Gunner's seat.
*(c)* Commander's seat.
*(d)* Gunner's intercommunication box.
*(e)* Commander's handle.
*(f)* Commander's periscope and linkage.
*(g)* Ballistics computer
*(h)* Azimuth indicator.
*(i)* Main accumulator and support.
*(j)* 105-mm ammunition ready rack.
*(k)* 7.62-mm ammunition ready rack.
*(l)* Deflection shield and radio guard.
*(m)* Elevating cylinder.

**WARNING**

**Tie down gun with rope inside turret to prevent gun movement before disengaging turret lock.**

(3) Disengage turret traversing lock.

(4) Remove turret lock (para 2-37).

(5) Remove traversing gearbox (para 2-33).

(6) Remove remaining 22 screws securing turret race to turret (view A).

(7) Install turret sling (1, table 2-1) in turret lifting eyes (view G, fig 2-31).

**WARNING**

**When lifting the turret, use a crane with a minimum lifting capacity of 20 tons and capable of a 20-foot vertical lift from the ground.**

(8) Perform a trial lift to insure a direct vertical lift and that the turret remains level when raised. Position the crane and adjust sling as necessary.

**CAUTION**

**Care should be taken not to damage the ammunition racks, handles, or hydraulic lines when lifting turret.**

(9) Remove turret (leaving race on hull) and lower onto turret stand (2, table 2-1).

(10) Plug or cap all hydraulic lines and ports. Cap all electrical connectors and receptacles.

(11) Remove two turret race access hole plugs (view a, fig 2-31).

(12) Manually rotate turret race to expose screw through access hole. Remove screw.

(13) Rotate race and repeat procedure until all 48 screws are removed.

(14) Install three eye bolts (3, table 2-1) equal distances apart around the circumference of the turret race (view B, fig 2-32). Lift race and lower to a turret stand or to blocks.

**NOTE**

When turret is removed, inspect dust seal for damage. If damaged or deteriorated, replace seal (para 2-24).

*b. Installation (fig 2-32).*

**NOTE**

Position area of turret race stamped FRONT to the front of the tank. Aline dowel pins and install race.

(1) Install turret race in the reverse order of the removal procedure.

(2) Install and tighten 48 screws securing turret race to the hull to 300 lb-ft (407 N.m).

(3) Install turret in reverse order of the removal procedure.

**NOTE**

Position turret to aline single dowel pin on front of the turret with dowel pin hole on inner race at front of vehicle.

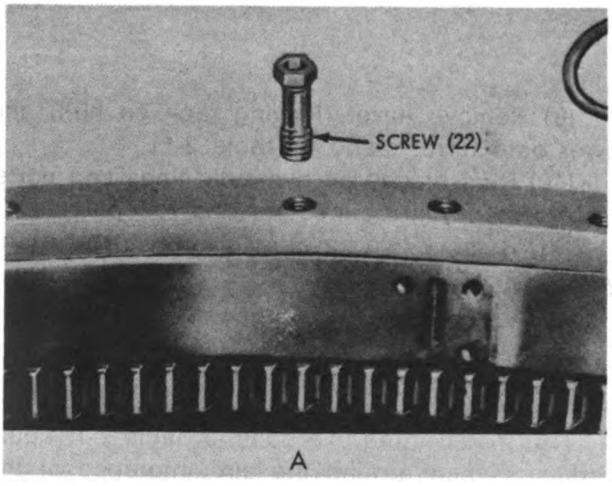
(4) Prior to releasing hoist, start one screw on either side of turret to insure proper alinement of holes.

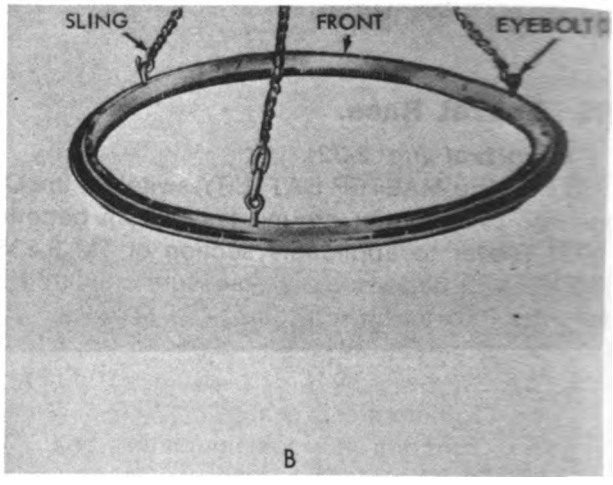
(5) Install and tighten 36 screws securing turret to race to 300 lb-ft (407 N.m).

(6) Fill power pack reservoir (LO 9-2350-258-12).

(7) Bleed hydraulic system (TM 9-2350-258-20-2).

(8) Check turret hydraulic system operation (TM 9-2350-258-10).



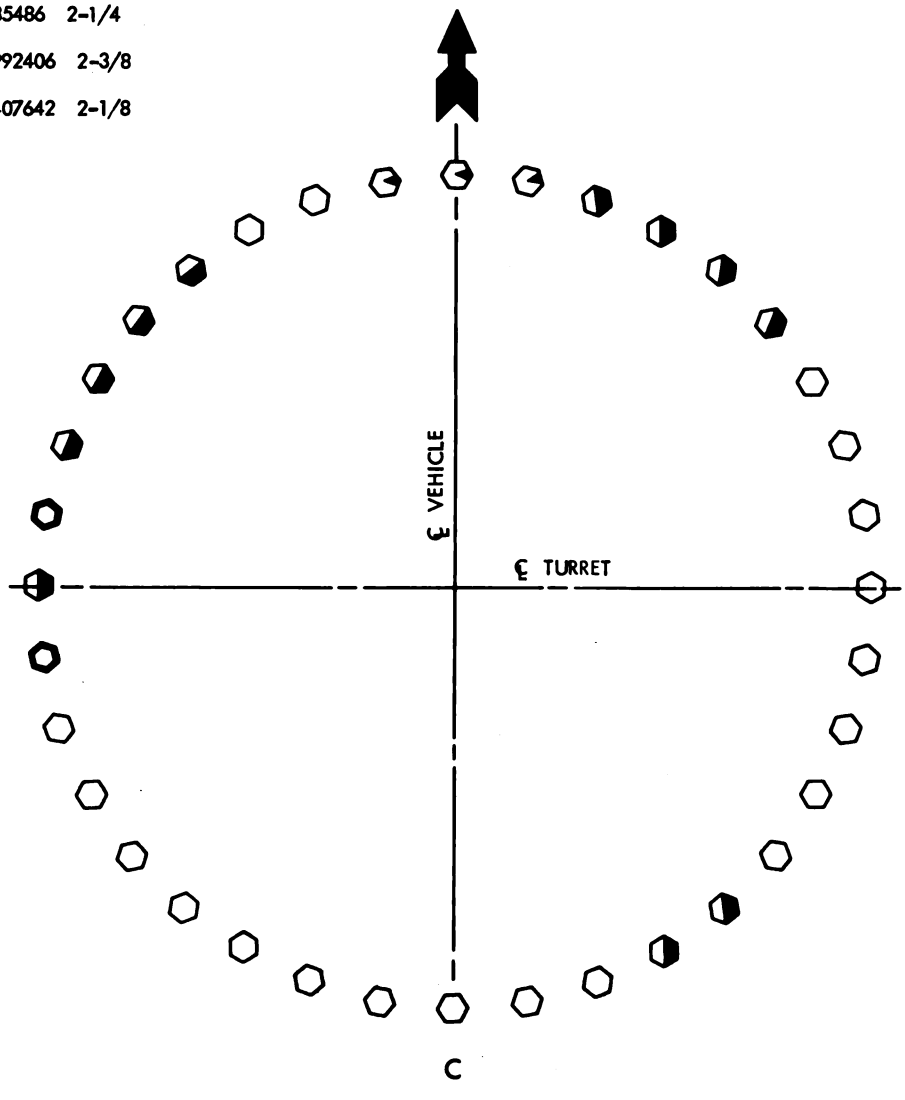

BOLT PATTERN

= (3) 7699601 3-1/8

= (2) 7985486 2-1/4

= (11) 7992406 2-3/8

= (20) 7407642 2-1/8




AR905995

*Figure 2-32. Turret race removal or installation.*

**2-24. Dust Seal.** Seal must not be cracked, broken, torn, brittle, or deformed.

**NOTE**
Remove seal only if replacement is necessary.

*a. Removal (fig 2-33).*

(1) Pry seal from groove and surface of inner race groove with a putty knife or other suitable tool.

*(2)* Clean grooved surface with wire brush.

*b. Installation (fig 2-33).*

(1) Apply oil resistant synthetic rubber adhesive (MIL-A-5092) grooved surface of inner race and to seal.

(2) Install seal in groove.

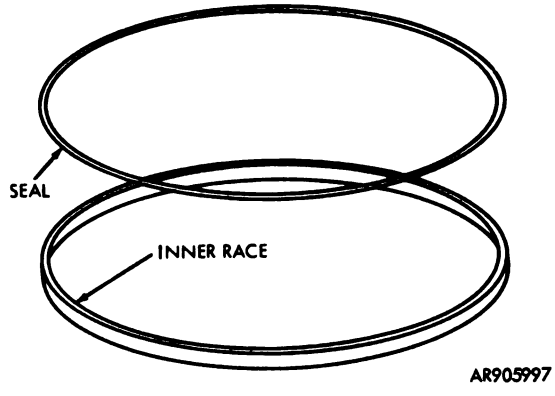



*Figure 2-33. Dust seal removal or installation.*

## 2-25. Power Pack Control Assembly.

*a. Removal (fig 2-34).*

(1) Refer to TM 9-2350-258-20-2 and perform the following:

*(a)* Place MASTER BATTERY switch in OFF position.

*(b)* Perform zero pressure check.

*(c)* Drain turret hydraulic system.

*(d)* Remove gunner's control box.

*(e)* Remove gunner's seat from pedestal.

(2) Remove two screws and lockwashers securing commander's control rod levers to gunner's control shafts (view A). Remove control rods.

(3) Disconnect electrical connector from gunner's control receptacle (view A).

(4) Disconnect electrical connector from deck clearance valve solenoid (view B).

**NOTE**

Port identification letters are used in view B to identify hydraulic tubes.

(5) Disconnect and tag hydraulic lines from ports TR, TL, SP and A of gunner's control valve (view B)

(6) Disconnect and tag hydraulic line from shutoff needle valve to super-elevation actuator at needle valve (view B).

(7) Disconnect and tag hydraulic lines from ports CE, EE, and D of elevation shutoff valve (view B).

**NOTE**

Elevation shutoff valve is not present in all vehicles.

(8) Disconnect and tag hydraulic lines from ports CD, CE, ED, and A of deck clearance valve (view B).

(9) Disconnect accumulator-to-relief valve hydraulic line at relief valve (view B).

(10) Disconnect and tag hydraulic lines from ports ME and MD of manual elevation accumulator (view C).

(11) Disconnect three hydraulic drain lines from superelevation actuator port D2 and deck clearance valve port D at tees near power pack.

(12) Remove three screws and lockwashers securing gunner's footrest to turret floor and remove footrest (view E).

(13) Disconnect electrical connector from electric drive motor (view F).

(14) Remove screw and lockwasher securing ground strap to motor.

(15) Install rope sling on power pack.

(16) Lower hoist hook through commander's hatch. Attach hoist hook to sling and remove slack.

(17) Remove four screws, lockwashers, and washers securing electric drive motor to lower mounting bracket (view G).

(18) Remove two screws and lockwashers securing power pack to upper support bracket, and remove power pack (view H) and lower to turret floor.

(19) Remove hoist hook from rope sling.

(20) Raise hoist hook through commander's hatch and lower through loader's hatch.

(21) Install hoist hook on sling and remove power pack through loader's hatch.

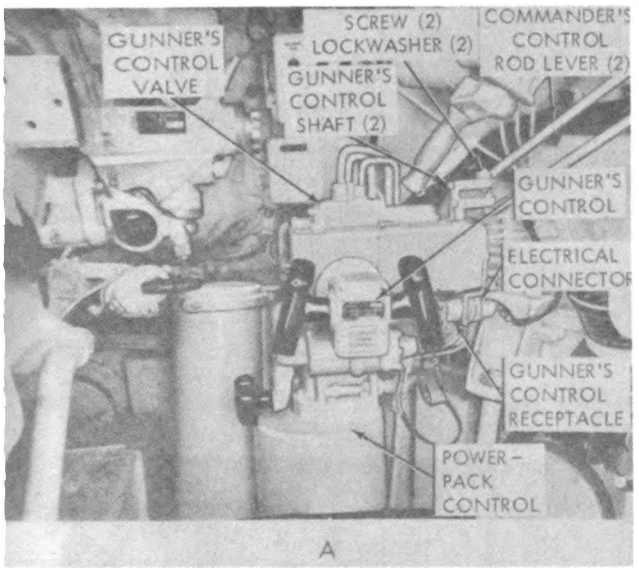
(22) Plug and cap all hydraulic lines and ports. Cap electrical connectors and receptacles.

*b. Installation (fig 2-34).*

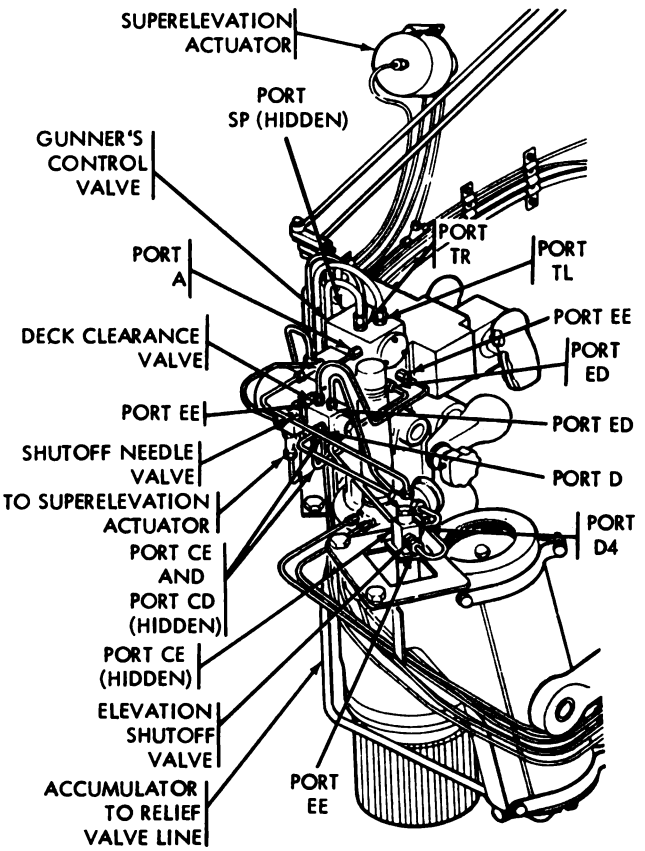
(1) Install in reverse order.

(2) Fill hydraulic system (LO 9-2350-258-12). Bleed system.

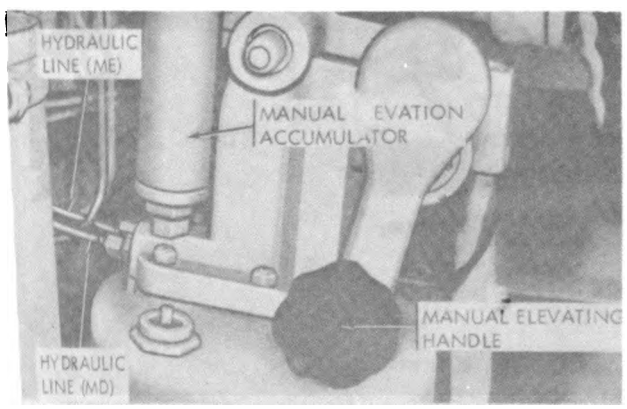
(3) After installation, check power pack control assembly for proper operation (TM 9-2350-258-10).




A




B




C

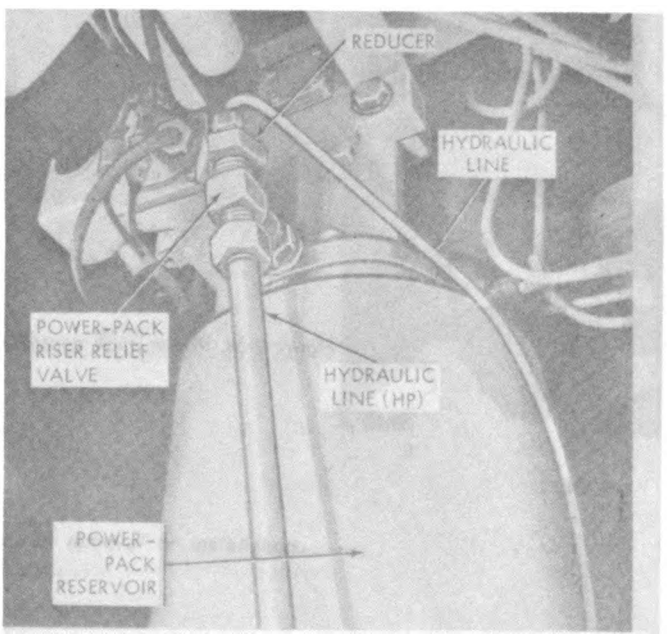



*Figure 2-34. Power pack control removal or installation (1 of 2).*

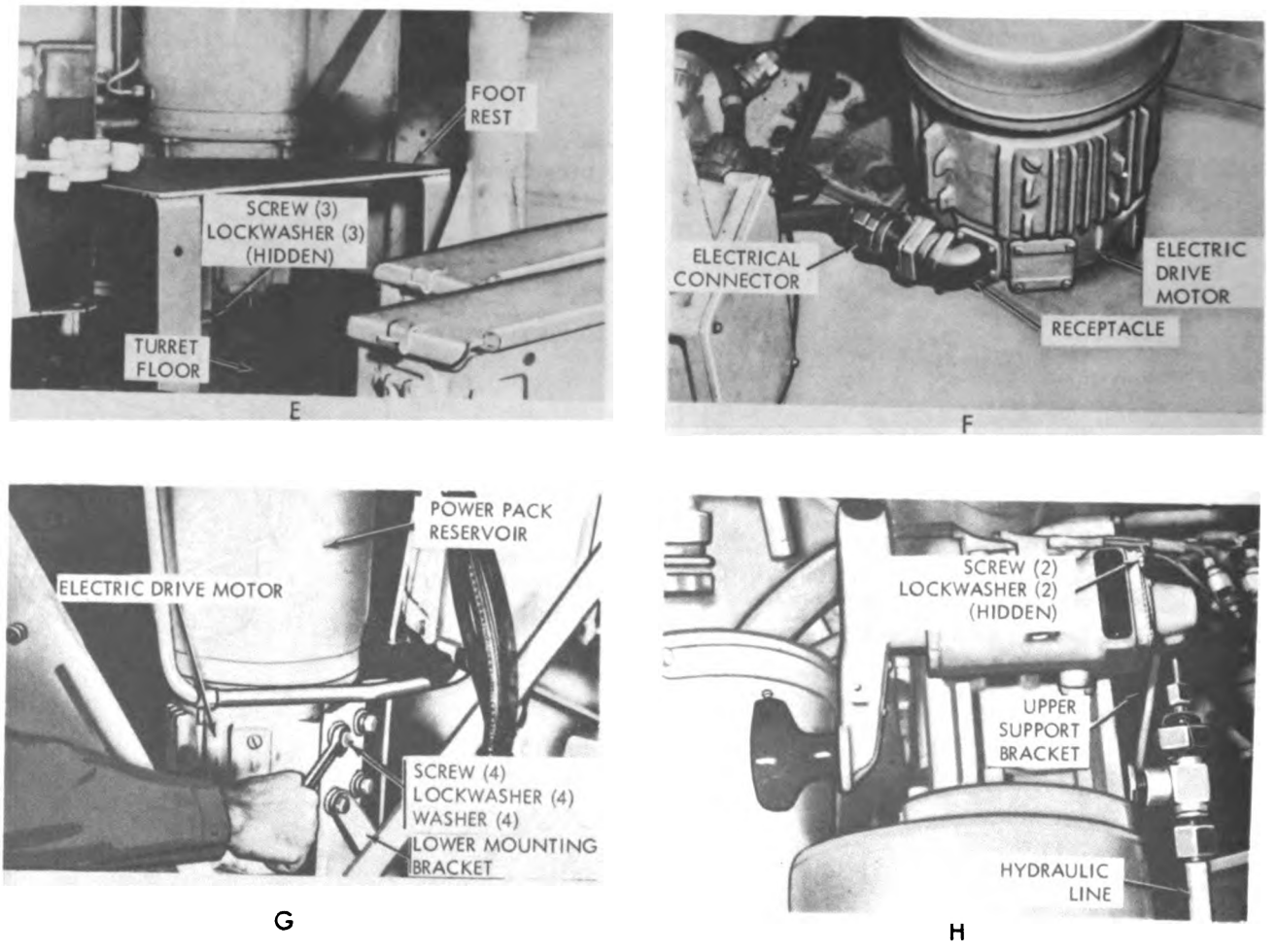



*Figure 2-34. Power pack control removal or installation (2 of 2).*

## 2-26. Manual Elevation Pump.

*a. Removal (fig 2-35).*

(1) Place MASTER BATTERY switch in OFF position.

(2) Refer to TM 9-2350-258-20-2 and perform the following:

*(a)* Perform zero pressure check.

*(b)* Drain turret hydraulic system.

(3) Disconnect two electrical connectors from gunner's control harness (view A).

(4) Remove six screws and lockwashers securing pump to riser (view B). Remove pump and three packings from riser. Discard packing.

*b. Installation (fig 2-35).*

(1) Install in reverse order. Check operation after installation.

(2) Install three new packings. Lubricate new packing with hydraulic fluid (MIL-H-46170(FRH)).

(3) Fill power pack reservoir (LO 9-2350-258-12).

(4) Bleed system (TM 9-2350-258-20-2).

(5) Check hydraulic system operation (TM 9-2350-258-10).

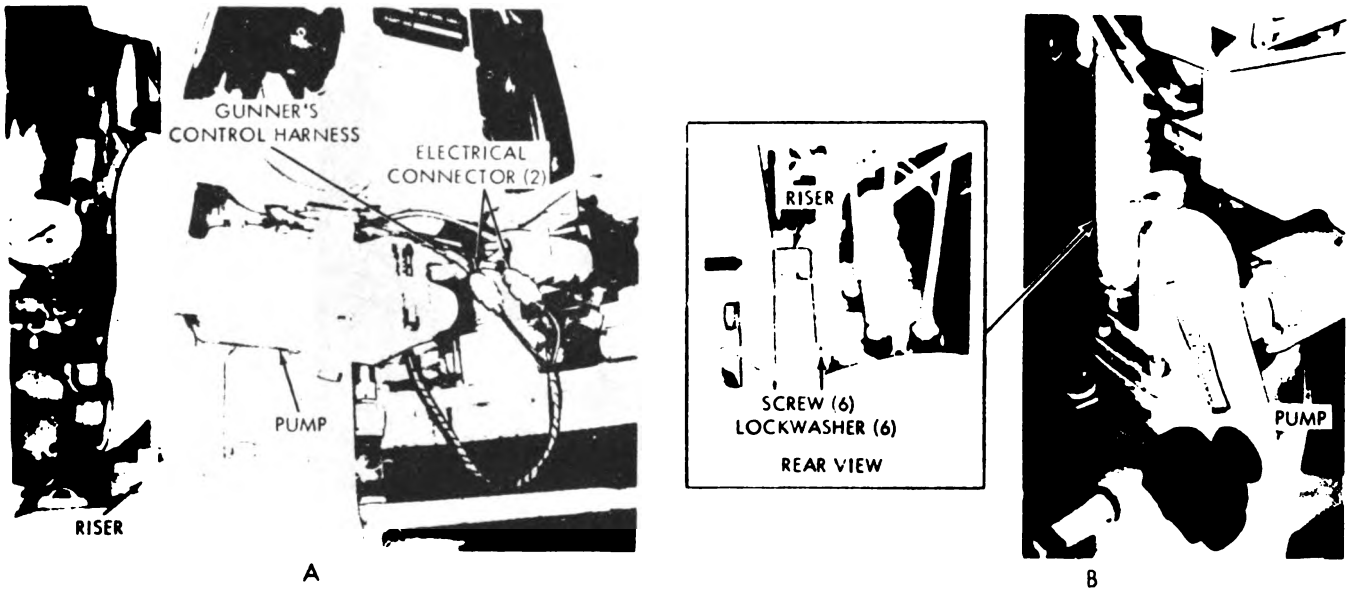



*Figure 2-35. Manual elevation pump removal or installation.*

**2-27. Manual Elevation Pump Shuttle Valve.** Refer to TM 9-2350-258-20-2 and perform the following: Place MASTER BATTERY switch in OFF position. Perform zero pressure check.

*a. Removal (fig 2-36).* Remove two screws and lockwashers securing shuttle valve to riser and remove valve and three packings. Discard packing.

*b. Installation (fig 2-36).*

(1) Install in reverse order of removal procedure.

(2) Install three new packings. Lubricate new packing with hydraulic fluid (MIL-H-46170(FRH)).

(3) Fill power pack reservoir with hydraulic fluid (LO 9-2350-258-12).

(4) Bleed hydraulic system (TM 9-2350-258-20-2).

(5) Check operation of hydraulic system (TM 9-2350-258-10).

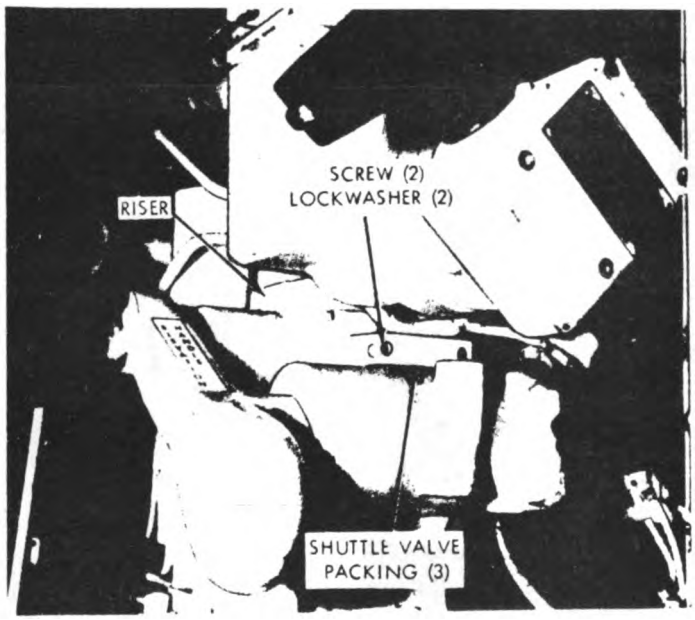



*Figure 2-36 Manual elevation pump shuttle valve removal or installation*

## 2-28. Power Pack Hydraulic Riser.

**NOTE**

If high-pressure regulator in the riser is suspected of malfunctioning, perform the following test. Connect a vehicle pressure gage to port A of the hydraulic valve assembly. Place MASTER BATTERY and TURRET POWER switches in ON position. Slowly elevate/depress gun or traverse turret. Pressure gage should read 900-950 psi. If pressure reading is not 900-950 psi, remove riser.

*a. Removal (fig 2-37).*

(1) Perform zero pressure check (TM 9-2350-258-20-2).

(2) Drain hydraulic system (TM 9-2350-258-20-2).

(3) Remove power pack pump dc motor (para 2-31).

(4) Remove power pack reservoir (para 2-31).

(5) Remove elevation relief valve line and return line from riser.

(6) Disconnect hydraulic tubes from ports ME and MD (view A).

(7) Remove two electrical connectors from manual elevation trigger circuit (view A, fig 2-35).

(8) Remove two screws and lockwashers securing riser to power pack upper mounting bracket (view B, fig 2-37).

(9) Remove riser assembly. Discard four O-rings. Allow control valve to be supported by riser support bracket.

(10) If a new riser is to be installed, perform the following:

*(a)* Remove manual elevation accumulator (TM 9-2350-258-20-2).

*(b)* Remove manual elevation pump (para 2-26).

*(c)* Remove adapters and packings from ports ME and MD of riser (view A).

(11) Plug or cap all open hydraulic lines and ports to prevent entry of foreign material.

*b. Installation (fig 2-37).*

(1) Install power pack hydraulic riser in reverse order of the removal procedure.

(2) Install four new riser O-rings, and lubricate with hydraulic fluid (MIL-H-46170(FRH)) during installation.

(3) Fill power pack reservoir with hydraulic fluid (LO 9-2350-258-12).

(4) Bleed hydraulic system (TM 9-2350-258-20-2).

(5) Check hydraulic system operation (TM 9-2350-258-10).


*Figure 2-37. Power pack hydraulic riser removal or installation*

## 2-29. Manual Elevation Pump Check Valve and Reservoir Oil Drain Tube.

*a. Removal (fig 2-38).*

(1) Refer to TM 9-2350-258-20-2 and perform the following:

*(a)* Place MASTER BATTERY switch in OFF position.

*(b)* Perform zero pressure check.

*(c)* Remove gunner's control box.

(2) Remove power pack reservoir (para 2-30).

(3) Unscrew check valve and drain tube from riser (view C). Discard packings.

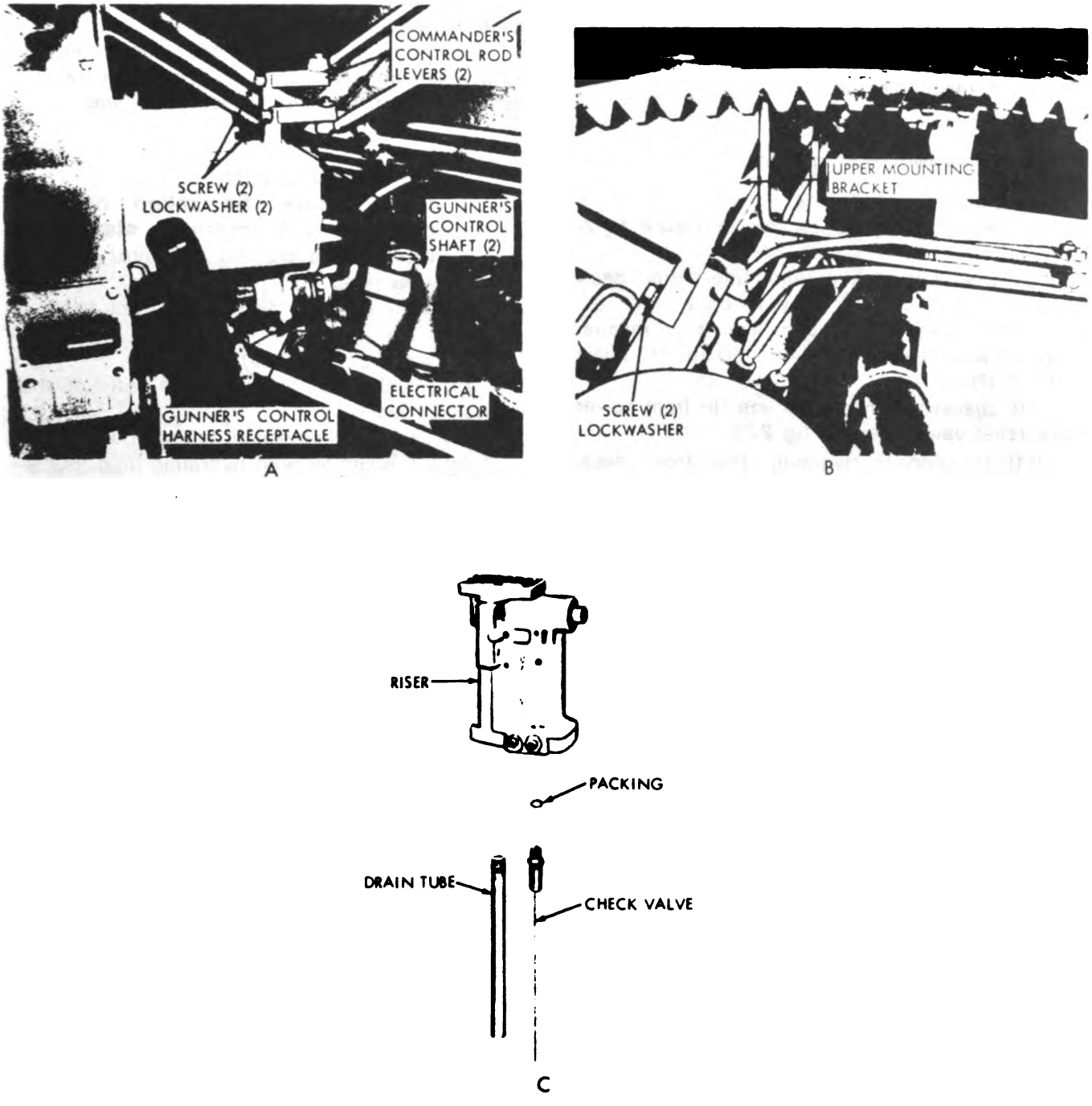



*Figure 2-38. Manual elevation pump check valve and reservoir oil drain tube removal or installation.*

(4) Remove two screws and lockwashers securing commander's control rod levers to gunner's control shafts (view A).

(5) Disconnect electrical connector from gunner's control harness receptacle (view A).

(6) Disconnect harness connector from deck clearance valve solenoid.

NOTE

Ports are identified in figure 2-34.

(7) Disconnect hydraulic lines from gunner's control valve ports SP, TL, TR and DA (view B, fig 2-34).

(8) Disconnect hydraulic line from deck clearance valve port ED (view B, fig 2-34).

(9) Disconnect hydraulic line from manual elevation accumulator riser ports MD and ME (view A, fig 2-37).

(10) Disconnect hydraulic line HP from power pack relief valve (view D, fig 2-34).

(11) Disconnect hydraulic line from deck clearance valve ports CD and CE (view B, fig 2-34).

(12) Remove two screws and lockwashers securing riser to power pack upper mounting bracket (view B, fig 2-37).

(13) Remove riser and gunner's control as a unit.

(14) Plug and cap all open hydraulic tubes and ports.

*b. Install (fig 2-38).*

(1) Install in reverse order.

(2) Install new packing. Lubricate packing with hydraulic fluid (MIL-H-46170(FRH)).

(3) Fill power pack reservoir (LO 9-2350-258-12) and bleed hydraulic system (TM 9-2350-258-20-2).

(4) Check hyraulic system operation (TM 9-2350-258-10).

## 2-30. Power Pack Reservoir and Filter.

*a. Power Pack Reservoir.*

(1) *Removal (fig 2-39).*

*(a)* Remove power pack pump dc motor (para 2-31).

*(b)* Drain hydraulic system (TM 9-2350-258-20-2).

*(c)* Remove pressure bypass line from bottom of reservoir.

*(d)* Remove six screws and lockwashers securing reservoir to riser. Lower reservoir to turret basket floor (view A).

*(e)* Remove reservoir from under riser by tilting reservoir and sliding it out past the return line and manual elevation check valve line.

**CAUTION**

**Care should be taken not to damage the manual elevation check line during removal of the reservoir.**

*(f)* Remove and discard reservoir-to-riser gasket.

(2) *Installation (fig 2-39).*

*(a)* Install reservoir in reverse order of the removal procedure.

*(b)* Use a new reservoir-to-riser gasket.

*(c)* Fill reservoir with hydraulic fluid (LO 9-2350-258-12).

*(d)* Bleed hydraulic system (TM 9-2350-258-20-2).

*(e)* Check operation of hydraulic system (TM 9-2350-258-10).

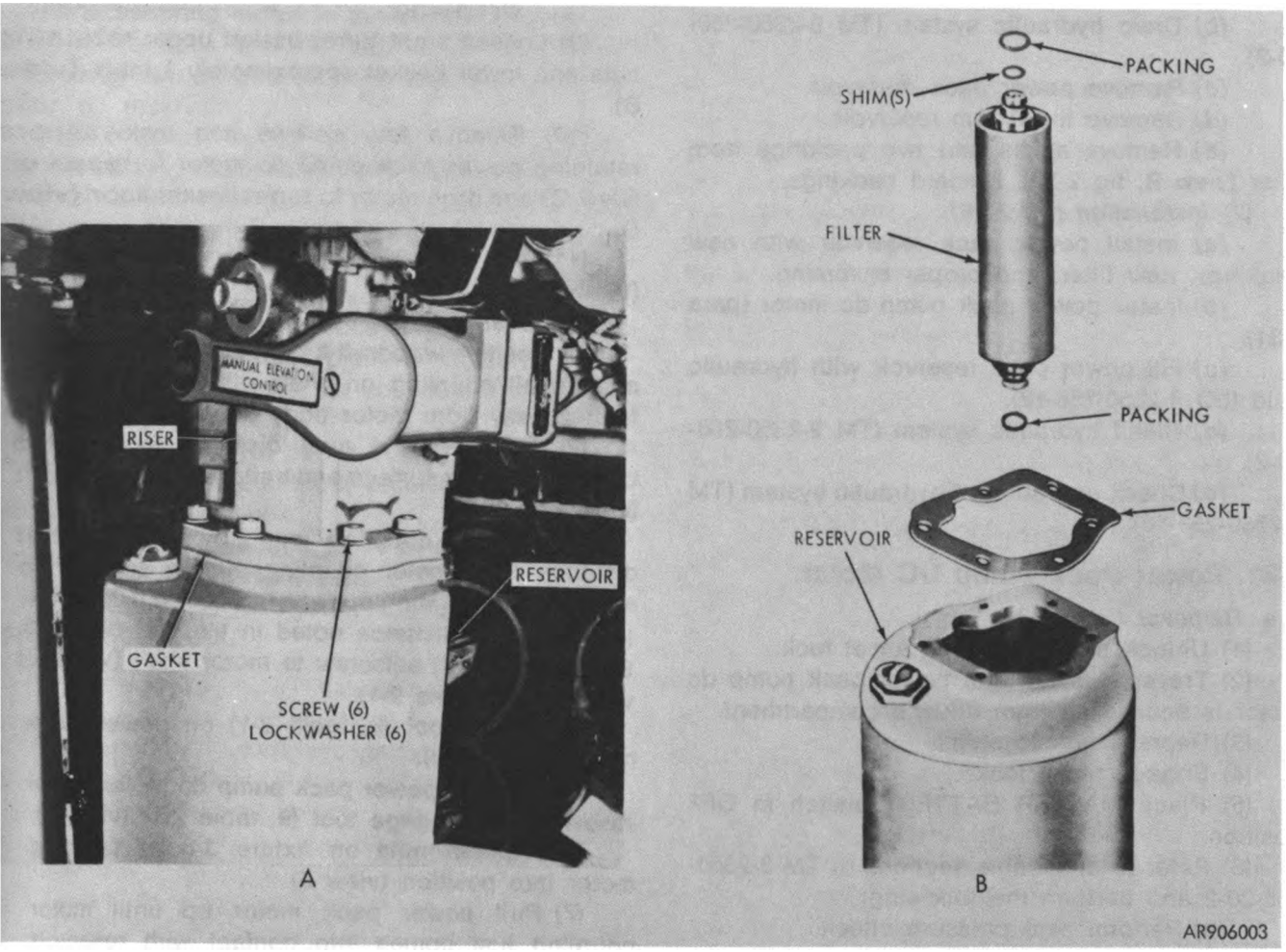



*Figure 2-39. Power pack reservoir and filter removal or installation.*

*b. Filter, Power Pack Reservoir.*

(1) *Removal (fig 2-39).*

*(a)* Remove power pack pump dc motor (para 2-31).

*(b)* Drain hydraulic system (TM 9-2350-258-20-2).

*(c)* Remove power pack reservoir.

*(d)* Remove filter from reservoir.

*(e)* Remove shims and two packings from filter (view B, fig 2-39). Discard packings.

(2) *Installation (fig 2-39).*

*(a)* Install power pack reservoir with new packings, new filter, and proper shimming.

*(b)* Install power pack pump dc motor (para 2-31).

*(c)* Fill power pack reservoir with hydraulic fluid (LO 9-2350-258-12).

*(d)* Bleed hydraulic system (TM 9-2350-258-20-2).

*(e)* Check operation of hydraulic system (TM 9-2350-258-10).

## 2-31. Power Pack Pump DC Motor.

*a. Removal (fig 2-40).*

(1) Unlock travel lock and turret lock.

(2) Traverse turret until power pack pump dc motor is accessible from driver's compartment.

(3) Depress gun to stops.

(4) Engage turret lock.

(5) Place MASTER BATTERY switch in OFF position.

(6) Refer to applicable sections of TM 9-2350-258-20-2 and perform the following:

*(a)* Perform zero pressure check.

*(b)* Remove gunner's seat.

*(c)* Remove gunner's platform (footrest).

*(d)* Disconnect electrical connectors from turret power supply relay box.

*(e)* Remove turret power supply relay box.

*(f)* Disconnect electrical connector from power pack pump dc motor.

*(g)* Remove gunner's platform supports.

(7) Remove four screws, lockwashers, and washers securing power pack dc motor support bracket (view A).

(8) Remove ground strap from power pack motor.

**CAUTION**

**Leave a minimum of three thread of upper retaining nuts engaged to prevent turret basket from dropping.**

(9) Loosen eight turret basket upper retaining nuts and lower basket approximately 1 inch (view B).

(10) Remove four screws and lockwashers retaining power pack pump dc motor to reservoir (view C) and drop motor to turret basket floor (view D).

(11) Tilt motor and slide from under reservoir (Views E and F).

*b. Installation (fig 2-40).*

(1) Position woodruff key in slot in motor shaft and install coupling on shaft with serrated edge facing away from motor body (view G).

(2) Measure and note distance from pump coupling mating surface and bottom of pump mount (view H).

(3) Adjust coupling on motor shaft until distance from motor coupling mating surface to electric motor mating surface is 0.030 to 0.060 inch less than the distance noted in step (2) (view I). Secure coupling setscrew to motor shaft (view G) with key (7, table 2-1).

(4) Install tool (9, table 2-1) on power pack reservoir (view J).

(5) Position power pack pump dc motor under reservoir and engage tool (9, table 2-1) (view J).

(6) Tighten nuts on fixture J-bolts to raise motor into position (view J).

(7) Pull power pack motor up until motor coupling just comes into contact with reservoir coupling.

**CAUTION**

**Tighten fixture J-bolts only until couplings come into contact. Over tightening could force coupling up into reservoir.**

(8) Engage tool (8, table 2-1) in (view J) armature slot in bottom of motor. Rotate armature until couplings are alined.

(9)Tighten J-bolts until motor is pulled up into position.

(10) Install two of the four screws and lockwashers securing motor to the reservoir (view C).

(11) Remove tool (9, table 2-1) and install remaining two screws and lockwashers securing motor to reservoir.

(12) Tighten upper retaining nuts on turret basket, raising basket back into position (view B).

(13) Install four power pack pump dc motor support bracket screws lockwashers, and washers (view A).

(14) Refer to applicable sections of TM 9-2350-258-20-2 and perform the following:

*(a)* Install gunner's platform supports.

*(b)* Connect electrical connectors to power pack pump dc motor.

*(c)* Install turret power supply relay box.

*(d)* Connect electrical connectors to turret power supply relay box.

*(e)* Install gunner's platform (footrest).

*(f)* Install gunner's seat.

(15) Check turret hydraulic system operation (TM 9-2350-258-10).

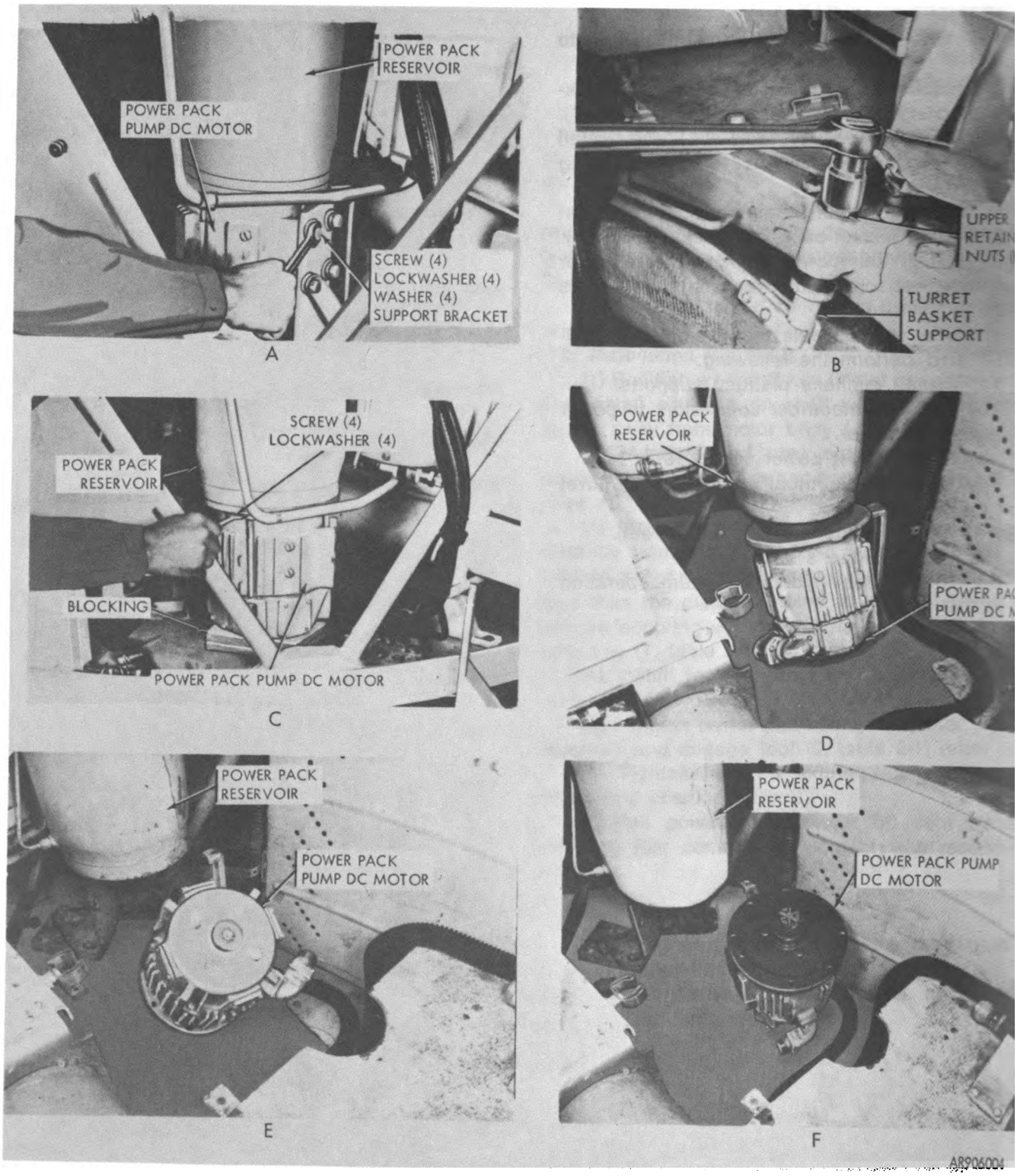
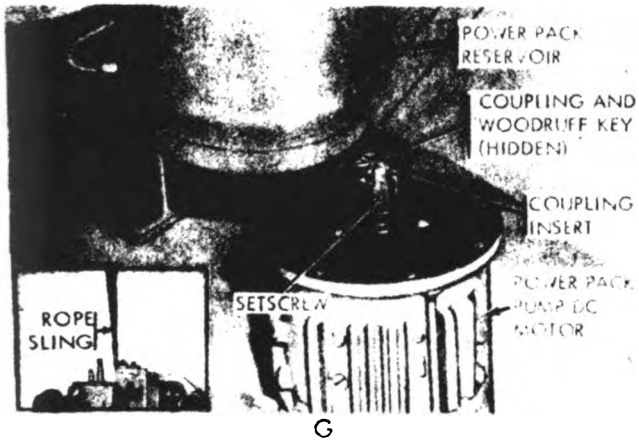
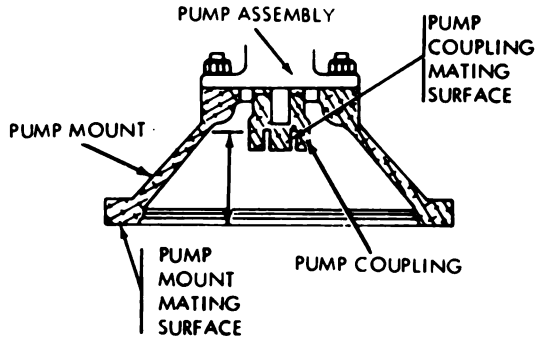



*Figure 2-40. Power pack pump dc motor removal or installation (1 of 2)*




G

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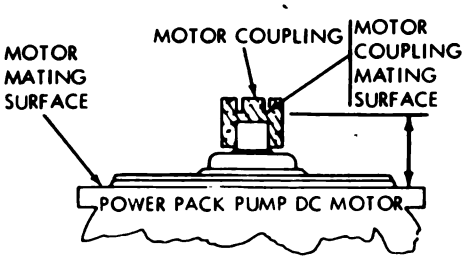


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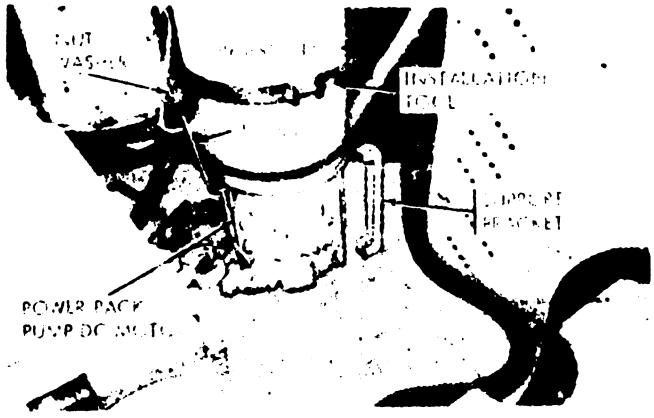


*Figure 2-40. Power pack pump dc motor removal or installation (2 of 2).*

## 2-32. Power Pack Hydraulic Pump.

*a. Removal (fig 2-41).*

(1) Remove power pack pump dc motor (para 2-31).

(2) Remove power pack reservoir (para 2-30).

(3) Remove power pack reservoir filter (para 2-30).

(4) Remove four allen head screws and lockwashers securing pump to power pack reservoir. Remove mount, pump, and packing. Discard packing.

(5) Remove two nuts and lockwashers securing pump to mount. Remove pump and packing. Discard packing. Remove coupling from shaft.

*b. Installation (fig 2-41).*

(1) Install power pack pump in reverse order of the removal procedure.

**(2) Install two new packings. Lubricate with hydraulic fluid (MIL-H-46170(FRH)).**

(3) Tighten pump-to-mount nuts and pump-to-reservoir screws to 16-18 lb-ft (22-24 N.m).

**(4) Fill reservoir with hydraulic fluid (LO 9-2350-258-12).**

(5) Check hydraulic system operation (TM 9-2350-258-10).

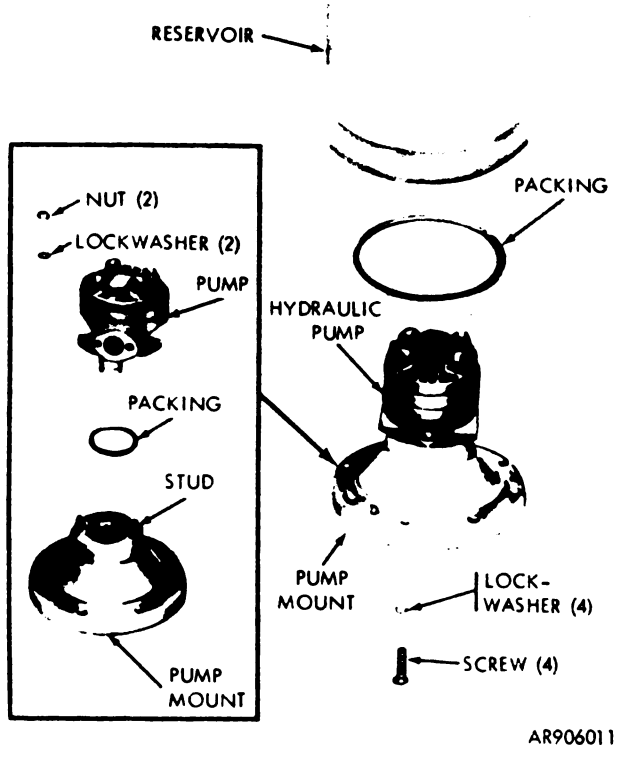



*Figure 2-41. Power pack hydraulic pump removal or installation.*

## 2-33. Traversing Gearbox.

*a. Removal (fig 2-42).*

(1) Refer to applicable sections of TM 9-2350-258-20-2 and perform the following:

*(a)* Place MASTER BATTERY switch in OFF position.

*(b)* Perform zero pressure check.

*(c)* Remove commander's control.

*(d)* Remove manual traversing drive.

(2) Remove one hydraulic tube from pin lock port D at tee connector (view A).

(3) Disconnect hydraulic tube from port G of pin lock (view A).

(4) Disconnect hydraulic tubes from ports M1 and M2 of hydraulic motor (view A).

(5) Plug and cap all open hydraulic lines and ports.

(6) Disconnect electrical connector from magnetic brake receptacle and remove clamp securing harness to traversing gearbox (view A).

(7) Remove commander's periscope and linkage.

(8) Place opening of cupola to front of turret.

(9) Attach lifting sling (19, table 2-1) to traverse mechanism bolt (view B).

(10) Position communication cable out of way when lifting traversing mechanism.

(11) Position commander's elevation handle out of way when lifting traversing mechanism.

(12) Lower a hoist through the commander's hatch, attach hoist to sling, and remove slack from sling.

(13) Remove six screws and lockwashers, and two bolts securing traverse mechanism to turret race (view A).

(14) Lift gearbox and remove through commander's hatch.

**NOTE**

Pinlock should face toward rear of cupola when lifting the hatch.

*b. Installation (fig 2-42).*

(1) Install in reverse order.

(2) Fill traversing gearbox with lubricant and power pack reservoir with hydraulic fluid (LO 9-2350-258-12).

(3) Refer to TM 9-2350-258-20-2, and perform antibacklash adjustment procedure.

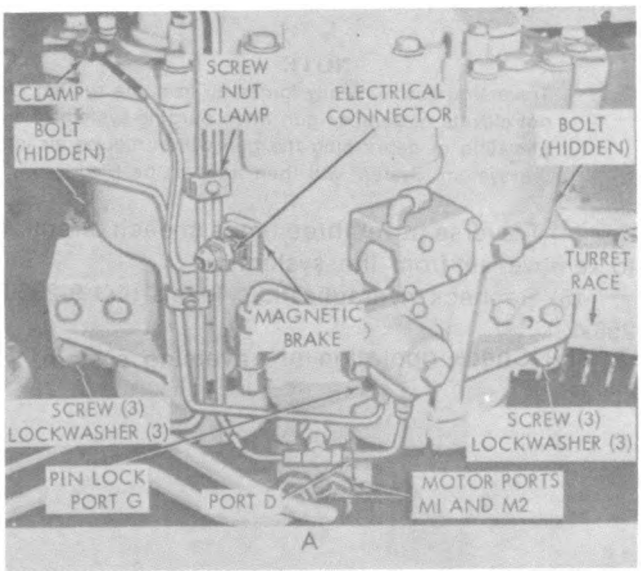
**NOTE**

Traversing automatically forces air from the system. Do not elevate or depress gun when purging system of air. Elevating or depressing the gun will introduce air into the system. System will then have to be bled.

(4) Traverse turret three times in each direction to remove air from the system.

(5) Recheck hydraulic fluid levels (LO 9-2350-258-12).

(6) Check operation of traversing system.



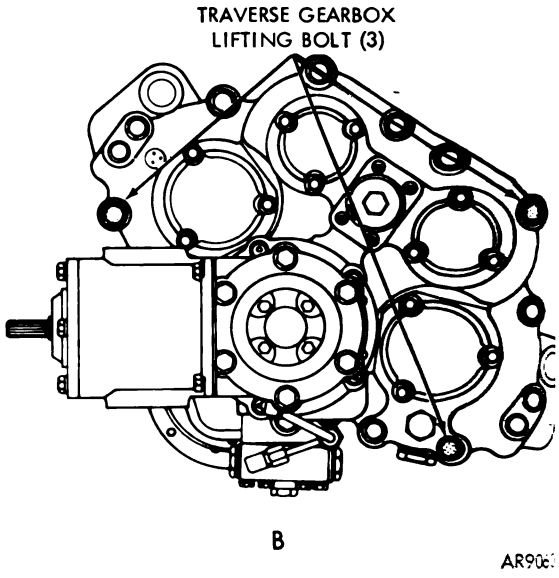




*Figure 2-42. Traversing gearbox removal or installation.*

## 2-34. Traversing Gearbox Clutch.

*a. Removal (fig 2-43).*

(1) Refer to TM 9-2350-258-20-2 and perform the following:

*(a)* Place MASTER BATTERY switch to OFF position.

*(b)* Perform zero pressure check.

*(c)* Remove commander's control.

*(d)* Remove manual traversing drive.

*(e)* Remove no-bak.

(2) Disconnect hydraulic line from gearbox upper housing tee.

(3) Remove five screws and lockwashers securing clutch to traversing gearbox and remove clutch. Tighten screws to 4-6 lb-ft (5-8 N.m) during installation.

(4) If clutch is being replaced, remove hydraulic line and elbow from clutch housing.

*b. Installation (fig 2-43).*

(1) Install in reverse order.

(2) Fill traversing gearbox with lubricant and power pack reservoir with hydraulic fluid (LO 9-2350-258-12).

**NOTE**

Traversing automatically forces air from the system. Do not elevate or depress gun when purging system of air. Elevating or depressing gun will introduce air into system. System will then have to be bled.

(3) Traverse turret three times in each direction to purge air from system.

(4) Recheck hydraulic fluid level (LO 9-2350-258-12).

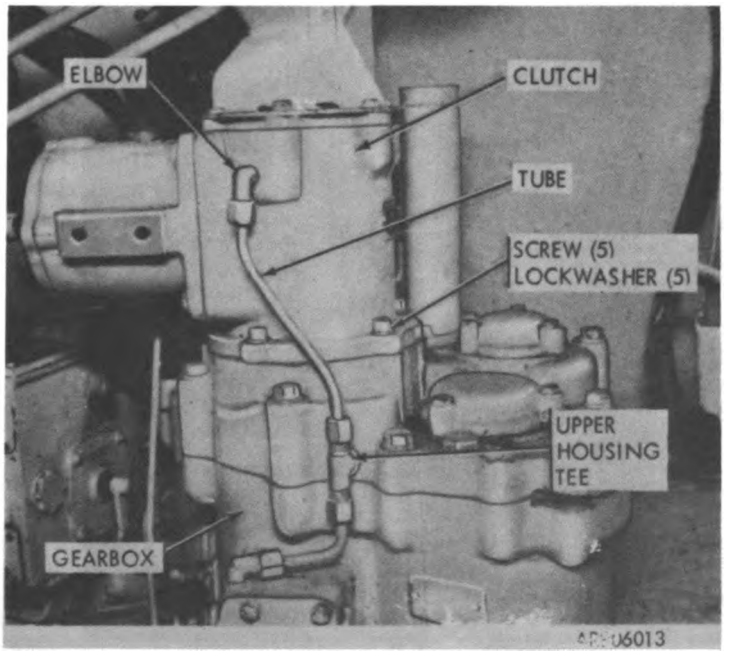



*Figure 2-43. Traversing gearbox clutch removal and installation*

## 2-35. Traversing Gearbox Pump.

*a. Removal (fig 2-44).*

(1) Place MASTER BATTERY switch in OFF position.

(2) Remove drain cap from filter and drain lubricant.

(3) Disconnect two lubricant lines from pump.

(4) Remove four screws and lockwashers securing pump to housing and remove pump and gasket. Discard gasket.

(5) Remove two elbows from pump.

*b. Installation (fig 2-44).*

(1) Install in reverse order.

(2) Install new gasket and tighten screws to lb-ft (7 N.m).

(3) Fill gearbox with lubricant (LO 9-2350-25 12) and check operation of traversing system.

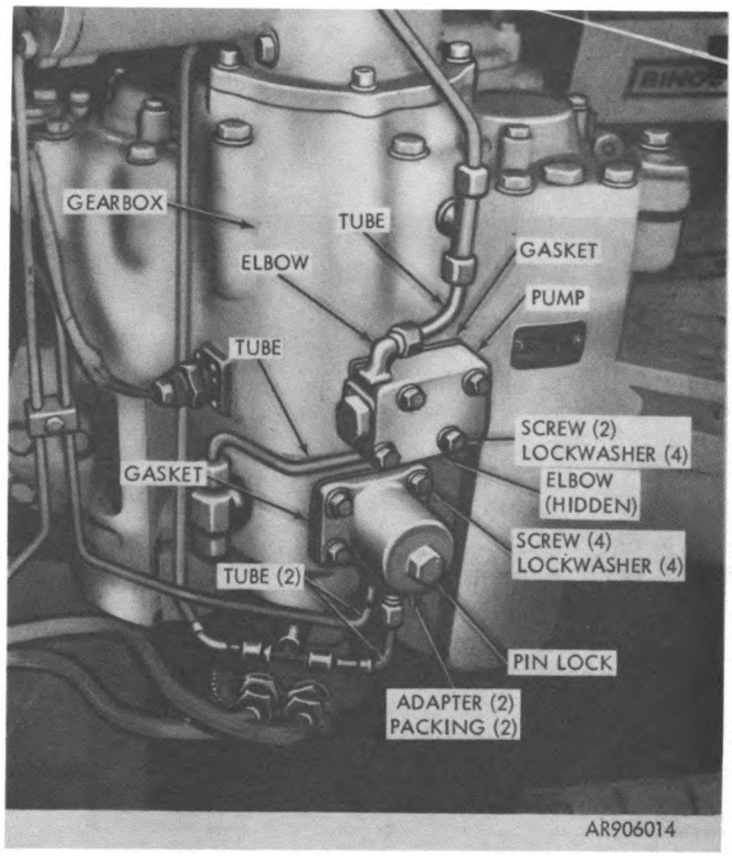



*Figure 2-44. Traversing gearbox pump removal or installation.*

## 2-36. Electrical Harnesses.

*a. Removal.*

**NOTE**

Refer to the applicable illustration (figs 2-45 through 2-59) for harness, cable, and/or lead disconnect points.

(1) Place MASTER BATTERY switch in OFF position.

(2) Refer to applicable wiring harness diagram and disconnect harness from the electrical components.

(3) Prior to attempting to remove harness assemblies, insure that all harness retaining hardware has been removed.

*b. Refer to TM 9-2350-258-20-2. If heat shrink tubing is installed during repair, shrink tubing with heat gun (3, table 2-1).*

*c. installation.*

(1) Install wiring harness in the reverse order of removal.

(2) Check electrical components for proper operation (TM 9-2350-258-10).

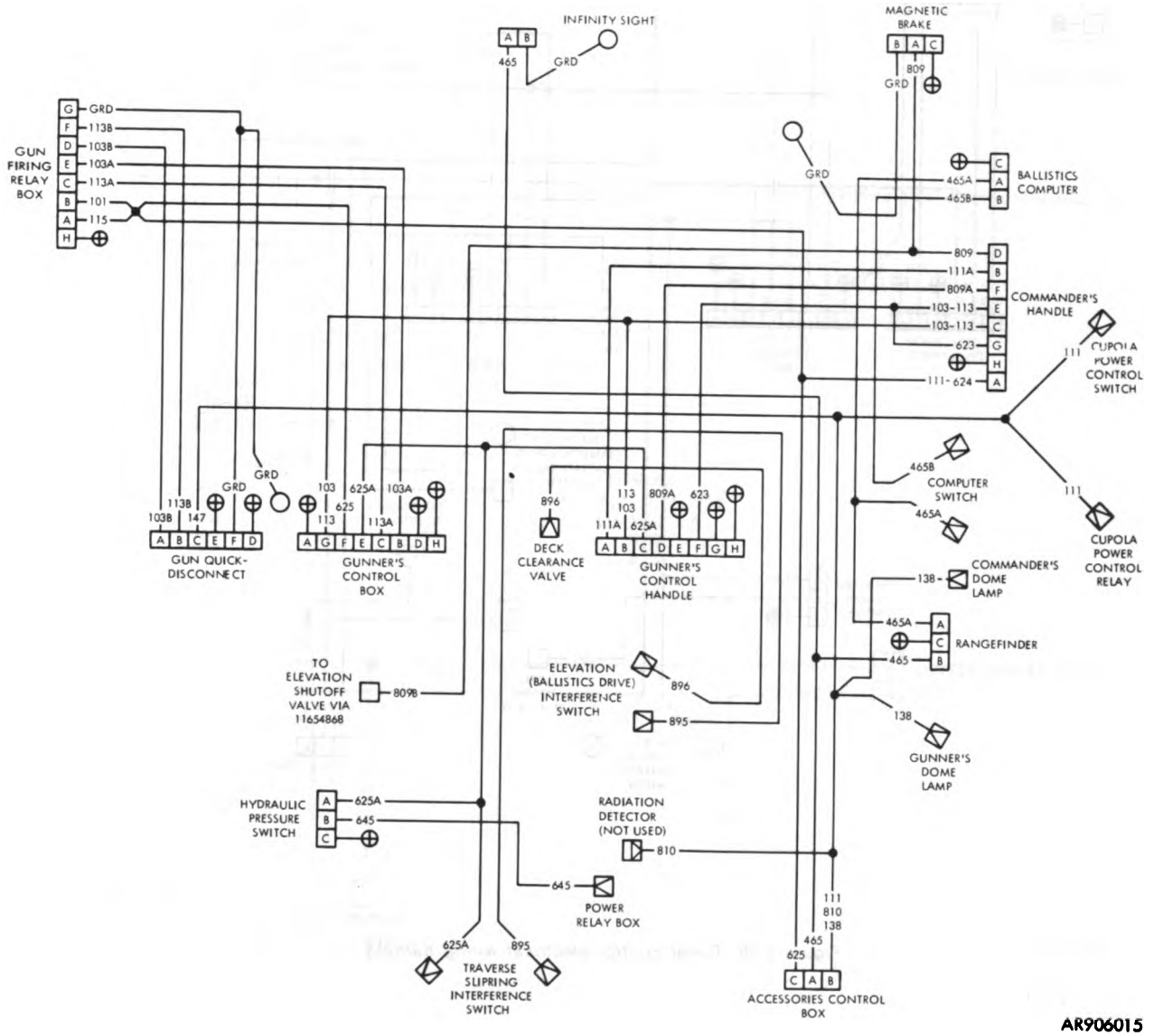



*Figure 2-45. Turret control electrical wiring harness.*

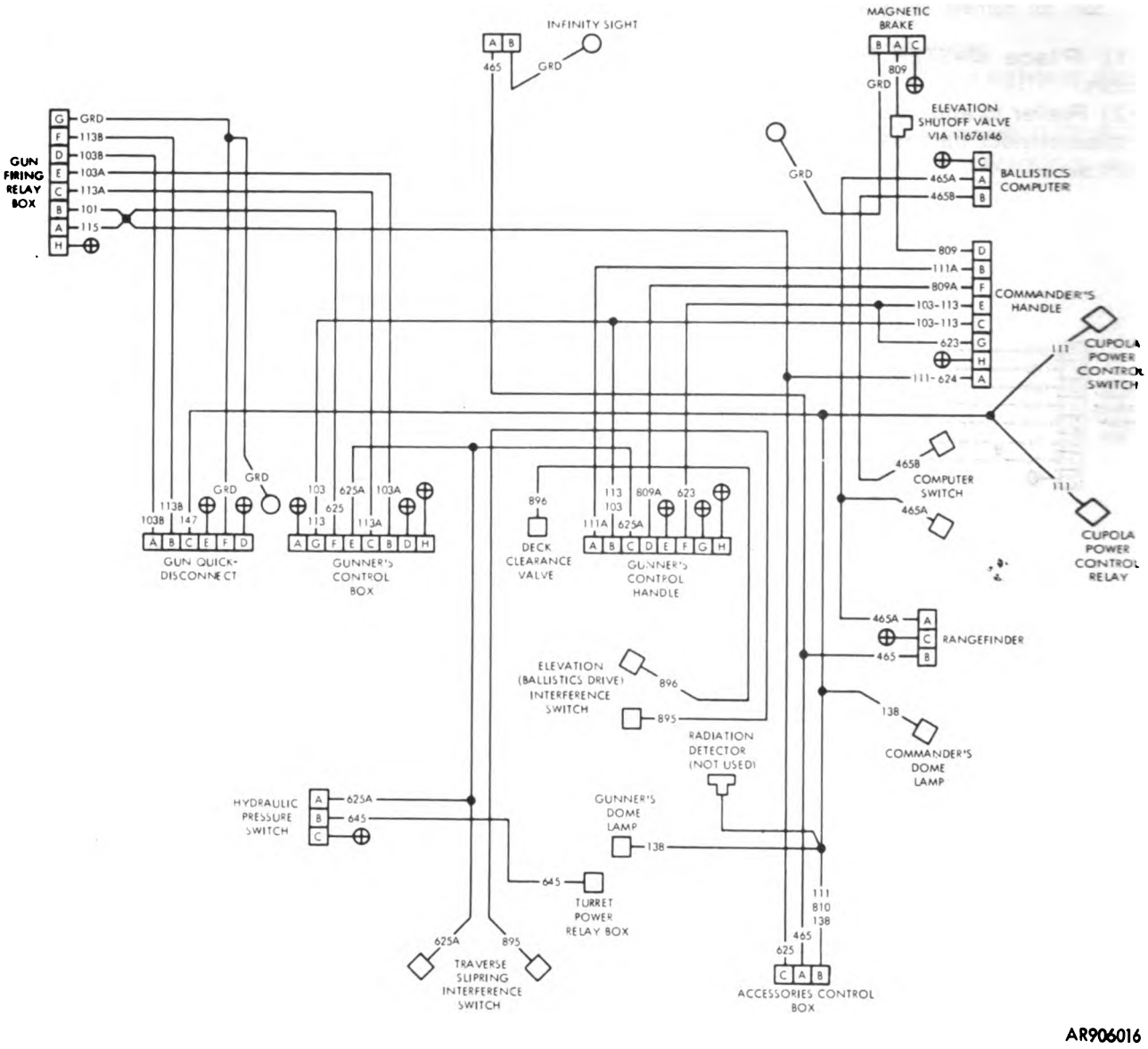



*Figure 2-46. Turret control electrical wiring harness.*

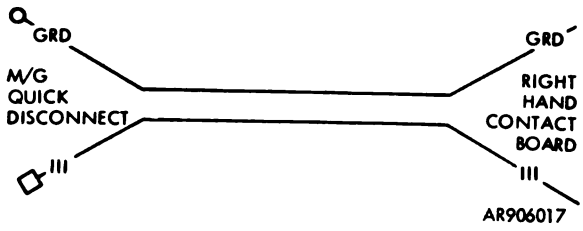



*Figure 2-47. M1 cupola terminal board electrical wiring harness.*

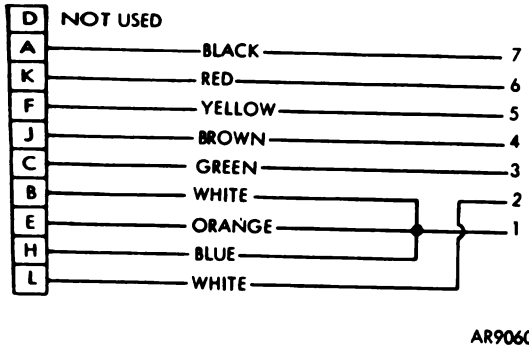



*Figure 2-48. M1 cupola terminal board electrical wiring harness.*

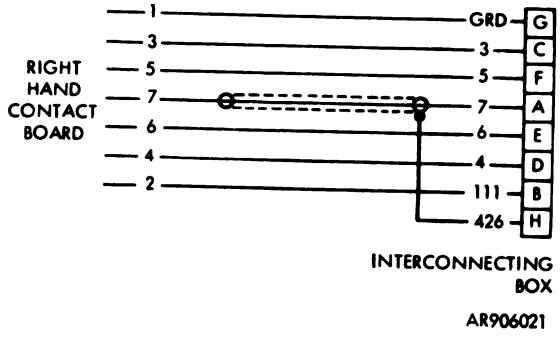



*Figure 2-49. M1 cupola interconnecting box electrical wiring harness.*

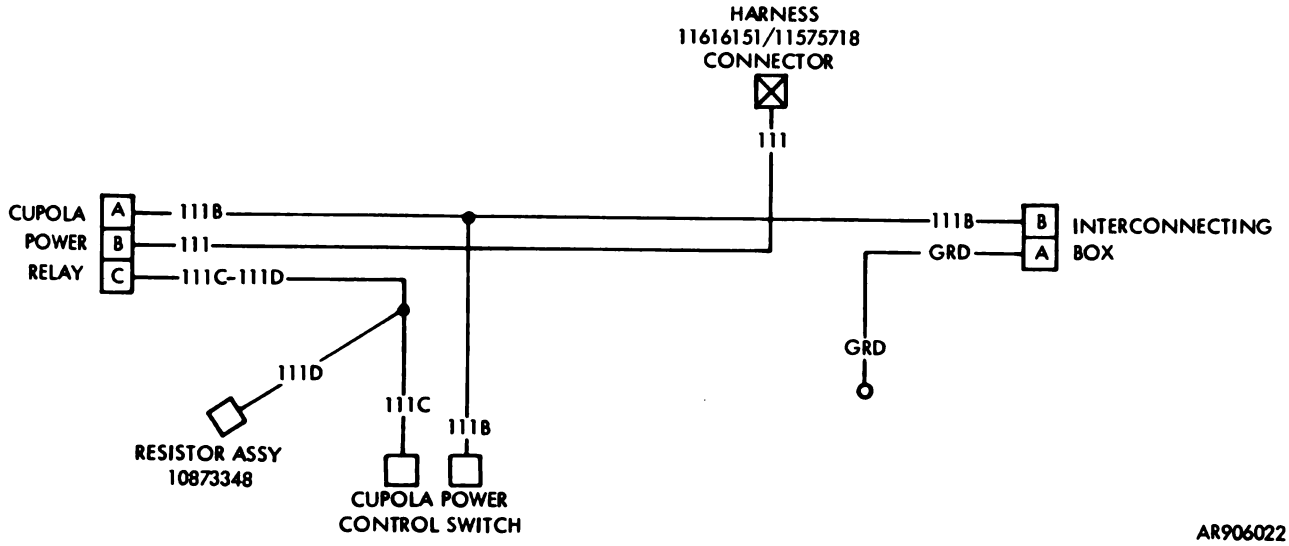



*Figure 2-50. M1 cupola power control electrical wiring harness.*

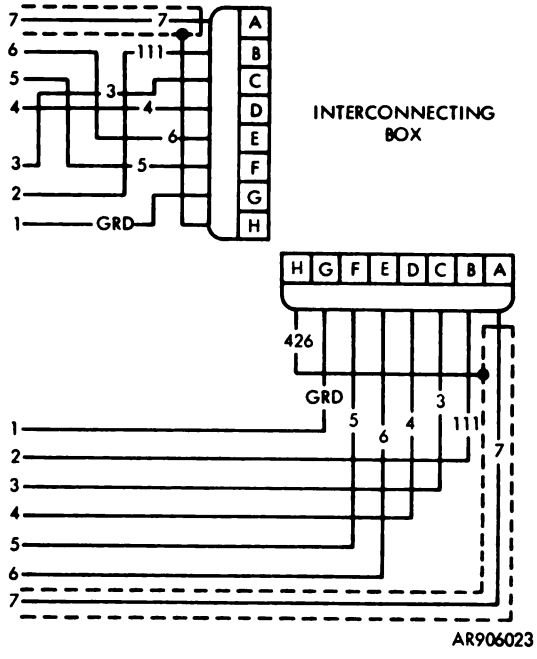



Figure 2-51. M1 cupola interconnecting box electrical wiring harness.

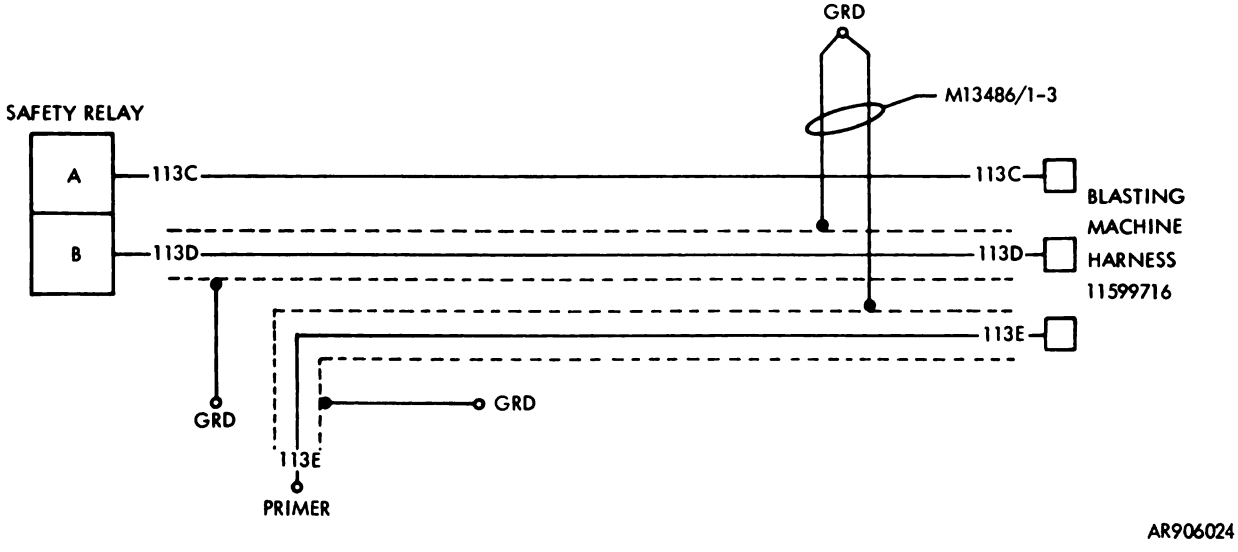



*Figure 2-52. Turret blasting machine electrical wiring harness.*

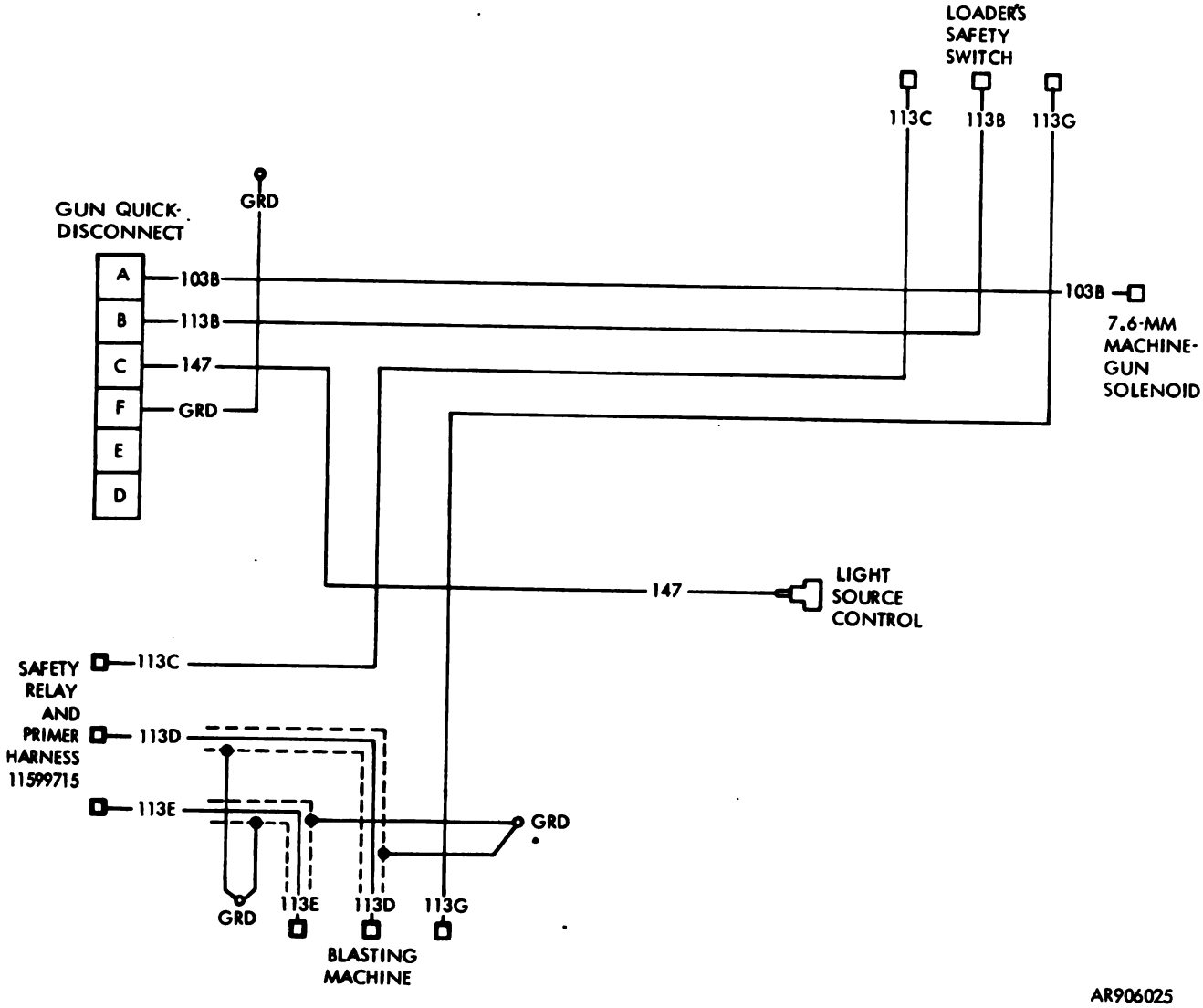



*Figure 2-53. Turret machinegun firing electrical wiring harness.*

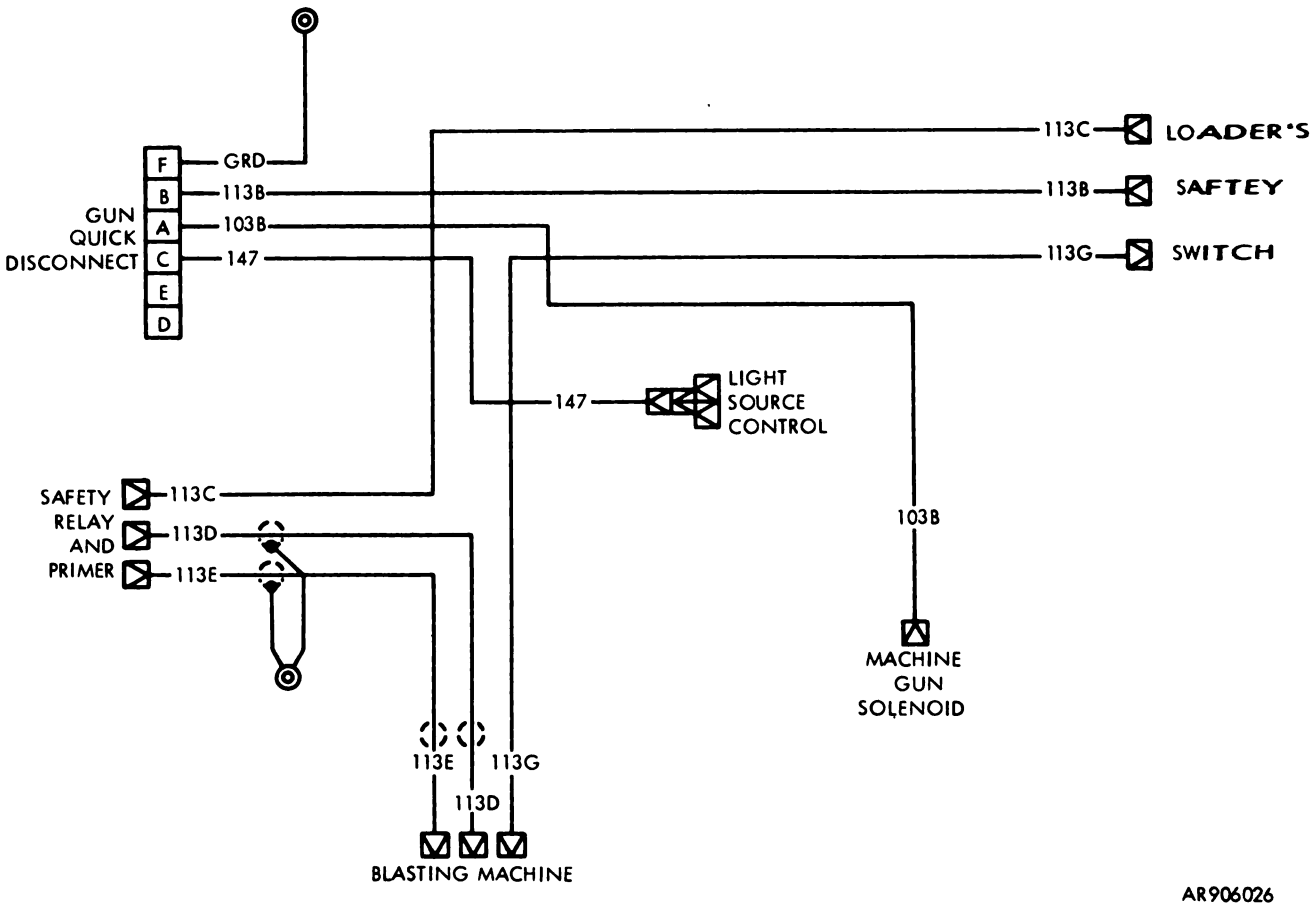



*Figure 2-54. Turret machinegun firing electrical wiring harness.*

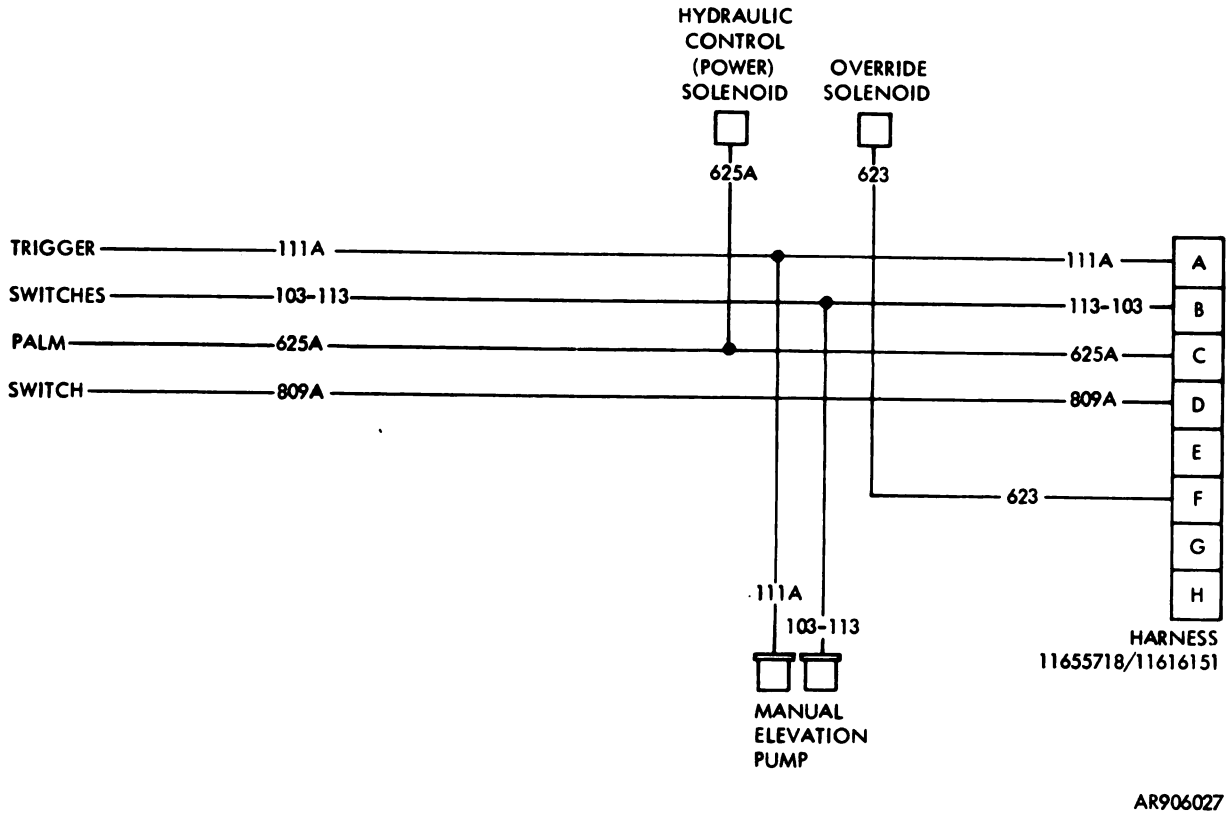



*Figure 2-55. Gunner's control internal wiring harness.*

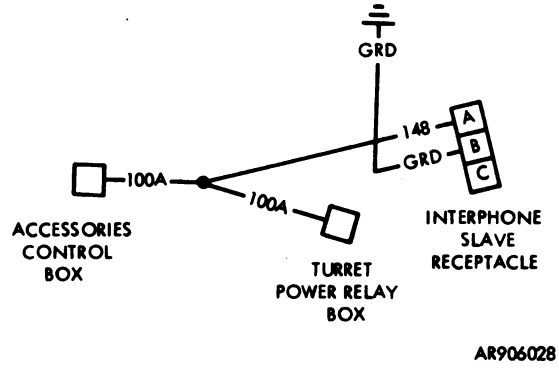



*Figure 2-56. Turret power electrical wiring harness.*

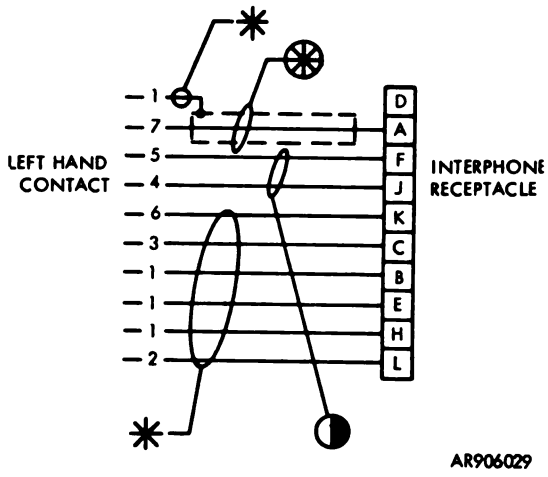



*Figure 2-57. M1 cupola interphone electrical wiring harness.*

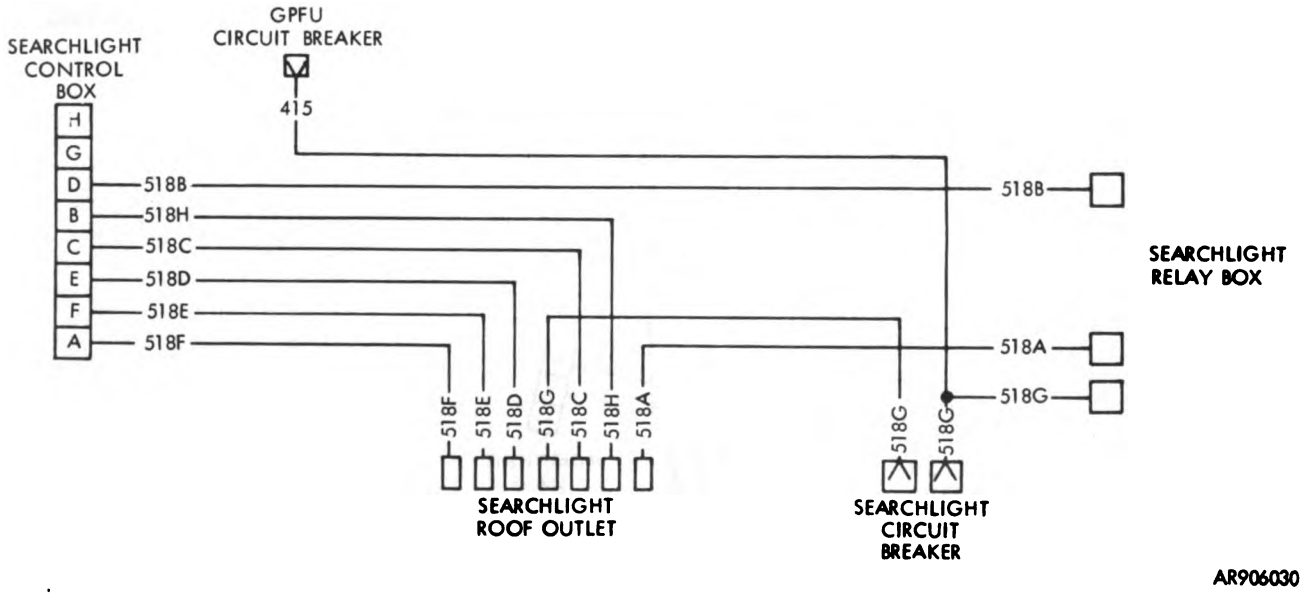



*Figure 2-58. Searchlight electrical wiring harness.*

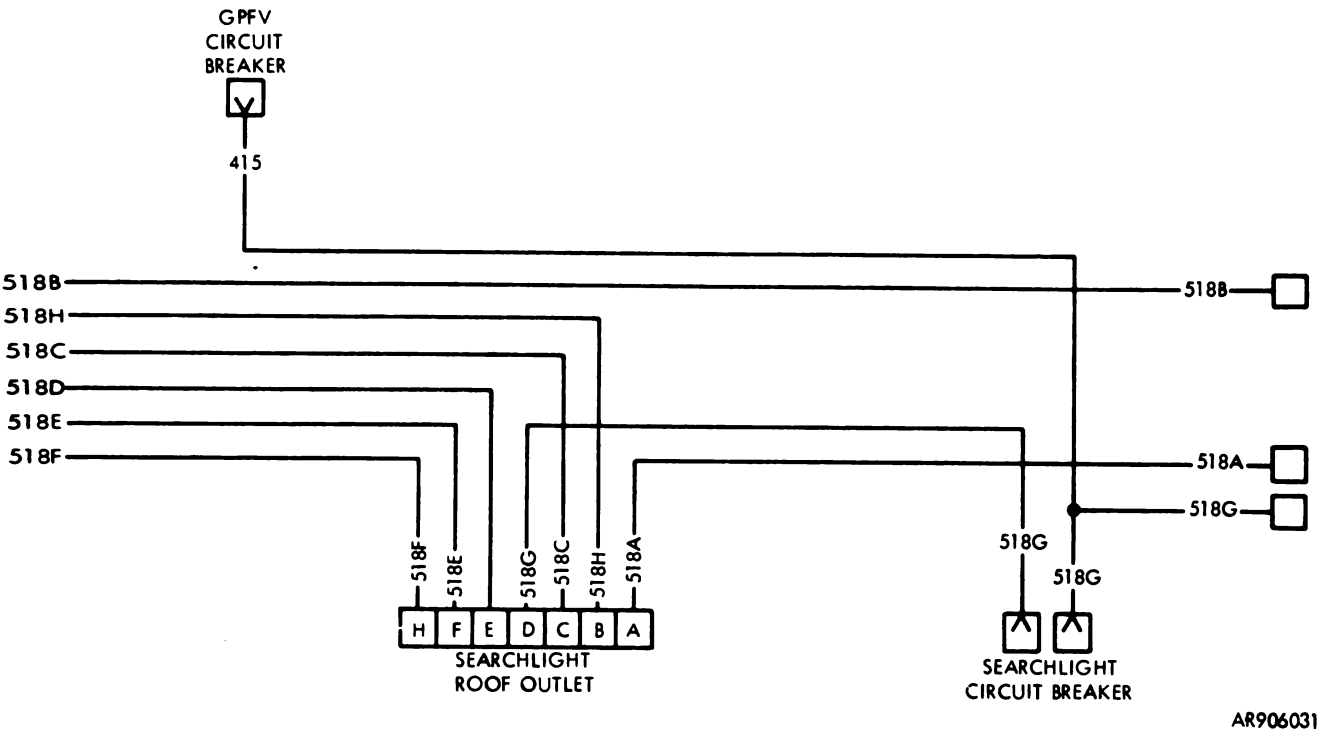



*Figure 2-59 Searchlight electrical wiring harness*

## 2-37. Turret Lock Housing.

*a. Removal (fig 2-60).*

(1) Place MASTER BATTERY switch in OFF position.

(2) Remove 12 screws and lockwashers from turret lock housing end covers.

(3) Remove two housing end covers.

(4) Remove four pads and two spacers from turret lock housing assembly.

(5) Remove four screws securing turret lock housing to turret race ring.

(6) Install two jackscrews in tapped holes on turret lock housing assembly.

(7) Tighten jackscrews alternately to remove dowel pins from turret race.

(8) Remove turret lock housing from turret race ring.

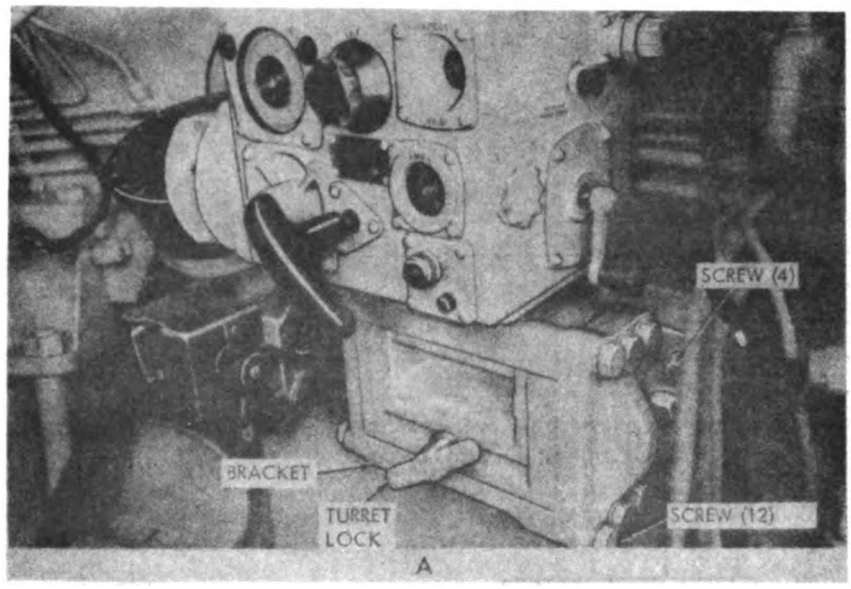
*b. Installation (fig 2-60).*

(1) Install turret lock housing on turret race ring.

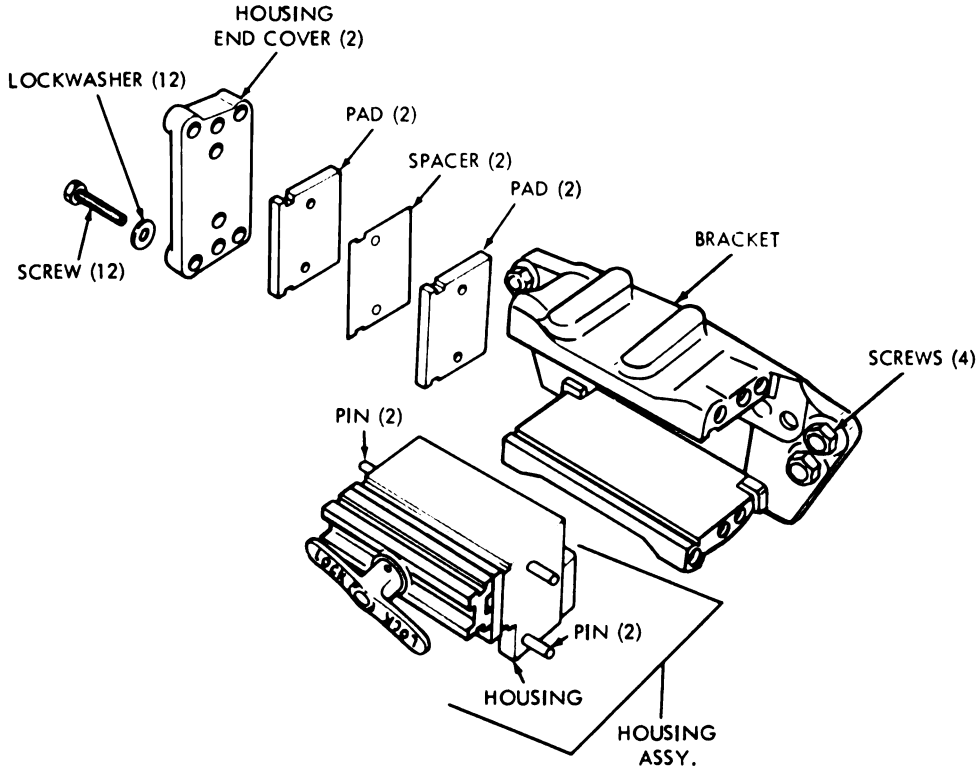
(2) Install four screws and lockwashers securing housing to race ring.

(3) Install four pads and two spacers in turret lock housing assembly.

(4) Install to housing end covers and secure with 12 screws and lockwashers.




A




B

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*Figure 2-60. Turret lock housing component removal or installation.*

## 2-38. M1 Cupola and Vision Block Adapter Ring (Vehicles Serial Numbers A3001 thru A3374) (fig 2-61).

*a. Removal (fig 2-62).*

(1) Place MASTER BATTERY switch in OFF position.

**WARNING**
**Insure all weapons are clear of ammunition before removing cupola.**

(2) Refer to applicable sections of TM 9-2350-258-20-2 and perform the following:

*(a)* Remove commander's periscope.

*(b)* Remove cupola caliber .50 ammunition box.

(3) Remove seven screws and lockwashers securing guard and rubber strip (view A). Remove guard.

(4) Manually traverse cupola to expose left contact board (view B).

(5) Remove four screws securing left spring assembly and remove assembly (view B).

(6) Manually traverse cupola to expose right contact board (view C).

(7) Remove four screws securing right spring assembly and remove assembly (view C).

(8) Use allen wrench (40. table 2-1) to remove 12 socketthead screws securing vision ring to turret (view D).

(9) Install 3 clevises (39. table 2-1) into lifting eyes on cupola (view E).

(10) Attach cupola sling (37. table 2-1) to 3 clevises in lifting eyes on cupola. Attach sling to hoist hook and lift cupola and vision ring from turret (view E).

(11) Place cupola on a stand (38. table 2-1) and remove hoist hook and sling (view F).

*b. Installation (fig 2-62).*

(1) Install cupola in reverse order of removal. Tighten vision ring socket head screws to 304-336 lb-ft (412-455 N.m).

(2) Bottom edge of contact springs (left and right) must be in the same horizontal plane as the bottom edge of the contact strip within 0.010 inch.

(3) If it is necessary to aline the contact springs, loosen four spring retaining screws and aline springs and contact strip. Tighten retaining screws.

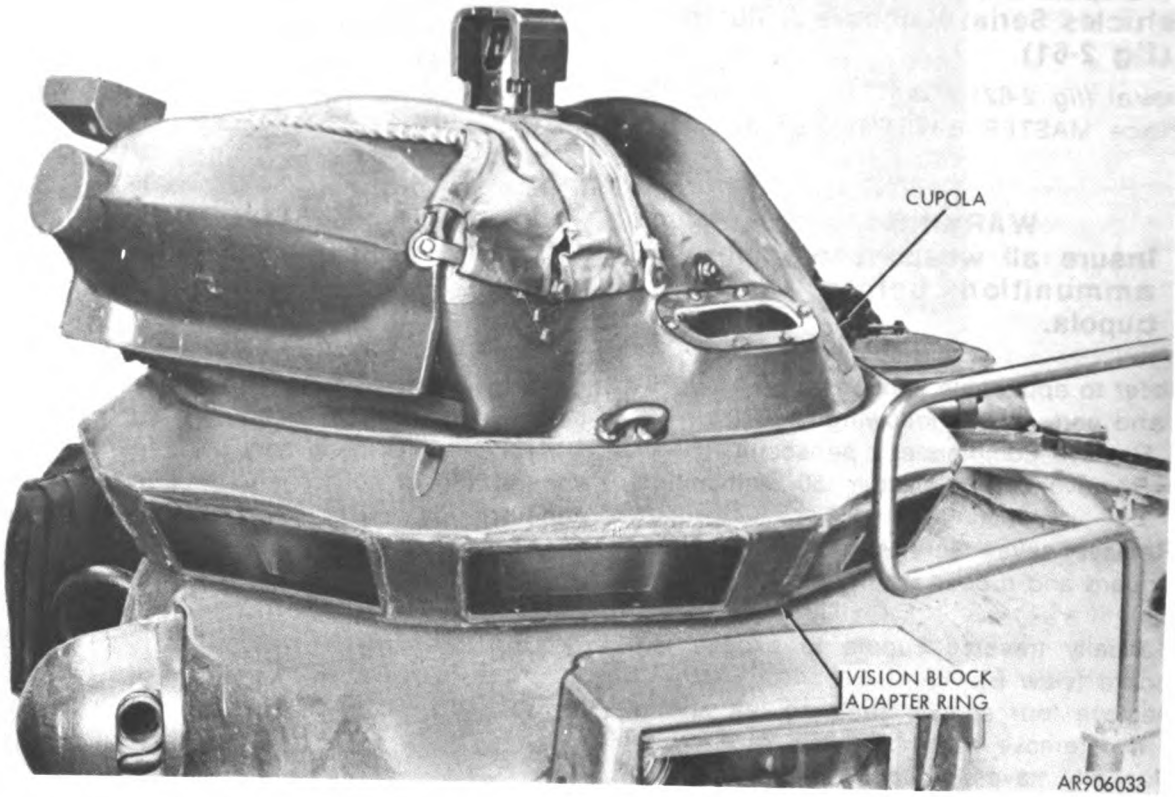
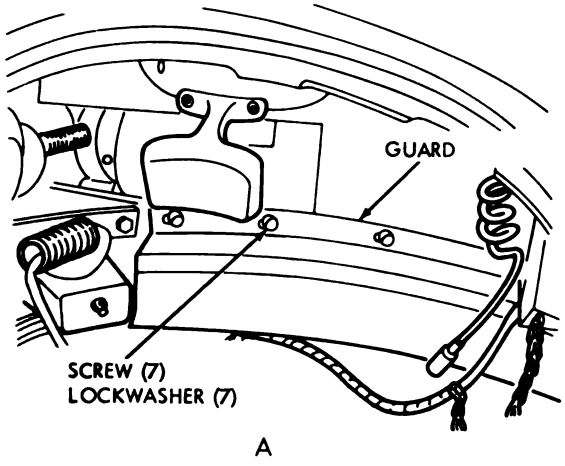
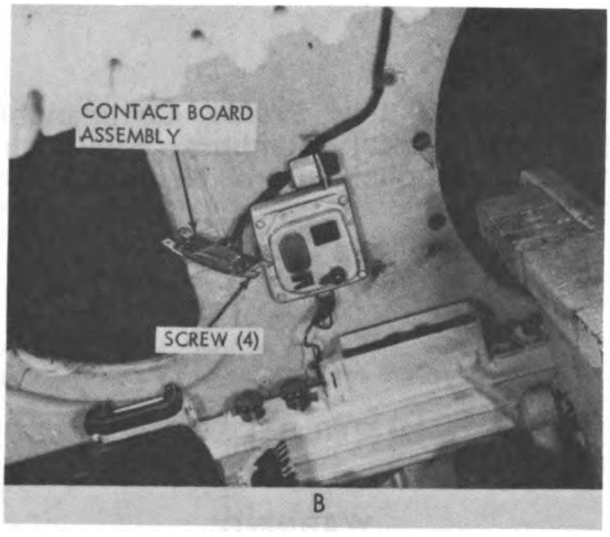


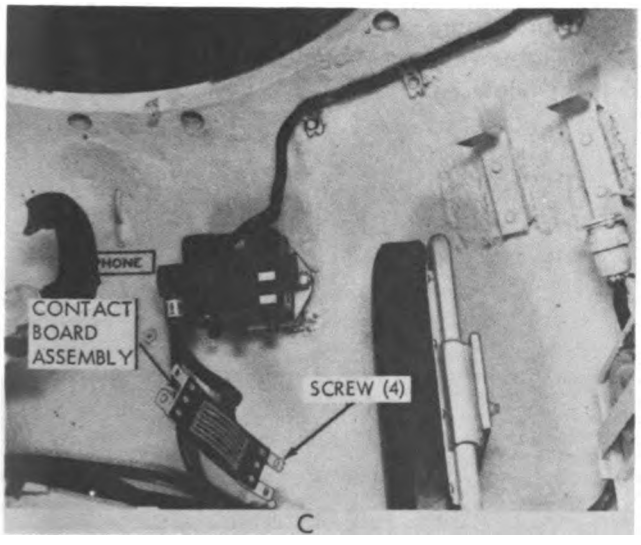

*Figure 2-61. M1 cupola and vision block adapter ring. (vehicles serial numbered A3001 thru A3374).*



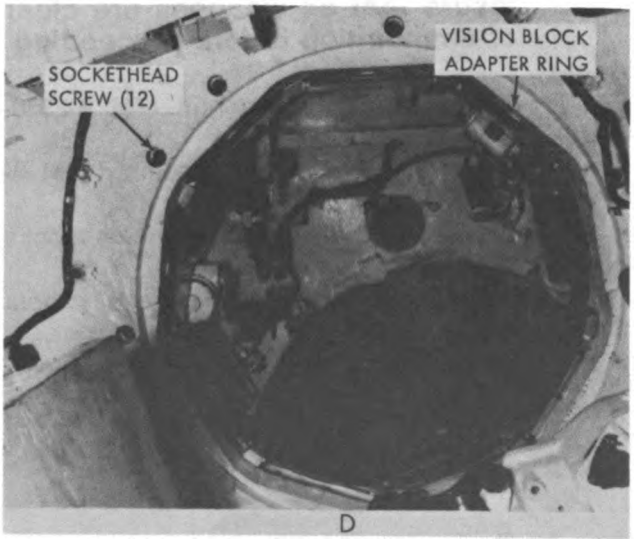

A



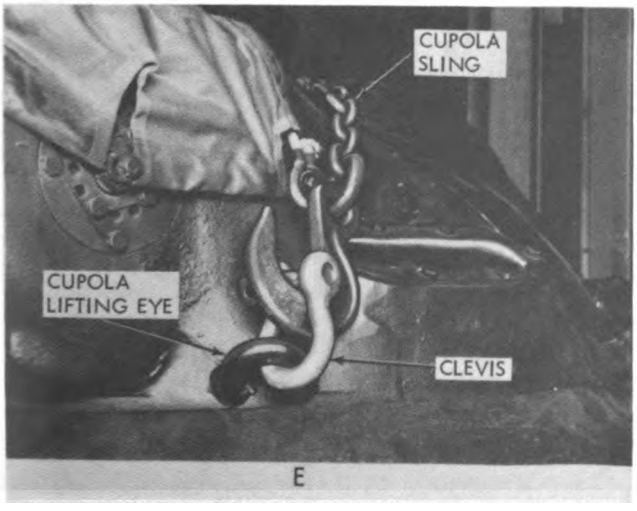

B




C




D




E

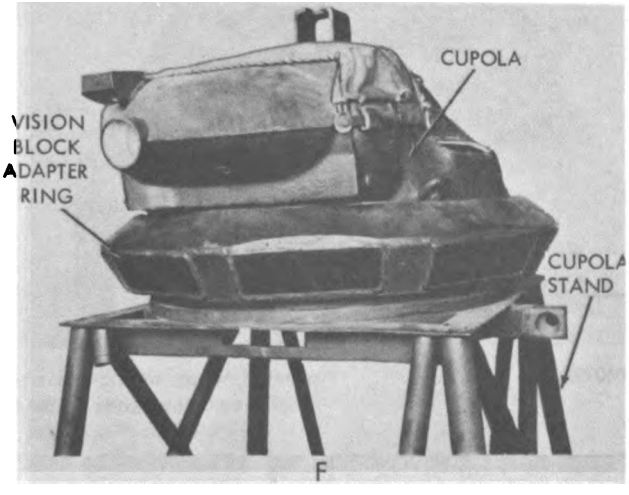



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*Figure 2-62. M1 cupola and vision block adapter ring removal or installation (vehicles serial numbered A3001 thru A3374).*

## 2-39. Cupola, Low Profile, Commander's (Vehicles Serial Numbers A1001 thru A1999 and Vehicles Serial Numbers A3375 thru A3999).

*a. Removal (fig 2-63).*

**NOTE**

The low-profile cupola is used on vehicles A1001 through A1999 and A3375 through A3999.

(1) Place MASTER BATTERY switch in OFF position.

**WARNING**

**Insure that all weapons are clear of ammunition before proceeding.**

(2) Remove M60D machinegun (TM 9-2350-258-10).

(3) Remove scissors mount assembly (TM 9-2350-258-20-2).

(4) Remove three M17 periscope vision blocks (TM 9-2350-258-10).

(5) Close cupola hatch and engage cupola traverse lock.

**CAUTION**

**Cupola weighs 700 pounds. Use a lifting device capable of lifting and holding this weight.**

(6) Attach cupola sling (37, table 2-1) to lifting device and secure three sling hooks to lifting eyes on cupola. Take up slack on sling (view A).

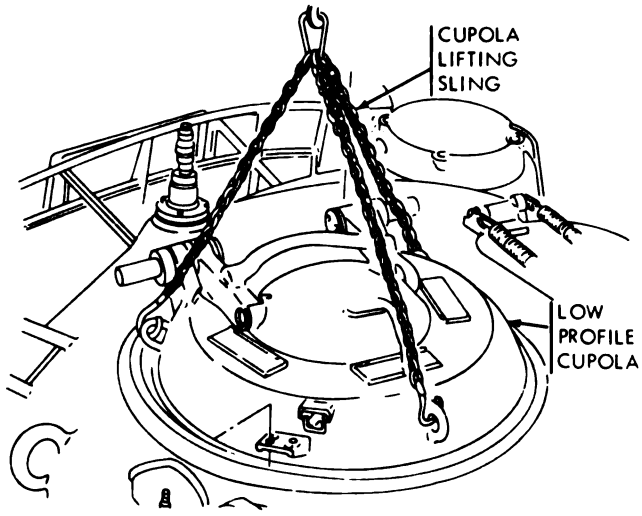
(7) Remove 12 self-locking bolts securing cupola to turret (view B).

(8) Raise and remove cupola from turret and place cupola on stand (38, table 2-1) (view C).

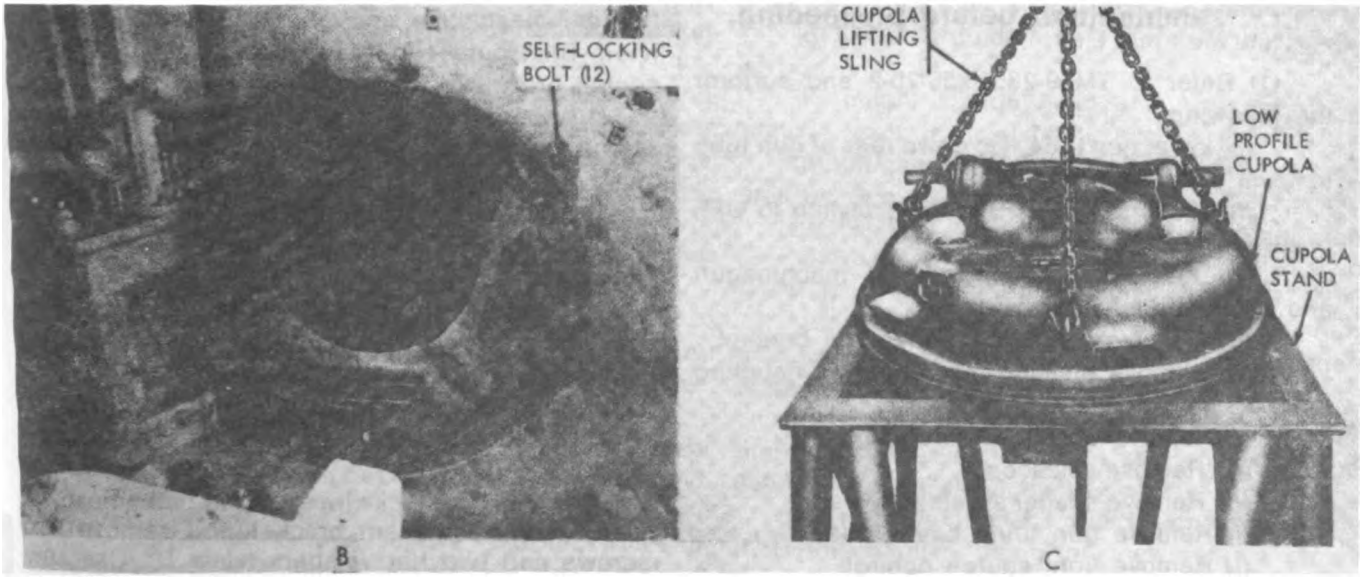
*b. Installation (fig 2-63).*

(1) Install cupola in the reverse order of the removal procedure.

(2) Tighten cupola bolts 304 to 336 lb-ft (412-455 N.m) (view A).




A




B C

*Figure 2-63. Commander's low-profile cupola removal or installation (vehicles serial numbered A1001 thru A1999 and A3375 thru A3999).*

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## 2-40. Azimuth Drive and Brake Assembly (Vehicles Serial Numbers A1009 thru A1999 and Vehicles Serial Numbers A3375 thru A3999).

*a. Description.* The azimuth drive and brake assembly gearbox is used to manually rotate the low profile cupola either to the left or right and is located on the ring gear in the interior of cupola. Rotational speed of cupola is controlled by the azimuth retarder handle which is a part of the azimuth drive and brake assembly. When the azimuth retarder handle is moved to the right, rotary movement of the cupola is decreased. The following procedures provide for the assembly and disassembly of the azimuth drive and brake assembly gearbox.

*b. Removal.* Refer to TM 9-2350-258-20-2.

*c. Installation.* Refer to TM 9-2350-258-20-2.

## 2-41. Cannon and Combination Gun Mount.

*a. Removal (fig 2-64).*

**WARNING**
**Insure all weapons are clear of ammunition before proceeding.**

(1) Refer to TM 9-2350-258-20-2 and perform the following:

*(a)* Level gun tube. Tie down rear of gun tube to level position.

*(b)* Place MASTER BATTERY switch to OFF position.

*(c)* Remove 7.62-mm coaxial machinegun and machinegun ammunition box.

*(d)* Remove 7.62-mm machinegun bracket.

*(e)* Remove blasting machine and mounting bracket.

*(f)* Remove telescope filter box.

*(g)* Remove telescope.

*(h)* Remove loader's safety switch.

*(i)* Remove gun firing safety relay.

*(j)* Remove light source control.

*(k)* Remove gunner's M50 instrument lamp.

*(l)* Remove replenisher and hose assembly.

*(m)* Remove searchlight. Remove searchlight mounting studs.

*(n)* Disconnect gun shield (mantlet) cover from turret.

*(o)* Remove telescope mount.

(2) Remove nylon personnel ballistics shield (TM 9-2350-258-20-2).

(3) Install hooks of sling through lifting eyes of gun shield (view A).

(4) Using an overhead crane with a lifting capacity of 3 tons, remove slack in sling (view A).

(5) Attach hook on 1/2-ton hoist body (item 28, table 2-1) to gun sling center cable (view A).

(6) Attach hoist cable hook to a webbed strap, looped around the gun barrel forward of the bore evacuator (view A).

(7) Remove slack from hoist cable to balance cannon and combination gun mount during removal.

(8) Fasten a guide rope 3 feet from muzzle of gun.

(9) Disconnect gun quick-disconnect connector and route harness away from gun mount (view B).

(10) Remove screw and lockwasher securing clamp and cable from loader's safety switch to recoil mechanism (view B).

(11) Remove screw and lockwasher securing clamp and harness to recoil mechanism (view B).

(12) Remove two screws and four lockwashers securing quick-disconnect plug mounting bracket to recoil mechanism and remove mounting bracket (view B). Route two ground leads from disconnected bracket down and away from gun mount.

(13) Remove screw and lockwasher securing clamp and harness to recoil mechanism at blasting machine. Remove clamp and harness.

(14) Remove elevating mechanism (TM 9-2350-258-20-2). Leave gun tied down to prevent movement.

(15) Remove three screws and lockwashers securing loader's guard to gun mount and remove loader's guard (view C).

(16) Remove six screws and lockwashers securing ejector mechanism bracket to recoil mechanism (view D).

(17) Remove lockwire securing two screws into ejector mechanism bracket and remove two screws and two flat washers (view D). Use new screws and new flat washers during installation. Torque 1/2-in. screws to between 90 and 110 ft-lb and torque 9/16-in. screws to between 120 and 140 ft-lb.

(18) Pry ejector mechanism bracket from locating key and remove bracket (view D).

(19) Install eyebolt in gunner's guard (view E).

(20) Install hoist hook in eyebolt and remove slack (view E).

(21) Remove two screws, lockwashers, and nuts securing gunner's guard to gunner's guard support bracket (view E).

(22) Remove two nuts and lockwashers securing gunner's guard to recoil mechanism and remove gunner's guard (view E).

(23) Remove five screws, lockwashers, and washers securing telescope mount to gun mount (view F).

(24) Install two jackscrews (1/2x20 unf-2B) into jackscrew holes in telescope mount (view F).

(25) Support mount and tighten jackscrew. Move mount to free mount from locating pins as jackscrew is tightened, and remove mount (view F).

(26) Disconnect electrical lead from firing contact on gunner's guard support bracket.

(27) Remove two screws and lockwashers securing firing contact to gunner's guard support bracket and remove firing contact (view E).

**(28) Remove lockwire, four screws, and four flat washers securing gunner's guard support bracket to recoil mechanism and remove bracket (view E).**

(29) Support trunnion connecting link and remove four screws and lockwashers retaining ballistics drive 11-inch arm bearing caps. Remove caps and carefully lower trunnion connecting link assembly (view G).

(30) Hold stud nut and loosen end nut securing stud to bearing cap lever (view H).

(31) Tap nut to loosen stud (view H).

(32) Remove nut and lockwasher securing trunnion connecting link to trunnion bearing cap lever and remove connecting link (view H).

(33) Remove four screws and lockwashers securing left trunnion bearing cap to gunshield and remove cap (view I).

(34) Remove four screws and lockwashers securing right trunnion bearing cap to gunshield and remove cap (view J).

(35) Lift cannon and combination gun mount and carefully remove from turret (view K). Lower onto suitable supports sawhorse or (12x12 blocks) (view L). Remove sling, 1/2-ton hoist, webbed strap (view A) and balance rope (view L).

(36) If trunnion bearings are defective, remove nut and washer securing each bearing and retainer to trunnion (view M).

(37) Heat bearing to approximately 250 degrees. Pull evenly on bearing and remove bearing and retainer (view M).

(38) Repeat steps (32) and (33) for remaining bearing. Replace bearings in pairs only.

*b. Installation (fig 2-64).*

(1) If trunnion bearings were removed, heat new bearing to 250 degrees in an oil bath and install retainer and bearing on trunnion. Repeat for remaining bearing (view M).

(2) Pack each bearing with grease (LO 9-2350-258-12).

(3) Secure each bearing and retainer to trunnion with nut and lockwasher (view M).

(4) Install hooks of sling through lifting eyes on gun shield (view L).

(5) Using an overhead crane capable of lifting a minimum of 3 tons, remove slack in sling (view L).

(6) Fasten a guide rope 3 feet from muzzle end of gun (view L).

(7) Install 1/2-ton hoist and web strap, and remove slack in hoist chain (view L).

(8) Lift cannon and gun mount and carefully install on gun trunnions in turret (view A).

(9) Position right trunnion bearing cap to trunnion and secure with four screws and lockwashers (view J).

(10) Position left trunnion bearing cap to trunnion and secure with four screws and lockwashers (view I).

(11) Insure mount is properly seated on trunnion and tighten eight screws securing bearing to 500-550 lb-ft (678-745 N.m) (view N).

(12) Position gunner's guard support bracket to recoil mechanism. Using four new screws, secure bracket to recoil mechanism (view E). Tighten to 90-110 lb-ft (122-149 N.m) and secure with lockwire (view E).

(13) Position firing contact to gunner's guard support bracket and secure with two screws and lockwashers (view E). Tignten to 2-3 lb-ft (3-4 N.m) (view E).

(14) Install nylon ballistic shield (TM 9-2350-258-20-2).

(15) Position trunnion connecting link to left trunnion bearing cap lever and secure with nut and lockwasher (view H). Tighten to 60-80 lb-ft (81-108 N m).

(16) Raise trunnion supporting link and position eccentric to upper bearing cap. Position two lower bearing caps to upper bearing cap and secure with four screws and lockwashers (view G).

(17) Position M105D and 105E1 telescope mount on locating pins of gun mount and secure with two screws and lockwashers (view F). Tighten to 43-63 lb-ft (58-85 N.m).

(18) Install eyebolt in gunner's guard (view E).

(19) Install hoist hook in eyebolt. Raise and position gunner's guard to recoil mechanism. Secure with two nuts and lockwashers (view E). Tighten to 100-180 lb-ft (136-244 N.M).

(20) Secure gunner's guard support bracket with two screws. lockwashers. and nuts (view E). Tighten to 80-100 lb-ft (108-133 N.m).

(21) Position ejector mechanism bracket to locating key on gun mount (view D).

(22) Secure ejector mechanism bracket with two screws and spacers. Tighten screws to 90-100 lb-ft (122-136 N.m). and secure with lockwire (view D).

(23) Install top two ejector mechanism bracket screws and lockwashers. Tighten to 70-90 lb-ft (95-122 N.m) (view D).

(25) Position loader's guard to gun mount and secure with three screws and lockwashers (view C). Tighten screws to 80-90 lb-ft (108-122 N.m) (view C).

(26) Position quick-disconnect plug mounting bracket on recoil mechanism and secure with one screw and lockwasher at front of bracket (view B).

(27) Connect gun quick-disconnect connector (view B).

(28) Route harness from quick-disconnect plug to loader's safety switch. Secure harness with screw. lockwasher. and clamp (view B).

(29) Secure harness to recoil mechanism front of quick-disconnect plug bracket with screw lockwasher. and clamp (view B).

(30) Position two ground leads to quick-disconnect plug mounting bracket and secure leads and bracket to recoil mechanism with screw and two lockwashers (view B).

(31) Position harness and clamp on recoil mechanism at blasting machine and secure with screw and lockwasher.

(32) Remove balance rope. 1 1/2-ton hoist. web strap. and sling.

(33) Refer to applicable sections of TM 9-2350-258-20-2 and perform the following:

*(a)* Install elevating mechanism.

*(b)* Mount light source control.

*(c)* Mount gun firing safety relay.

*(d)* Mount loader's safety switch.

*(e)* Mount blasting machine bracket and blasting machine.

*(f)* Connect blasting machine.

*(g)* Connect gun firing safety relay.

*(h)* Connect light source control

*(i)* Install replenisher and hose assembly.

*(j)* Install telescope M50 instrument light.

*(k)* Install 7.62-mm ammunition box.

*(l)* Install telescope filter box.

*(m)* Install M105D and M105E1 telescope.

*(n)* Install 7.62-mm machinegun bracket.

*(o)* Install 7.62-mm coaxial machinegun.

*(p)* Install gunshield (mantle) cover and searchlight mounting studs.

*(q)* Install searchlight.

*(r)* Lubricate trunnion bearing grease fittings.

*(s)* Perform fire control check.

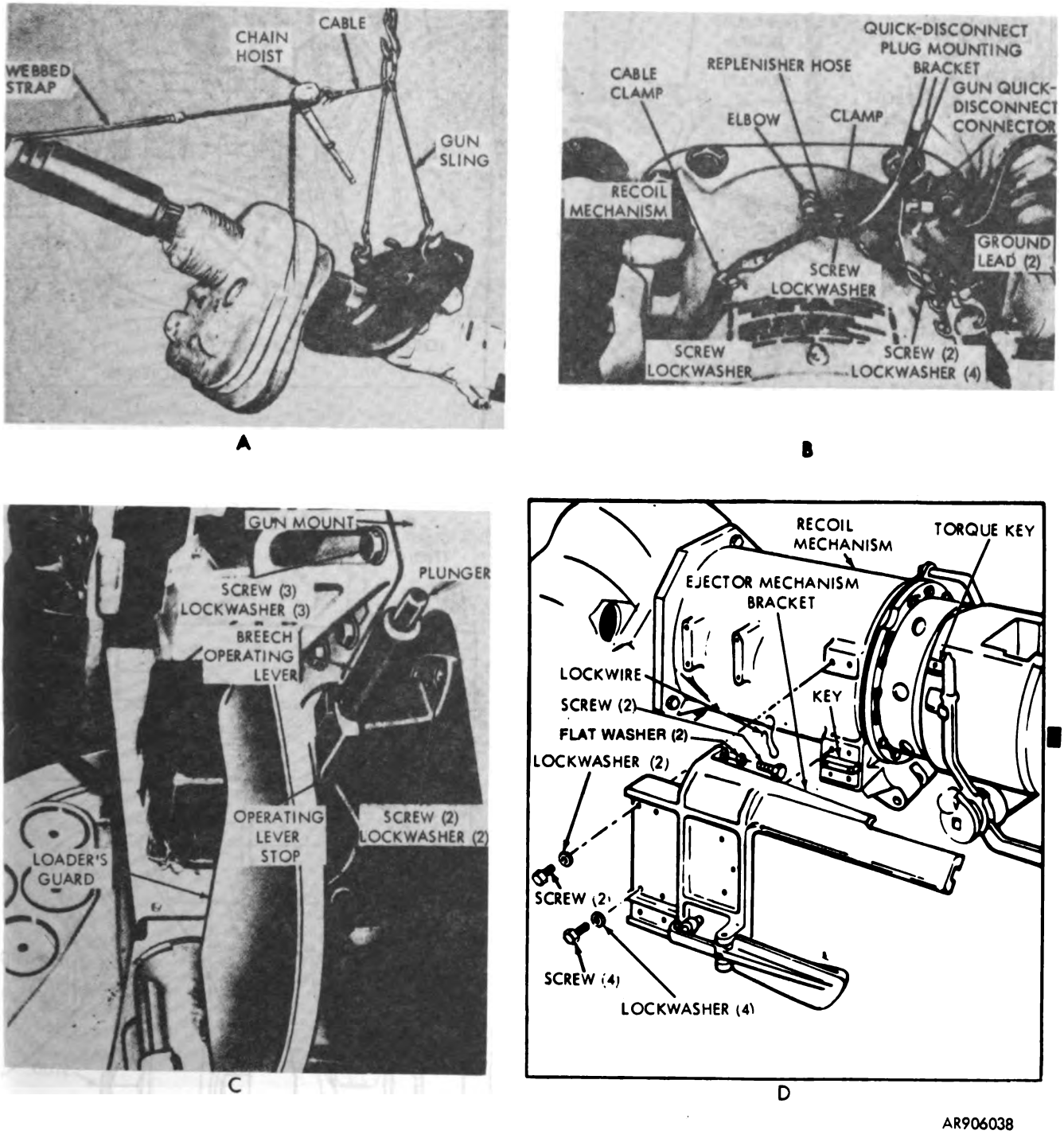
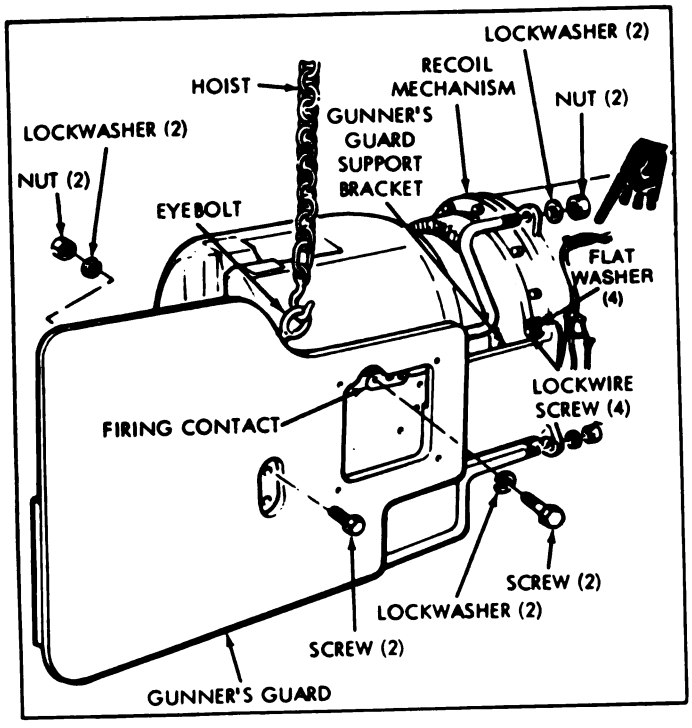



*Figure 2-64. Cannon and combination gun mount removal or installation (1 of 4).*

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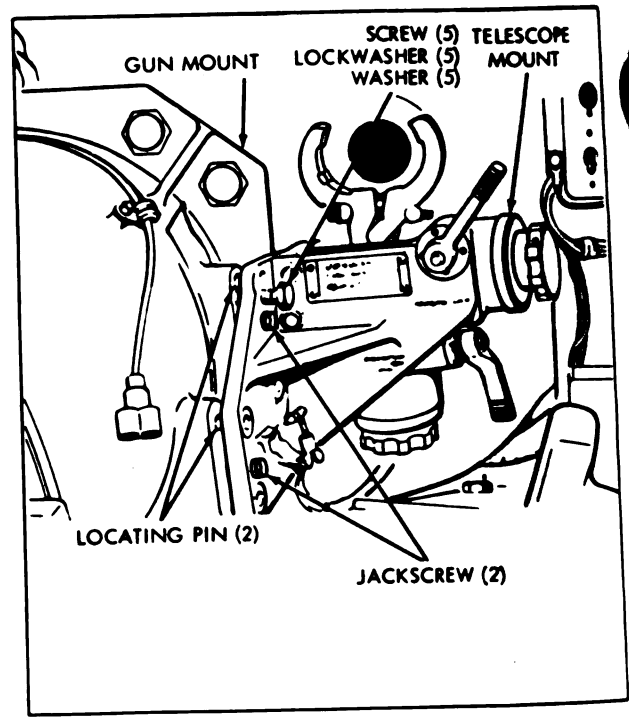


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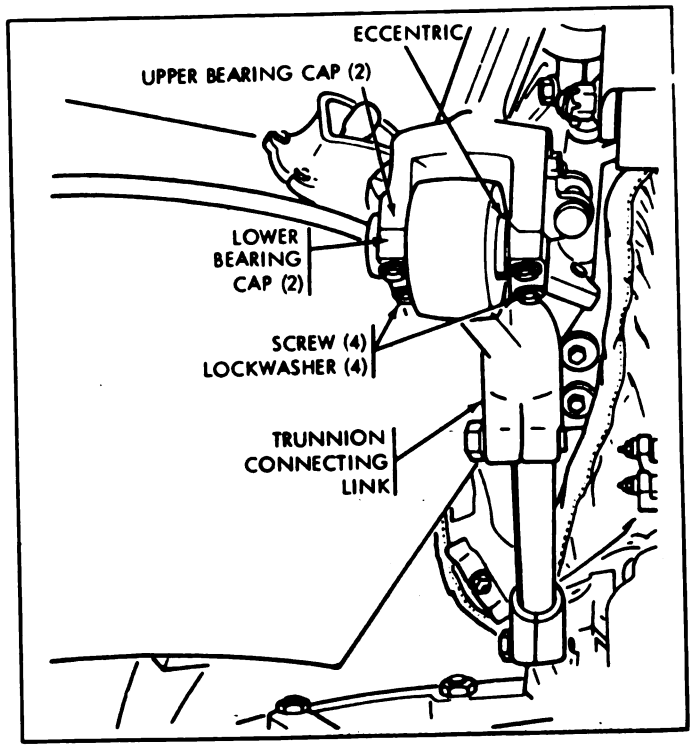


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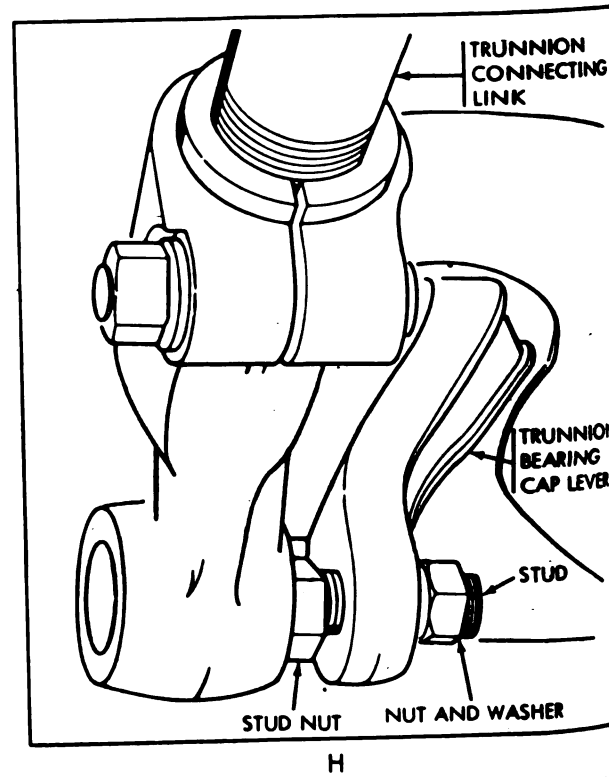


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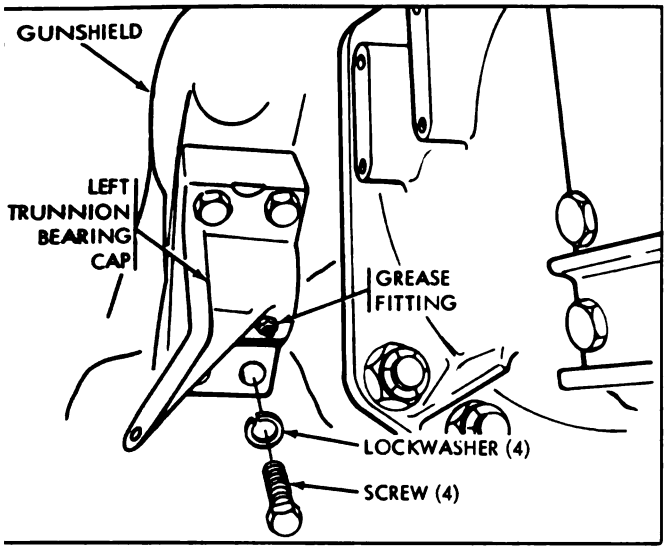
*Figure 2-64. Cannon and combination gun mount removal or installation (2 of 4).*

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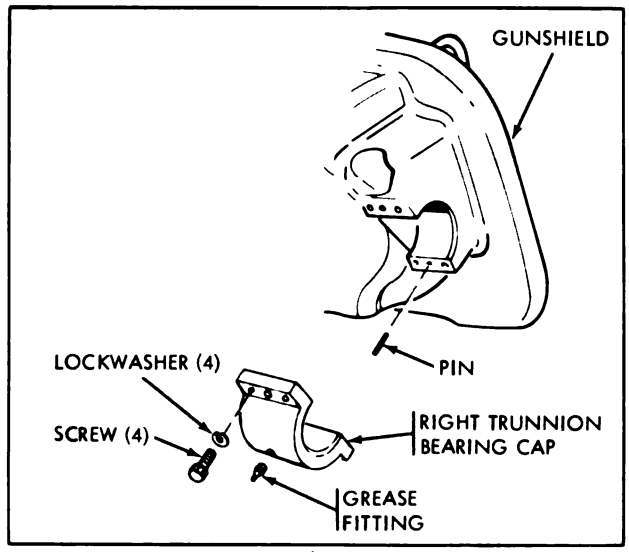


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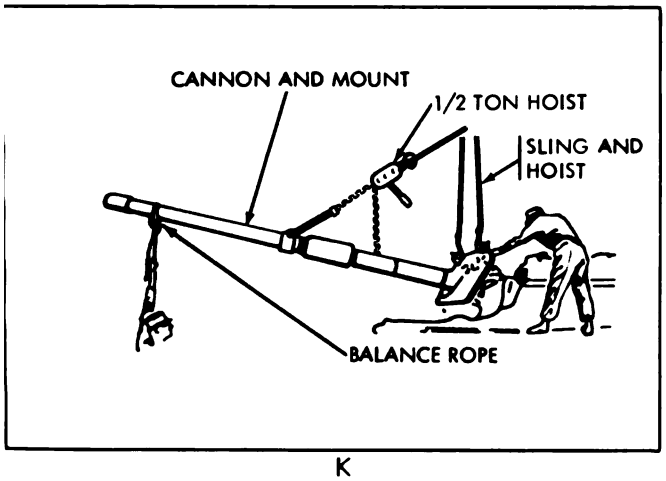


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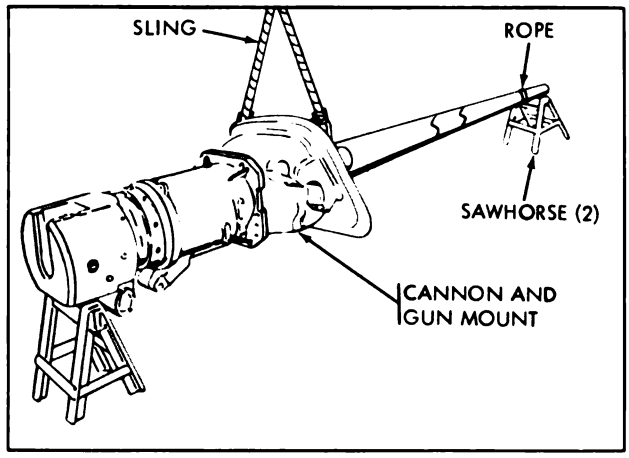


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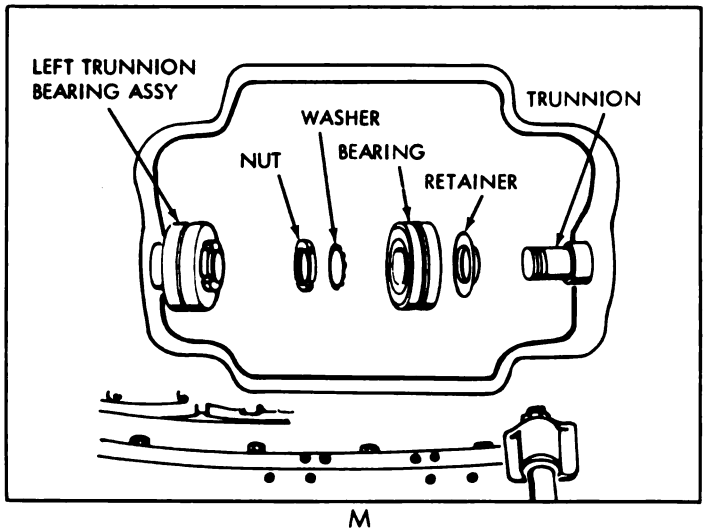


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*Figure 2-64. Cannon and combination gun mount removal or installation (3 of 4).*

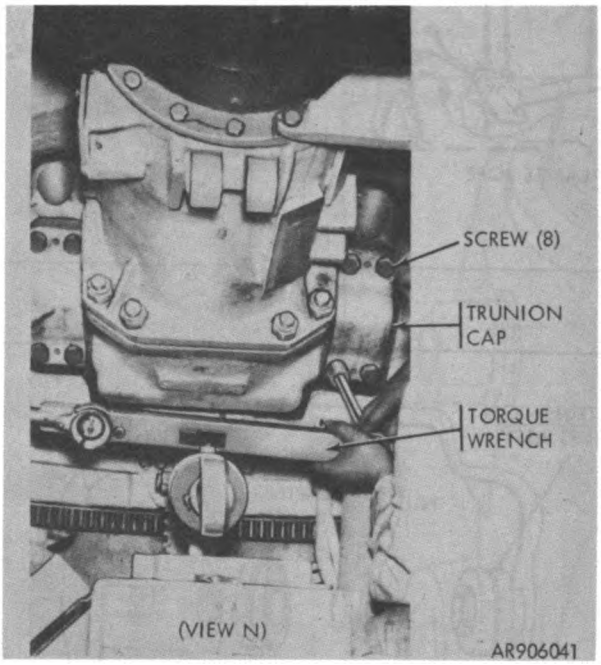



*Figure 2-64. Cannon and combination gun mount removal or installation (4 of 4).*

## -42. Gun Tube.

**WARNING**
**Insure all weapons are clear of ammunition before proceeding.**

NOTE
Inspect breech for number of retubings. A maximum of four retubings is permitted without replacing breech. Stamp breech with retubing number during installation and record on DA2408-4 and DA2408-10.

*a. Removal (fig 2-65).*

(1) Level gun tube.

(2) Place MASTER BATTERY switch in OFF position.

(3) Remove searchlight and searchlight mounting studs (TM 9-2350-258-20-2).

(4) Disconnect gun shield (mantlet) cover (TM 9-2350-258-20-2).

(5) Remove eight screws and lockwashers securing gun tube ring guard to gun shield (view A). Slide gun shield cover and guard toward bore evacuator (view B). Tighten screws to 70-80 lb-ft (95-108 N.m) during installation.

(6) Attach one end of rope sling to gun tube approximately 2-1/2 feet from gun shield at center of balance (view B).

(7) Attach other end of rope sling to gun tube at muzzle end of bore evacuator (view B).

(8) Connect hoist or overhead crane capable of lifting 2,500 pounds to sling. Raise hoist to remove slack in sling. Adjust sling at muzzle end of bore evacuator so that hoist is directly above or slightly forward of center of balance.

(9) Fasten guide rope 3 feet from muzzle of gun (view B).

(10) Remove three screws and lockwashers securing loader's guard to gun mount and remove guard (view C). Tighten screws to 80-90 lb-ft (108-122 N.m) during installation.

**WARNING**
**Remain clear of breech operating lever while it is in the unlatched position.**

(11) Open breech. Leave breech operating lever in unlatched (lower) position (view C).

(12) Remove setscrew securing locking pin in breech (view D).

(13) Thread a 3/18-16 NC x 1-1/2-inch screw into locking pin and pull out pin (view D). Turn gun tube slightly with girth wrench (view E) to relieve pressure on locking pin if necessary.

(14) Place breech operating lever in latched (up) position (view C).

(15) Using care not to damage buttress threads or machined area of gun tube, turn gun tube one-eighth of a turn (45 degrees) counterclockwise (left), as viewed from muzzle end of gun tube, with a girth wrench and remove gun tube (views E and F).

**CAUTION**
**Do not allow gun tube to rest on buttress threads or machined area.**

(16) Place gun tube on suitable supports (view G).

(17) Remove guide rope and sling.

**(18) Remove bore evacuator from gun tube (TM 9-2350-258-10).**

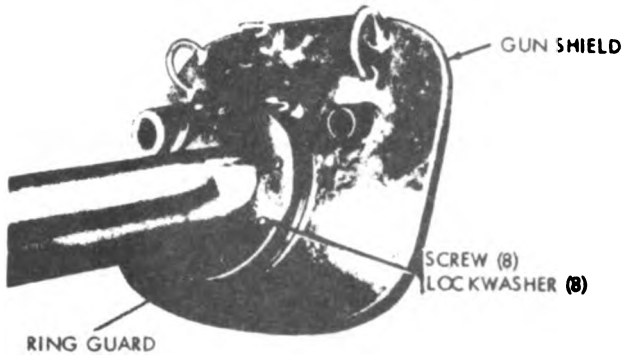
***b. Installation (fig. 2-65).***

**(1) Prepare replacement gun tube for use.**

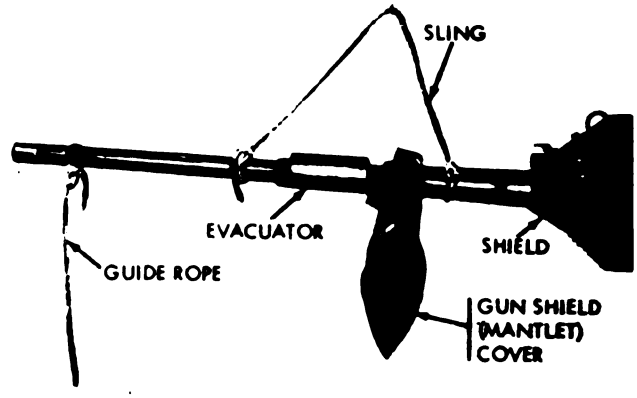
**(2) Wipe external machined surface of tube with a cloth soaked with oil (LO 9-2350-258-12).**

**(3) Install in reverse order of removal.**

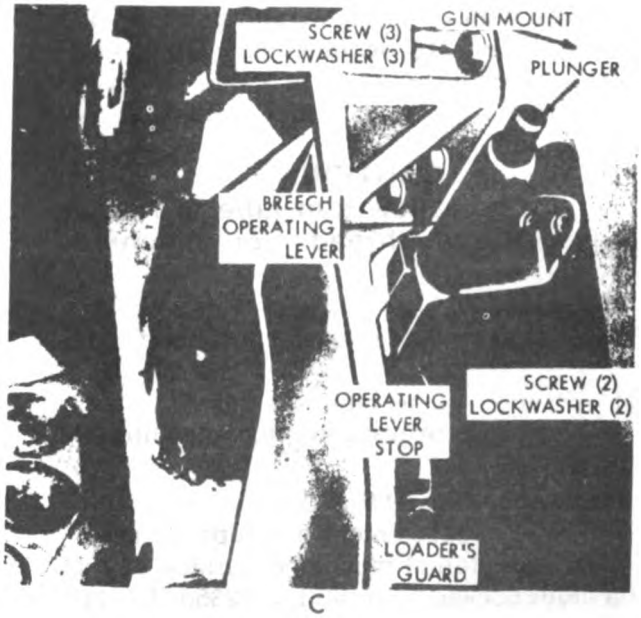
NOTE
To facilitate retubing, some gun tubes and gun shields have marks to indicate unlocked and locked positions of tube. Gun tube is marked by an arrow located 63 inches from breech end on a machined flat surface. The gun shield is marked in two places (1) one located on a horizontal plane (lower) that indicates unlocked position when aligned with the gun tube mark and (2) one located 45 degrees above lower mark that indicates locked gun position when aligned with gun tube mark.



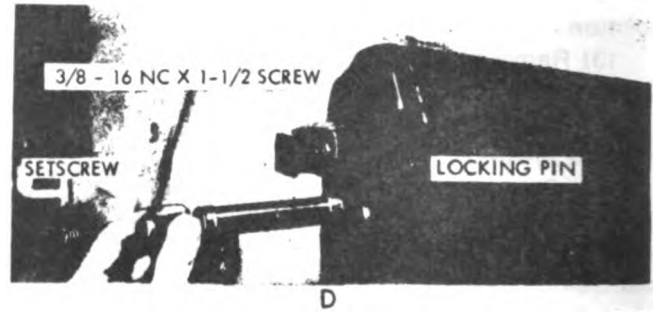

A



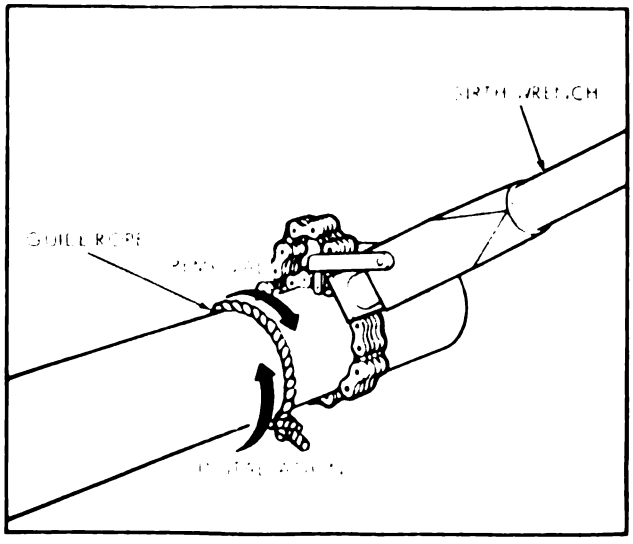

B




C




D




E

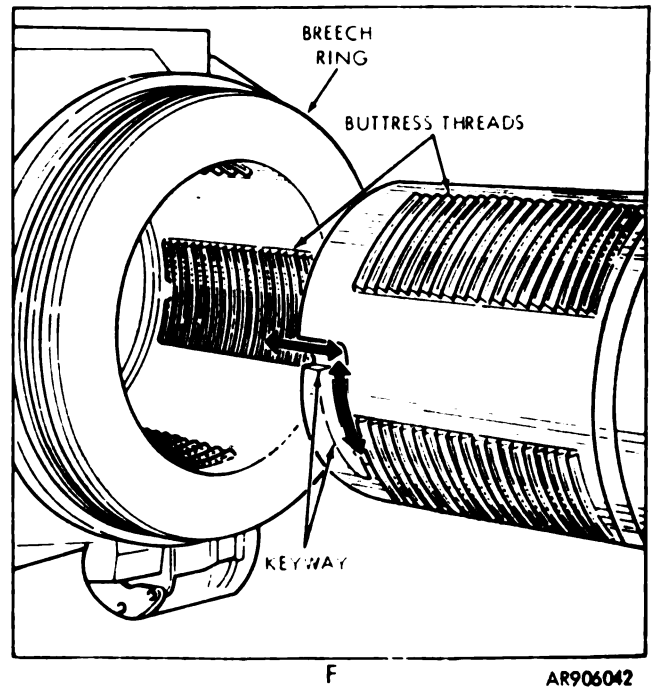



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Figure 2-65. Gun tube removal or installation (1 of 2)

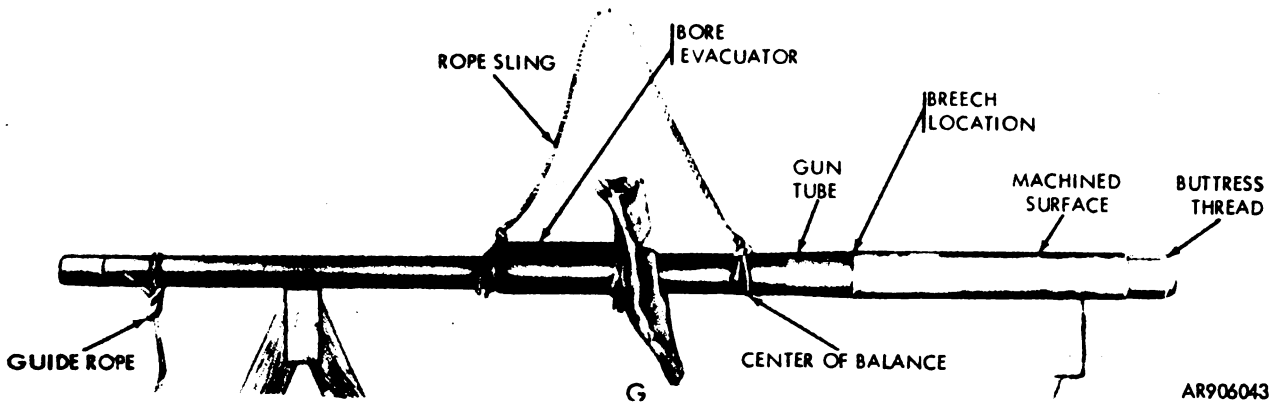



*Figure 2-65. Gun tube removal or installation (2 of 2).*

## 2-43. Cupola Electrical Terminal Boards.

*a. Removal (fig 2-66).*

(1) Place MASTER BATTERY switch in OFF position.

(2) Remove six screws and lockwashers securing ring gear guard and backrest to terminal board supports, and remove guard (view A).

(3) Remove six screws, lockwashers, and washers securing ring gear guard and remove guard (view B).

(4) Traverse cupola to expose right contact board (view C).

(5) Remove four screws and clamps securing right contact board wiring harness to turret wall (view C).

(6) Disconnect electrical connector, of right contact board wiring harness, from cupola interconnecting box (view D).

(7) Remove six screws and lockwashers securing contact board to bracket, and remove contact board (view C).

(8) Traverse cupola to expose left contact board (view C).

(9) Remove four screws and clamps securing left terminal board wiring harness to turret wall (view C).

(10) Disconnect electrical connector, of left contact board wiring harness, from cupola interconnecting box (view C).

(11) Remove six screws and lockwashers securing left contact board to bracket, and remove contact board (view C).

(12) Remove two screws and washers securing interphone receptacle to bracket. Depress receptacle against spring tension and remove receptacle from bracket (view E).

(13) Remove two screws, two lockwashers, and cable clamps securing wiring harness (view E).

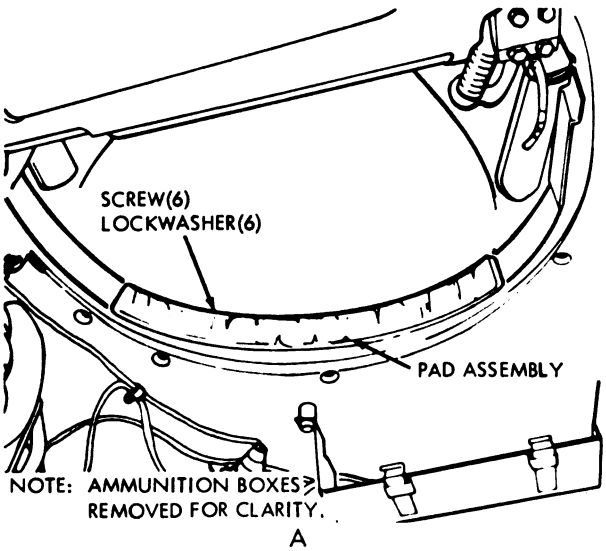
(14) Remove two screws, lockwashers, and clamps securing remainder of wiring harness (view E).

(15) Lift flap and remove 13 screws securing terminal board to supports, and remove terminal board (view F).

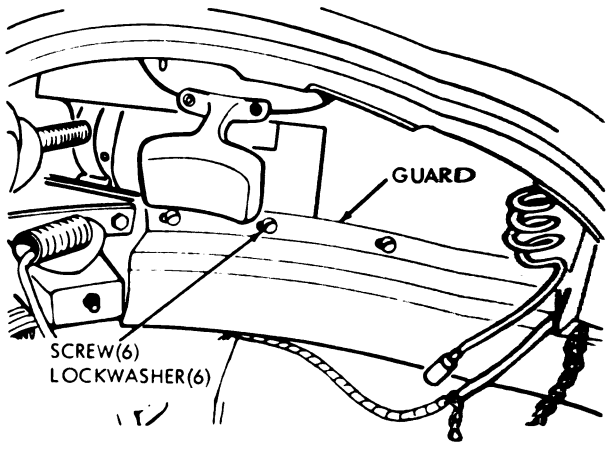
*b. Installation (fig 2-66).* Install in reverse order.

**NOTE**

Bottom edge of spring must be alined in same horizontal plane as bottom edge of contact strip within 0.0010 inch.




A

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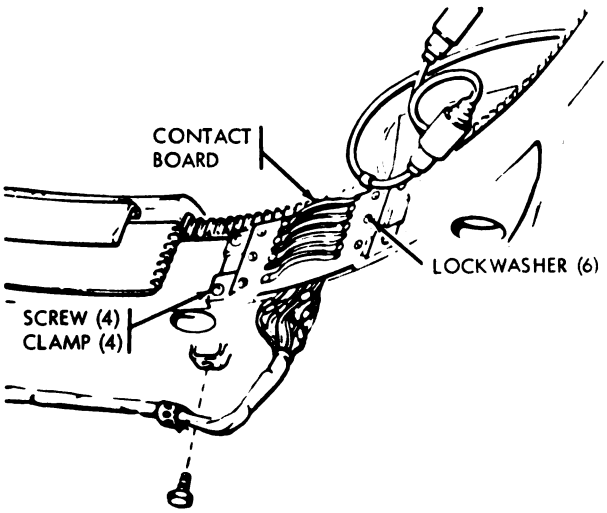
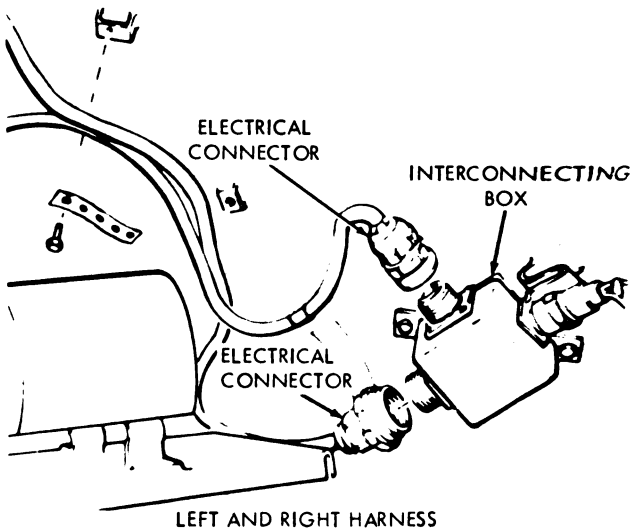


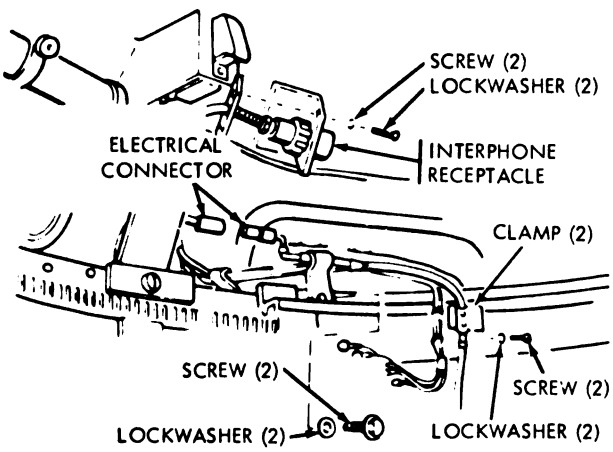

RIGHT AND LEFT CONTACT BOARDS (LEFT SHOWN)

C




LEFT AND RIGHT HARNESS

D

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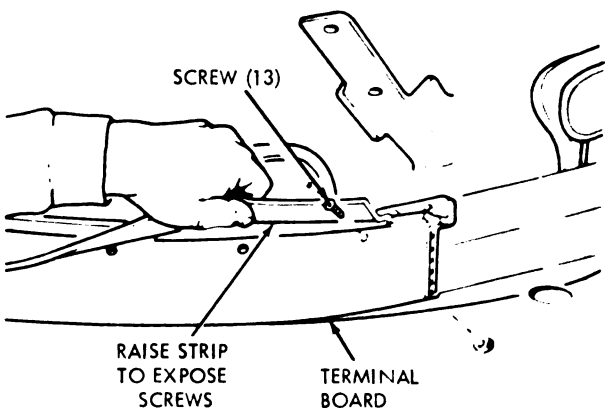


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*Figure 2-66. M1 cupola electrical terminal boards removal or installation.*

## 2-44. Cupola Interconnecting Box.

*a. Removal (fig 2-67).*

(1) Remove radio (view A and TM 9-2350-258-10).

(2) Discohnect three electrical connectors from interconnecting box (view B).

(3) Remove two screws, lockwashers, washers, and nuts securing interconnecting box and remove box (view B).

*b. Installation (fig 2-67).* Install in reverse order of removal.

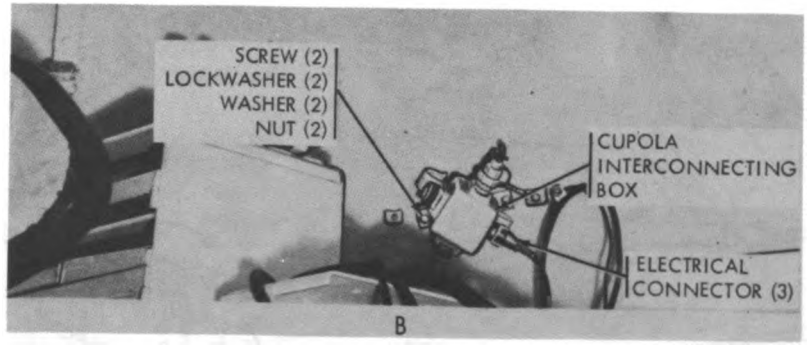




*Figure 2-67. M1 cupola interconnecting box removal or installation.*

# CHAPTER 3
# REPAIR INSTRUCTIONS

## Section I. GENERAL

**Scope.** This chapter contains instructions e components and assemblies allocated for . These instructions include procedures for sembly, cleaning, inspection, repair, assembly, g, adjustment, and removal and installation, pplicable. Component descriptions are ded as a repair and troubleshooting aid. Refer M 9-2350-258-34P-2 for requisitioning spare and special tools or equipment needed for ponent repair.

## Section II. REPAIR OF SLIPRING

**Description.** The slipring assembly is ted in an opening in the center of the turret form and provides electrical power and in- hone connections between the hull and turret. assembly consists of a lower section secured ne hull and an upper section that is fastened to, rotating with, the turret. A system of rotating gs and stationary brushes in the assembly vides electrical power and communication cir- ts between hull and turret. A traverse in- erence switch mounted on top of the rotating tion, in conjunction with an elevation in- ference switch on the ballistics drive, actuates turret hydraulic system to automatically raise gun tube to 0 degrees during power traverse er the rear of the vehicle. Raising the gun tube is cessary to clear vehicle fenders, air cleaners, d rear deck grille. The traverse interference itch is activated by a cam and cam follower ounted on the slipring assembly.

**3. Removal.** Refer to TM 9-2350-258-20-2.

**4. Disassembly (fig 3-1).**

NOTE

Prior to disassembly, the specified tests must be conducted to verify that a malfunction does exist. If the unit fails to pass all tests, perform the following repair procedures. If the unit passes all test, repair is not required.

Each brush and terminal assembly in the slipring lower housing is identified by an alphabetical designation from A through M. Disassembly is accomplished by starting from brush and terminal designation M and removing the assemblies in reverse order until all of the assemblies have been removed. Brush assemblies are separated by two insulators, an insulator ring, a separator, separator ring, and shims. It is important that the order of disassembly or removal of components be carefully noted, to insure proper positioning during reassembly.

*a.* Remove three screws securing interrupter switch bracket to upper housing.

*b.* Loosen four captive screws securing cover to upper housing. Remove cover and gasket (view A). Discard gasket.

*c.* Remove nut and lockwasher securing power lead to power ring stud and disconnect lead (view B).

*d.* Remove four screws and lockwashers securing turret power receptacle to upper housing. Remove receptacle and gasket (view B). Discard gasket.

NOTE

Insure that all wiring is tagged during disassembly and note position of wiring crimp connectors, lockwashers, and nuts on terminal board to insure proper assembly

*e.* Remove twelve nuts and lockwashers securing leads to terminals A through M of upper housing terminal block and disconnect leads (view C).

*f.* Remove screw and captive washer securing lead N to terminal N and disconnect wire from terminal on upper housing (view C).

*g.* Remove four screws and lockwashers securing turret interphone receptacle to upper housing. Remove receptacle and gasket (view C). Discard gasket.

*h.* Loosen five captive screws securing cover to lower housing and remove cover and gasket (view D). Discard gasket.

*i.* Remove 12 nuts and lockwashers securing leads to terminals A through M of lower housing terminal block and disconnect wires (view E).

*j.* Remove screw and captive washer securing lead N and brush frame ground lead to terminal N in lower housing. Disconnect lead N and frame ground lead from terminal (view E).

*k.* Remove four screws and lockwashers securing hull interphone receptacle to lower housing. Remove receptacle and gasket (view E).

*l.* Remove nut and lockwasher securing power lead to hull power receptacle to power brush stud and disconnect lead (views F and S). Remove four screws and lockwashers securing hull power receptacle to lower housing. Remove receptacle and gasket. Discard gasket.

*m.* Remove 12 nuts and lockwashers securing brush lead terminal assemblies to lower housing terminal block and disconnect brush leads (view G).

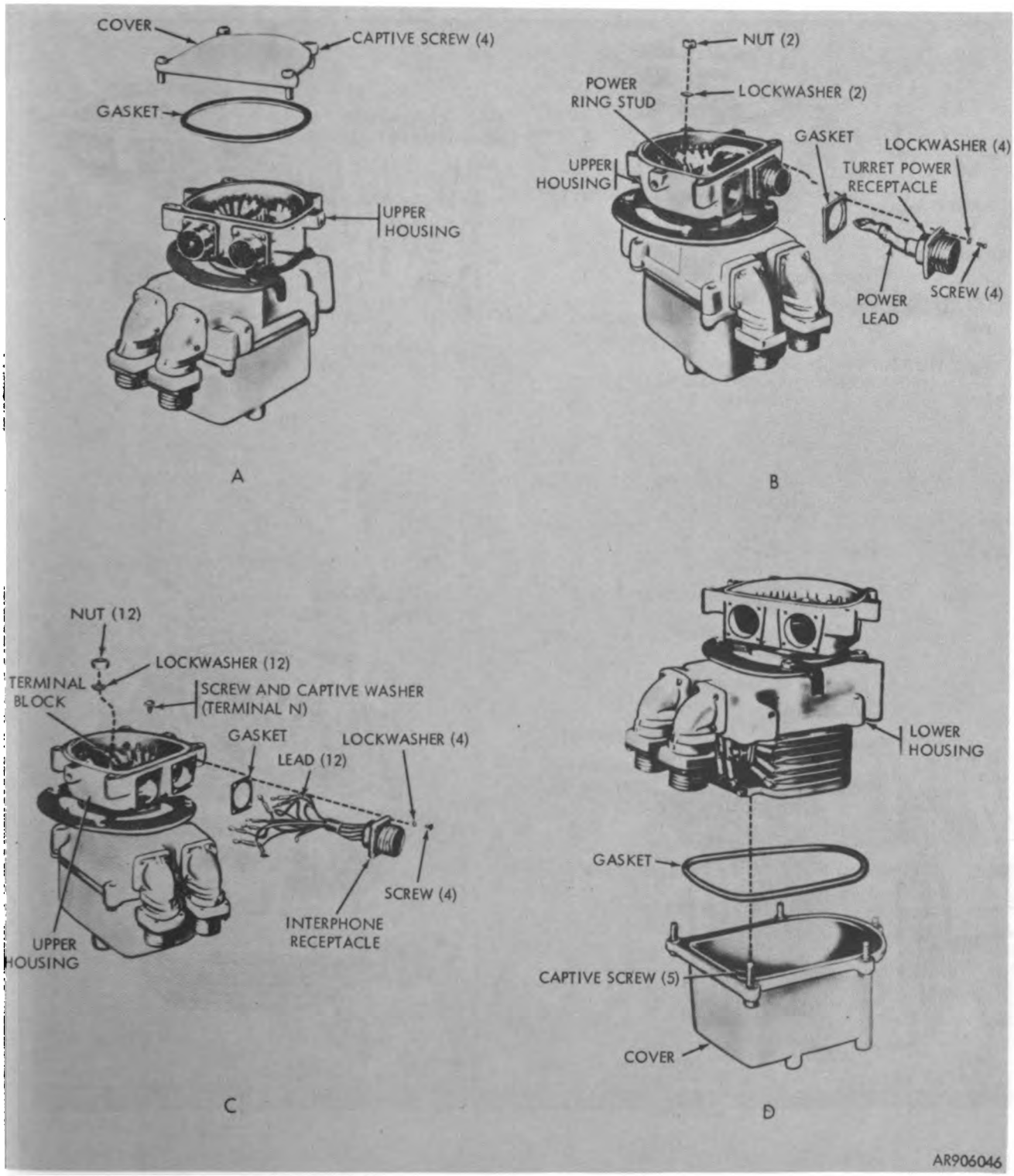
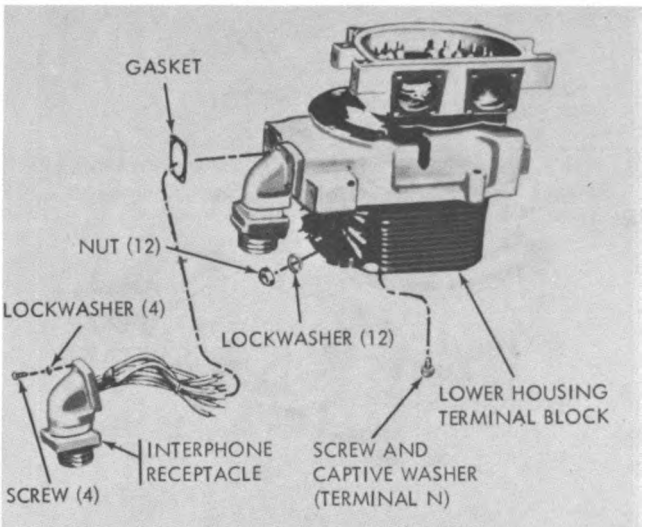



*Figure 3-1. Slipring box disassembly or assembly (1 of 7).*

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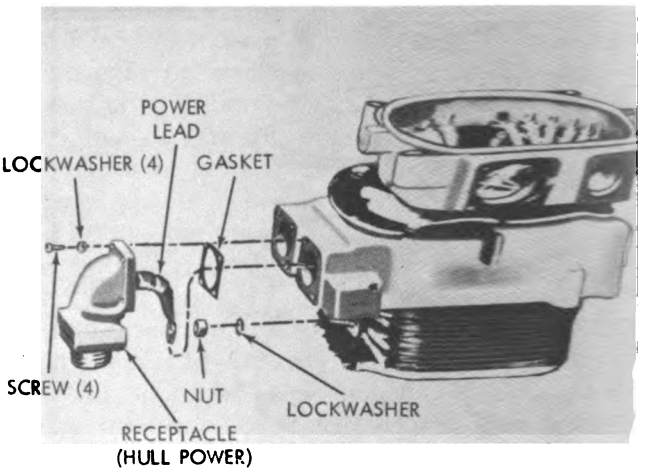


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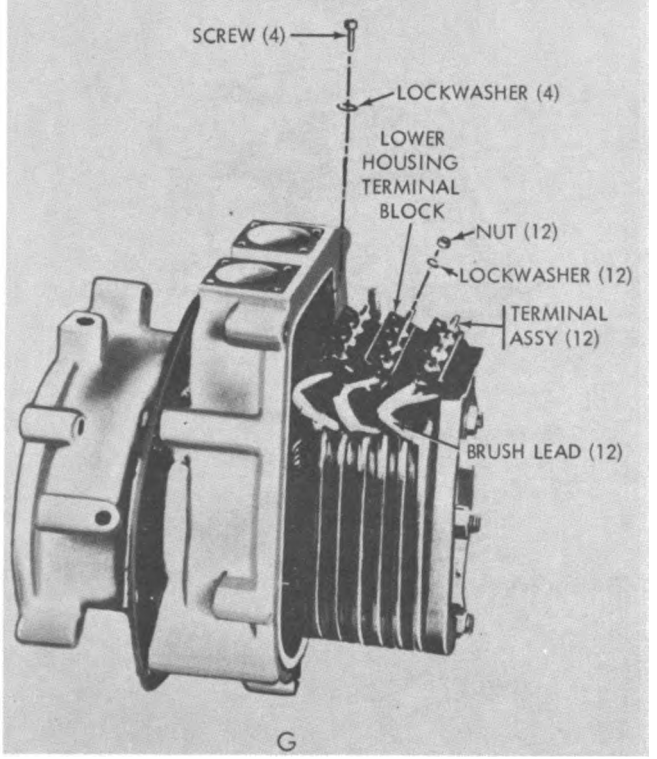


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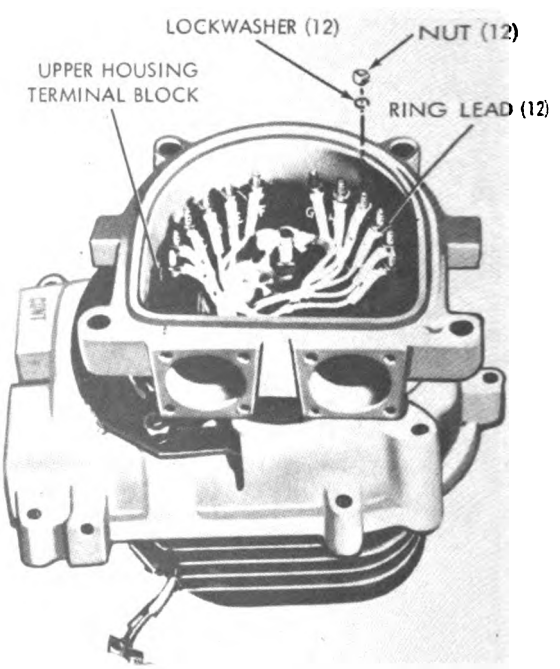



H

3-4 *Figure 3-1. Slipring box disassembly or assembly (2 of 7).*

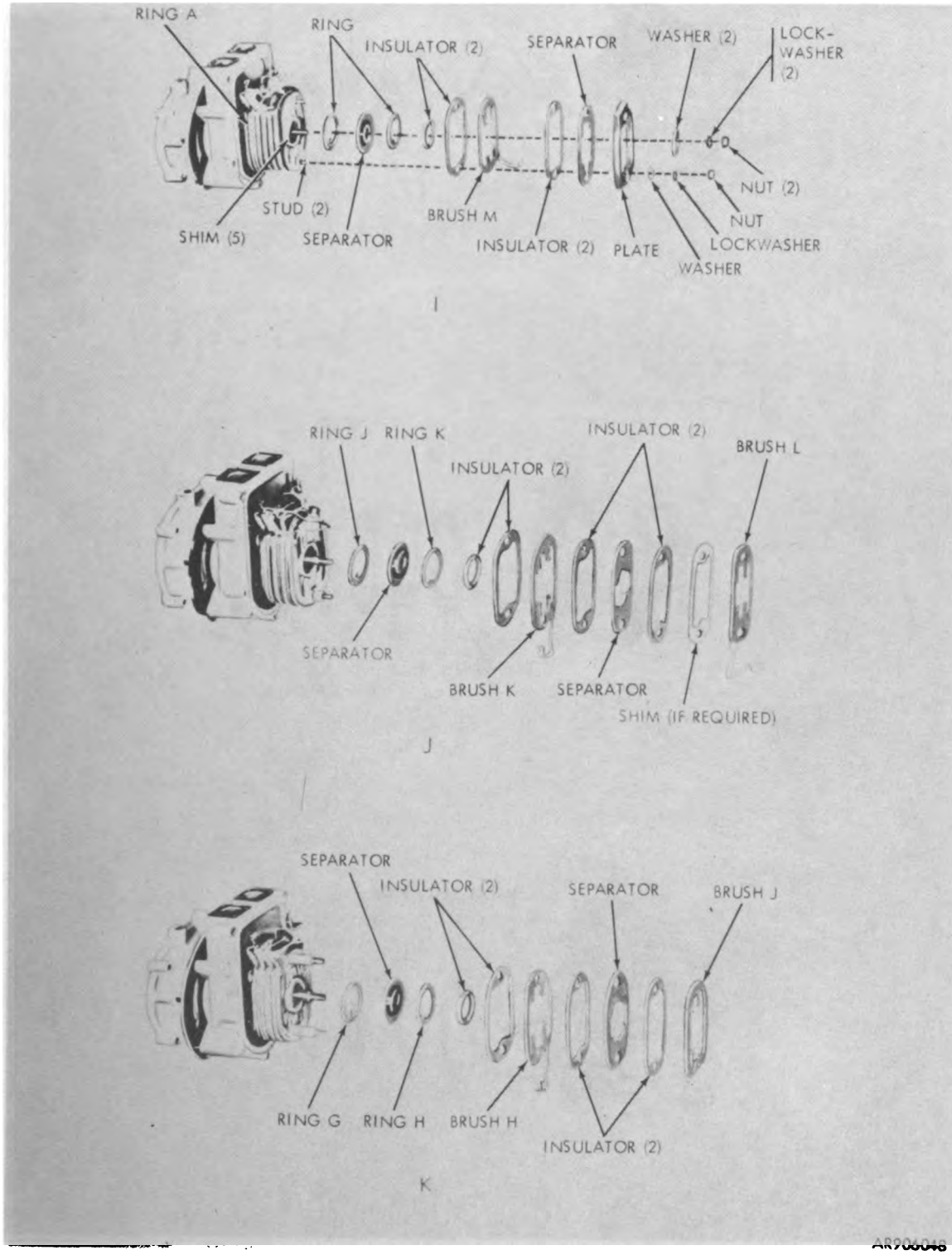
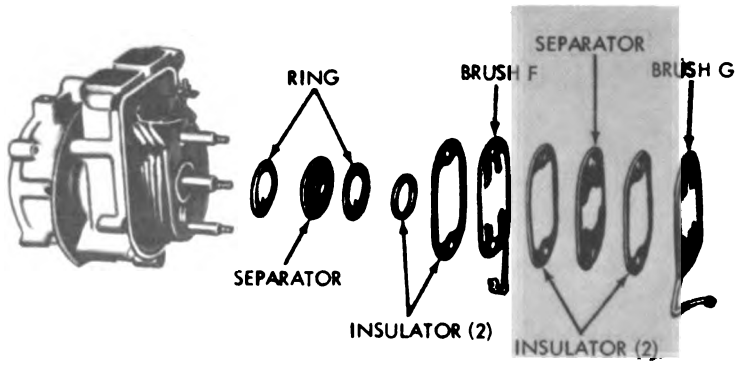



*Figure 3-1. Slipring box disassembly or assembly (3 of 7).*

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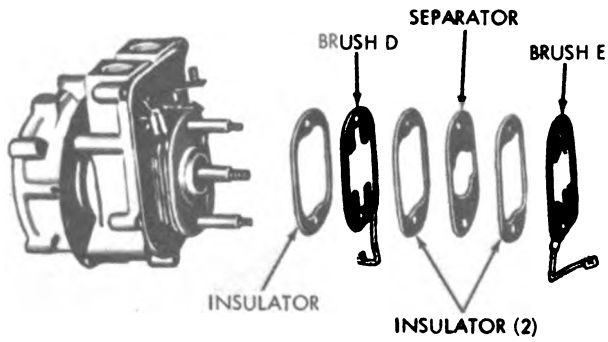


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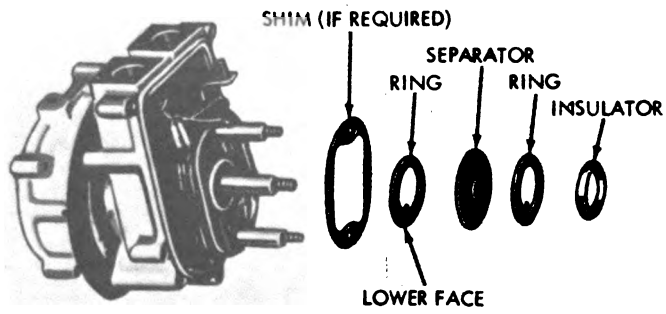


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*Figure 3-1 Slipring box disassembly or assembly (4 of 7).*

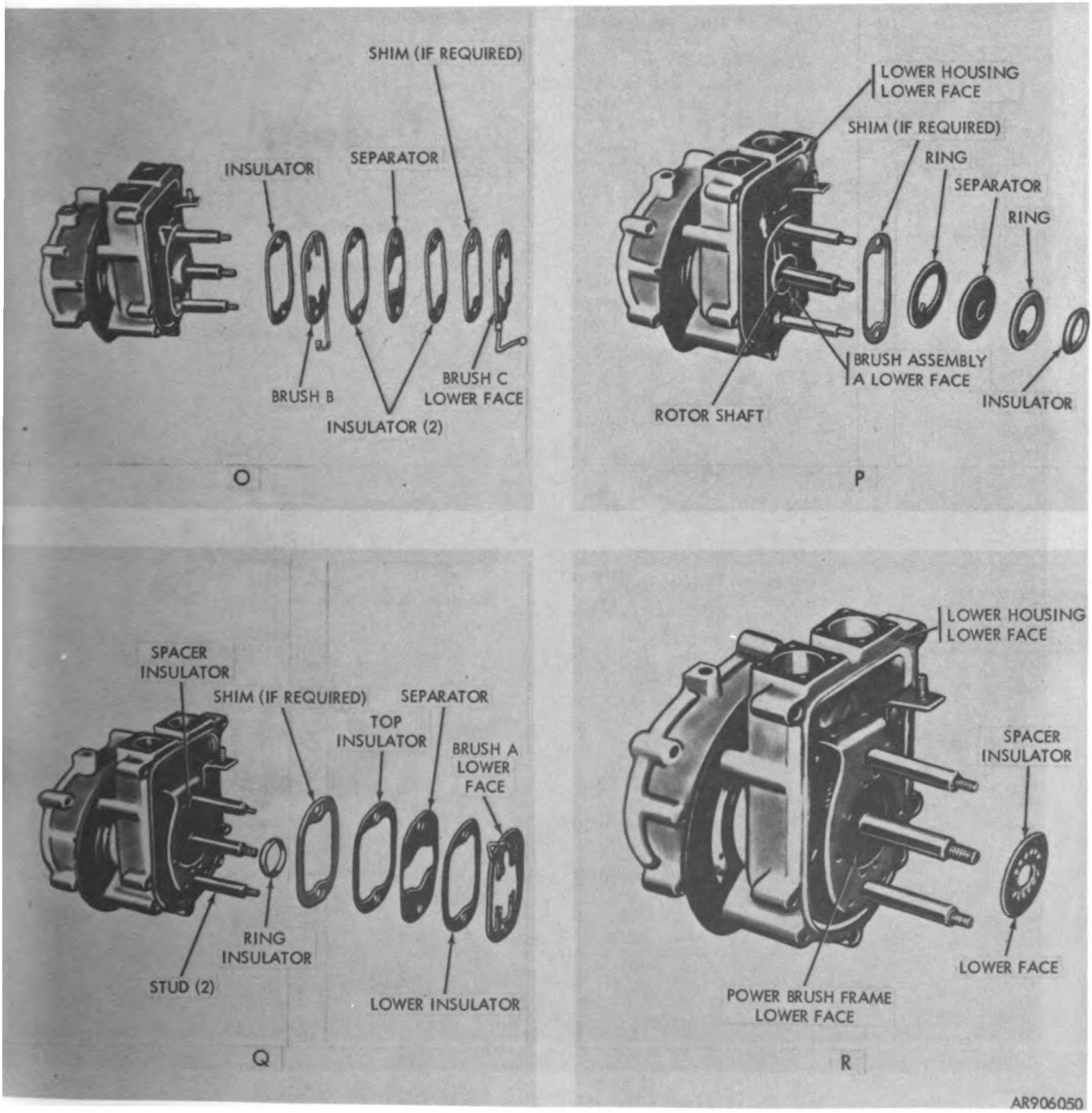


*Figure 3-1. Slipring box disassembly or assembly (5 of 7).*

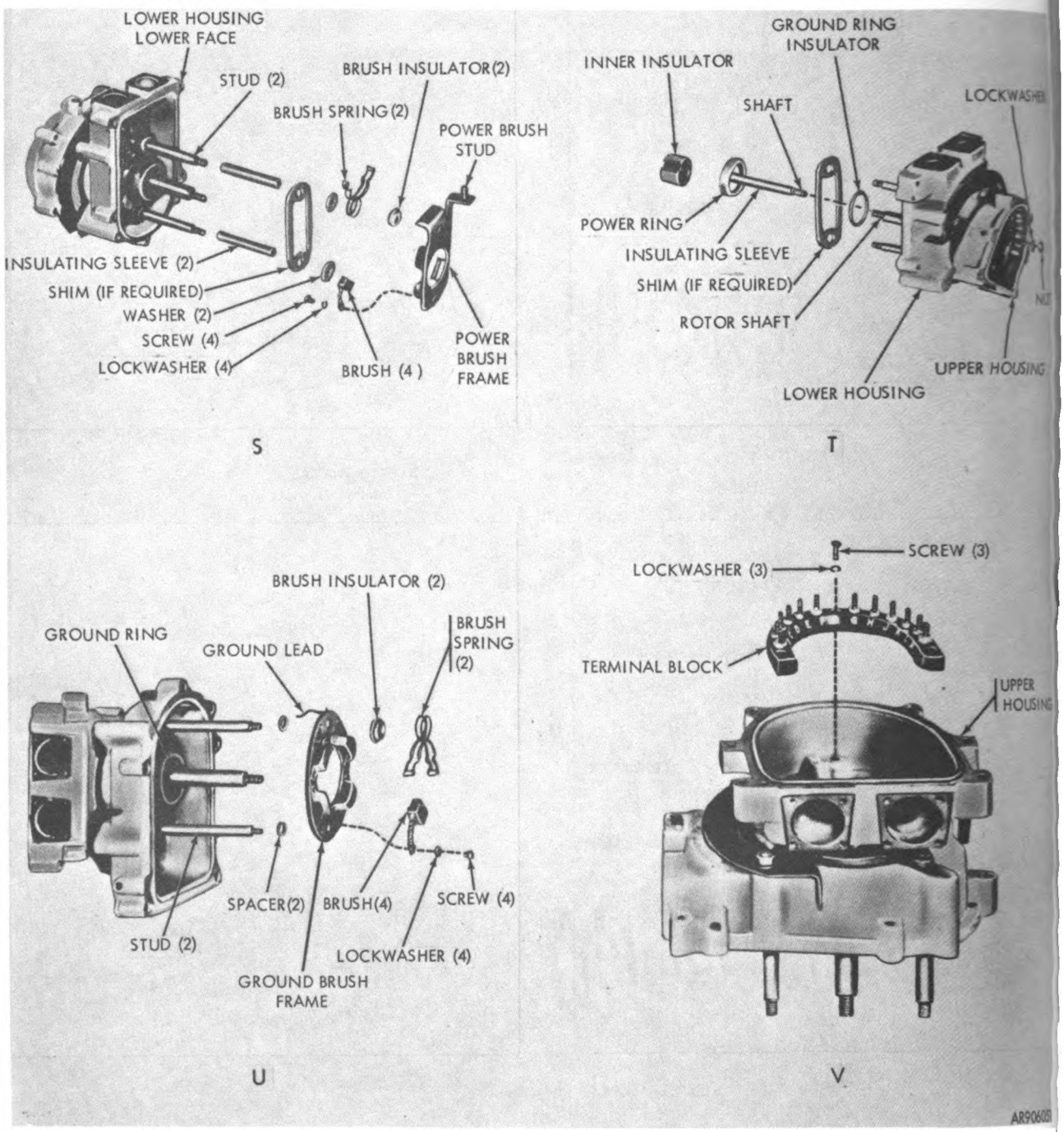


*Figure 3-1. Slipring box disassembly or assembly (6 of 7).*

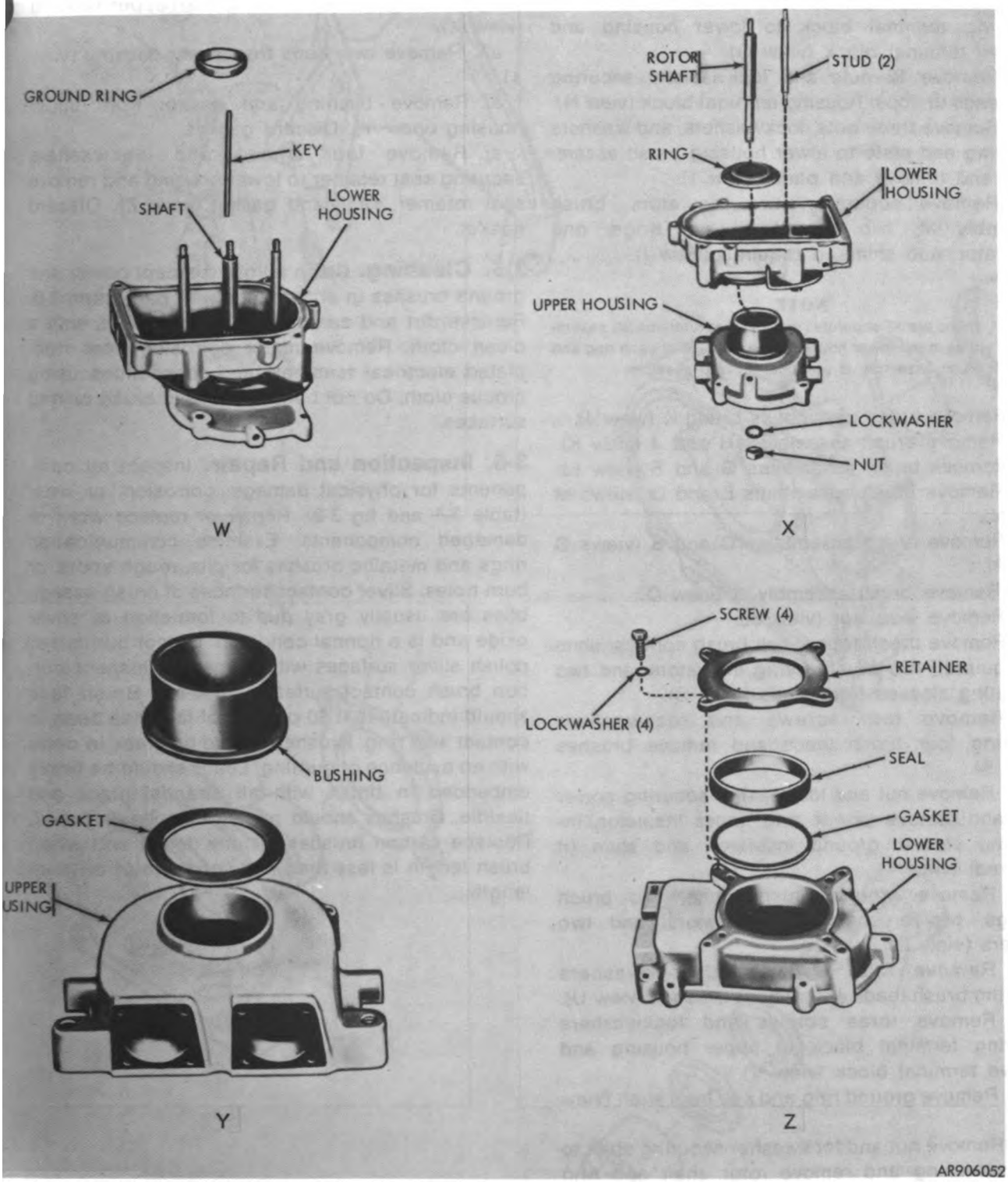


*Figure 3-1. Slipring box disassembly or assembly (7 of 7).*

*n.* Remove four screws and lockwashers securing terminal block to lower housing and remove terminal block (view G).

*o.* Remove 12 nuts and lockwashers securing ring leads to upper housing terminal block (view H).

*p.* Remove three nuts, lockwashers, and washers securing end plate to lower housing brush assemblies and remove end plate (view 1).

*q.* Remove separator, two insulators, brush assembly M, two insulators, two rings, one separator, and shims, if required (view I).

**NOTE**

There are 12 separate ring and stationary brush assemblies in the lower housing. The removal of each ring and brush assembly is identical to step *q* above.

*r.* Remove brush assemblies L and K (view J).

*s.* Remove brush assemblies H and J (view K).

*t.* Remove brush assemblies G and F (view L).

*u.* Remove brush assemblies E and D (views M and N).

*v.* Remove brush assemblies C and B (views O and P).

*w.* Remove brush assembly A (view Q).

*x.* Remove insulator (view R).

*y.* Remove brush frame, two brush springs, shim (if required), two brush spring insulators, and two insulating sleeves from studs (view S).

*z.* Remove four screws and lockwashers securing four brush leads and remove brushes (view S).

*aa.* Remove nut and lockwasher securing power ring and remove power ring, inner insulator, insulating sleeve, ground insulator, and shim (if required) (view T).

*ab.* Remove ground brush frame, two brush springs, two brush spring insulators, and two spacers (view U).

*ac.* Remove four screws and lockwashers securing brush leads and remove brushes (view U).

*ad.* Remove three screws and lockwashers securing terminal block to upper housing and remove terminal block (view V).

*ae.* Remove ground ring and key from shaft (view W).

*af.* Remove nut and lockwasher securing shaft to upper housing and remove rotor shaft and ring (view X).

*ag.* Separate lower housing from upper housing (view X).

*ah.* Remove two studs from lower housing (view X).

*ai.* Remove bushing and gasket from upper housing (view Y). Discard gasket.

*aj.* Remove four screws and lockwashers securing seal retainer to lower housing and remove seal retainer, seal, and gasket (view Z). Discard gasket.

**3-5. Cleaning.** Clean all parts except power and ground brushes in accordance with paragraph 2-9. Remove dirt and carbon dust from brushes with a clean cloth. Remove minor corrosion from nonplated electrical terminals and connections using crocus cloth. Do not burnish metallic brush or ring surfaces.

**3-6. Inspection and Repair.** Inspect all components for physical damage, corrosion, or wear (table 3-1 and fig 3-2). Repair or replace worn or damaged components. Examine communication rings and metallic brushes for pits, rough spots, or burn holes. Silver contact surfaces of brush assemblies are usually gray due to formation of silver oxide and is a normal condition. Do not burnish or polish silver surfaces with abrasives. Inspect carbon brush contact surfaces for wear. Brush face should indicate that 80 percent of face has been in contact with ring. Brushes should be black in color with no evidence of burning. Leads should be firmly embedded in brush with all strands intact and flexible. Brushes should not be chipped or pitted. Replace carbon brushes for any defect and when brush length is less than three-quarters of original length.

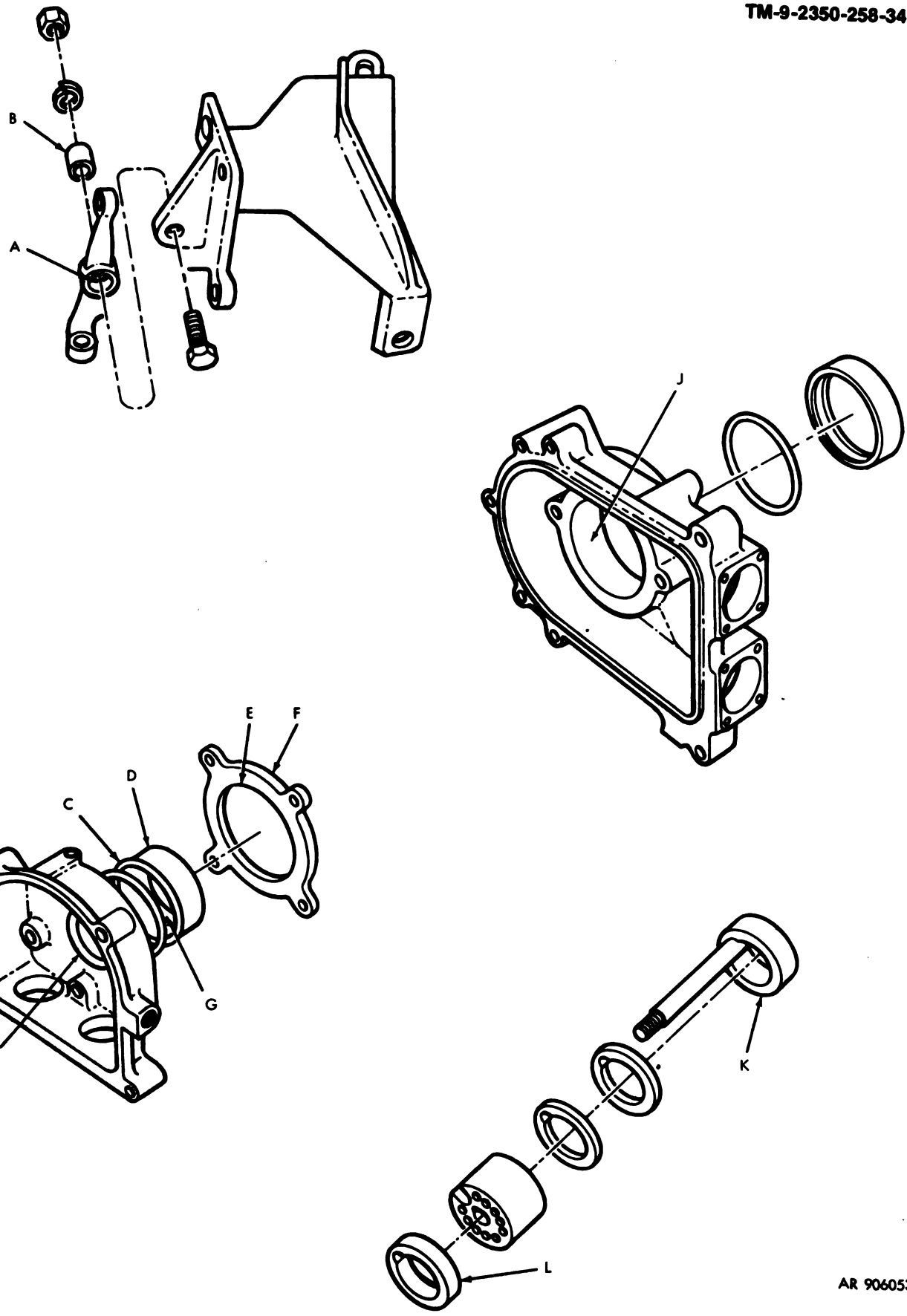


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*Figure 3-2. Slipring wear limits.*

## 3-7. Assembly (fig 3-1).

*a.* Install new gasket and new seal in lower housing. Position retainer on lower housing and secure with four screws and lockwashers (view Z).

*b.* Position new gasket in upper housing and install bushing (view Y).

*c.* Mate upper and lower housings (view X).

*d.* Position ring in lower housing and install shaft and secure with nut and lockwasher (view X). Tighten nut to 370-410 lb-in. (42-46 N.m).

*e.* Thread two studs into lower housing (view X). Tighten studs to 48-96 lb-in. (4.5-11 N.m).

*k.* Install two spacers over insulating sleeve (view S).

*l.* Position four brushes on power brush frame and secure brush leads with four screws and lockwashers (view S). Tighten screws to 20-22 lb-in. (2.3-2.5 N.m).

*m.* Install shim (if required), two washers, two brush springs, two brush insulators, and power brush frame on lower housing studs (view S).

*n.* Lift power brushes and slide frame onto studs so that brushes will contact power ring when released (view R).

*Table 3-1. Slipring Wear Limits*

| Figure | Reference | Measurement | Wear Limit (in.) |
|---|---|---|---|
| 3-2 | A | ID of bore in arm | 0.442 max |
| 3-2 | B | OD of bushing | 0.432 min |
| 3-2 | C | Thickness of bushing shoulder | 1.682 min |
| 3-2 | D | OD of bushing | 2.541 min |
| 3-2 | E | ID of retainer | 2.548 max |
| 3-2 | F | Thickness of retainer | 0.318 min |
| 3-2 | G | ID of bushing | 2.251 max |
| 3-2 | H | OD of housing | 2.252 min. |
| 3-2 | J | ID of lower housing | 2.548 max* |
| 3-2 | K | OD of power ring | 2.120 min |
| 3-2 | L | OD of ground ring | 2.120 min |

*f* Install ground ring and key on shaft (view W).

*g.* Position terminal block in upper housing and secure with three screws and lockwashers (view V).

*h.* Position four brush lead terminals on ground brush frame and secure with four screws and lockwashers (view U). Tighten to 20-22 lb-in. (2.3-2.5 N.m).

*i.* Install two spacers, ground brush frame, two brush insulators, and two brush springs on lower housing studs (view U). Lift brushes and slide brush over ground ring (view U).

*j.* Slide ground ring insulator over rotor shaft and position on ground ring. Install insulating sleeve over power ring shaft. Insert power ring shaft through hole in ground ring and upper housing. Secure shaft with nut and lockwasher. Install inner insulator (view T).

**NOTE**

When necessary to replace one of the components of the slipring which control stack-up dimensions, use a micrometer to measure the overall thickness of the part to be replaced and its shim(s). Note the measurement. Measure the thickness of the new part to be installed and select the proper shim(s) so that the overall thickness is within ± 0.001 inch of the dimension noted above.

*o.* Install spacer insulator on rotor shaft. Compress insulator to eliminate any excess space between parts previously assembled, and measure distance between lower face of upper housing and lower face of insulator (view R). Distance should be 1.437 ± 0.005 inches. Install shim stock 7351459 at insulator between power and ground rings as necessary (view T).

*p.* Compress power brush frame to eliminate any excess space between parts previously assembled, and measure distance between lower face of power brush frame and lower face of upper housing (view R). Distance should be 1.437 ± 0.005 inches. Install shim stock 7351459 at washer between ground brush and power brush frames, as required (view S).

*q.* Inspect compressed assembly. Brushes must be in full contact with respective ring.

*r.* Install insulators, separators, and brush A on studs (view Q).

*s.* Compress brush A to remove excess space between parts previously assembled, and measure distance between lower face of brush A and lower face of upper housing. Distance should be 1.625 ± 0.005 inches. Install shim stock 7351477 behind top insulator, as required (views P and Q).

*t.* Install rings, separator, and insulator on rotor shaft (view P).

*u.* Compress ring to remove excess space between parts previously assembled, and measure distance between lower face of ring assembly A and lower face of upper housing. Distance should be 1.640 ± 0.005 inches. Install shim stock 7351452 immediately behind ring assembly, as required (view P).

*v.* Install insulators, brush assemblies, and separator on studs (view O).

*w.* Compress brush C to remove excess space between parts previously assembled, and measure distance between lower face of brush A and lower face of brush C. Distance should be 0.375 ± 0.005 inch. Install shim stock 7351477 immediately behind ring C, as required (view O).

*x.* Install rings, separator, and insulator on rotor shaft (view N).

*y.* Compress ring D to remove excess space between parts previously assembled, and measure distance between lower face of ring C and lower face of ring A. Distance should be 0.375 ± 0.005 inch. Install shim stock 7351452 immediately behind ring assembly C, as required (view N).

*z.* Install rings, separators, insulators, and brushes on rotor shaft and studs (views M. N, L, K, and J).

*aa.* Compress brush L to remove excess space between parts previously assembled, and measure distance between lower face of brush L and lower face of brush A. Distance should be 1.875 ± 0.010 inches. Install shim stock 7351477 immediately behind brush L, as required (view J).

*ab.* Install rings, separators, insulators, brush, and clamping plate on rotor shaft and studs. Secure plate with two nuts, lockwashers, and washers. Tighten to 75 lb-in. (8.6 N.m). Install nut, lockwasher, and washer on rotor shaft. Tighten to 100 lb-in. (11.3 N.m).

*ac.* Recheck all distances in steps *s.*, *u.*, *w.*, *y.*, and *aa.* Inspect brushes for contact with rings. Disassemble and reshim, if necessary.

*ad.* Connect ring leads A through M to upper housing block terminal block. Secure with twelve nuts and lockwashers (view H).

*ae.* Install brush lead terminals A through M through lower housing terminal block and secure with twelve nuts and lockwashers (view H).

*af.* Dress leads and position terminal block on housing. Secure terminal block to housing with four screws and lockwashers (view G).

*ag.* Place new gasket over power lead of hull power receptacle. Position gasket and receptacle on lower housing. Secure with four screws and lockwashers (view F).

*ah.* Place new gasket over leads of hull interphone receptacle. Position gasket and receptacle on lower housing. Secure with four screws and lockwashers (view E).

*ai.* Connect leads A through M to lower housing terminal block and secure with 12 nuts and lockwashers (view F).

*aj.* Secure lead N and ground lead from brush frame with screw and captive washers (views E and U).

*ak.* Position lower housing cover and new gasket on housing and secure with five captive screws (view D).

*al.* Place new gasket over leads of turret interphone receptacle. Position gasket and receptacle to upper housing. Secure with four screws and lockwashers (view C).

*am.* Connect leads A through M to upper housing terminal block and secure with 12 nuts and lockwashers (view C).

*an.* Secure N lead to upper housing with screw and captive washer (view C).

*ao.* Place new gasket over lead of turret power receptacle. Position gasket and receptacle to upper housing. Secure with four screws and lockwashers (view B).

*ap.* Connect power lead to power ring stud and secure with nut and lockwasher (view B).

*aq.* Position upper housing cover and new gasket to housing. Secure with four captive screws (view A).

*ar.* Install and secure interrupter switch bracket to upper housing with three screws. Tighten screws to 25 lb-in. (2.8 N.m).

## 3-8. Tests.

**NOTE**

The following tests must be conducted after the completion of all repair procedures to determine that any malfunction has been repaird.

*a. Torque Test.*

(1) Clamp slipring box in a suitable clamping fixture.

(2) Rotate upper housing a minimum of two full turns in both directions. Rotation should be smooth without binding or sticking.

(3) Attach a spring scale to upper housing torque assembly mounting hole. Rotate housing 360 degrees in each direction. Scale reading should not vary more than 10 percent with a maximum reading of 15 lb-ft (20 N.m).

*b. Electrical Tests (fig 3-3).*

(1) Using slipring interphone test cable type 6 (46, table 2-1), connect an ohmmeter between pin A and pins B through M, respectively, of turret interphone receptacle (view A). Insulation resistance between pins should be a minimum of 5 megohms at each pin throughout 360 degrees of rotation.

(2) Using slipring interphone test cable type 6 (46, table 2-1), connect an ohmmeter between slipring box housing and pins A through M, respectively, of turret interphone receptacle (view B). Insulation resistance to ground should be a minimum of 5 megohms at each pin throughout 360 degrees of rotation.

(3) Using slipring test cable type 6 (46, table 2-1), connect an ohmmeter between pin A of turret interphone receptacle and pin A of hull interphone receptacle (view C). Internal resistance should be constant and a maximum of 1.0 ohm through 360 degrees of rotation.

(4) Repeat steps (1) through (3) for pins B through N.

(5) Connect an ohmmeter between terminal N of either interphone receptacle and slipring box housing. Resistance should be constant and a maximum of 1.0 ohm throughout 360 degrees of rotation.

(6) Connect an ohmmeter between hull power receptacle pin and turret power receptacle pin. Resistance should be constant and less than 1.0 ohm throughout 360 degrees of rotation.

(7) Connect an ohmmeter between either power receptacle pin Z or pin W and slipring box housing. Resistance should be a minimum of 5 megohms throughout 360 degrees of rotation.

(8) Mount slipring in vise on a moveable cart. Connect to slipring test equipment as shown (view A). Use cables 3-1/2 feet or less in length and at least the following conductor sizes.

| Test Current Amperes (Max) | AWG Cable Size (Min) |
|---|---|
| 0-15 | 16 |
| 200 | 0 |

(9) Set load bank to minimum load (all load switches to OFF) and variable load control to minimum (CCW) with the variable volt switch to OFF position.

(10) Set multimeter to 30 vdc scale.

(11) Turn test stand ON and verify regulator output is 28±2 vdc (between B+ AND B-).

(12) Turn variable load switch to ON.

(13) Adjust variable load control to obtain 5±0.5 amps.

**CAUTION**

**If slipring is defective, the voltage could be 28 vdc across the interphone receptacles and damage to multimeter could occur if scaling is reduced to 1 vdc scale.**

(14) Set multimeter to the applicable volt dc scale and rotate slipring 360 degrees in each direction. Voltage drop between receptacles shall not exceed 1.0 volt.

**WARNING**

**If pin N of slipring is connected to regulator output and the slipring case is grounded, a short will be applied to power supply output.**

(15) Turn test stand OFF and repeat steps (9) through (14) for interphone pins B through M (less 1).

(16) Turn OFF test stand, set variable load switches to OFF, and variable load to minimum.

(17) Connect test equipment to slipring as shown (view E). Use cable 3-1/2 feet or less in length and at least the conductor size shown in table in step (8) above.

(18) Set multimeter to 30 vdc scale.

(19) Turn ON test stand and verify regulator output is 28±2 vdc (between B+ AND B-).

**CAUTION**

**If the slipring is defective, voltage could be 28 vdc across the power receptacle. Damage to the multimeter could occur if scaling is reduced to 1 vdc.**

(20) Turn ON load switches for a 200-amp load. Set multimeter to the applicable vdc scale and rotate 360 degrees in each direction. Internal voltage drop between hull receptacle pins of slipring shall not exceed 0.600 volt.

(21) Turn OFF test stand, set load switches to OFF, and variable load to minimum. Disconnect teshset up.

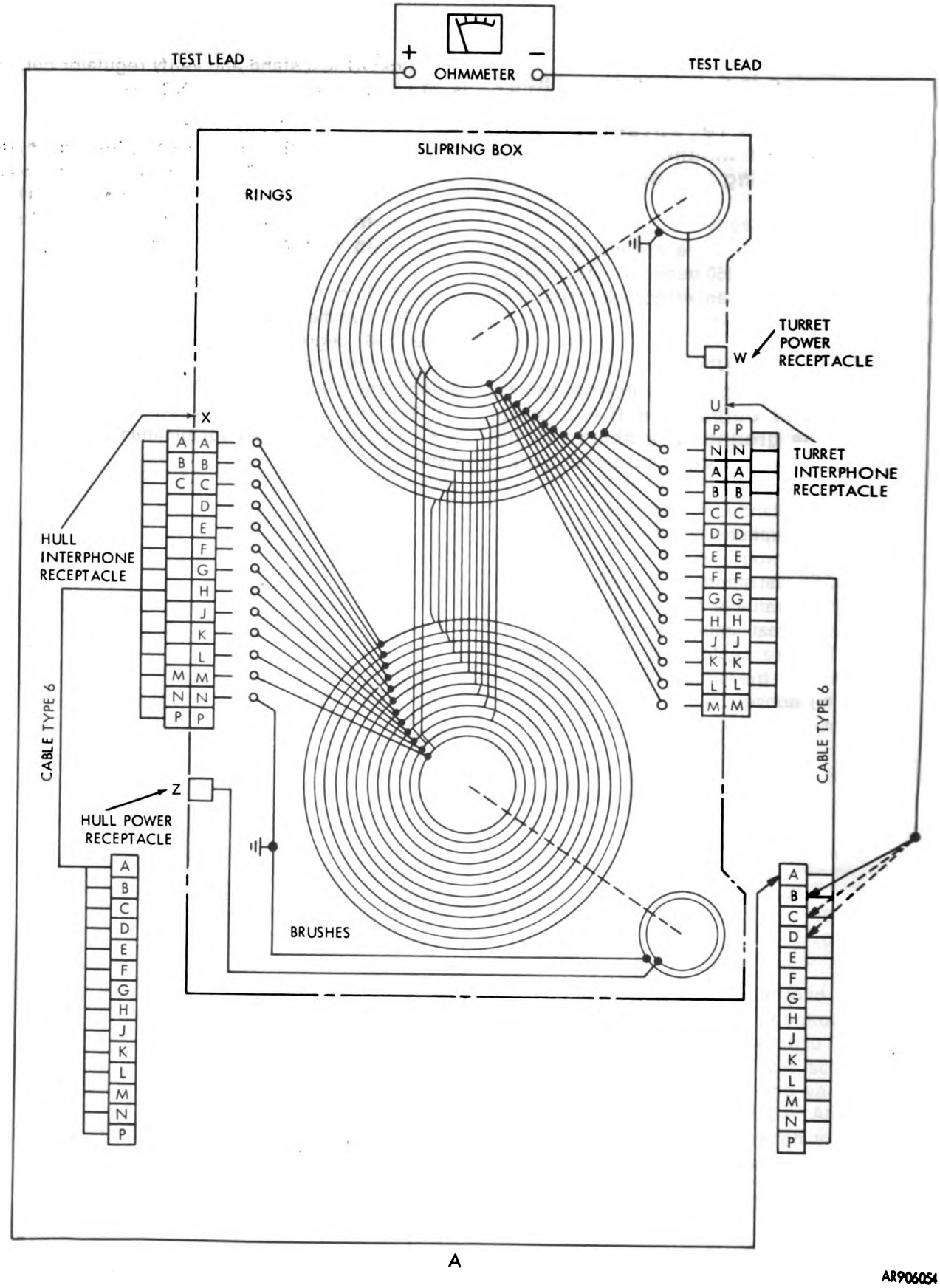



*Figure 3-3. Slipring interphone continuity test (1 of 5).*

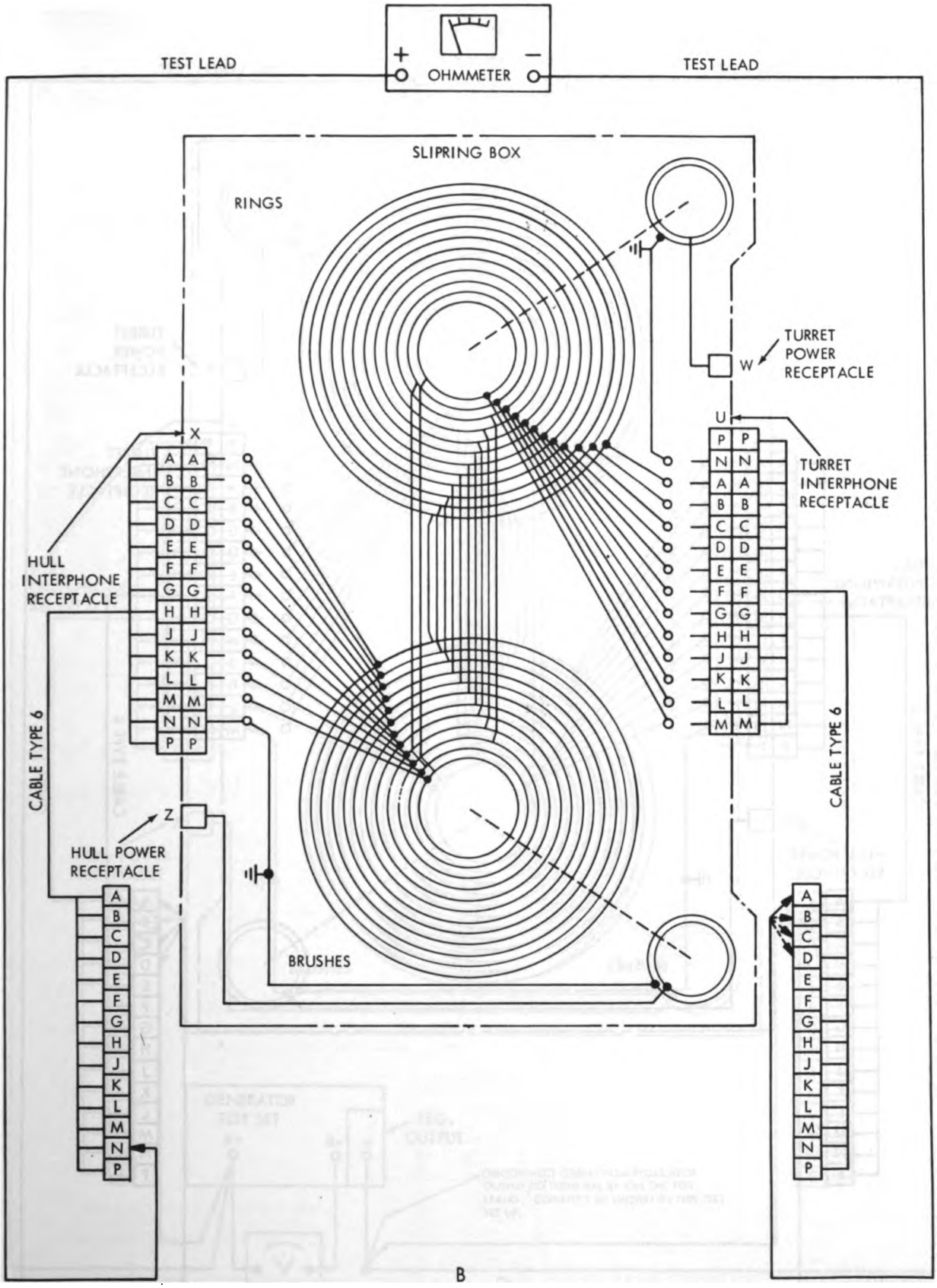



*Figure 3-3. Slipring interphone continuity test (2 of 5).*

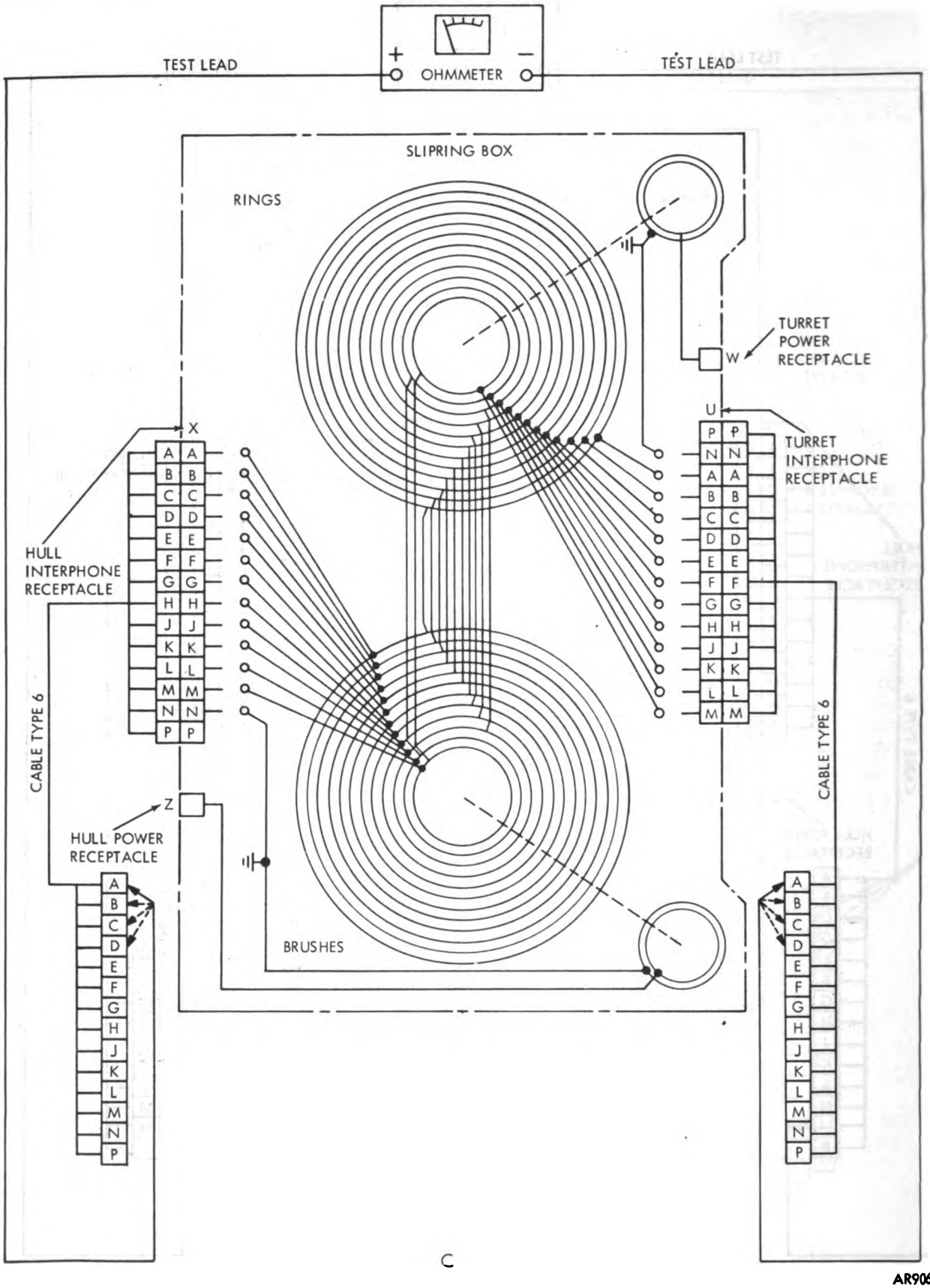



*Figure 3-3. Slipring interphone continuity test (3 of 5).*

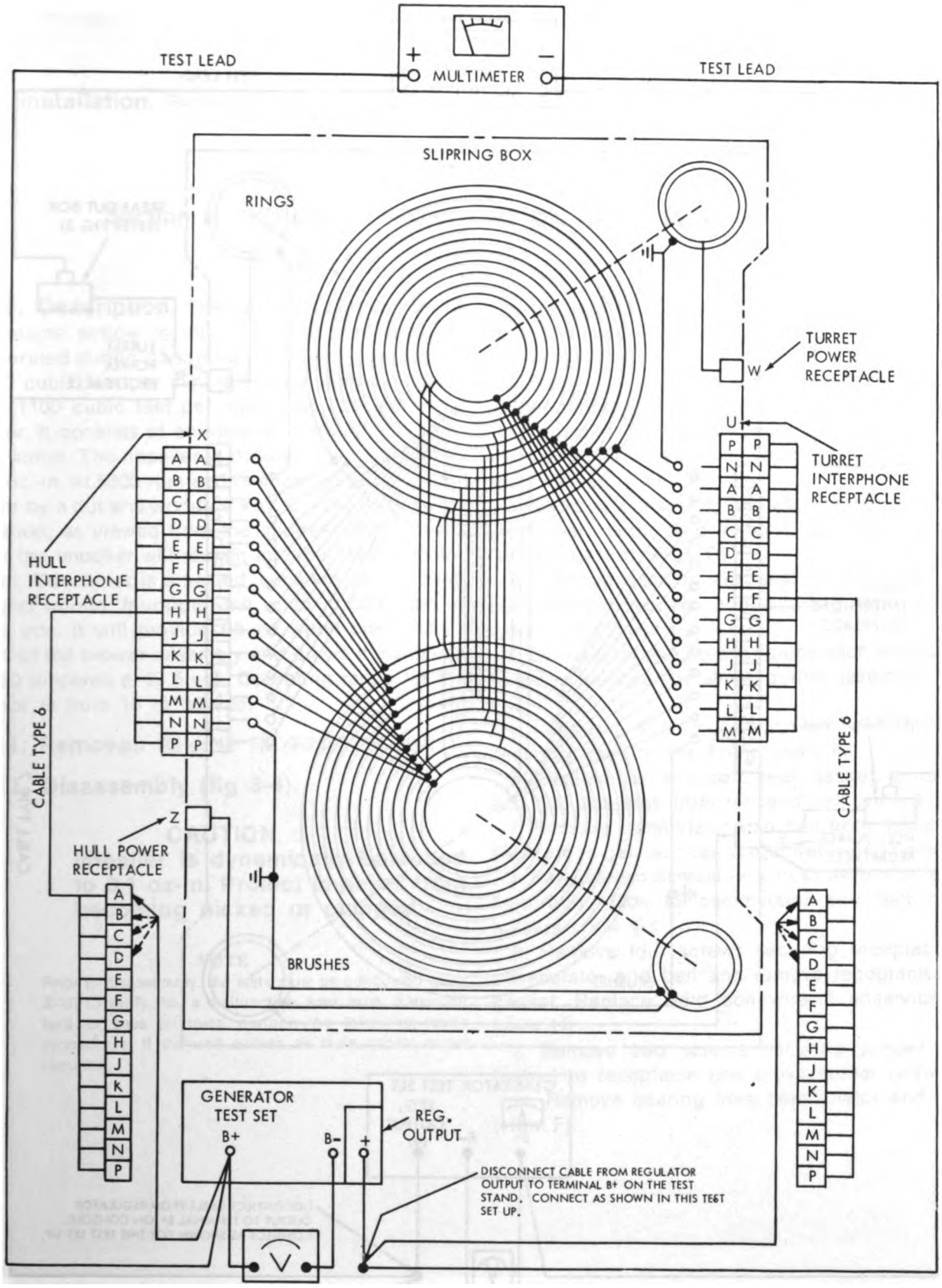



*Figure 3-3. Slipring interphone 5-amp test (4 of 5).*

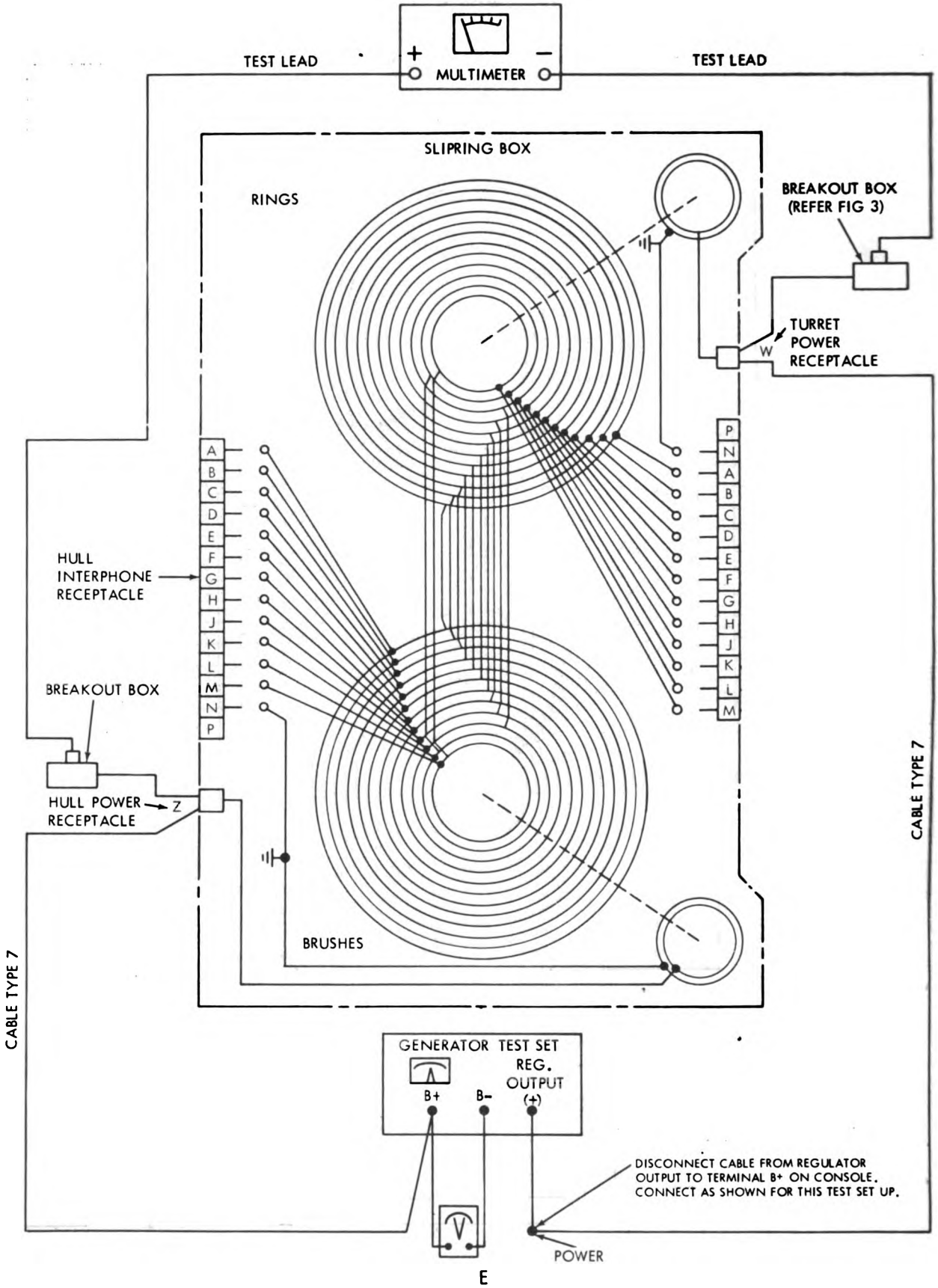



*Figure 3-3. Slipring interphone 200-amp test (5 of 5).*

**3-9. Installation.** Refer to TM 9-2350-258-20-2.

## Section III. REPAIR OF TURRET VENTILATING BLOWER

**3-10. Description.** The turret ventilating blower maintains airflow in the turret and purges gases generated during gun firing. The blower is rated at 1500 cubic feet per minute at 2.00 inches of water and 1100 cubic feet per minute at 4.25 inches of water. It consists of an impeller, shroud, and electric motor. The impeller is dynamically balanced to 0.1 oz.-in. at 5800 rpm and is attached to the motor shaft by a nut and woodruff key. Counter-clockwise rotation, as viewed from the impeller end, insures that the impeller will remain attached to the motor shaft. The motor is a sealed, constant speed, compound wound, four-pole unit rated at 5600 rpm at 27.5 vdc. It will provide 1.5 hp when operated as part of the blower assembly and draws a maximum of 60 amperes at 27.5 vdc. Operating range for the motor is from 18 to 30 vdc.

**3-11. Removal.** Refer to TM 9-2350-258-20-2.

**3-12. Disassembly (fig 3-4).**

**CAUTION**

**Impeller is dynamically balanced to 0.1 oz-in. Protect impeller from becoming nicked or chipped.**

NOTE

Prior to disassembly, the tests must be conducted (para 3-16) to verify that a malfunction does exist. If the unit fails to pass all tests, perform the following repair procedures. If the unit passes all tests, repair is not required.

*a.* Remove nut securing impeller to blower motor shaft and remove impeller and woodruff key (views A and B).

*b.* Remove four screws and lockwashers securing blower motor to shroud and remove motor (view B).

*c.* Unscrew four brush caps using a number 2 spanner wrench and remove four caps, gaskets, and brushes (view C).

*d.* Remove four screws and washers securing cap to blower motor and remove cap and gasket. Discard gasket (view D).

*e.* Remove packing and seal from the fan end bell. Remove spacer and packing from blower motor shaft (view E).

*f.* Scribe a locating mark across each end bell to frame so bells can be alined during assembly (view F).

*g.* Remove four plugs, screws, and washers securing ends to the frame (view F).

*h.* Remove fan end bell, seal, gasket, armature, and two bearings from fan end bell (view F).

*i.* Remove commutator end bell from frame and separate to gain access to internal wiring (view G).

*j.* Remove two screws and lockwashers securing field coil leads to commutator end bell brush holders (view G).

*k.* Remove four screws securing receptacle to commutator end bell and remove receptacle and gasket. Replace field coil wire if unserviceable (view H).

*l.* Remove two screws securing jumper wire (cable) to receptacle and brush holder (view G).

*m.* Remove bearing from commutator end head (view F).

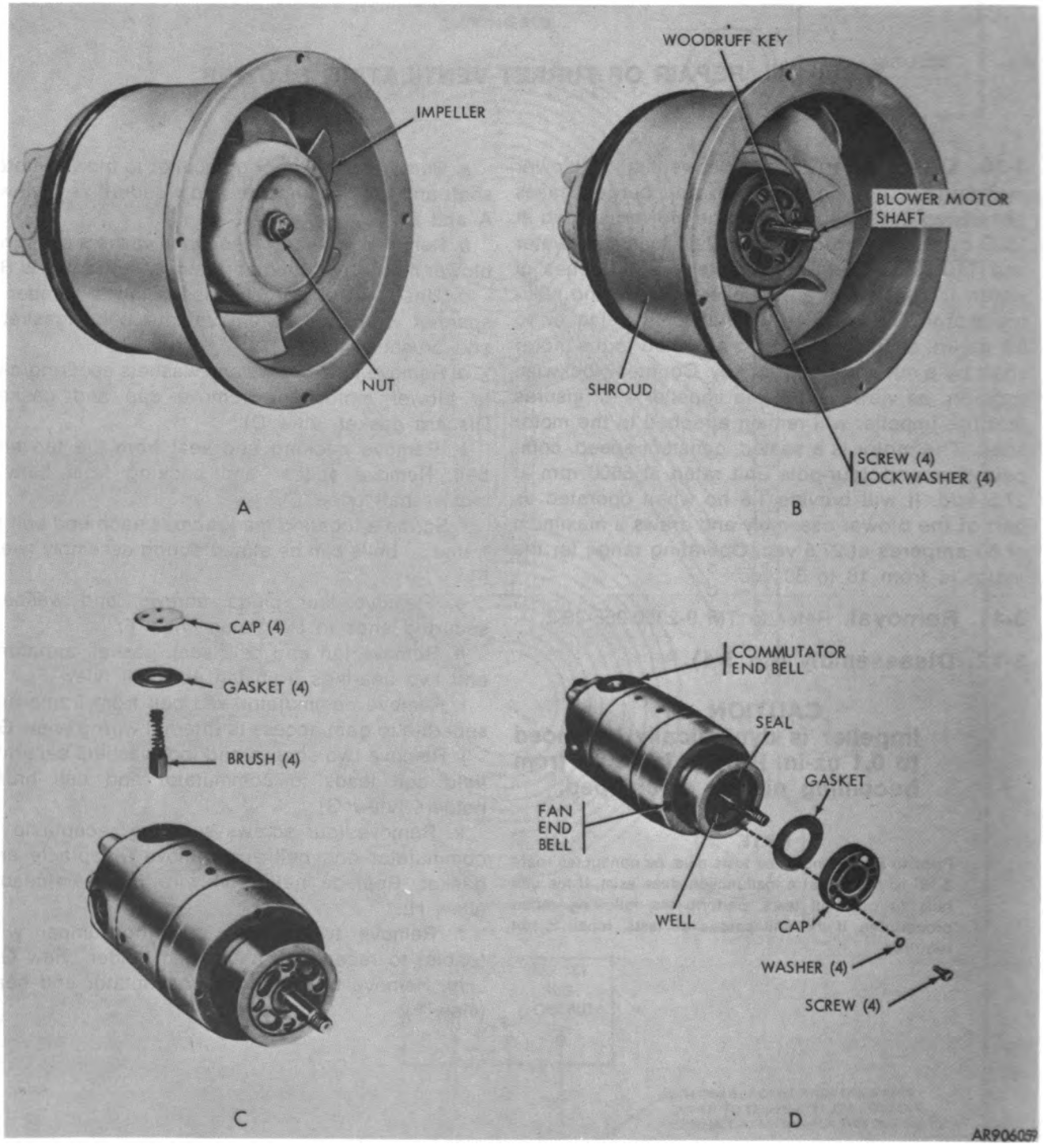
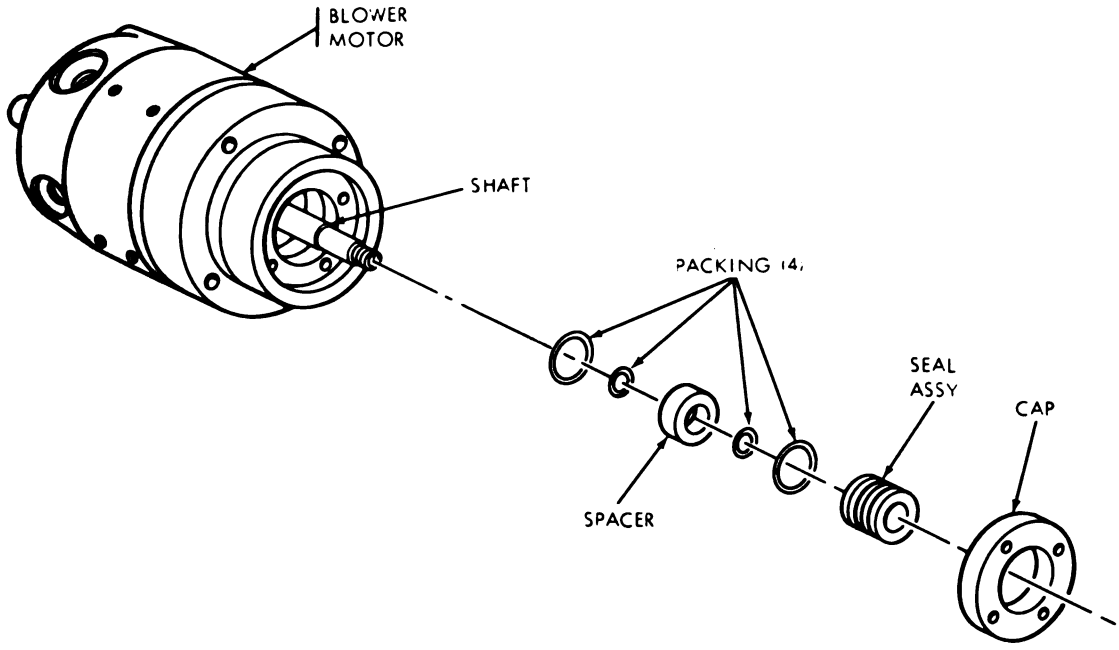
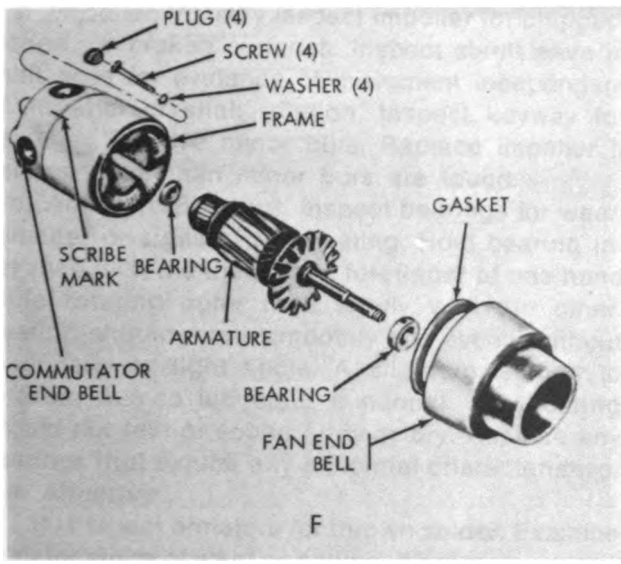



*Figure 3-4. Turret ventilating blower disassembly or assembly (1 of 3).*




E




F

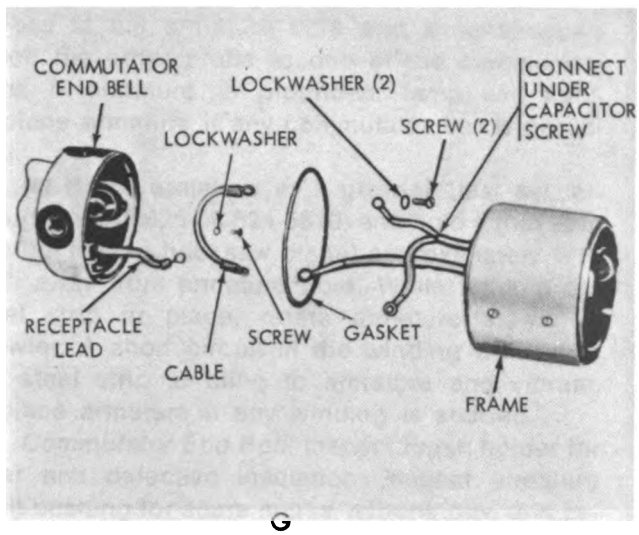



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*Figure 3-4. Turret ventilating blower disassembly or assembly (2 of 3).*

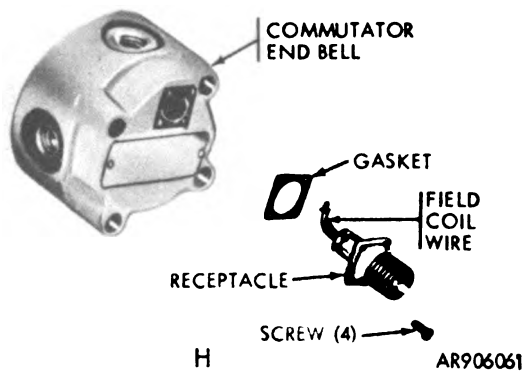



*Figure 3-4. Turret ventilating blower disassembly or assembly (3 of 3).*

## 3-13. Cleaning.

*a. General.* Clean parts according to the following instructions and paragraph 2-9.

*b. Field Coils.* Wipe outer surfaces of field coils and pole shoes with a cloth dampened with drycleaning solvent (P-D-680). Exercise care to avoid damaging the protective insulating coating on field coil windings. Dry all parts thoroughly with dry compressed air.

*c. Armature.* Remove loose particles from armature with dry compressed air and wipe outer surfaces with a clean cloth dampened with drycleaning solvent (P-D-680). After noting color of commutator, clean lightly with number 4/0 sandpaper. Remove all traces of sanding dust with dry compressed air.

*d. End Bells.* Clean with a bristle brush and dry compressed air. After removal of all loose material, use brush and cloth moistened with drycleaning solvent (P-D-680). Wipe all surfaces thoroughly to remove foreign material not removed with compressed air.

## 3-14. Inspection and Repair.

*a. General Inspection (table 3-2 and fig 3-5).* Inspect components for wear. Repair or replace damaged or worn components.

*b. Shroud.* Visually inspect shroud for cracks or breaks. Replace if defective.

*c. Impeller.* Visually inspect impeller for chipped, nicked, or broken surfaces. Inspect steelsleeve in shaft hole for evidence of movement independent of impeller or shaft rotation. Inspect keyway for damage. Remove minor burs. Replace impeller if defects other than minor burs are found.

*d. Armature Bearings.* Inspect bearings for wear, damage, or signs of overheating. Hold bearing inner race with the thumb and forefinger of one hand while rotating outer race slowly with the other. Bearing should rotate smoothly and evenly without roughness or tight spots. A slight resistance to rotation, due to lubricant, is normal. The bearing should not feel or sound gritty or dry. Replace any bearings that exhibit any abnormal characteristics.

*e. Armature.*

(1) Inspect armature for thrown solder. Examine shaft for signs of wear or galling. If present, replace armature. Examine commutator surfaces. Surfaces should be a highly burnished, dark copper color prior to cleaning. Surfaces should not be scored, burned, or coated with hardened varnish or carbon accumulations. If present, commutator must be resurfaced. Resurface only the amount required to remove all pits and scores. Check bar-to-bar eccentricity and total eccentricity in a full revolution of armature. Resurface only as necessary to reduce bar-to-bar eccentricity to 0.0002 inch and total eccentricity to 0.001 inch. If resurfacing reduces commutator diameter to 1.975 inches or less, replace armature.

(2) Measure depth and width of commutator slots. Slots should be 3/64 inch deep and 0.022 inch wide. Undercut mica in commutator slots as necessary using a hacksaw blade or cutter. Check commutator for bar-to-bar shorts with an ohmmeter or test lamp.

**WARNING**

**Exercise care when using a 220-volt source. Do not use a voltage in excess of 220-volts for any of these tests.**

(3) Check for a grounded armature with a 220-volt ac or dc line, having a 50-watt lamp connected in series with the test circuit. If a 220-volt source is not available, a 110-volt source may be used with reasonable effectiveness. Touch one of the test probes to the armature core and simultaneously touch the other probe to one of the commutator bars. If armature is grounded, lamp will light. Replace armature if any commutator bar is grounded.

(4) Place armature in a growler (test set, armature, NSN 6625-00-824-5810) and hold a thin strip of steel (e.g., a hacksaw blade) approximately 1/16 inch away from armature core. While holding the steel strip in place, rotate armature slowly in growler. A short circuit in the winding will cause the steel strip to cling to armature and vibrate. Replace armature if any winding is shorted.

*f. Commutator End Bell.* Inspect brush holder for wear and defective insulation. Inspect armature shaft bushing for score marks, eccentricity, and excessive wear. Replace motor if any defect is present.

*g. Fan End Bell.* Inspect armature shaft bushing for score marks, eccentricity, and excessive wear. Replace motor if any defect is present.

*h. Brush Assemblies.* Inspect brush condition. Brushes should not be chipped, broken, or burned. The surface contacting commutator should show even wear over at least 85 percent of the possible contact area. Brush leads should be flexible and without broken strands. Brush length should be at least 5 8 inch. Test brush springs. Compression to 3/4 inch and 1-1 4 inch should require 25 to 29 ounces and at least 16 ounces of pressure, respectively. Replace brushes or springs if any defects are present or when commutator is resurfaced.

*i. Receptacle and Wiring.* Visually inspect electrical receptacle and wiring for damage. Test receptacle for continuity and a short circuit to case with an ohmmeter. Replace damaged components. Replace receptacle, including capacitor, if continuity is not present or if shorted.

*j. Field Coils.* Visually examine coils for evidence of burned or charred insulation. Test field coils for continuity. If coil insulation is damaged or continuity is not present, replace blower motor.

## 3-15. Assembly (fig 3-4).

*a.* Position receptacle and new gasket on end bell and secure with four screws (view H).

*b.* Fit bearing in commutator end bell (view G).

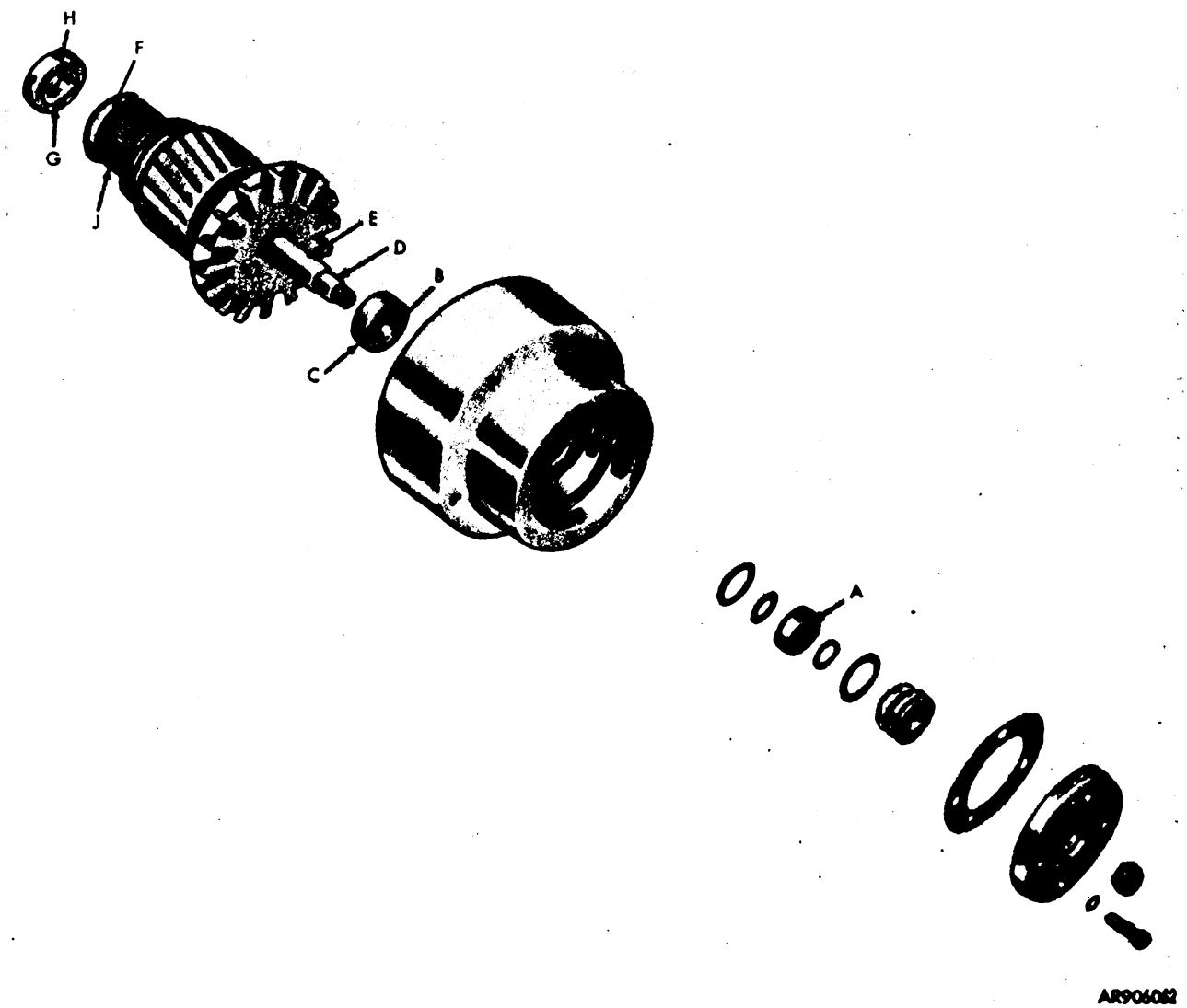



*Figure 3-5 Turret ventilating blower wear limits.*

*c.* Aline scribe marks on commutator end bell and frame. Position end bell close enough to frame to make electrical connections (view G).

*d.* Slip new gasket over frame onto field coil leads (view G). Secure jumper lead and one long coil lead to ungrounded brush holder using two screws and lockwashers. Secure capacitor positive lead and remaining jumper cable to ungrounded brush holder using two screws and lockwashers. Secure capacitor ground and small field coil lead to grounded brush holder with screw and lockwasher.

*o.* Position motor in shroud and secure with four screws and lockwashers (view B).

*p.* Install woodruff key in blower motor shaft. Position impeller on shaft and secure with nut (views A and B).

## 3-16. Tests (fig 3-6).

**NOTE**

Tests must be conducted after the completion of all repair procedures to determine that any malfunction has been repaired.

*Table 3-2. Turret Ventilating Blower Wear Limits*

| Figure | Reference | Measurement | Wear Limit (in.) |
|---|---|---|---|
| 3-5 | A | ID of spacer | 0.6360 max |
| 3-5 | B | ID of bearing | 0.6693 max |
| 3-5 | C | OD of bearing | 1.5743 min |
| 3-5 | D | OD of shaft at spacer | 0.6250 min |
| 3-5 | E | OD of shaft at bearing location | 0.6690 min |
| 3-5 | F | OD of shaft at bearing location | 0.4720 min |
| 3-5 | G | ID of bearing | 0.4724 max |
| 3-5 | H | OD of bearing | 1.2594 min |
| 3-5 | J | Undercut of commutator | Not less than 1/32 inch |

*e.* Aline scribe marks on commutator and bell and frame. Position gasket and mate end bell to frame (view F).

*f.* Assemble ring to armature and fit armature into commutator end bell bearing (view F).

*g.* Install bearing in fan end bell (view F).

*h.* Aline scribe marks on frame and fan end bell and mate end bell to frame using new gasket (view F). Secure end bells to frame with four screws and washers (view F).

*i.* Install four plugs (view F).

*j.* Install seal assembly and spacer (view E).

*k.* Fill the well with instrument oil (MIL-L-6085) (view D).

*l.* Position cap and new gasket to fan end bell and secure with four screws and lockwashers (view D).

*m.* Install four brushes in brush holders. Secure with four caps and new gaskets (view C).

*n.* Perform free run test (para 3-16).

*a. General.* Two types of tests are performed; the free run test, which is performed in open air, and the full load test performed with the motor installed in the blower assembly. The free run test checks main bearings and general electrical condition under no load conditions. The full load test simulates actual operation in the vehicle.

*b. Free Run Test.*

(1) Secure motor in vise on portable test stand (53, table 2-1).

(2) Connect test equipment (fig 3-6).

(3) Turn ON the test stand.

(4) Verify that the regulator output voltage is 28±2 vdc (between B+ and B-) and monitor current. Current draw shall be less than 15 amperes. Repair motor if bearings squeal, howl, or make unusual noise.

(5) If motor passes the free run test, install motor in blower assembly (para 3-15) and perform full load test below.

*c. Full Load Test.*

(1) Secure blower assembly to test stand.
(2) Connect test equipment (fig 3-6).
(3) Turn ON test stand.

(4) Verify regulator voltage output is 28 ±2 vdc (between B+ and B-) and monitor current drawn by motor. Current draw should be 57 amperes or less. Repair motor if unusual noise is heard.

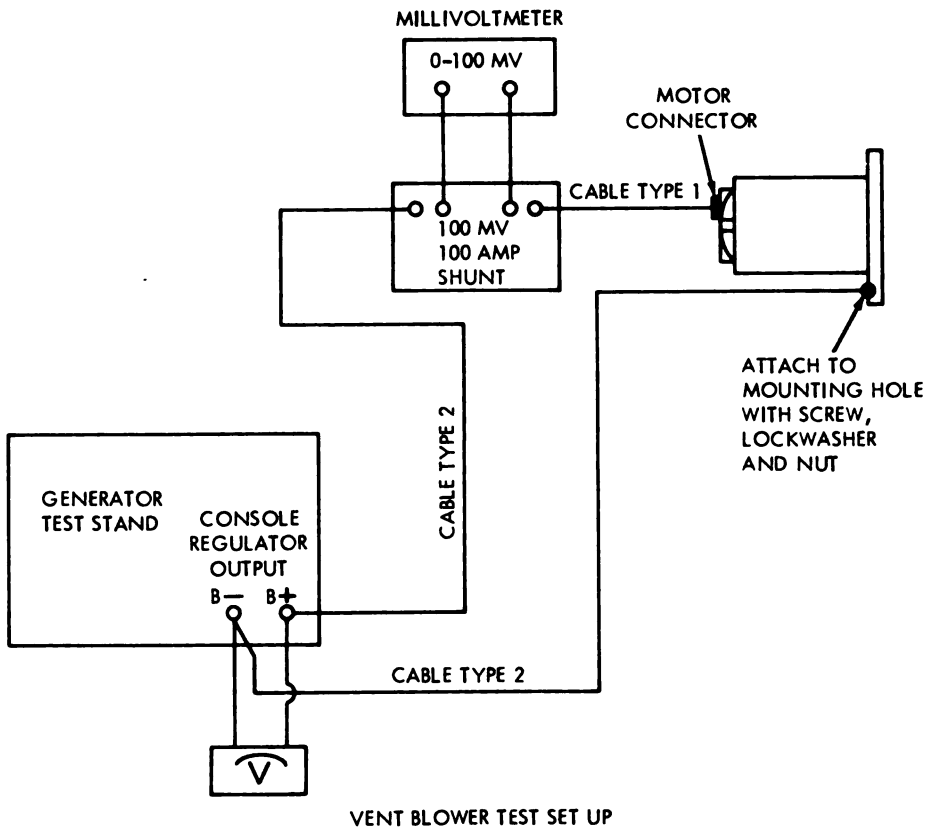



*Figure 3-6. Turret ventilating blower test setup.*

**3-17. Installation.** Refer to TM 9-2350-258-20-2.

## Section IV. REPAIR OF TURRET POWER RELAY BOX AND SEARCHLIGHT RELAY BOX

**3-18. General.** The turret power relay box and the searchlight relay box are physically and electrically identical. The turret power relay box operates in conjunction with TURRET POWER and hydraulic pressure switches to control application of vehicle power to the power pack dc motor. The searchlight relay box is controlled by searchlight control box C-7163/VSS-1, and controls application of vehicle power to the 2.2 kw xenon searchlight. Each relay box contains a 200-ampere, automatic-resetting thermal circuit breaker, 400-ampere relay, four receptacles, case, and associated wiring and bus bars.

**3-19. Removal.** Refer to TM 9-2350-258-20-2.

**3-20. Disassembly (fig 3-7).**

NOTE

Prior to disassembly, tests must be conducted to verify that a malfunction does exist. If the unit fails to pass all tests, perform the following repair procedures. If the unit passes all tests, repair is not required

*a.* Remove six screws and lockwashers securing cover to relay box. Remove cover and gasket.

*b.* Remove nut, lockwasher, and washer securing relay bus bar to receptacle. Loosen nut securing relay bus bar to relay terminal and remove bus bar.

*c.* Remove four screws and lockwashers securing receptacle to relay box. Remove receptacle and gasket.

*d.* Remove nut, lockwasher, and washers securing electrical cable to relay terminal and disconnect cable.

*e.* Remove nut, lockwasher, and washer securing relay/circuit breaker bus bar to circuit breaker. Loosen nut securing relay/circuit breaker bus bar to relay terminal and remove bus bar.

*f.* Remove two screws and lockwashers securing relay in box and remove relay.

*g.* Remove nut, lockwasher, and washer securing circuit breaker bus bar to circuit breaker. Loosen two nuts securing circuit breaker bus bar to two receptacles and remove bus bar.

*h.* Remove 12 screws and lockwashers securing three receptacles to box. Remove three receptacles and gaskets.

*i.* Remove four screws securing circuit breaker to box and remove circuit breaker.

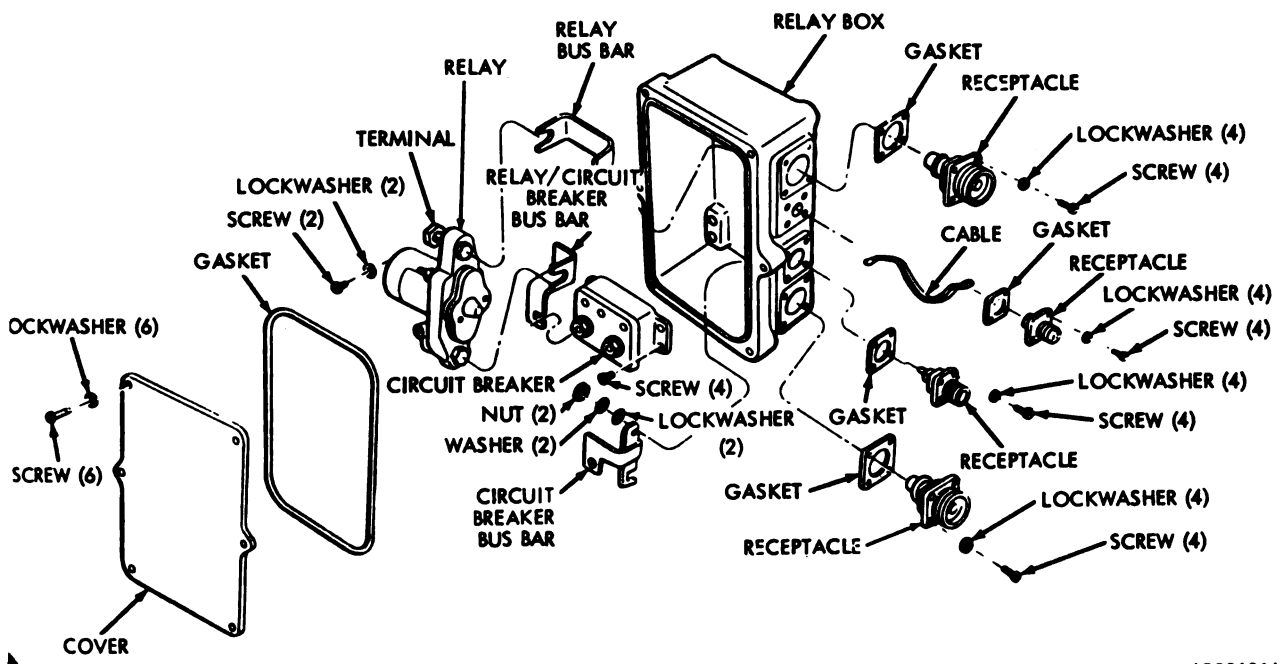



*Figure 3-7. Turret power relay box and searchlight relay box.*

**3-21. Cleaning.** Refer to paragraph 2-9.

**3-22. Inspection and Repair.** Visually inspect components for corrosion and damage. Inspect relay terminals and receptacle studs for security of mounting. Remove corrosion with crocus cloth. Repair or replace damaged components. Inspect insulation for defects. Repair any defects using electrical tape (MIL-I-15126, type EF—9 or MIL-I-631, type F, form T, grade a, class 1, 0.010 inch thick) provided that insulation is not dry, cracked, or brittle. Replace wires if insulation is brittle, cracked, or peeling.

**3-23. Assembly (fig 3-7).** Assemble in reverse order of disassembly (para 3-20).

**3-24. Tests (fig 3-8).**

NOTE

Tests must be conducted after the completion of all repair procedures to determine that any malfunction has been repaired.

*a. General.* The tests performed on the relay box insure that: (1) the relay will energize and deenergize at the proper voltages. (2) relay contact resistance is within tolerance and contacts are not burned. (3) relay coil resistance is within tolerance. (4) bus bar connections are satisfactory, and (5) the circuit breaker will carry maximum rated load.

*b. Relay Coil Test (fig 3-8).*

(1) Connect test equipment (view A). Connect ohmmeter, set at RX1, between pins A and D (view A) of turret power relay box.

(2) Place variable dc volt switch in ON position.

(3) Set variable load control for O vdc counterclockwise.

(4) Place variable load switch in ON.

(5) Turn test stand ON. Slowly advance variable load control while observing ohmmeter for indication of continuity on ohmmeter. At point where ohmmeter indicates continuity, note voltage on test stand variable voltage meter (pickup voltage). Replace relay if voltage is less than 7 or more than 18 vdc. Slowly decrease the variable voltage while observing the ohmmeter for loss of continuity. At point where continuity is lost, note voltage on test stand variable voltage meter (dropout voltage). Replace relay if voltage is less than 1.5 vdc or more than 7 vdc.

(6) Turn variable dc volt switch OFF and disconnect test equipment.

(7) Turn variable load control to minimum counterclockwise position.

(8) Turn variable load switch OFF.

*c. Relay Contact and Bus Bar Tests (fig 3-8).*

(1) Connect test equipment (view B).

(2) Set multimeter to fifty (50) volt "dc" scale.

(3) Set load bank switch for no load.

(4) Turn test stand ON and verify 28±2 vdc at regulator output (between B+ AND B-).

**CAUTION**

**If the relay box is defective, the voltage could be 28 vdc across the power receptacle and damage could occur to the multimeter if scale is reduced to 1 vdc.**

(5) Set load bank switches for a 200-ampere load. Set multimeter to applicable vdc scale and note multimeter reading. Multimeter should indicate less than o.15 volt when connected between terminals A and D. If greater than 0.15 volt between terminals A and D, but less than 0.07 volts across relay contacts, repair circuit breaker, relay, and receptacle bus bar connections.

(6) Set load bank for minimum load. Turn power supplies OFF, move multimeter and load bank connections from relay box terminal A to terminal C.

(7) Turn test stand ON and verify 28t2 vdc (between B+ AND B-). Set load bank switches for a 200-ampere load. Multimeter shall read less than o.15 volt between receptacles C and D.

(8) Turn OFF test stand and clean bus bar connections between receptacles C and D if multimeter indicates greater than 0.15 volt.

(9) Repeat step (7) if it was necessary to clean bus bar in step (8).

(10) Set load switches to minimum load and turn test stand OFF.

*d. Circuit Breaker Test (fig 3-8).*

(1) Connect all test equipment except multimeter )view B).

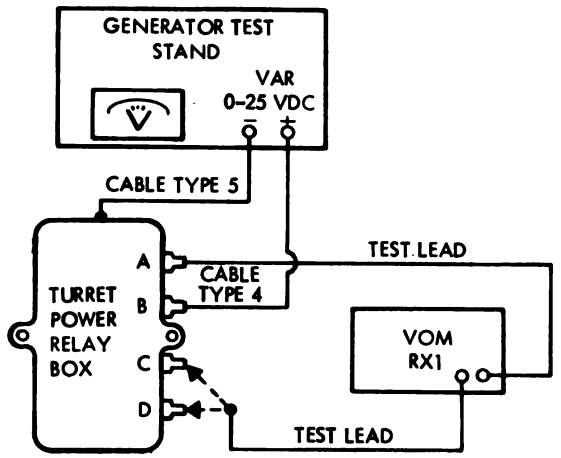
(2) Set load bank switches to minimum load.

(3) Turn ON test stand and verify 28±2 vdc (between B+ AND B-).

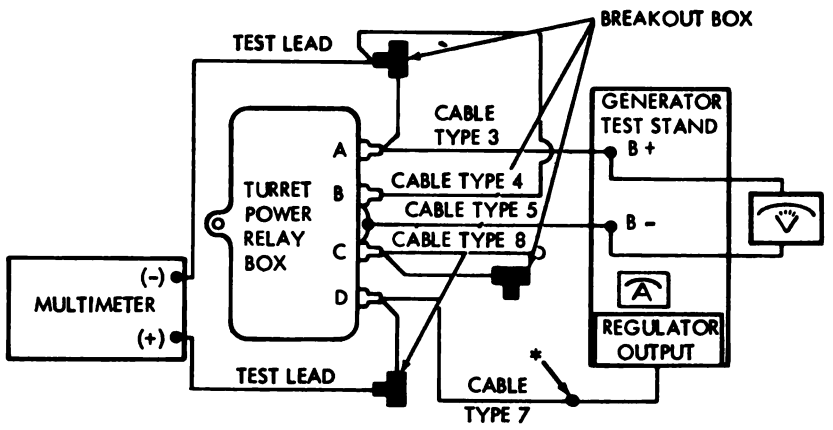
(4) Set load bank switches for a 200+ 5/-0-amp load. Verify 28±2 vdc (between B+ and B-).

(5) Monitor load current for a minimum of two minutes. Maintain 200+ 5/-0-amps. during test by adjusting the variable load control if necessary. Replace circuit breaker if it trips during test.

(6) Set load bank switches for minimum load and turn the test stand OFF.




RELAY PICK UP & DROPOUT VOLTAGE TEST
A




200 AMP LOAD TEST
B

*DISCONNECT CABLE FROM REGULATOR OUTPUT TO TERMINAL B+ ON TEST STAND CONNECT AS SHOWN FOR THIS TEST.

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*Figure 3-8. Turret power relay or searchlight relay test setup.*

**3-25. Installation.** Refer to TM 9-2350-258-20-2.

## Section V. REPAIR OF SEARCHLIGHT AN/VSS-1.

Refer to TM 11-6230-219-35.

## Section VI. REPAIR OF MANUAL TRAVERSING DRIVE.

**3-26. Description.** Refer to TM 9-2350-258-20-2.

**3-27. Removal.** Refer to TM 9-2350-258-20-2.

**3-28. Disassembly (fig 3-9).**

*a.* Remove retaining ring securing crank handle to arm (view A).

*b.* Remove screw and lockwasher securing crank arm to drive gear shaft and remove arm (view B).

*c.* Remove four screws and lockwashers securing drive gear assembly to housing (view C). Remove drive gear and shim(s).

*d.* Remove three screws and lockwashers securing output gear assembly to housicg (view D). Remove output gear and shim(s).

*e.* Remove pin securing lever in crank handle and remove lever assembly (view E).

*f.* Remove pins securing shaft to link and remove shaft (view F).

*g.* Remove pin securing link to lever and remove link (view F).

*h.* Remove pin securing lever to crank arm and remove lever, plunger, and spring (view G).

*i.* Remove needle bearing from crank arm (view H).

*j.* Remove retaining ring securing ball bearing in crank arm and remove bearing (view H).

*k.* Remove retaining ring securing drive gear and bearing in housing and remove gear and bearing (view J).

*l.* Remove bearing (press fit) from drive gear shaft (view j).

*m.* Remove needle bearing (press fit) from drive gear housing (view K).

*n.* Remove pin securing universal joint to output gear shaft and separate universal joint from shaft (view L).

*o.* Remove housing extension from output gear shaft (view M).

*p.* Remove ball bearing (press fit) from output gear shaft (view N).

q. Remove needle bearing (press fit) from housing extension (view N).

*r.* Remove rivet securing adapter to universal joint and remove adapter (view O).

*s.* Remove two rivets securing universal joints to drive tube and remove universal joints from tube (view P).

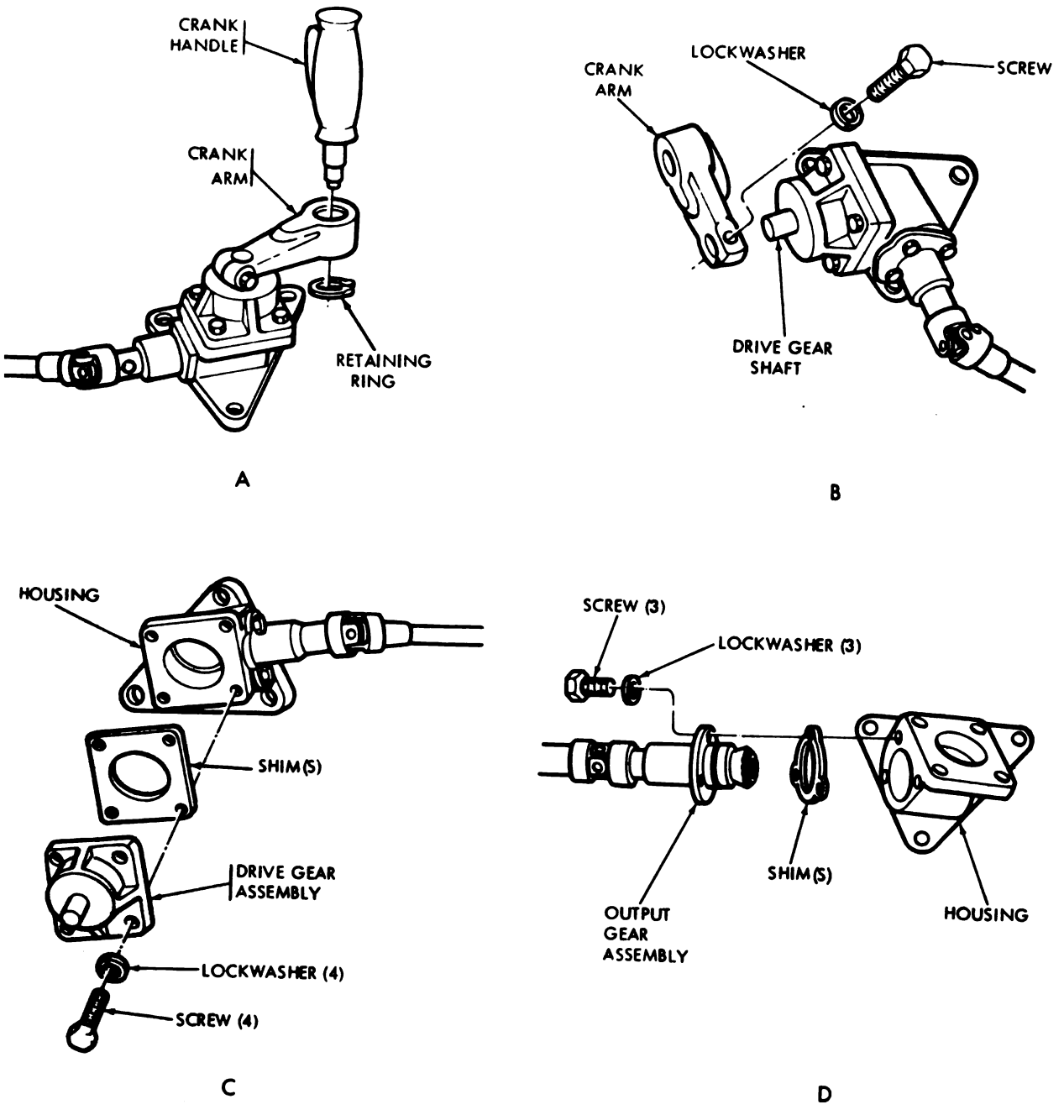
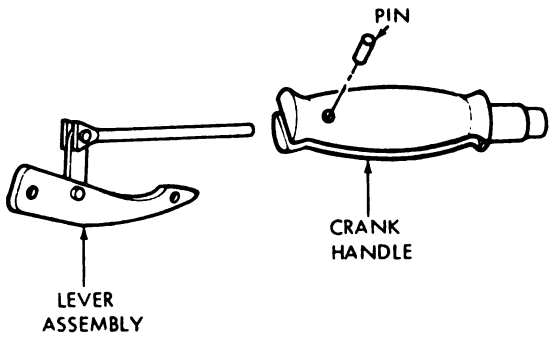



*Figure 3-9. Manual traversing drive disassembly or assembly (1 of 4).*

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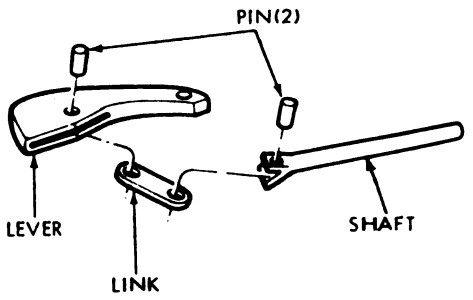


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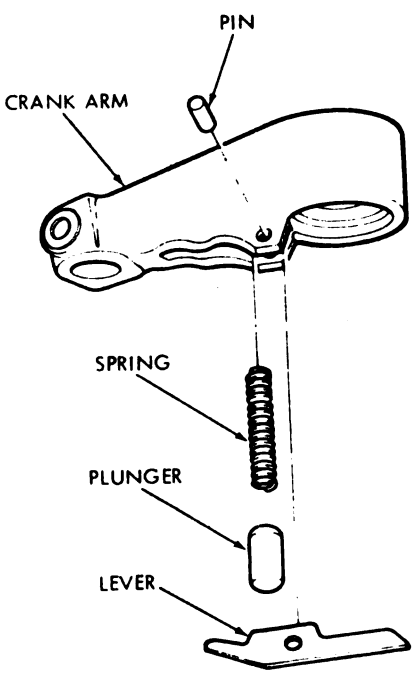
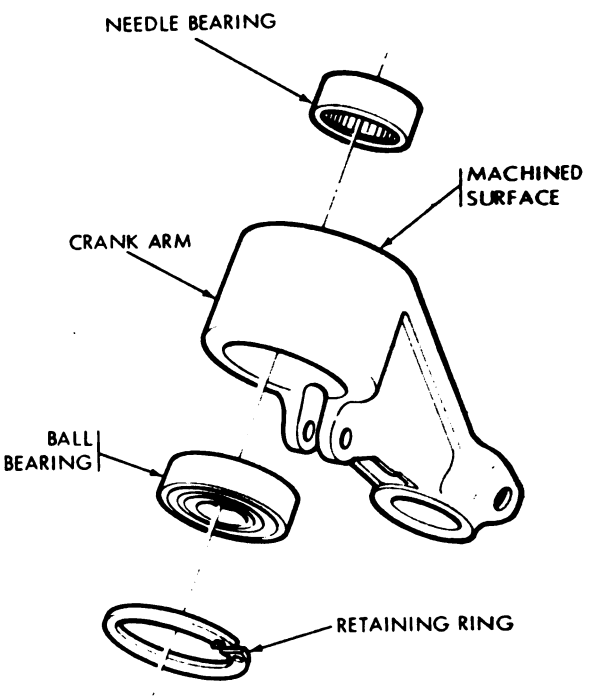



G




H

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*Figure 3-9. Manual traversing drive disassembly or assembly (2 of 4)*

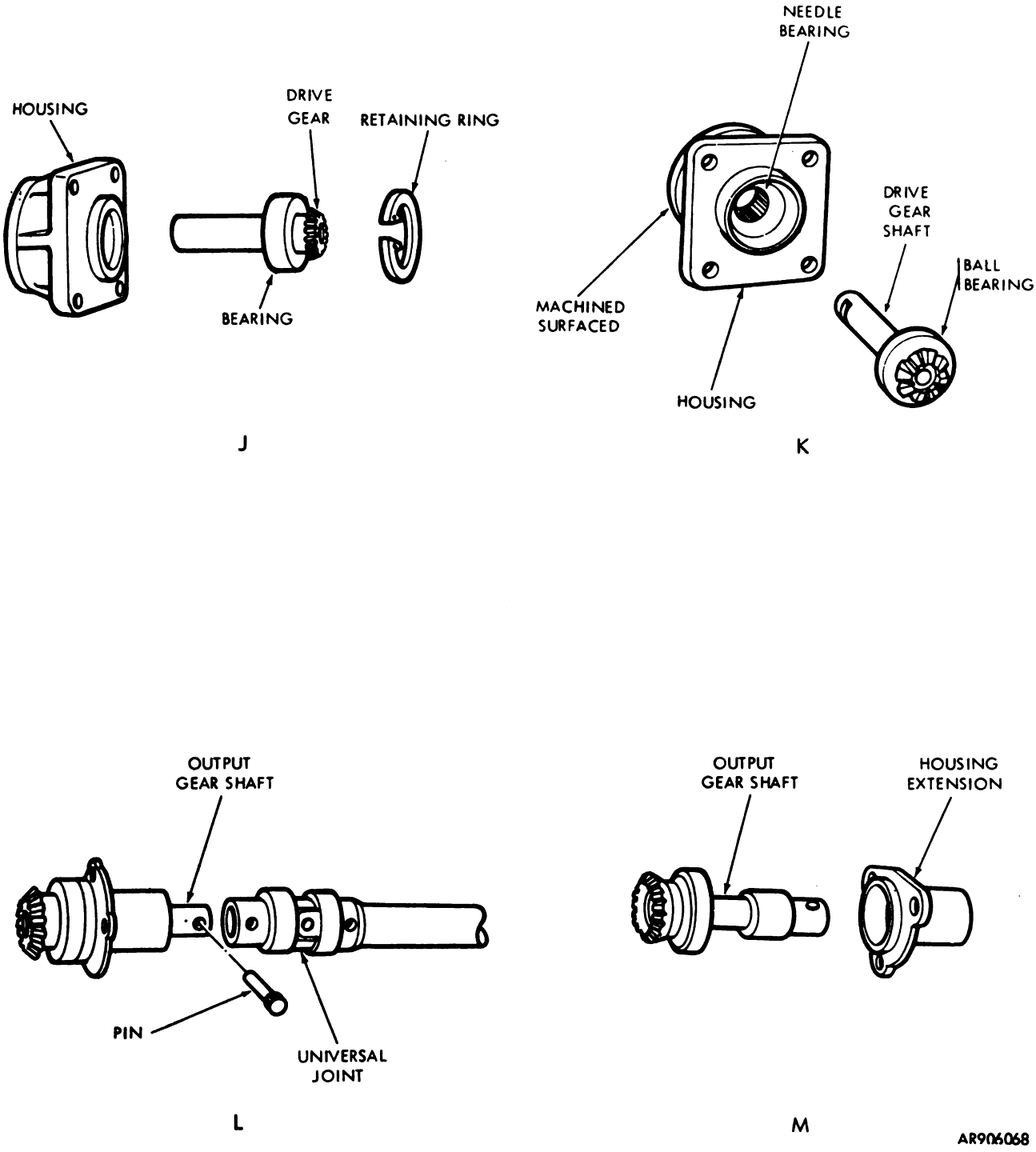



*Figure 3-9. Manual traversing drive disassembly or assembly (3 of 4).*

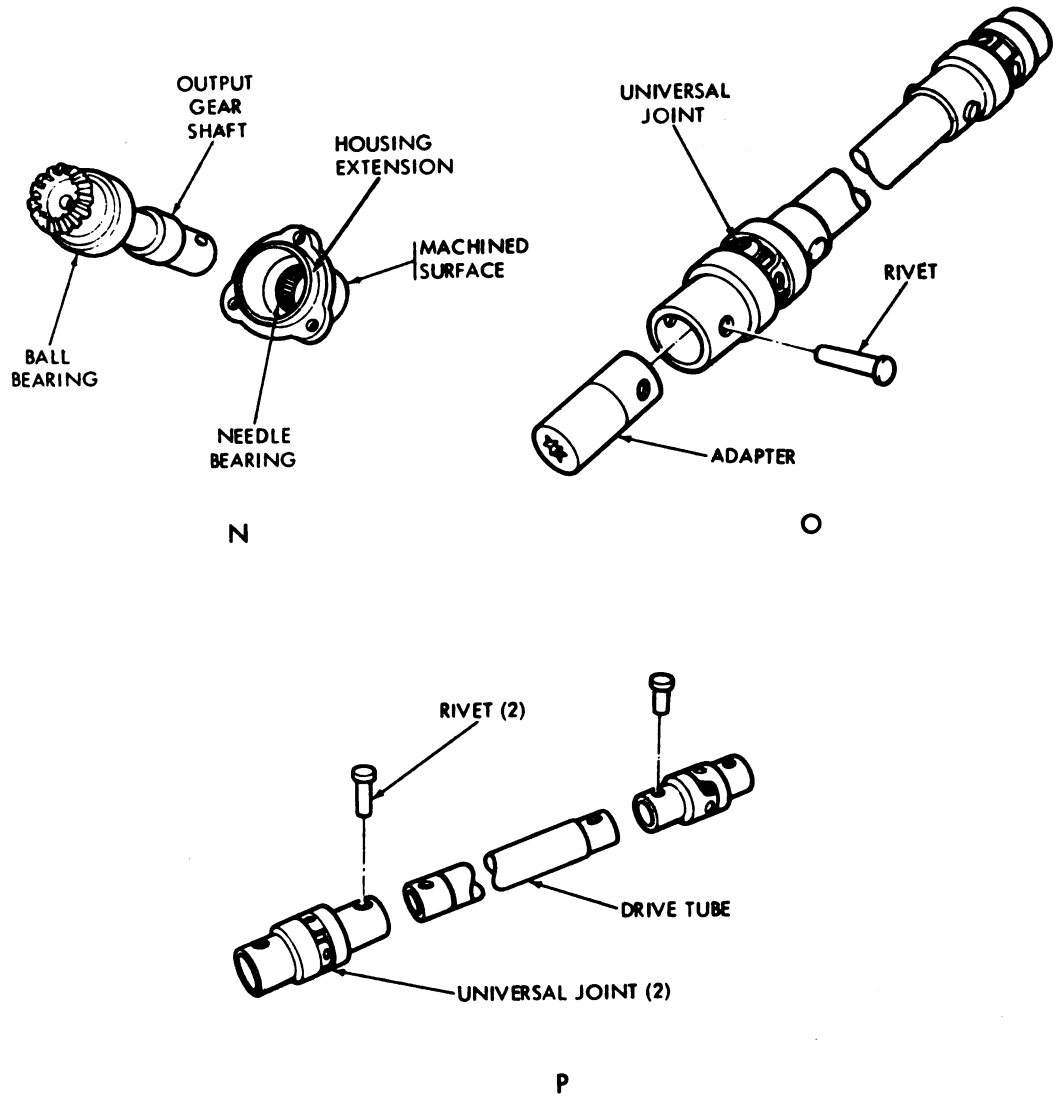



*Figure 3-9. Manual traversing drive disassembly or assembly (4 of 4).*

**3-29. Cleaning.** Refer to paragraph 2-9.

**3-30. Inspection and Repair.** Refer to paragraph 2-9.

**3-31. Assembly (fig 3-9).**

NOTE

Coat bearings, gear teeth, and sliding surfaces with a light coat of grease MIL-G-10924) during assembly.

*a.* Position universal joints on drive tube and secure with two rivets (view P).

*b.* Insert adapter into universal joint and secure with rivet (view O).

*c.* Install needle bearing (press fit) into housing extension (view N). Bearing must be flush to 0.03 inch below machined surface (view N).

*d.* Install ball bearing (press fit) onto output gear shaft (view N).

*e.* Insert output gear shaft into housing extension (view M).

*f.* Insert output gear shaft into universal joint and secure with pin (view L).

*g.* Install ball bearing (press fit) onto drive gear shaft (view K).

*h.* Install needle bearing (press fit) into drive gear housing (view K). Bearing must be flush to 0.03 inch below machined surface.

*i.* Insert drive gear and bearing into housing and secure with retaining ring (view J).

*j.* Install needle bearing (press fit) into crank arm (view H). Bearing must be flush to 0.03 inch below machined surface of handle.

*k.* Position ball bearing in crank arm and secure with retaining ring (view H).

*l.* Position spring, plunger, and lever in crank arm and secure with pin (view G).

*m.* Assemble shaft and link to crank handle lever and secure with two pins (view F).

*n.* Position lever assembly in crank handle and secure with pin (view E).

*o.* Assemble output gear assembly to housing (view D).

*p.* Assemble drive gear assembly to housing (view C).

*q.* Shim as required between drive and output gear assemblies and housing to obtain 0.000 to 0.003 inch backlash between gear teeth (views C and D).

*r.* Position crank arm on drive gear shaft and secure with screw and lockwasher (view B).

*s.* Position crank handle in crank arm and secure with retaining ring (view A).

**3-32. test.** Verify that handle rotates freely without evidence of binding.

**3-33. Installation.** Refer to TM 9-2350-258-20-2.

## Section VII. REPAIR OF COMMANDER'S CONTROL

**3-34. Description (fig 3-10).**

*a. General.* The commander's control consists of a traversing cam, handle arms, centering spring, and miscellaneous hardware enclosed in a cast aluminum housing, and an external grip on the handle which houses the gun firing trigger, palm switch actuator, trigger switch, override switch, and magnetic brake/elevation shutoff valve switch.

*b. Gun Firing and Control Override.* Depressing the palm switch actuator mechanically closes the override switch contacts and opens the magnetic brake/elevation shutoff valve switch contacts. The closed override switch contacts energize the override solenoid which shifts control of the power pack from gunner to commander. Transfer of control from gunner to commander also closes the gun firing circuit to the commander while opening the firing circuit to the gunner. Opening the magnetic brake/elevation shutoff valve switch contacts deenergizes the magneic brake in the traversing gearbox and elevation shutoff valve, if present.

*c. Traverse Movement.* The handle is pinned to the handle bracket, and the bracket is, in turn, secured to the traversing cam. Rotation of handle to the right or left results in rotation of the cam in the same direction. As the traversing cam rotates, a rod end bearing riding in the cam track is translated laterally forward or rearward, depending on direction of cam rotation. The rod end bearing is secured to the handle traverse arm which pivots on a pin passing through the housing. The traverse control rod is also connected to the same arm, and lateral movement of the bearing is transferred to the traverse control rod. A centering spring acts on the handle traverse arm to return the bearing and cam and the control handle to the neutral centered position when the handle is released.

*d. Elevation Movement.* The same pin that secures the grip of the control handle to the handle bracket also acts as a pivot pin and allows the handle to pivot rearward or forward in the bracket. The relative rotational position of the handle bracket does not affect this pivoting action. An elevation rod passes through the traversing cam and is pinned to the grip of the control handle. Movement of the handle is thus transferred to the rod. The opposite end of the elevation rod is threaded to receive the rod end bearing, and the bearing is secured to the elevation arm which is pinned to the housing. The elevation control is also connected to the elevation arm so that as the arm pivots and the control rod moves in response to handle rod movement. A centering spring acts on the elevation arm to return the control handle to the neutral centered position when the handle is released.

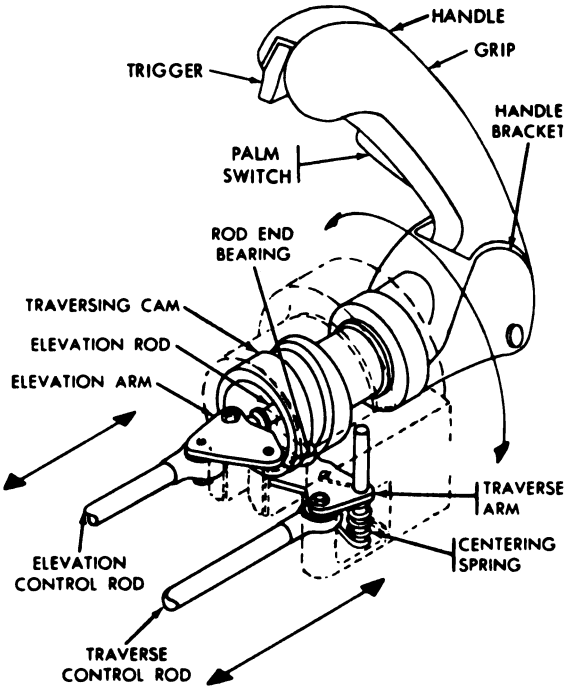



*Figure 3-10. Commander's control.*

**3-35. Removal.** Refer to TM 9-2350-258-20-2.

## 3-36. Disassembly (fig 3-11).

*a.* Remove screw, spacer, and nut securing rod end to handle elevation arm and remove rod end (view A).

*b.* Remove four screws and lockwashers securing electrical receptacle to housing cover (view A).

*c.* Unscrew nut from electrical receptacle (view B).

*d.* Unsolder switch leads from receptacle pins and remove receptacle and nut (view B).

*e.* Remove screw and nut securing rod end to handle elevation arm (view C).

*f.* Remove nut and lockwasher from threaded pin (view D).

*g.* Hold cam lock block in position and remove elevation arm and spacer (view E).

*h.* Slowly release cam lock block until plunger spring is decompressed and remove cam lock block spacer, cam follower plunger, and plunger spring from housing (view E).

*i.* Remove threaded pin from cam lock block (view E).

*j.* Remove elevation arm bushing from housing (view E).

*k.* Remove three screws and lockwashers securing housing cover to housing and remove cover (view F).

*l.* Remove centering spring and traverse arm from housing (view G).

*m.* Remove nut securing rod end to traverse arm and remove rod end (view H).

*n.* Remove nut and screw securing bearing to traverse arm and remove bearing (view H).

*o.* Remove two bushings from traverse arm (view H).

*p.* Remove six setscrews (two from each hole) securing control handle bracket to traversing cam and remove handle and bracket from cam (view J).

*q.* Remove six screws and lockwashers securing cam plate to housing and remove cam plate, cam bearing, and traversing cam from housing (view K).

*r.* Remove setscrew securing handle pivot shaft in bracket and remove pivot shaft, handle, and spacers from bracket (view L).

*s.* Do not disassemble rod end from handle rod unless necessary. If disassembly is required, measure distance from handle rod pivot pin hole to rod end and record measurement for assembly.

*t.* Remove pivot pin securing handle rod to handle and remove rod (view M).

*u.* Loosen rod end jamnut and remove rod end and nut from handle rod (view M).

*v.* Remove three screws and lockwashers from handle and separate handle halves (view N).

*w.* Remove trigger, trigger return spring, and spring pin from trigger pivot pin (view N).

*x.* Remove trigger pivot pin from handle (view N).

*y.* Remove trigger stop pin from handle (view N).

*z.* Remove setscrew from trigger (view N).

*aa.* Remove setscrew from left half handle (view N).

*ab.* Remove actuator pivot pin from right half handle and remove actuator (view P).

*ac.* Remove setscrew from actuator (view P).

*ad.* Remove two straps and tubing from switch.

*ae.* Remove override switch from clip (view Q).

*af.* Remove trigger switch from handle (view Q).

*ag.* Remove two screws and lockwashers securing guard and adapter to handle and remove guard and adapter (view Q).

*ah* Remove screw and lockwasher securing magnetic brake/elevation shutoff valve switch to handle and remove clip and magnetic bracket switch (view Q).

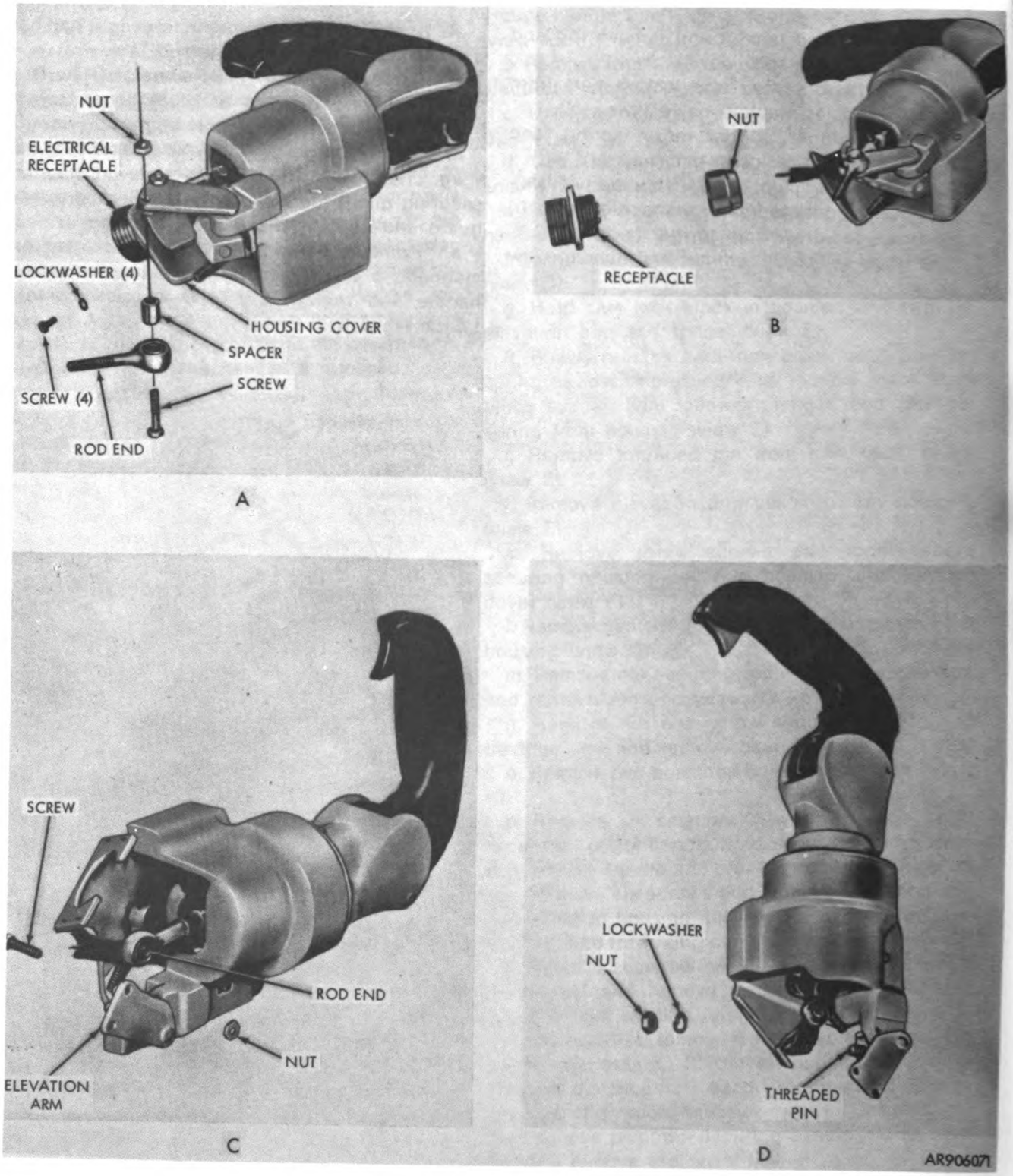



*Figure 3-11. Commander's control disassembly or assembly (1 of 4).*

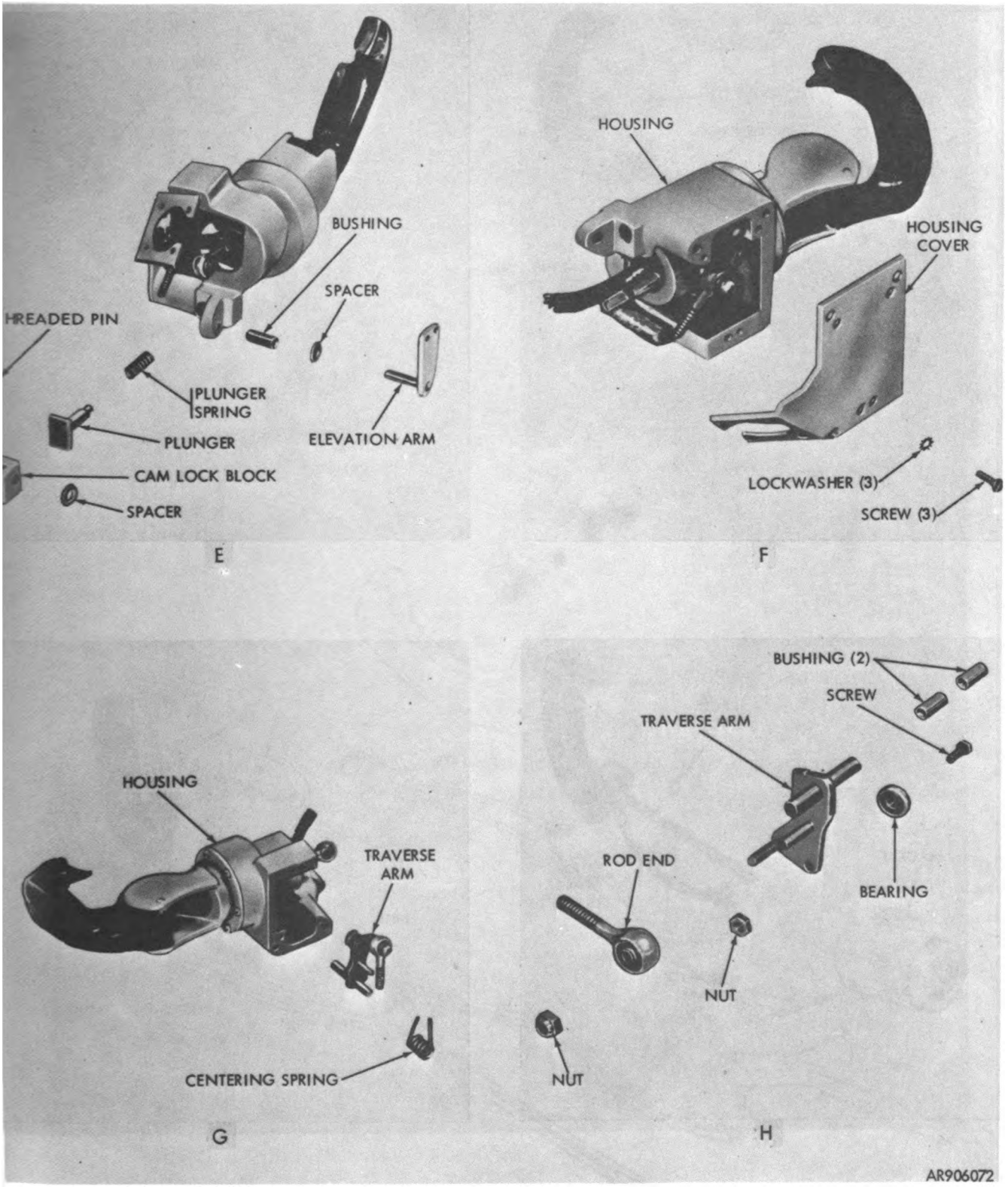



*Figure 3-11. Commander's control disassembly or assembly (2 of 4).*

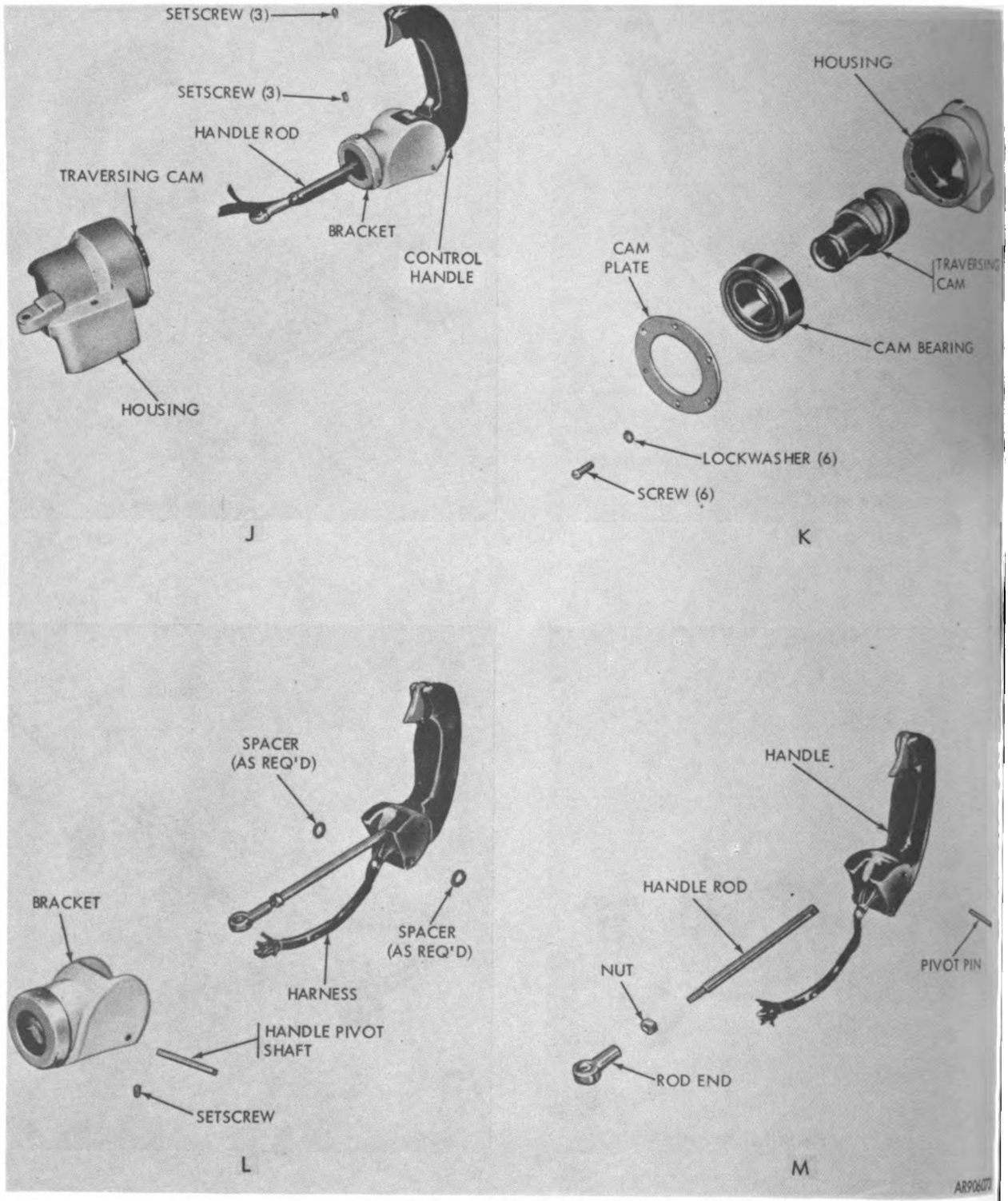
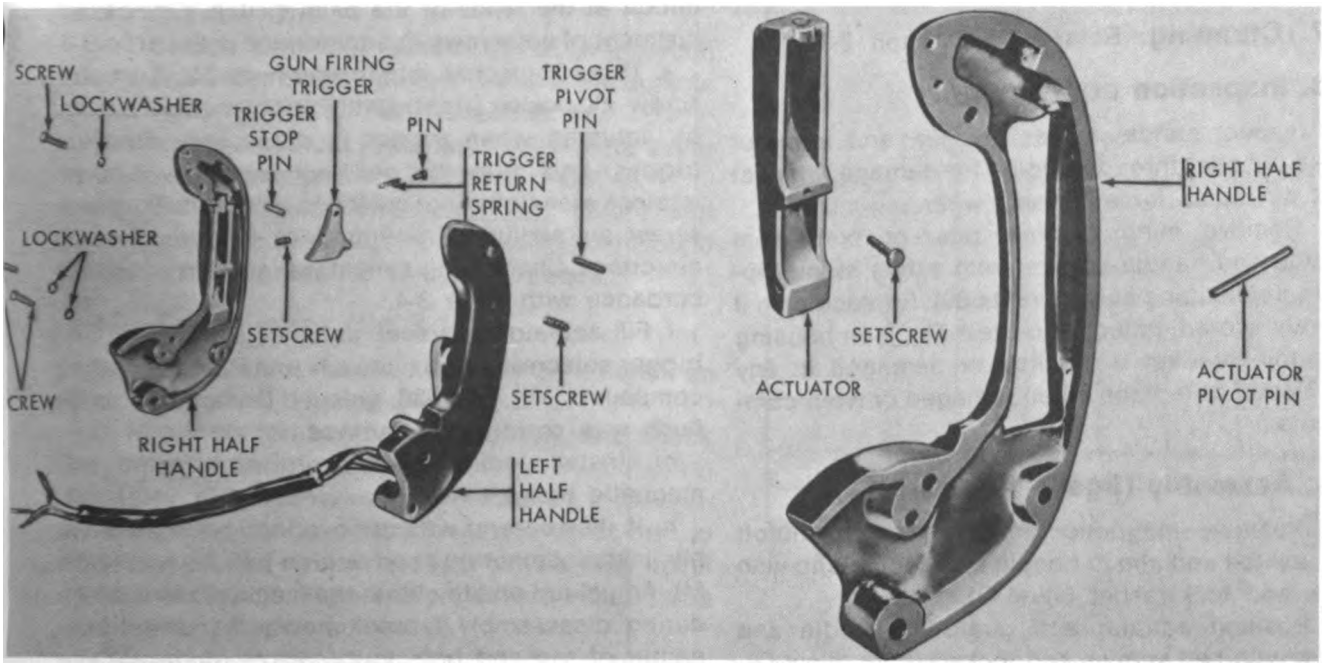
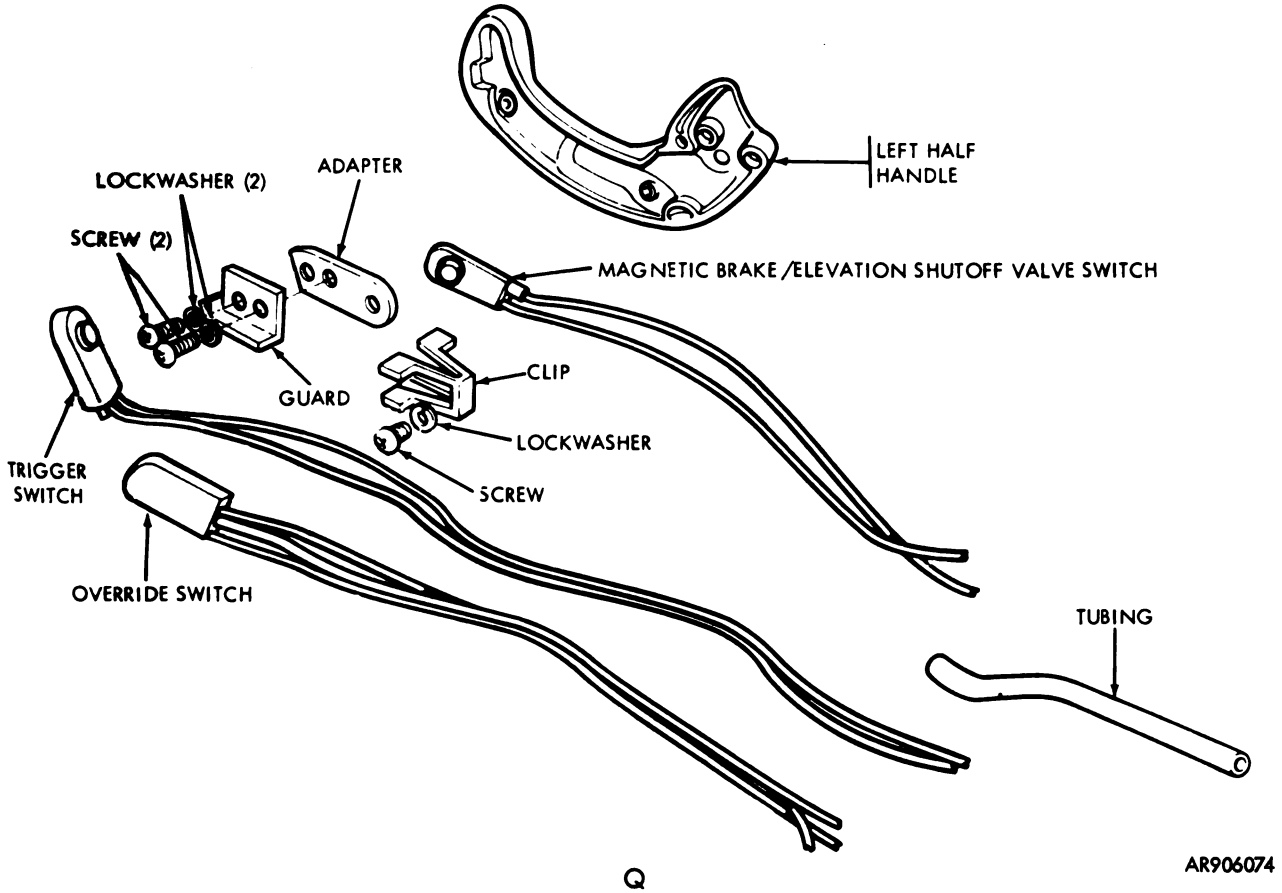



*Figure 3-11. Commander's control disassembly or assembly (3 of 4)*




Q

*Figure 3-11. Commander's control disassembly or assembly (4 of 4).*

**3-37. Cleaning.** Refer to paragraph 2-9.

**3-38. Inspection and Repair.**

*a.* Inspect handle halves, trigger, and actuator tracks. Inspect threaded holes for damage. Inspect pivot pin holes for excessive wear.

*b.* Remove minor scores, pits, or burs from traverse and handle bracket with a fine stone dipped in drycleaning solvent (PD-680). Replace cam if severely scored, pitted, or burred. Replace housing or handle bracket if cracked or damaged in any way. Repair or replace other damaged or worn components.

**3-39. Assembly (figs 3-10 and 3-11).**

*a.* Position magnetic brake/elevation shutoff valve switch and clip in handle and secure clip with screw and lockwasher (view Q).

*b.* Position adapter and guard in handle and secure with two screws and lockwashers (view Q).

*c.* Position trigger switch in handle (view Q).

*d.* Position override switch in clip (view Q).

NOTE

Apply a coating of grease (MIL-G-10924) to all rotating or sliding parts during assembly.

*e.* Install trigger stop pin and pivot pin into right half of handle (view N).

*f.* Insert trigger return spring and pin into trigger and position trigger on trigger pivot pin (view N).

*g.* Join handle halves and secure with three screws and lockwashers (view N).

*h.* Thread setscrew into actuator (view P).

*i.* Position actuator in handle and install pivot pin (view P).

*j.* With multimeter test leads on normally open leads of override switch, turn actuator adjuster setscrew clockwise until continuity is indicated. Place test leads on leads of palm switch. Multimeter should indicate open circuit. If not, turn actuator adjuster setscrew slowly clockwise until open circuit is indicated. Depress palm switch actuator. With test leads on normally open leads of override switch, turn actuator limit setscrew clockwise until multimeter indicates open circuit. With multimeter test leads on palm switch, multimeter should indicate continuity. If not, turn setscrew slowly clockwise until continuity is indicated. With palm switch actuator depressed, turn actuator limit setscrew counterclockwise until continuity is indicated at normally open leads of override switch, and open circuit at the leads of the palm switch. Check adjustment of setscrews in accordance with table 3-3.

*k.* Thread setscrew into trigger (view N). Turn setscrew clockwise (right) until trigger switch cannot be actuated when trigger is depressed. Depress trigger and turn trigger-limit setscrew counterclockwise (left) until switch is actuated. Turn setscrew an additional one-third of a turn in same direction. Check adjustment of setscrew in accordance with table 3-4.

*l.* Fill actuator pretravel, actuator overtravel, and trigger setscrew holes (views N and P) with sealing compound (MIL-S-11030, type 1). Compound to be flush with surrounding surface.

*m.* Install tubing over override, trigger, and magnetic brake switch leads (view Q).

*n.* If the rod end was removed during disassembly, install jamnut and rod end on handle rod (view M). Adjust rod end to obtain the measurement taken during disassembly (approximately 7 inches from center of rod end hole to center of rod pivot pin hole). Tighten jamnut.

*o.* Position handle rod in handle and install pivot pin (view M). Stake both ends of pin.

*p.* Position bracket on handle (view L). Install spacers between bracket and handle to obtain 0.003 to 0.008 inch end play between handle and bracket. Install handle pivot shaft and secure with setscrew.

*q.* Install traversing cam and cam bearing into housing (view K). Secure with cam plate, six screws, and six lockwashers.

*r.* Position handle and bracket on traversing cam and secure with three setscrews (one in each hole) (view J).

*s.* Assemble traverse arm as shown in view H. Apply sealing compound (MIL-S-22473, grade C) to rod end stud threads and bearing screw threads.

*t.* Install traverse arm and centering spring into housing using tool (16, table 2-1) (view G).

*u.* Position housing cover on housing and secure with three screws and lockwashers (view F).

*v.* Install plunger spring, cam follower plunger, cam lock block, spacers, and threaded pin (view E). Aline hole in cam lock block with hole in housing and install bushing, spacer, and elevation arm (view E).

*w.* Position cam lock block on elevation arm shaft to obtain a total end play of 0.005 to 0.010 inch between block and housing (view E). Install nut and lockwasher onto threaded pin (view D) to secure cam lock block on elevation arm shaft.

*x.* Secure rod end to elevation arm with screw and nut (view C).

*y.* Position electrical receptacle nut over switch leads (view B). Solder switch leads to receptacle pins (fig 3-12). Install nut on receptacle.

*z.* Secure electrical receptacle to housing cover with four screws and lockwashers (view A).

*aa.* Install rod end and spacer and secure with screw and nut (view A). Apply sealing compound (MIL-S-22473, grade C) to screw threads.

## 3-40. Adjustment (fig 3-11).

*a.* Place control handle assembly on a bench so that it rests on housing cover.

*b.* Move control handle left and right, and check for equal travel in both directions from neutral position. If travel is not equal, loosen three setscrews securing control handle bracket to traversing cam (view J) and turn control until travel is equal. Tighten three setscrews and install three additional setscrews (view J).

*c.* Push control handle forward, in depression, until it touches stop.

*d.* Pull control handle rearward, in elevation, until it touches stop.

*e.* If movement of control handle in depression and elevation is not equal, remove screw and nut securing rod end to elevation arm (view C), and adjust rod end until movement is equal in both elevation and depression. Secure rod end to handle elevation arm with screw and nut. Apply thread sealing compound (MIL-S-22473, grade C) to screw threads. Tighten rod and jamnut.

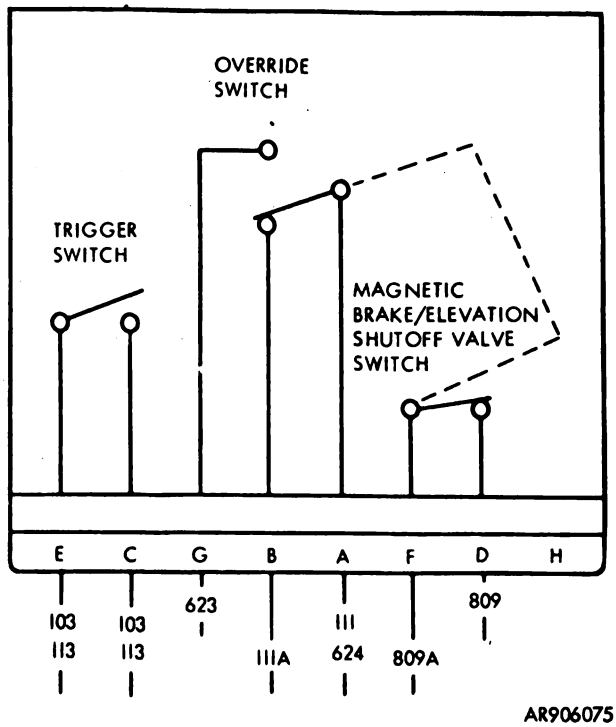



*Figure 3-12. Commander's control wiring diagram.*

*Table 3-3. Commander's Palm Switch Adjustment Checks*

| Multimeter test leads connected to | Palm switch depressed | Palm switch released |
|---|---|---|
| Normally open-override | Continuity | Open circuit |
| Normally closed-override | Open circuit | Continuity |
| Palm switch | Open circuit | Continuity |

*Table 3-4. Commander's Trigger Switch*

| Multimeter test leads connected to | Trigger switch depressed | Trigger switch released |
|---|---|---|
| Normally open-trigger | Continuity | Open Circuit |

## 3-41. Tests.

*a.* Handle movement must produce a movement of the elevation arm and traverse rod end of not less than 1.0 inch.

*b.* Switches must operate in accordance with tables 3-3 and 3-4.

**3-42. Installation.** Refer to TM 9-2350-258-34-2.

## Section VIII. REPAIR OF MANUAL ELEVATION PUMP AND CABLE HOUSING.

**3-43. Description (fig 3-13).** The manual elevation pump is mounted on the front of the hydraulic riser and is used to manually elevate or depress the gun and to charge the manual elevation circuit. The pump contains eight sliding pistons. By rotating the pump shaft counterclockwise (left), fluid flow is generated in the manual elevation hydraulic system and this depresses the gun. By rotating the pump shaft clockwise (right), fluid flow is reversed and the gun elevates. As the pump shaft is turned, an eccentric pump shaft is rotated, which rotates a slide. As the slide rotates, it contacts eight spring-loaded pistons in sequence and fluid flow is directed throughout the manual elevation hydraulic system. When direction of pump shaft rotation is reversed, the slide rotates in the opposite direction and the direction of fluid flow is reversed. The rate of manual elevation or depression is controlled by the speed of rotation.

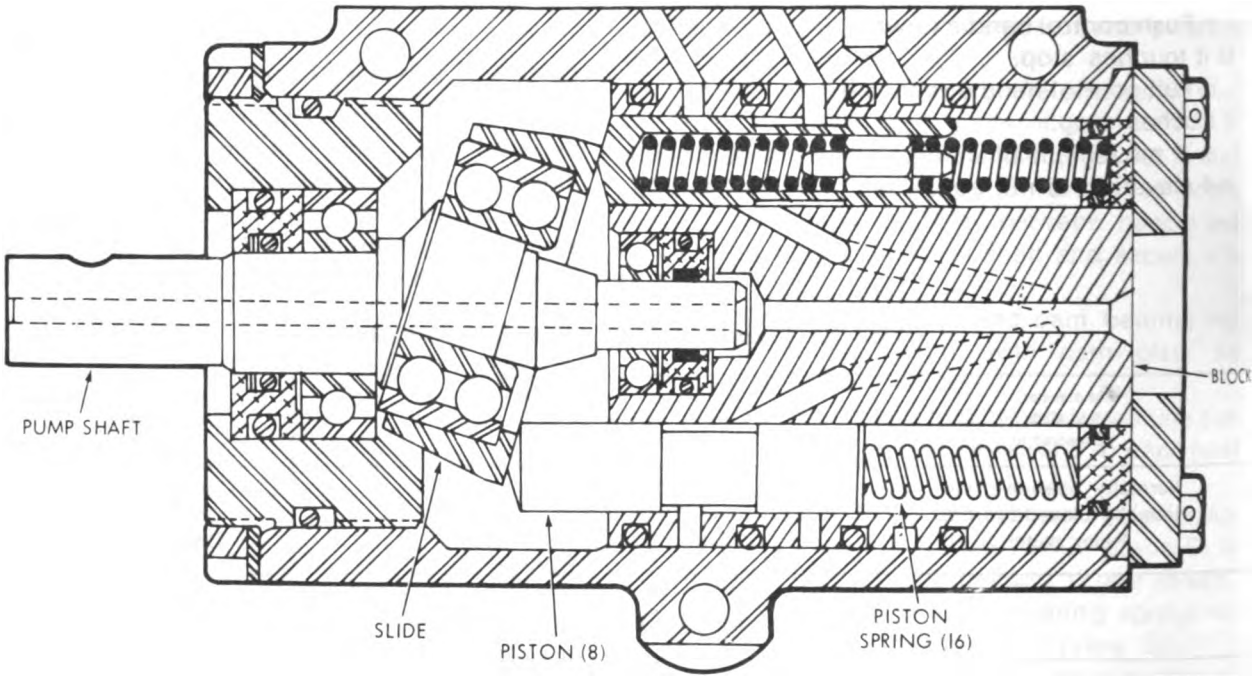



*Figure 3-13. Manual elevation pump — sectional view.*

**3-44. Removal.** Refer to paragraph 2-26.

**3-45. Disassembly (fig 3-14).**

NOTE

Prior to disassembly, tests must be conducted to verify that a malfunction does exist. If the unit fails to pass all tests, perform the following repair procedures. If the unit passes all tests, repair is not required.

*a.* Remove three screws securing cable housing to pump body and remove housing (view A).

*b.* Unscrew nut from cable housing (view B).

*c.* Remove four screws securing switch and gasket to cable housing and disconnect two electrical leads from switch (view C).

*d.* Remove cable from housing and remove nut and grommet from cable (view D).

*e.* Remove screw securing arm assembly to pump shaft and remove arm assembly and actuating pin (view E).

**WARNING**

**Insure retainer does not move when locknut is removed.**

*f.* Remove locknut and washer from pump body (view F).

*g.* Back off retainer until oil seal is just visible using spanner wrench (item 12, table 2-1) to partially relieve spring pressure on plate (views F and G).

**WARNING**

**Components under spring pressure are released when plate is removed.**

*h.* Remove four screws and lockwashers, in opposition, securing plate to housing and remove plate (view H). Cross tighten screws to 5 — 7 lb-ft (7-9 N.m) during assembly.

*i.* Remove eight retainers, packing, eight pistons, 16 springs, and eight guides from block (view J). Retain pistons, as they are matched to the block. Discard retainers, packing, springs and guides.

*j.* Remove retainer from pump housing (view G).

*k.* Remove block from housing (view K).

*l.* Remove four packings from block (view L). Discard packing.

*m.* Remove retainer from shaft (view M).

*n.* Remove packing from retainer (view N). Discard packing.

*o.* Remove bushing from shaft (view P).

*p.* Remove two packings and retainer from bushing (view Q). Discard packing and ring.

*q.* Remove bearing (press fit) from shaft (view R).

*r.* Remove spacer from shaft (view S).

*s.* Remove two packings and ring from spacer (view T). Discard packing and ring.

*t.* Remove bearing (press fit) from shaft (view U).

*u.* Remove slide from shaft (view V).

*v.* Remove bearing from shaft (view W).

*w.* Remove plug and packing from housing (view X). Discard packing.

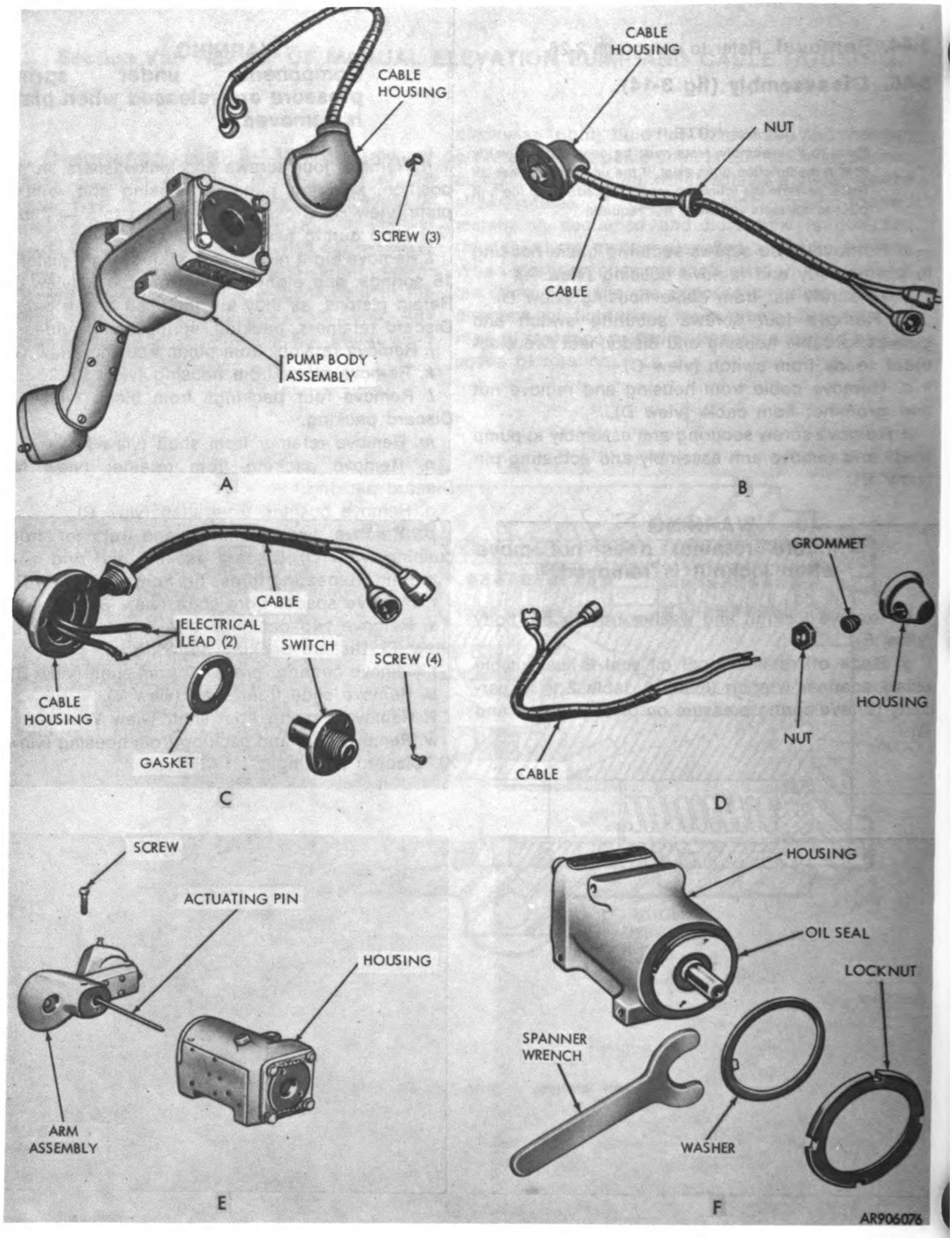



*Figure 3-14. Manual elevation pump disassembly or assembly (1 of 4).*

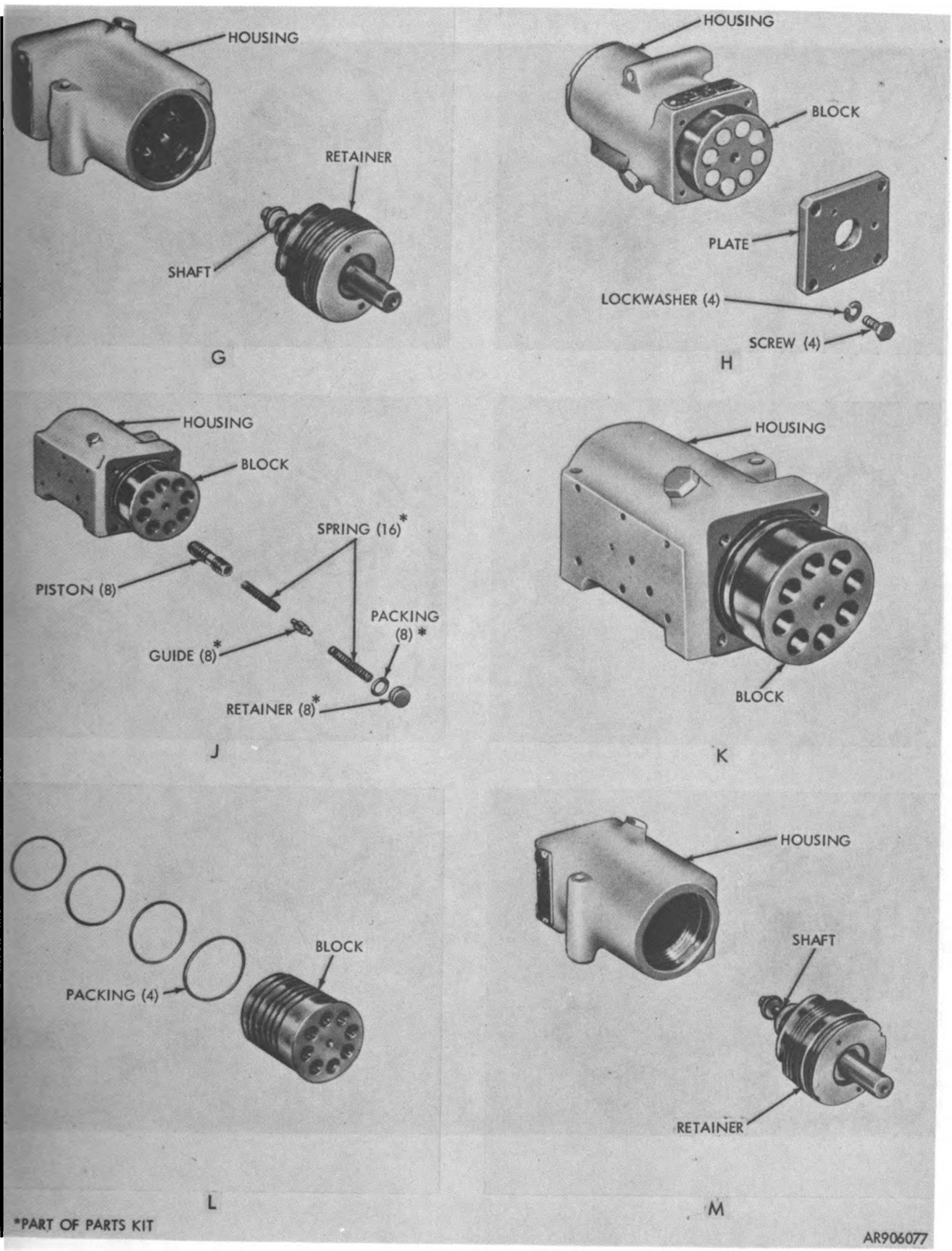



*Figure 3-14. Manual elevation pump disassembly or assembly (2 of 4).*

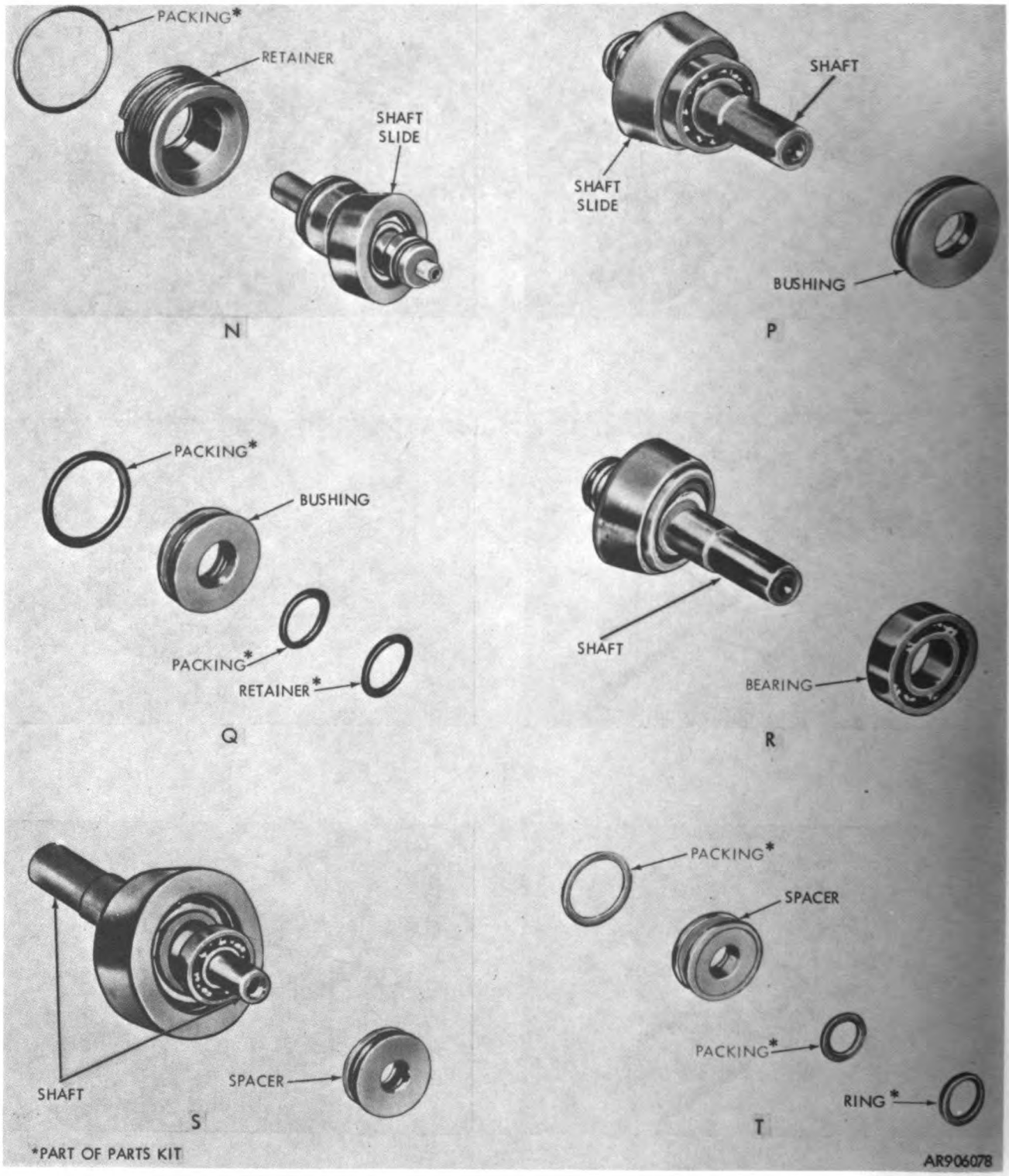



Figure 3-14. Manual elevation pump disassembly or assembly (3 of 4)

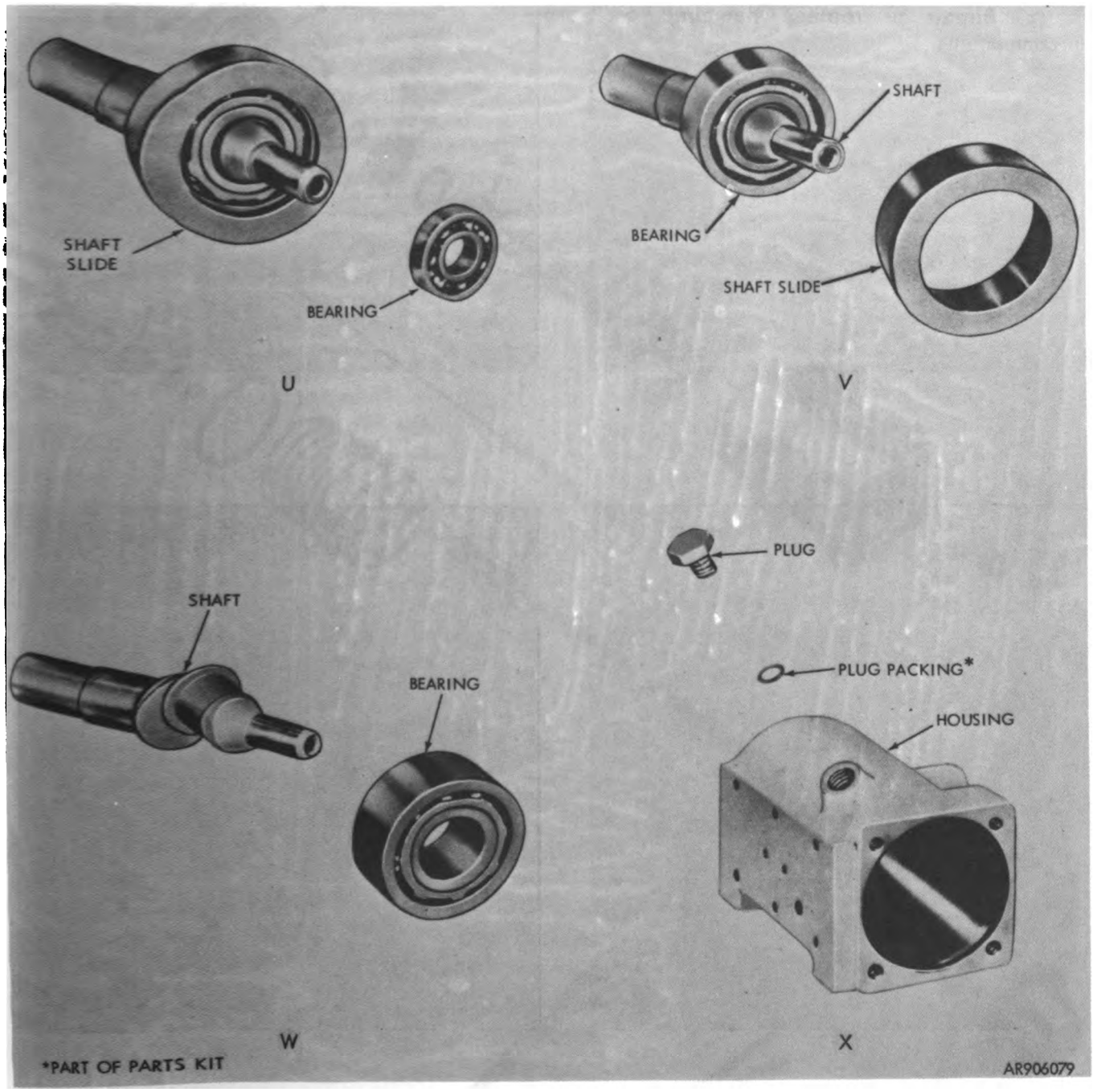



*Figure 3-14. Manual elevation pump disassembly or assembly (4 of 4).*

**3-46. Cleaning.** Refer to paragraph 2-9.

**3-47. Inspection and Repair.**

*a.* Inspect components for wear or damage as specified in table 3-5 and figure 3-15.

*b.* Repair or replace damaged or worn components.

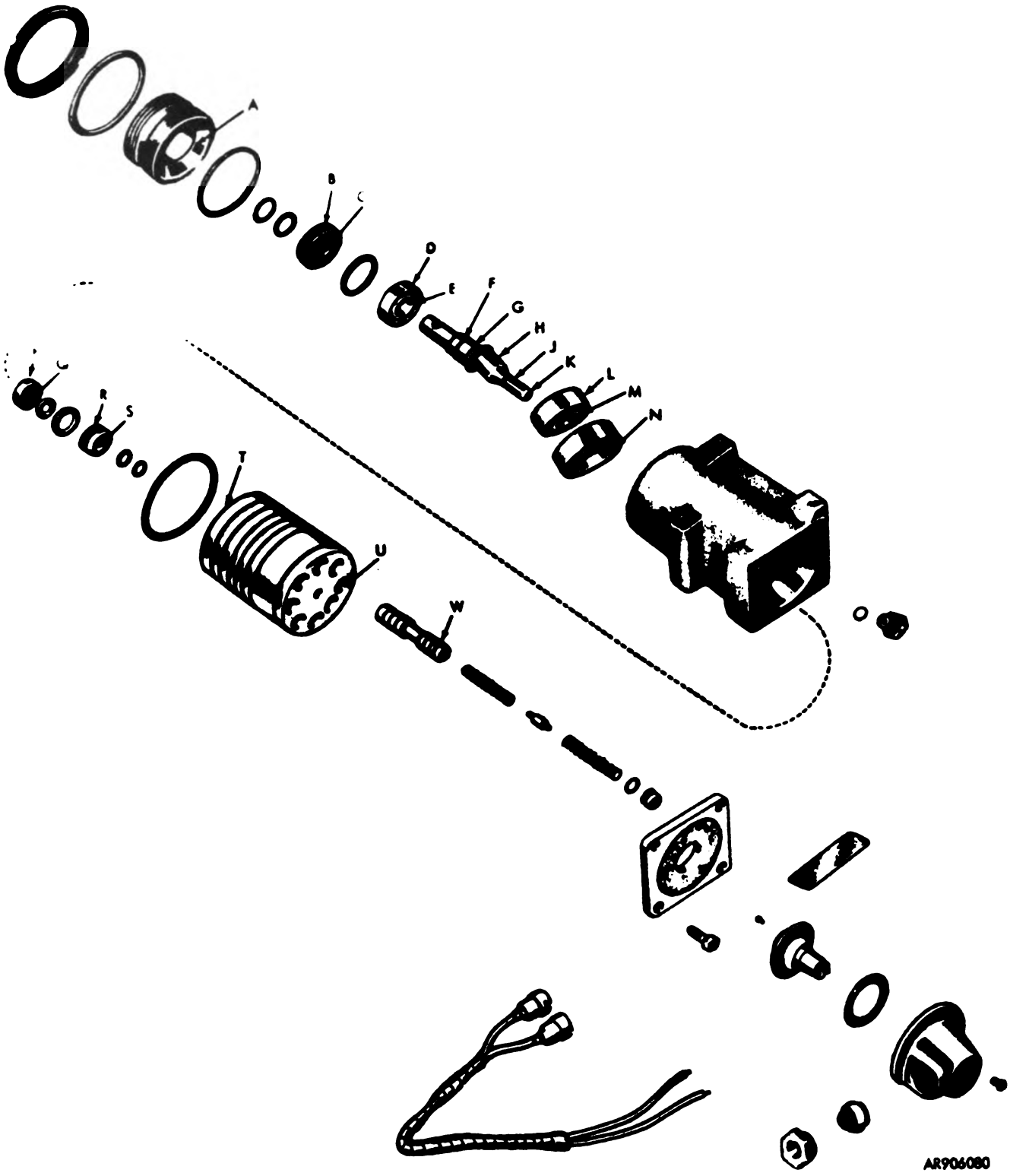



*Figure 3-15. Manual elevation pump wear and test points.*

*Table 3-5. Manual Elevation Pump Wear Limits*

| Figure | Reference | Measurement | Wear Limit (in.) |
|---|---|---|---|
| 3-15 | A | ID of bearing retainer | 1.3790 max |
| 3-15 | B | OD of shaft bushing | 1.3750 min |
| 3-15 | C | ID of shaft bushing | 0.6290 max |
| 3-15 | D | OD of bearing | 1.3775 min |
| 3-15 | E | ID of bearing | 0.6693 max |
| 3-15 | F | OD of shaft bearing shoulder | 0.6695 min |
| 3-15 | G | OD of shaft bushing shoulder | 0.0230 min |
| 3-15 | H | OD of shaft shoulder | 0.6692 min |
| 3-15 | J | OD of handle shaft bearing shoulder | 0.3749 min |
| 3-15 | K | OD of handle shaft spacer shoulder | 0.3100 min |
| 3-15 | L | OD of bearing | 1.5743 min |
| 3-15 | M | ID of bearing | 0.6693 max |
| 3-15 | N | ID of shaft slide | 1.5753 max |
| 3-15 | P | OD of bearing | 0.8745 min |
| 3-15 | Q | ID of bearing | 0.3750 max |
| 3-15 | R | OD of spacer | 0.8700 min |
| 3-15 | S | ID of spacer | 0.3800 max |
| 3-15 | T | ID of block center bore | 0.8753 max |
| 3-15 | R — T | Fit of spacer in block | 0.00532 max |
| 3-15 | U | ID of block piston bore | 0.5010 max |
| 3-15 | W | OD of piston | 0.3150 min |

## 3-48. Assembly (fig 3-14).

*a.* Obtain manual elevation pump parts kit (TM 9-2350-258-34P-2). Use all parts during assembly.

***b.* Use new packings, seals, O-rings, gaskets, and any other component performing a sealing function. Coat all internal components, cylinder bores, and sleeves and spools with hydraulic fluid (MIL-H-46170(FRH)) in assembly.**

*c.* Assemble in reverse order of disassembly observing any torque values or other criteria specified during disassembly (para 3-45). Cross tighten screws where applicable.

*d.* Press fit bearing onto shaft (view W) until bearing is no more than 0.250 inch from shoulder of shaft.

*e.* Install retainer and shaft (view M) into housing and tighten until retainer lip is within 5/16 inch from housing face.

## 3-49. Tests.

**NOTE**

Tests must be conducted after the completion of all repair procedures to verify that any malfunction has been repaired.

***a. General.*** **The following tests shall be accomplished using hydraulic fluid (MIL-H-46170(FRH)). All tests shall be conducted at a temperature between 70 and 110 degrees Fahrenheit.**

**WARNING**

**Defective or improperly installed components may cause pump to burst during tests.**

*b. Leakage (fig 3-16).*

(1) Install fabricated test manifold (5, table 2-1) on manual elevation pump body (view A).

(2) Connect M3 hydraulic pump to inlet port of hand elevation pump as shown (view B).

**CAUTION**
**Prevent handle from turning when pressure is applied.**

(3) Subject hand elevation pump to an internal pressure of not less than 1,000 psi for one minute. No external leakage is allowed.

(4) Remove plug and packing from housing. Apply hydraulic pressure of 78 psi to plug port. There shall be no leakage.

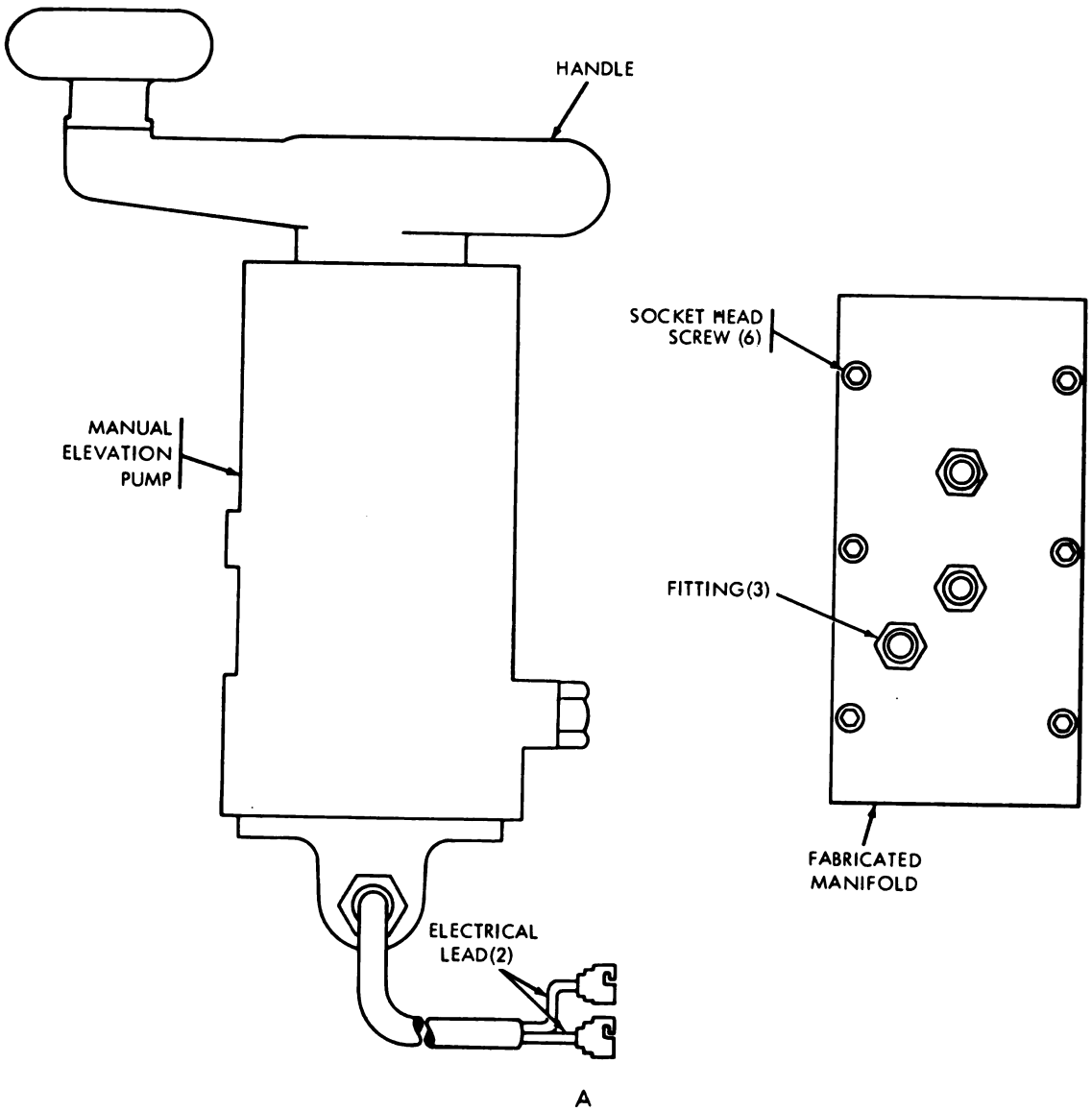
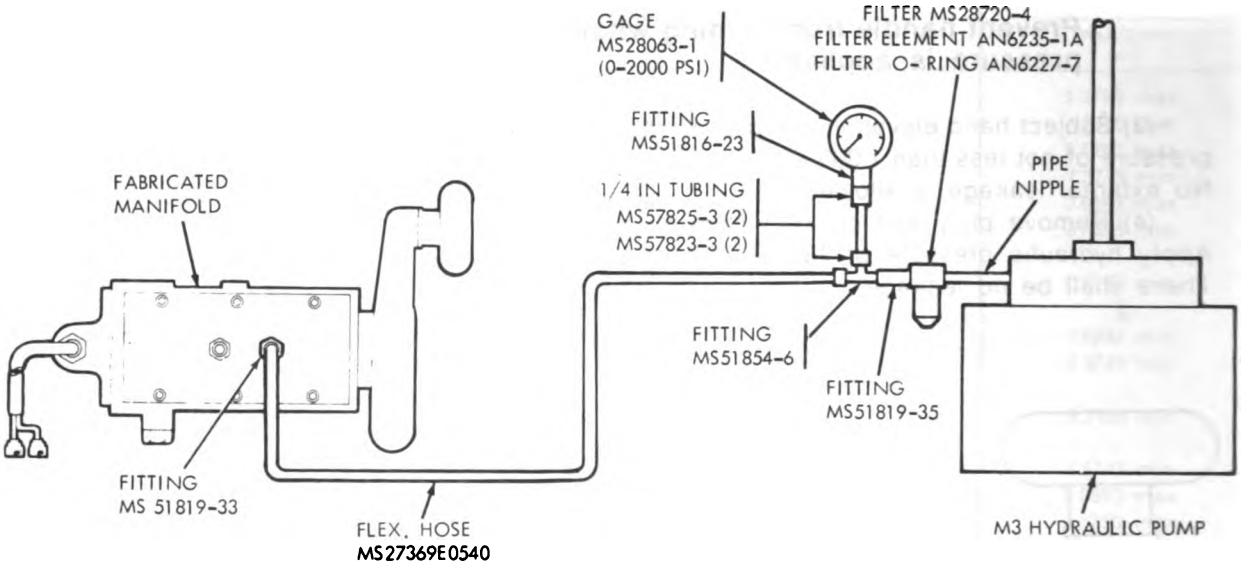
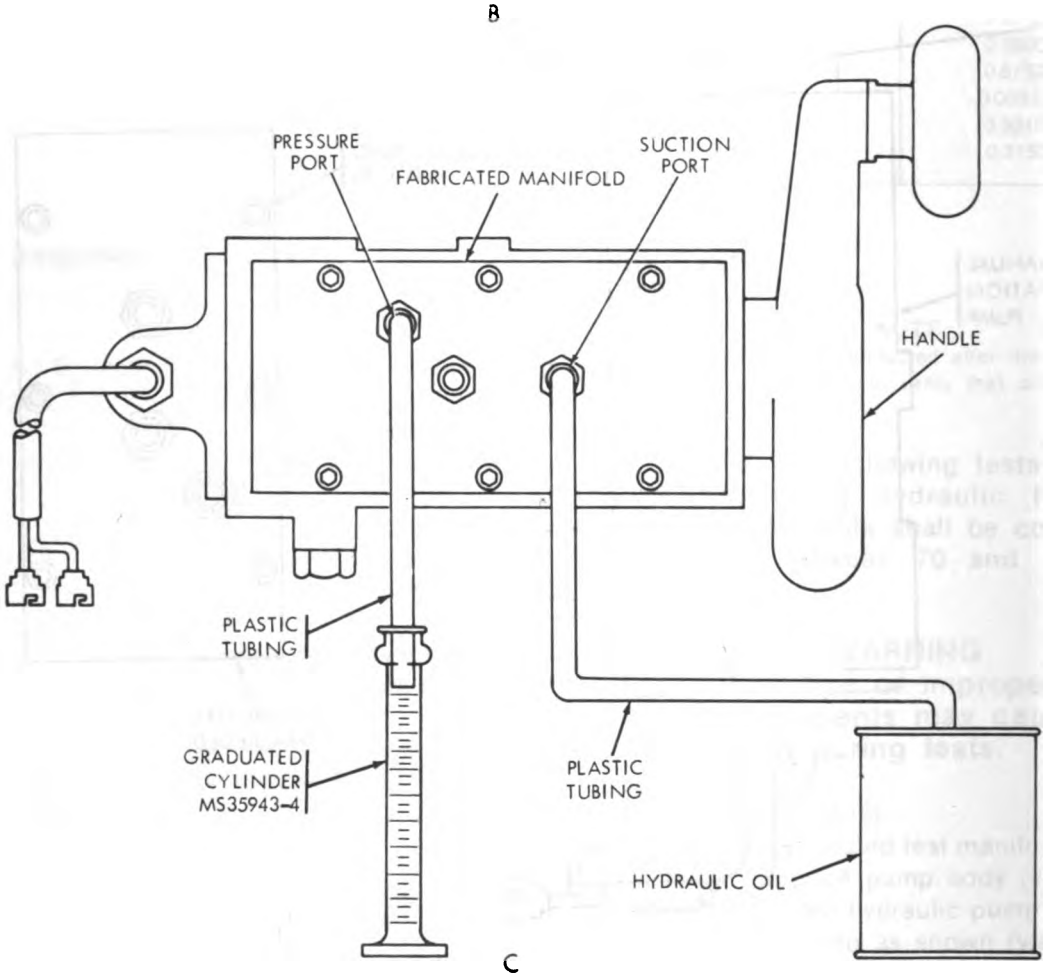



*Figure 3-16. Manual elevation pump body test setup (1 of 2).*




B




C

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*Figure 3-16. Manual elevation pump body test setup (2 of 2).*

*c. Handle Torque.*

(1) Rotate handle in a clockwise direction at a speed of 1 rpm.

(2) Rotate handle counterclockwise at a speed of 1 rpm. The handle shall move with a smooth uniform motion.

(3) Use spring scale to check force required to rotate handle. Force should not exceed 10 pounds.

*d. Volume Test (fig 3-16).*

**NOTE**

When handle is rotated clockwise, the port closest to the handle is the pressure (output) port.

(1) Connect the suction (input) port to suitable container of hydraulic fluid (view C).

(2) Rotate the handle until hydraulic fluid comes out of the pressure (output) port. Prime pump if necessary.

(3) Measure the amount of hydraulic fluid pumped for one handle revolution.

(4) The quantity should be between 9.0 ml and 13.0 ml.

(5) Repeat test turning the handle in the opposite direction (after changing the hydraulic lines to the new suction and pressure ports).

(6) Fluid output should be approximately equal in both pumping directions ( 2 ml).

*e. Electrical Test.* Trigger switch must operate in accordance with table 3-6.

**3-50. Installation.** Refer to paragraph 2-26.

*Table 3-6. Manual Elevation Pump Trigger Switch*

| Multimeter tests leads connected to | Trigger switch depressed | Trigger switch released |
|---|---|---|
| Normally open trigger | Continuity | Open circuit |

## Section IX. REPAIR OF MANUAL ELEVATION PUMP ARM

**3-51. Description.** The manual elevation pump arm is attached to the manual elevation pump shaft. Counterclockwise rotation of the arm depresses the gun. Clockwise rotation of the arm elevates the gun. The arm knob contains a gun firing trigger switch for use by the gunner.

**3-52. Removal (fig 3-17).** Remove screw securing arm to pump shaft and remove arm and actuating pin (view A).

**3-53. Disassembly (fig 3-17).**

*a.* Remove actuating pin from arm (view B).

*b.* Remove five screws securing cover to arm and remove cover (view B).

*c.* Depress tension spring and remove pivot pin (press fit) from arm (view C).

*d.* Remove tension spring from arm (view D).

*e.* Disengage upper end of operating arm from actuating rod and remove operating arm from pump arm (view D).

*f.* Remove two screws securing knob cap to knob base and remove knob cap (view E).

*g.* Remove pivot pin securing yoke to knob cap and remove yoke (view F).

*h.* Remove retaining ring securing gun firing push pin in knob cap and remove pin (view F).

*i.* Remove actuating rod from arm (view G).

*j.* Remove retaining ring and washer securing knob base to arm and remove knob base from arm (view H).

*k.* Remove bushings (press fit) from knob base if replacement is required (view I).

*l.* Remove sleeve clamp and bushing clamp from arm (view J).

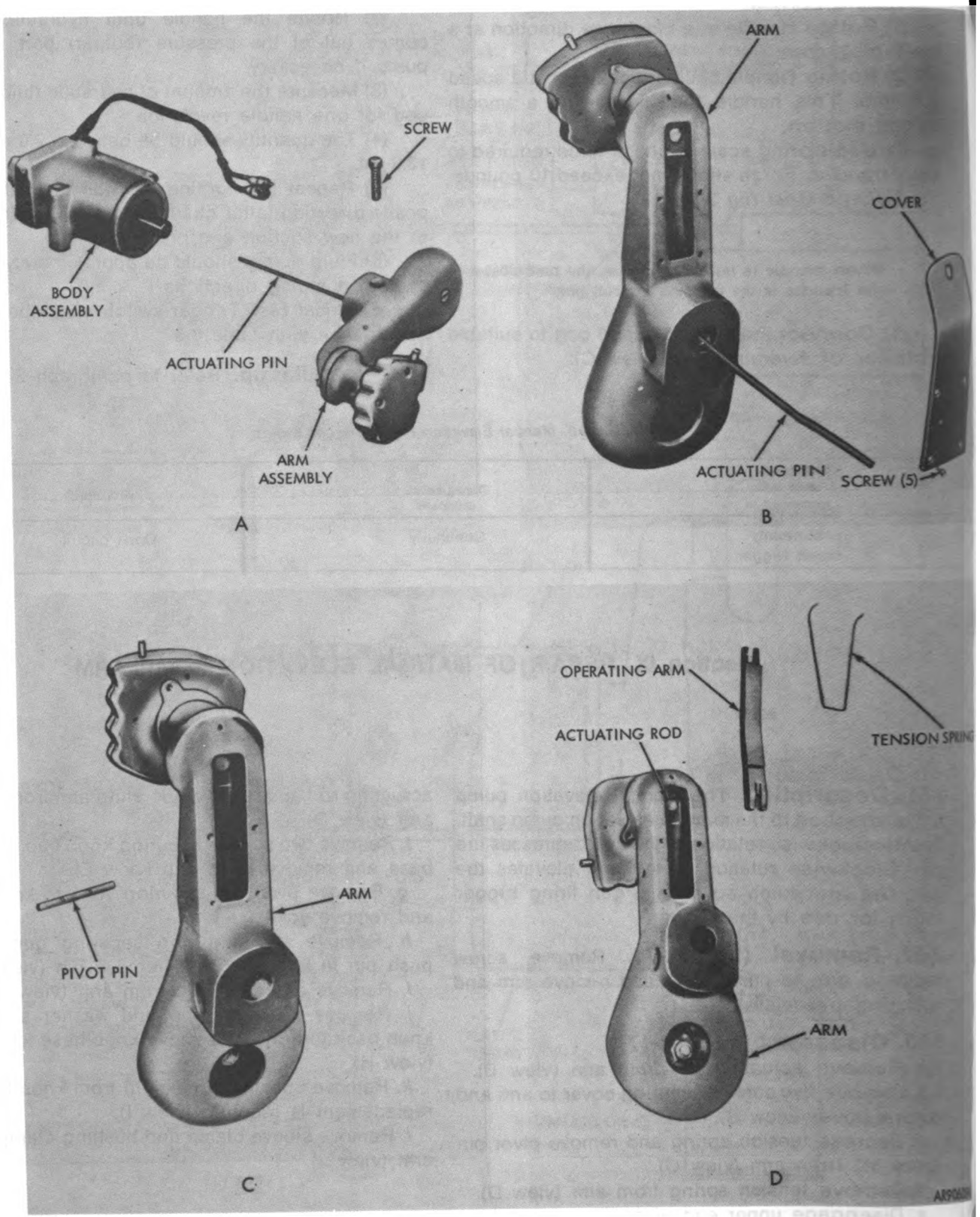



*Figure 3-17. Manual elevation pump arm removal, disassembly, or assembly (1 of 3).*

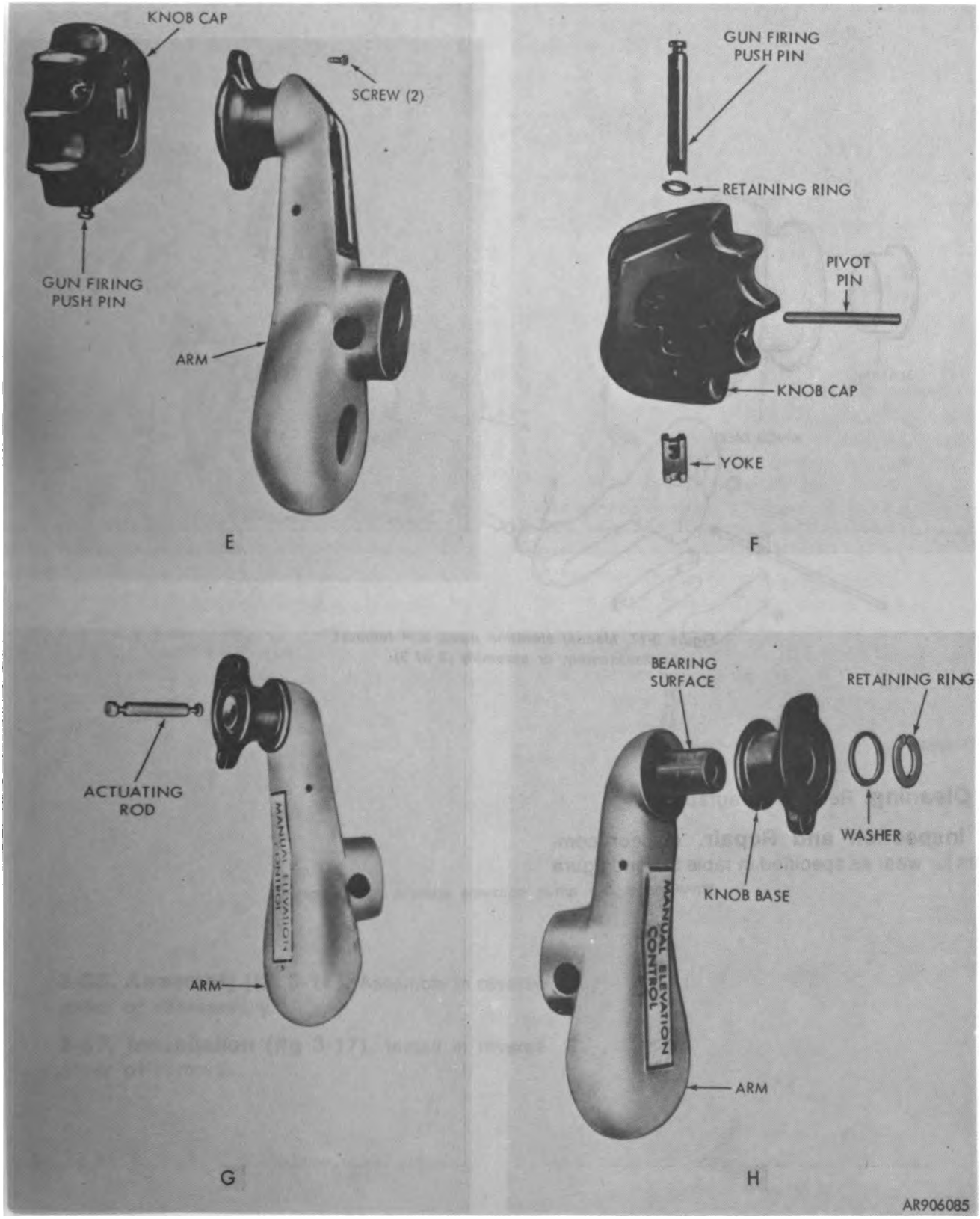
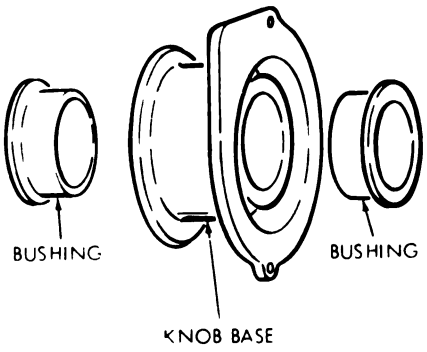



*Figure 3-17. Manual elevation pump arm removal, disassembly, or assembly (2 of 3).*



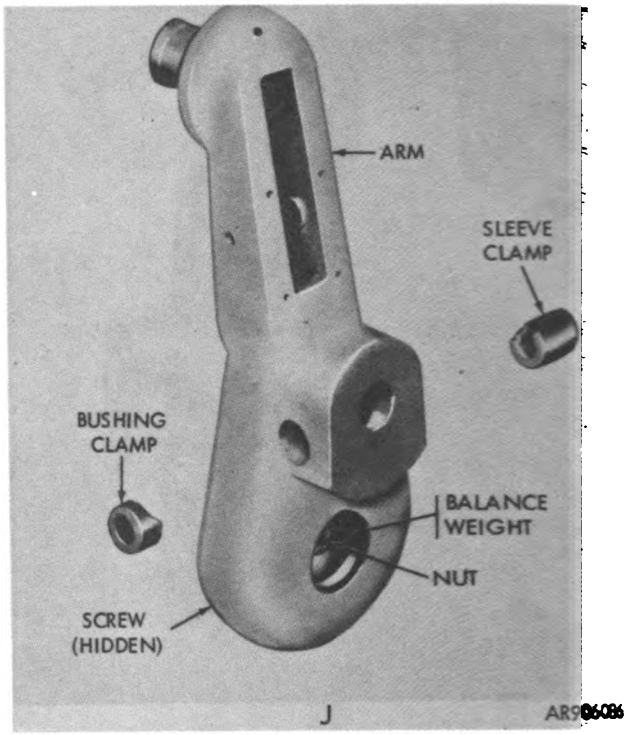




*Figure 3-17. Manual elevation pump arm removal, disassembly, or assembly (3 of 3).*

**3-54. Cleaning.** Refer to paragraph 2-9.

**3-55. Inspection and Repair.** Inspect components for wear as specified in table 3-7 and figure 3-18.

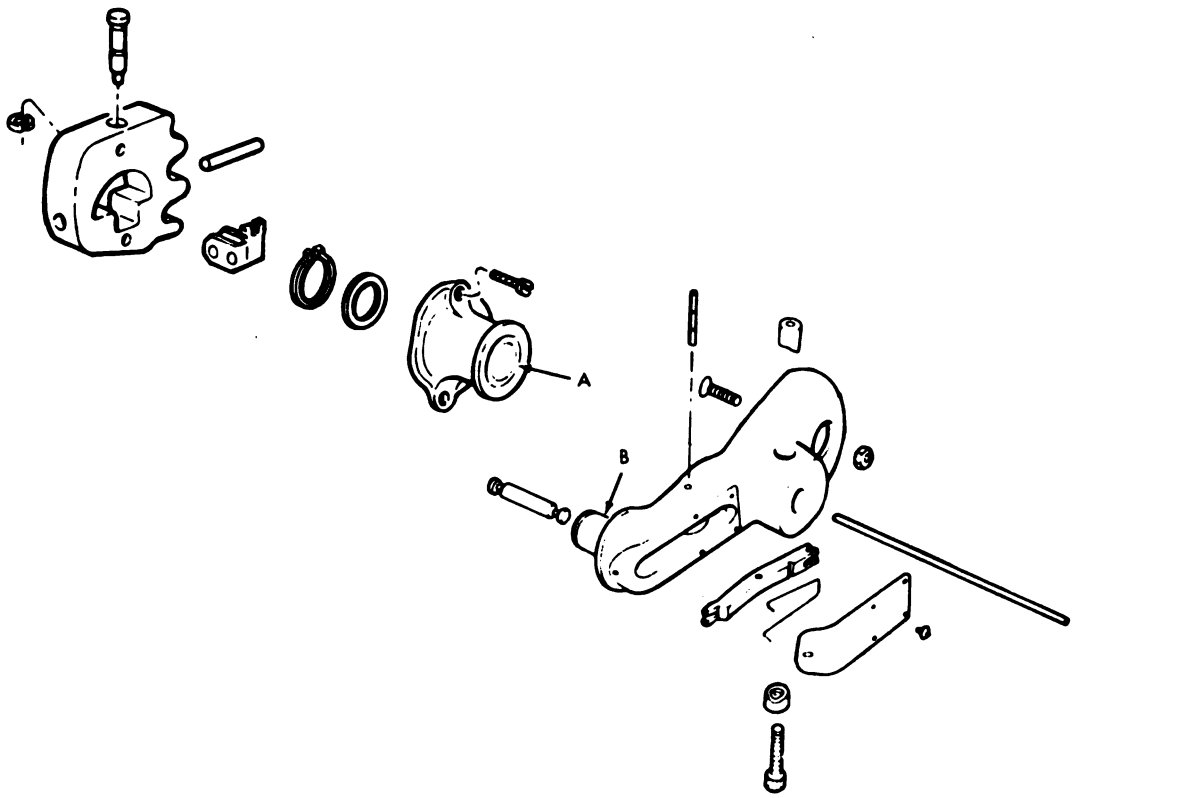



*Figure 3-18. Manual elevation pump arm wear points.*

**3-56. Assembly (fig 3-17).** Assemble in reverse order of disassembly.

**3-57. Installation (fig 3-17).** Install in reverse order of removal.

*Table 3-7. Manual Elevation Pump Arm Wear Limits*

| Figure | Reference | Measurement | Wear Limit (in.) |
|---|---|---|---|
| 3-18 | A | ID of knob support bore | 0.822 max |
| 3-18 | B | OD of arm projection | 0.809 min |
| 3-18 | A—B | Fit of support on arm | 0.018L max |

## Section X. REPAIR OF MANUAL ELEVATION PUMP SHUTTLE VALVE

**3-58. Description (fig 3-19).** The manual elevation pump shuttle valve is part of the manual elevation pump and is used to reduce pump handle rotation effort by porting low pressure hydraulic fluid into the manual elevation pump case. The pump case is pressurized to keep the handle rotational effort at a minimum. Since the low-pressure fluid changes to the opposite side of the pump when handle rotation is reversed, the shuttle valve is moved to the opposite side by the high pressure fluid of the manual circuit, thus maintaining low pressure fluid in the pump casing. The spool within the valve moves each time the direction of pump handle rotation is changed.

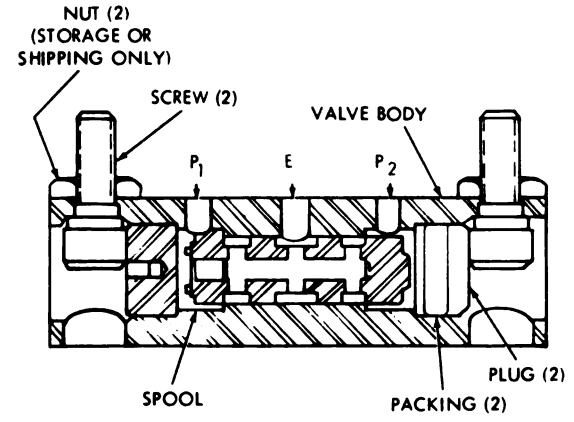



*Figure 3-19. Manual elevation pump shuttle valve — sectional view.*

**3-59. Removal.** Refer to paragraph 2-27.

**3-60. Disassembly (fig 3-20).**

**NOTE**

Prior to disassembly, tests must be conducted to verify that a malfunction does exist. If the unit fails to pass all tests, perform the following repair procedures. If the unit passes all tests, repair is not required.

*a.* Thread a 4-40 screw into each plug and pull plugs from valve (view A). Remove screw(s) from plug(s).

*b.* Remove packings from plugs (view A).

*c.* Using a wooden dowel, push spool from valve (view B).

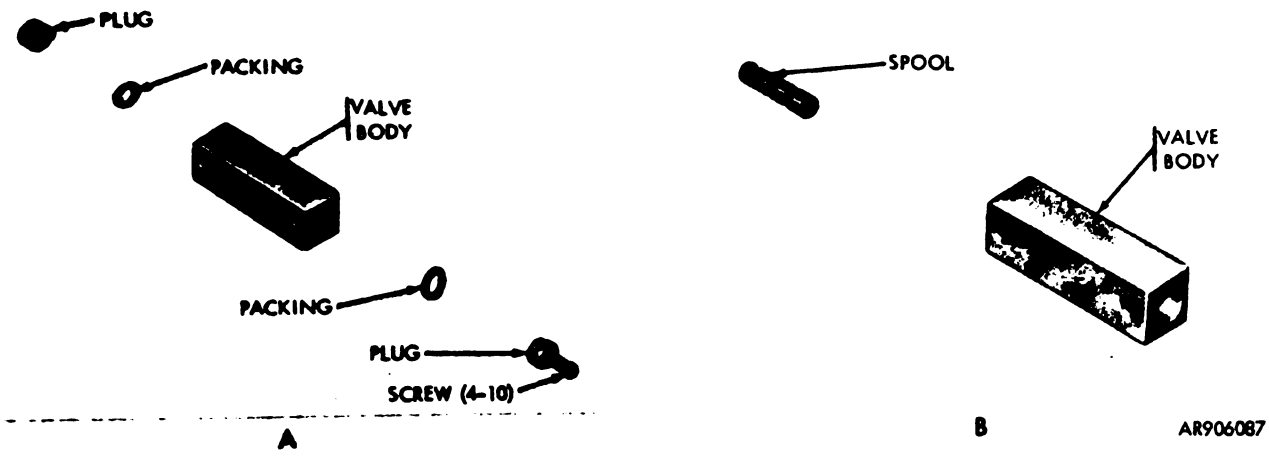



*Figure 3-20. Manual elevation pump shuttle valve disassembly or assembly.*

**3-61. Cleaning.** Refer to paragraph 2-9.

**3-62. Inspection and Repair (fig 3-21).** Inspect components for wear as specified in table 3-8 and figure 3-21. Repair or replace defective components.

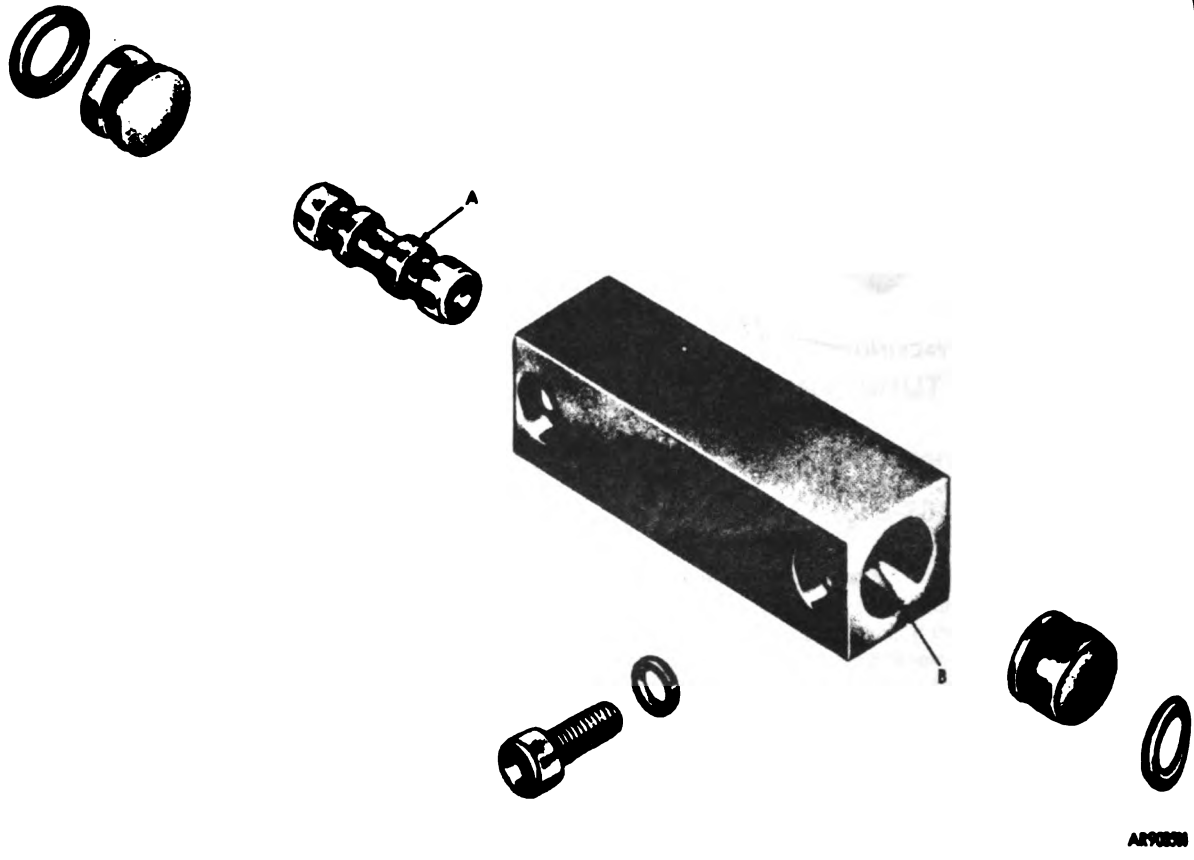



*Figure 3-21. Manual elevation pump shuttle valve wear points.*

## 3-63. Assembly (fig 3-20).

*a.* Use new packings, seals, O-rings, gaskets, and any other component performing a sealing function. Coat all internal components, cylinder bores, and sleeves and spools with hydraulic fluid (MIL-H-46170(FRH)) in assembly.

*b.* Assemble in reverse order of disassembly (para 3-60).

*Table 3-8. Manual Elevation Pump Shuttle Valve Wear Limits*

| Figure | Reference | Measurement | Wear Limit in |
|---|---|---|---|
| 3-21 | A | OD of spool assembly | 0.3135 min |
| 3-21 | B | ID of body | 0.3130 max |

## 3-64. Tests (fig 3-22).

**WARNING**
**Defective or improperly installed components may cause valve to burst during tests.**

**NOTE**
Tests must be conducted after the completion of all repair procedures to determine that any malfunction has been repaired.

*a.* Attach shuttle valve to manifold (6, table 2-1), as shown in figure 3-22.

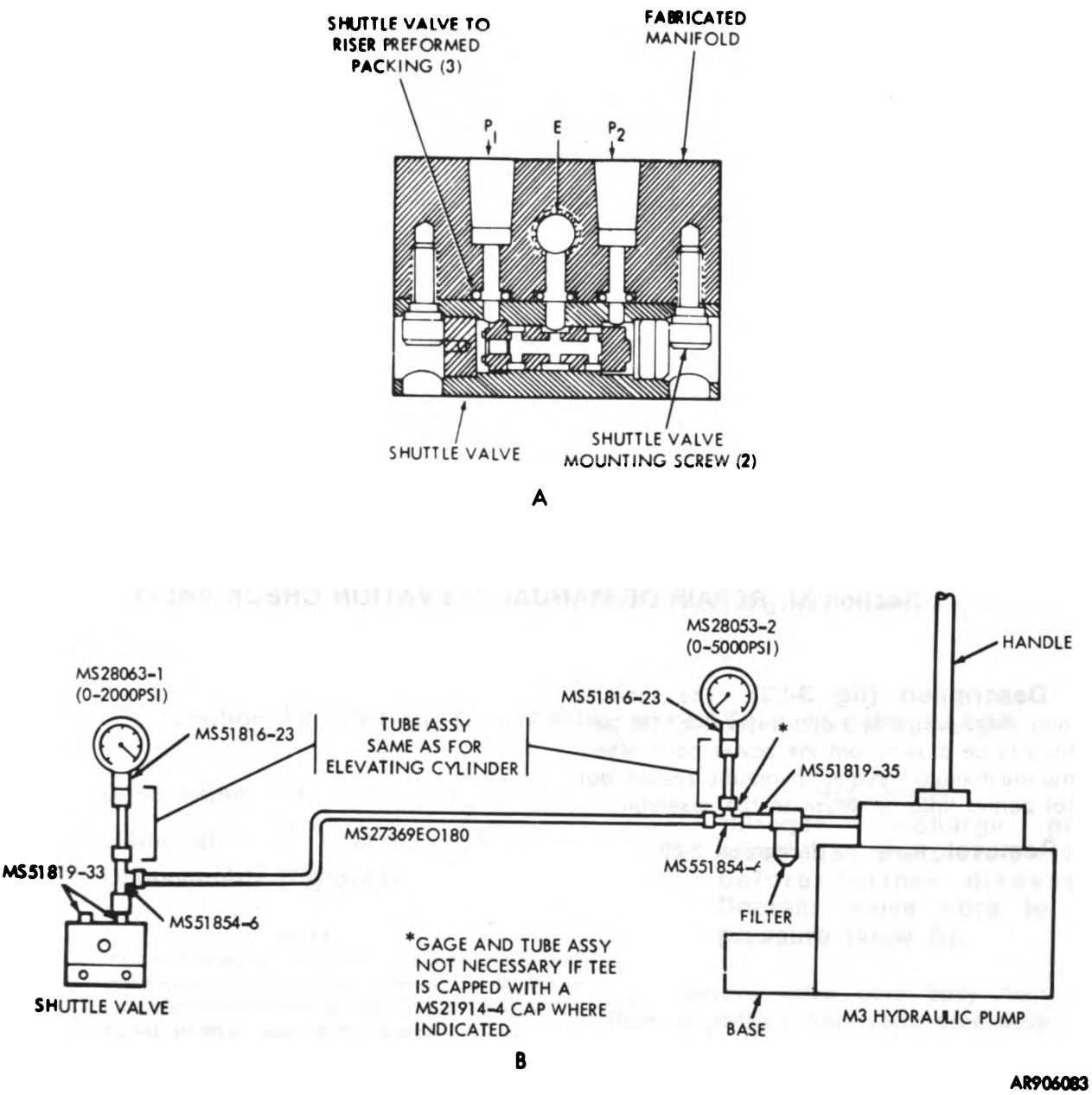



*Figure 3-22. Manual elevation shuttle valve test setup.*

**CAUTION**
**Insure M3 hydraulic pump and fluid are clean and free of contamination.**

*b.* Using the test hookup figure 3-22, perform tests specified in table 3-9.

*c.* If valve is not installed after tests, remove test fixture and install two nuts on mounting screws (fig 3-19).

**3-65. Installation.** Refer to paragraph 2-27.

*Table 3-9. Manual Elevation Shuttle Valve Pressure Test*

| | Pressure | | Leakage or flow per port | | |
|---|---|---|---|---|---|
| Test No | PSI | Apply at* | Maximum (ml/min) | Check at | Remarks |
| 1 | 925±25 | P1 | 0.3 | P2 | Valve to be full of hydraulic fluid. No external leakage permitted. Check leakage after one minute. |
| 2 | 925±25 | P2 | 0.3 | P1 | Valve to be full of hydraulic fluid. No external leakage permitted. Check leakage after one minute. |

## Section XI. REPAIR OF MANUAL ELEVATION CHECK VALVE

**3-66. Description (fig 3-23).** The manual elevation check valve is a one-way valve that permits fluid to be drawn from the power pack reservoir into the manual elevation hydraulic system, but will not permit fluid to return to the reservoir.

**3-67. Removal.** Refer to paragraph 2-29.

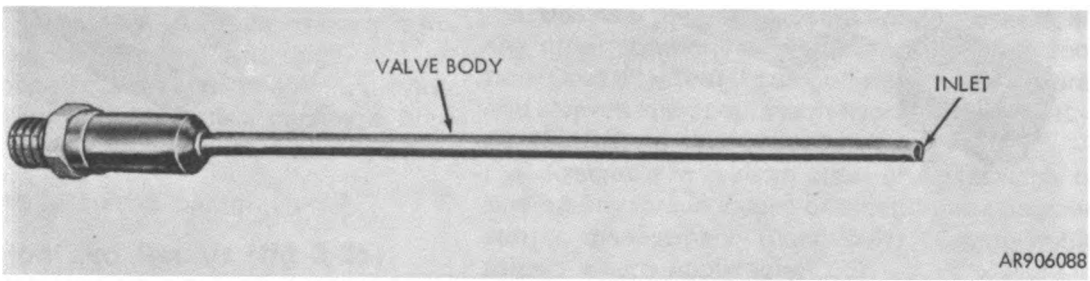



*Figure 3-23. Manual elevation check valve.*

**3-68. Cleaning.** Refer to paragraph 2-9.

**3-69. Inspection and Repair.**

*a.* Inspect components for cracks, burs, or wear.

*b.* If any components except packings are defective, replace valve assembly.

**3-70. Tests.**

**WARNING**
**Defective or improperly installed components may cause check valve to burst during test.**

**CAUTION**
**Insure M3 hydraulic pump and fluid used to perform tests are clean and free of contamination.**

*a. Leakage Test.* Using the M3 hydraulic pump and a turret hydraulic system pressure gage (TM 9-2350-258-34P-2), apply 2,000 psi to outlet side of check valve. Verify that no leakage occurs at inlet side of valve or adapter packing. If leakage occurs, replace check valve assembly.

*b. Flow Tests.* Apply 3—5 psi to inlet side of check valve. Verify that check valve is open. If check valve fails flow test, replace check valve.

**3-71. Installation.** Refer to paragraph 2-29.

## Section XIII. REPAIR OF MANUAL ELEVATION ACCUMULATOR

**3-72. Description.** Refer to TM 9-2350-258-20-2.

**3-73. Removal.** Refer to TM 9-2350-258-20-2.

**3-74. Disassembly (fig 3-24).**

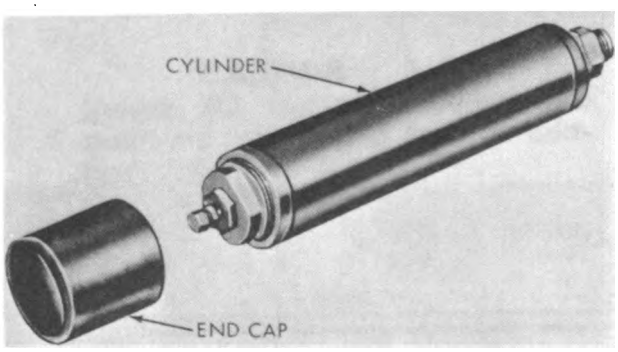
**NOTE**
Prior to disassembly, test must be conducted to verify that a malfunction does exist. If the unit fails to pass all tests, perform the following repair procedures. If the unit passes all tests, repair is not required.

*a.* Remove end cap from cylinder (view A).

*b.* Remove valve core cap from valve core (view B).

**WARNING**
**Nitrogen precharge pressure must be completely relieved before further disassembly. Depress valve core to relieve pressure (view B).**

*c.* Remove valve core body from cylinder. Remove packing from valve core body (view C). Discard packing.

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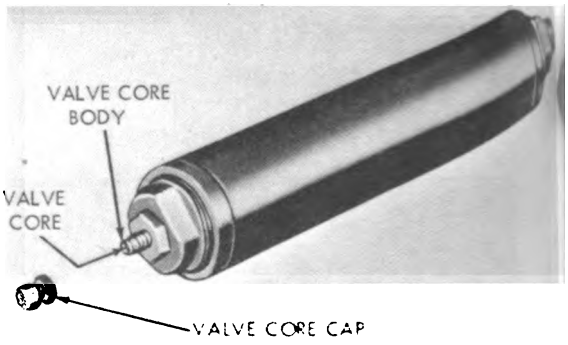


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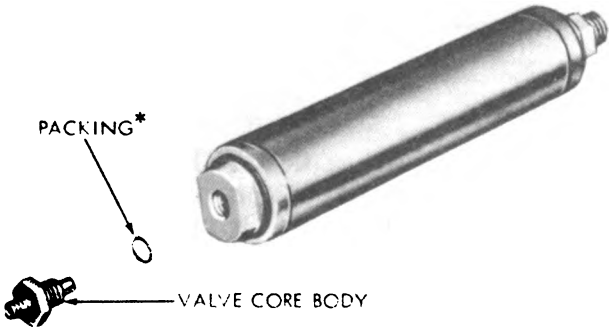


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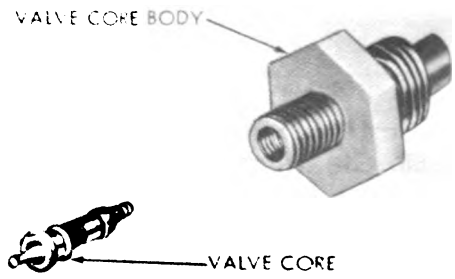


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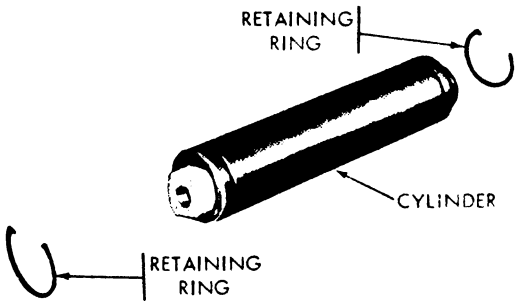


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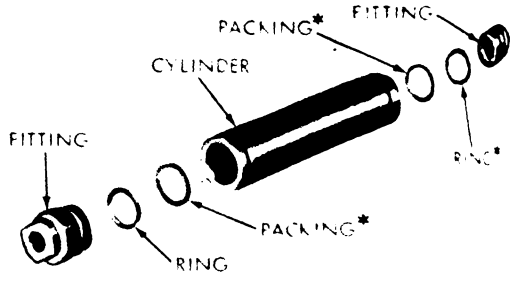


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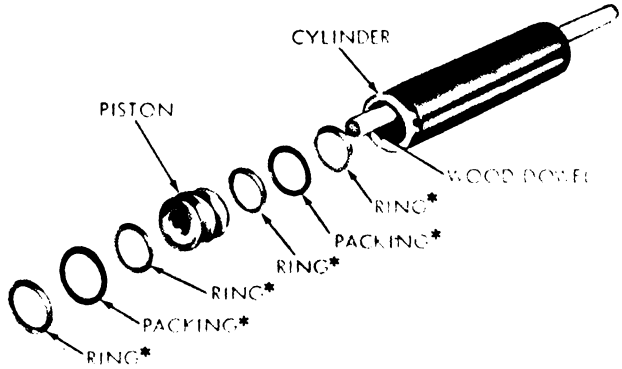


G

*PART OF PARTS KIT

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*Figure 3-24. Manual elevation accumulator disassembly or assembly.*

*d.* Remove valve core from body (view D).

*e.* Remove two retaining rings from cylinder (view E).

*f.* Remove fitting from each end of cylinder and remove two packings and two rings from each fitting (view F). Discard packing and rings.

*g.* Using a wooden dowel, push piston from cylinder. Remove four rings and two packings from piston (view G). Discard packings and rings.

**3-75. Cleaning.** Refer to paragraph 2-9.

## 3-76. Inspection and Repair (fig 3-25).

*a.* Inspect laminations of end cap for separation. Inspect components for damage or wear as specified in table 3-10 and figure 3-25.

*b.* Repair or replace damaged or worn components (section IV).

## 3-77. Assembly (fig 3-24).

*a.* Obtain manual accumulator parts kit (TM 9-2350-258-34P-2).

*b.* Use new packings, seals, O-rings, gaskets, and any other component performing a sealing function. Coat all internal components, cylinder bores, and sleeves and spools with hydraulic fluid (MIL-H-46170(FRH)) in assembly.

*c.* Assemble in reverse order of disassembly observing any torque values or other criteria specified during disassembly (para 3-74). Cross tighten screws where applicable.

## 3-78. Tests.

**WARNING**

**Defective or improperly installed components may cause accumulator to burst during testing.**

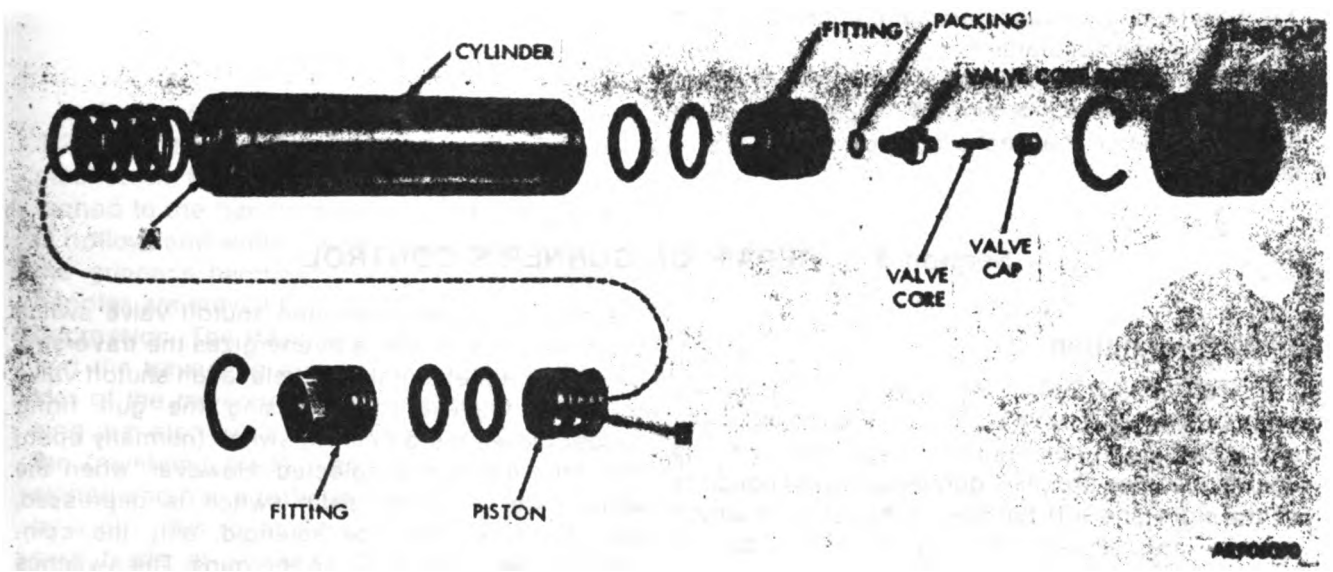



*Figure 3-25. Manual elevation accumulator wear points.*

*Table 3-10. Manual Elevation Accumulator Wear Limits*

| Figure | Reference | Measurement | Wear limit (in.) |
|---|---|---|---|
| 3-25 | A | ID of accumulator cylinder | 1.516 max |
| 3-25 | B | OD of piston | 1.506 min |
| 3-25 | A — B | Fit of piston in cylinder | 0.010L max |

**CAUTION**
**Insure M3 hydraulic pump and fluid used to perform tests are clean and free of contamination.**

NOTE
Tests must be conducted after completion of the repair procedure to insure that any malfunction has been corrected

*a. Proof Test (fig 3-25).*

(1) Remove end cap and valve core body from cylinder.

(2) Position piston at least 2 inches away from either end of cylinder.

(3) Fill nitrogen chamber (valve core end) with hydraulic fluid (MIL-H-46170(FRH)) and replace valve core and valve cap.

(4) Fill fluid chamber with hydraulic fluid (MIL-H-46170(FRH)).

(5) Attach pressure gage with a range of 0 to 2,000 psi to M3 hydraulic pump and connect to fluid chamber of accumulator.

(6) Apply 1800 ± 100 psi pressure to fluid chamber and maintain for 5 minutes. Repair or replace any accumulator that leaks or show any signs of failure.

(7) Relieve pressure from cylinder, then remove pressure gage and pump.

(8) Drain hydraulic fluid from accumulator.

(9) Install packing and valve core body.

*b. Nitrogen Precharge Leakage Test (fig 3-25).*

(1) Connect accumulator charging regulator and dry nitrogen tank to accumulator (refer to TM 9-2350-258-20-2).

(2) Charge accumulator with nitrogen (BBN-411) to 35 ± 5 psi with fluid port open.

(3) Disconnect accumulator charging regulator from accumulator.

(4) With valve cap removed and fluid port open, completely submerge accumulator in hydraulic fluid for 10 minutes. Bubbles indicate leakage. Repair and retest any accumulator which leaks.

(5) Release nitrogen pressure from accumulator and install valve cap and end cap.

**3-79. Installation.** Refer to TM 9-2350-258-20-2.

## Section XIII. REPAIR OF GUNNER'S CONTROL

### 3-80. Description.

*a. General (fig 3-26).* The gunner's control contains controls and switches to operate the elevating and traversing system and to fire the main gun and coaxial machine gun. The gunner's control consists of the right and left handles, a housing in which various mechanical linkages function, and a hydraulic control valve. The handles and housing assembly mechanically control the valve which, in turn, controls the fluid flow in the elevating and traversing system.

*b. Palm Switch and Gun Firing Switches (fig 3-26).* Two neoprene encased waterproof, single-pole, single-throw switches are incorporated in each gunner's handle. Depressing the palm switch opens the magnetic brake/elevation shutoff valve switch (normally closed) which deenergizes the traversing gearbox magnetic brake and elevation shutoff valve solenoid if present. Depressing the gun firing trigger closes the gun firing switch (normally open) and fires the gun(s) selected. However, when the commander's control palm switch is depressed, energizing the override solenoid, only the commander can fire or position the guns. The switches automatically return to the normal position when released. Energizing the power solenoid with the TURRET POWER switch supplies the hydraulic control valve with hydraulic fluid under pressure. Power and control signals are supplied via an electrical harness connector attached to a bracket on the lower right side of the assembly.

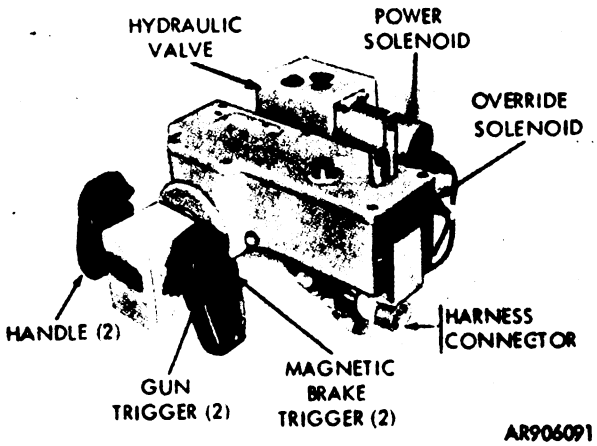



*Figure 3-26. Gunner's control.*

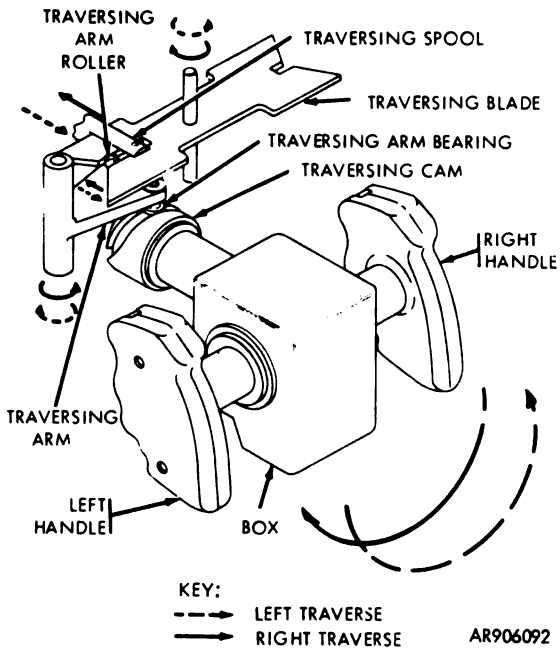



*Figure 3-27. Traversing with gunner's control.*

*c. Traversing with Gunner's Control (figs 3-27 and 3-28).* A traversing cam, which activates the mechanism to cause traversing, is mechanically attached to the handle assembly (fig 3-27). The cam is hollow, and while it responds to radial turning of the gunner's handles, it does not move when the handles are moved back and forth for elevation and depression. The traversing arm is pivoted on a pin and the traversing arm bearing rides in the spiral slot of the traversing cam at all times. The traversing arm also has a roller which rides in the slot of the traversing blade. The traversing spool end is slotted and has a roller in the slot secured in place by a pin. This roller rides in the slot of the traversing blade at all times. The traversing blade is pivoted on a blade pin (fig 3-28). The blade pin is positioned to the extreme left of the slots in the upper and lower blade plates. This is the normal position for the traversing blade while the gunner has power control.

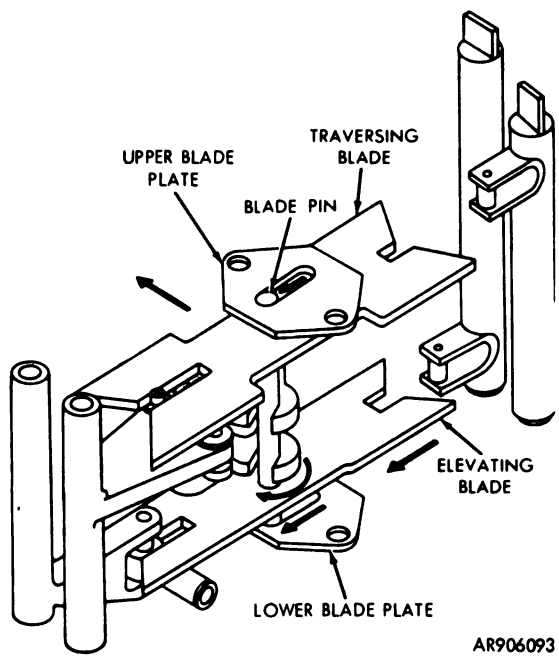



*Figure 3-28. Gunner's control elevating and traversing blade.*

*d. Elevating with Gunner's Control (fig 3-29).* The traversing cam, traversing arm, traversing blade, and traversing spool have no control over elevation. The gunner's handles are connected by linkage extending from the control handle shaft to the elevating arm. The elevating arm roller rides in a slot in the elevating blade. The roller attached to the elevating spool also rides in the same slot and rotation of the gunner's handles is transmitted to the elevating spool.

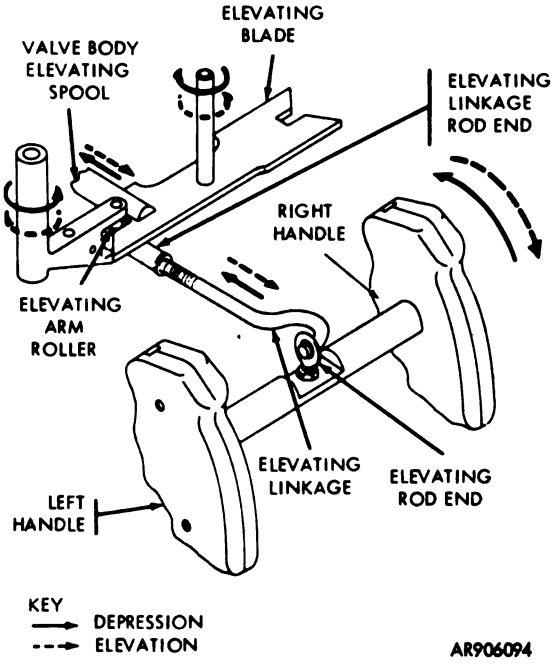



*Figure 3-29. Elevating gun with gunner's control.*

**3-81. Removal.** Refer to TM 9-2350-258-20-2.

**3-82. Disassembly.**

*a. Handles and Mechanical Controls (fig 3-30).*

(1) Remove four drive screws securing nameplate to cover and remove nameplate if replacement is required (view A).

(2) Remove four screws and lockwashers securing cover to handle box and remove cover (view A).

**NOTE**

Remove stop screw and jamnut (view J) from the cover only if replacement is necessary. If removal is necessary measure stop screw protrusion and record measurement for use in assembly.

(3) Remove five wiring connector nuts from inserts (view B).

(4) Loosen five connector insert screws and remove five inserts (view C).

(5) Remove two screws and lockwashers securing cover to left handle and remove cover (view C).

(6) Remove gun firing switch and magnetic brake/elevation shutoff valve switch from handle (view D).

(7) Remove palm switch and gun trigger from handle (view D).

(8) Remove palm switch and gun trigger pivot pins from handle (view D).

(9) Remove adjusting screw and return spring from gun trigger (view D).

(10) Remove adjusting screw from palm switch (view D).

(11) Repeat steps (5) through (10) above to disassemble right handle.

(12) Remove six screws and lockwashers securing cover to housing and remove cover (view F).

(13) Remove elevation and traverse shaft bearings (press fit) from cover (view G).

(14) Remove two setscrews securing right handle to shaft and remove handle (view K).

(15) Remove cotter pin from elevation rod (view K).

(16) Move handle shaft to the left and disengage elevation rod from rod end (view L).

(17) Remove two setscrews securing left handle to shaft and remove handle (view L).

(18) Remove setscrew securing rod end in handle shaft and remove rod end (view L).

(19) Remove handle shaft (view N).

(20) Unscrew elevation rod and remove (view N).

(21) Remove four screws and lockwashers securing handle box and bushing to traverse cam and remove box and bushing (views O and P).

(22) Remove two shaft bearings from handle box (view P).

(23) Insert 10-24 x 3-1/2 screw with a number 10 washer through access hole in housing and thread into override spring guide (view Q). Tighten screw to compress spring and disengage spring guide from blade pin.

(24) Remove upper blade plate (view Q).

(25) Disconnect spring from blade pin and elevation shaft (view R).

(26) Disconnect spring from blade pin and elevation arm (view R).

(27) Remove elevation and traverse shafts from housing (view R).

(28) Remove blade plate pin (view R).

(29) Remove assembled override arm spring, guide, and retainer from housing (view R).

(30) Compress override arm spring and remove screw and washer installed in step (23) above (view S). Separate guide and retainer from spring.

(31) Remove pin from override arm and lower blade plate (view T).

(32) Remove assembled blades and override arm from housing (views T and U).

(33) Remove override arm from blade pin (view U).

(34) Remove two retaining rings, two washers, and shim(s) from blade pin (view U). Separate blades from pin.

(35) Remove lower blade plate from housing (view V).

(36) Remove traverse arm and pin from housing (view V).

(37) Remove screw, lockwasher, rectangular washer, and spring from traverse arm (view W).

(38) Remove roller and pin (staked) from traverse arm (view W).

(39) Remove bearing and pin (staked) from traverse arm (view W).

(40) Remove elevation arm and pin from housing (view X).

(41) Remove depression stop screw and jamnut from elevation arm only if necessary. If removal is necessary, measure the stop screw protrusion and record the measurement for use in reassembly (view Y).

(42) Remove spring pin (press fit) from elevation arm (view Y).

(43) Remove rod end, roller pin (staked) and roller from elevation arm (view Y).

(44) Remove four screws and lockwashers securing traverse cam bearing cover to housing and remove cover (view Z).

**NOTE**

Insure lockwashers are replaced. Traverse 90 degrees to left and right to insure stops are working.

(45) Remove traverse cam and bearing from housing (view AA).

(46) Remove bearing from traverse cam (view AB).

(47) Remove two screws and lockwashers securing clamp and block to traverse spool and remove clamp and block (view AC).

(48) Remove screw and lockwasher securing support to elevation spool and remove support (view AC).

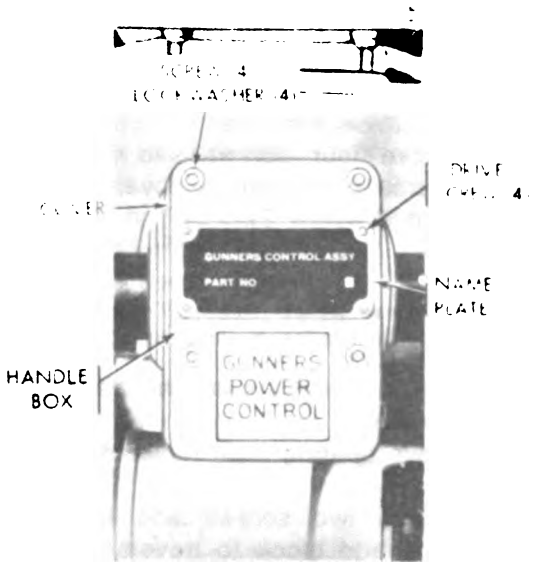
(49) Disconnect harness leads from override solenoid and power solenoid (view AD).

(50) Remove four screws and lockwashers securing harness connector to bracket and remove connector (view AE).

(51) Remove two screws and lockwashers securing harness connector bracket to housing and remove bracket (view AD).

(52) Remove three screws and lockwashers securing hydraulic control valve to housing and remove housing (view AF).

(53) Remove elevation and traverse shaft bearings (press fit) from housing (view AF).

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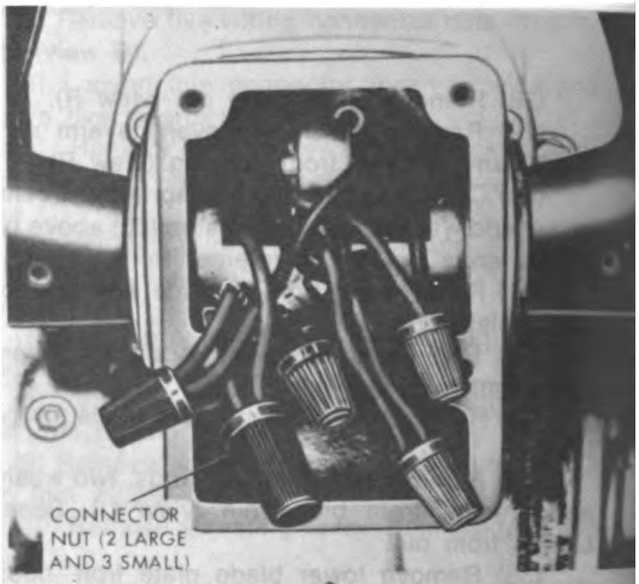


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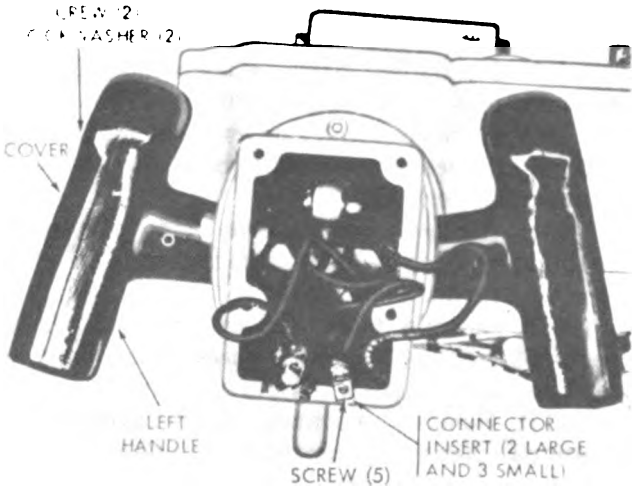


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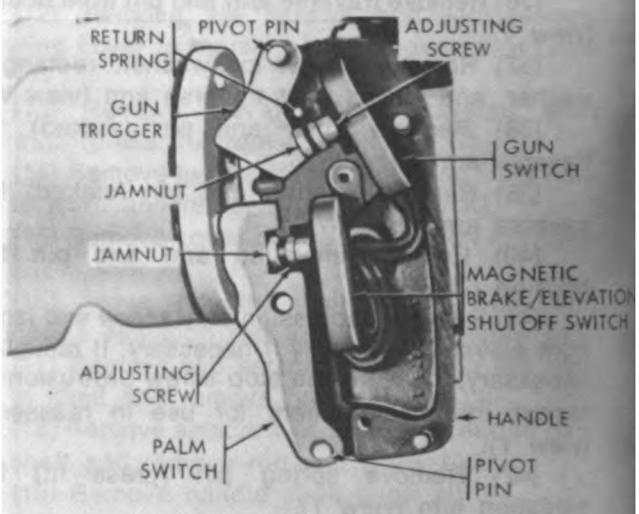


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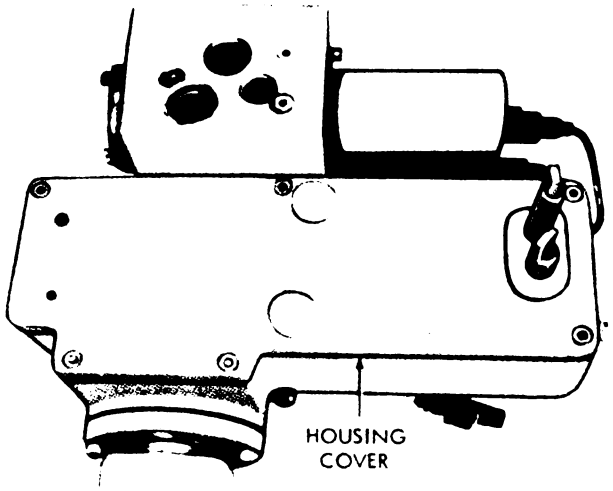


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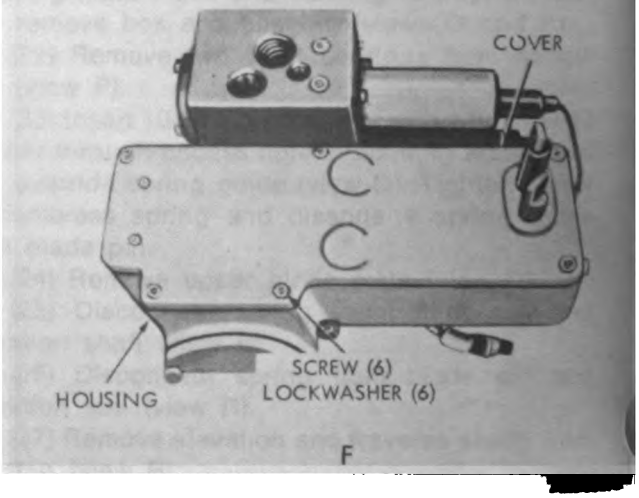
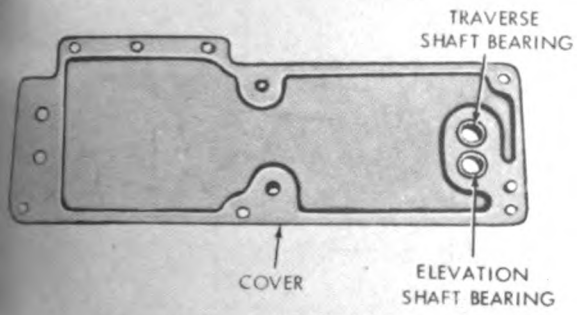



F

***Figure 3-30. Gunner's control disassembly or assembly (1 of 6)***

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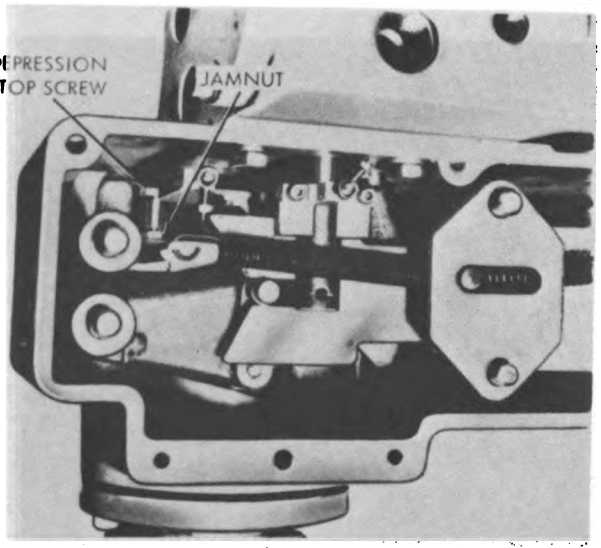


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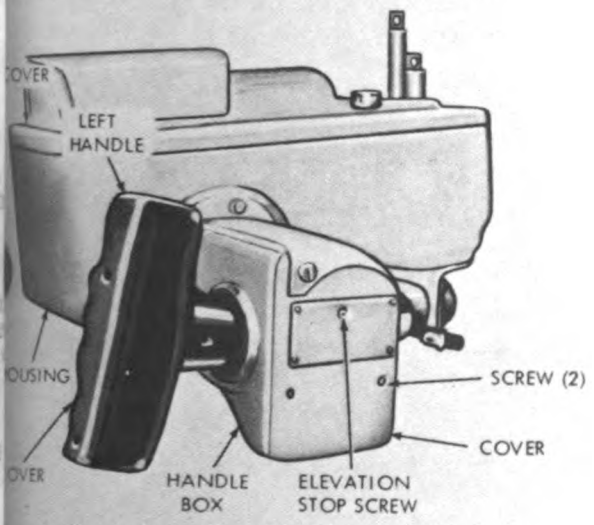


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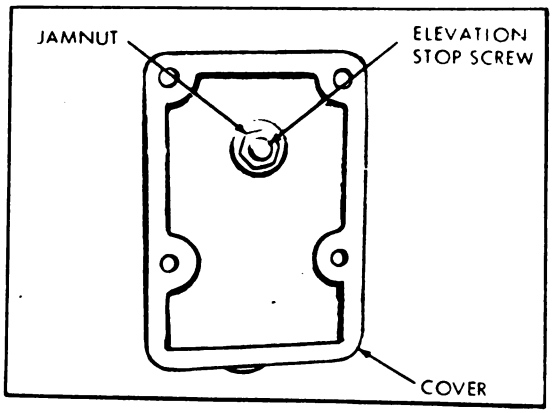


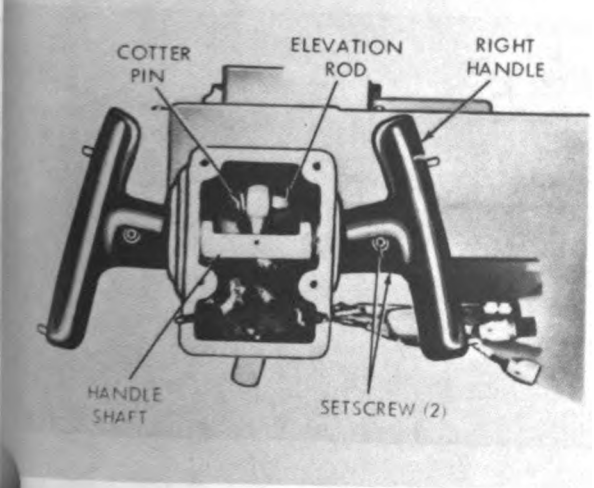


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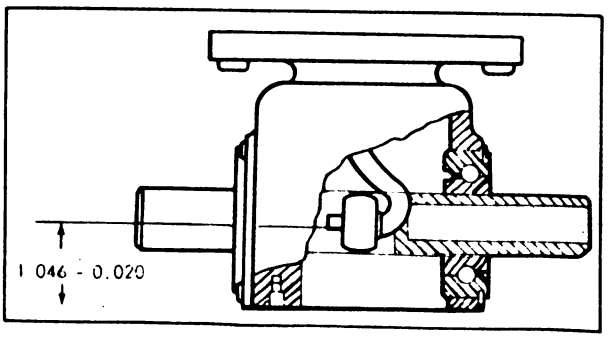


*Figure 3-30. Gunner's control disassembly or assembly (2 of 6).*

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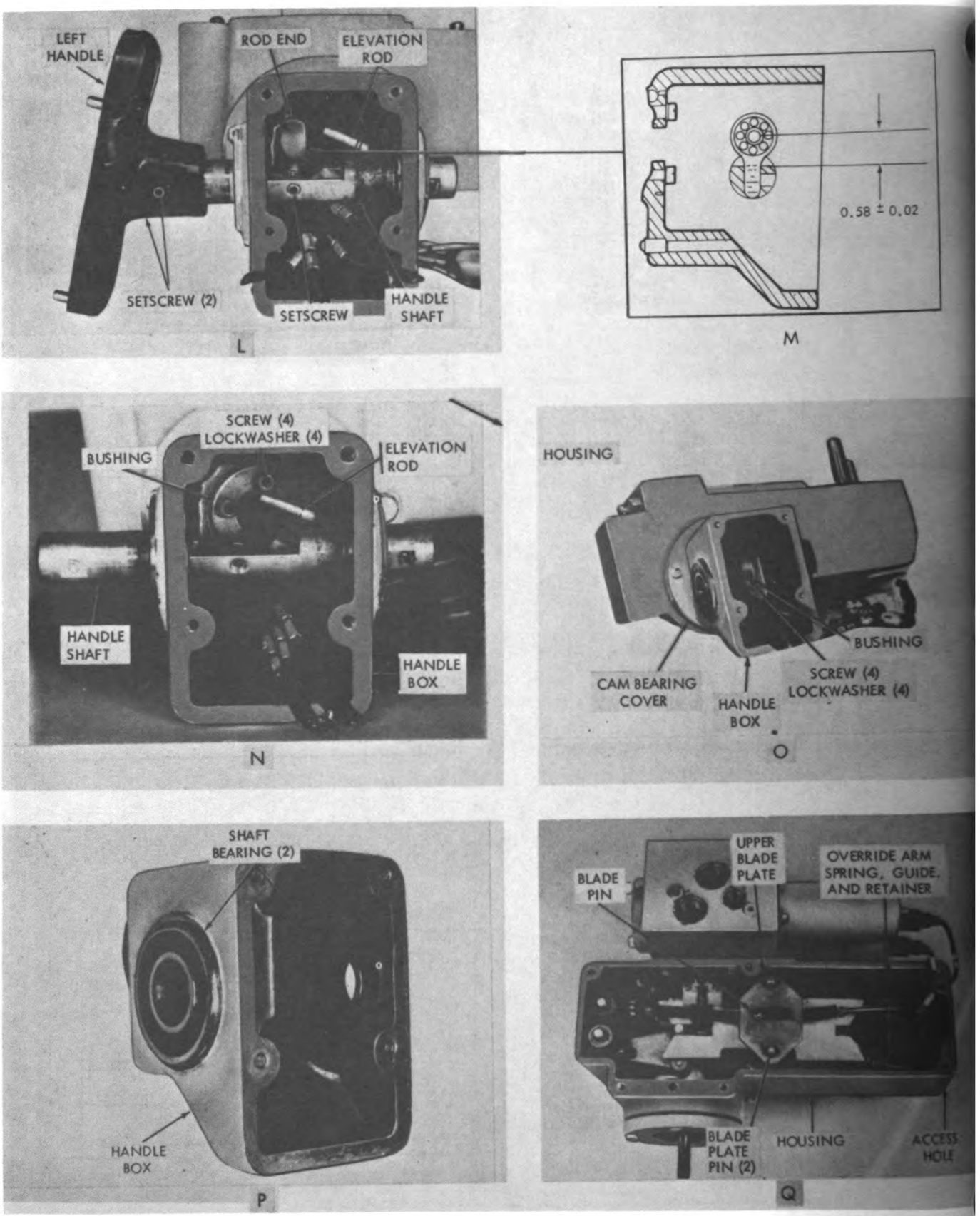
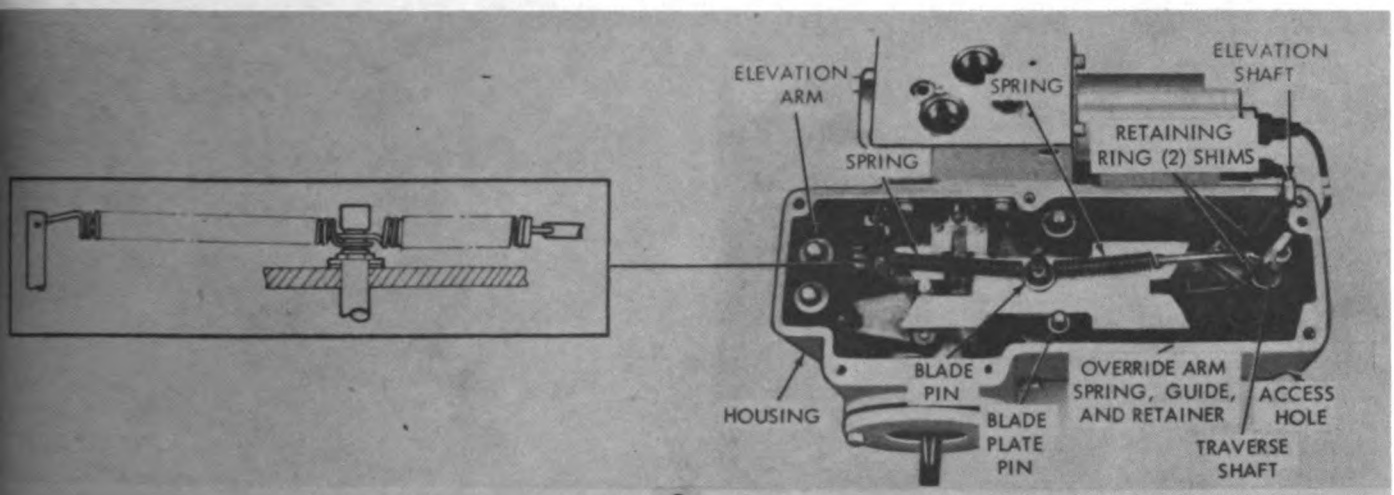
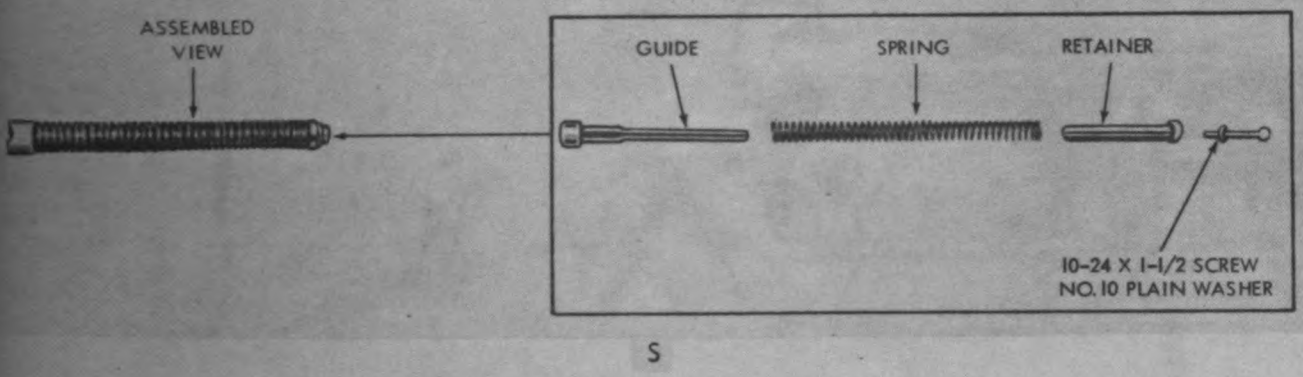
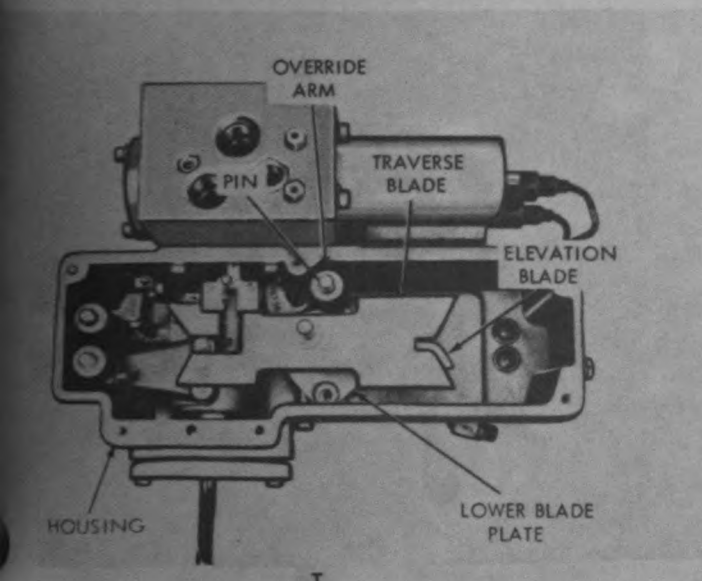



*Figure 3-30. Gunner's control disassembly or assembly (3 of 6).*



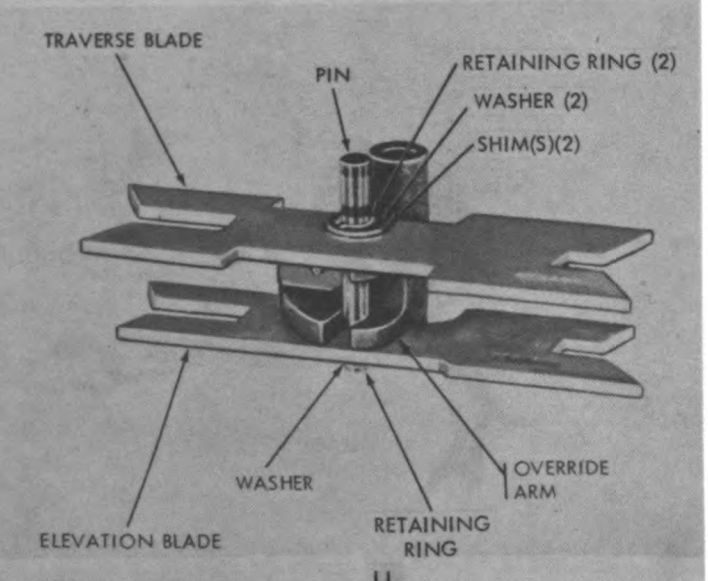




*Figure 3-30. Gunner's control disassembly or assembly (4 of 6).*

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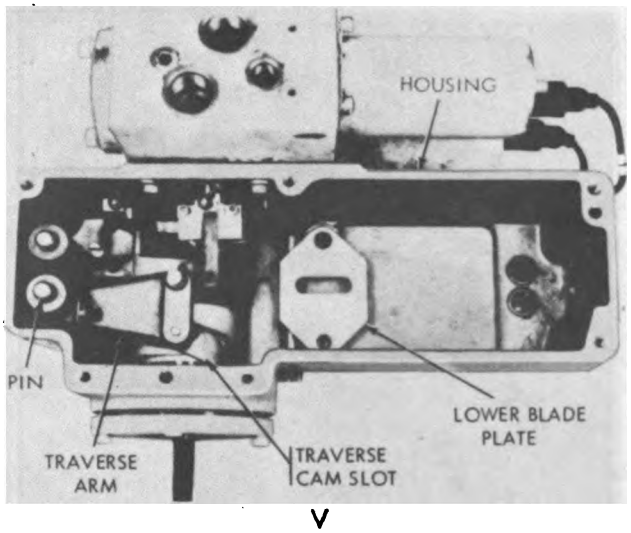


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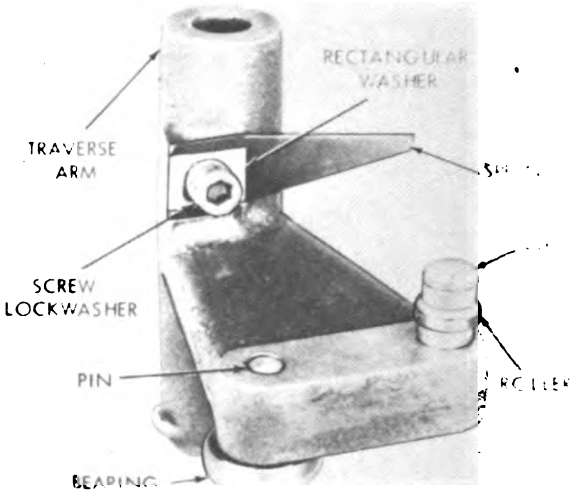


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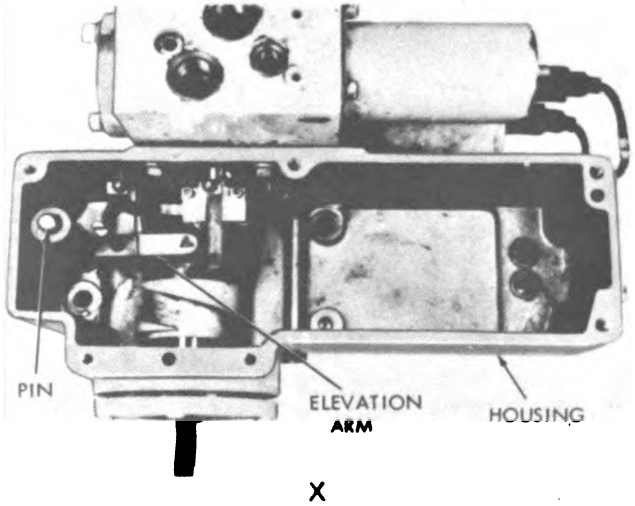


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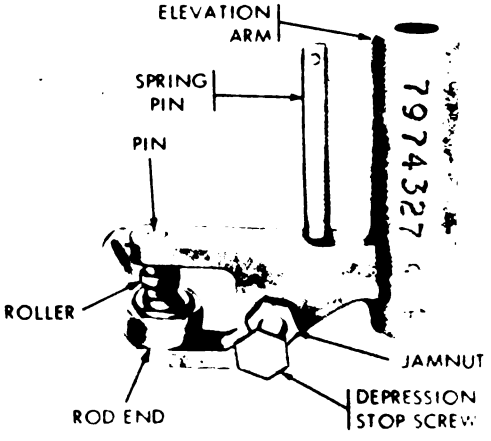


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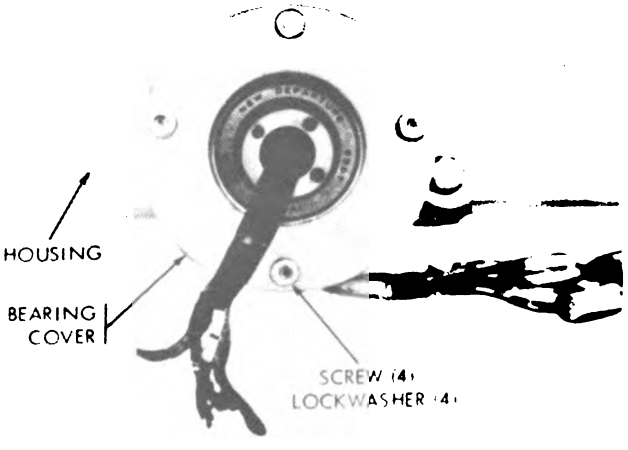


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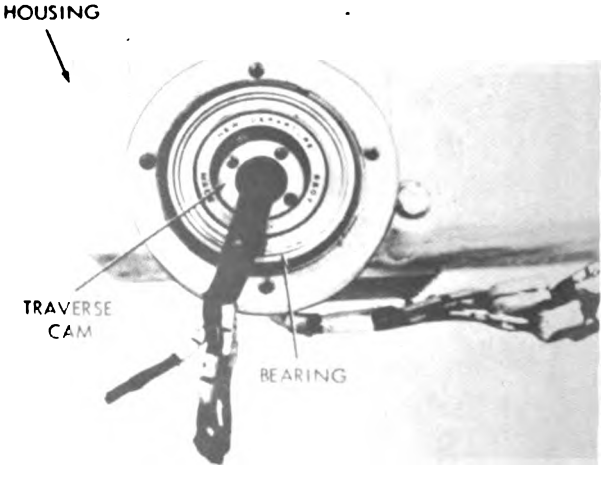


AA

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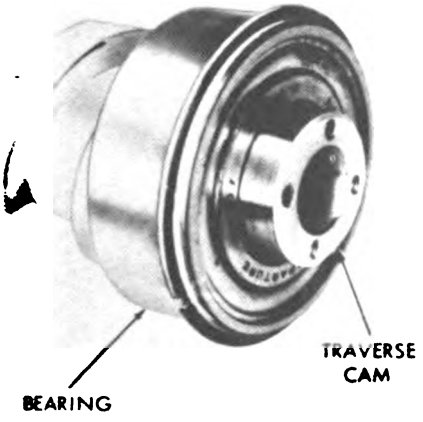
*Figure 3-30. Gunner's control disassembly or assembly (5 of 6).*

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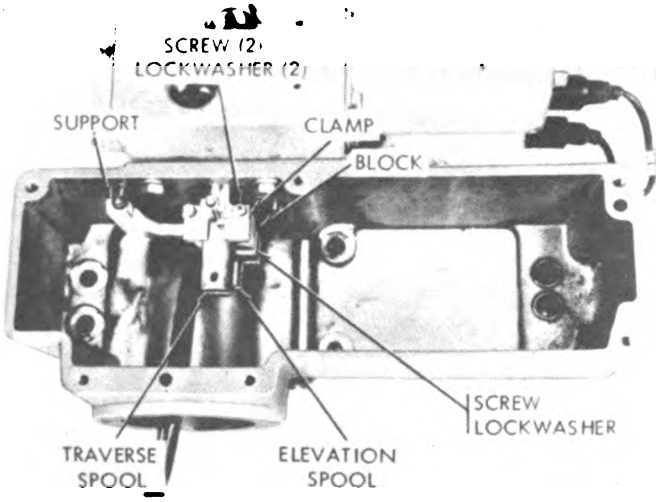


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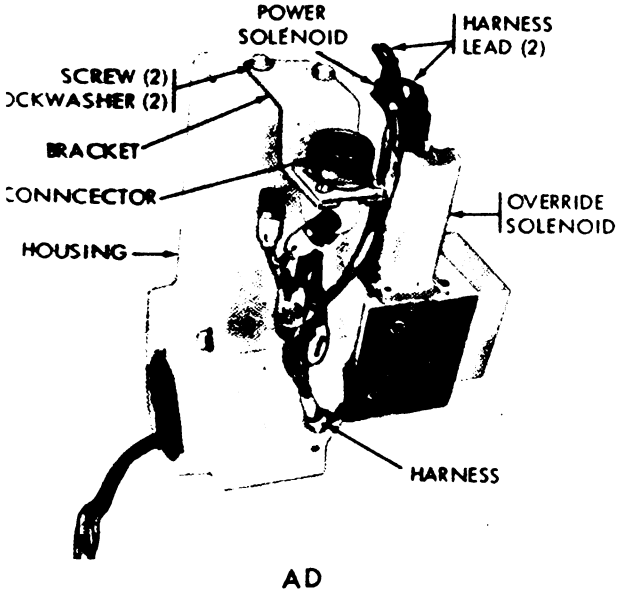


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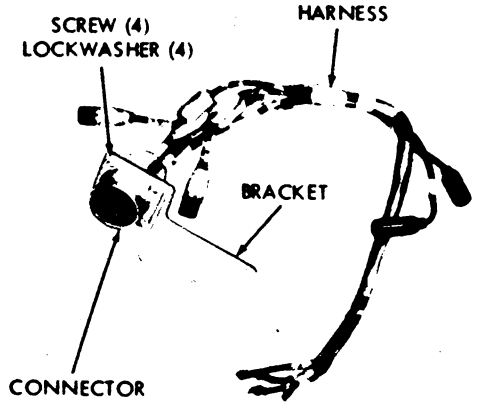


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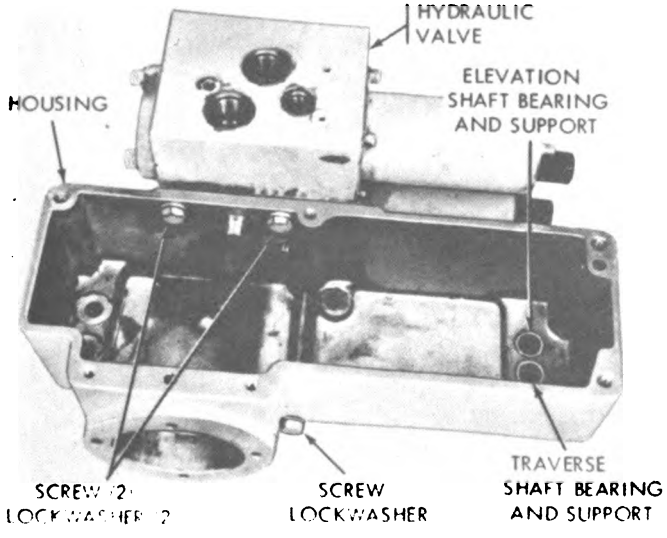


AF

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*Figure 3-30. Gunner's control disassembly or assembly (6 of 6).*

## 3-83. Inspection and Repair (fig 3-31).

*a.* Inspect components for wear as specified in table 3-11 and figure 3-31.

*b.* Repair or replace defective components.

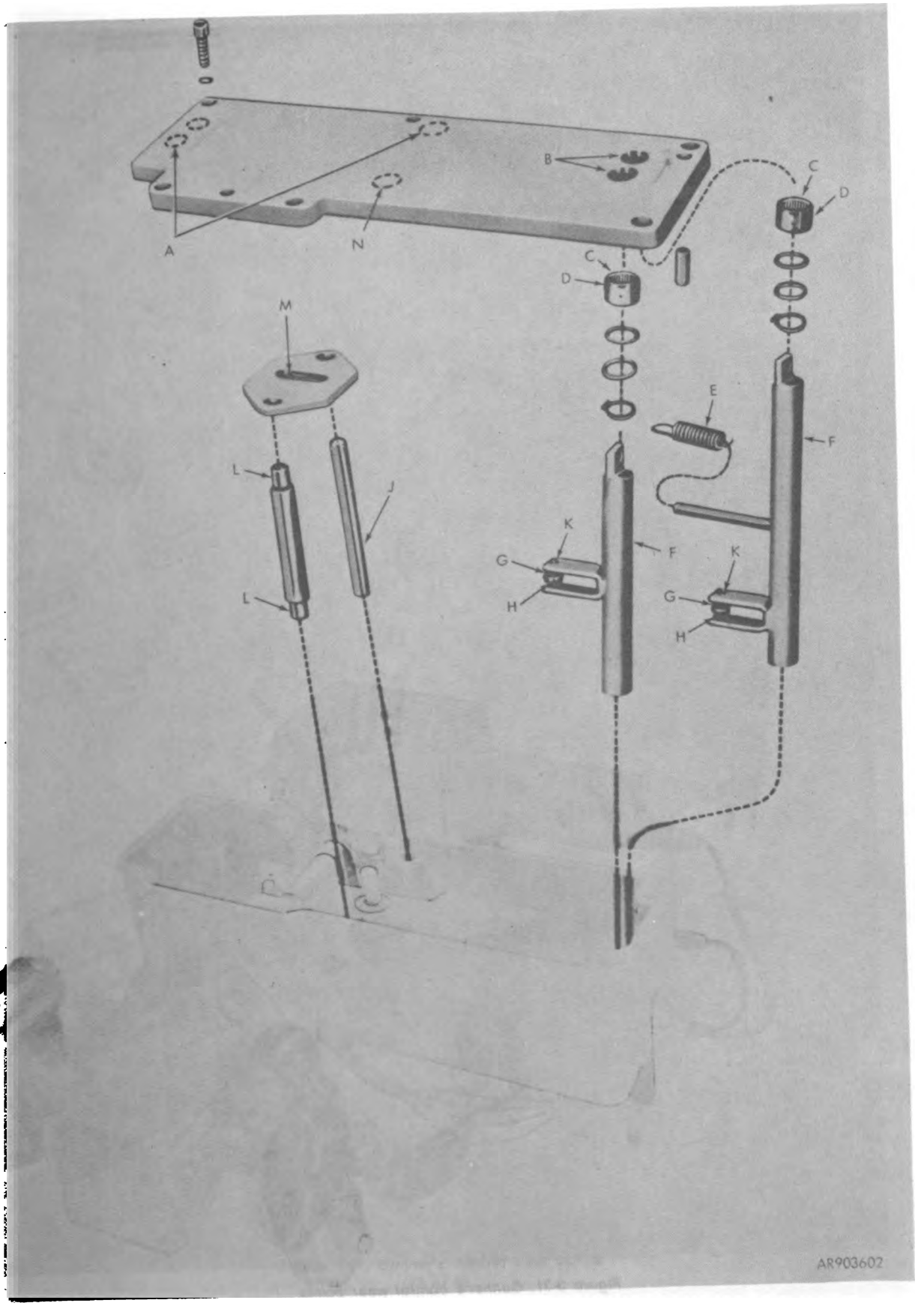



*Figure 3-31. Gunner's control wear points (1 of 6).*

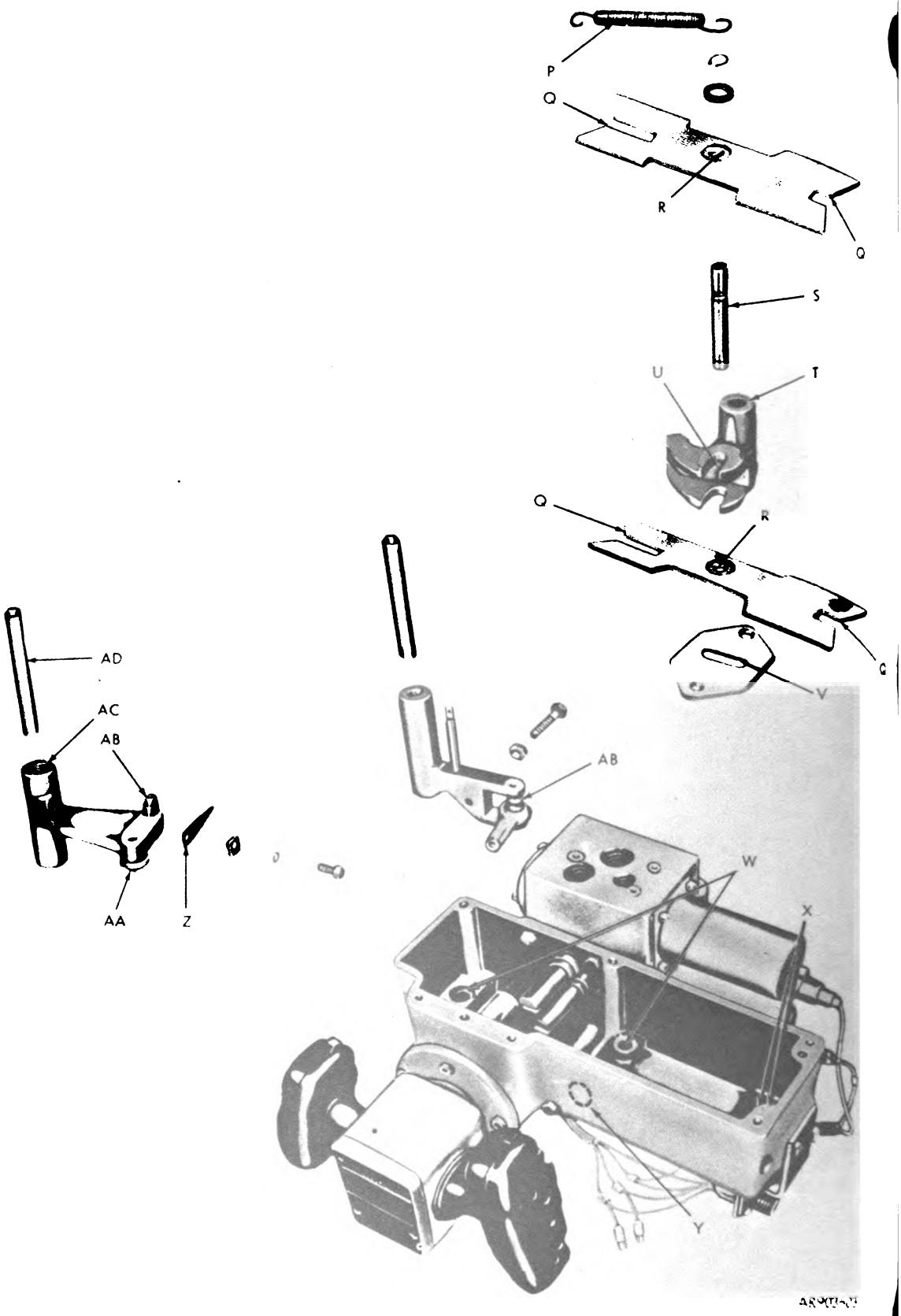



*Figure 3-31. Gunner's control wear points (2 of 6).*

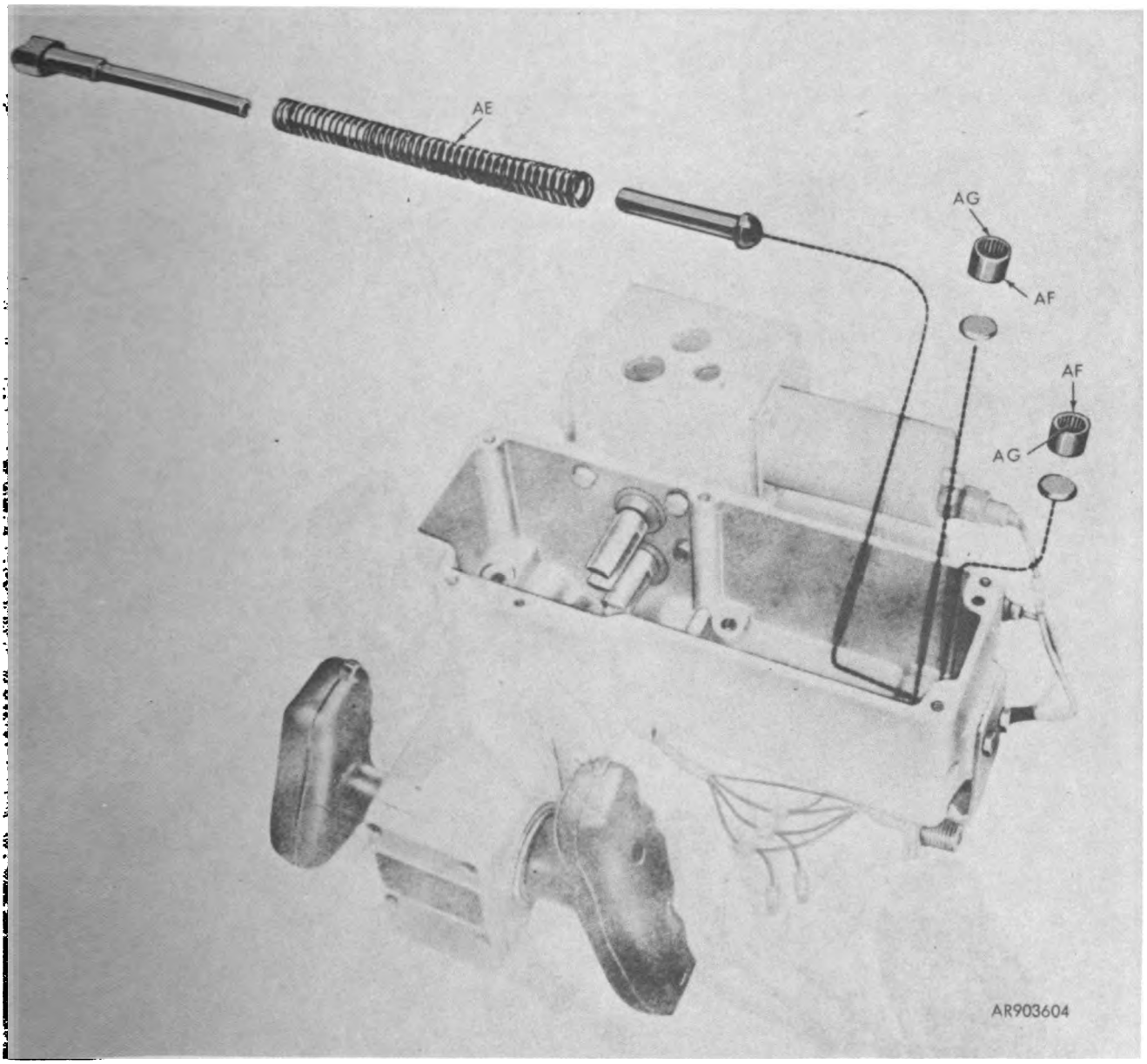



*Figure 3-31. Gunner's control wear points (3 of 6).*

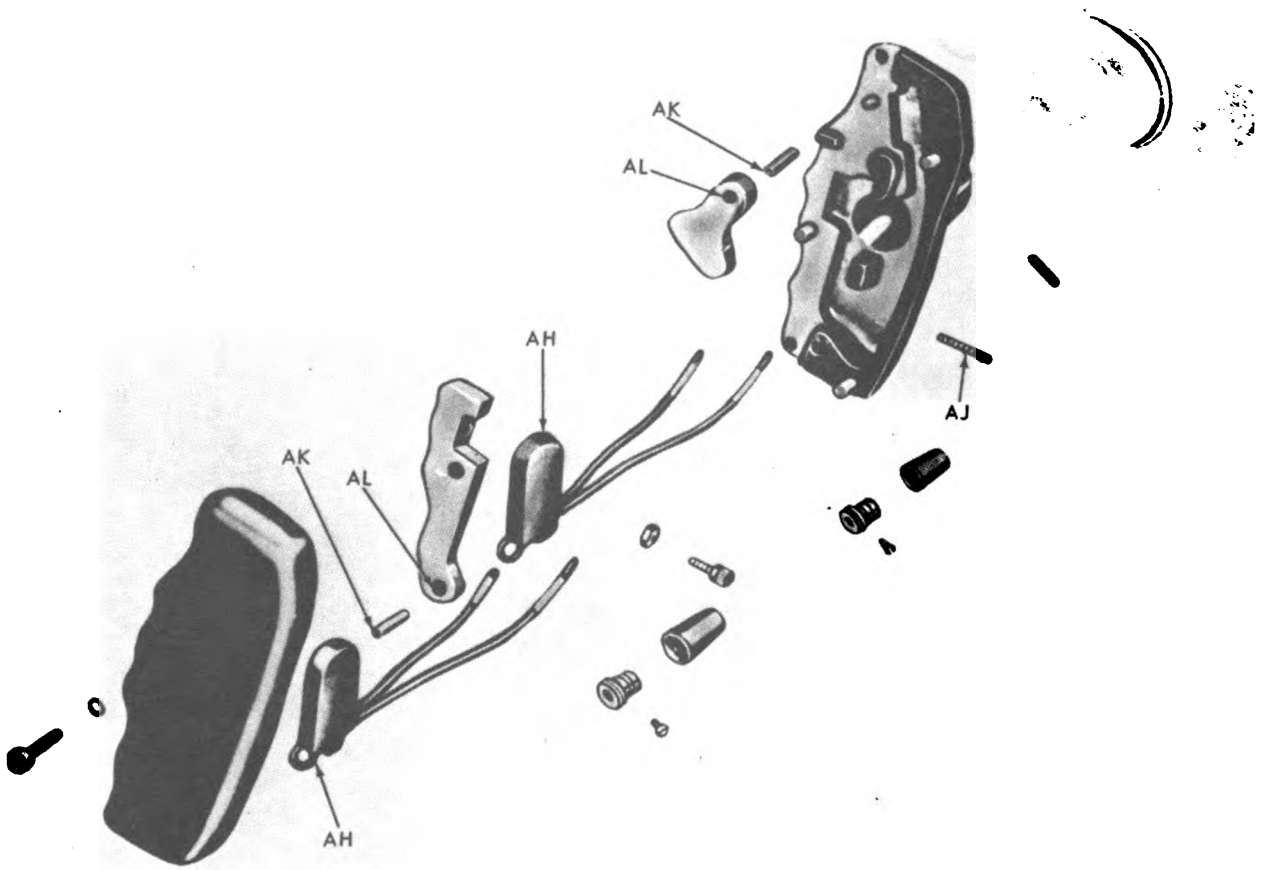



*Figure 3-31. Gunner's control wear points (4 of 6).*

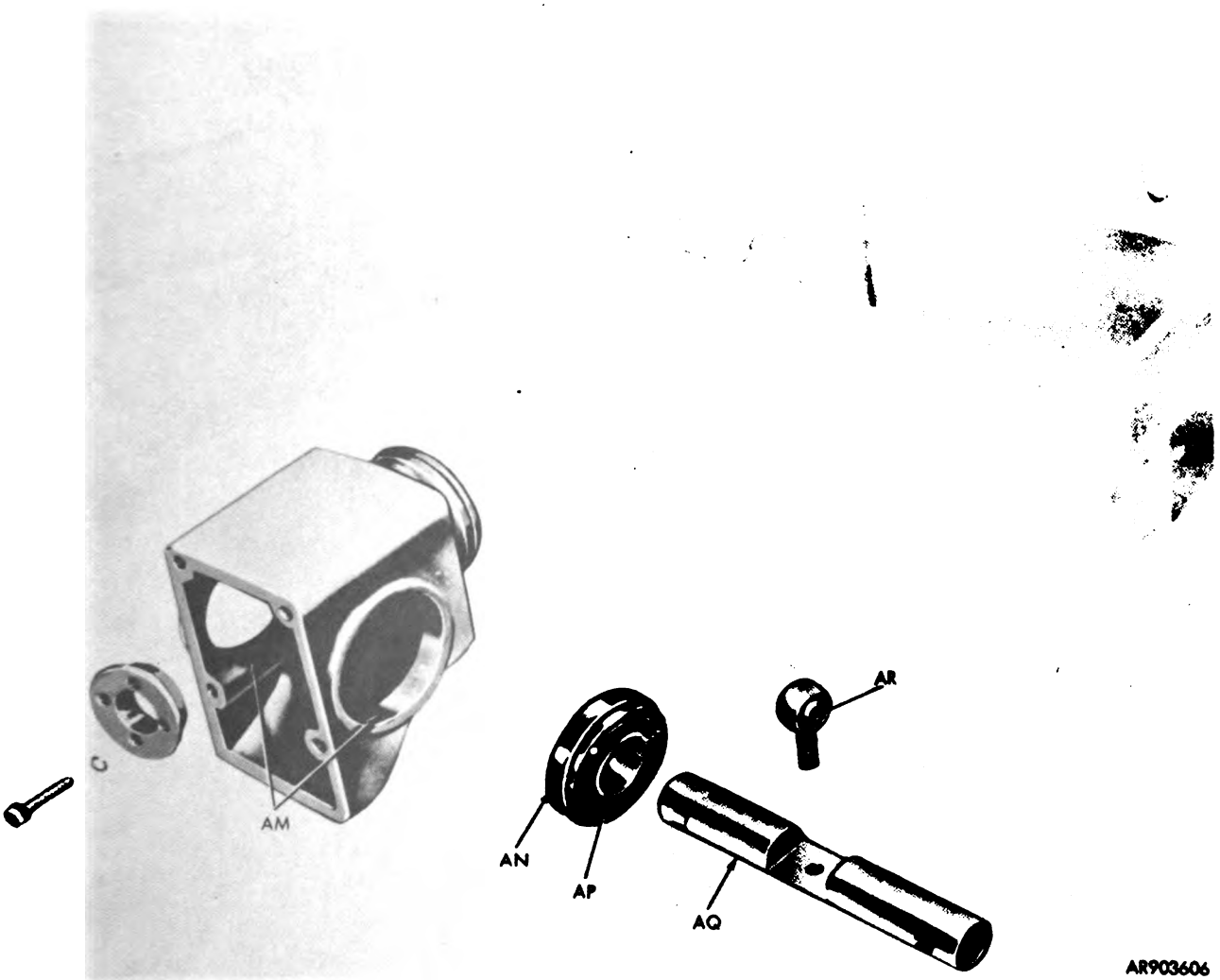



*Figure 3-31. Gunner's control wear points (5 of 6).*

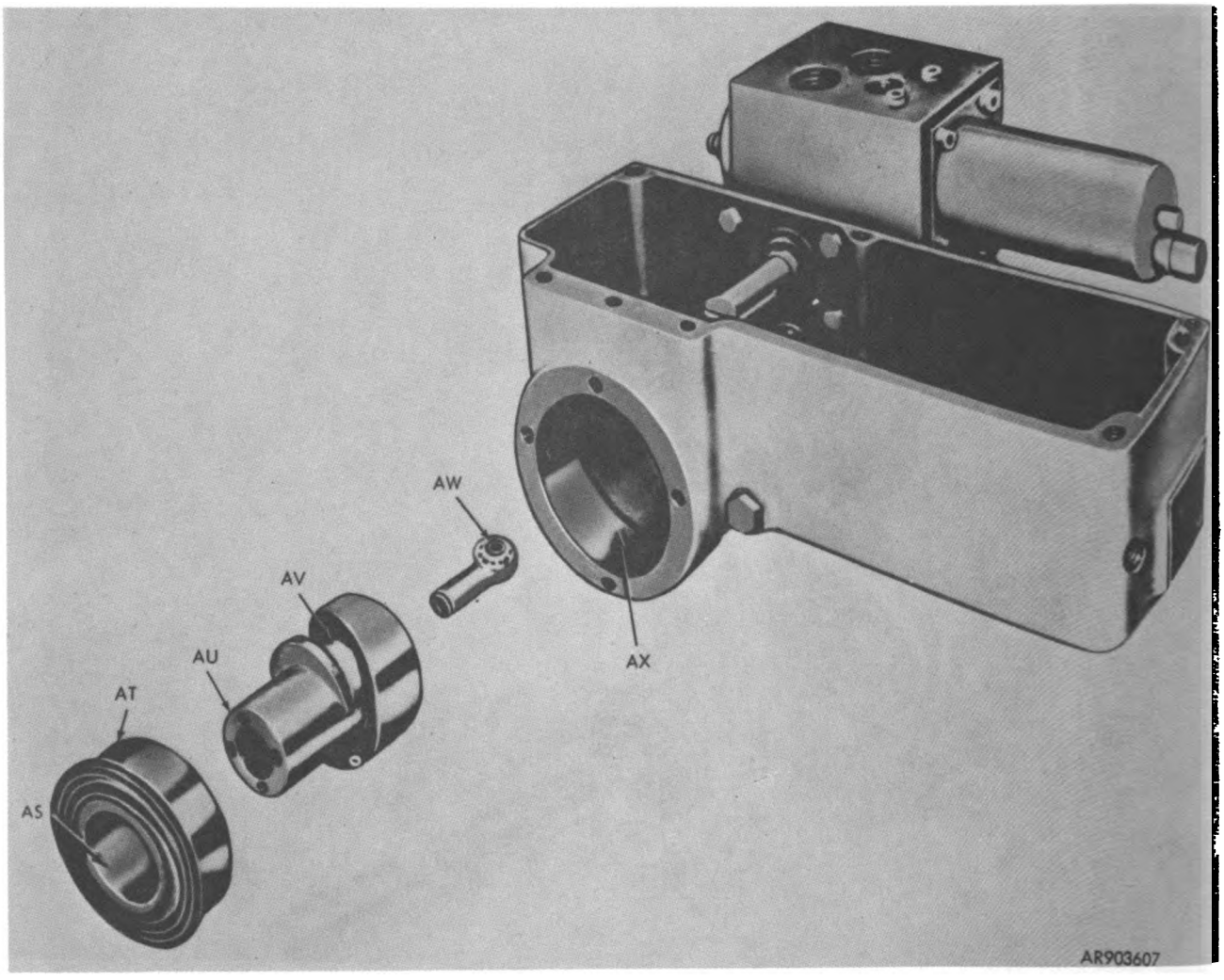



*Figure 3-31. Gunner's control wear points (6 of 6).*

## 3-84. Assembly. (fig 3-30).

**NOTE**

Apply coating of grease (MIL-G-23827) to all rotating or sliding parts during assembly.

*a.* Install traverse and elevating shaft supports and bearings (press fit) into housing (view AF).

*b.* Position hydraulic control valve on housing and secure with three screws and lockwashers (view AF).

*c.* Position harness connector in bracket and secure with four screws and lockwashers (view AE).

*d.* Position harness connector bracket on housing and secure with two screws and lockwshers (view AD).

*e.* Connect harness lead (circuit 625A) to power solenoid (view AD).

*f.* Connect harness lead (circuit 623) to override solenoid (view AD).

*g.* Insert switch leads through hole in bottom of housing and out through cam bearing hole (view AD).

*h.* Position support on elevation spool (view AC).

**NOTE**

Lock support screw with sealing compound (grade E. MIL-S-22473).

*Table 3-11. Gunner's Control Wear Limits*

| Figure Ref ere nce | Measurement | Wear Limit | (in.) |
|---|---|---|---|
| 3-31 | A | ID of cover counterbore | 0.3765 max |
| 3-31 | B | ID of cover counterbore | 0.6875 max |
| 3-31 | C | ID of bearing | 0.5005 max |
| 3-31 | D | OD of bearing | 0.6870 min |
| 3-31 | E | Spring: Free length (ref) | 1.58 min |
| 3-31 | F | OD of shafts | 0.4975 min |
| 3-31 | G | OD of roller | 0.3746 min |
| 3-31 | H | ID of roller | 0.1898 max |
| 3-31 | J | OD of blade plate bin | 0.3735 min |
| 3-31 | A-J | Fit of pin on cover | 0.0030L max |
| 3-31 | K | OD of pin | 0.1893 min |
| 3-31 | H-K | Fit of roller on pin | 0.0012L max |
| 3-31 | L | Diameter of pin ends | 0.3105 min |
| 3-31 | M | Width of slot in plate | 0.3800 max |
| 3-31 | N | Diameter of cover counterbore | 0.3135 max |
| 3-31 | L-N | Fit of pin in cover counterbore | 0.0030L max |
| 3-31 | P | Spring: | 3.4800 min |
| 3-31 | Q | Width of slot in traversing blade | 0.3756 max |
| 3-31 | G-Q | Fit of roller on elevating arm in slot | 0.0010L max |
| 3-31 | R | ID of hole in blade | 0.0015L max |
| 3-31 | S | OD of pin | 0.3745 min |
| 3-31 | R-S | Fit of pin in blade | 0.0015L max |
| 3-31 | T | ID of override arm bore | 0.3765 max |
| 3-31 | S-T | Fit of pin in override arm | 0.0020L max |
| 3-31 | U | Width of slots in override arm | 0.3768 max |

*Table 3-11. Gunner's Control Wear Limits — Continued*

| Figure | Reference | Measurement | Wear limit (in.) |
|---|---|---|---|
| 3-31 | S-U | Fit of pin in override arm slots | 0.0023L max |
| 3-31 | V | Width of slot in blade plate | 0.3800 max |
| 3-31 | S-V | Fit of pin in blade plate slot | 0.0055L max |
| 3-31 | W | ID of housing bores | 0.3765 max |
| 3-31 | J-W | Fit of pin in housing | 0.0030L max |
| 3-31 | X | ID of housing counterbores | 0.6875 max |
| 3-31 | Y | Diameter of housing counterbore | 0.3135 max |
| 3-31 | L-Y | Fit of pin in housing counterbore | 0.0030L max |
| 3-31 | Z | Load to deflect spring 1/8 in. | 4 lb min |
| 3-31 | AA | OD of traversing arm bearing | 0.6840 min |
| 3-31 | AB | OD of elevating and traversing rollers | 0.3748 min |
| 3-31 | Q-AB | Fit of roller in blade slot | 0.0008L max |
| 3-31 | AC | ID of arm bore | 0.3765 max |
| 3-31 | AD | Diameter of pins | 0.3735 max |
| 3-31 | A-AD | Fit of pins in cover | 0.0030L max |
| 3-31 | AC-AD | Fit of pin in lever arm | 0.0030L max |
| 3-31 | AE | Spring: | |
| | | Free length | 6.9215 min |
| 3-31 | AF | OD of bearing | 0.6870 min |
| 3-31 | AG | ID of bearing | 0.5005 max |
| 3-31 | F-AG | Fit of shaft in bearing | 0.0030L max |
| 3-31 | AH | Trigger switch: | |
| | | Pretravel | 0.020 min |
| | | Overtravel | 0.010 min |
| | | Operating effort at center of switch | 16 to 32 oz |
| 3-31 | AK | OD of pins | 0.1845 min |
| 3-31 | AL | Diameter of hole in triggers | 0.1920 max |
| 3-31 | AK-AL | Fit of pins in triggers | 0.0075L max |
| 3-31 | AM | ID of bore in handle box | 1.8509 max |
| 3-31 | AN | OD of bearing | 1.8499 min |
| 3-31 | AP | ID of bearing | 0.7874 max |
| 3-31 | AQ | OD of shaft | 0.7858 max |
| 3-31 | AP-AQ | Fit of shaft in bearing | 0.0021L max |
| 3-31 | AR | ID of bearing | 0.1900 max |
| 3-31 | AS | ID of bearing | 1.3780 max |
| 3-31 | AT | OD of bearing | 2.8341 min |
| 3-31 | AU | OD of cam shank | 1.3750 min |
| 3-31 | AS-AU | Fit of bearing on cam | 0.0030L max |
| 3-31 | AV | Width of traversing cam groove | 0.6887 max |
| 3-31 | AA-AV | Fit of bearing in cam | 0.0047L max |
| 3-31 | AW | ID of bearing | 0.1900 max |
| 3-31 | AX | ID of bearing bore | 2.8358 max |

*i.* Insure support is against elevation spool shoulder and alined with blade slot. Secure support with screw and lockwasher (view AC). Torque screw to 17 lb-in. (1.7 N.m).

*j.* Position clamp and block on traverse spool (view AC).

*k.* Insure clamp and block are against traverse spool shoulder and alined with blade slot. Secure clamp and block with two screws and lockwashers (view AC).

*l.* Position bearing on traverse cam (view AB).

*m.* Position traverse cam and bearing in housing (view AA).

*n.* Position traverse cam bearing cover over bearing with screw holes in cover alined with screw holes in housing (screw holes are not equally spaced) and counterbored side of screw holes facing out (view Z). Secure cover to housing with four screws and lockwashers.

*o.* Position rod end and roller in elevation arm and install pin (view Y). Stake pin at both ends.

*p.* Install spring pin (press fit) into elevation arm (view Y).

*q.* Install elevation arm stop screw and jamnut (view Y) if they have been removed. Adjust stop screw protrusion to dimension recorded during disassembly. Tighten jamnut.

*r.* Position elevation arm and pin in housing (view X).

*s.* Position traverse arm bearing on pin and insert pin into arm (view W). Stake pin and insure bearing rotates freely after staking.

*t.* Position traverse arm roller on pin and insert pin into arm (view W). Stake pin and insure roller rotates freely after staking.

*u.* Position spring and rectangular washer on traverse arm and secure with screw and lockwasher (view W).

*v.* Position traverse arm and pin in housing with bearing in traverse cam slot (view V).

*w.* Assemble traverse blade, elevation blade, and pin as shown in view U.

*x.* Position override arm between blades and engages with pin (view U). Add or remove shims as required to obtain 0.001 to 0.008 inch end play between blades and arm.

*y.* Position assembled blades in housing with blades engaged with traverse spool, traverse arm, elevation spool, and elevation arm (view T).

*z.* Aline override arm and lower blade plate pin holes with corresponding pin hole in housing and install pin (view T).

*aa.* Assemble override arm spring, retainer, and guide. Compress spring, using tool (16, table 2-1), and install 10-24x1-1/2 screw and number 10 plain washer (view S).

*ab.* Position assembled override arm spring, retainer, and guide between elevation and traverse blades (view R).

*ac.* Aline lower blade plate small hole with corresponding hole in housing and install pin (view R).

*ad.* Engage override arm spring retainer with blade pin (view R). Insert screwdriver through access hole in housing and remove screw and washer (step *aa*) from retainer (view s). Insure spring retainer is engaged with blade pin.

*ae.* Position elevation and traverse shafts in bearings and install two retaining rings and shims (view R).

*af.* Install elevation arm spring as shown in view R.

*ag.* Install elevation shaft spring as shown in view R.

*ah.* Position upper blade plate on blade plate pins (view Q).

*ai.* Install two handle shaft bearings into handle box (view P).

*aj.* Position handle box and bushing on traverse cam and install four screws and lockwashers (view O). Do not tighten screws.

*ak.* Aline handles horizontally. Hold handle box and tighten bushing screws (view N).

*al.* Move handle box to the full right and left traverse positions (stop-to-stop). (view O) Handle box must move freely without evidence of binding an equal amount right and left and return to the horizontal position when released.

*am.* Insert handle shaft through bearings (view N).

*an.* Thread rod end into handle shaft (view L and M). Adjust rod end to obtain 0.58 ± 0.02 inch from center of rod end bearing to flat surface on shaft as shown in view L.

*ao.* Secure rod end with setscrew (view L).

*ap.* Position left handle on shaft with setscrew holes alined with flats on shaft and secure with two setscrews (view L).

*aq.* Install and adjust elevation rod to obtain 1.046 ± 0.020 inch from cover mounting surface to small diameter of rod as shown in view K. Measurement to be made at cotter pin end of rod with rod inserted through rod end.

*ar.* Secure elevation rod with cotter pin (view K).

*as.* Position right handle on shaft with setscrew holes alined with flats on shaft and secure with two setscrews (view K).

*at.* Position cover on handle box and secure with two screws in lower holes (view J).

*au.* With handle in the released position, the handles are alined vertically.

*av.* Install traverse and elevation shaft bearing (press fit) into housing cover (view G).

*aw.* Position cover on housing and secure with three screws at traverse and elevation shaft end (view F). Check traverse and elevation shaft end play. End play shall be 0.002 to 0.006 inch. If not, remove cover and add or remove elevation and/or traverse shaft shims as necessary to obtain 0.002 to 0.006 inch end play (view R)

*ax.* Secure cover to housing with six screws and lockwashers (view F).

**NOTE**

The palm switch is normally closed, and the gun switch is normally open. Check marking on switch to determine position of contacts when installing.

*ay.* Insert palm and gun switch leads through handle shaft and position switches in handle as shown in view D.

*az.* Thread adjusting screw with jamnut into gun trigger (view D). Do not tighten jamnut.

*ba.* Position return spring in gun trigger (view D).

*bb.* Insert gun trigger pivot pin (13/16 inch long) into handle and position trigger on pin (view D).

*bc.* Using a multimeter to determine position of switch contacts, adjust trigger adjusting screw clockwise until trigger switch cannot be actuated when trigger is depressed. Depress trigger and turn trigger-limit setscrew counterclockwise until switch is actuated. Turn setscrew an additional one-third turn in same direction. Tighten adjusting screw jamnut.

*bd.* Thread adjusting screw with jamnut into palm switch actuation (view D). Do not tighten jamnut.

*be.* Insert palm switch actuator pivot in (11/16 inch long) into handle and position trigger on pin (view D).

*bf.* Using a multimeter to determine position of palm switch contacts, adjust actuator adjusting screw clockwise until switch cannot be actuated. Depress actuator and turn setscrew counterclockwise until switch is actuated. Turn setscrew an additional one-third turn in the same direction. Tighten adjusting screw jamnut.

*bg.* Position cover on handle and secure with two screws and lockwashers (view C).

*bh.* Repeat steps *ay* through *bg* above to assemble opposite handle.

*bi.* Using a multimeter and wiring diagram (fig 3-32), splice trigger switch leads to harness leads as follows:

(1) Insert wiring leads into connector inserts and secure with screws (view C, fig 3-30).

(2) Thread connector nuts on inserts and waterproof with molding compound (type 1 or 2, MIL-M-2404) (view B).

*bj.* Position cover on handle box and secure with four screws and lockwashers (view A).

*bk.* Position nameplate on handle box cover and secure with four drive screws (view A).

## 3-85. Mechanical Test.

*a. Test Equipment.*

(1) 24-28 vdc power supply.

(2) Multimeter.

**(3) Hydraulic fluid (MIL-H-46170(FRH)).**

**NOTE**

Refer to the applicable paragraph in this section for disassembly, inspection, assembly, and adjustment procedures unless otherwise indicated.

*b. Switches and Harness.*

(1) Using a multimeter and wiring diagram (fig 3-32), perform continuity checks to determine condition of harness, gun switches, and palm switches.

(2) Repair or replace harness if defective.

(3) Replace switch(es) if defective.

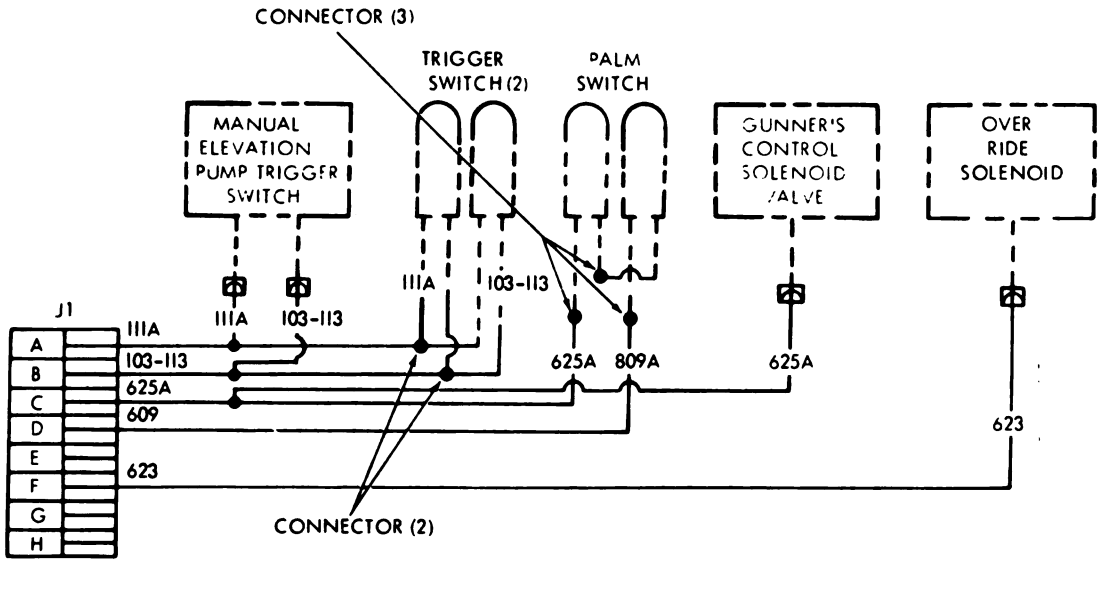



*Figure 3-32. Gunner's control electrical wiring diagram.*

*c. Power Solenoid (fig 3-32).*

(1) Connect 24-vdc power supply positive lead to pin C of harness connector (fig 3-32).

(2) Connect ground lead to solenoid mounting screw or gunner's control housing.

(3) Energize solenoid. When solenoid is energized, solenoid plunger should move inward to the energized position (fig 3-33). If not, replace solenoid.

*d. Override Solenoid (figs 3-32 and 3-33).* Perform test specified for power solenoid (3) above with power supply positive lead connected to pin F of harness connector.

*e. Handle Movement — Traversing, Elevation, and Depression Adjustment.*

**NOTE**

Refer to figures 3-27 and 3-29 unless otherwise indicated. At the first indication of a defective part within the hydraulic valve, discontinue tests and repair or replace valve assembly. If the hydraulic valve is serviceable, remove only those items necessary to permit access to the defective part(s).

(1) Move handle to the full rearward position (elevation). Travel should be approximately 30 degrees.

(2) Move handle to the full forward position (depression). Travel should be approximately 30 degrees.

(3) Adjust stop screws as necessary.

**NOTE**

Travel in the elevation and depression mode should be approximately the same. Note movement in both positions. If movement is not equal, adjustment of elevation or depression stopscrew must be made.

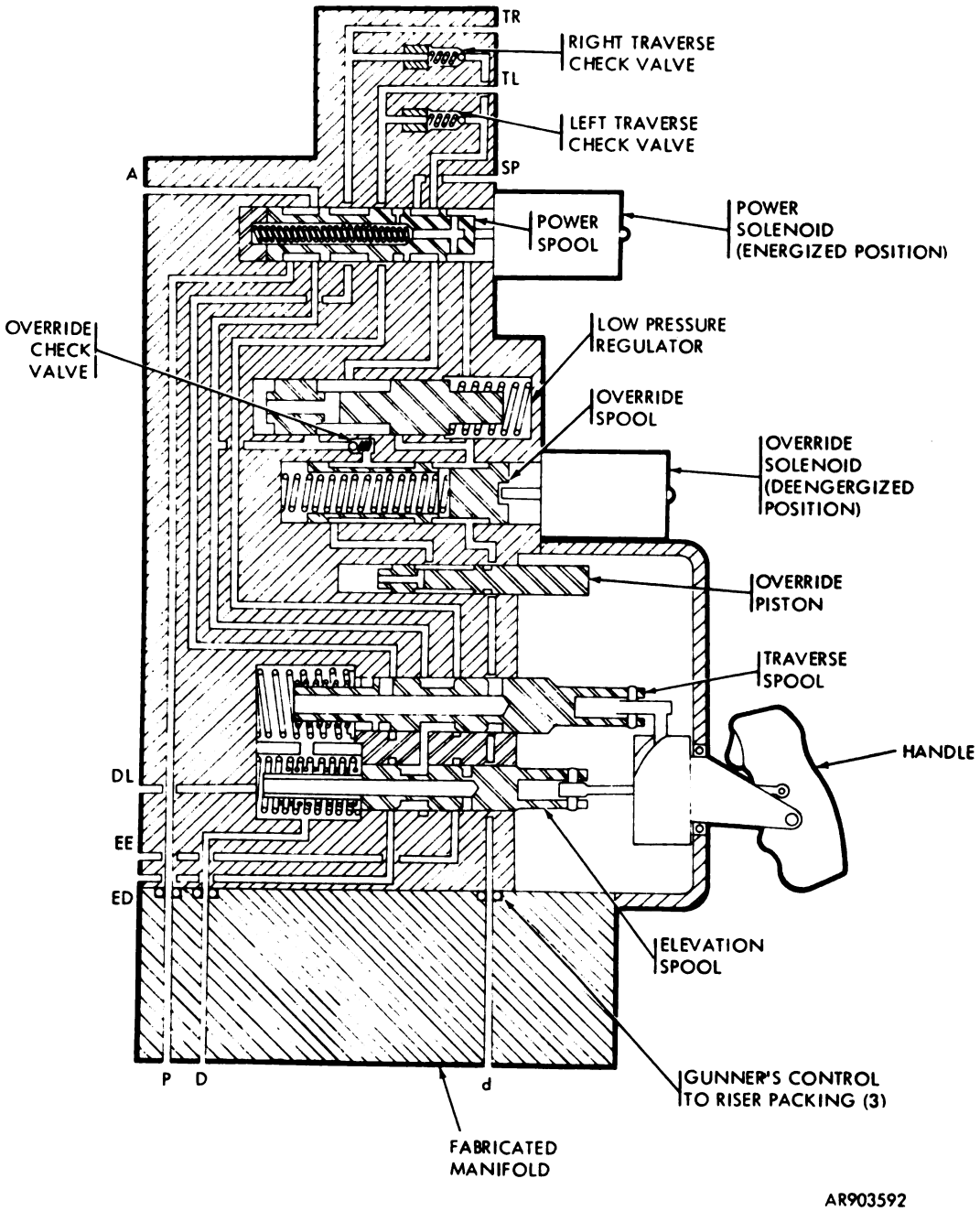



*Figure 3-33. Gunner's control hydraulic schematic diagram with test manifold installed.*

*f. Adjustment of Elevation Stopscrew (fig 3-30).*

(1) Remove four drive screws securing nameplate to handle box cover and remove nameplate (view A).

(2) Remove four screws and lockwashers securing handle box cover and remove nameplate (view A).

(3) Loosen elevation stopscrew jamnut on the underside of the handle box cover (view J).

(4) Reinstall cover on handle box and secure with four screws.

(5) Move handle to the full rearward position (elevation).

(6) Adjust stopscrew through access hole in the cover to obtain equal motion to depression.

(7) Remove four screws and remove handle box cover. Hold elevation stopscrew to prevent it from turning and tighten jamnut (view J).

(8) Reinstall and secure handle box cover with four screws and lockwashers (view A).

(9) Reinstall and secure nameplate with four drive screws.

*g. Adjustment of Depression Stopscrew.*

(1) Remove four screws and lockwashers securing cover to handle box and remove cover.

(2) Adjust stopscrew on elevation arm to obtain proper amount of depression.

(3) Reinstall and secure handle box cover with four screws and lockwashers.

*h. Coordination of Adjustments.*

(1) If movement is not equal, adjust elevation or depression stopscrew (whichever has the least movement) until movement is equal.

(2) With handles released, they should be centered horizontally. If not, handle box is improperly adjusted on cam.

(3) Move handles to full right traverse, left traverse, elevation, and depression position. There should be no evidence of binding and handles must be returned to center position in both elevation and traverse when released.

NOTE

Tilt handles right and left to insure stops are effective. Add spacers as required to obtain proper movement.

*i. Hydraulic Valve.* A sufficient quantity of hydraulic fluid (MIL-H-46170(FRH)) shall be retained in the hydraulic valve to insure proper lubrication during storage. Ports shall be covered with suitable plugs or caps.

**3-86. Installation.** Refer to TM 9-2350-258-20-2.

## Section XIV. REPAIR OF GUNNER'S HYDRAULIC CONTROL VALVE.

### 3-87. Removal (fig 3-30).

*a.* Disconnect harness leads from override and power solenoids (view AD).

*b.* Remove six screws and lockwashers securing cover to housing and remove cover (view F).

*c.* Insert 10-24 x 3-1/2 screw with number 10 washer through access hole in housing and thread into override spring guide (view Q). Tighten screw to compress spring and disengage spring guide from blade pin.

*d.* Remove upper blade plate (view Q).

*e.* Disconnect spring from blade pin and elevation shaft (view R).

*f.* Disconnect spring from blade pin and elevation arm (view R).

*g.* Remove elevation and traverse shafts from housing (view R).

*h.* Remove blade plate pin (view R) and override arm pin.

*i.* Remove assembled blades and override arm from housing (views T and U).

*j.* Remove three screws and lockwashers securing hydraulic control valve to housing and remove valve (viw AF).

### 3-88. Disassembly (fig 3-34).

**WARNING**

**Exercise care when removing solenoids. Solenoid retains spring loaded components.**

NOTE

Prior to disassembly, test must be conducted to verify that a malfunction does exist. If the unit fails to pass all tests, perform the following repair procedures. If the unit passes all tests, repair is not required.

*a.* Remove eight screws and lockwashers securing power and override solenoid to valve body, and remove solenoids and gaskets (view A). Discard gaskets. Tighten screws to 2 — 3 lb-ft (3 — 4 N.m) during assembly.

*b.* Thread 6 — 40 screw into override spool and pull spool from valve body (view B). Note position of spool when spool is removed.

*c.* Remove override spool spring (view C).

*d.* Remove three screws and lockwashers securing cover to valve body (view D). Lightly coat screws with grease (9150-291-9088) prior to installation. Torque screws to 5 — 7 lb-ft (7-9 N.m) during assembly.

*e.* Remove cover and packing from vavle body (view I). Discard packing.

*f.* Remove power spool spring and power spool from valve body (view E).

*g.* Remove two traverse check valve plugs, springs, and balls from valve body (view F). Discard springs and balls.

**WARNING**

**Traverse elevation and low pressure regulator spool covers are under spring pressure. Injury to personnel could result.**

*h.* Remove five screws and lockwashers securing cover to valve body and remove cover and gasket (view G). Tighten screws to 5 — 7 lb-ft (6.7 — 9.5 N.m) during assembly.

*i.* Remove spring from traversing spool (view G). Discard spring.

*j.* Remove spring from elevating spool (view G). Discard spring.

*k.* Remove spring from low pressure regulating spool (view G). Discard spring.

*l.* Remove packing and override piston from valve body (view H). Discard piston and packing.

*m.* Remove low pressure regulating spool, plug, and packing from valve body (view I).

NOTE

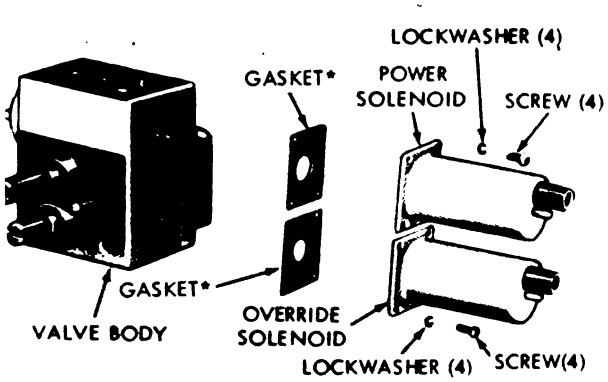
Insure slot of plug is in toward the spool during assembly

*n.* Remove packing from plug (view I). Discard packing.

*o.* Remove traversing and elevating spools from valve body (views J and K).

*p.* Remove retaining ring, retainer, centering spring, and stop from traversing spool and elevating spool (views J and K). Discard retaining rings and retainers.

*q.* Remove override check valve plug, packing, pin, spring, and ball from valve body (view L). Discard packing, springs, and balls.

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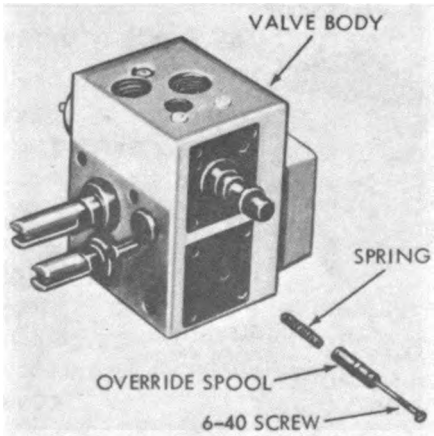


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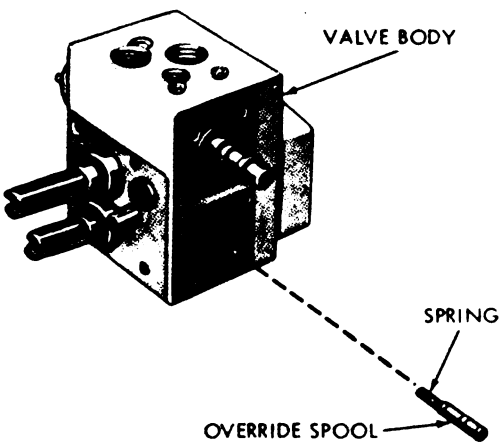


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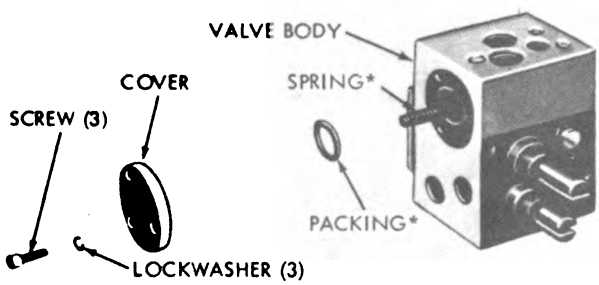


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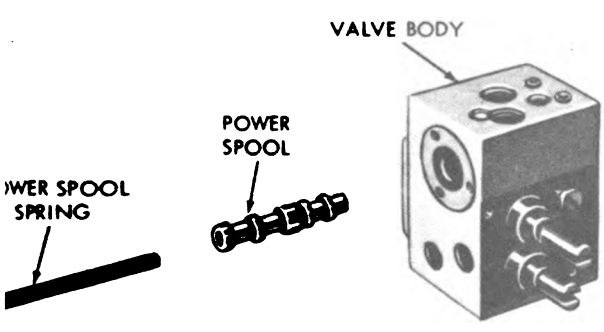


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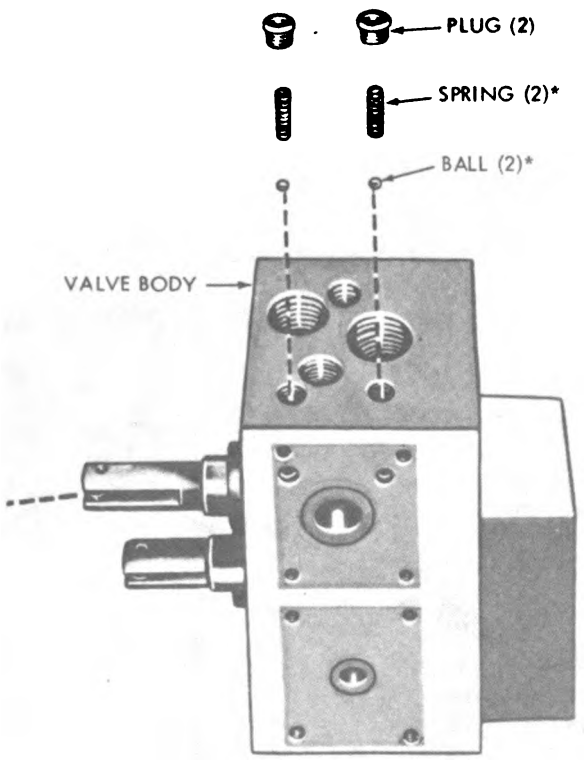


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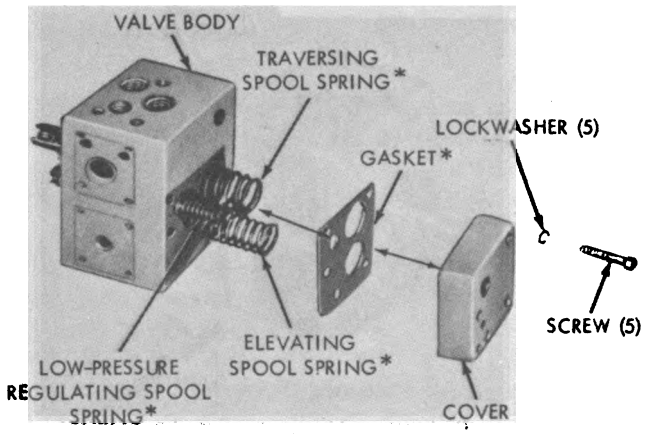
*Figure 3-34. Gunner's hydraulic control valve disassembly or assembly (1 of 2).*

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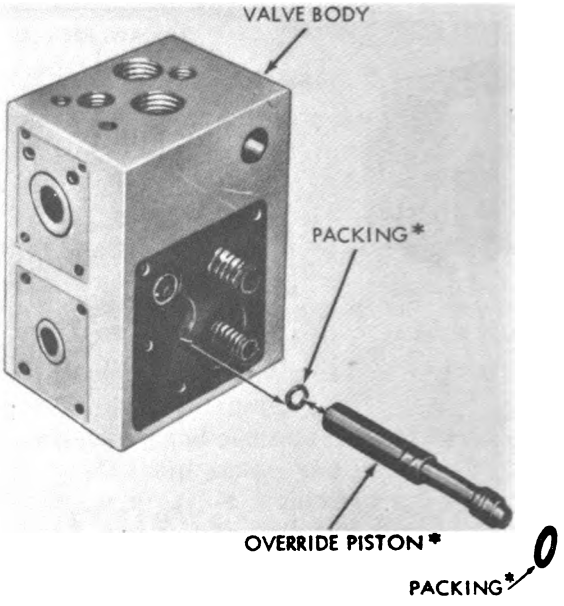


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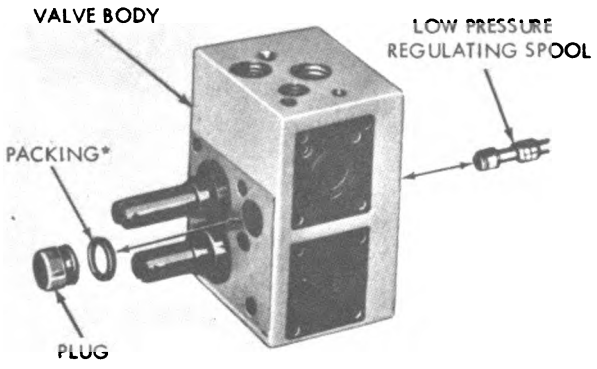


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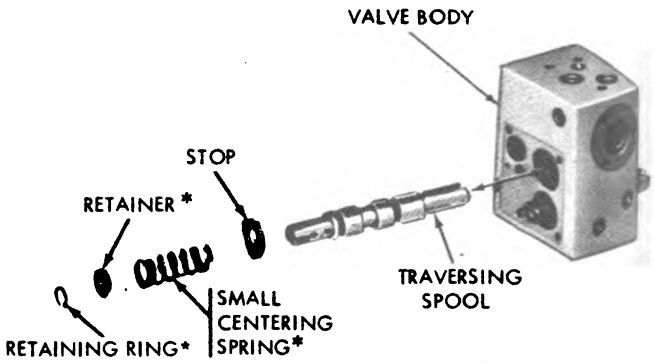


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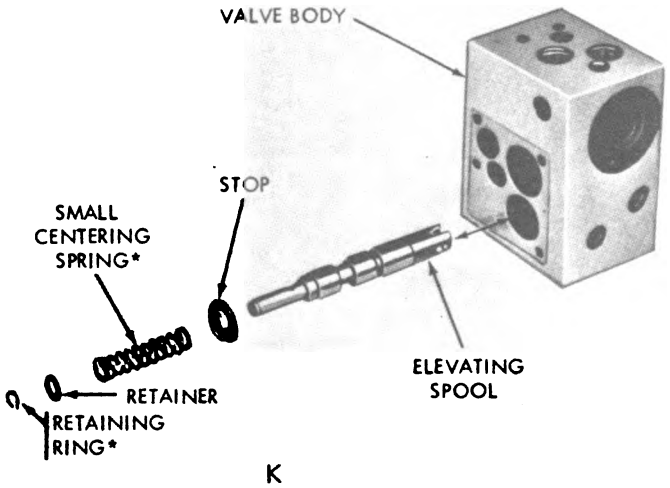


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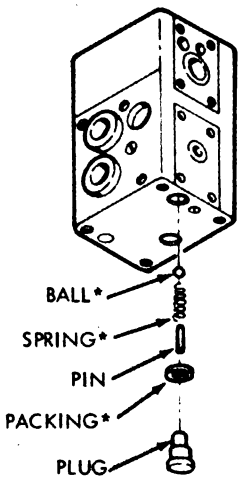


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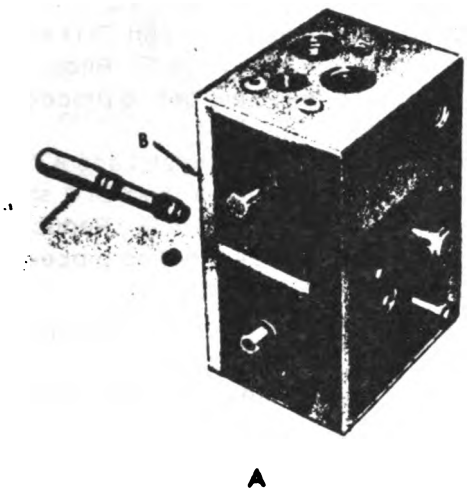
*Figure 3-34. Gunner's hydraulic control valve disassembly or assembly (2 of 2).*

**3-89. Cleaning.** Refer to paragraph 2-9.

**3-90. Inspection and Repair.**

*a.* Inspect components for wear as specified in table 3-12 and figure 3-35.

*b.* Repair or replace defective components.




**3-91. Assembly. (fig 3-34).**

*a.* Obtain hydraulic valve repair kit (TM 9-2350-258-34P-2). Use all repair parts during assembly

*b.* Use new packings, seals, O-rings, gaskets, and any other components performing a sealing function. Coat all internal components, cylinder bores, and sleeves and spools with hydraulic fluid (MIL-H-46170(FRH)) in assembly.

*c.* Assemble in reverse order of disassembly observing any torque valves or other criteria specified during disassembly. Cross-tighten screws where applicable.

*d.* Perform specified tests.

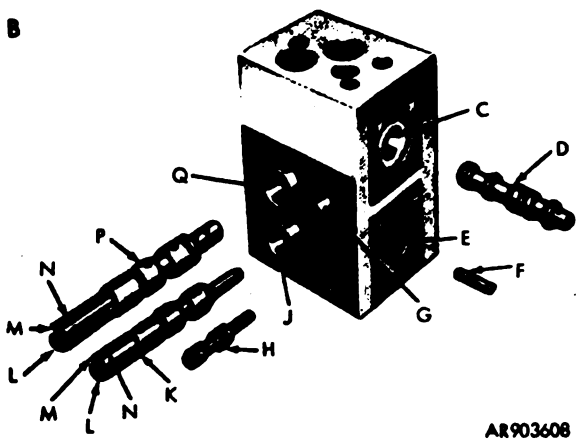



*Figure 3-35. Hydraulic control valve wear points.*

*Table 3-12. Gunner's Hydraulic Control Valve Wear Limits*

| Figure | Reference | Measurement | Wear Limit (in.) |
|---|---|---|---|
| 3-35 | A | OD of piston | 0.4975 min |
| 3-35 | B | ID of body bore | 0.501 max |
| 3-35 | A-B | Fit of piston in body | 0.0035L max |
| 3-35 | C | ID of power spool sleeve in block | 0.7505 max |
| 3-35 | D | OD of power spool | 0.7520 min |
| 3-35 | E | ID of override spool sleeve in block | 0.3755 max |
| 3-35 | G | ID of low-pressure regulating spool sleeve in block | 0.5005 max |
| 3-35 | H | OD of low-pressure regulating spool | 0.5005 min |
| 3-35 | J | ID of elevating spool sleeve in block | 0.7505 max |
| 3-35 | K | OD of elevating spool | 0.7520 min |
| 3-35 | L | OD of roller | 0.3740 |
| 3-35 | M | ID of roller | 0.1907 max |
| 3-35 | N | OD of pin | 0.1893 min |
| 3-35 | M-N | Fit of pin in roller | 0.014L max |
| 3-35 | P | OD of traversing spool | 0.8768 min |
| 3-35 | Q | ID of traversing spool sleeve in block | 0.8755 max |

## 3-92. Hydraulic Tests.

*a. Description.* The hydraulic tests of the gunner's control valve must be conducted after the mechanical and hydraulic portions of the control have been separated, and prior to disassembly of the gunner's control valve. These tests are designed to enable the following evaluations: Check internal leakage past the override spool traversing valve. Check operation of the low pressure regulator. Check leakage past the traversing and elevating spools. Check for proper operation of the override piston. The tests must be reconducted after assembling the valve to verify that any above malfunction has been corrected.

(1) Insure that the M3 hydraulic pump and fluid used to perform the hydraulic tests are clean and free of contamination. Prior to conducting the tests, fill the specified valve body or manifold port with hydraulic fluid. Bleed the test fixture line to purge the system of air.

(2) Ports in the valve body are identified by letters stamped on the body. Refer to figure 3-33 for identification of the manifold ports.

(3) The power and override solenoids may be operated manually by depressing the plunger located in the end of each solenoid.

*b. Test (figs 3-36 and 3-37).*

(1) Assemble fabricated test manifold (14, table 2-1) to hydraulic valve and fixture (15, table 2-1 fig 3-36).

(2) With both solenoids deenergized and port SP capped, apply 925±25 psi to port P (view A). Leakage at port A and port D(1) should not exceed 2.0 ml per minute at each port. There should be no leakage at all other ports and no external leakage.

(3) With power solenoid energized and ports TR, TL, A, SP and DL capped, apply 925±25 psi to port P (view B). Leakage from EE, Ed, and D(1) (view B) should not exceed 2.0 ml per minute at each port. Leakage at port D(2) should not exceed 3.0 ml per minute. There should be no external leakage.

(4) With power solenoid energized, ports TR, TL, and A capped, and a pressure gage installed at port SP, apply 925±25 psi at port P (view C). Pressure at port SP shall be 125±25 psi. Reduce M3 hydraulic pump pressure to zero before proceediing to step (5).

(5) Remove all caps and pressure gage with power solenoid energized and 925±25 psi applied to port TR, leakage at port D(1) should not exceed 2.0 ml per minute (view D). Reduce M3 hydraulic pump pressure to zero before proceeding to step (6).

(6) With power solenoid energized and 925±25 psi applied to port TL, leakage at port D(1) should not exceed 2.0 ml per minute (view E). Reduce M3 hydraulic pump pressure to zero before proceeding to step (7).

(7) With power solenoid energized and 925±25 psi applied to port ED, leakage at port D(1) should not exceed 1.5 ml per minute (view F). Reduce M3 hydraulic pump pressure to zero before proceeding to step (8).

(8) With power solenoid energized and 925±25 psi applied to port EE, leakage at port D(1) should not exceed 1.5 ml per minute (view G). Reduce M3 hydraulic pump pressure to zero before proceeding to step (9)

(9) Remove test fixture (14, table 2-1) installed in step (1) above.

(10) Assemble test fixture (14 and 15, table 2-1).

**WARNING**

**Plug is under spring pressure. Care should be exercised when removing plug to prevent injury to personnel.**

(11) Remove plug from valve body (view I, fig 3-34). If plug cannot easily be removed, place a rag over plug port and slowly pressurize system. Plug will be forced from port.

(12) Install assembled test fixture and adapter (17, table 2-1) as shown in view C, fig 3-37.

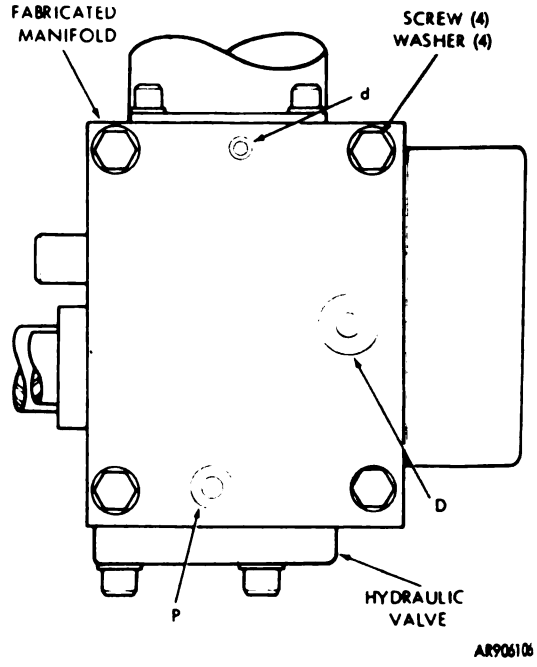



*Figure 3-36. Gunner's hydraulic control valve with test manifold installed (1 of 2).*

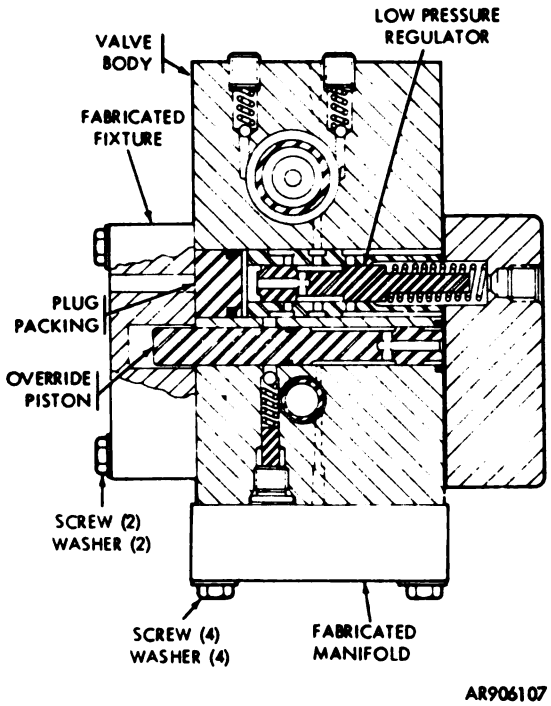



*Figure 3-36. Gunner's hydraulic control valve with test manifold installed (2 of 2).*

(13) With power and override solenoids energized and port A capped. apply 925±25 psi at port P (view H). Override piston should extend from valve body. and there should be no leakage past the override piston. Remove pressure from port P.

(14) With power solenoid energized and ports A and SP capped. apply 925±25 psi to port P (view I). Leakage at ports TL and TR should not exceed 2.0 ml per minute at each port. Remove pressure from port P.

(15) Remove test equipment from valve.

(16) Install plug and packing (view I, fig 3-34).

**(17) A sufficient quantity of hydraulic fluid (MIL-H-46170(FRH)) shall be retained in the hydraulic valve to insure proper lubrication during storage. All ports shall be covered with suitable plugs or caps.**

(18) Repeat steps *a* through *ak* of paragraph 3-84 to reconnect control valve to handle box. Do not reinstall cover at this time.

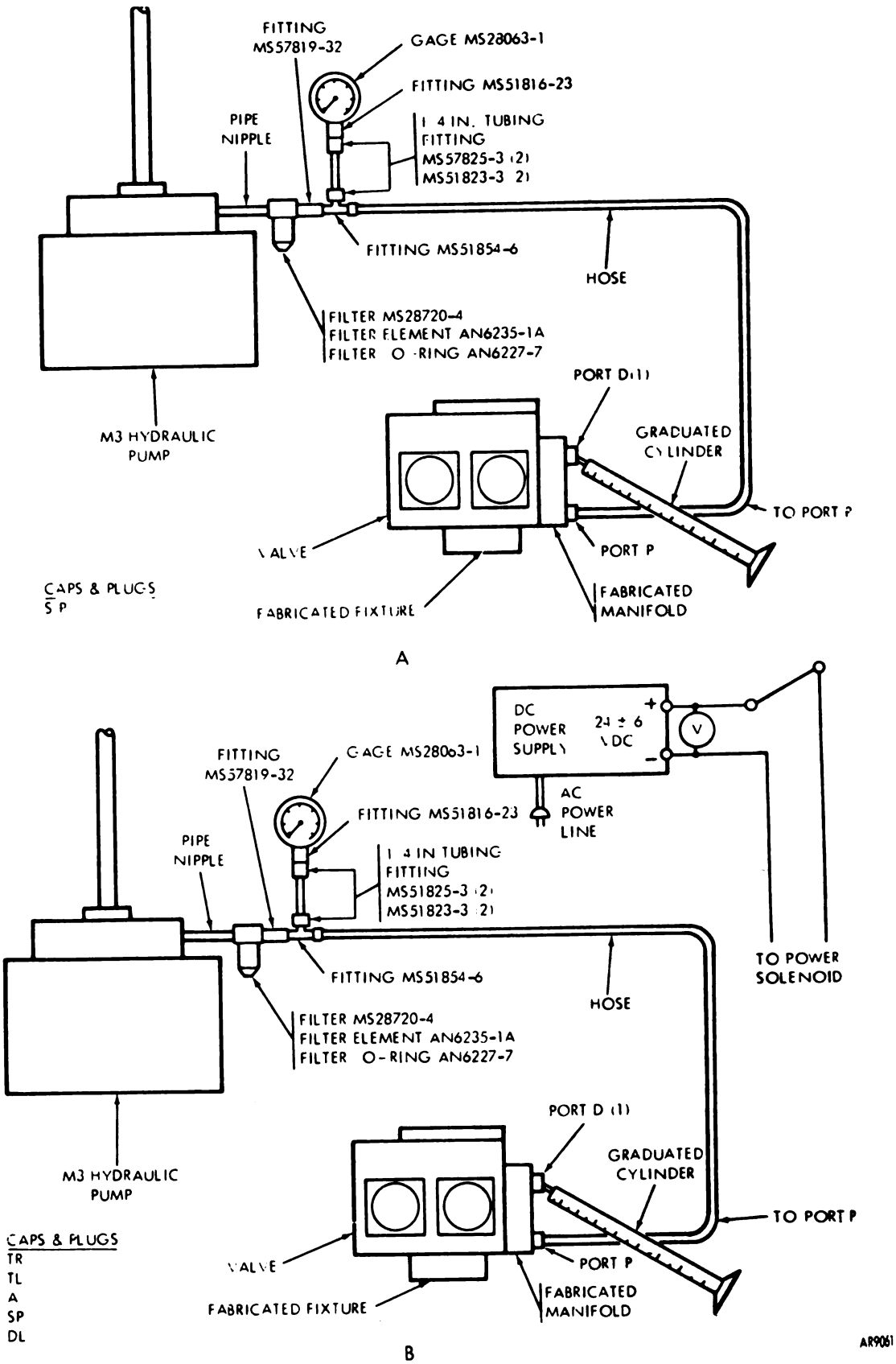
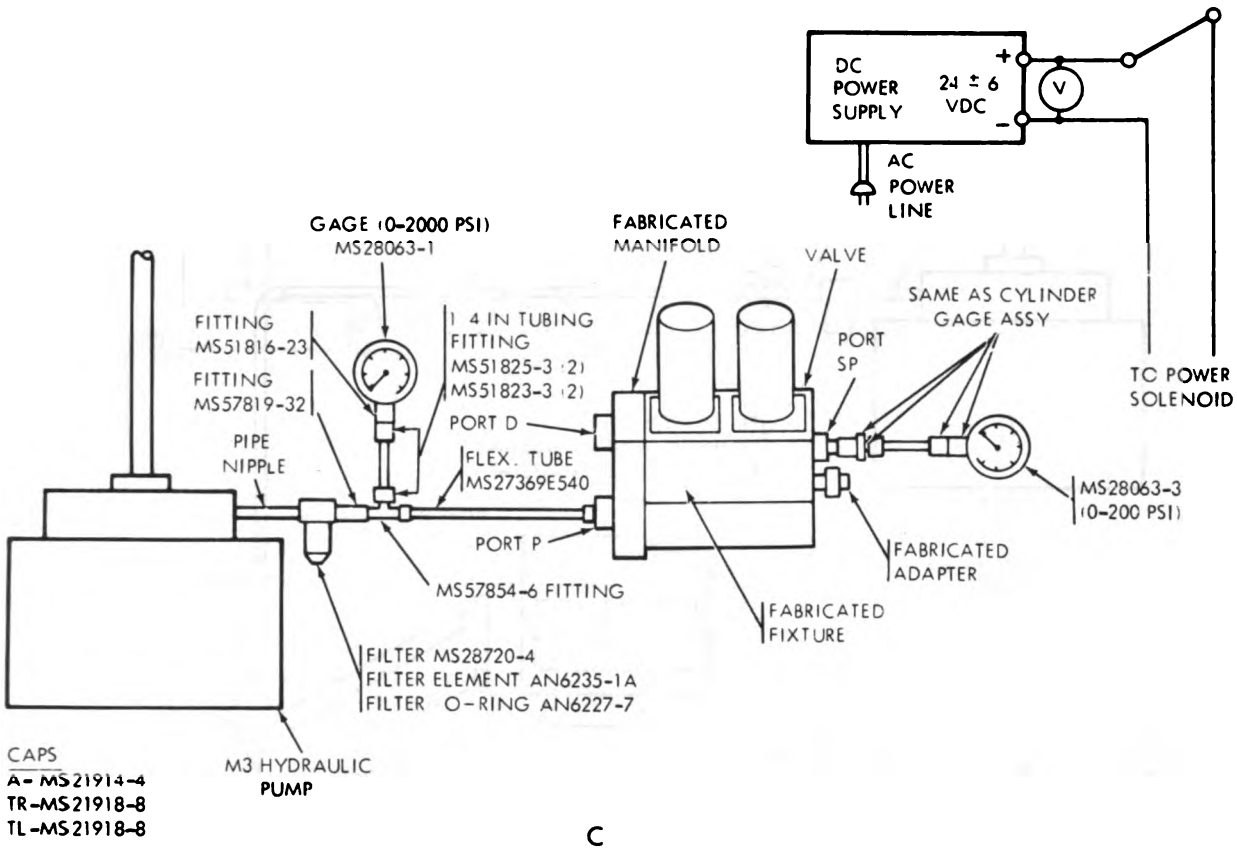



*Figure 3-37 Gunner's hydraulic control valve test (1 of 5)*

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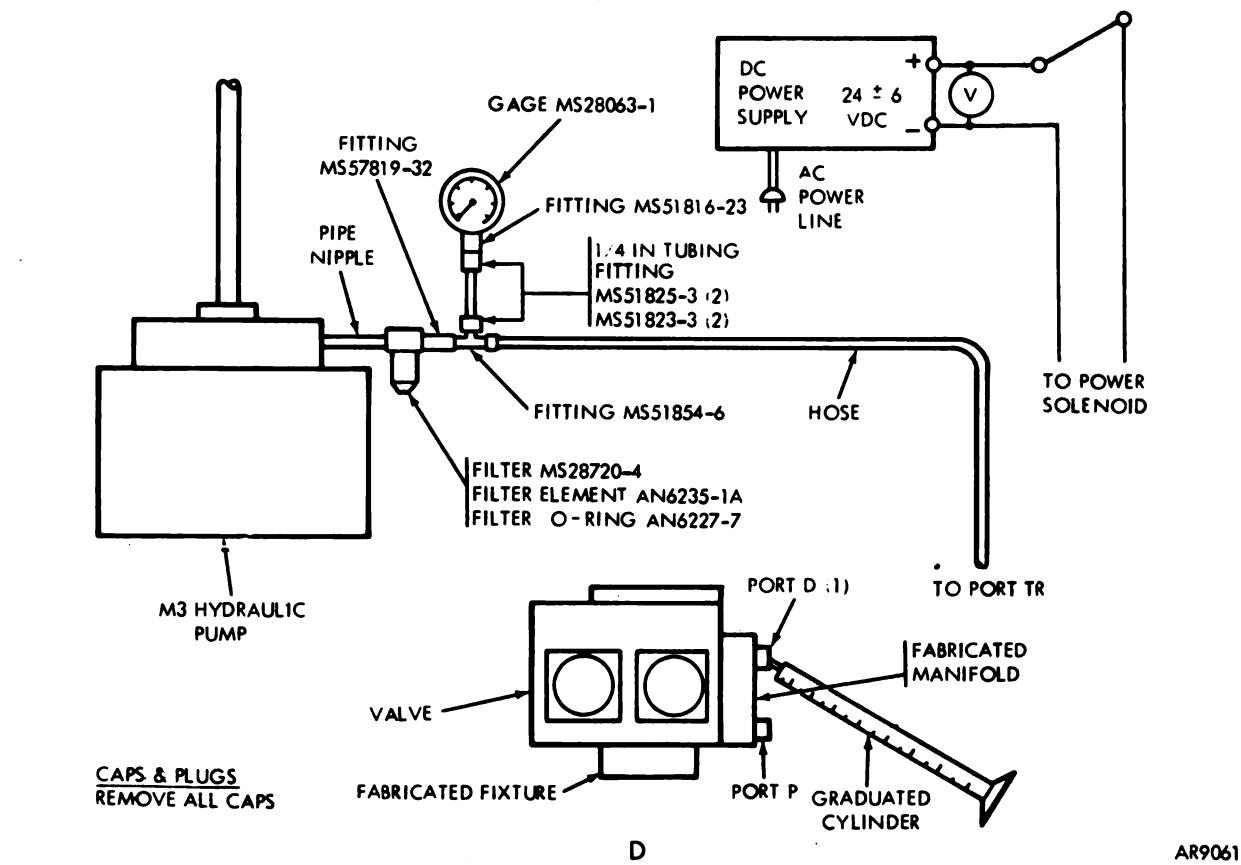


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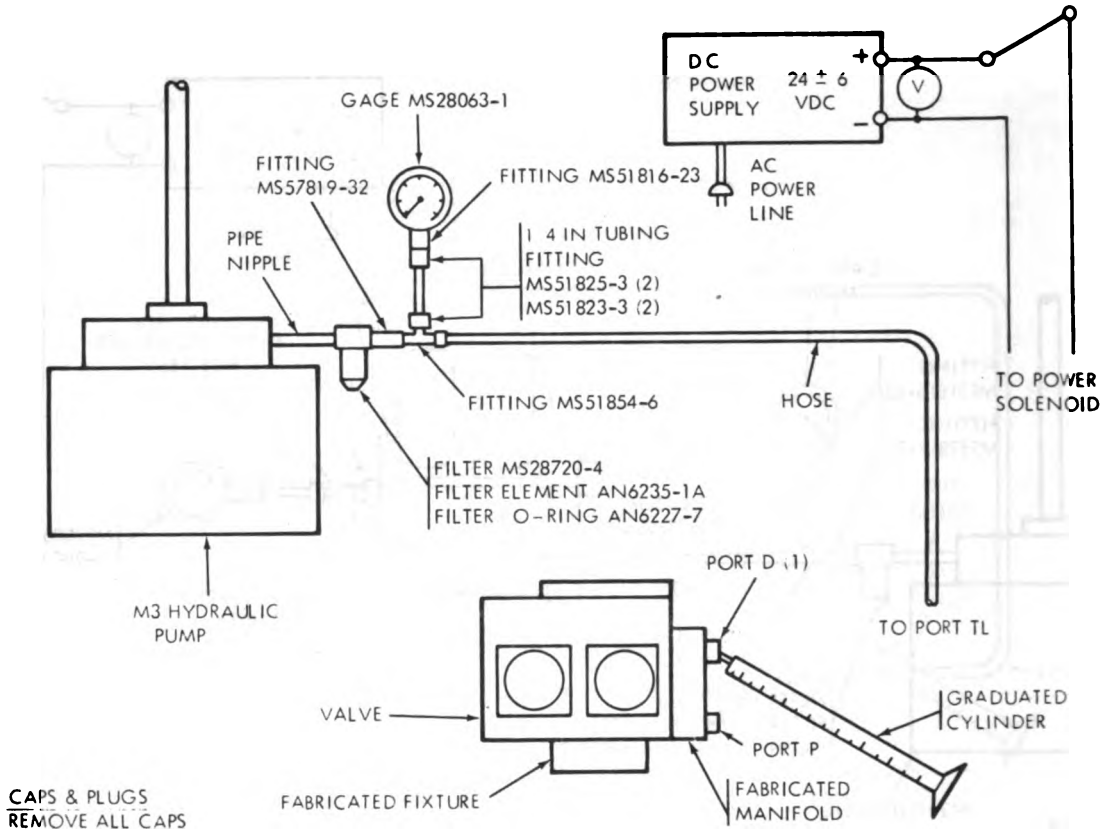
*Figure 3-37. Gunner's hydraulic control valve test (2 of 5).*

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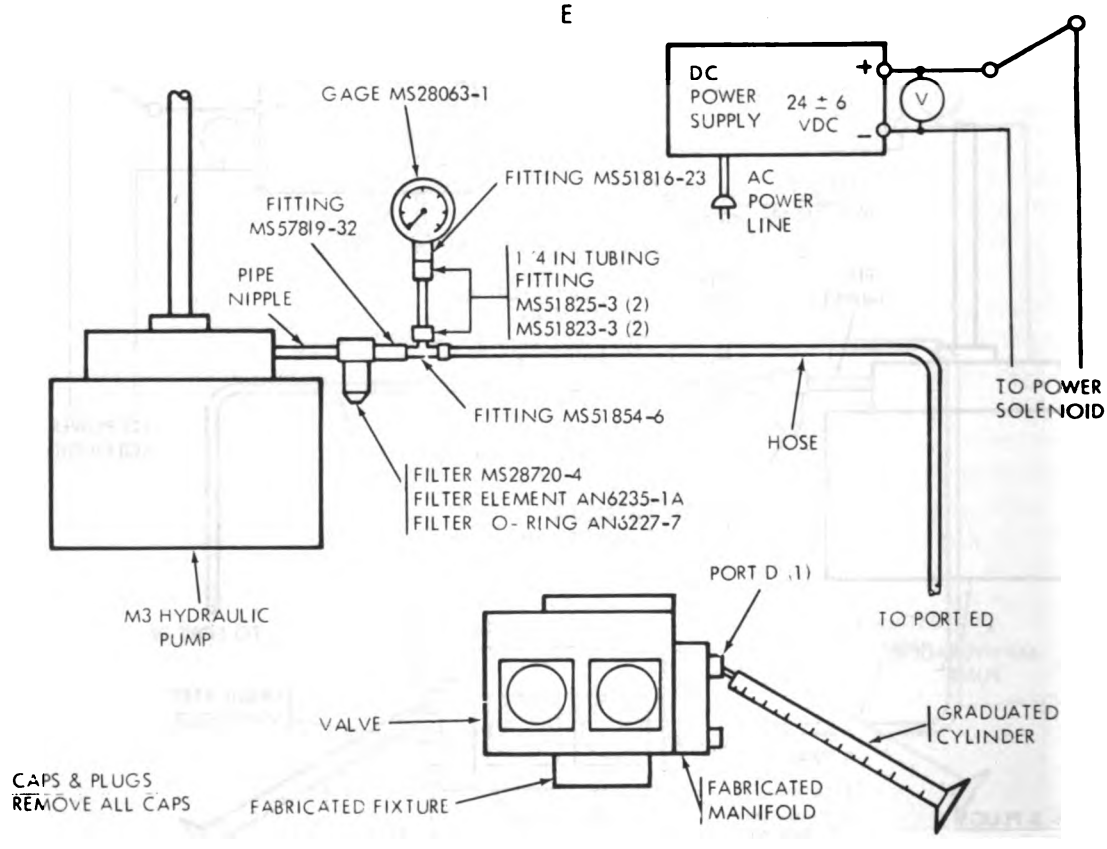


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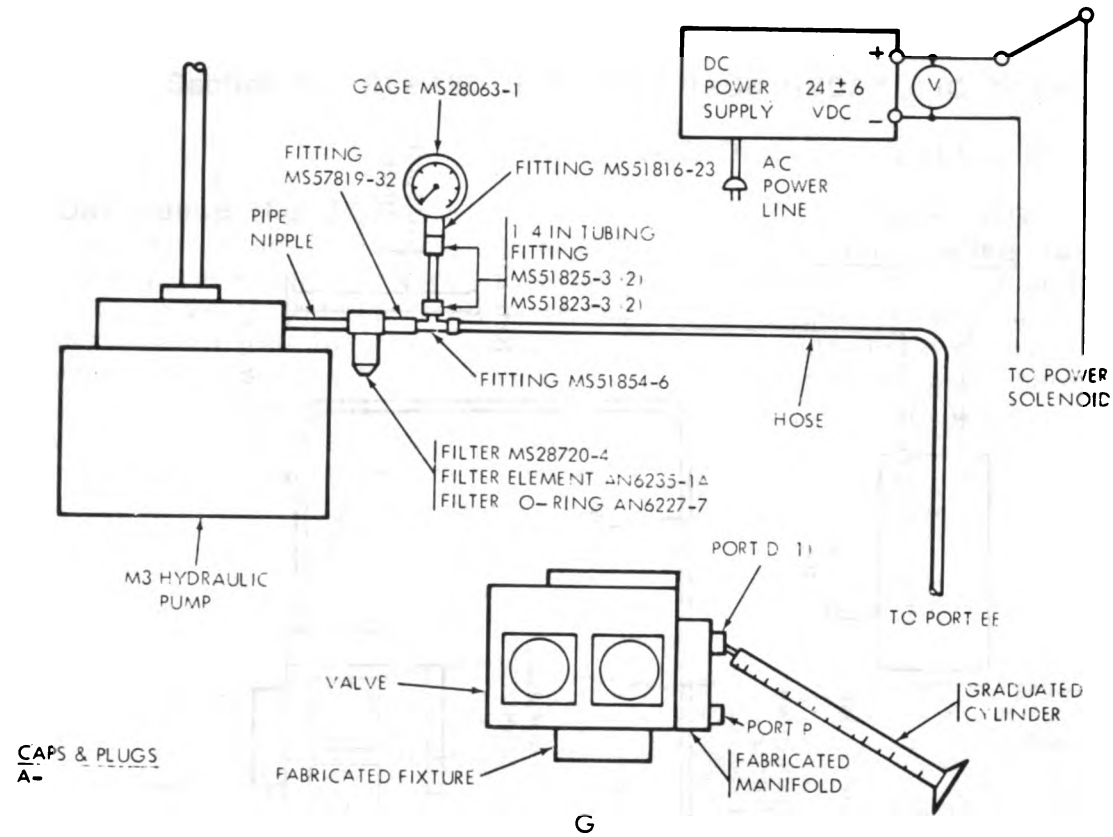
***Figure 3-37. Gunner's hydraulic control valve test (3 of 5).***

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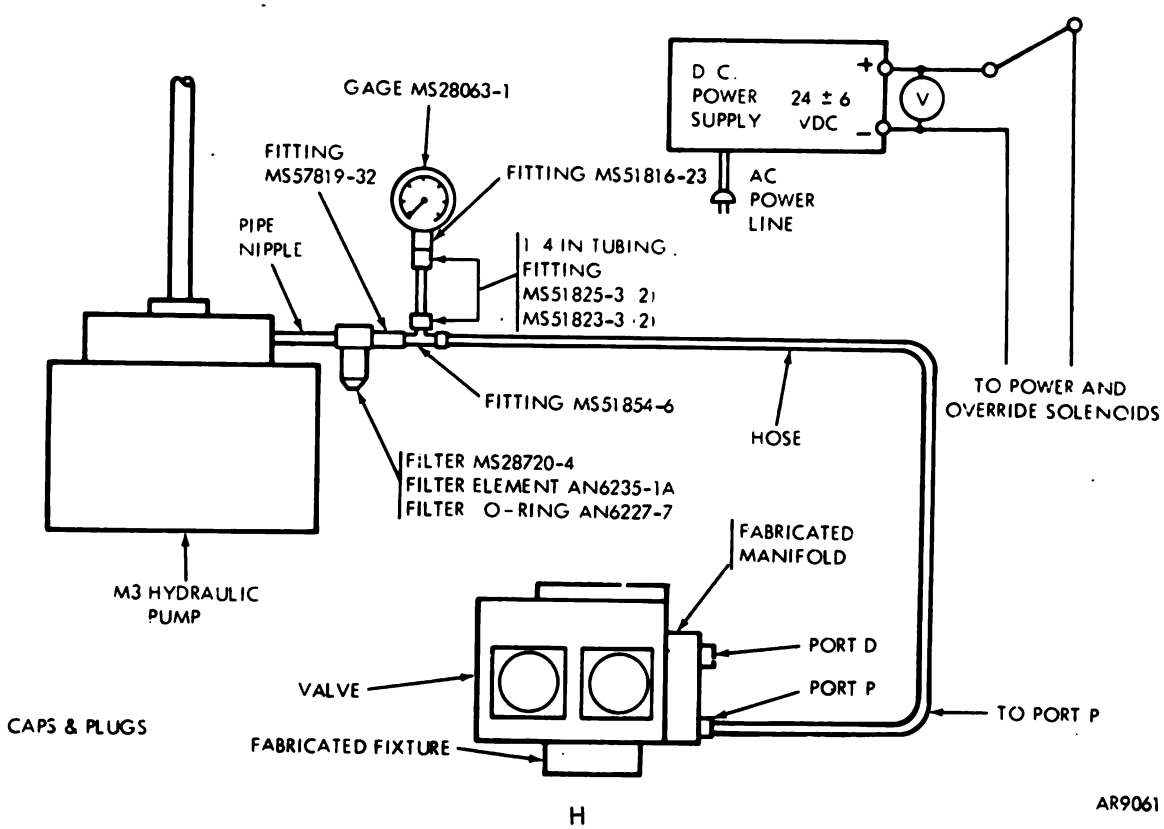


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***Figure 3-37. Gunner's hydraulic control valve test (4 of 5).***

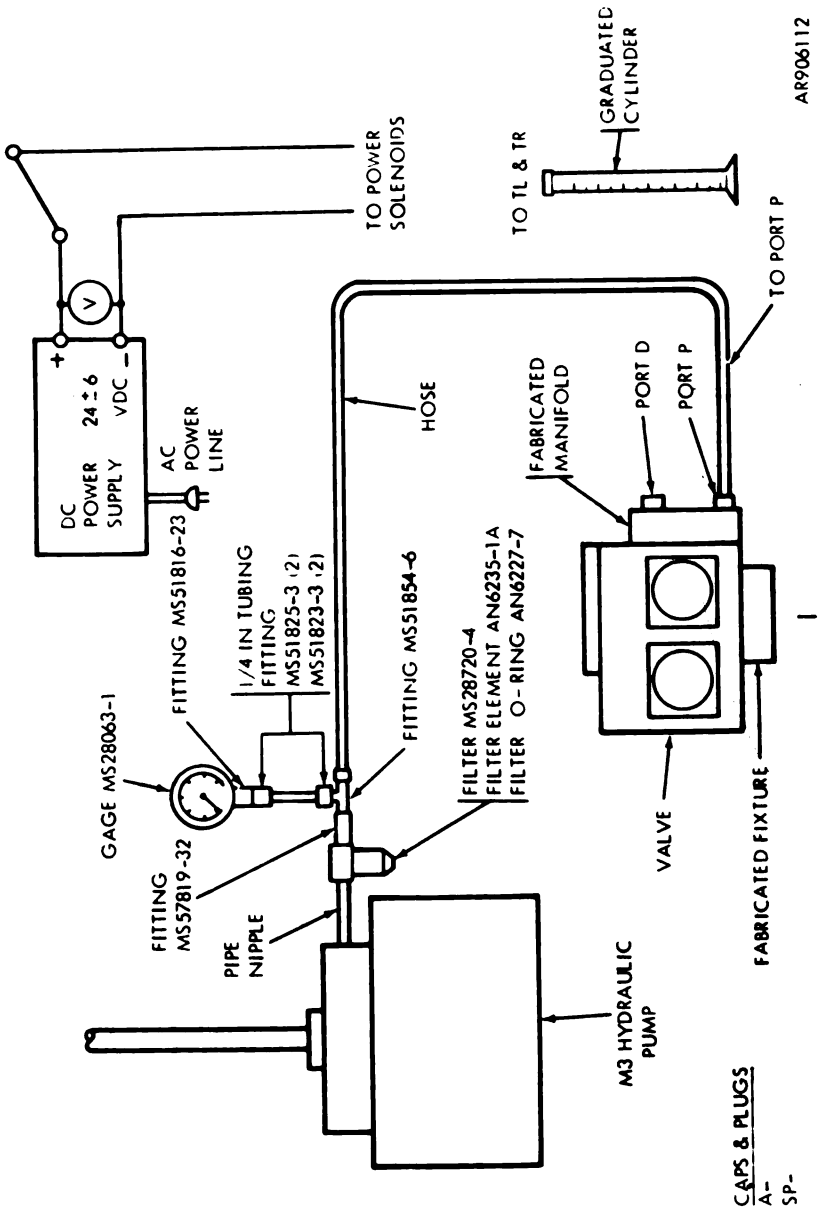



*Figure 3-37. Gunner's hydraulic control valve test (5 of 5).*

**3-93. Installation.** Install in reverse order of removal.

## Section XV. REPAIR OF POWER PACK HYDRAULIC RISER

**3-94. Description (fig 3-38).** The hydraulic riser is positioned between the power pack reservoir and the gunner's control. It directs hydraulic fluid to various valves and houses the pressure regulating valve (fig 3-38). The pressure regulating valve keeps available pressure fluid constant as accumulator pressure changes. It regulates the accumulator pressure within the range of 925 to 1,225 psi into regulated pressure fluid at a constant pressure of 900 psi. The valve is spring loaded in the open position. As fluid enters the valve from the main accumulator, it flows through the valve until pressure builds up and forces the pressure regulating spool back against the spring where it shuts off fluid flow at 900 psi. As fluid flows through the system and pressure drops, the spring opens the valve and permits flow. A snubber cup and a light followup spring dampen rapid oscillations of the valve, which would cause erratic and noisy operation.

**3-95. Removal.** Refer to paragraph 2-28.

**3-96. Disassembly (fig 3-39.**

**WARNING**

**Use care when removing riser covers. Springs under cover are under tension. Injury to personnel could result if spring compression is not released slowly.**

*a.* Remove four screws and lockwashers securing cover to riser and remove cover and gasket (view A). Discard gasket. Tighten screws to 5 — 7 lb-ft (7 — 9 N.m) during installation.

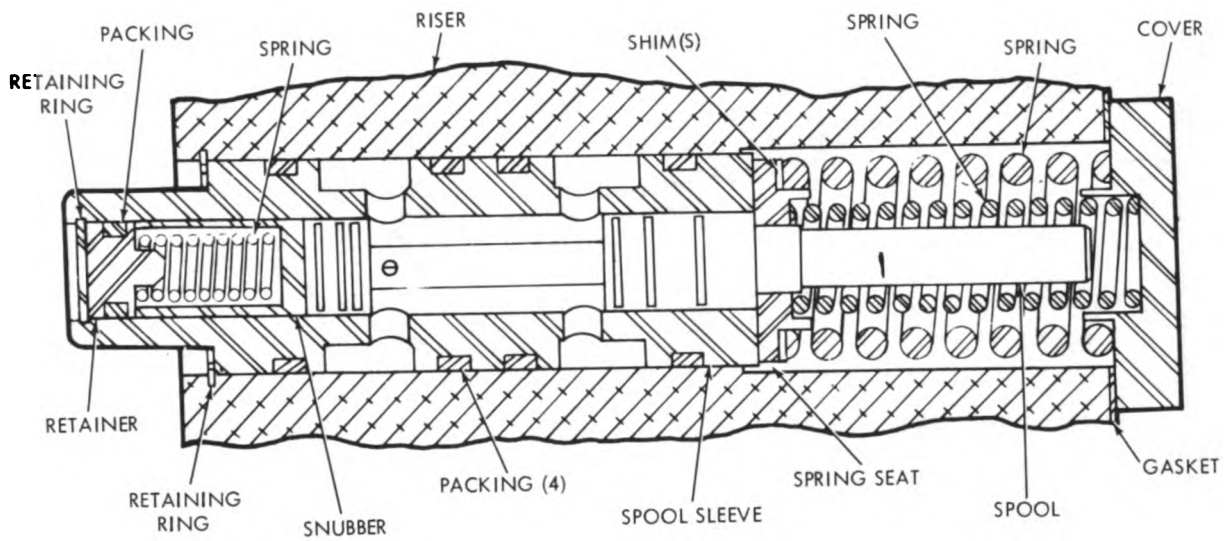



*Figure 3-38. Power pack hydraulic riser pressure regulating valve-sectional view.*

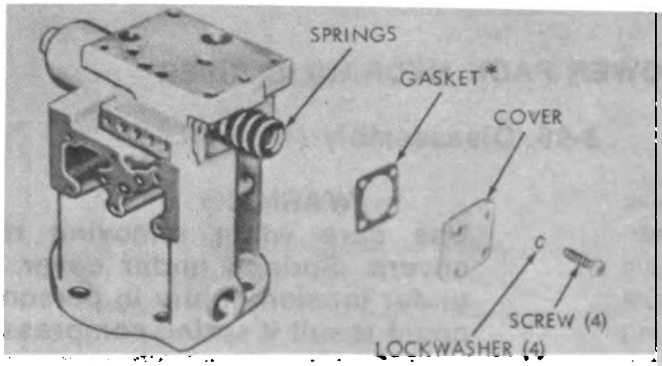
*b.* Remove two springs and spool from riser (view B and C).

*c.* Remove shim(s) and spring seat from spool (view C).

*d.* Remove retaining ring from sleeve and remove spring retainer with packing compression spring, snubber, and spool (view D).

*e.* Remove packing from retainer (view D). Discard packing.

*f.* Remove four packings from sleeve (view E). Discard packing.

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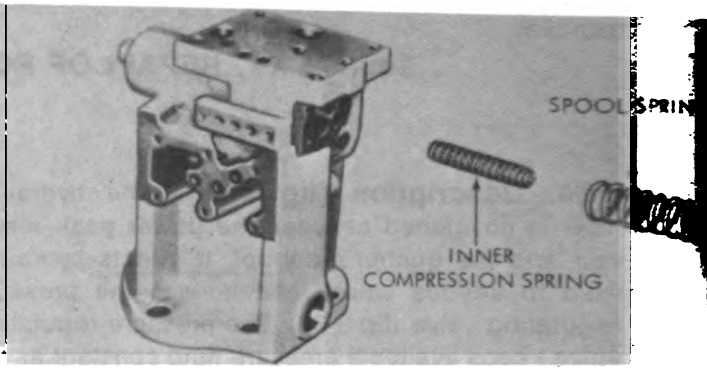


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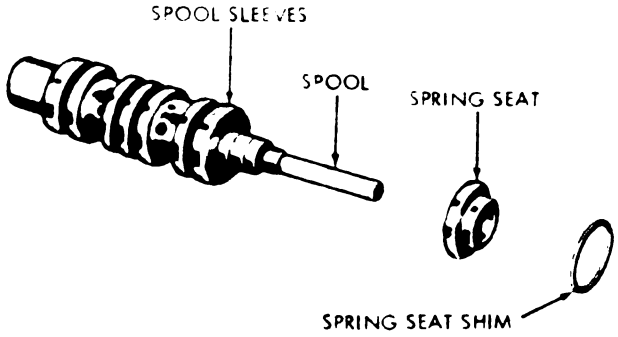


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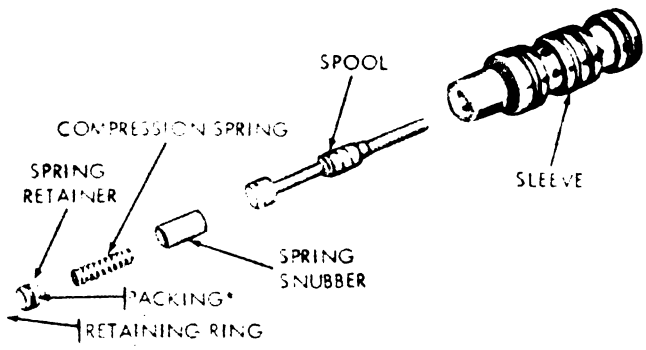


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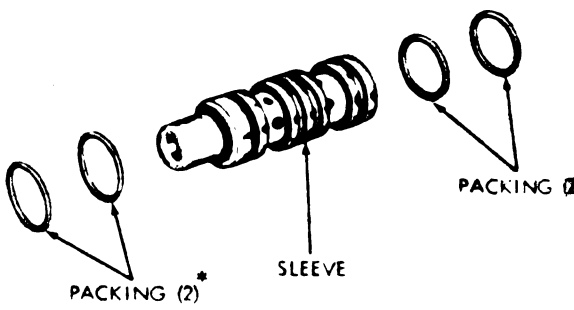


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*Figure 3-39. Power pack hydraulic riser disassembly or assembly.*

**3-97. Cleaning.** Refer to paragraph 2-9.

**3-98. Inspection and Repair (fig 3-40).**

*a.* Inspect components for damage or wear as specified in table 3-13.

*b.* Repair or replace defective components.

*Table 3-13. Power Pack Hydraulic Riser Pressure Regulating Valve Wear Limits*

| Figure | Reference | Measurement | Wear Limit (in.) |
|---|---|---|---|
| 3-40 | A | Spring: Free length | 2.8550 min |
| 3-40 | B | Spring: Free length | 2.0040 min |
| 3-40 | C | OD of spool | 0.5623 min |
| 3-40 | D | ID of spool sleeve | 0.5620 max |
| 3-40 | E | Spring: Free length | 1.3860 min |

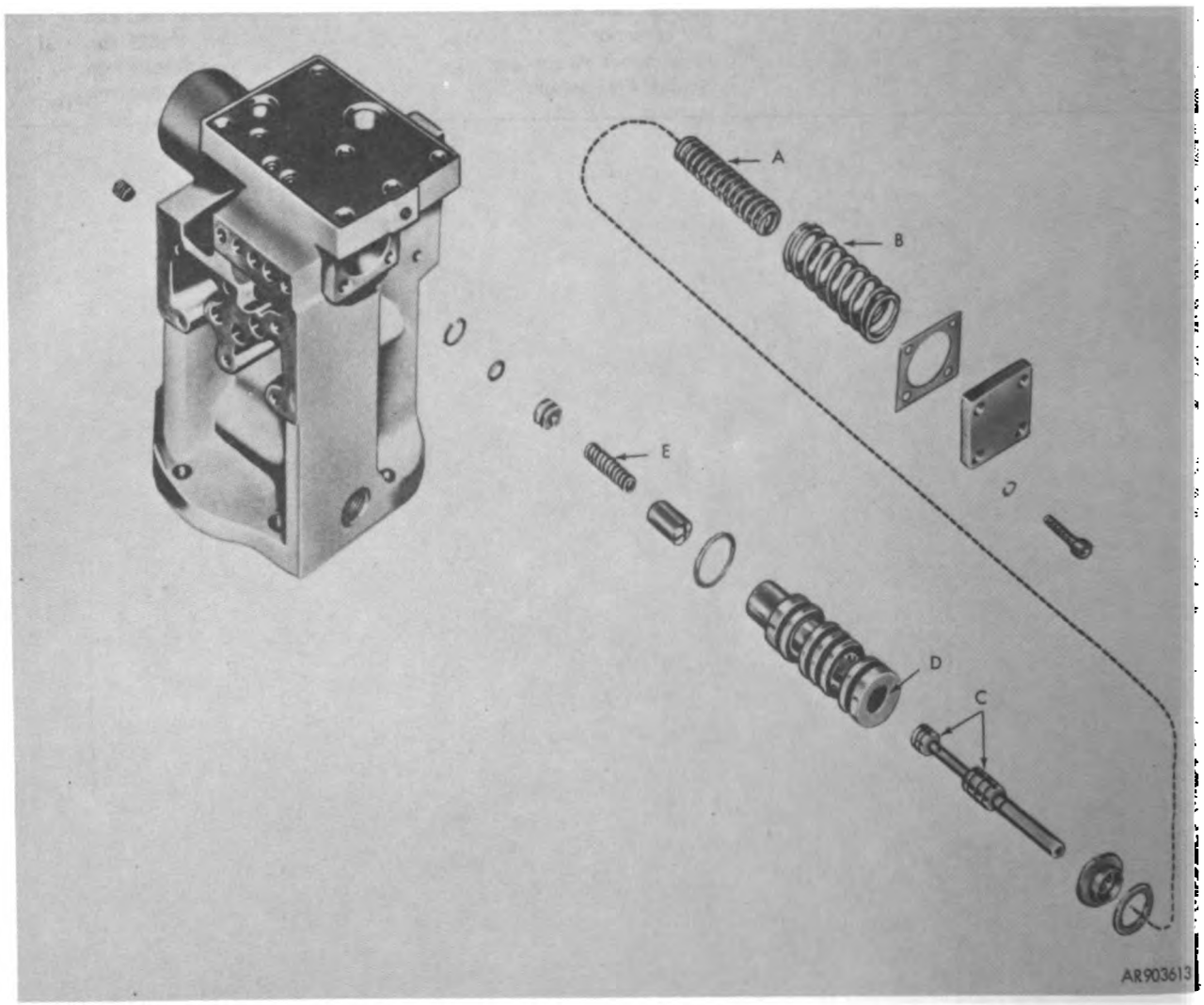



*Figure 3-40. Power pack hydraulic riser pressure regulating valve wear points.*

## 3-99. Assembly (fig 3-39).

*a.* Use new packings, seals, O-rings, gaskets, and any other components performing a sealing function. Coat all internal components, cylinder bores, and sleeves and spools with hydraulic fluid (MIL-H-46170(FRH)) in assembly.

*b.* Assemble in reverse order of disassembly, observing any torque values or other criteria specified during disassembly (para 3-96). Cross-tighten screws where applicable.

## 3-100. Test and Adjustment.

*a.* Install top and bottom riser testing manifolds (10 and 11, table 2-1) and hydraulic system pressure gage and fitting (TM 9-2350-258-34P-2) to riser (fig 3-41).

**NOTE**

Bleed air at gage fitting. Tighten only enough to allow a slight leakage at fitting, to allow regulator to operate.

*b.* Apply 1,200 psi pressure using M3 hydraulic pump.

**WARNING**

**Reduce hydraulic system pressure to zero before removing riser cover and springs. Use care when removing riser cover. Springs under cover are under tension. Injury to personnel could result if spring compression is not released slowly.**

*c.* If gage attached to port A of riser indicates available pressure less than 900 psi, add shim(s) to spring seat of riser pressure regulating valve (fig 3-41) until available pressure is 900 to 950 psi.

*d.* After 900 to 950 psi is obtained, reduce hydraulic system pressure to zero. Remove manifolds and gage.

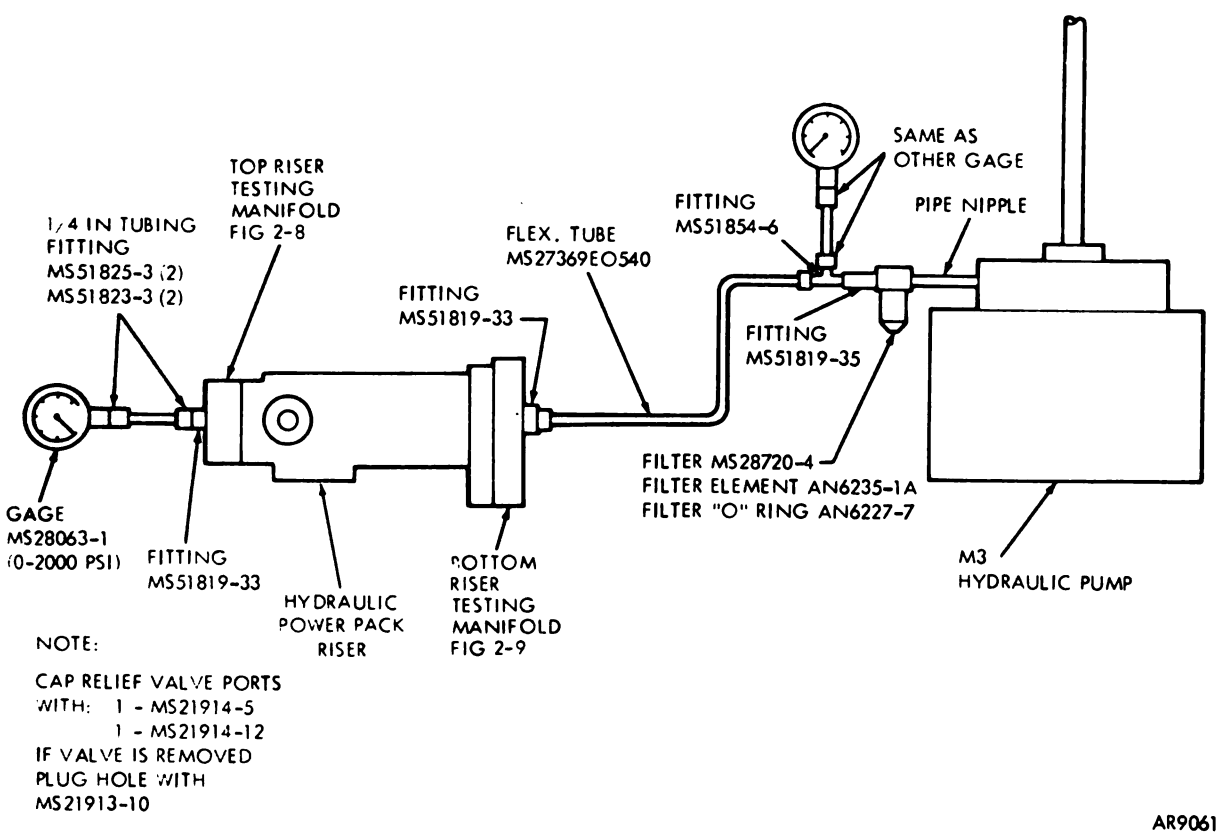



*Figure 3-41. Power pack hydraulic riser test.*

**3-101. Installation.** Refer to paragraph 2-28.

## Section XVI. REPAIR OF POWER PACK FILTER

**3-102. Description.** The power pack filter is located in the power pack reservoir and is connected to the hydraulic pump and riser. The filter contains a check valve to prevent high-pressure fluid from returning to the reservoir after the pump has stopped. a relief valve to bypass the filter element if clogged. and a 40-micron filter element.

**3-103. Removal.** Refer to paragraph 2-30.

**3-104. Disassembly (fig 3-42).**

NOTE

Prior to disassembly. tests must be conducted to verify that a malfunction does exist If the unit fails to pass all tests. perform the following repair procedures. If the unit passes all tests. repair is not required

*a.* Remove retaining ring securing filter element in filter body and remove element (view A).

*b.* Deleted.

*c.* Remove packing from upper cap (view B). Discard packing.

*d.* Remove retaining ring securing lower cap in filter body and remove cap (view C).

*e.* Remove packing from cap (view C). Discard packing.

*f.* Remove two screws and lockwashers securing ball guide retainer to lower cap and remove retainer, spring, guide, and ball from cap (view C).

**3-105. Cleaning.**

*a.* Clean with drycleaning solvent (P-D-680).

*b.* Dry with compressed air.

**3-106. Inspection and Repair.** Refer to paragraph 2-9.

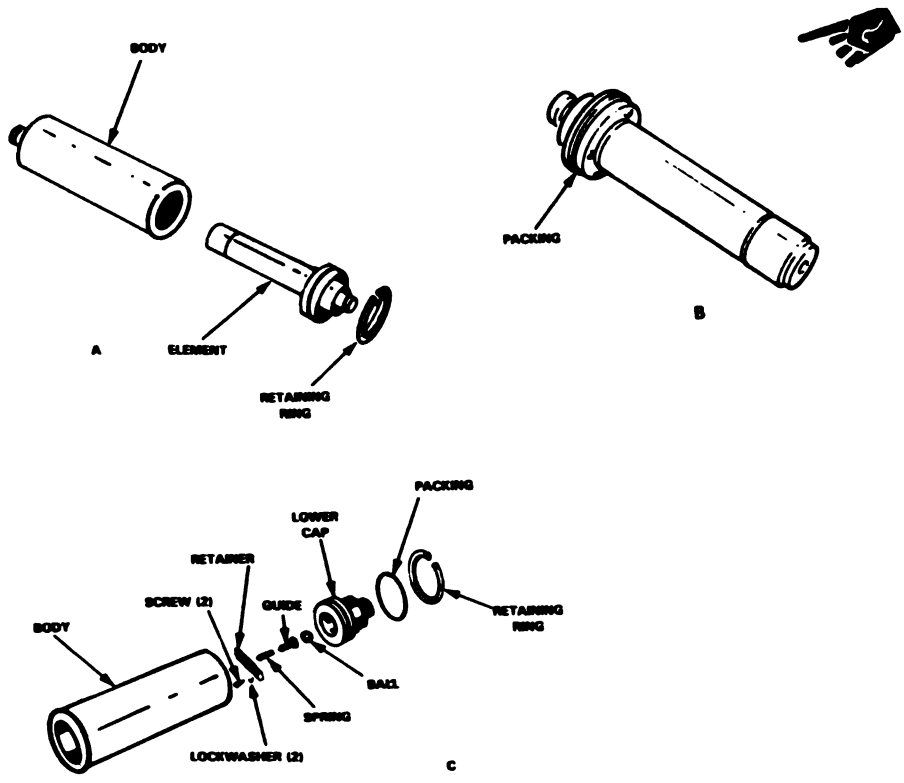



*Figure 3-42. Power pack filter disassembly or assembly.*

## 3-107. Assembly (fig 3-42).

*a.* Use new packings and gaskets.

*b.* **Coat all internal components, cylinder bores, sleeves, and spools with hydraulic fluid (MIL-H-46170(FRH)).**

*c.* Install two new packings, one on each end of filter (views B and C). Install filter in reservoir.

*d.* Position new gasket on reservoir (view A, fig 3-43).

## 3-108. Adjustment (fig 3-43).

**CAUTION**

**Insure M3 hydraulic pump and fluid used to adjust filter are clean and free of contamination.**

*a.* Install fixture (4, table 2-1) on reservoir filter assembly (view B).

*b.* Connect the M3 hydraulic pump and pressure gage to fixture (view B).

*c.* Operate pump until pressure gage indicates 100 psi.

*d.* Use a depth gage and measure distance from top of fixture shoulder (view B). Subtract thickness of fixture from depth gage reading. The difference should be 0.010 inch to 0.020 inch. Add or subtract shims to obtain the proper reading.

## 3-109. Leakage Test (fig 3-44).

**NOTE**

Tests must be conducted after completion of the repair procedure to verify that any malfunction has been corrected

**CAUTION**

**Insure M3 hydraulic pump and fluid used to perform tests are clean and free of contamination.**

*a.* Position new gasket on reservoir (view A, fig 3-43).

*b.* Install fixture (4, table 2-1), M3 hydraulic pump and pressure gage (fig 3-44).

*c.* Operate pump until gage indicates 1,250 psi. Close shutoff valve on pump.

*d.* Pressure reading must remain constant for 10 minutes. If pressure drops, disassemble filter and inspect components for defects. Replace defective parts and repeat test.

**WARNING**

**Pressure must be removed from reservoir before removing fixture.**

*e.* Open bleeder valve on M3 hydraulic pump and reduce pressure to 0 psi.

*f.* Remove fixture from reservoir.

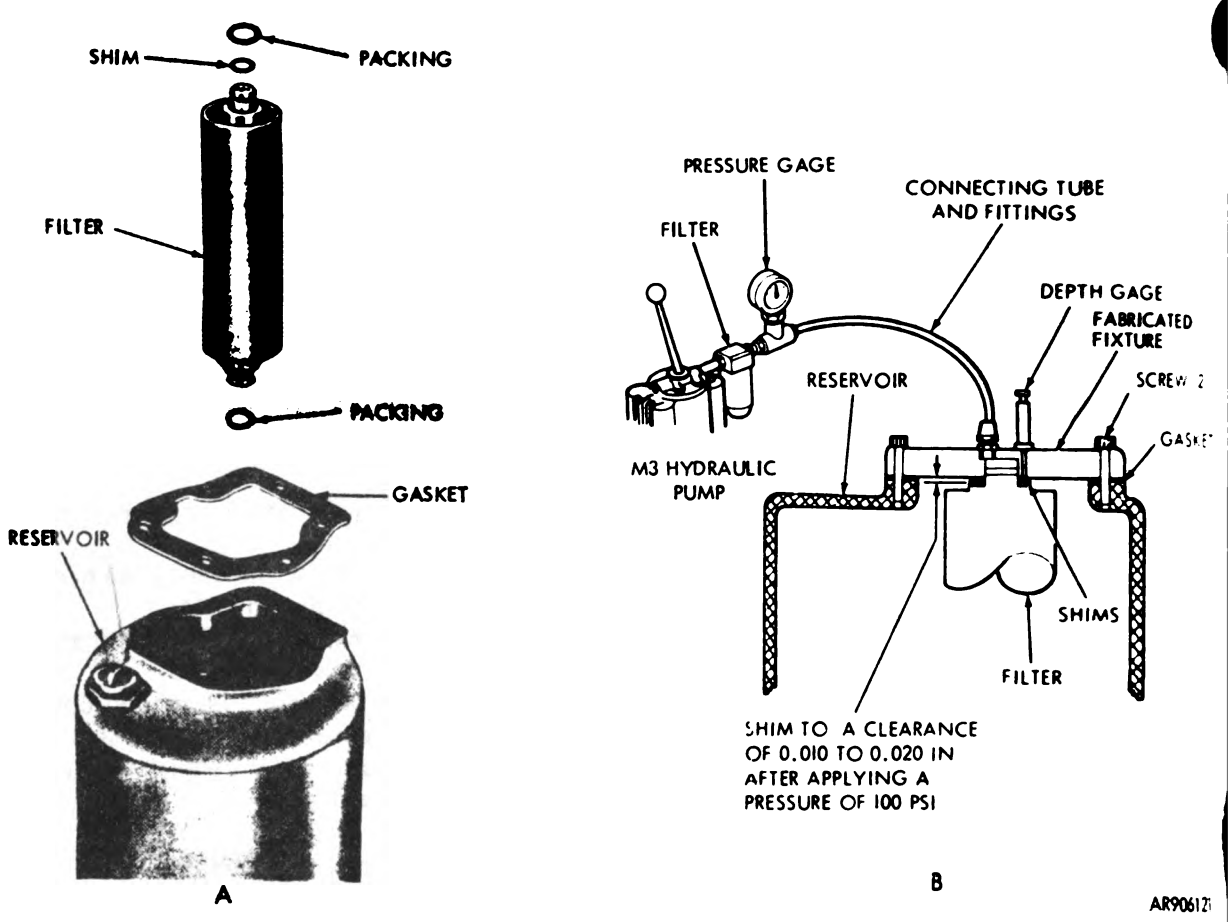



*Figure 3-43 Power pack filter test*

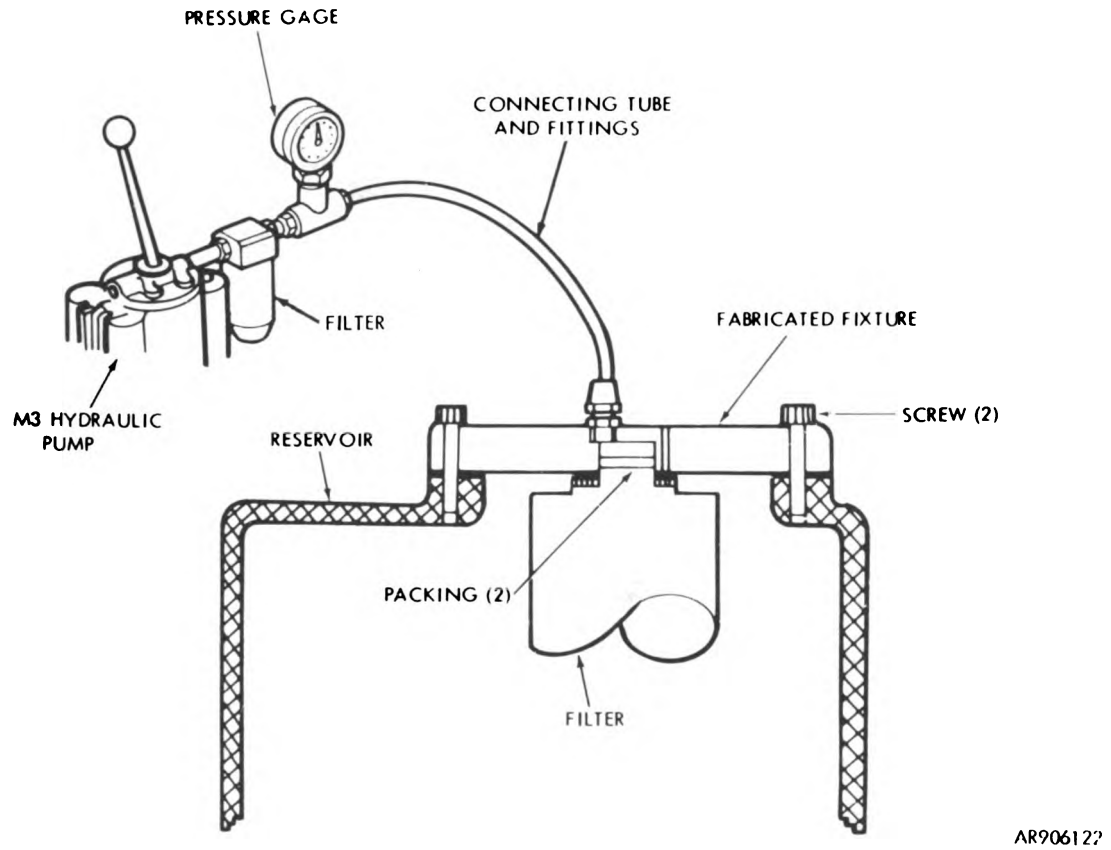



*Figure 3-44. Power pack filter leakage test.*

**3-110. Installation.** Refer to paragraph 2-30.

## Section XVII. REPAIR OF HYDRAULIC (MAIN) ACCUMULATOR

**3-111. Description (fig 3-45).** The hydraulic (main) accumulator consists of a cylinder enclosing a floating piston. The cylinder is closed on both ends. The top end contains an air valve and the bottom end contains two threaded ports. One port is connected to the power pack housing and valve assembly and the other is connected to the pressure switch and pressure gage. One side of the piston is precharged with dry nitrogen gas, while the other side stores hydraulic fluid under pressure. The nitrogen gas and fluid are separated by the floating piston. Pressurized fluid is supplied to the main accumulator by a hydraulic pump located in the power pack reservoir. The power pack pump dc motor which drives the pump is controlled by the turret power relay which, in turn, is controlled by the pressure switch. When the pressure of the fluid in the accumulator drops below minimum pressure, the pressure switch closes and energizes the turret power relay which turns the motor on. When the pump has built up sufficient hydraulic pressure in the accumulator, the pressure switch opens and breaks the electrical circuit to the coil of the turret power relay, turning the motor off. In the event the pressure switch fails to open on rising pressure, the motor will continue to operate the pump to higher pressures. However, before excessive load overheats the motor and excessive pressure develops, a relief valve opens and vents excessive pressure to the power pack reservoir.

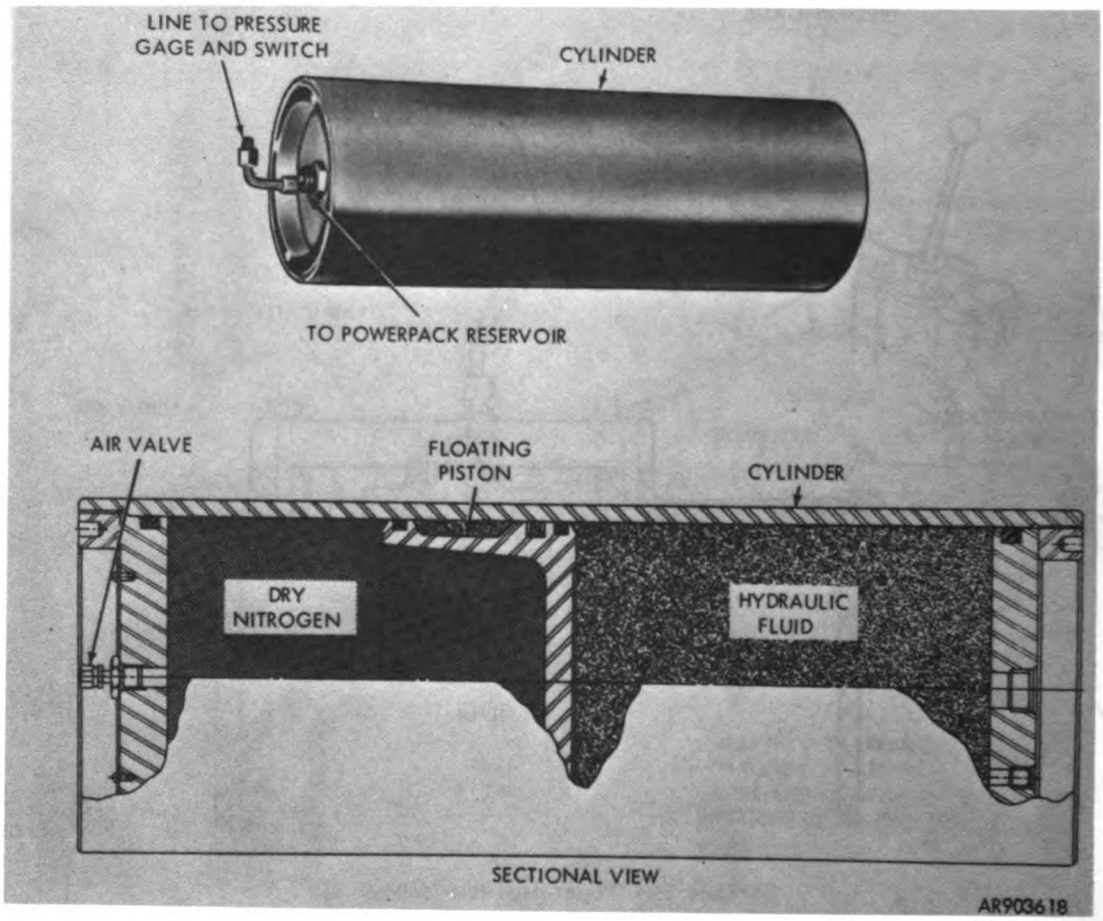



*Figure 3-45. Hydraulic (main) accumulator.*

**3-112. Removal.** Refer to TM 9-2350-258-20-2.

**3-113. Disassembly (fig 3-46).**

**WARNING**
**Release nitrogen gas pressure from accumulator before disassembling.**

**NOTE**
Prior to disassembly, tests must be conducted to verify that a malfunction does exist. If the unit fails to pass all tests, perform the following repair procedures. If the unit passes all tests, repair is not required.

*a.* Using spanner wrench (18, table 2-1), remove retaining ring from each end of cylinder (view A).

*b.* Remove cap, ring, and gasket from each end of cylinder (view B). Discard gasket.

*c.* Remove two adapters and two packings from bottom cylinder cap (view C).

*d.* Remove valve cap, valve core, valve body, and gasket from top cylinder cap (view D).

*e.* Remove piston from cylinder (view E).

*f.* Remove two ring guides and seal assembly (consisting of three seal rings) from piston (view F). Discard guides and seals.

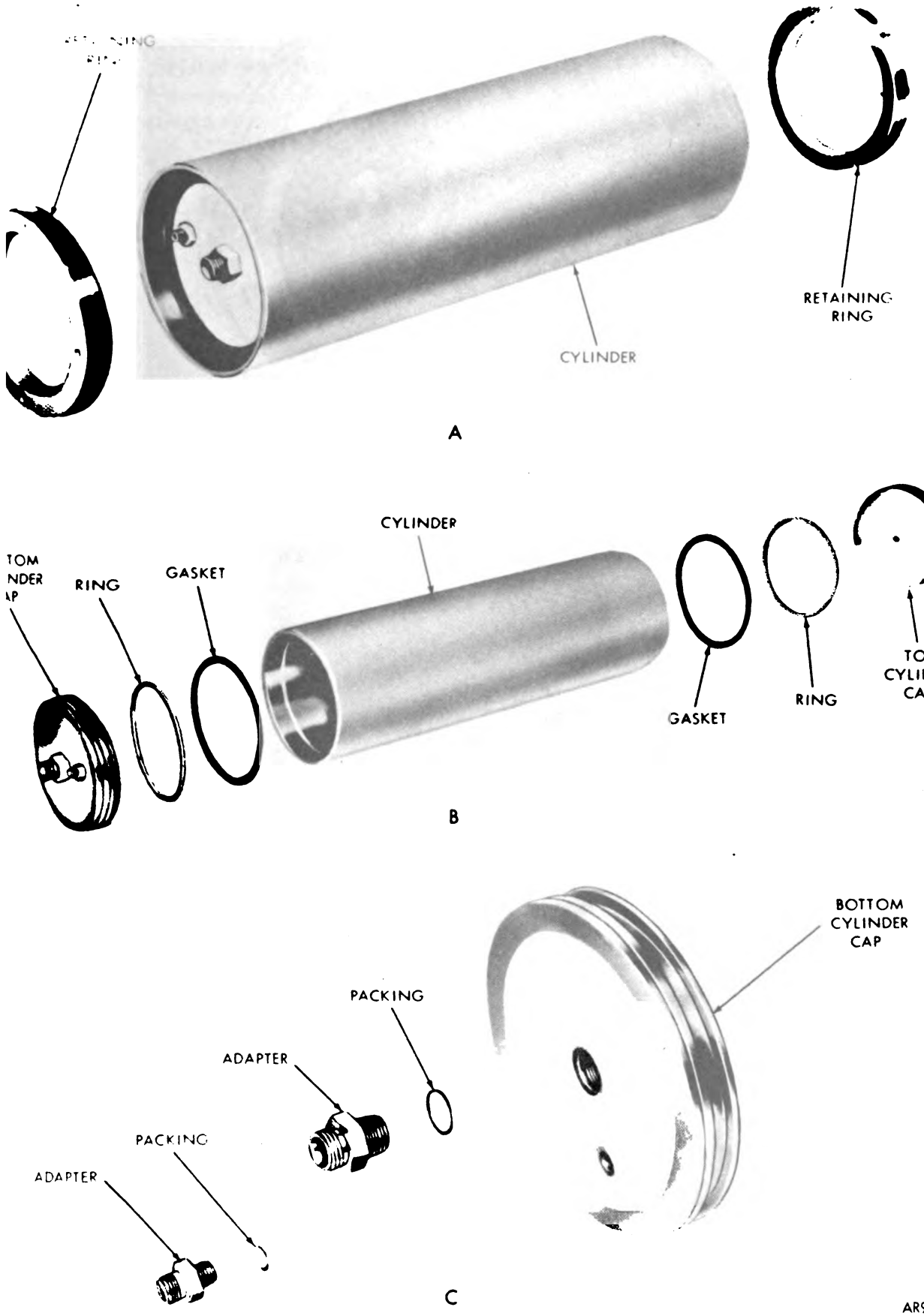



*Figure 3-46. Hydraulic (main) accumulator disassembly or assembly (1 of 2).*

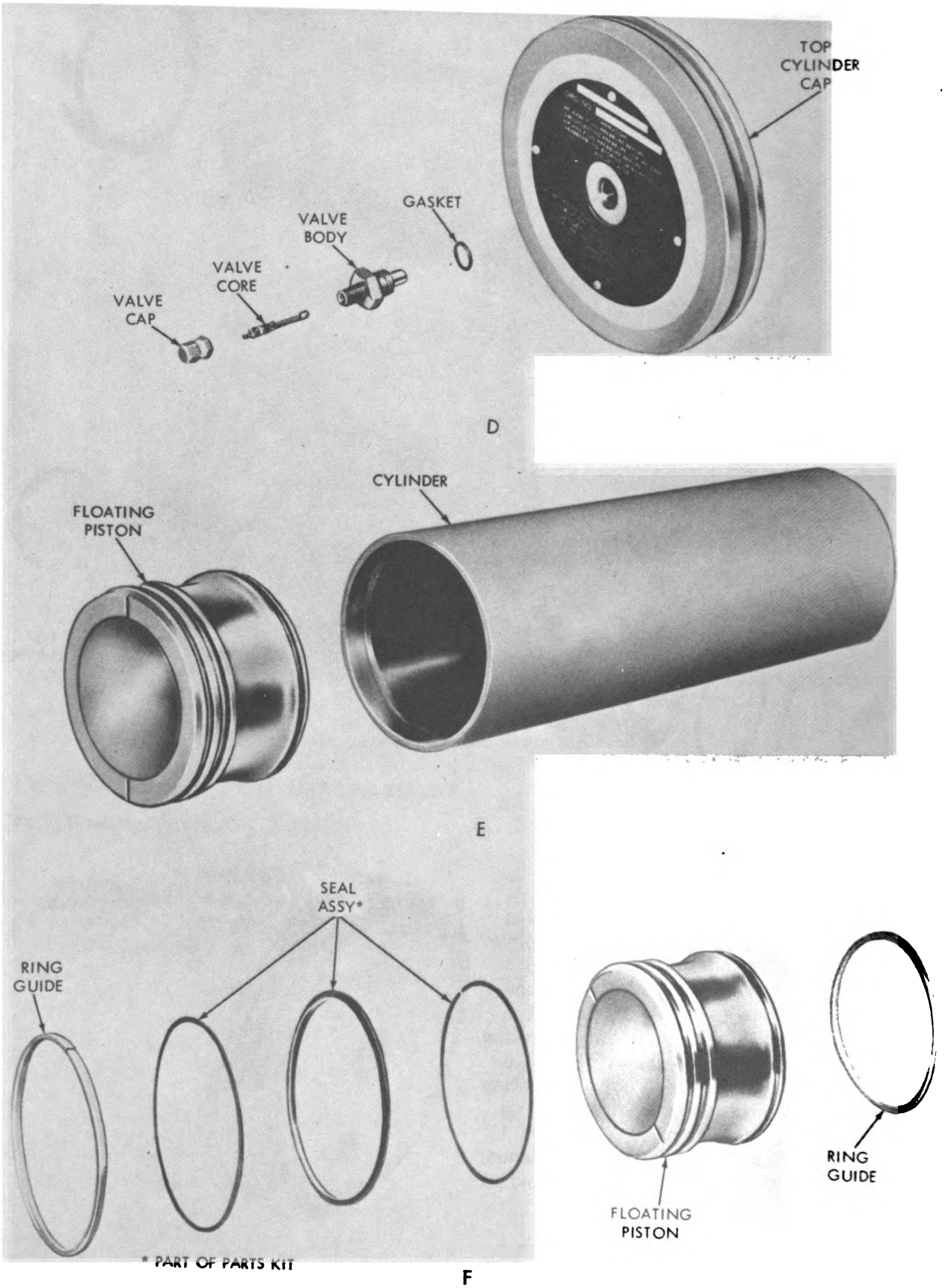



*Figure 3-46. Hydraulic (main) accumulator disassembly or assembly (2 of 2).*

**3-114. Cleaning.** Refer to paragraph 2-9.

**3-115. Inspection and Repair.**

*a.* Inspect components for wear as specified in table 3-14 and figure 3-47.

*b.* Repair or replace defective components.

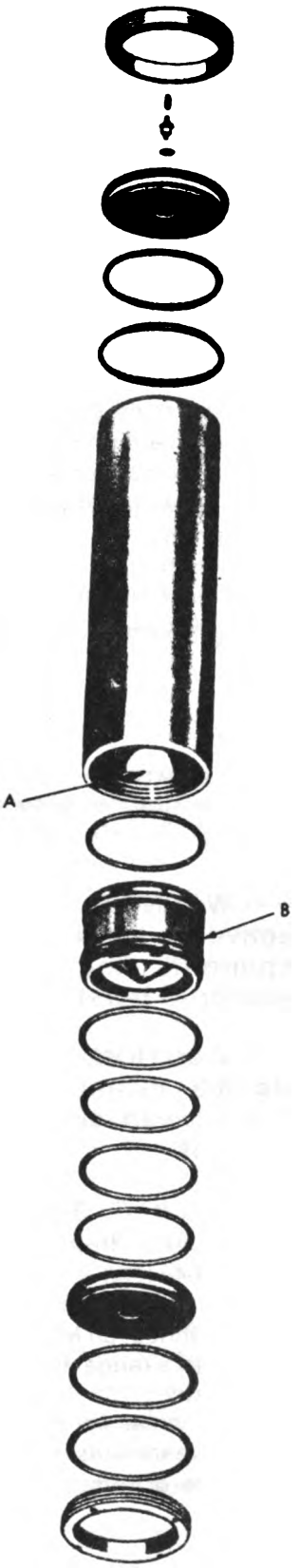



*Figure 3-47. Hydraulic (main) accumulator wear points.*

*Table 3-14. Hydraulic (main) Accumulator Wear Limits*

| Figure | Reference | Measurement | Wear Limit (in.) |
|---|---|---|---|
| 3-47 | A | ID of cylinder | 6.545 max |
| 3-47 | B | OD of piston | 6.538 min |

## 3-116. Assembly (fig 3-46).

*a.* Obtain accumulator repair parts kits (TM 9-2350-258-34P-2).

*b.* Use new packings, seals, O-rings, gaskets, and any other components performing a sealing function. Coat all internal components, cylinder bores, and sleeves and spools with hydraulic fluid (MIL-H-46170(FRH)) in assembly.

*c.* Assemble in reverse order of disassembly observing any torque values or other criteria specified during disassembly. Cross-tighten screws where applicable.

## 3-117. Tests.

NOTE

Tests must be conducted after completion of the repair procedure to verify that any malfunction has been corrected.

**WARNING**

**Defective or improperly installed components may cause accumulator to burst during testing.**

**CAUTION**

**Insure M3 hydraulic pump and fluid are clean and free of contaminations.**

*a. Proof Pressure Test (fig 3-48).*

(1) Fill accumulator fluid chamber with hydraulic fluid (MIL-H-46170(FRH)). Plug ports.

(2) Fill nitrogen chamber with hydraulic fluid (MIL-H-46170(FRH)), connect an M3 hydraulic pump and pressure gage with a range of 0 to 5,000 psi to nitrogen chamber port.

(3) Apply 3,000 psi pressure to nitrogen chamber and maintain for five minutes. Repair or replace accumulator if leakage occurs.

(4) Relieve pressure from accumulator and remove pressure gage and pump.

(5) Drain hydraulic fluid from accumulator.

*b. Nitrogen Precharge Leakage Test.*

(1) Connect accumulator charging regulator and dry-nitrogen tank to accumulator nitrogen inlet (TM 9-2350-258-20-2).

(2) Charge accumulator with nitrogen gas (BBN-411) to 175±10 psi with fluid chamber ports open.

(3) Disconnect accumulator charging regulator from accumulator.

(4) With valve cap removed and the fluid port open, completely submerge the accumulator in hydraulic fluid for 10 minutes. The appearance of bubbles indicates leakage. If leakage occurs, repair or replace accumulator.

(5) Release nitrogen gas pressure from accumulator and install valve cap and fittings.

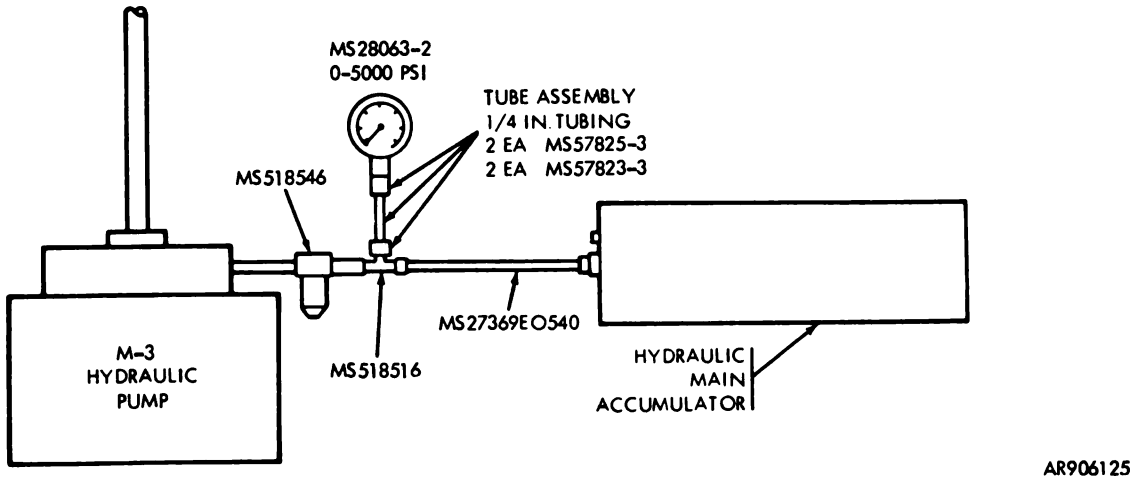



*Figure 3-48. Hydraulic (main) accumulator proof pressure test.*

**3-118. Installation.** Refer to TM 9-2350-258-20-2.

## Section XVIII. REPAIR OF SUPERELEVATION ACTUATOR

### 3-119. Description (fig 3-49).

*a.* The superelevation actuator consists of a piston, sleeve and spool, adjusting screw and nut, ported body, a ported housing and end plate, spring, and hardware.

*b.* The superelevation actuator is hydraulically connected to the elevating mechanism and power pack and mechanically coupled to the ballistics computer. After laying the gun-laying reticle of the rangefinder on target, the range knob on the rangefinder is turned to determine target range in accordance with type of ammunition in use. This target range reading is mechanically fed to the ballistics computer, which computes the required superelevation angle. The superelevation angle data is transmitted mechanically from the computer to the superelevation actuator, which automatically adds sufficient fluid to the elevating mechanism to correctly position the gun in accordance with range data and characteristics of the ammunition selected.

*c.* The adjusting nut, extending from the body of the superelevation actuator, controls the flow of fluid and its resultant action of the piston within the housing. The adjusting nut is threaded on the inside. As the nut rotates, it advances or retracts a spring loaded spool. A sleeve surrounding the spool is mechanically fastened to the piston. The adjusting screw is keyed to a component part of the sleeve and spool to prevent the screw from turning while it is being advanced or retracted. When the adjusting nut turns so that the spring loaded spool is advanced, hydraulic fluid is released into the piston housing by flowing past one end of the spool. The piston, in turn, forces fluid in the other side of the piston housing out through the one line in the housing end plate to the elevating mechanism. The spool, in moving, has also opened a port in the sleeve to drain. As the elevating mechanism piston moves, the return oil enters through the one line to the housing end plate and moves the piston and sleeve so that a second port in the sleeve is closed to operating pressure. The first port is closed to drain and the gun stops after having moved the computed number of mils.

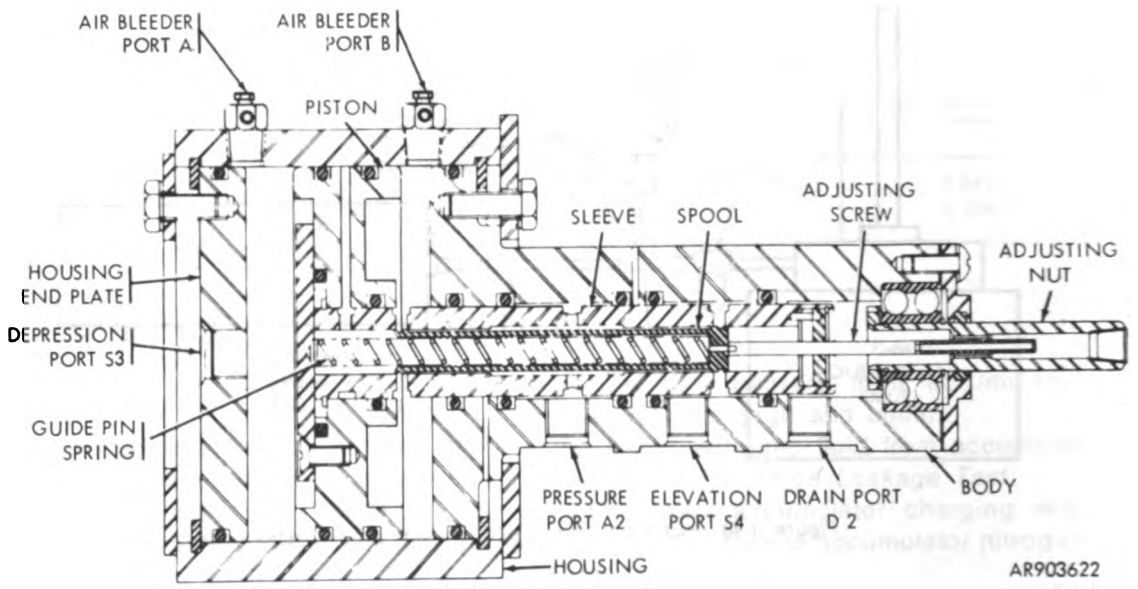



*Figure 3-49. Superelevation actuator — sectional view.*

**3-120. Removal.** Refer to TM 9-2350-258-20-2.

**3-121. Disassembly (fig 3-50).**

*a.* Scribe a mark across bracket to housing and bracket to body for alinement of components during assembly.

*b.* Remove two air bleed fittings from housing ports A and B (fig 3-49).

*c.* Drain hydraulic fluid from cylinder into a suitable container.

*d.* Remove three fittings from ports A2, S4, and D2 (fig 3-49).

*e.* Remove four screws and lockwashers securing ring to end plate (view A, fig 3-50). Remove plate.

*f.* Remove retaining ring securing end plate in housing (view A). Remove end plate and packing. Discard packing.

*g.* Remove four screws and lockwashers securing bracket to body (view A). Remove bracket.

*h.* Remove retaining ring securing body and piston in housing. Remove body and piston (view A).

*i.* Remove piston and sleeve from body (view B).

*j.* Remove outer packing from body (view B). Discard packing.

*k.* Remove four screws and lockwashers securing cover to body (view B).

*l.* Remove assembled adjusting nut, adjusting screw, and bearing from body (view B).

*m.* Remove cover and gasket from adjusting nut (view B).

*n.* Remove quad ring from cover (view B).

*o.* Remove adjusting screw from adjusting nut (view B).

*p.* Bend edges of locking nut from grooves in adjusting nut (view B).

*q.* Remove nut, lockwasher, bearing, and retaining ring from adjusting nut (view B).

*r.* Remove plug from adjusting nut (view B).

*s.* Remove five inner packings from bore of body (view B). Discard packings.

*t.* Maintain pressure on retainer and remove four screws and lockwashers securing retainer to piston (view C).

*u.* Slowly remove retainer to allow spring to decompress.

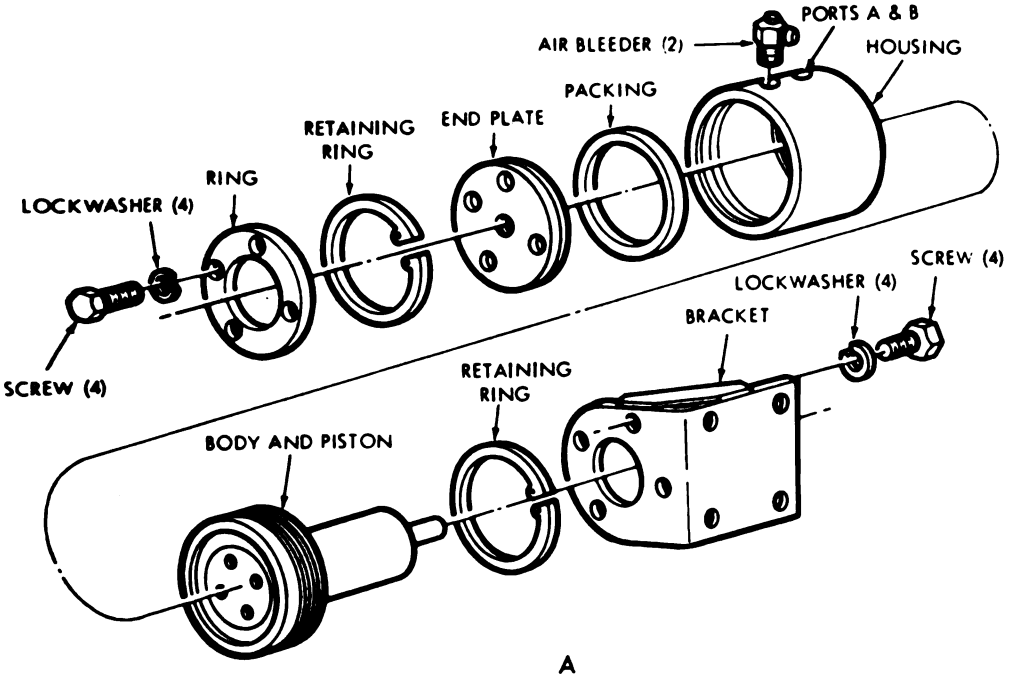
*v.* Remove guide and spring from spool (view C).

*w.* Remove retaining ring and shims from sleeve (view C).

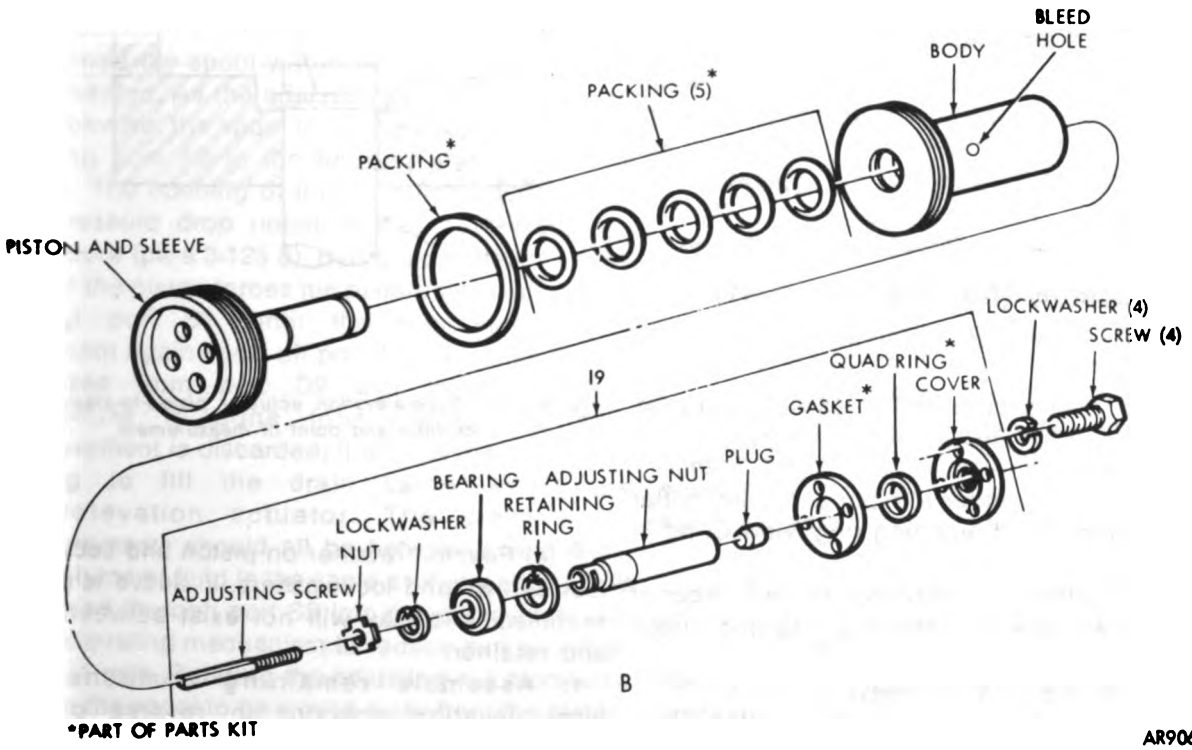
*x.* Remove piston from sleeve (view C).

*y.* Remove four packings from piston (view C). Discard packing.

*z.* Remove spool from sleeve (view C). Remove retaining ring, collar, and pin from sleeve (view C).




A




B

*PART OF PARTS KIT

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H

*Figure 3-50. Superelevation actuator disassembly or assembly (1 of 2).*

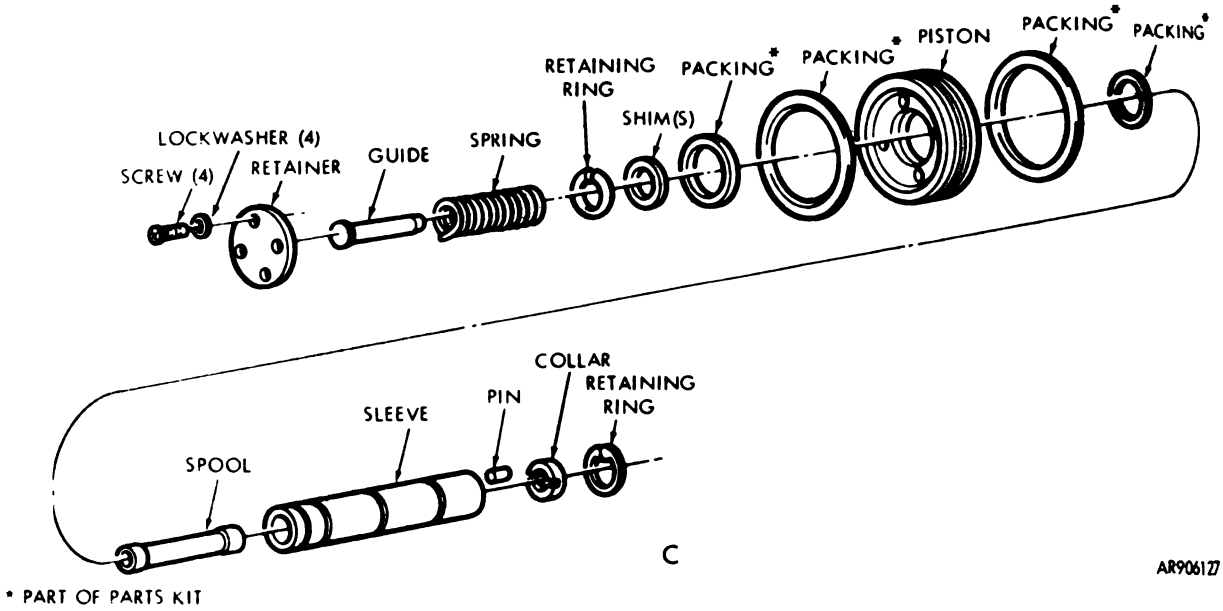



*Figure 3-50. Superelevation actuator disassembly or assembly (2 of 2).*

**3-122. Cleaning.** Refer to paragraph 2-9.

**3-123. Inspection and Repair.**

*a.* Inspect all components for damage or wear. Inspect finishes of spool, sleeve, body, housing, and piston for scratches or galling. Inspect adjusting screw and adjusting nut operation for smoothness.

*b.* Repair or replace damaged components.

**3-124. Assembly (figs 3-50 and 3-51).**

*a.* Obtain superelevation actuator parts kit (TM 9-2350-258-34P-2).

*b.* Coat all internal parts and bores with hydraulic fluid (MIL-H-46170(FRH)) prior to assembly.

*c.* Install pin into sleeve (view C, fig 3-50).

*d.* Aline groove in collar with pin and insert collar into sleeve and install retaining ring (view C, fig 3-50).

*e.* Prior to further assembly, determine number of shims required between retaining ring and piston as follows:

(1) Position piston on sleeve.

(2) Position shims on sleeve and install retaining ring.

(3) Add or remove shims to obtain 0.000 to 0.002 inch protrusion of sleeve from piston as shown in figure 3-51.

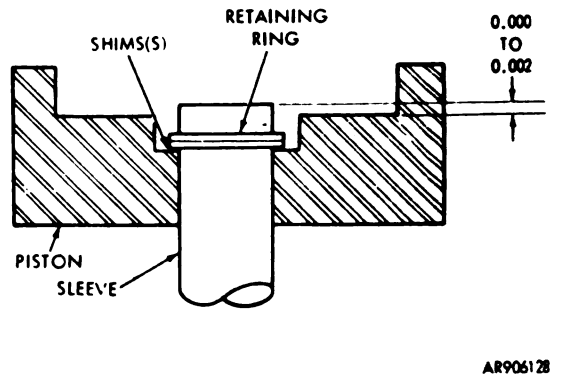



*Figure 3-51. Superelevation actuator piston-to-sleeve shim location and point of measurement.*

(4) Position retainer on piston and secure with four screws and lockwashers. If sleeve is properly shimmed, end play will not exist between sleeve and retainer.

*f.* Assemble remaining components of superelevation actuator in reverse order of disassembly (para 3-121).

## 3-125. Test.

*a. General.* Testing should be conducted prior to the disassembly of the superelevator actuator to determine the possible areas of malfunction or improper operation. The tests are conducted to check for internal leakage, proper fluid output per revolution of adjusting nut and force required to rotate adjusting nut. Tests must be reconducted after completion of the rebuild to insure that the malfunction has been corrected.

*b. Functional Test Description.* This test determines if the superelevation actuator is performing properly by measuring the quantity of hydraulic fluid output of the actuator for one revolution of the adjusting nut. The specification for the superelevation actuator states that each revolution of the adjusting nut should produce a change in gun elevation of 6-1/4 mils. To meet this requirement, the superelevation actuator must put out between 6 and 8 ml of hydraulic fluid. The tests are performed using the test setup shown in figure 3-52. First, the adjusting nut is set three turns counterclockwise from the stop — this is the same adjustment made when installing the superelevation actuator in the vehicle. At step (5) in the functional test procedure (para 3-125 (*d*), the adjusting nut has positioned the spool within the sleeve so that port A2 is sealed. As the adjusting nut is rotated counterclockwise, the spool is forced toward the piston, opening port A2 to the housing area behind the piston. The opening of this fluid path accounts for the pressure drop noted in step (5) of the test procedure (para 3-125 *d*). Hydraulic pressure on the rear of the piston forces the piston/sleeve assembly toward port S3, until the new sleeve-spool alinement again seals off port A2. Hydraulic fluid is collected from port D2 and measured. This procedure is done four times. The first measurement is discarded; it may be in error due to having to fill the drain cavity within the superelevation actuator. The other three measurements should all be between 6 and 8 ml. The volume of fluid is the same as that which would be forced through port S3 into the depression port of an elevating mechanism to reduce gun elevation by 6-1/4 mils. Rotating the adjusting nut clockwise causes the spool to be moved away from the piston. This movement connects ports A2 and S4. In a tank, the pressure applied at S4 would be applied to the elevating port of the elevating mechanism causing the gun to elevate. Fluid would be forced from the depression port of the elevating mechanism to port S3 of the superelevation actuator, forcing the piston/sleeve assembly rearward (a connection has been opened between the rear of the piston and port D2 to permit fluid flow from the chamber). In the test procedure, a connection between ports S3 and S4 simulates the elevating mechanism and its tubing. Again the procedure is done four times. The first measurement may be in error due to the filling of the drain cavity within the superelevation actuator. The remaining three measurements should all be between 6 and 8 ml. The test procedure is repeated after the adjusting nut has been set at 10 turns counterclockwise from the stop. Thus, the tests are conducted over most of the superelevation actuator operating range.

*c. Setup and Leak Test (fig 3-52).*

(1) Connect hydraulic pump (with pressure gage) to port A2.

(2) Connect a 1/4 inch hydraulic line between ports S3 and S4.

(3) Connect a short hydraulic line to port D2. Provide a plastic hose and container to collect any drainage from port D2.

(4) Bleed air from system as follows:

**NOTE**

If no fluid flows through ports A and B, it is possible that the piston is blocking the port (view A, fig 3-50). If superelevation acutator has older type bleed port (no nipple), substitute bleed port from hydraulic kit for testing. Rotate actuator until bleeder ports are at the highest position during bleeding operation.

*(a)* Open bleeder port A and operate hydraulic pump until fluid begins to flow from bleeder port or pressure builds up. Close bleeder port A.

*(b)* With bleeder port B open slightly, rotate adjusting nut clockwise until it is felt to run against a stop. Operate hydraulic pump and allow oil to bleed through port B until all indication of air is absent or pressure builds up. Close bleeder port B.

*(c)* With bleeder port A opened slightly, rotate adjusting nut counterclockwise until it runs off the adjusting screw (approximately 17 turns). Operate hydraulic pump and allow oil to bleed through port A until indications of air are absent or pressure builds up. Close port A.

(5) Repeat steps *(b)* and *(c)* until all air is bled from the system.

(6) Rotate the adjusting nut clockwise until it runs against a stop.

(7) Wrap a piece of white tape around the adjusting nut adjacent to actuator housing. Scribe an index mark on the actuator housing and tape.

(8) Insure that both bleeders (ports A and B) are closed.

(9) Rotate the adjusting nut three turns counterclockwise.

(10) Slowly attempt to pressurize the system, observing the line connected to port D2. Bleed fluid from port D2 until fluid flow stops.

(11) Position the graduated cylinder to collect fluid from port D2. Pressurize the system to 900 — 950 psi. Collect the fluid from port D2 for one minute. Leakage shall not exceed 3.0 ml.

(12) Reduce system pressure to zero. Cap port D2. Raise system pressure slowly to 150 psi. Maintain 150 psi for one minute. There shall be no leakage past the adjusting nut or the end plate.

(13) Reduce system pressure to zero. Remove cap from port D2. Any leakage in excess of that allowed in steps (11) and (12) will require disassembly of the superelevation actuator for repair. Do not continue testing until the superelevation actuator passes the leakage tests.

(14) Reinstall short hydraulic tube to port D2.

*d. Functional Test Procedure (fig 3-52).*

(1) Pressurize the system to 900 psi. Position the graduated cylinder to collect fluid from port D2. Slowly rotate adjusting nut one turn counterclockwise. Observe pressure gage as you rotate the shaft, and maintain 200 — 500 psi as the shaft is rotated. Repressurize system to 900 — 950 psi. Continue to collect the fluid output from port D2 for 10 seconds after the steady flow stops.

(2) Discard the fluid collected. Repeat step (1) three times, measuring and recording the fluid collected. Be sure to clean and dry the graduated cylinder before each measurement. The three measurements taken should be between 6 and 8 ml.

(3) Position the graduated cylinder to collect fluid from port D2. While maintaining system pressure between 200 — 500 psi, very slowly rotate the adjusting shaft one turn clockwise. Raise system pressure to 900 — 950 psi. Continue to collect the fluid output from port D2 for 10 seconds after the steady flow stops.

(4) Discard the fluid collected. Repeat step (3) three times, measuring and recordiing the fluid collected. Be sure to clean and dry the graduated cylinder before each measurement. The three measurements taken should be between 6 and 8 ml.

(5) Depressurize the system. Provide plastic hose and container to catch fluid drainage from port D2. Rotate the adjusting nut seven turns counterclockwise. Slowly attempt to pressurize the system, observing the line connected to port D2. Bleed fluid from port D2 until the fluid flow stops. Repeat functional test procedure steps (1) through (4), then proceed to step (6).

(6) Pressurize the system to 900 — 950 psi. Place a container under the line connected to port D2 to catch any hydraulic fluid. Maintaining the pressure between 900 — 950 psi, rotate the adjusting nut one turn clockwise, measuring the torque. Using a spring scale, measure force required to turn adjusting nut (16 lb max).

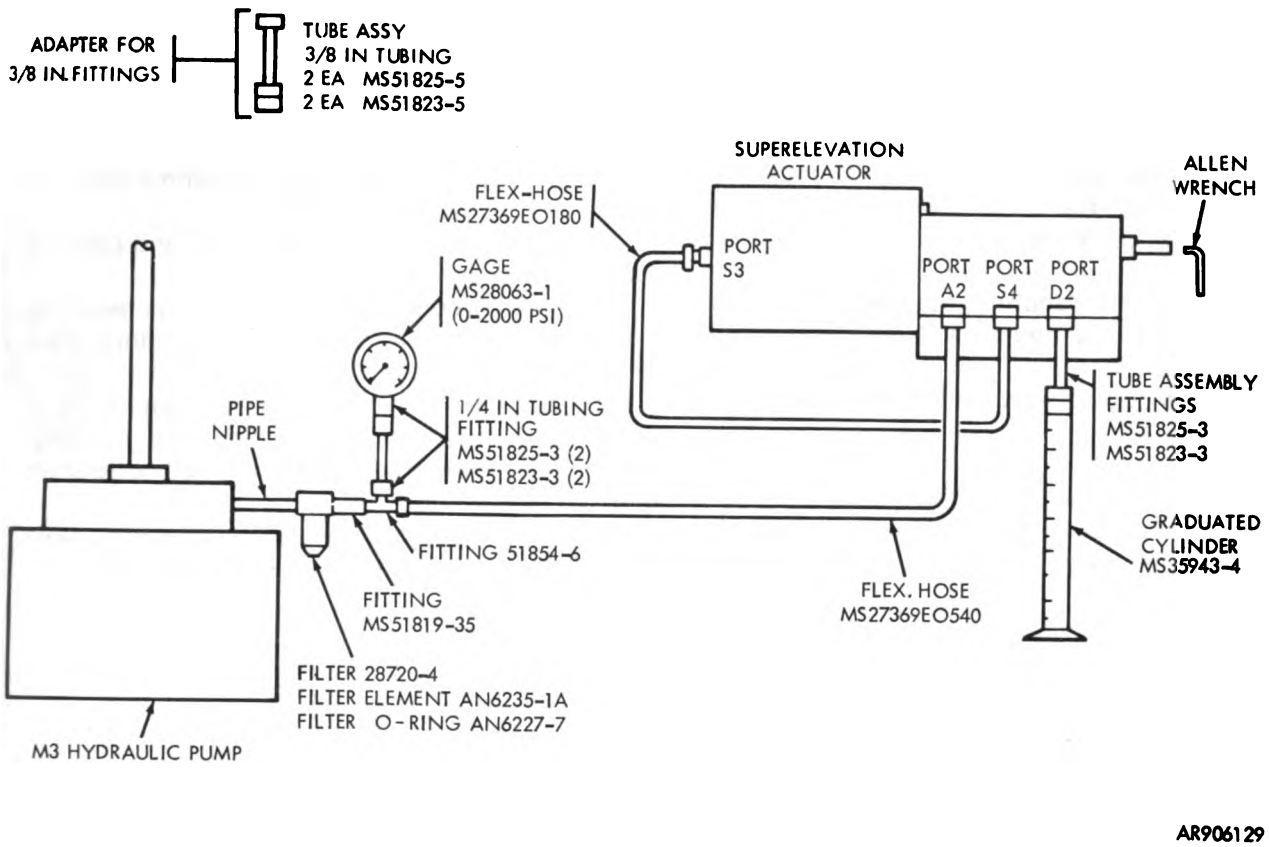



*Figure 3-52. Superelevation actuator test setup.*

(7) Depressurize system. Disconnect and drain lines connected to the superelevation actuator. If the requirements of this test are not met, the superelevation actuator must be repaired and retested.

(8) If test results are satisfactory, cap all ports of the superelevation actuator. A sufficient quantity of hydraulic fluid shall be retained in the superelevation actuator to assure proper lubrication during shipment or extended storage.

*e. Interpretation of Test Results.* As stated previously, the measurements taken should be between 6 and 8 ml. These results indicate correct and consistent superelevation actuator fluid output over its operating range. However, tests results may not be within the required range. Results may be consistently high (readings greater than 8 ml), consistently low (readings less than 6 ml), or erratic (a difference of more than 1 ml between each of the three measurements). Each of these possibilities is discussed below, including probable defects within the superelevation actuator which can cause them.

(1) Consistently high readings (greater than 8 ml). High readings are probably the result of fluid leakage past the piston, or leakage past the spool-body surface.

(2) Consistently low readings (below 6 ml). Consistently low readings are probably the result of insufficient movement of the spool. This could be caused by sticking of the spool or by a defect in the adjusting shaft/screw/nut assembly.

(3) Erratic readings (more than 1 ml difference between each measurement). Erratic readings are probably caused by erratic movement of the spool caused by sticking. It is possible, however, that the adjusting screw assembly is sticking or slipping, causing the erratic spool movement.

**3-126. Installation (fig 3-50).** Refer to TM 9-2350-258-20-2.

## Section XIX. REPAIR OF POWER PACK PUMP DC MOTOR

**3-127. Description.** Refer to TM 9-2350-258-20-2.

**3-128. Removal.** Refer to paragraph 2-31.

**3-129. Disassembly (fig 3-53).**

*a.* Remove 16 screws and lockwashers securing brush inspection port covers to commutator head and remove four covers and gaskets (view A). Identify port using cover with nameplate for use during assembly.

*b.* Remove nut securing field shunt coil and power leads to insulated brush holder and remove leads (view B).

*c.* Remove two screws housing field leads to jumper (view C).

*d.* Remove eight screws securing brush leads and remove brushes from holder (view D).

*e.* Remove four screws and lockwashers securing receptacle to elbow. Remove receptacle and gasket (view D).

*f.* Remove four screws and lockwashers securing elbow to commutator head. Remove elbow, two gaskets, and spacer (view D).

*g.* Scribe a line across flange of drive head and flange of frame for alinement during assembly. Repeat for commutator end head and frame (view D).

*h.* Remove four screws and lockwashers securing drive head to frame (view E).

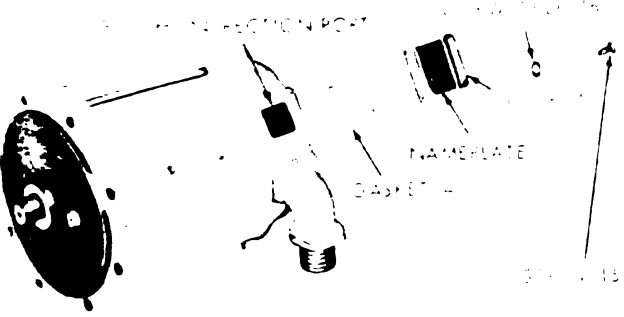
*i.* Remove drive head with armature and packing (view E). Discard packing.

*j.* Remove three screws and packings securing armature to drive head and remove armature (view F). Discard packings.

*k.* Remove seal from drive head (view G).

*l.* Remove retaining ring, mating ring, bearing, and retaining plate from drive end of armature shaft (view H).

*m.* Remove seal, mating ring, and bearing from commutator end of armature shaft (view H).

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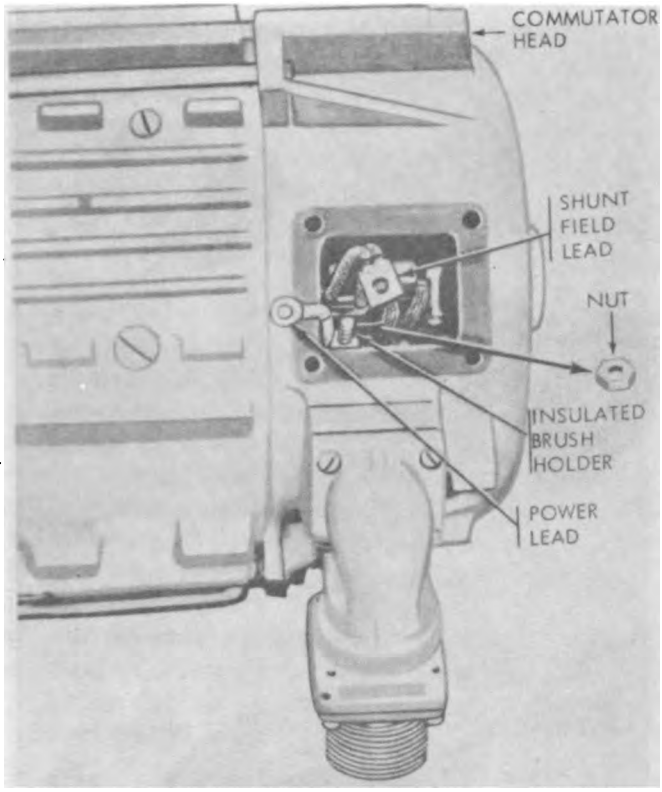


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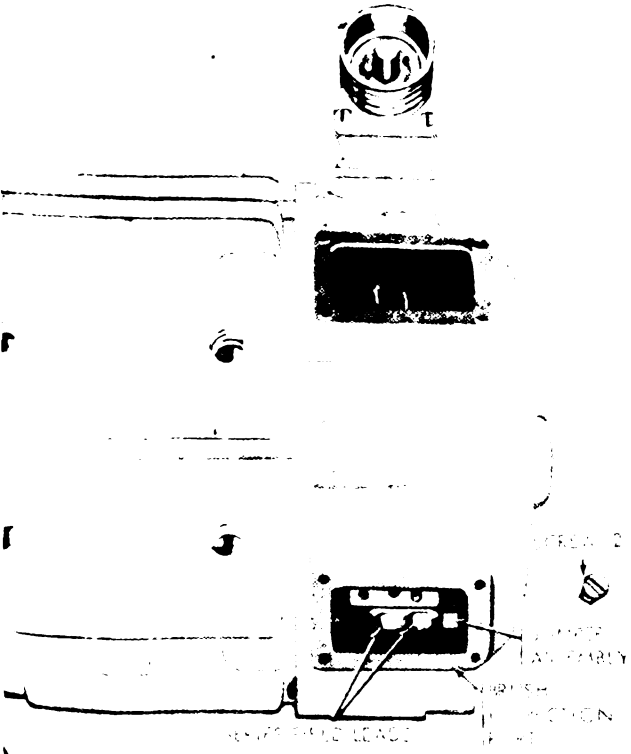

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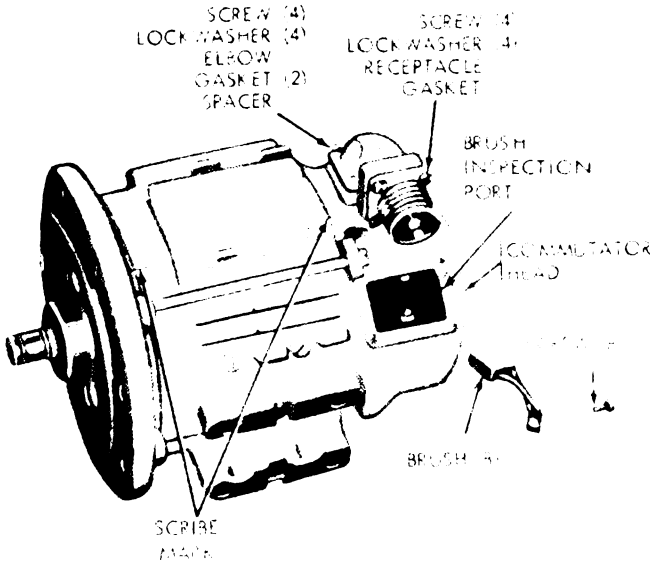


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*Figure 3-53. Power pack pump dc motor disassembly or assembly (1 of 2).*

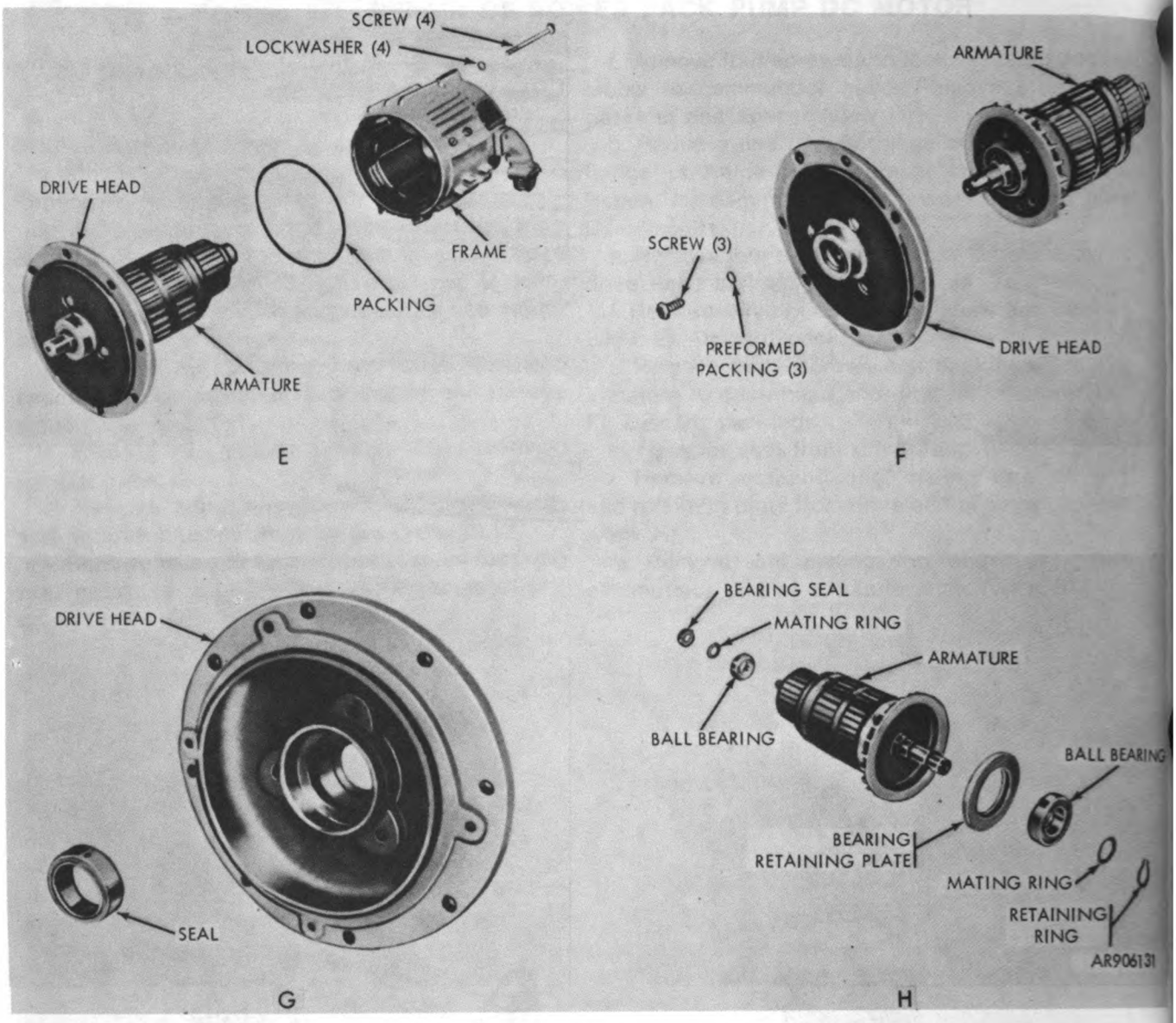



*Figure 3-53. Power pack pump dc motor disassembly or assembly (2 of 2).*

## 3-130. Cleaning.

*a. General.* Special cleaning instructions for electrical parts are detailed in the following instructions. All other parts are to be cleaned using drycleaning solvent (P-D-680). After cleaning, dry parts with filtered compressed air.

*b. Field Coils.* Wipe outer surfaces of field coils and pole shoes with a cloth dampened with drycleaning solvent (P-D-680). Exercise care to avoid damaging the protective coating on field coil windings. Dry all parts thoroughly with compressed air.

**NOTE**

Do not clean armature prior to inspection.

*c. Armature.* Remove loose particles from armature with compressed air and wipe outer surfaces with a clean cloth dampened with drycleaning solvent (P-D-680). Clean commutator lightly with number 4/0 sandpaper and remove all traces of sanding dust with compressed air.

*d. Commutator Head.* Clean with a bristle brush and compressed air. After removal of all loose material, use a cloth moistened with drycleaning solvent (P-D-680) and wipe all surfaces thoroughly to remove foreign material not removed with compressed air.

## 3-131. Inspection and Repair.

*a. Impeller.* Visually inspect impeller for evidence of damage. If any broken blades are found, replace motor.

*b. Armature Bearings.* Hold bearing inner race with the thumb and forefinger of one hand while rotating outer race slowly with the other hand. Bearing should rotate smoothly and evenly without feel of roughness or tight spots. A slight resistance to rotation, due to lubricant, is normal. The bearing should not feel or sound gritty or dry. Replace bearings that exhibit any abnormal characteristics, however slight.

*c. Armature.*

(1) Inspect brush contact surfaces. A satisfactory condition is indicated by a highly burnished dark copper color. When contact surface is rought, pitted, scored, burned in areas, or coated with hardened varnish or carbon accumulations (not removed by the cleaning process), the commutator must be resurfaced, provided that it is in good mechanical and electrical condition. A short circuited or open circuited armature coil will leave adjacent commutator bars burned or extremely dark in color. A test with an ohmmeter or test lamp and a growler will determine if either of these conditions exist. A short circuit could be caused by particles of copper and/or carbon bridging the space between commutator bars. Determine whether or not an indicated fault is definitely in the coil insulation before rejecting the armature.

(2) When a series of adjacent commutator bars are burned, the trouble may be due to eccentricity or grease deposits on the surface. When burned areas are present, the commutator must be resurfaced. If resurfacing reduces commutator diameter to less than 2.963 inches, replace motor. Support armature on its bearings and use a dial indicator to check for concentricity.

*d. Field Coils.* Test field coils for continuity. If continuity exists, visually examine coils for evidence of burned or charred insulation. If coil insulation is damaged or continuity is not present, replace motor.

*e. Brushes.* Always replace brushes whenever armature commutator has been reconditioned. Replace brushes whenever brush length is less than 0.7500 inch.

**3-132. Assembly (fig 3-53).** Assemble in reverse order of disassembly.

## 3-133. Tests (fig 3-54).

*a.* Secure motor in vise on portable test stand (53, table 2-1).

*b.* Connect test equipment (fig 3-54).

*c.* Apply 28.0±2 vdc by turning on test stand. Observe ammeter for current draw. This should be between 25.5 and 28.2 amperes. If shunt is used, reading shall be 25.5 to 28.2 millivolts on the 100-milivolt range.

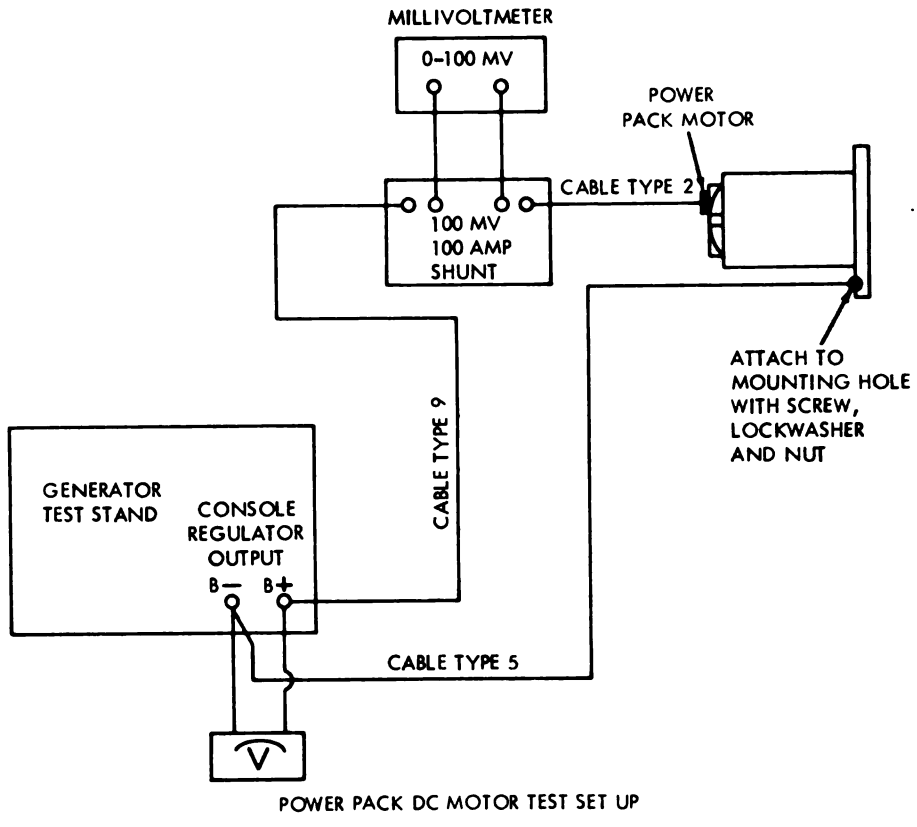



*Figure 3-54. Electrical test setup for power pack dc motor.*

**3-134. Installation.** Refer to paragraph 2-31.

## Section XX. REPAIR OF TRAVERSING GEARBOX

### 3-135. Description.

*a. General.* The traversing gearbox assembly components include a hydraulic motor, hydraulic (pin) lock assembly, clutch, and no-bak assembly. These components are described in the appropriate sections of this manual. Input to the traversing gearbox is applied by the hydraulic motor which is driven by the power pack control assembly during power mode or by the hand traversing drive assembly during manual mode.

*b. Traversing Gearbox (fig 3-55).* The traversing gearbox is composed of a gearbox oil pump, lower housing assembly, and upper housing assembly. The gearbox oil pump is a single-action, cam operated pump which circulates lubricating oil through the upper housing and clutch. Oil is drawn from a sump in the lower housing and applied to the upper housing and clutch via an external oil tube (not shown). The upper and lower housing assemblies contain a differential and the gear train which drives the turret. Mechanical inputs from the hand traversing drive through the no-bak and from the hydraulic motor are applied to the differential in the upper housing assembly. When power is applied to either of the differential bevel side gears, the two differential bevel pinions rotate. When power is applied to the upper differential bevel side gear through the hand traversing drive assembly, the opposite differential bevel side gear is locked out by the pin lock assembly and/or magnetic brake. When power is applied to the lower differential bevel side gear through the hydraulic motor assembly, the opposite differential bevel side gear is locked out by the no-bak assembly. Since the opposite side gear will not rotate, the two differential pinions revolve around the opposite (locked) side gear, thereby rotating the differential carrier and driving the gear train through an output gear which is part of the differential carrier. Output from the gear train is applied to the turret race ring by two pinion gears, rotating the turret. Components in the upper housing provide an antibacklash adjustment. A magnetic brake in the lower housing prohibits power mode traversing unless deenergized.

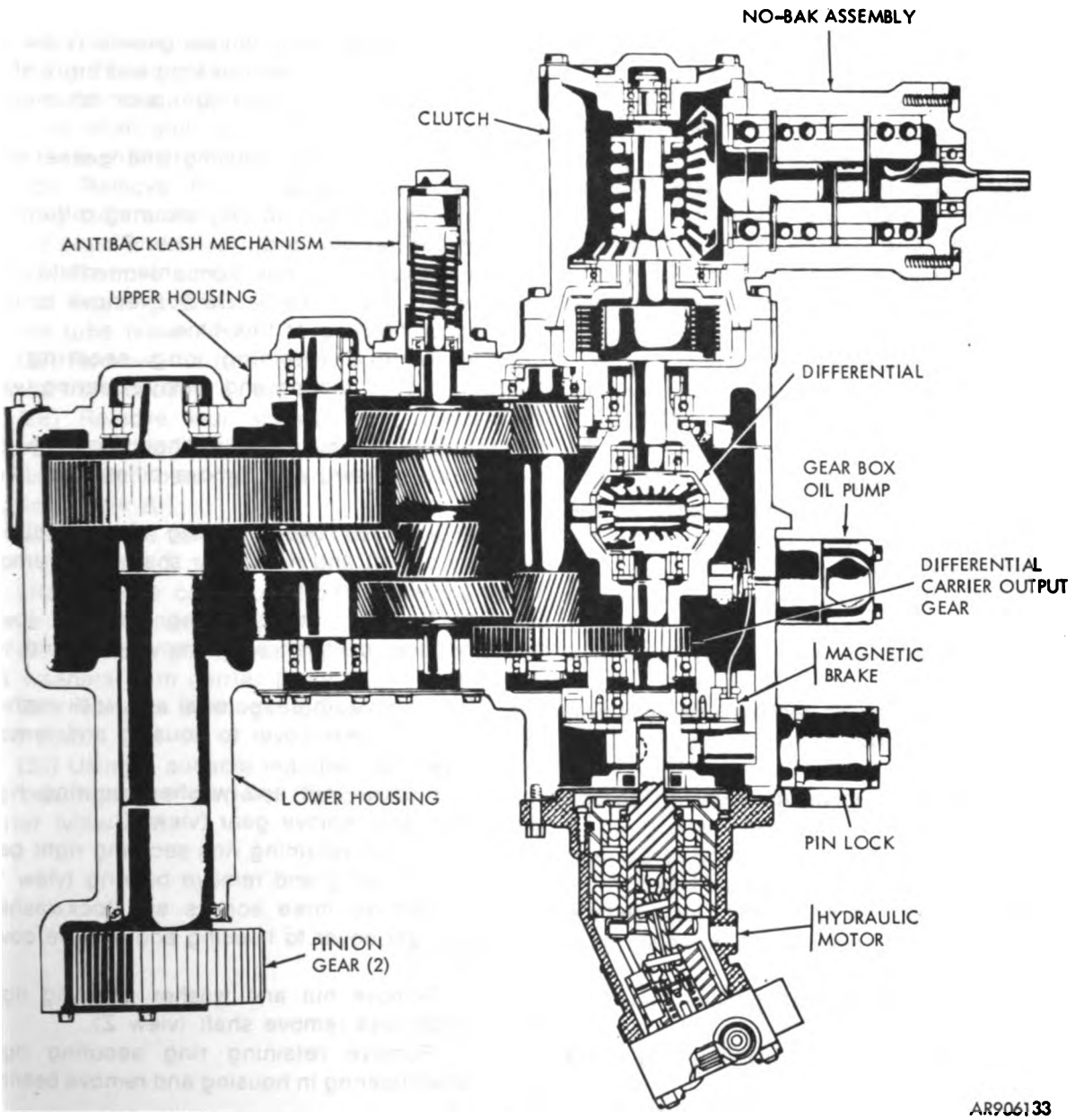



*Figure 3-55. Traversing gearbox — sectional view.*

**3-136. Removal.** Refer to paragraph 2-33.

**3-137. Disassembly (fig 3-56).**

*a. Traverse Gearbox No-Bak (view A).*

(1) Remove four screws and lockwashers securing the no-bak assembly (view B).

(2) Remove no-bak and shim from clutch assembly (view B).

*b. Traversing Gearbox Clutch (fig 3-56).*

(1) Loosen fittings securing hydraulic tube between clutch assembly and upper housing tee (view B).

(2) Remove five socket head screws and lockwashers securing clutch assembly to upper housing and remove clutch assembly (view C).

(3) Remove hydraulic tube from upper housing tee and clutch assembly elbow (view D).

(4) Remove elbow from clutch assembly (view D).

(5) Remove plug from tee (view E).

(6) Drain oil into a container with a minimum capacity of 2 quarts. (view E.

*c. Oil Pump, Gearbox Assembly (fig 3-56).*

(1) Remove tube assembly from lower housing tee and pump assembly elbow (view F).

(2) Remove tube assembly from upper housing tee and pump assembly elbow (view F).

(3) Remove four screws and lockwashers securing pump to lower housing (view G).

(4) Remove pump and gasket from housing. Discard gasket. Remove two elbows (view G).

NOTE

Install screws in pump and install a shipping nut on each screw.

*d. Pin Lock, Traversing Gearbox (fig 3-56).*

(1) Disconnect tube assembly from pin lock assembly and tee on hydraulic motor (view H). Remove tube assembly.

(2) Remove four screws and lockwashers securing pin lock to housing (view H).

(3) Remove pin lock and gasket (view H). Discard gasket.

(4) If pin lock is being replaced, remove two nipples and packings for use in installation of the new pin lock.

*e. Antibacklash Mechanism, Traversing Gearbox (fig 3-56).*

(1) Remove cover, gasket, adjusting screw, and backlash spring from housing (views I and J).

(2) Remove four screws and lockwashers securing antibacklash housing to traverse gear housing (view J).

(3) Remove housing and gasket (view J). Discard gasket.

(4) Remove bearing and guide housing using bearing puller (view K).

*f. Hydraulic Motor Traversing Gearbox (fig 3-56).*

(1) Remove four screws and lockwashers securing motor to lower housing (view L).

(2) Remove motor, woodruff key, and gasket from lower housing (view L).

(3) If motor is to be replaced, remove three adapters to be used during installation of replacement motor.

*g. Upper Housing and Gear Train (fig 3-56).*

(1) Remove six screws securing two pinion guard plates to gearbox and remove plates (view M).

(2) Remove two retaining rings securing drive pinions to shafts. Remove pinions (view N).

(3) Remove four screws securing two pinion guards to gearbox and remove guards (view O).

(4) Remove 14 screws (six long and eight short) and 14 lockwashers securing upper housing to lower housing (view P).

(5) Remove upper housing and gasket from lower housing (view Q).

(6) Remove retaining ring securing differential bearing and remove bearing (view R).

(7) Unscrew locknut from intermediate gear and remove gear (view S). Do not remove locknut from upper housing at this time.

(8) Remove retaining ring securing intermediate gear bearing and remove bearing (view T).

(9) Remove nut and washer securing differential to housing and remove differential (view U).

(10) Remove two retaining rings securing bearings on left and right gear shafts and remove bearings (view V).

(11) Remove retaining ring securing lower backlash gear on shaft and remove gear and two washers (view W).

(12) Remove three screws and lockwashers securing right gear cover to housing and remove cover (view X).

(13) Remove nut and washer securing right gear shaft and remove gear (view X).

(14) Remove retaining ring securing right gear bearing in housing and remove bearing (view Y).

(15) Remove three screws and lockwashers securing right cover to housing and remove cover (view Z).

(16) Remove nut and washer securing right piston shaft and remove shaft (view Z).

(17) Remove retaining ring securing right pinion shaft bearing in housing and remove bearing (view AA).

(18) Remove three screws and lockwashers securing left pinion shaft cover to housing and remove cover (view AB).

(19) Remove nut and washer securing left pinion shaft to housing and remove shaft (view AB).

(20) Remove retaining ring securing left pinion shaft bearing in housing and remove bearing (view AC).

(21) Remove three screws and lockwashers securing left gear cover to housing and remove cover (view AD).

(22) Remove nut and washer securing left gear shaft and remove gear (view AD).

(23) Remove retaining ring securing left gear bearing in housing and remove bearing (view AE).

(24) Remove retaining ring securing backlash gear and shaft and upper backlash gear. Remove gears and shaft from housing (view AF).

(25) Remove five screws and lockwashers securing differential bearing retaining plate and remove plate and bearing from housing (view AG).

(26) Remove screw and lockwasher securing tube to housing. Disconnect tube from tee and remove tube (view AH).

(27) Remove nut from tee and remove tee and washer from housing (view AH).

(28) Remove four screws and lockwashers securing bearing retaining plate to housing and remove plate, bearing, washer, and nut from housing (view AI).

(29) Remove vent and plug from housing (view AJ).

(30) Remove cotter pin from differential gear sleeve and pin (view AK).

(31) Remove pin (press fit), sleeve, two gears, and washers from carrier (view AL).

(32) Remove bearings (press fit) from gears (view AM).

(33) Using a suitable mandrel, tap two pinions and bearings from carriers. Remove washers from carrier (view AN).

(34) Remove bearings (press fit) from pinions (view AO).

*h. Magnetic Brake (fig 3-56).*

(1) Remove retaining ring securing pin lock shaft and remove shaft and disk from lower housing (view AP).

(2) Unsolder magnetic brake electrical leads from receptacle. Remove four screws and lockwashers securing receptacle to housing and remove receptacle and gasket (view AQ).

(3) Remove screw, lockwasher, and clamp securing magnetic brake electrical leads to housing (view AR).

(4) Remove four screws and lockwashers securing brake retaining plate and remove plate (view AS).

(5) Remove brake and bearing from housing (view AT).

(6) Remove retaining ring from housing (view AU).

*i. Lower Housing Miscellaneous Components (fig 3-56).*

(1) Remove 16 screws securing cover to housing and remove cover and gasket (view AV).

(2) Remove magnetic plug and gasket from housing (view AV).

(3) Remove screw, lockwasher, and shear key from housing (view AW).

(4) Remove seals and bushings (press fit) from housing (view AW).

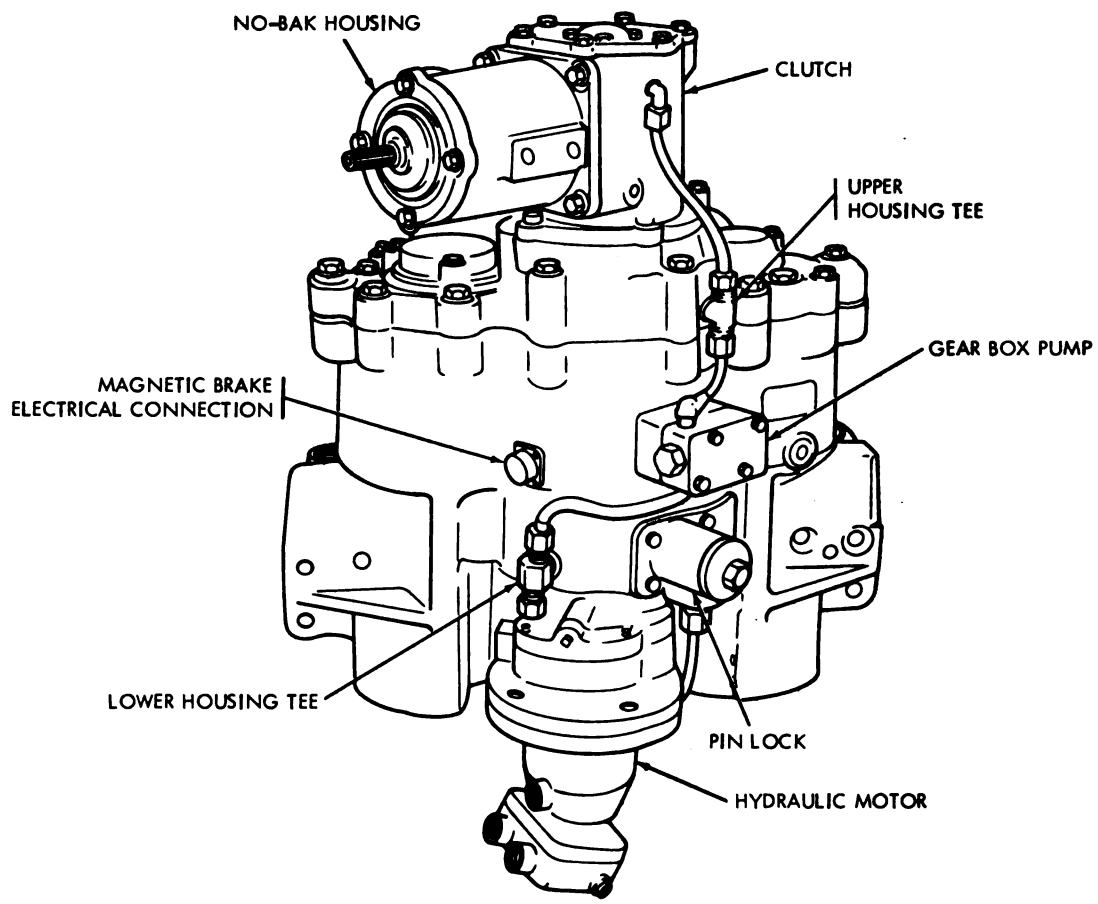
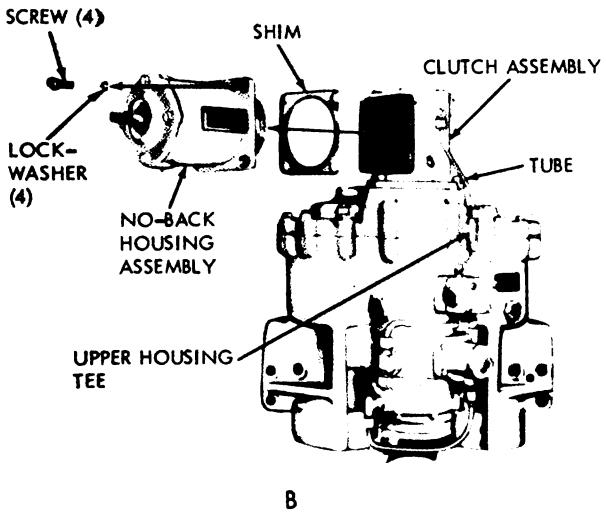



*Figure 3-56. Traversing gearbox disassembly or assembly (1 of 15).*

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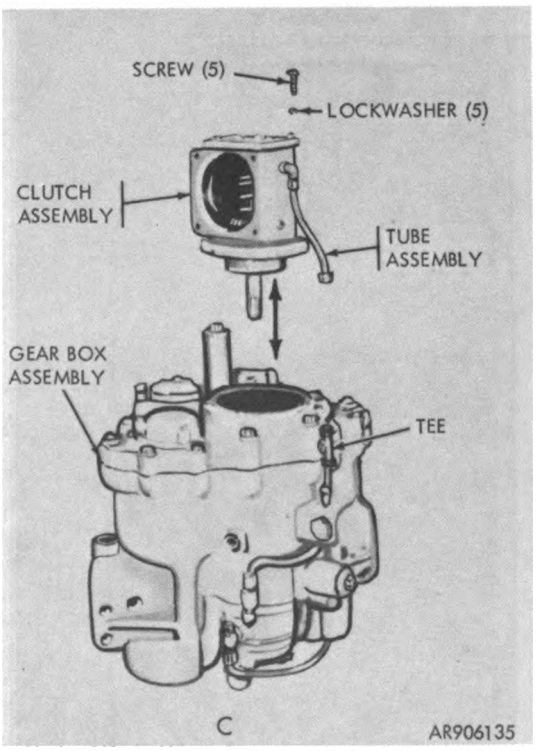



*Figure 3-56. Traversing gearbox disassembly o assembly (2 of 15).*

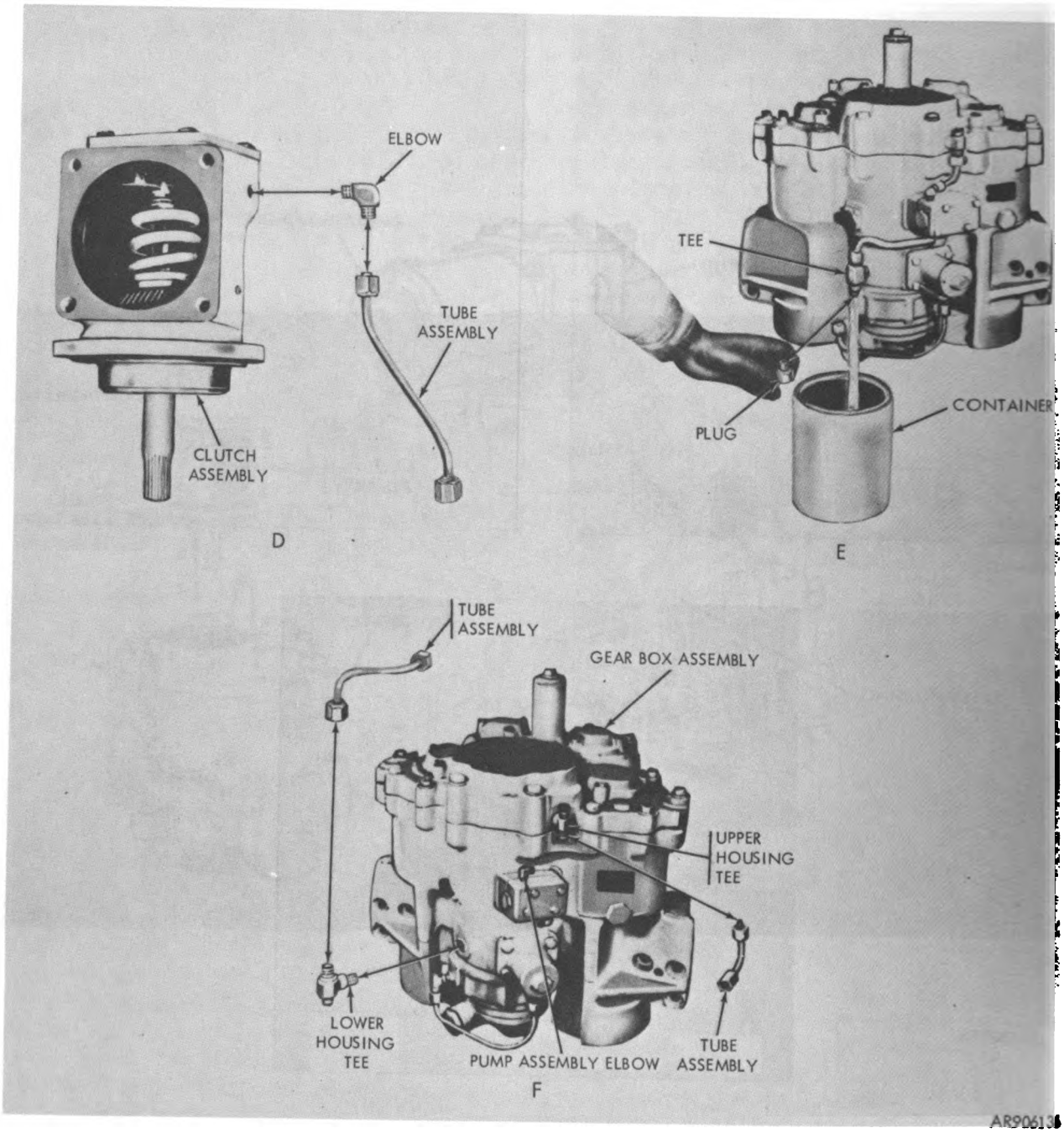



*Figure 3-56. Traversing gearbox disassembly or assembly (3 of 15).*

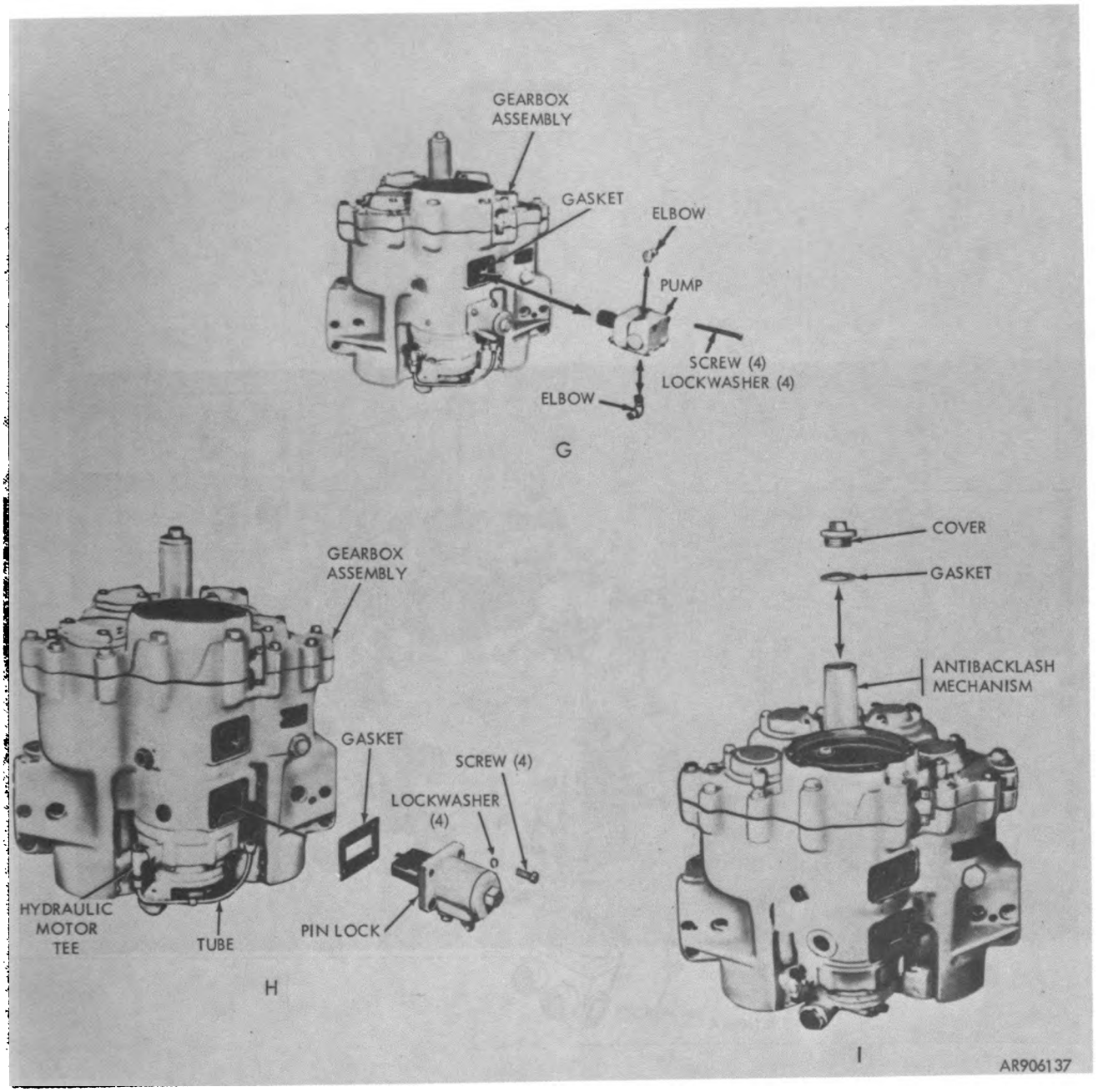



*Figure 3-56. Traversing gearbox disassembly or assembly (4 of 15).*

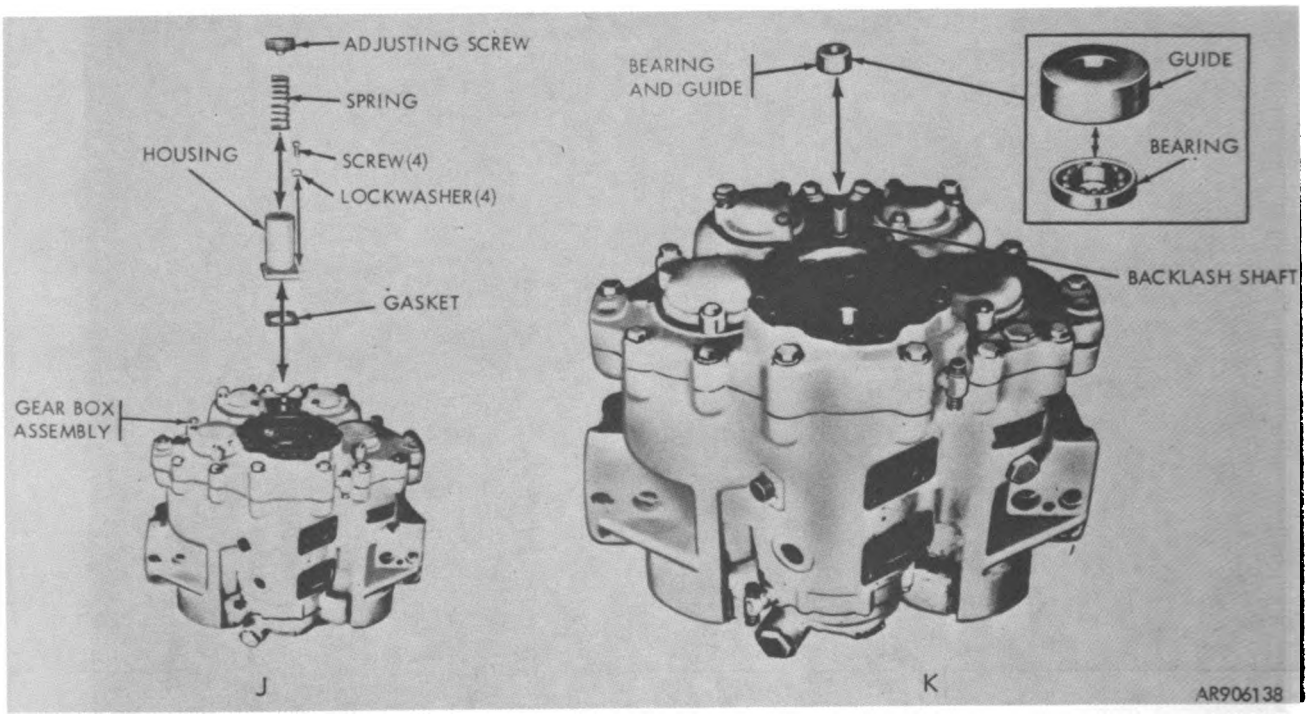



*Figure 3-56. Traversing gearbox disassembly or assembly (5 of 15).*

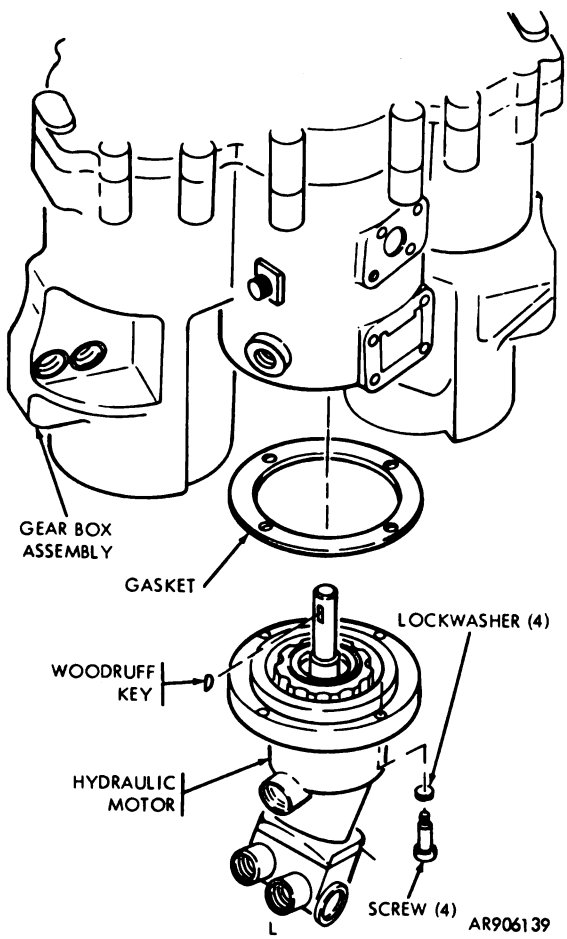



*Figure 3-56. Traversing gearbox disassembly or assembly (6 of 15).*

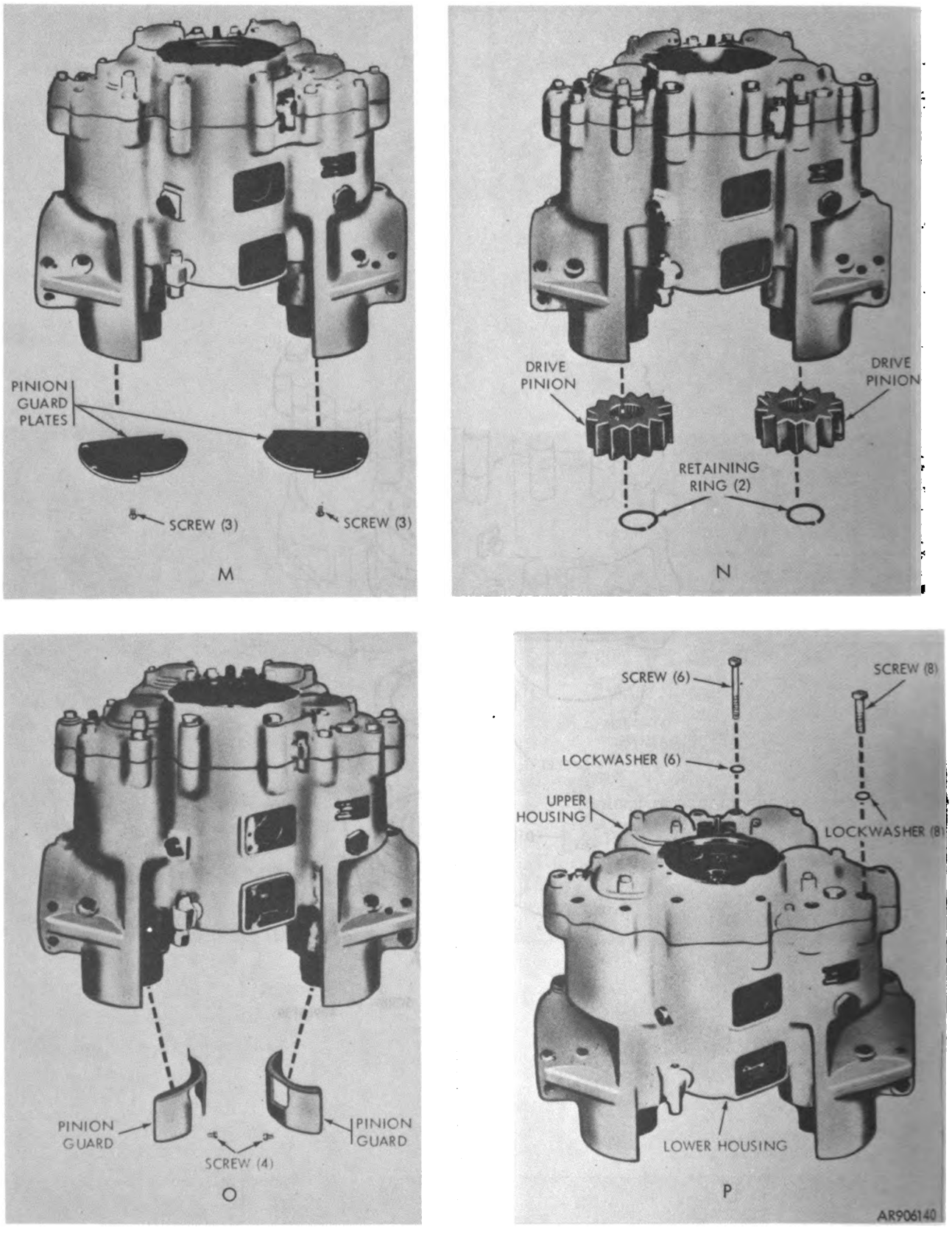
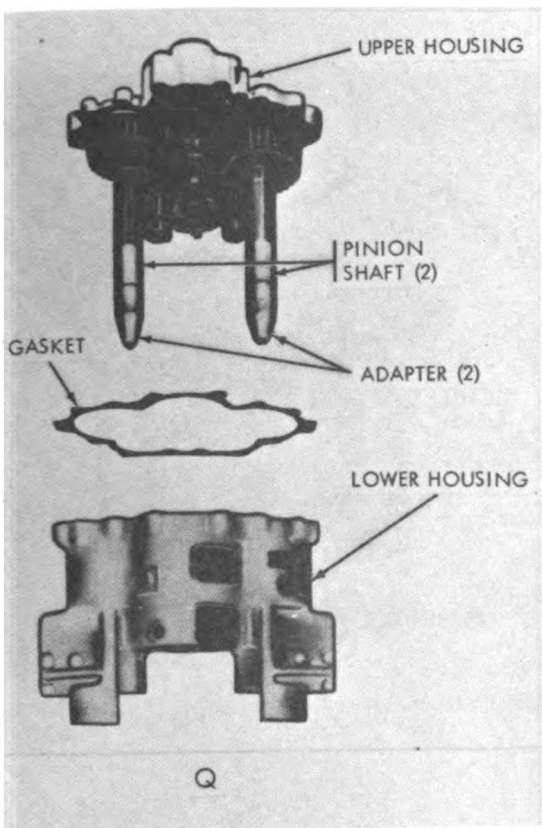
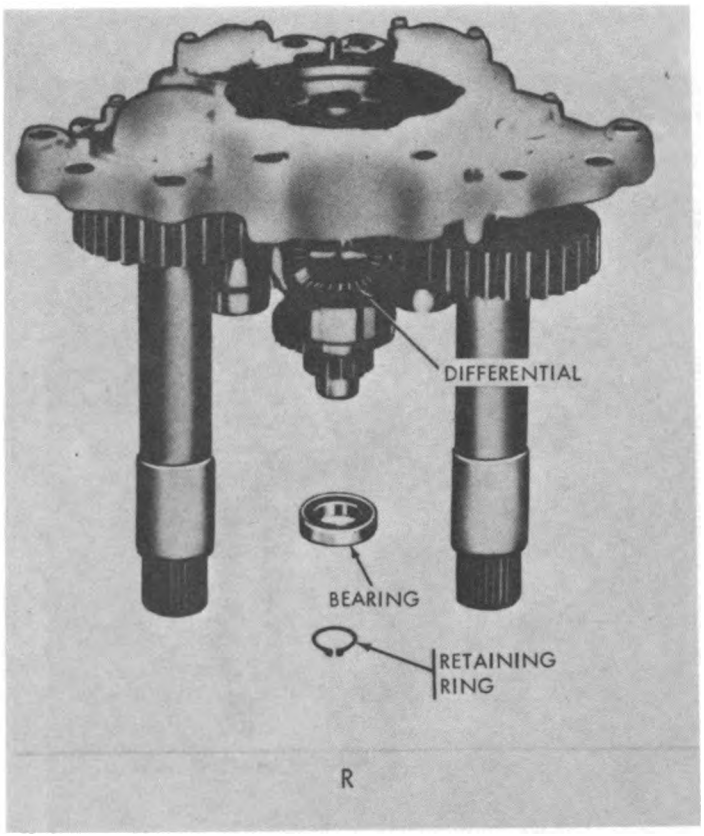
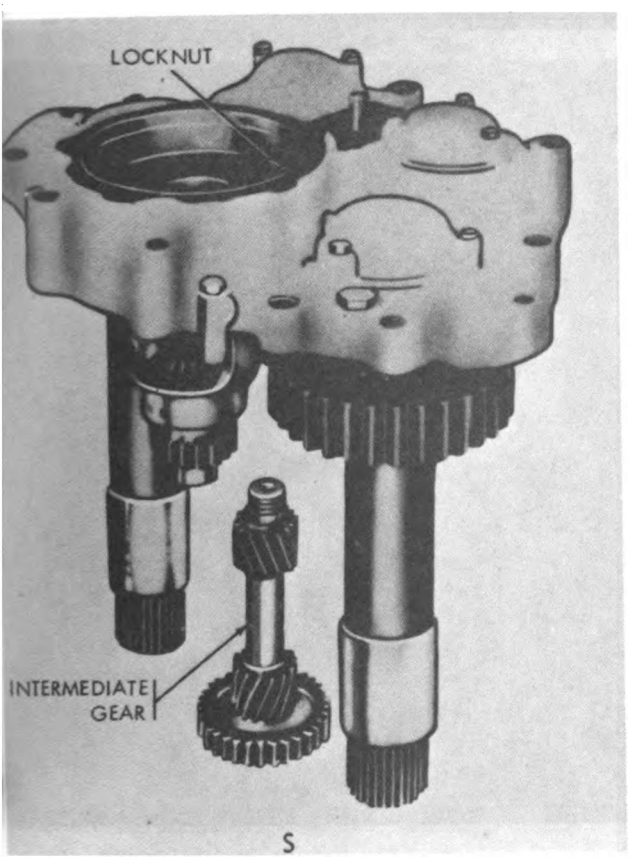



*Figure 3-56. Traversing gearbox disassembly or assembly (7 of 15).*



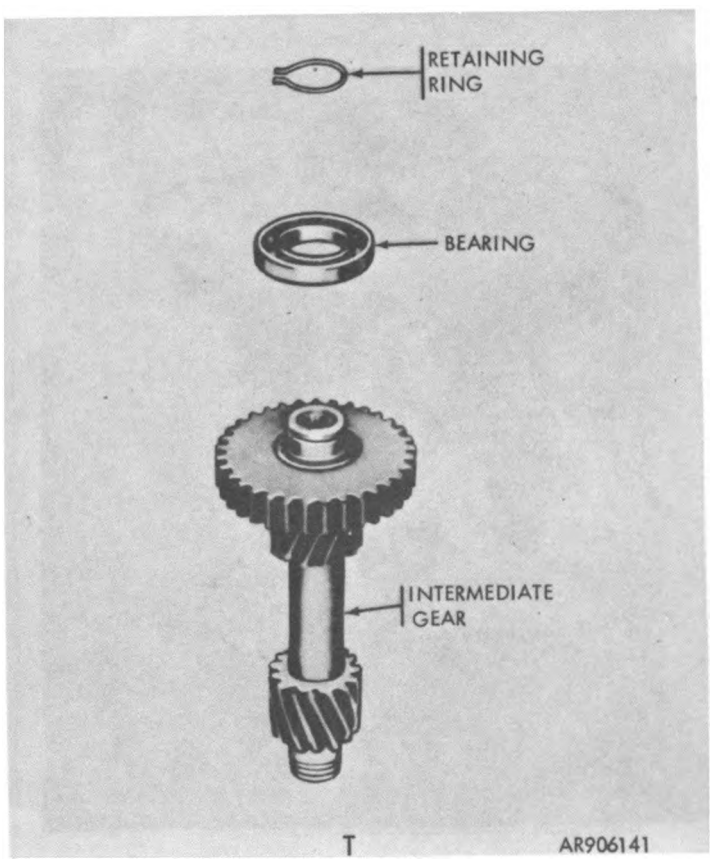
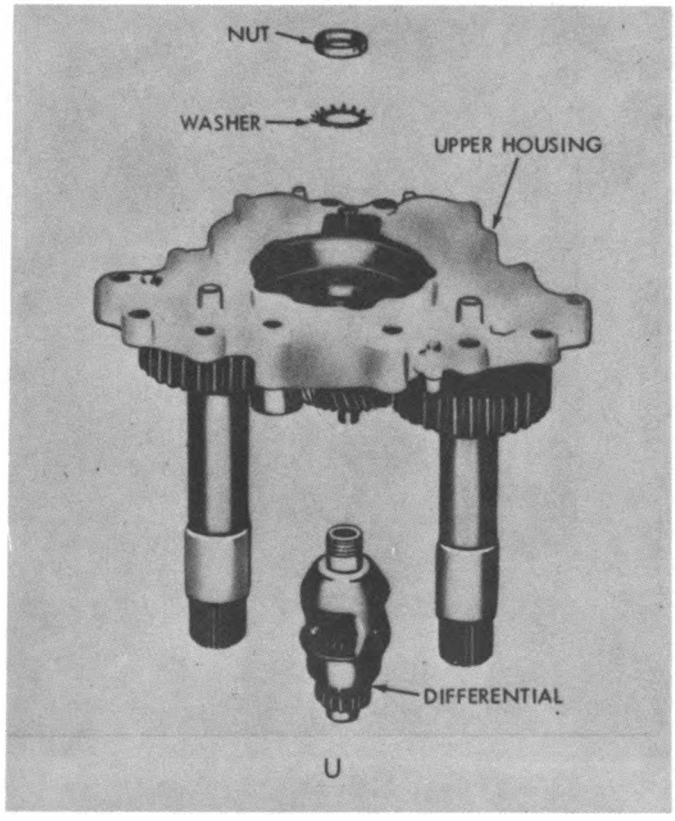
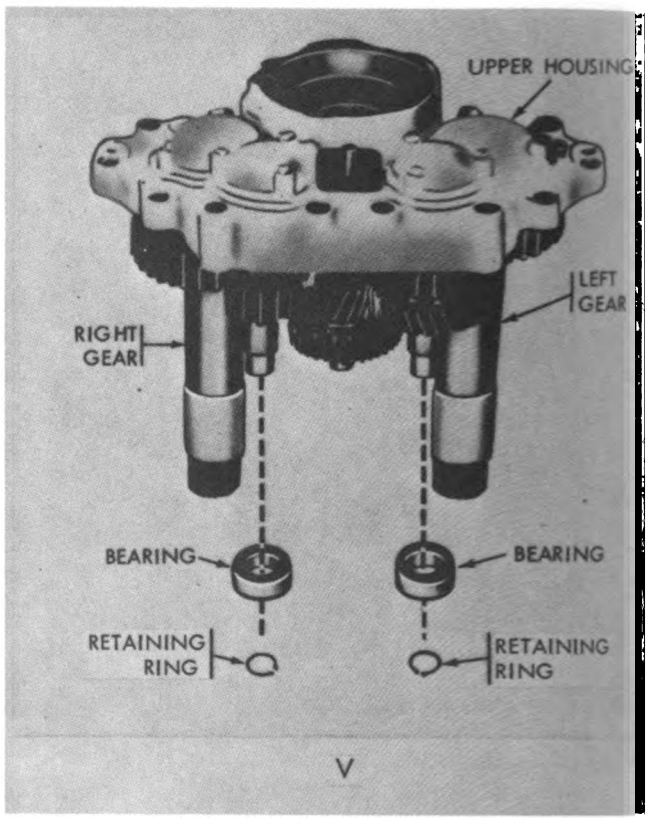
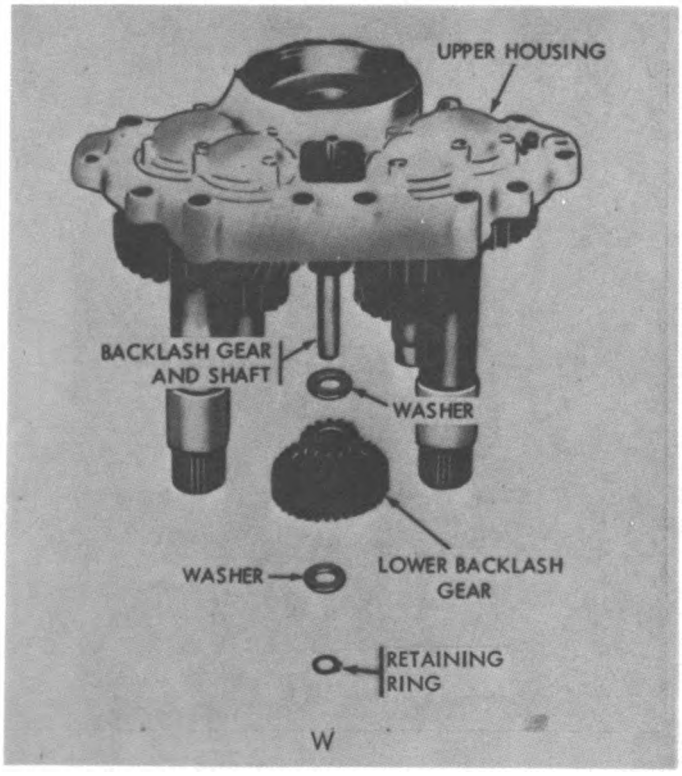




*Figure 3-56. Traversing gearbox disassembly or assembly (8 of 15).*



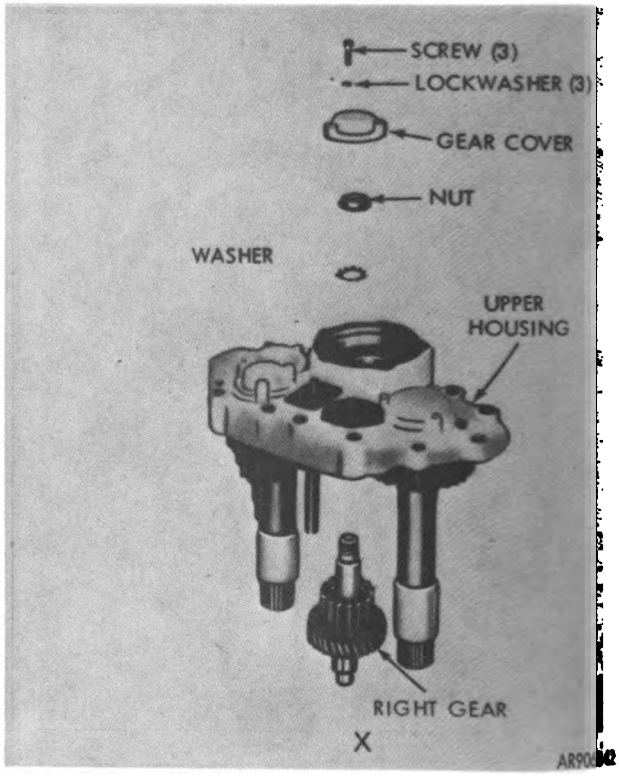




*Figure 3-56. Traversing gearbox disassembly or assembly (9 of 15).*

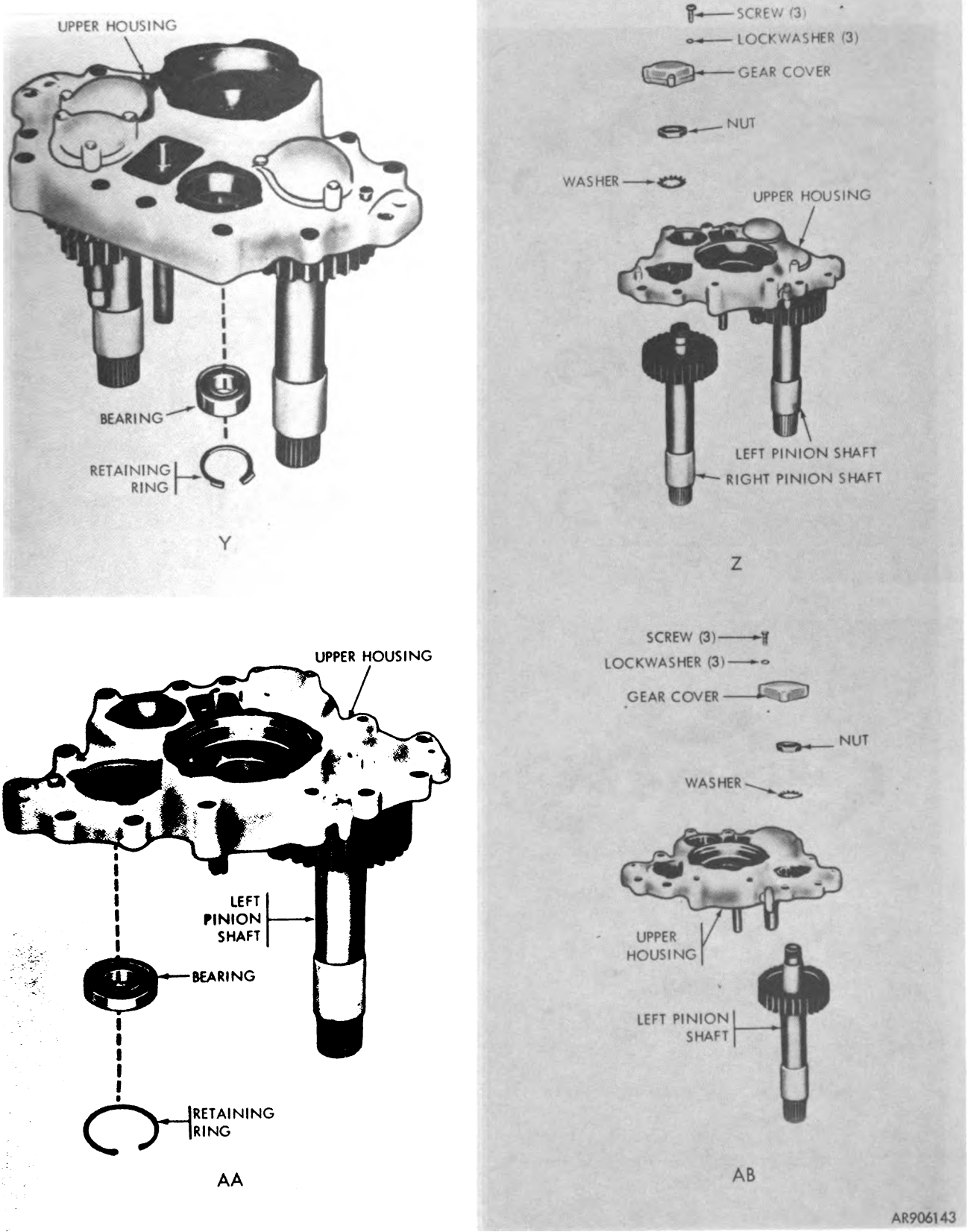



*Figure 3-56. Traversing gearbox disassembly or assembly (10 of 15).*

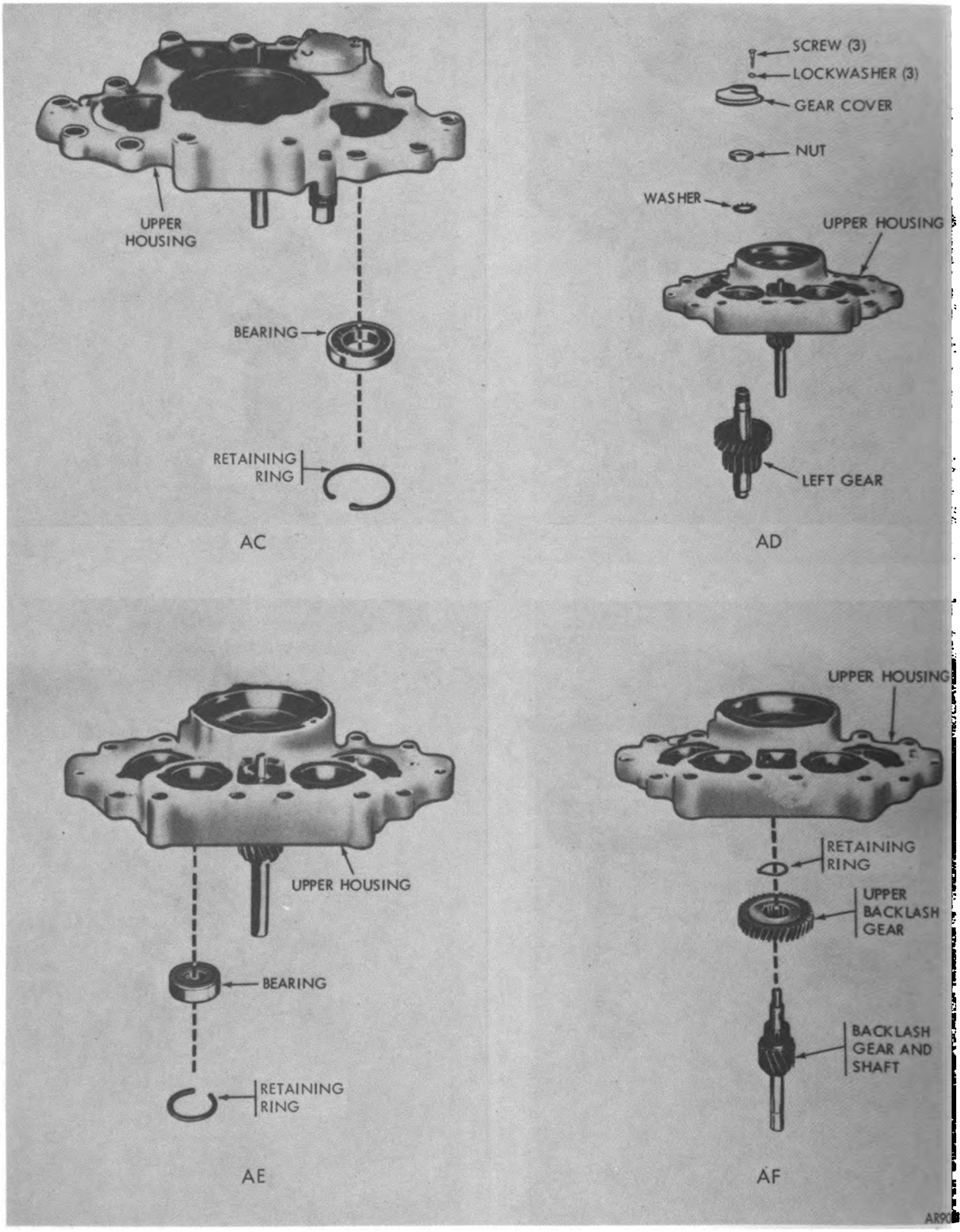
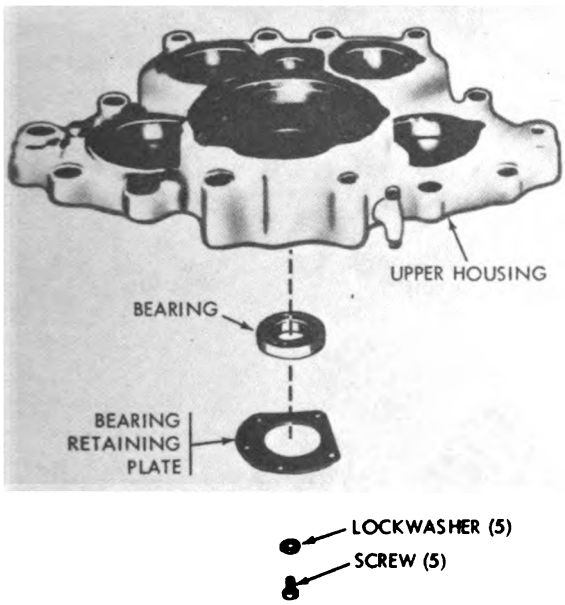



*Figure 3-56. Traversing gearbox disassembly or assembly (11 of 15).*

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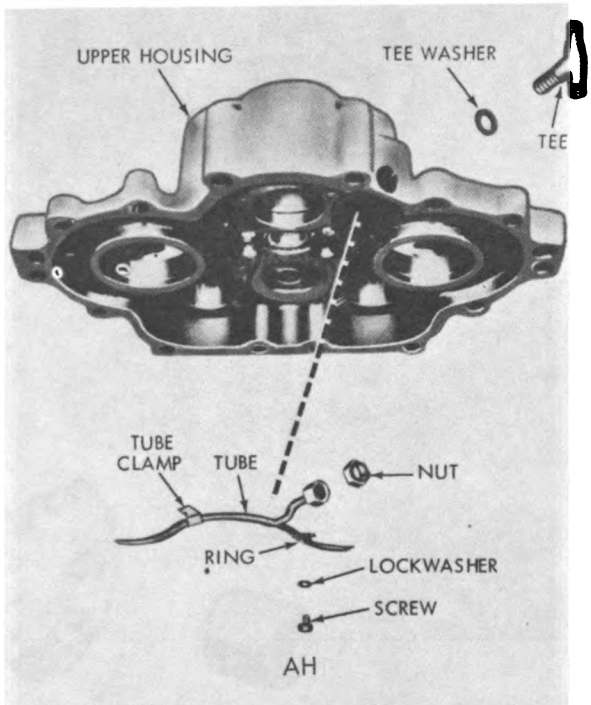


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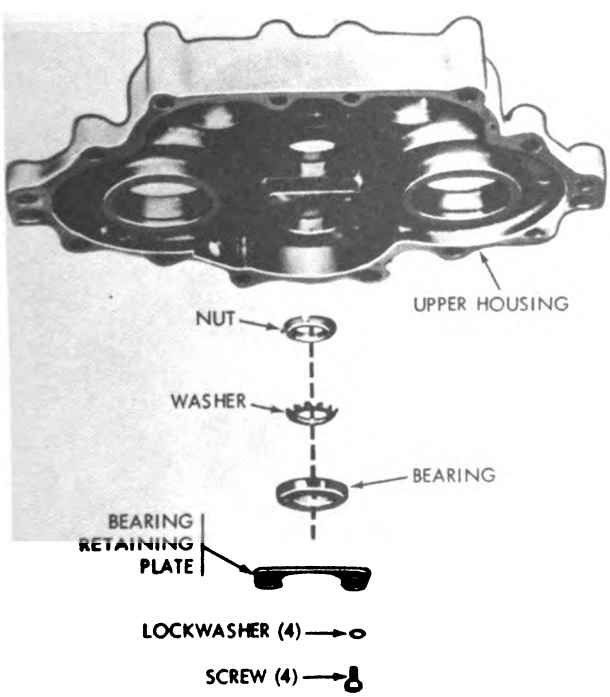


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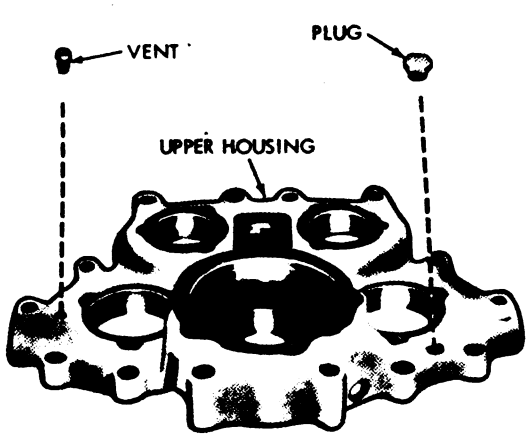


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*Figure 3-56. Traversing gearbox disassembly or assembly (12 of 15).*

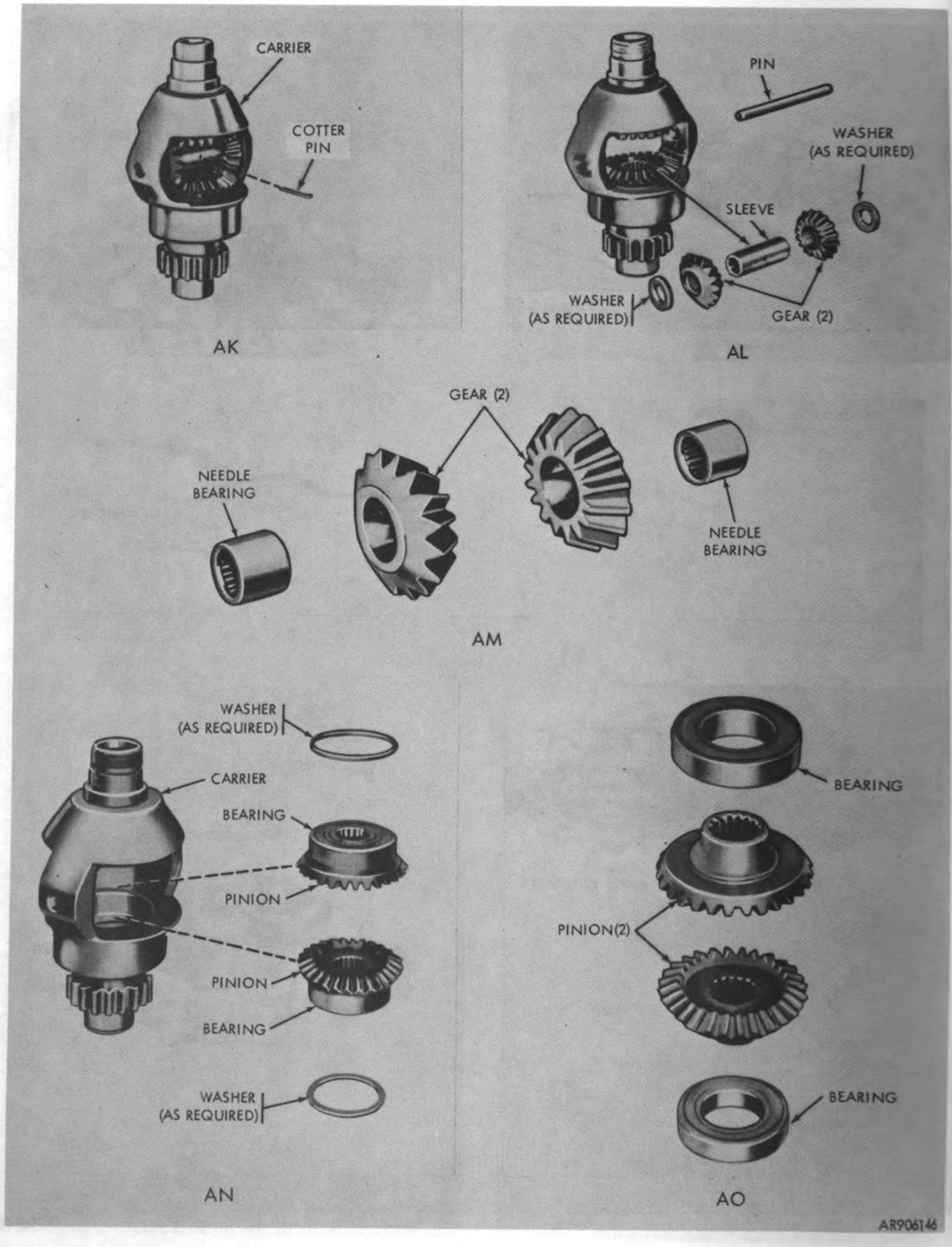
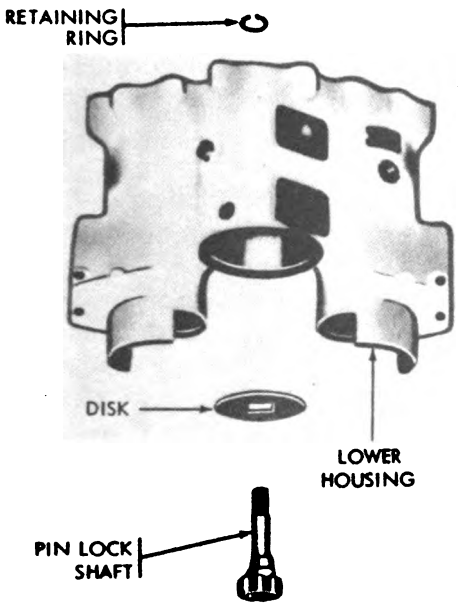



*Figure 3-56. Traversing gearbox disassembly or assembly (13 of 15).*

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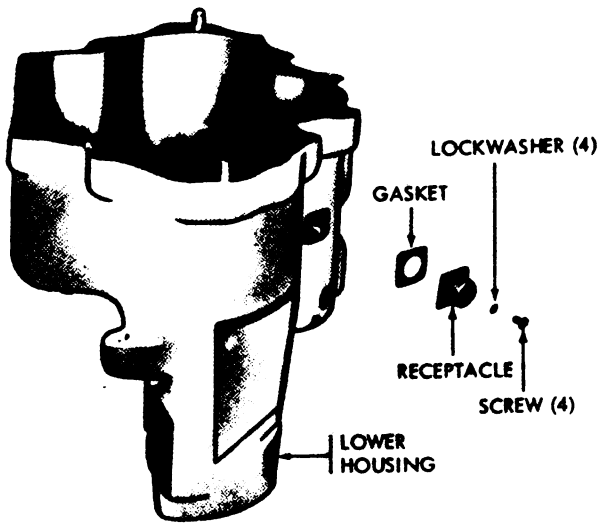


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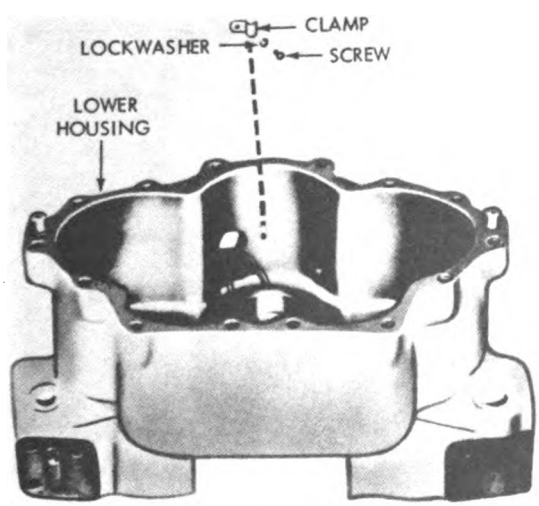


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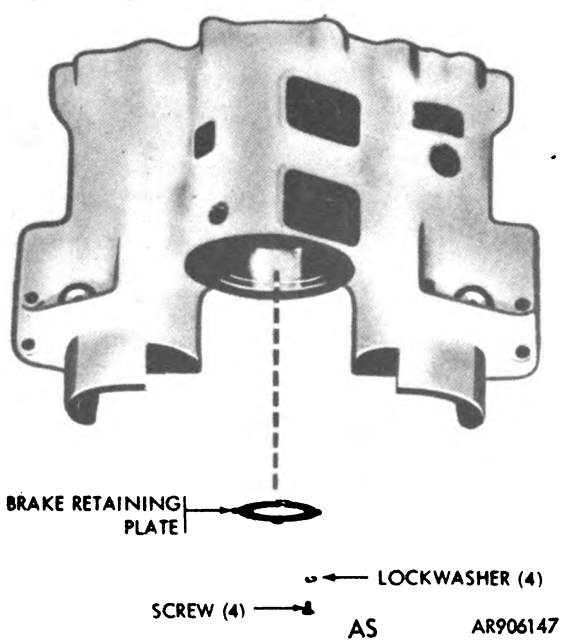


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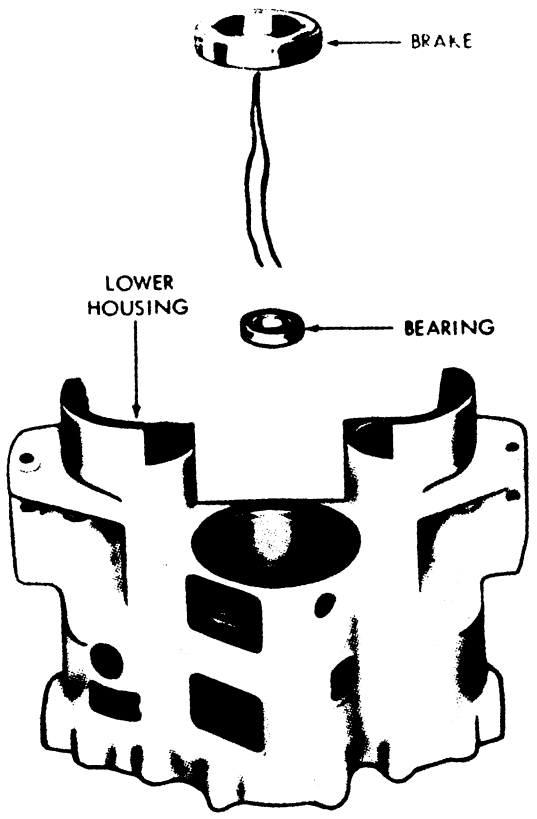
*Figure 3-56. Traversing gearbox disassembly or assembly (14 of 15).*

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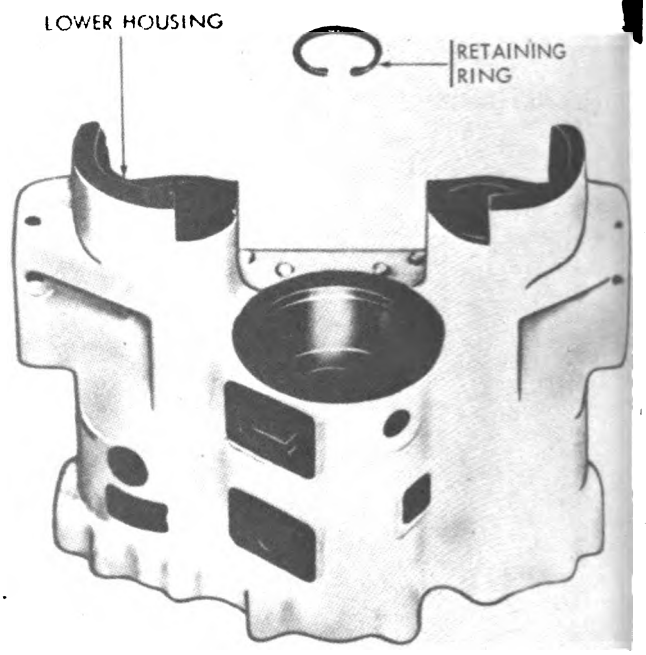


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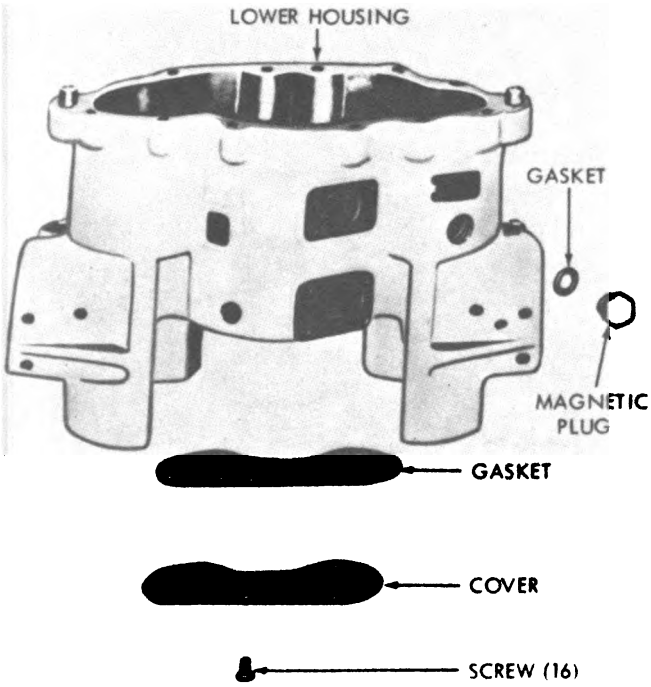


AV

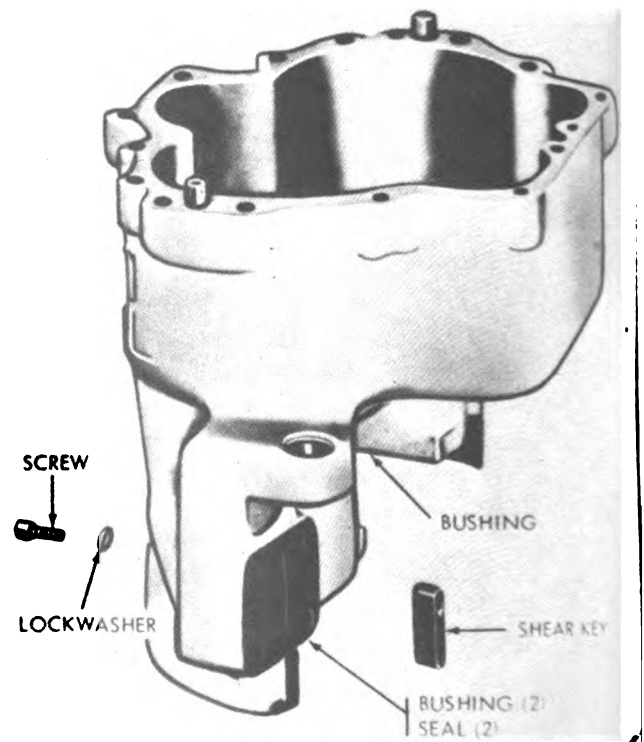


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*Figure 3-56. Traversing gearbox disassembly or assembly (15 of 15).*

**3-138. Cleaning.** Refer to paragraph 2-9.

**3-139. Inspection, Test and Repair.**

*a.* Inspect components for wear as specified in table 3-15, 3-16, and 3-17.

*b.* Replace all defective components.

*c.* Test the following components, and repair components which fail these tests prior to installation in traversing gearbox.

(1) Traversing gearbox no-bak.

(2) Traversing gearbox clutch.

(3) Traversing gearbox oil pump.

(4) Traversing gearbox pin lock (TM 9-2350-258-20-2).

*Table 3-15. Traversing Gearbox Upper Housing And Gear Train Wear Limits*

| Figure | Reference | Measurement | Wear Limit (in.) |
|---|---|---|---|
| 3-57 | A | ID of ball bearing | 0.9843 max |
| 3-57 | B | OD of ball bearing | 2.0467 min |
| 3-57 | C | OD of shaft shoulder | 0.928 min |
| 3-57 | D | Diameter of gear over 0.2880 inch pins | 2.8786 min |
| 3-57 | E | Diameter of gear over 0.2160 inch pins | 4.0789 min |
| 3-57 | F | ID of ball bearing | 1.3780 max |
| 3-57 | G | OD of ball bearing | 2.8341 min |
| 3-57 | H | ID of ball bearing | 1.1811 max |
| 3-57 | J | OD of ball bearing | 2.1649 min |
| 3-57 | K | OD of differential bearing surface | 1.1797 min |
| 3-57 | L | Diameter of differential over 0.1728 inch pins | 2.0340 min |
| 3-57 | M | OD of shaft (finished at assembly) | 2.21235 min |
| 3-57 | N | Diameter of shaft over 0.2880 inch pins | 5.7326 min |
| 3-57 | N-D | Backlash with right gear | 0.0091 max |
| 3-57 | P | OD of shaft assembly | 1.3765 min |
| 3-57 | Q | Housing bore for bearing | 2.8356 max |
| 3-57 | R | Upper housing bore for bearing | 2.1664 max |
| 3-57 | S | Diameter of gear over 0.1728 inch pins | 4.0640 min |
| 3-57 | T | OD of backlash shaft bearing surface | 0.4987 min |
| 3-57 | U | OD of backlash shaft | 0.7489 min |
| 3-57 | V | Diameter of backlash shaft over 0.2160 pins | 2.0707 min |
| 3-57 | W | OD of backlash shaft | 0.7489 min |

*Table 3-15. Traversing Gearbox Upper Housing And Gear Train Wear Limits — Continued*

| Figure | Reference | Measurement | Wear Limit (in.) |
|---|---|---|---|
| 3-57 | X | ID of lower backlash gear | 0.7532 min |
| 3-57 | W-X | Fit of shaft in gear | 0.0043L max |
| 3-57 | Y | Diameter of gear over 0.2160 inch pins | 2.707 min |
| 3-57 | Y-D | Backlash with right gear | 0.0093 max |
| 3-57 | Z | Diameter of gear over 0.1728 inch pins | 3.0639 min |
| 3-57 | AA | OD of ball bearing | 1.9995 min |
| 3-57 | BB | ID of ball bearing | 1.0000 max |
| 3-57 | CC | OD of intermediate shaft shoulder | 0.9985 min |
| 3-57 | DD | Diameter of gear over 0.1728 inch pins | 3.5277 min |
| 3-57 | DD-L | Backlash with differential gear | 0.0065 max |
| 3-57 | EE | Diameter of gear over 0.1728 inch pins | 1.7480 min |
| 3-57 | S-EE | Backlash with intermediate gear | 0.0093 max |
| 3-57 | EE-Z | Backlash with intermediate gear | 0.0093 max |
| 3-57 | EE-V | Backlash with backlash gear | 0.0093 max |
| 3-57 | FF | ID of bearing | 0.9843 max |
| 3-57 | GG | OD of bearing | 2.0467 min |
| 3-57 | GG | Fit of bearing in housing | 0.0015L max |
| 3-57 | HH | OD of shaft bearing surface | 0.9819 min |
| 3-57 | JJ | Diameter of gear over 0.2160 inch pins | 4.0789 min |
| 3-57 | JJ-V | Backlash with backlash gear | 0.0093 max |
| 3-57 | KK | Diameter of gear over 0.2880 inch pins | 2.8786 min |
| 3-57 | LL | OD of shaft (finished at assembly) | 2.1230 min |
| 3-57 | MM | Diameter over 0.2880 inch pins | 5.7343 min |
| 3-57 | KK-MM | Backlash with left pinion | 0.0091 max |
| 3-57 | NN | OD of shaft | 1.3765 min |
| 3-57 | PP | OD of bearing | 2.8341 min |
| 3-57 | QQ | ID of bearing | 1.3780 max |
| 3-57 | RR | ID of bushing | 0.7509 max |
| 3-57 | SS | OD of bushing | 1.0025 min |
| 3-57 | TT | Housing bore for bushing | 1.0010 max |
| 3-57 | UU | Housing bore for bearing | 2.0482 max |
| 3-57 | VV | Housing bore for bearing | 2.8356 max |

*Table 3-16. Traversing Gearbox Lower Housing Wear Limits.*

| Figure | Reference | Measurement | Wear Limit (in.) |
|---|---|---|---|
| 3-59 | A | Diameter of gear over 0.4800 inch pins | 4.7630 min |
| 3-59 | B | Housing bore for bearing | 2.0482 max |
| 3-59 | C | Housing bore for bearing | 2.0010 max |
| 3-59 | D | Housing bore for bushing | 2.3130 max |
| 3-59 | E | ID of bushing | 0.7509 max |
| 3-59 | E | Fit of shaft in bushing | 0.0020L max |
| 3-59 | F | OD of bushing | 1.0025 min |
| 3-59 | G | OD of bushing | 2.3175 min |
| 3-59 | H | ID of shaft bushing (finished at assembly | 2.1275 max |
| 3-59 | H | Fit of shaft in bushing | 0.0045L max |
| 3-59 | J | Housing bore for bushing | 1.0010 max |
| 3-59 | K | Housing bore for bearing | 2.1664 max |
| 3-59 | L | OD of bearing | 2.1649 min |
| 3-59 | M | OD of pinlock shaft | 1.1797 min |
| 3-59 | N | ID of bearing | 1.1811 max |
| 3-59 | P | Disk must be flat | |
| 3-59 | Q | Using a suitable ohmmeter, check coil for continuity | 38.5 to 42.5 ohms |

*Table 3-17. Traversing Gearbox Differential Wear Limits.*

| Figure | Reference | Measurement | Wear Limit (in.) |
|---|---|---|---|
| 3-58 | A | OD of center pin | 0.4373 min |
| 3-58 | B | OD of needle bearing | 0.6249 min |
| 3-58 | C | ID of needle bearing | 0.4376 max |
| 3-58 | D | ID of differential pinion gear | 0.6203 max |
| 3-58 | E | ID of sleeve | 0.445 max |
| 3-58 | F | ID of bore | 0.4378 max |
| 3-58 | G | ID of differential carrier counterbore | 1.8509 max |
| 3-58 | H | ID of ball bearing | 0.9843 max |
| 3-58 | J | OD of ball bearing | 1.8499 min |
| 3-58 | K | OD of differential gear shoulder | 0.9842 min |
| 3-58 | L | When damaged, the differential gears must be replaced as a complete matched set | .0010L max |
| 3-58 | M | When damaged, the pinion gears must be replaced as a complete matched set | |
| 3-58 | L-M | Backlash between gear and pinion | 0.006 max |

## 3-140 Assembly.

*a. Lower Housing Miscellaneous Components (fig 3-56).*

(1) Install three bushings and two seals into housing (press fit) (view AW).

(2) Install shear key and secure with screw and washer. Tighten screw to 3 — 5 lb-ft (4-7 N.m) (view AW).

(3) Install magnetic plug and gasket (view AV).

(4) Position gasket and cover on housing and secure with 16 screws. Tighten screws to 3 — 5 lb-ft (4-7 N.m) (view AV).

*b. Magnetic Brake (fig 3-56).*

**NOTE**

Oil brake surfaces with lubricating oil (MIL-L-10295) prior to assembly.

(1) Install retaining ring into housing (view AU).

(2) Position bearing and brake in housing (view AT) and secure with brake retaining plate, four screws, and four lockwashers (view AS). Tighten screws to 22—24 lb-in. (2.2 — 2.7 N.m).

(3) Secure brake electrical leads to housing with clamp, screw, and lockwasher (view AR).

(4) Position brake electrical receptacle and gasket on housing and secure with four screws and lockwashers (view AQ).

(5) Solder brake leads (view AQ) to receptacle pins (view AQ).

(6) Position disk and hydraulic pin lock shaft in housing and secure with snapring (view AP).

*c. Upper Housing and Gear Train (fig 3-56).*

(1) Press bearings onto pinion gears (view AO).

(2) Position washers and pinions in carrier and tap pinions to seat against washers (view AN).

(3) Press bearings into gears (view AM).

(4) Position two gears, washers, and sleeve in carrier and secure with pin (press fit) (view AL). Each end of pin must be flush with outer surface of carrier.

(5) Backlash between gears (views AL and AM) must be within 0.001 to 0.003 inch. Add washers or shims (view AL) as required to obtain specified tolerance.

(6) Install cotter pin through sleeve and pin (view AK).

(7) Position nut, washer, and bearing in housing and secure with bearing retaining plate, four screws, and four lockwashers (view AI). Tighten screws to 3 — 5 lb-ft (4—7 N.m). Install vent and plug in upper housing (view AJ).

(8) Position tee and washer in housing and secure with nut (view AH). Tighten tee nut to 50 — 64 lb-ft (68—87 N.m).

(9) Connect tube to tee and secure tube to housing with screw and lockwasher (view AH).

(10) Position bearing in housing and secure with retaining plate, five screws, and five lockwashers (view AG). One screw also secures tube clamp (view AH). Tighten screws to 22 — 24 lb-ft (30 — 33 N.m).

(11) Position upper backlash gear end backlash gear and shaft in upper housing and secure with retaining ring (view AF). Position bearing in housing and secure with retaining ring (view AE).

(12) Position left gear in housing and secure with nut and washer (view AD). Tighten nut with brass drift pin and bend washer tangs to lock nut.

(13) Position gear cover on housing and secure with three screws and lockwashers (view AD). Tighten screws to 3 — 5 lb-ft (4—7 N.m).

(14) Position left pinion shaft bearing in housing and secure with retaining ring (view AC).

(15) Position left pinion shaft through bearing secure with nut and washer (view AB). Tighten nut with brass drift pin and bend washer tangs to lock nut.

(16) Position left pinion shaft cover on housing and secure with three screws and lockwashers (view AB). Tighten screws to 3 — 5 lb-ft (4—7 N.m).

(17) Position right pinion shaft bearing in housing and secure with retaining ring (view AA).

(18) Position right pinion shaft through bearing and secure with nut and washer (view Z). Tighten nut with brass drift pin and bend washer tangs to lock nut.

(19) Position right pinion shaft cover on housing and secure with three screws and lockwashers (view Z).

(20) Position right gear bearing in housing and secure with retaining ring (view Y).

(21) Position right gear through bearing and secure with nut and washer (view X). Tighten nut with brass drift pin and bend washer tangs to lock nut.

(22) Position right gear cover on housing and secure with three screws and lockwashers (view X). Tighten screws to 3 — 5 lb-ft (4—7 N.m).

(23) Position lower backlash gear and two washers on backlash gear shaft and secure with retaining ring (view W).

(24) Position bearings on right and left gear shafts and secure with retaining rings (view V).

(25) Position differential shaft through bearing and secure with nut and washer (view U). Tighten nut with brass drift pin and bend washer tangs to lock nut.

(26) Position bearing on intermediate gear and secure with retaining ring (view T).

(27) Position intermediate gear shaft through bearing and secure with locknut and washer (view S). Tighten locknut with brass drift pin and bend washer tangs to lock nut.

(28) Position bearing on differential and secure with retaining ring (view R).

(29) Install adapters (24, table 2-1) onto ends of pinion shafts (view Q).

(30) Position gasket on lower housing (view Q).

(31) Position upper housing on lower housing (view Q) and secure with 14 screws (six long and eight short) and lockwashers (view P). Tighten screws to 27 — 32 lb-ft (37—43 N.m).

(32) Remove adapters (view Q) from pinion shafts.

(33) Position two pinion guards on lower housing and secure with four screws (view O).

(34) Position two pinions on pinion shafts and secure with snaprings (view N).

(35) Position two pinion guard plates on lower housing and secure with six screws (view M).

*d. Magnetic Brake Test (fig 3-56).*

(1) Connect positive lead of a 27.5-vdc power supply to magnetic brake receptacle pin A (view AQ).

(2) Connect negative lead of power supply to magnetic brake receptade pin B (view AQ).

(3) Turn power supply on.

(4) Using torque wrench adapter (25, table 2-1) and torque wrench, apply 170 lb-in. (19 N.m) to hydraulic pin lock shaft (view AP). Brake shall not slip at applied torque of 170 lb-in. (19 N.m). If brake slips at less than 170 lb-in (19 N.m) torque, repair or replace magnetic brake.

*e. Hydraulic Motor (fig 3-56).*

(1) Install three new adapters and tee, if motor is being replaced.

(2) Position new gasket on hydraulic motor. Position woodruff key on motor shaft and aline with internal keyway on hydraulic pin lock shaft (view L).

(3) Position motor on lower housing and secure with four screws and lockwashers (view L).

*f. Traversing Gearbox Antibacklash Mechanism (fig 3-56).*

(1) Press bearing and guide onto backlash shaft and gear (view K).

(2) Position antibacklash housing and gasket on upper housing (view J).

(3) Install four screws and lockwashers securing antibacklash housing to gearbox housing (view J).

(4) Tighten screws to 54—59 lb-ft (73—80 N.m).

(5) Install spring in housing (view J).

NOTE

Install adjusting screw in housing until top of screw is 5/16 inch below top edge of the housing.

(6) Install adjusting screw into antibacklash housing (view J).

(7) Install cover and gasket on antibacklash mechanism (view I).

*g. Traversing Gearbox Pin Lock (fig 3-56).*

(1) Install two nipples and packings on pin lock.

(2) Position pin lock and gasket on housing (view H).

(3) Install four screws and lockwashers (view H).

(4) Tighten screws to 3.0 lb-ft. (4.0 N.m).

(5) Connect tube to pin lock and hydraulic motor (view H).

*h. Traversing Gearbox Oil Pump (fig 3-56).*

NOTE

Remove shipping nuts from gear box oil pump screws (if installed) during disassembly.

(1) Install two elbows in pump ports (view G).

(2) Position pump and gasket on housing.

(3) Secure pump with four screws and lockwashers (view G).

*i. Traversing Gearbox Clutch (fig 3-56).*

(1) Install tube and elbow on clutch housing (view D). Do not tighten tube nut at this time.

(2) Position clutch on traversing gearbox (view C).

(3) Secure clutch to gearbox with five screws and lockwashers (view C).

(4) Tighten screws to 4—6 lb-ft (5 — 8 N.m).

(5) Connect tube to upper housing tee (view B).

*j. Traversing Gearbox No-Bak (fig 3-56).*

(1) Position no-bak on clutch (view A). Shim as required to obtain 0.001 to 0.003 inch backlash between bevel gears of no-bak and clutch (TM 9-2350-258-20-2).

(2) Secure no-bak to clutch with four screws and lockwashers (view B).

(3) Tighten screws to 17 — 19 lb-ft (23 — 26 N.m).

(4) Install plug in tee (view E).

(5) Fill traversing gearbox to proper level with lubricating oil. Refer to LO 9-2350-258-12.

**3-141. Installation.** Refer to paragraph 2-33.

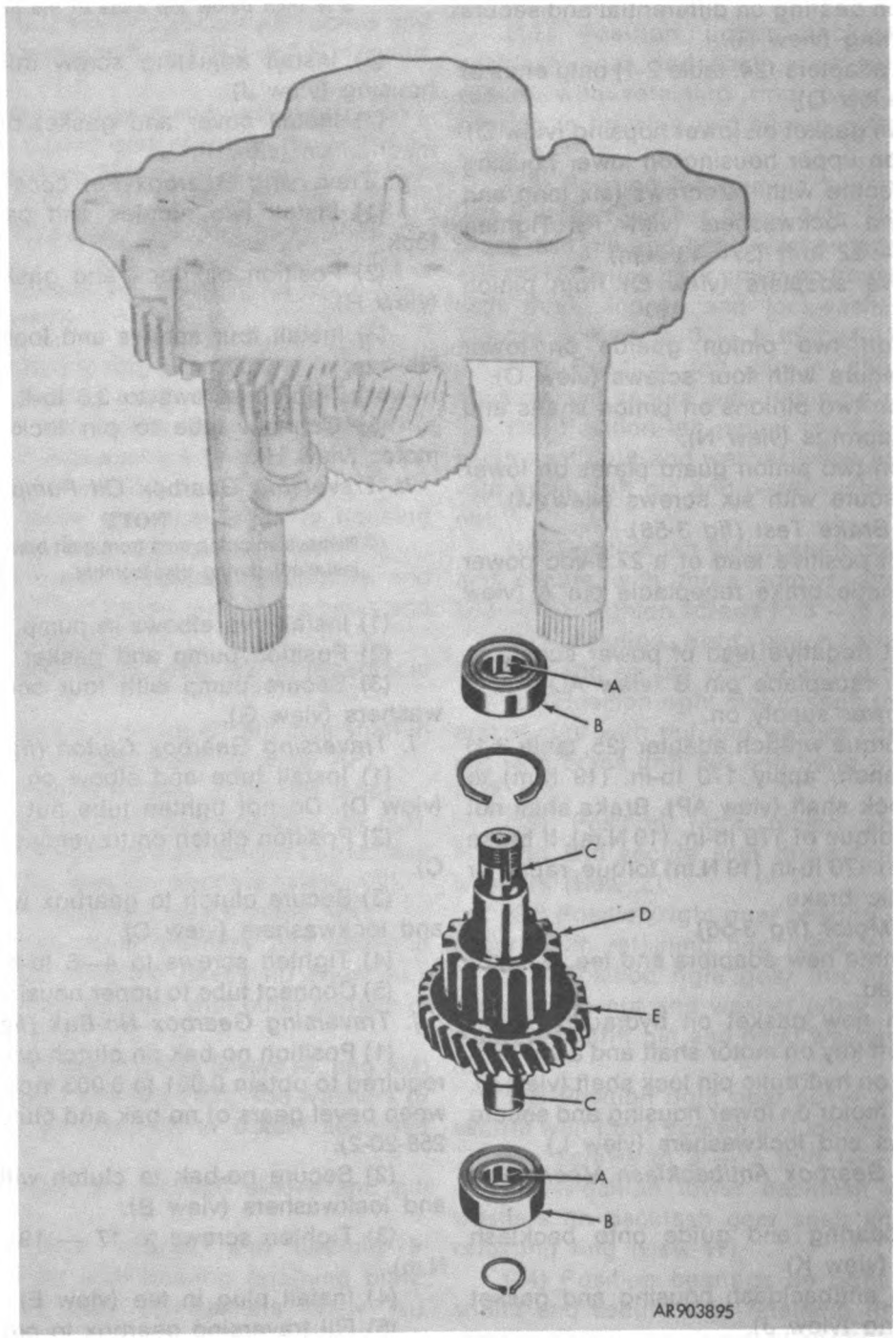



*Figure 3-57. Traversing gearbox upper housing and gear train wear points (1 of 5).*

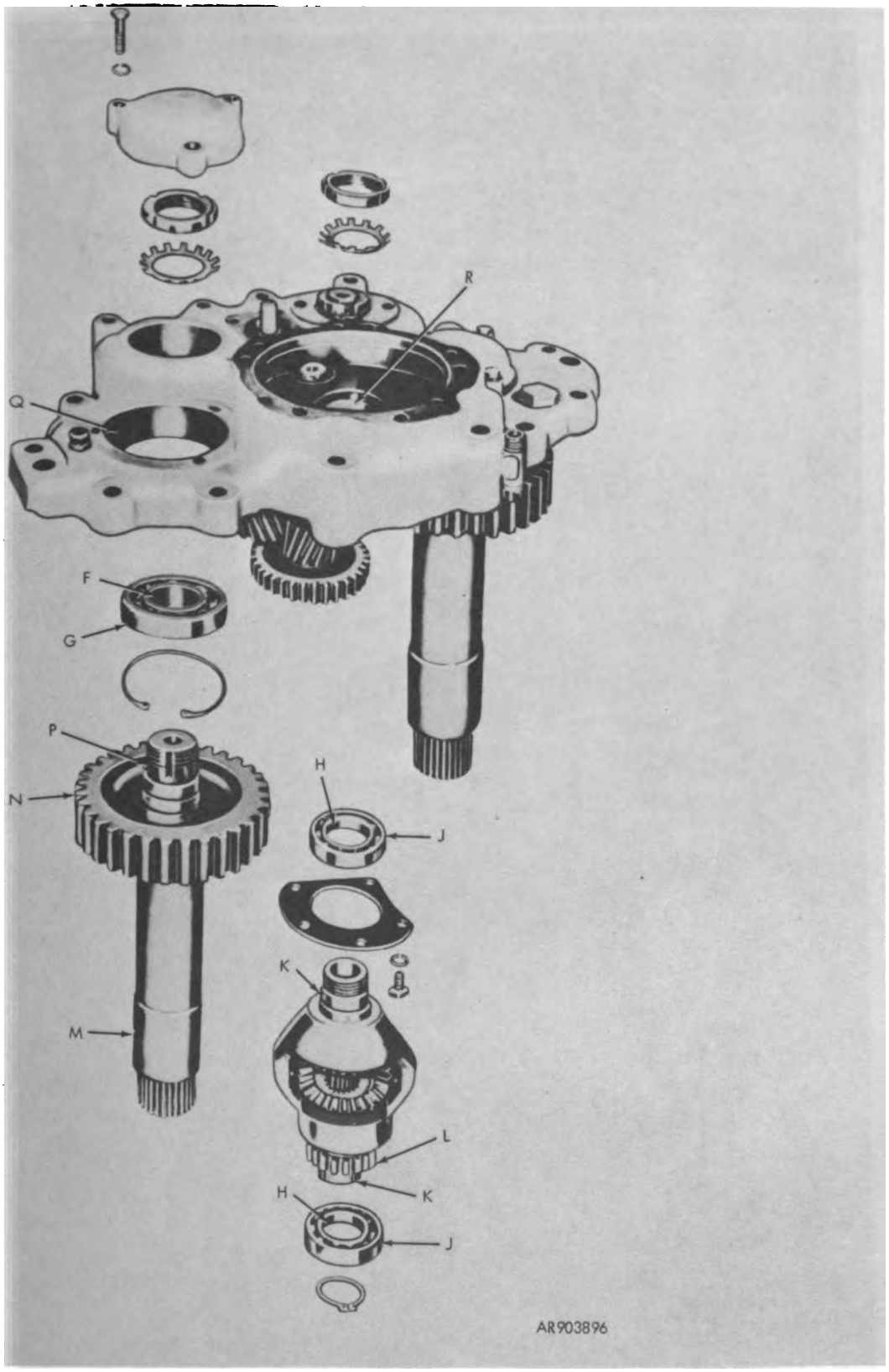



*Figure 3-57. Traversing gearbox upper housing and gear train wear points (2 of 5).*

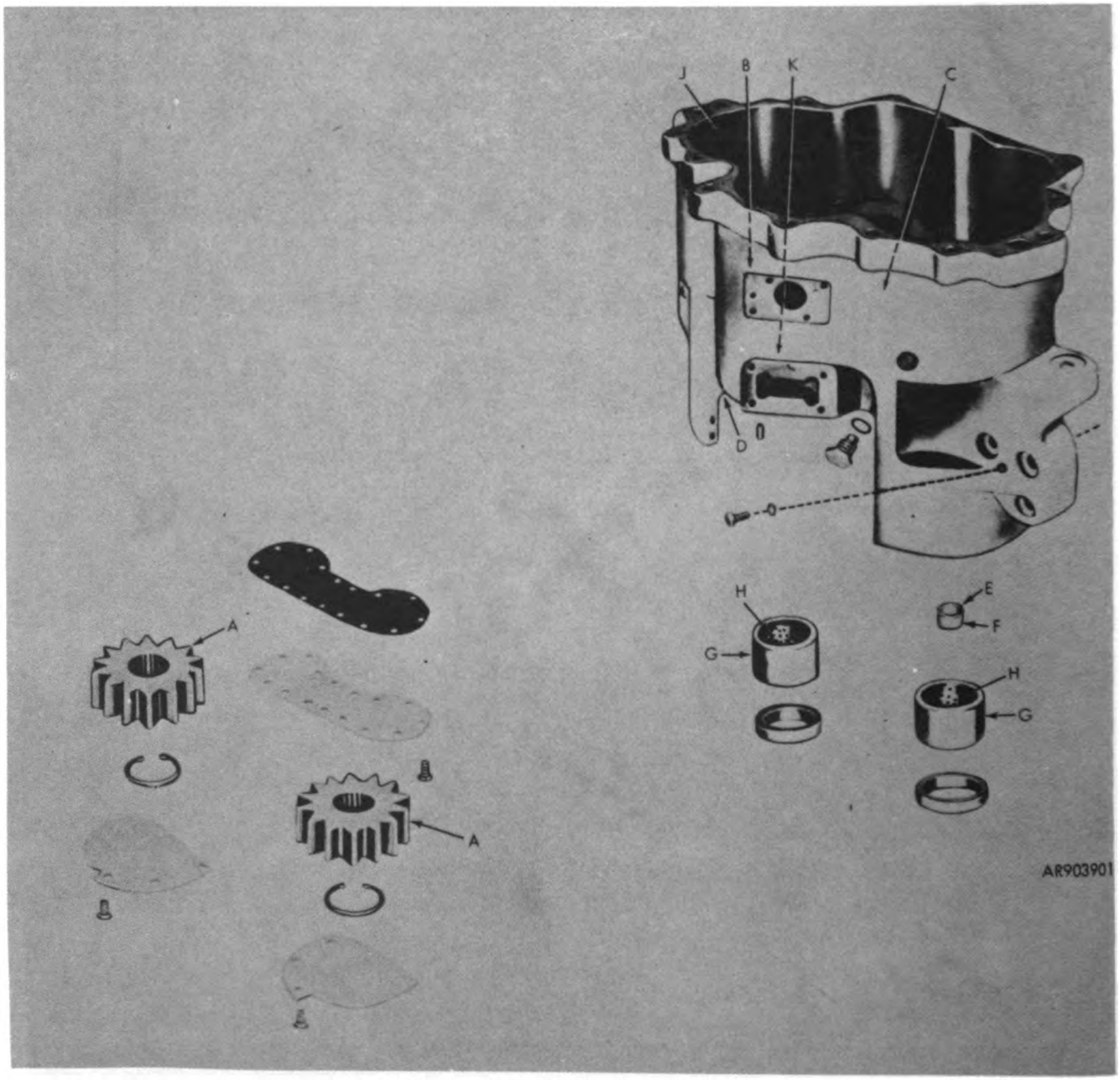



*Figure 3-59. Traversing gearbox lower housing wear points (1 of 2).*

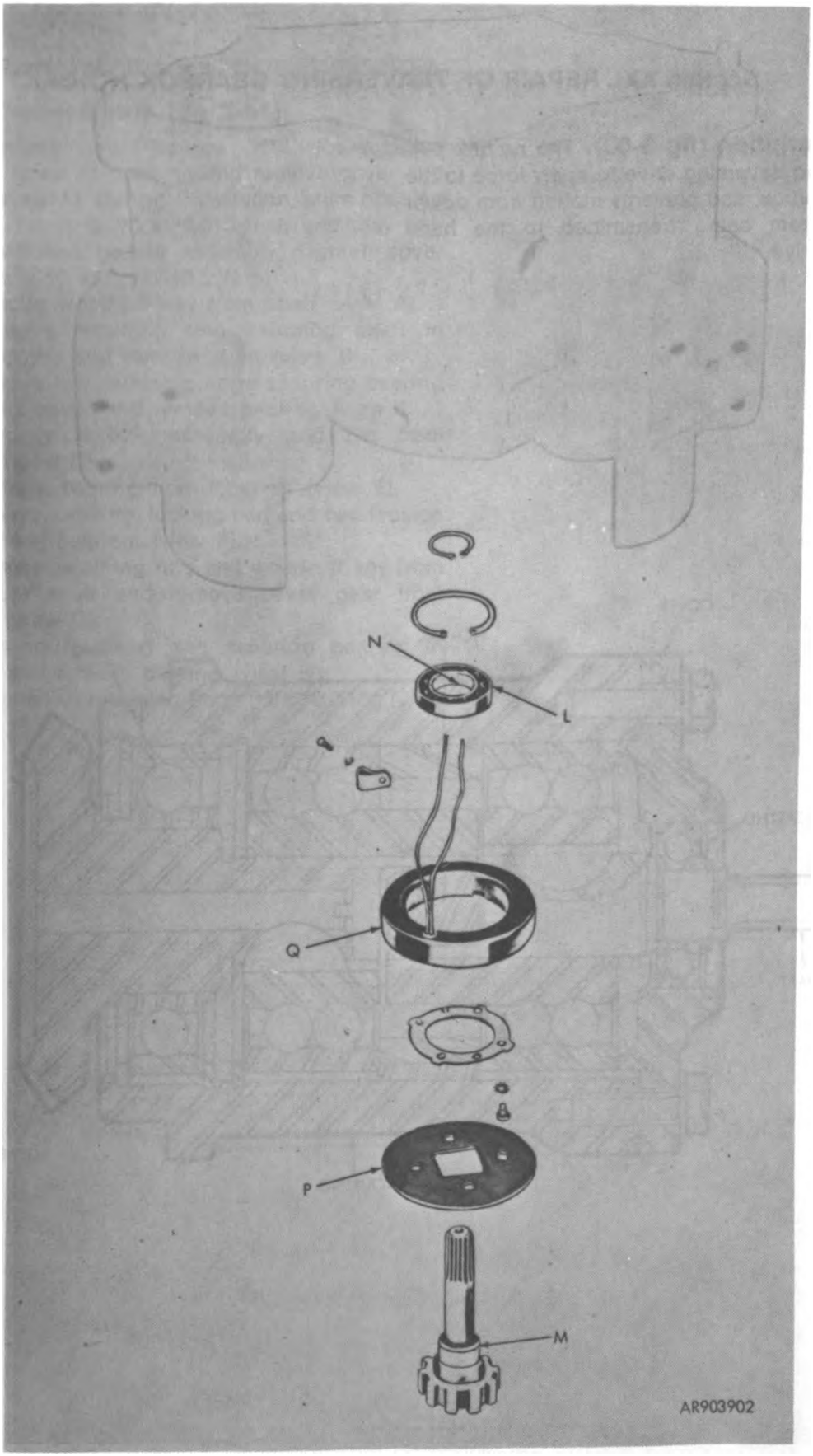



*Figure 3-59. Traversing gearbox lower housing wear points (2 of 2).*

## Section XXI. REPAIR OF TRAVERSING GEARBOX NO-BAK

**3-142 Description (fig 3-60).** The no-bak permits the hand traversing drive to apply force to the traverse gearbox, and prevents motion from power traversing from being transmitted to the hand traversing drive.

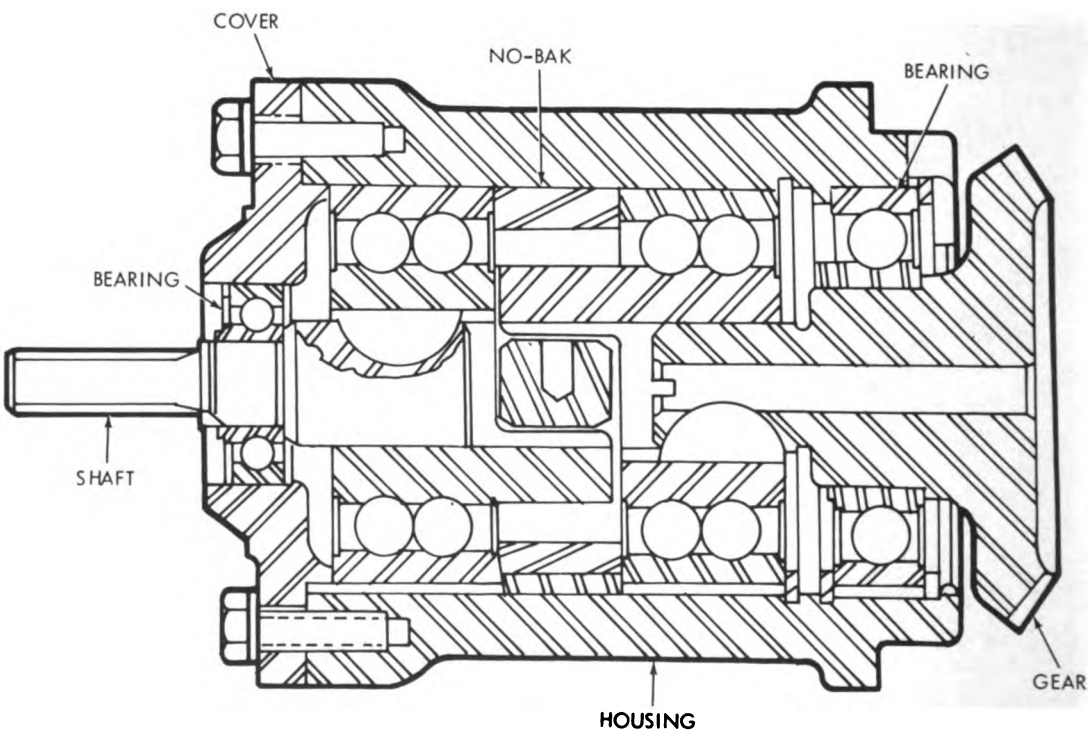



*Figure 3-60. Traversing gearbox no-bak — sectional view.*

**3-143. Removal.** Refer to TM 9-2350-258-20-2.

**3-144. Disassembly (fig 3-61).**

*a.* Remove four screws and lockwashers securing cover to housing and remove cover and shim(s) (view A). During installation, shim housing cover to obtain 0.000 to 0.010 inch end play between shaft and no-bak assembly. Tighten cover screws to 9-10 lb-ft (12-13.5 N.m).

*b.* Remove woodruff key from shaft (view A).

*c.* Remove retaining ring securing shaft in housing cover and remove shaft (view B).

*d.* Remove two retaining rings securing bearing in housing cover and remove bearing (view C).

*e.* Remove no-bak assembly and pin from housing (view D).

*f.* Separate bearing from lockring (view E).

*g.* Remove lockring, locking bar, and two tension springs from bearing. (view F).

*h.* Remove retaining ring and woodruff key from bevel gear shaft and remove bevel gear from housing (view G).

*i.* Remove retaining ring securing bearing in housing and remove bearing (view H).

*j.* Remove two retaining rings from housing (view H).

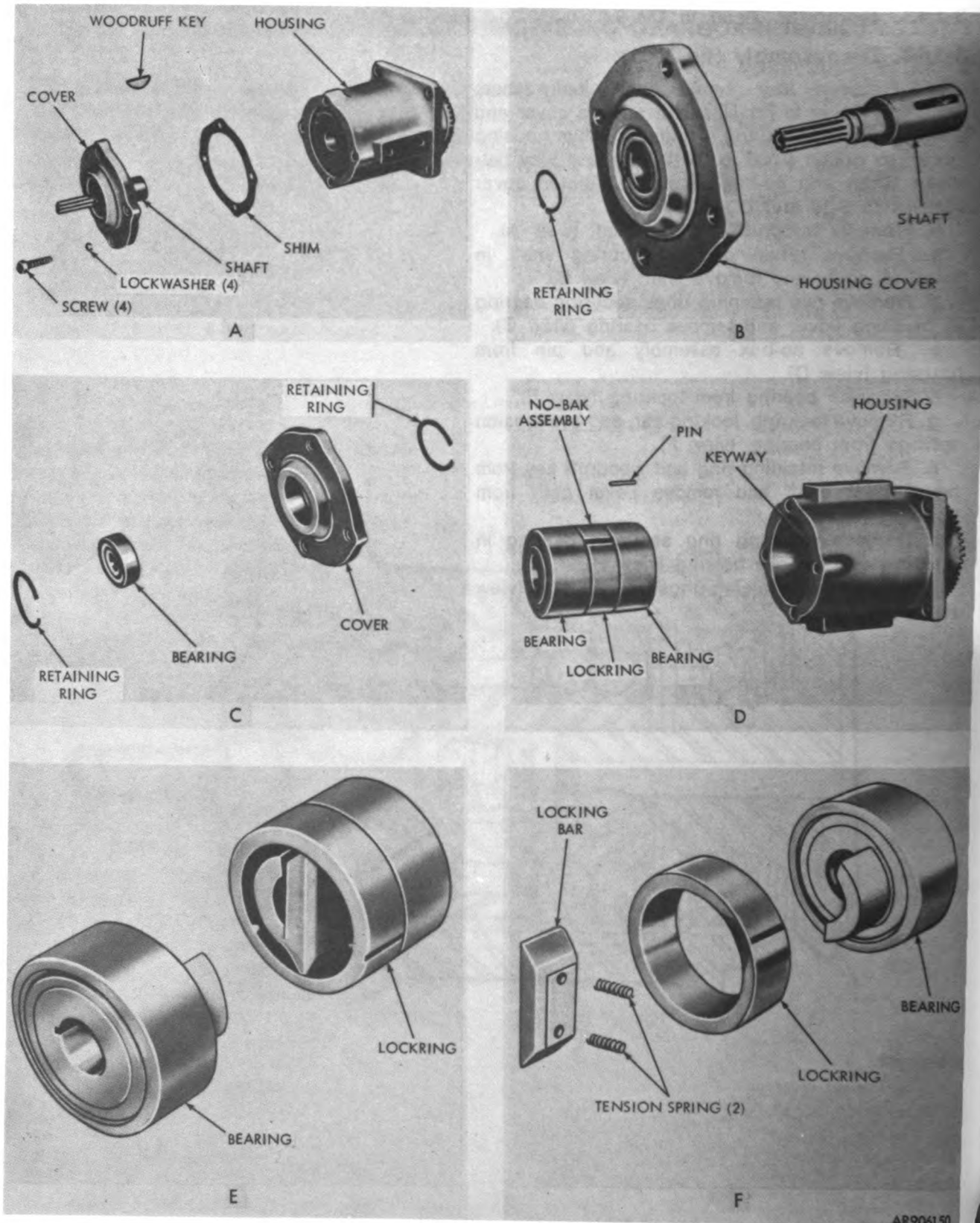



*Figure 3-61. Traversing gearbox no-bak disassembly or assembly (1 of 2).*

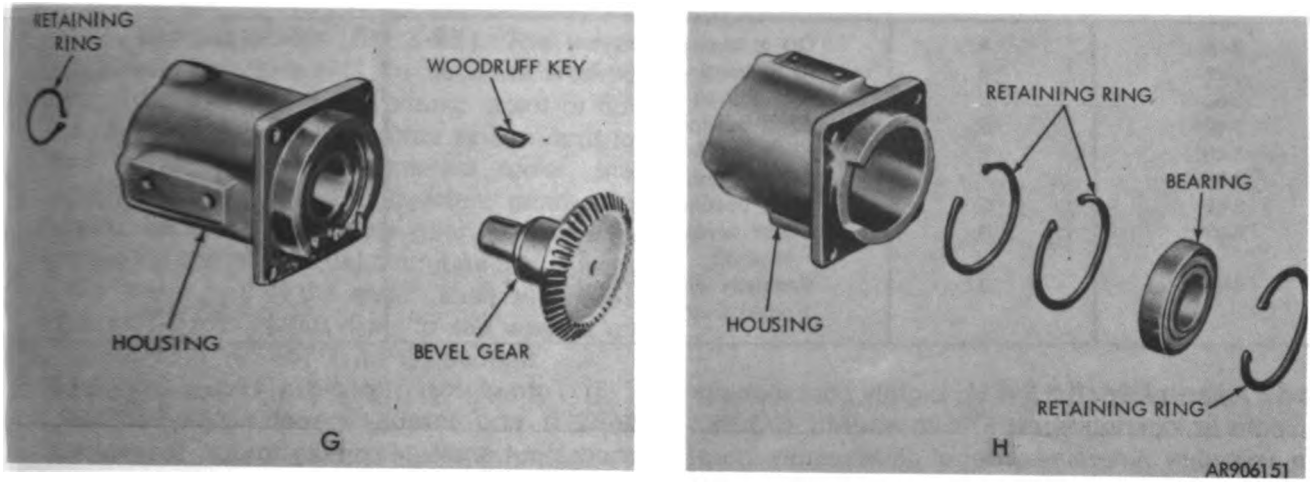



*Figure 3-61. Traversing gearbox no-bak disassembly or assembly (2 of 2).*

**3-145. Cleaning.** Refer to paragraph 2-9.

**3-146. Inspection and Repair.**

*a.* Inspect components for damage or wear as specified in table 3-18 and figure 3-62.

*b.* Repair or replace defective components.

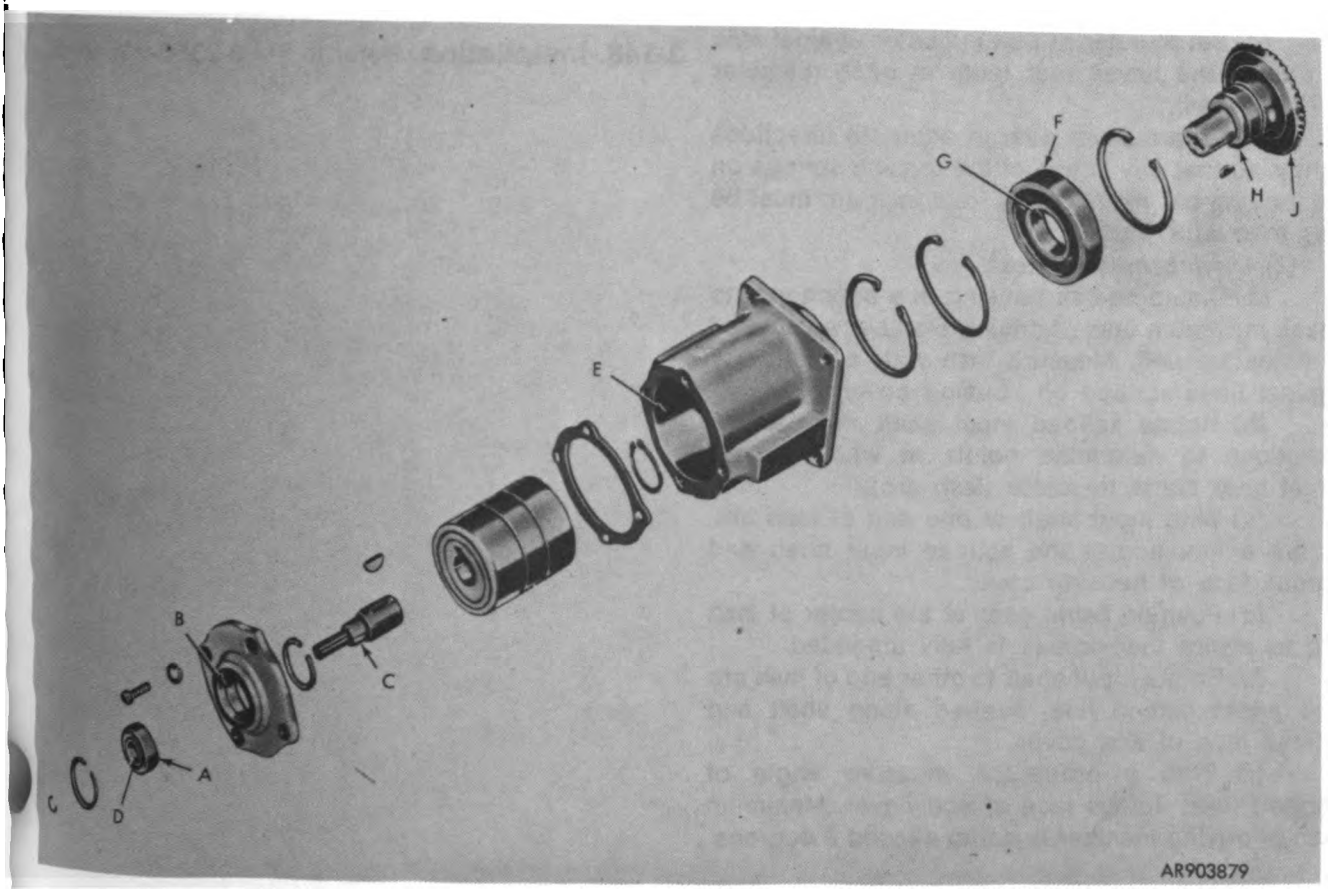



*Figure 3-62. Traversing gearbox no-bak wear points.*

*Table 3-18. Traversing Gearbox No-Bak Wear Limits*

| Figure | Reference | Measurement | Wear limit (in.) |
|---|---|---|---|
| 3-62 | A | OD of bearing | 1.5745 min |
| 3-62 | B | ID of housing cover bore | 1.5753 max |
| 3-62 | C | OD of shaft shoulder | 0.6692 min |
| 3-62 | D | ID of bearing | 0.6693 max |
| 3-62 | E | ID of housing | 3.1503 max |
| 3-62 | F | OD of bearing | 3.1491 min |
| 3-62 | G | ID of bearing | 1.5748 max |
| 3-62 | H | OD of bevel gear shoulder | 1.5749 min |
| 3-62 | J | Backlash with driven bevel gear | 0.007 max |

**3-147 Assembly (fig 3-61).** Lightly coat locking bar bore in lockring (view F) with oil (MIL-G-3278) and assemble in reverse order of disassembly (para 3-144).

*a. Tests.*

(1) *Driven member test.*

*(a)* Clamp no-bak housing in a bench vise to check internal lash. A dial indicator is required.

*(b)* Rotate splined input shaft by hand in alternate directions to determine points at which the output bevel gear (view G) starts to rotate (lash arc). Position splined input shaft (view B) approximately at center of lash arc to insure that no-bak is fully unloaded.

*(c)* Set plunger of dial indicator against side of one of the bevel gear teeth at pitch diameter (3.750 inches).

*(d)* Rotate bevel gear in alternate directions lightly, so that any action of the tension springs on the locking bar may be felt. Total lash arc must be less than 0.065 inch.

(2) *Driving member test.*

*(a)* Clamp no-bak housing in a bench vise to check maximum lash of driving member as applied to unloaded unit. Measure lash with a protractor against lines scribed on housing cover.

*(b)* Rotate splined input shaft in alternate directions to determine points at which output bevel gear starts to rotate (lash arc).

*(c)* With input shaft at one end of lash arc, scribe a line across the splined input shaft and across face of housing cover.

*(d)* Position bevel gear at the center of lash arc to insure that no-bak is fully unloaded.

*(e)* Rotate input shaft to other end of lash arc and again extend line, scribed along shaft and across face of end cover.

*(f)* With a protractor, measure angle of scribed lines across face of end cover. Maximum lash of driving member is not to exceed 2 degrees.

(3) *Torque test (fig 3-61).* Using socket (21, table 2-1) and torque wrench, apply torque to splined input shaft. Maximum torque to rotate no-bak housing should be 19 lb-in. (1.9 N.m). If this torque cannot be met, disassemble no-bak housing and replace springs (view F).

*b. Adjustment (fig 3-61).*

(1) If there is binding at input end install additional housing cover shims (view A) between housing and housing cover.

(2) If lash is excessive at driven or driving end, replace no-bak assembly (view D).

(3) If slippage is present replace tension springs (view F).

**3-148. Installation.** Refer to TM 9-2350-258-20-2.

## Section XXII. REPAIR OF TRAVERSING GEARBOX CLUTCH

**3-149. Description (fig 3-63).** The traversing gearbox clutch prevents an overload from being transmitted back to the hydraulic motor or no-bak. The clutch also prevents either of the input forces from acting against a jammed turret, thereby protecting the traversing gearbox gears. Should binding occur in the power gear train, the torque applied by the differential output gear to the splines at the lower end of the clutch shaft will cause the inner and outer clutch disks to slip when a torque of 33-42 lb-ft (45—57 N.m) is reached.

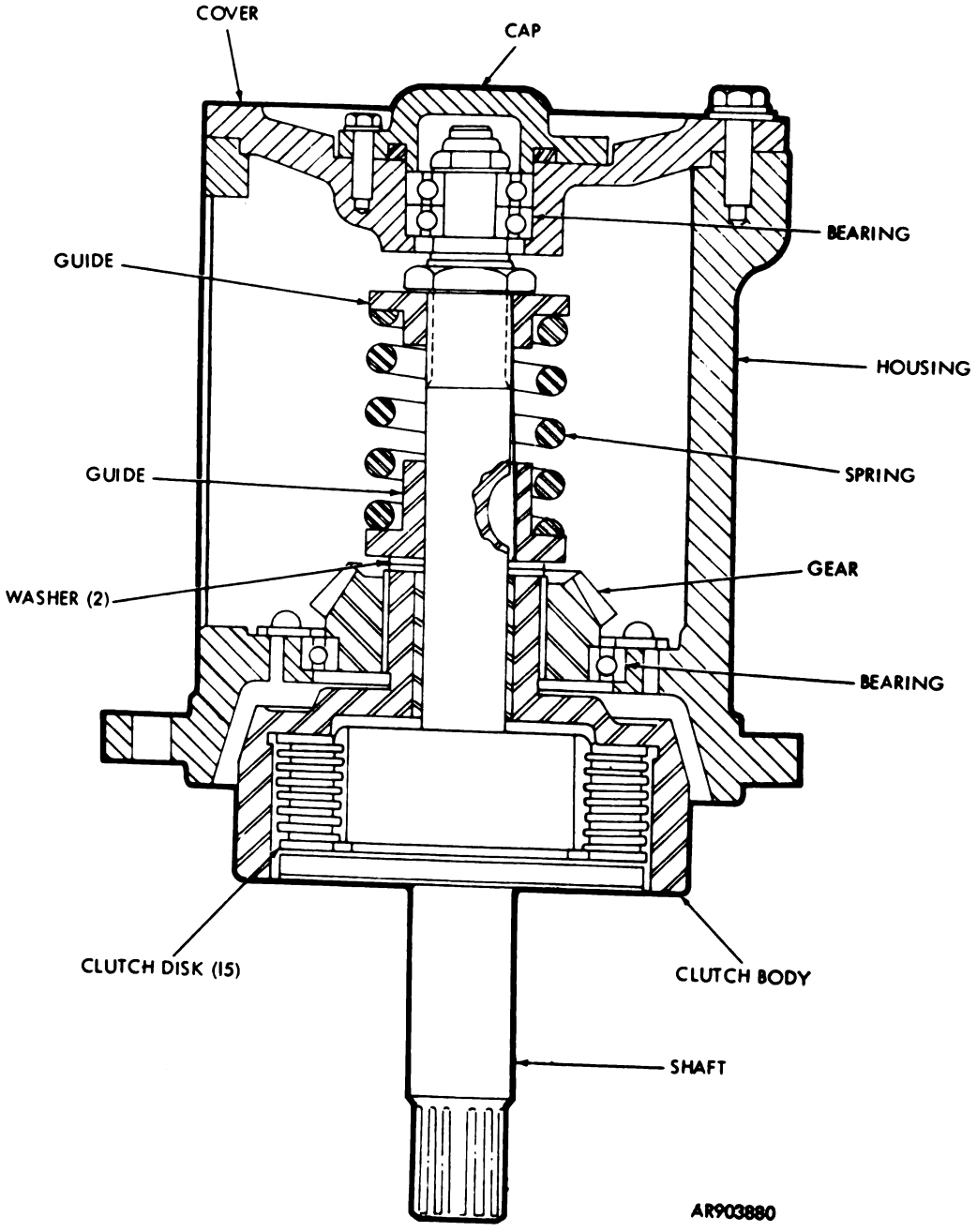



*Figure 3-63. Traversing gearbox clutch — sectional view.*

**3-150. Removal.** Refer to paragraph 2-34.

**3-151. Disassembly (fig 3-64).**

*a.* Remove four screws and lockwashers securing cap to cover and remove cap and packing (view A).

*b.* Remove nut and washer from shaft (view B).

*c.* Remove six screws, lockwashers, and washers securing cover to housing and remove cover (view C).

*d.* Remove bearing from cover (view C).

*e.* Remove spring guide locknut and upper spring guide from shaft (view D).

*f.* Remove spring, lower spring guide, two washers, gear, and woodruff key from shaft (view E).

*g.* Remove clutch from housing (view F).

*h.* Remove four screws securing bearing plate to housing and remove plate and bearing (view G).

*i.* Remove clutch body, eight outer disks, and seven inner disks from shaft (view H).

*j.* Remove bushing from clutch body (view H).

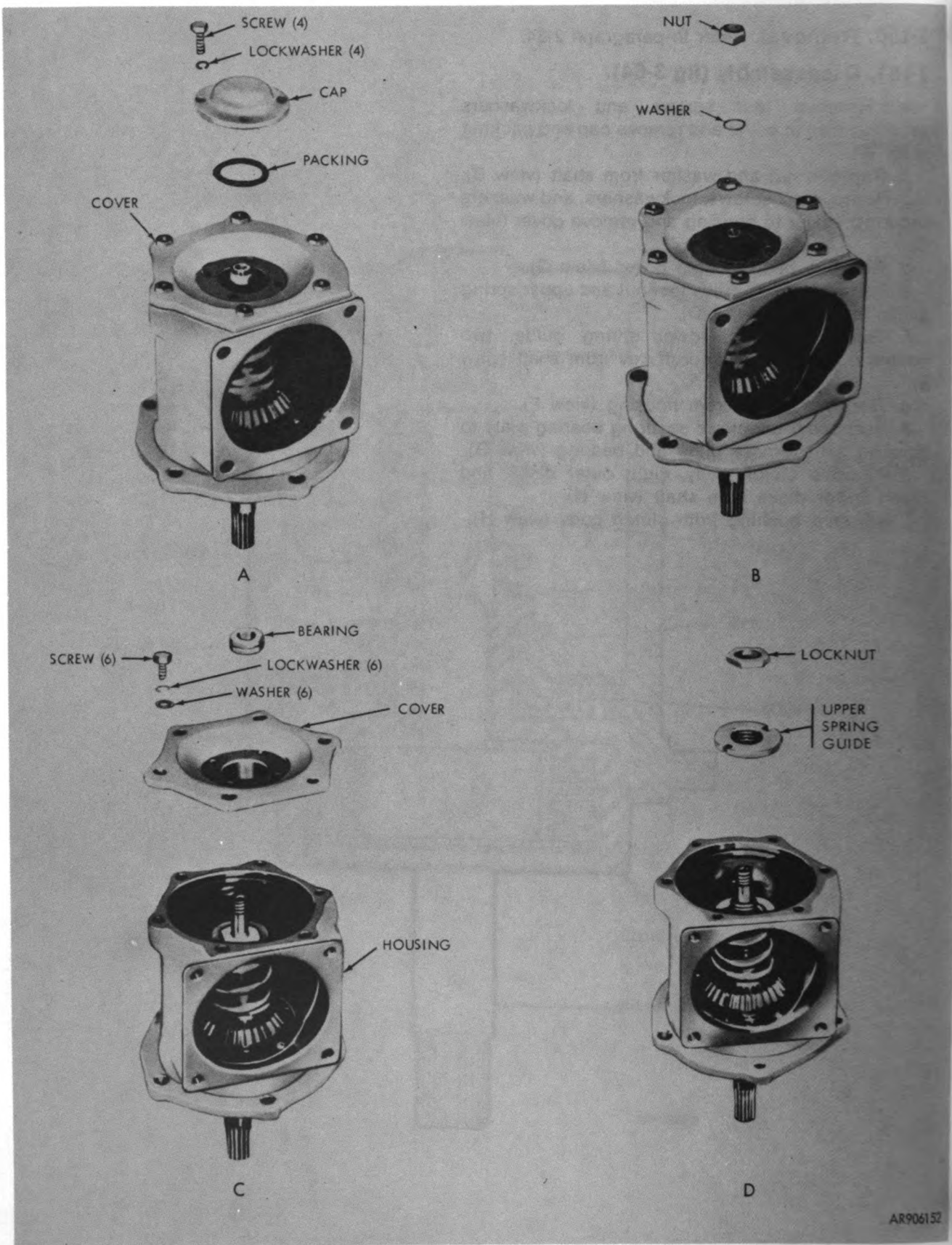



*Figure 3-64. Traversing gearbox clutch disassembly and assembly (1 of 2).*

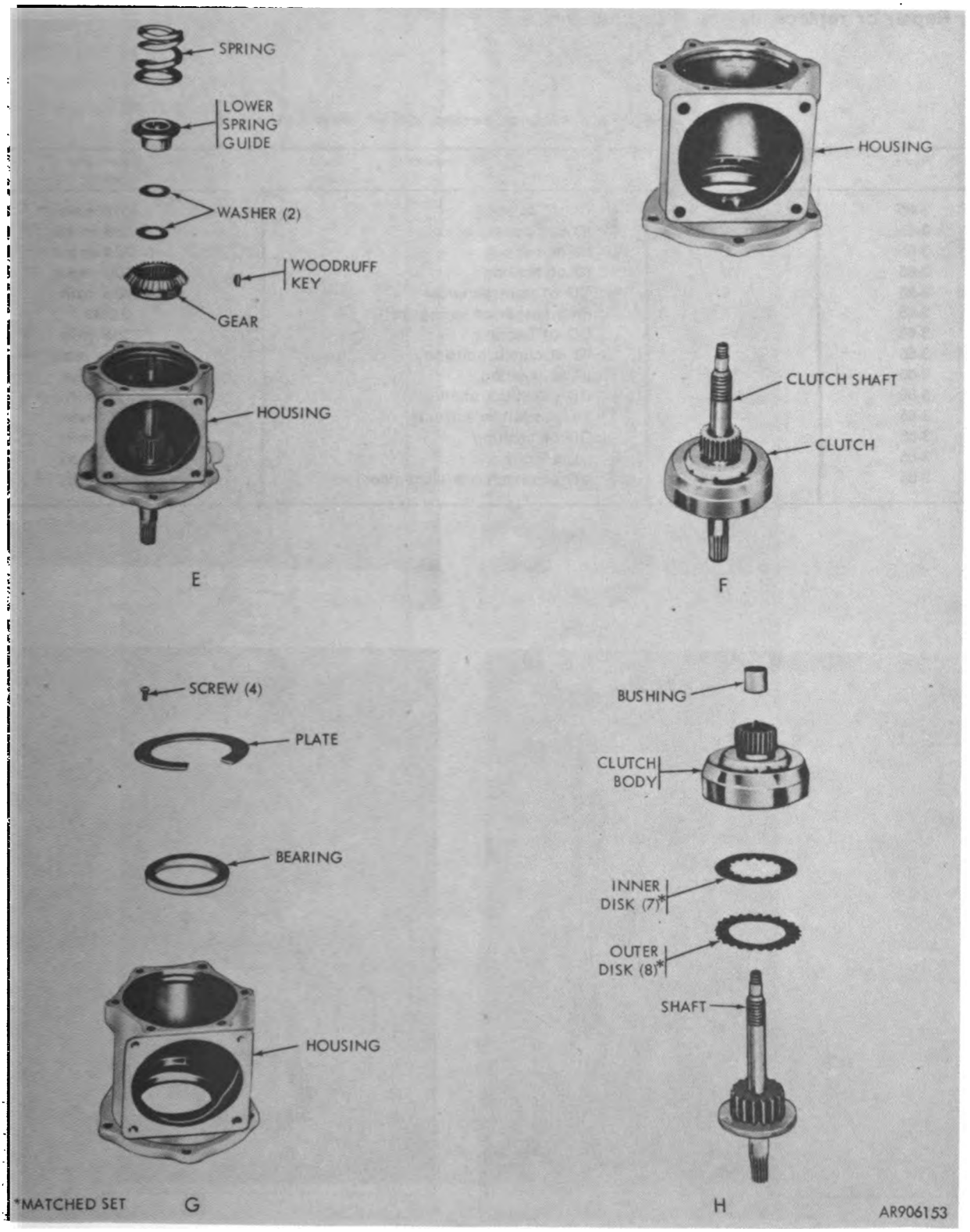



*Figure 3-64. Traversing gearbox clutch disassembly and assembly (2 of 2).*

## 3-152. Cleaning.

Refer to paragraph 2-9.

## 3-153. Inspection and Repair.

*a.* Inspect components for damage or wear as specified in table 3-19 and figure 3-65.

*b.* Repair or replace defective components.

*Table 3-19. Traversing Gearbox Clutch Wear Limits*

| Figure | Reference | Measurement | Wear Limit (in.) |
|---|---|---|---|
| 3-65 | A | OD of bearing | 1.1019 min |
| 3-65 | B | ID of housing cover | 1.1028 max |
| 3-65 | C | ID of bearing | 0.4724 max |
| 3-65 | D | ID of bearing | 2.2500 max |
| 3-65 | E | OD of gear shoulder | 2.2485 min |
| 3-65 | F | Free length of spring (ref) | 2.000 |
| 3-65 | G | OD of bearing | 2.9365 min |
| 3-65 | H | ID of clutch housing | 0.0015L max |
| 3-65 | J | ID of bushing | 0.755 max |
| 3-65 | K | OD of clutch shaft | 0.750 min |
| 3-65 | J—K | Fit of shaft in bushing | 0.005L max |
| 3-65 | L | OD of bushing | 0.8745 min |
| 3-65 | M | ID of body | 0.8755 max |
| 3-65 | N | OD of clutch shaft shoulder | 0.4711 min |

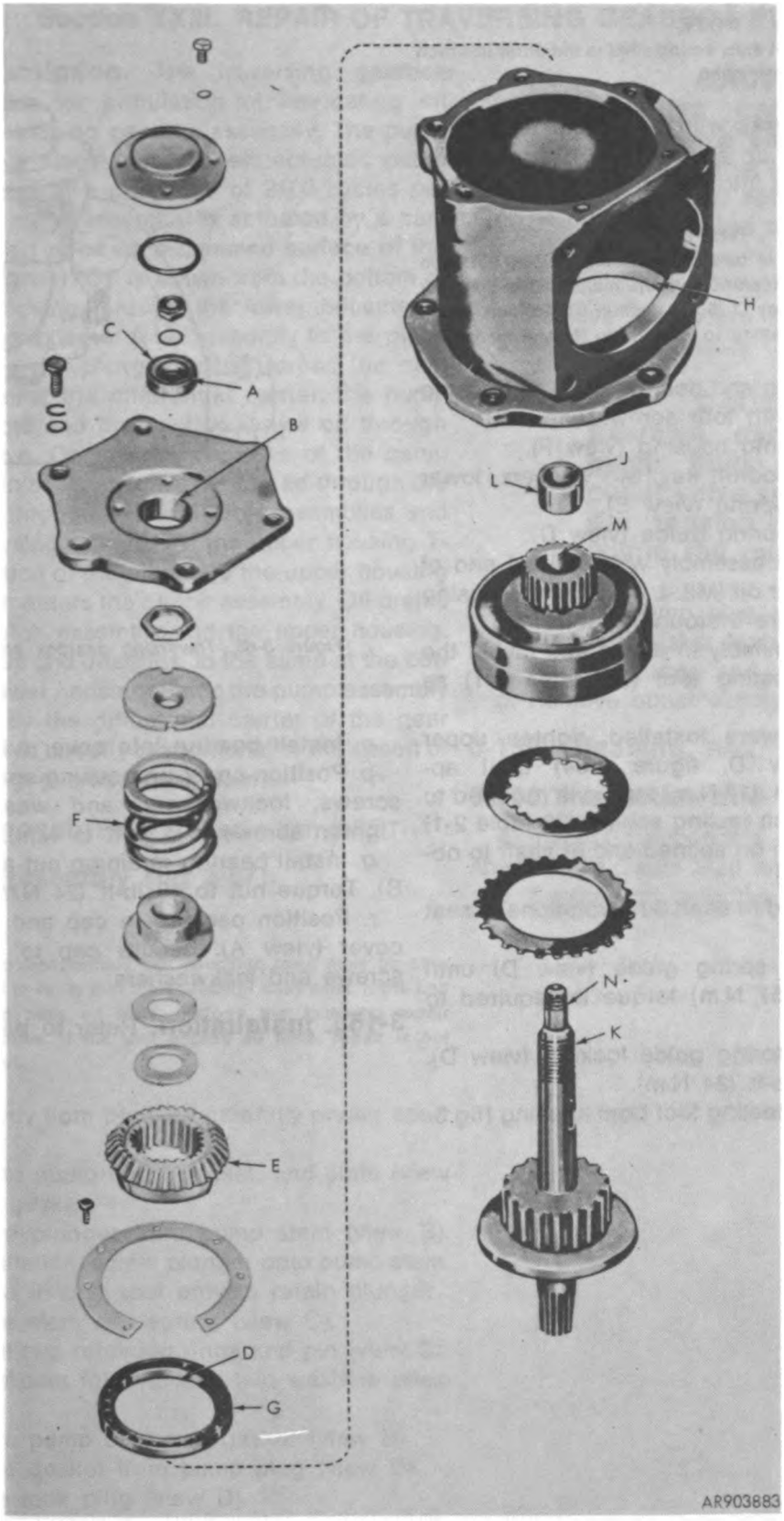



*Figure 3-65. Traversing gearbox clutch wear points.*

## 3-154. Assembly (fig 3-64).

**NOTE**

Matched disk set must be installed in the order in which the disks were removed.

*a.* Coat clutch disks with oil (MIL-L-10295).
*b.* Position disks on shaft (view H, fig 3-64).
*c.* Install bushing into clutch body (view H).

**NOTE**

Inside diameter of bushing must be 0.752±0.001 inch and must be concentric with the major inside diameter of the clutch body (3.260 in.) within 0.0015 inch. Ream bushing, if necessary, to conform to these dimensions.

*d.* Position bearing and bearing plate in housing and secure plate with four screws (view G).
*e.* Install clutch into housing (view F).
*f.* Install gear, woodruff key, two washers, lower spring guide, and spring (view E).
*g.* Install upper spring guide (view D).
*h.* Position clutch assembly with splined end of shaft down, and pour oil (MIL-L-10295) into housing until clutch disks are thoroughly lubricated.
*i.* Lock clutch assembly in a vise and install the gear-lock clutch testing tool (22, table 2-1) as shown in figure 3-66.
*j.* If new disks were installed, tighten upper spring guide (view D, figure 3-64) until approximately 150 lb-in. (17 N.m) torque is required to turn shaft (use clutch testing socket (23 table 2-1) and a torque wrench on splined end of shaft to obtain torque reading).
*k.* Turn splined end of shaft 30 revolutions to seat disks.
*l.* Tighten upper spring guide (view D) until 400—500 lb-in. (45-57 N.m) torque is required to turn shaft.
*m.* Install upper spring guide locknut (view D). Tighten nut to 18 lb-ft (24 N.m).
*n.* Remove clutch testing tool from housing (fig 3-66).

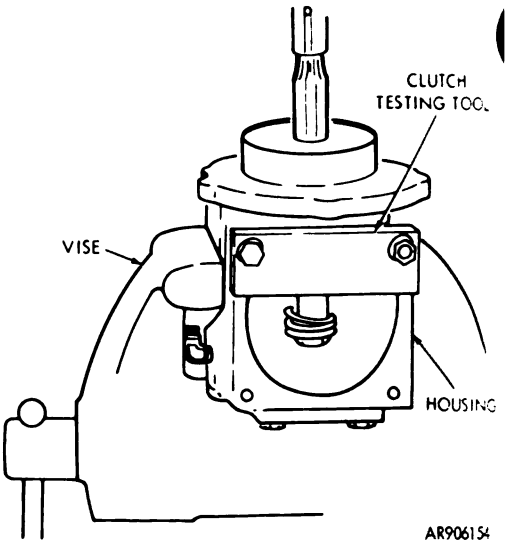



*Figure 3-66. Traversing gearbox clutch testing.*

*o.* Install bearing into cover (view C).
*p.* Position cover on housing and secure with six screws, lockwashers, and washers (view C). Tighten screws to 4 lb-ft (5 N.m).
*q.* Install bearing retaining nut and washer (view B). Torque nut to 18 lb-ft (24 N.m).
*r.* Position packing in cap and position cap on cover (view A). Secure cap to cover with four screws and lockwashers.

**3-155. Installation.** Refer to paragraph 2-34.

## Section XXIII. REPAIR OF TRAVERSING GEARBOX PUMP

**3-156. Description.** The traversing gearbox pump provides for circulation of lubricating oil within the traversing gearbox assembly. The pump assembly is a single action, cam actuated pump which operates at a maximum of 2400 cycles per minute. The pump assembly is actuated by a cam follower, which rides on a cammed surface of the differential carrier. Oil is drawn from the bottom of the lower housing through the lower housing T-fitting and an external tube assembly to the pump assembly. As the plunger spring forces the cam follower against the differential carrier, the pump plunger reacts and the suction draws oil through the inlet valve. On the return stroke of the pump plunger, oil in the body cavity is forced through the outlet valve through external tube assemblies and to upper housing T-fitting. At the upper housing T-fitting, a portion of the oil enters the upper housing and a portion enters the clutch assembly. Oil drains from the clutch assembly and the upper housing, over the gears and bearings, to the sump at the bottom of the lower housing. Since the pump assembly is actuated by the differential carrier of the gear train, oil flow is directly proportional to the speed of the traversing gearbox gear trains.

**3-157. Removal.** Refer to paragraph 2-35.

**3-158. Disassembly (fig 3-67).**

**NOTE**

Prior to disassembly, the specified tests must be conducted to verify that a malfunction does exist. If the unit fails to pass all tests, perform the following repair procedures. If the unit passes all tests, repair is not required.

*a.* Free body from plate by carefully prying apart (view A).

*b.* Separate pump body, gasket, and plate (view A). Discard gasket.

*c.* Remove plunger from pump stem (view B). During installation, screw plunger onto pump stem. Upset thread in one spot only to retain plunger.

*d.* Remove stem and spring (view C).

*e.* Remove two retaining rings and pin (view C).

*f.* Remove cam follower and two washers (view C).

*g.* Remove pump plug and gasket (view D).

*h.* Remove gasket from pump plug (view D).

*i.* Remove lock plug (view D).

**CAUTION**

**Exercise care when removing inlet valve seat from pump plate because the inlet valve and valve spring are retained under tension by the valve seat within the pump plate.**

*j.* Remove inlet valve seat (view E).

*k.* Remove inlet valve and spring (view E).

**CAUTION**

**Exercise care when removing pump plug plate because the outlet valve spring is retained under tension by the pump plug within the pump plate.**

*l.* Remove pump plug and gasket (view F).

*m.* Remove gasket from plug (view F).

*n.* Remove spring and outlet valve (view G).

*o.* Remove outlet valve seat (view G).

**3-159. Cleaning.** Refer to paragraph 2-9.

**3-160. Inspection and Repair.**

*a.* Inspect components for damage or wear as specified in Table 3-20 and figure 3-68.

*b.* Replace all defective components.

*Table 3-20. Traversing Gearbox Pump Wear Limits*

| Figure | Reference | Measurement | Wear Limit (in.) |
|---|---|---|---|
| 3-68 | A | OD of pump stem (3) | 0.3737 min |
| 3-68 | B | ID of pump body (7) | 0.3750 max |
| 3-68 | C | Free length of plunger spring (5) | 1.380 |
| 3-68 | D | (5) to 17/32 in. ID of body (7) plunger bore | 0.9848 max |
| | E | OD of plunger (8) | 0.9833 min |
| 3-68 | F | OD of cam follower pin (12) | 0.246 min |
| 3-68 | G | ID of pin holes in pump head (4) | 0.252 max |
| 3-68 | H | ID of pump cam follower (13) | 0.252 max |
| 3-68 | J | Free length of inlet valve spring (20) | 1.06 |
| 3-68 | K | (20) to 27/37 in. Free length of outlet valve spring (16) | 0.94 |

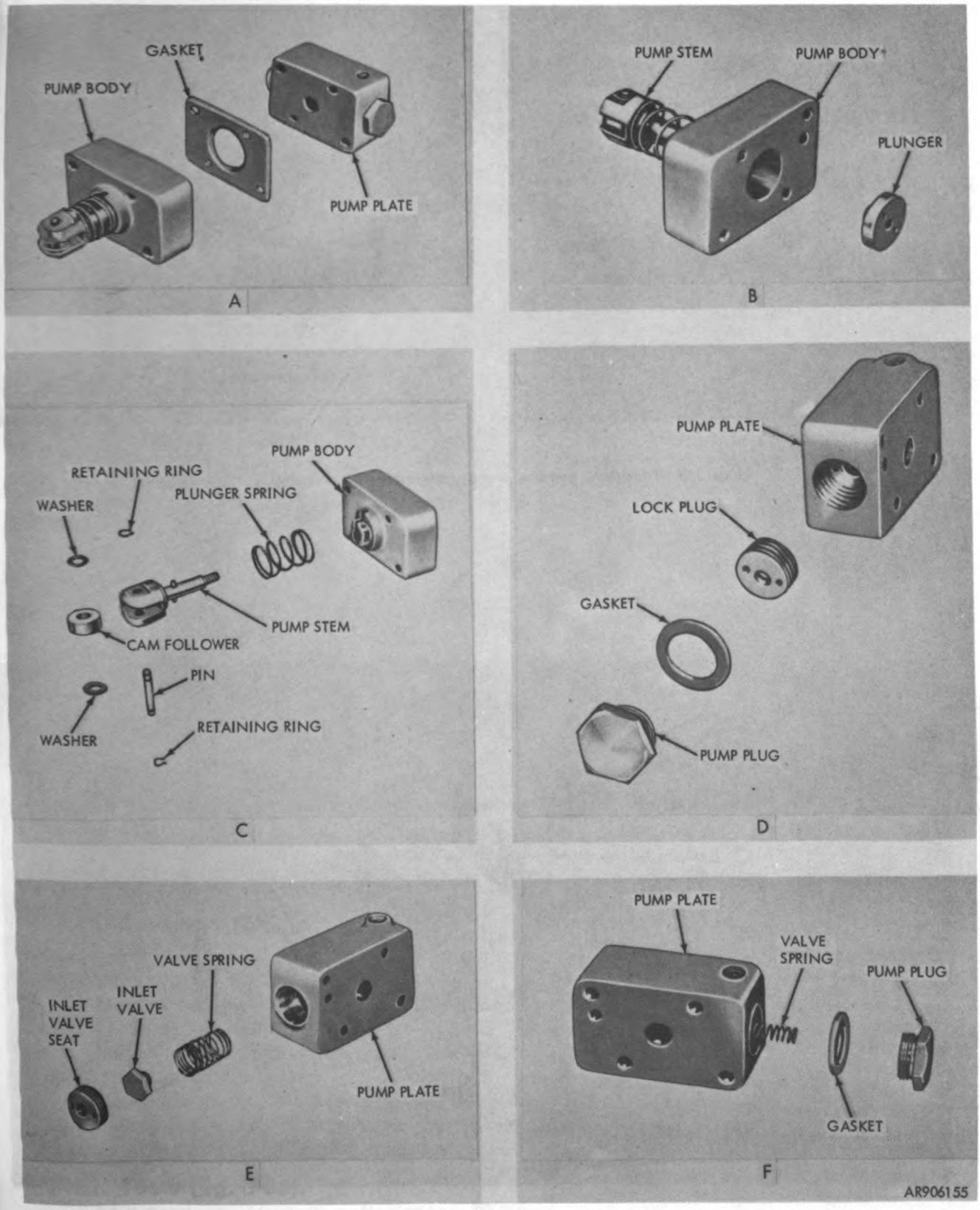
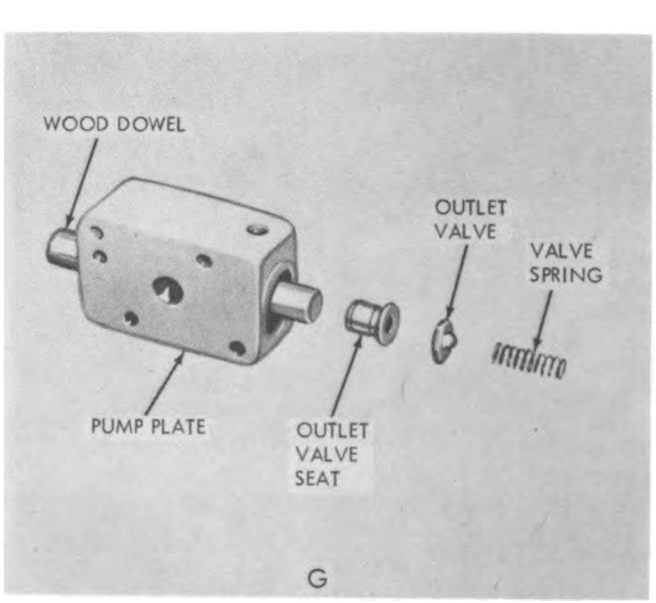



*Figure 3-67. Traversing gearbox pump disassembly or assembly (1 of 2).*



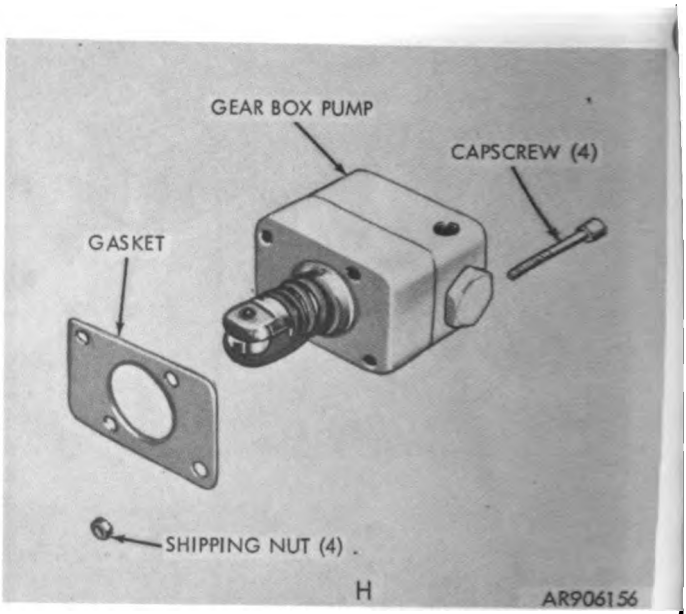




*Figure 3-67. Traversing gearbox pump disassembly or assembly (2 of 2).*

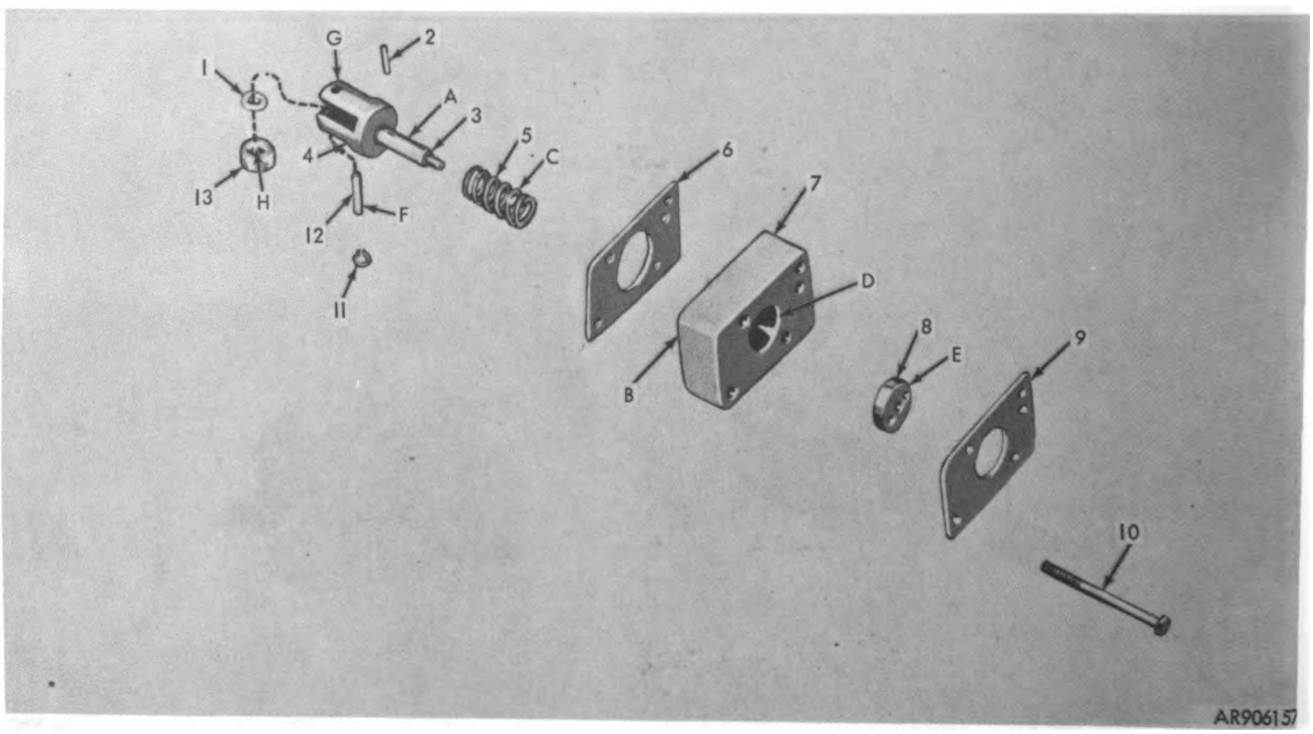



*Figure 3-68. Traversing gearbox pump wear points (1 of 2).*

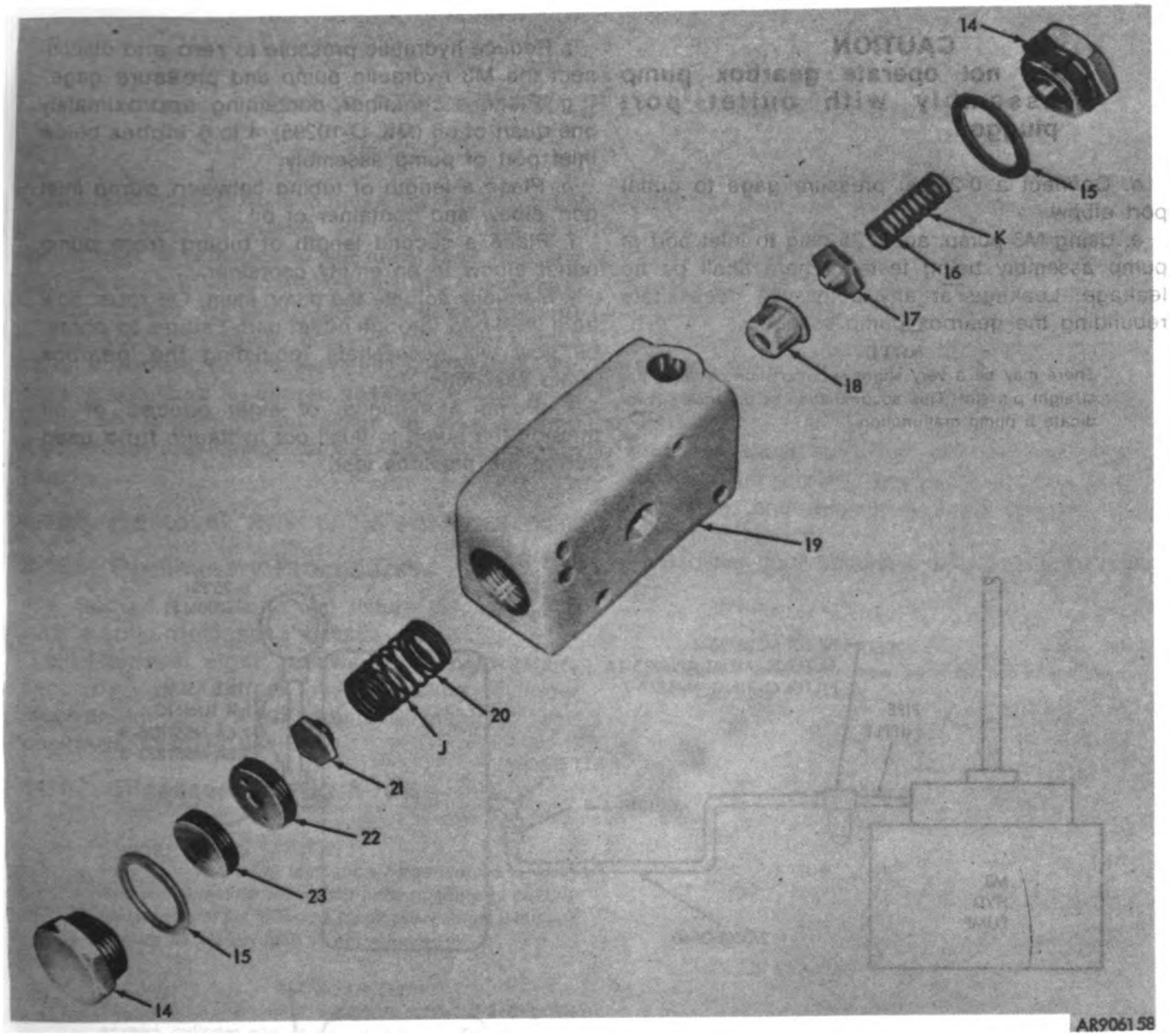



*Figure 3-68. Traversing gearbox pump wear points (2 of 2).*

## 3-161. Assembly (fig 3-67).

*a.* Requisition repair parts kit (TM 9-2350-258-34P-2).

*b.* Use new packings, seals, gaskets, and preformed packings.

*c.* Coat all internal parts with hydraulic fluid (MIL-H-6083D) in assembly.

*d.* Assemble pump in reverse order of the disassembly procedure. Observe all torque values or other criteria specified during disassembly.

## 3-162. Tests (fig. 3-69).

**NOTE**

Tests must be conducted after completion of the repair procedure to verify that any malfunction has been corrected.

*a.* Install four shipping nuts and capscrews (view H, fig 3-67).

*b.* Install elbows in inlet and outlet ports.

*c.* Connect M3 hydraulic pump to inlet port elbow as shown in figure 3-69.

**CAUTION**

**Do not operate gearbox pump assembly with outlet port plugged.**

*d.* Connect a 0-25-psi pressure gage to outlet port elbow.

*e.* Using M3 pump, apply 25 psig to inlet port of pump assembly being tested. There shall be no leakage. Leakage at any point will necessitate rebuilding the gearbox pump assembly.

**NOTE**

There may be a very slight accumulation of oil in the straight pin slot. This accumulation of oil does not indicate a pump malfunction.

*f.* Reduce hydraulic pressure to zero and disconnect the M3 hydraulic pump and pressure gage.

*g.* Place a container, containing approximately one quart of oil (MIL-O-10295), 4 to 6 inches below inlet port of pump assembly.

*h.* Place a length of tubing between pump inlet port elbow and container of oil.

*i.* Place a second length of tubing from pump outlet elbow to an empty container.

*j.* Manually actuate the pump stem. Oil must flow from inlet port through outlet port. Failure to obtain oil flow will necessitate rebuilding the gearbox pump assembly.

*k.* Pump a minimum of eight ounces of oil through the pump to flush out hydraulic fluid used during the previous test.

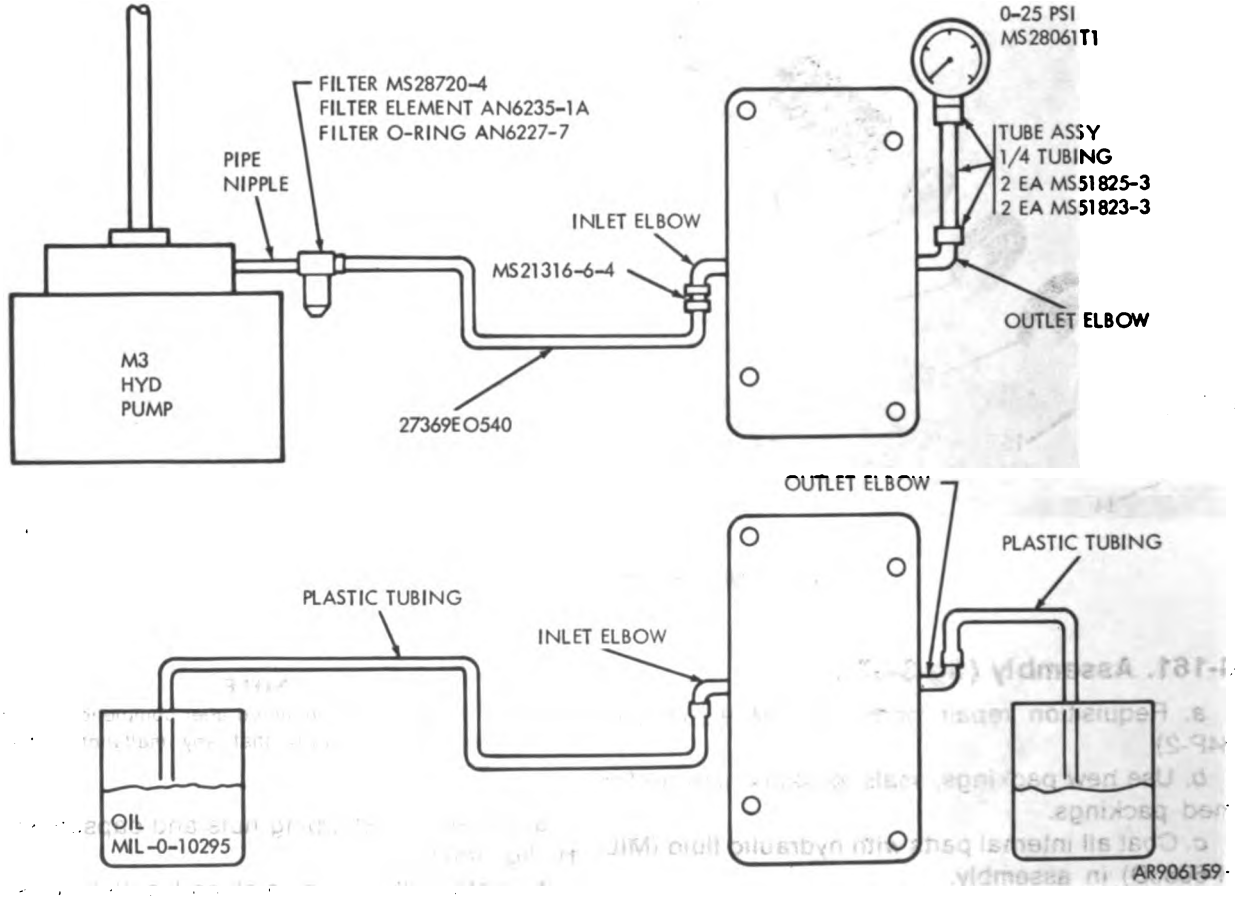



*Figure 3-69. Gearbox pump test.*

**3-163. Installation.** Refer to paragraph 2-35.

## Section XXIV. REPAIR OF ELEVATING MECHANISM

**3-164. Description.** The elevating mechanism is located directly beneath the combination gun mount and is attached to the turret race ring and gun mount. It is controlled by the power and manual mode elevating and depression circuits which apply hydraulic pressure through a lock valve mounted on the elevating mechanism. Excessive pressure is relieved by the crossover relief valve. Movement of the piston in the elevating mechanism elevates or depresses the 105-mm gun tube.

**3-165. Removal.** Refer to TM 9-2350-258-20-2.

**3-166. Preliminary Procedures.**

*a.* Secure cylinder to test fixture (54, table 2-1) with manifold mounting surface up.

*b.* Remove eight screws and lockwashers securing manifold to the elevating cylinder mechanism (fig 3-70). Remove manifold and packings. Discard packing.

**3-167. Disassembly (fig 3-70).**

NOTE

Prior to disassembly, tests must be conducted to verify that a malfunction does exist. If the unit fails to pass all tests, perform the following repair procedures. If the unit passes all tests, repair is not required.

NOTE

For ease of loosening elevating cylinder end guide screws, cylinder should be left mounted in test fixture (54, table 2-1).

*a.* For alinement during assembly, scribe a line across sleeve assembly, guide and cylinder, and across the guide of the eye and assembly and cylinder.

*b.* Loosen eight screws securing sleeve assembly and guide to elevating mechanism cylinder. Tighten screws to a minimum of 90 lb-ft (122 N.m) during assembly. Do not remove screws at this time.

*c.* Loosen clamp securing bellows nearest cylinder. Compress bellows toward eye end to gain access to eight screws securing guide assembly to cylinder.

*d.* Loosen eight screws securing eye end guide to elevating mechanism cylinder. Tighten screws to a minimum of 90 lb-ft. (122 N.m) during assembly.

*e.* Remove elevating mechanism from test fixture.

*f.* Remove eight screws securing sleeve assembly and guide to cylinder. Remove sleeve and guide.

*g.* Remove eight screws securing eye assembly and guide to cylinder.

*h.* Remove eye, guide, and piston from cylinder as an assembly.

*i.* Loosen clamp securing bellows to end eye.

*j.* Loosen set screw in end eye, unscrew end eye from piston, and remove end eye bellows, and guide assembly.

*k.* Remove four retainers and packings from piston.

NOTE

Replace bearing in sleeve assembly eye only if bearing is damaged or scored.

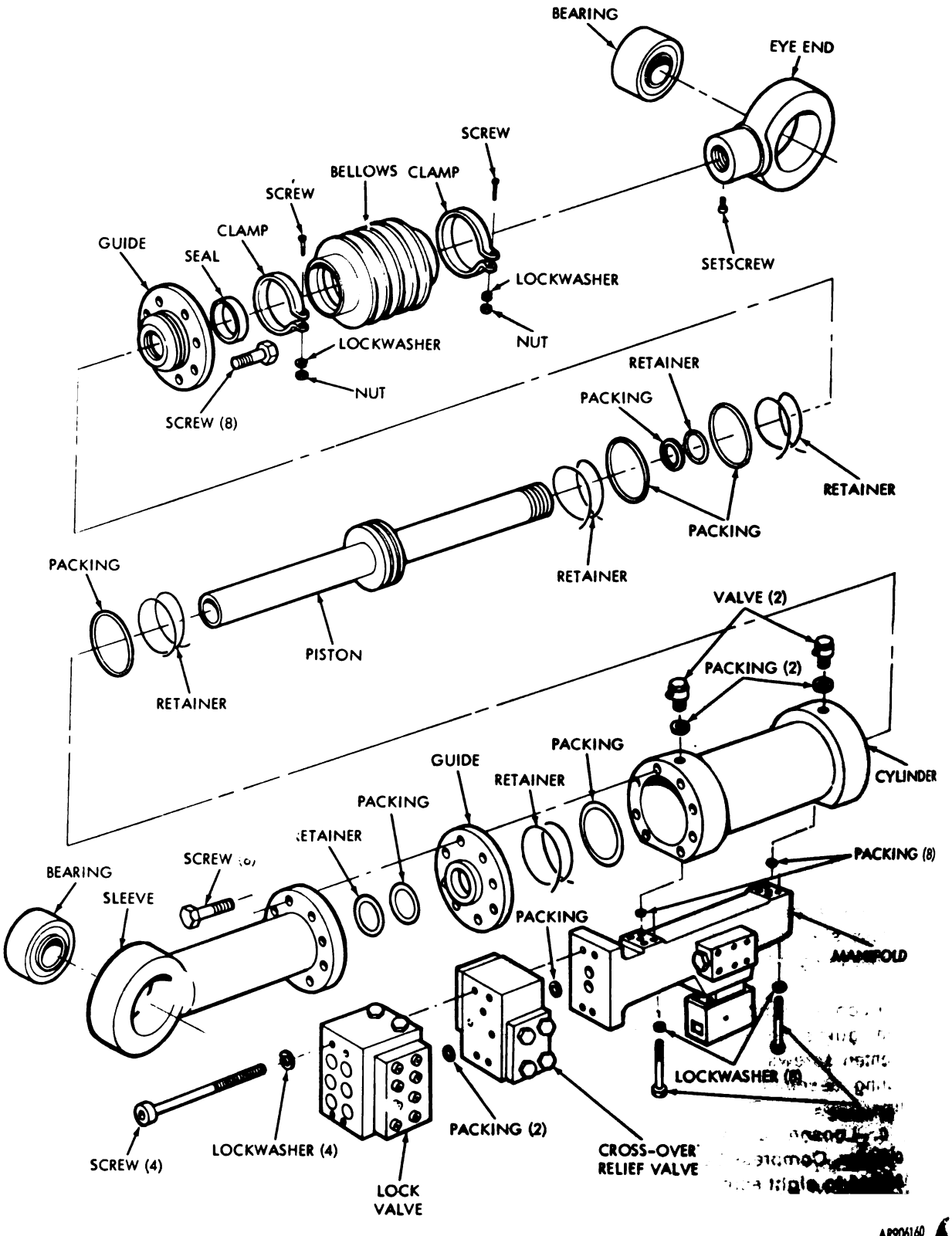



*Figure 3-70. Elevating cylinder disassembly or assembly.*

## 3-168. Tests.

*a. General.* Testing of the elevating mechanism cylinder and manifold valve assembly should be conducted prior to disassembly. These tests are conducted to determine areas of possible malfunction. Tests are conducted on the elevating mechanism cylinder to determine leakage past the seal guides and force required to move the piston within the cylinder. Smoothness test is conducted to insure there is no binding of the piston and piston is moving uniformly throughout its travel. Manifold valve assembly test is conducted for proper fluid flow past the bleed pins, proper operation of each lock valve, and reverse flow past the crossover relief and the lock valves. The tests must be reconducted after rebuild procedures to insure that the malfunction has been corrected.

**NOTE**

Tests must be conducted after completion of the repair procedure to verify that any malfunction has been corrected.

*b. Leakage Test (fig 3-71).*

**NOTE**

For ease of moving piston, rotate eye back and forth when moving the piston in and out. Fill both sides of cylinder with hydraulic fluid.

(1) Extend and retract piston as necessary to position to approximately the mid point of travel.

**NOTE**

Insure that ports in the test block aline with ports in the cylinder.

(2) Attach elevating cylinder manifold (55, table 2-1), gage, and M3 hydraulic pump lines and fittings to the cylinder (fig-71), and install elevating cylinder in test fixture (54, table 2-1).

**NOTE**

If cylinder has old style bleed valves (no nipples), substitute new bleeder valves from hydraulic test kit for testing.

(3) Tighten the pressure gage fitting. Turn elevating cylinder over in test fixture (bleeder ports up). Operate M3 pump until all air is expelled from system using bleeder ports.

(4) Raise system pressure to 1000 psi. Close shut off valve. At the end of three minutes, pressure gage should read 940 psi, minimum.

(5) If the cylinder has met the requirements of this test, remove tubing, fittings, and gage and conduct friction test. If the cylinder has not met the requirements of this test it must be disassembled and repaired.

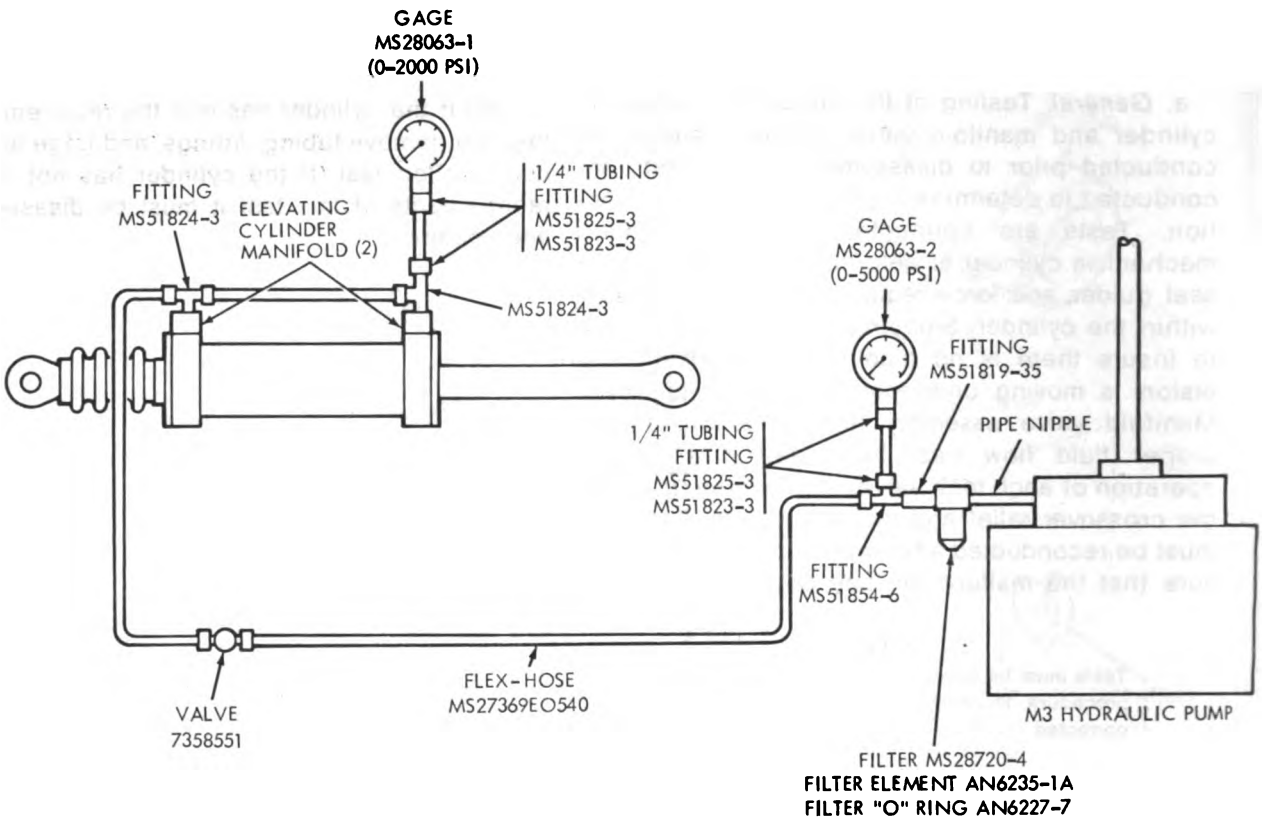



*Figure 3-71. Elevating cylinder mechanism leakage test.*

*c. Seal Friction Test (fig 3-71).*

(1) Connect pump to one end of the cylinder and pump until piston is at the end of its travel (in or out).

(2) Connect hydraulic pump and gage as shown in figure 3-71, with piston at the end of its travel.

(3) Operate pump until hydraulic fluid begins to flow from the drain. Close the shutoff valve. Observe needle on gage when needle stops moving. Record pressure gage reading.

(4) Repeat the above procedures a minimum of five times through the piston travel.

(5) Repeat steps (1) through (3) except with piston moving in opposite direction.

(6) Place gage and lines on opposite fittings shown in figure 3—71 and repeat the above procedures a minimum of five times.

(7) Pressure readings should not be below 10 psi. If the cylinder has not met the requirements of this test it must be disassembled and repaired.

*d. Smoothness Test (fig 3-72).*

(1) Move piston to one end of travel and fill cylinder with hydraulic fluid.

(2) Connect the low-pressure gage and orifice test block.

(3) Connect orifice in cap to one elevating cylinder manifold and insure orifice in cap is clean by inserting a no. 78 drill and rotating.

(4) Connect the regulator (nitrogen/hydraulic) supply to other elevating cylinder manifold.

(5) Regulator on nitrogen cylinder should be at zero pressure. Gradually increase pressure from nitrogen cylinder regulator output until low-pressure gage on test setup is 10 psi.

(6) Monitor low-pressure gage throughout piston travel. The pressure should not change 1.5 psi in any 15-second period.

**NOTE**

A gradual change in pressure may occur during piston travel. This gradual change does not indicate erratic piston travel. At the end of piston travel, pressure will rapidly drop to a few psi.

(7) Relieve pressure. Remove orifice fitting line and gage, and fill port B with hydraulic oil. Install fitting and gage.

(8) Repeat step (2) through (6) with nitrogen regulator connected to second elevating cylinder manifold and orifice fitting and gage connected to other elevating cylinder manifold. Reduce pressure to zero and remove test equipment from cylinder.

(9) If the cylinder does not meet the requirements of this test, the piston is not moving smoothly in the cylinder. The cylinder should be disassembled and a careful examination of the cylinder surface made to determine the defect. If cylinder surface is scratched, nicked or scored, the cylinder must be replaced.

*e. Manifold Valve Operation and Leak Test (fig 3-72).*

(1) Attach test blocks, with packing, to cylinder mounting surfaces of the manifold. Fill manifold assembly with hydraulic oil.

(2) Prior to conducting flow test, operate the M3 hydraulic pump until fluid flows from ports M2, S2 or P2 as applicable.

(3) Attach M3 pump to lock valve port M1. Slowly increase pressure to 75±5 psi. Flow from port M2 should be at least 1.0 ml and not more than 6.0 ml per minute.

(4) Repeat step (3) for ports S1 and P1. Slowly increase pressure to 75±5 psi. Flow should be at least 1.0 ml and not more than 6.0 ml per minute from ports S2 and P2 respectively.

(5) Attach M3 pump to lock valve port M2. Slowly increase pressure to 75±5 psi. Flow from port M1 should be at least 1.0 ml and not more than 6.0 ml per minute. Flow should begin from port B when pressure is 125-170 psi.

(6) Repeat step (5) for ports S2 and P2. Flow at 75±5 psi should be at least 1.0 ml and not more than 6.0 ml per minute from ports S1 and P1.

(7) Attach M3 pump to port A. Apply 200 psi. No leakage shall be evident from any port.

(8) Repeat step (6) for port B.

(9) If the assembly does not meet requirements of this test, disassemble and repair the lock valve.

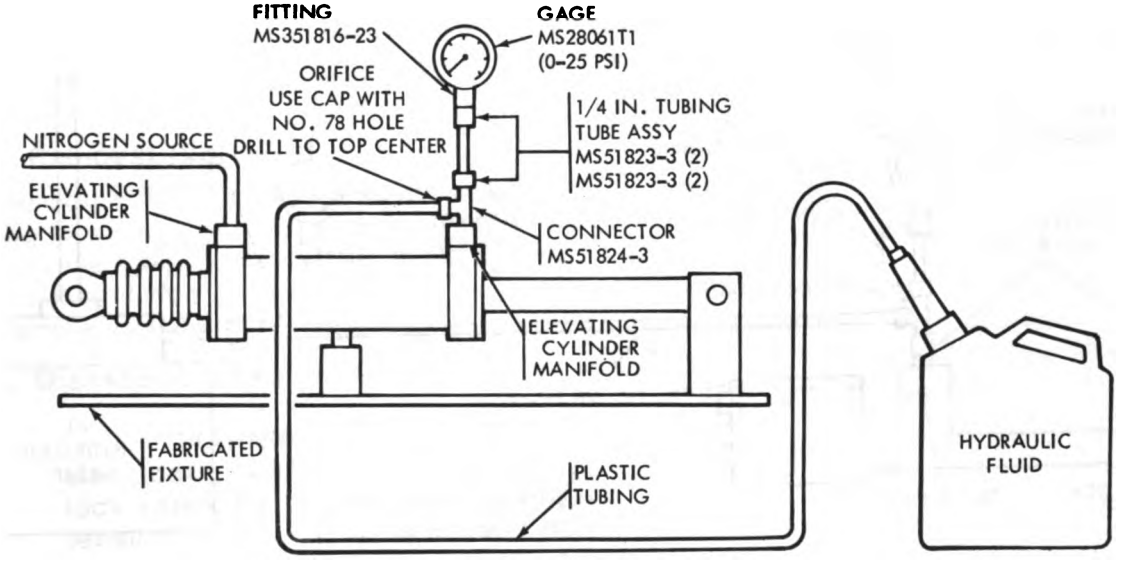



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*Figure 3-72. Elevating cylinder tests (1 of 2).*

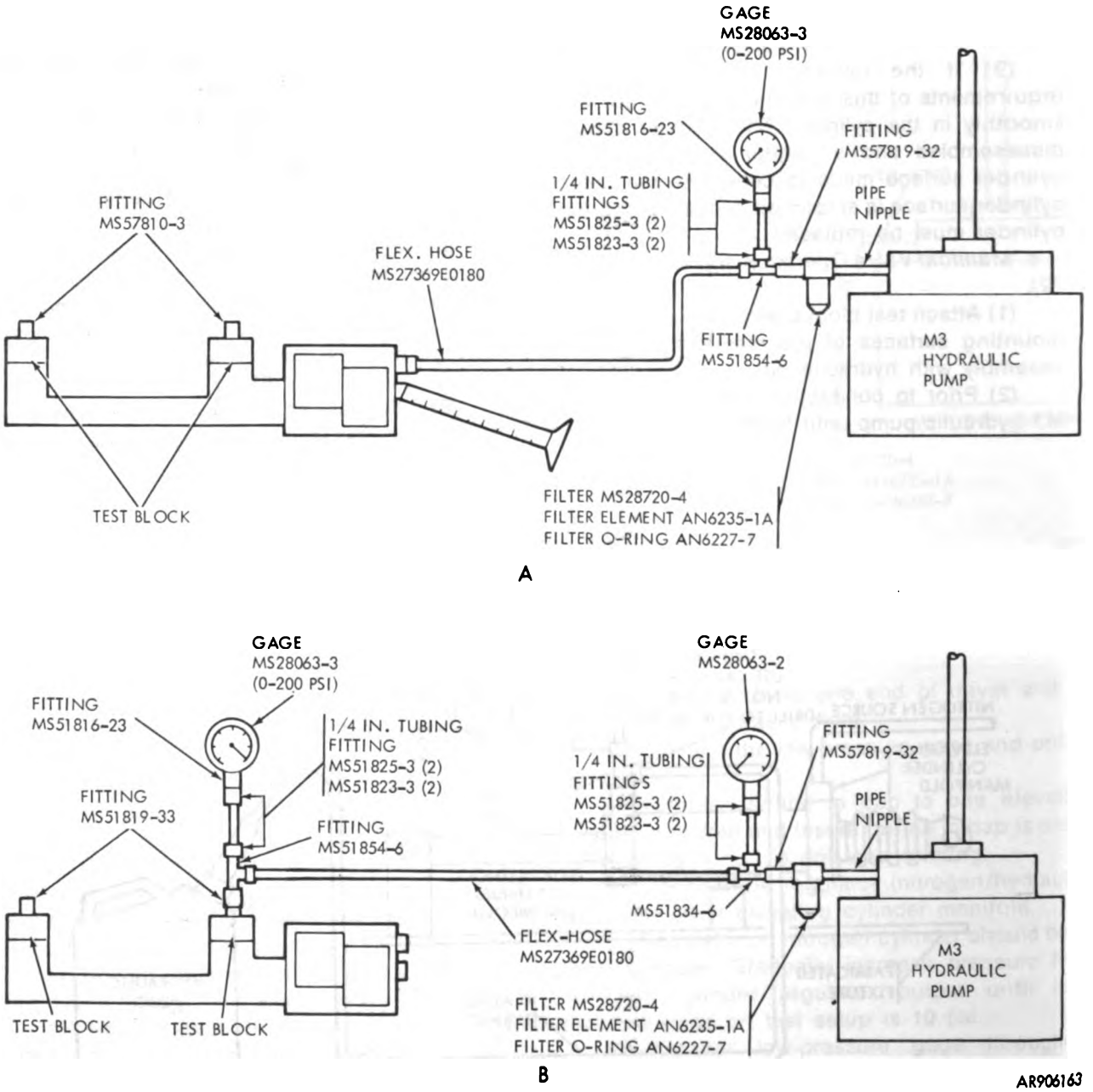


*Figure 3-72. Elevating cylinder tests (2 of 2).*

**3-169. Cleaning.** Refer to paragraph 2-9.

**3-170. Inspection and Repair.**

*a.* Inspect machined surfaces of cylinder manifold, guide, piston valve assembly, and all other mating surfaces that seal hydraulic pressure, for nicks, pits, flatness, burrs, corrosion, scratches, or scoring. Remove corrosion and minor surface abrasions. Original surface finish must be maintained. Measure inside diameter of piston guide. Replace if larger than 1.2505 inches. Measure cylinder bore. Replace if larger than 2.752 inches. Measure piston diameter. Replace if less than 1.2480 inches. Inspect castings and threads for damage or wear.

*b.* Repair or replace damaged components.

**3-171. Assembly (fig 3-70).**

*a.* Requisition elevating mechanism repair kit (TM 9-2350-258-34P-2). Use all parts during assembly.

*b.* Use new packings, seals, preformed packings, gaskets, and any other component performing a sealing function. Coat all internal components, cylinder boxes, and sleeves and spools with hydraulic fluid (MIL-H-46170(FRH)) in assembly.

*c.* Assemble in reverse order of disassembly observing any torque values or other criteria specified during disassembly. Cross-tighten screws where applicable. After assembly, fill with hydraulic fluid. Move cylinder to insure proper lubrication of seals and pistons.

**3-172. Installation.** Refer to TM 9-2350-258-20-2.

## Section XXV. REPAIR OF ELEVATING MECHANISM LOCK VALVE

**3-173. Description.** The lock valve is part of the elevating mechanism assembly. The lock valve and crossover relief valve (valve assembly) are both bolted to the manifold of the elevating mechanism. The lock valve assembly contains spring loaded valves connecting to hydraulic lines from the superelevation actuator and the manual and power mode elevation and depression lines. These valves control the flow of hydraulic fluid to the elevating mechanism.

**3-174. Removal (fig 3-70).**

*a.* Remove four screws and lockwashers securing lock valve and crossover relief valve to manifold. Alternately tighten screws to 60-70 lb-in. (6.8—7.9 N.m) during installation.

*b.* Remove valves and packings.

**3-175. Disassembly (fig 3-73).**

**WARNING**

**Use care when disassembling lock valve. Parts are under spring tension.**

*a.* Remove eight screws and lockwashers securing end plate to block of lock valve and remove plate, three springs, three cups, three packings, three spring guides, and balls. Tighten screws to 8-9 lb-ft (11—12 N.m) during assembly.

*b.* Remove eight screws and lockwashers securing other end plate to block of relief valve and remove plate and components as in step a. above. Tighten screws to 8-9 lb-ft (11—12 N.m) during installation.

*c.* Remove six spools and sleeves.

NOTE

Spools are matched to bores. During assembly, each spool must be installed in bore to which it is matched.

*d.* Insert a no. 4-10 screw into plug and remove plug pin packing from block of valve.

*e.* Remove six fittings and packings from side of block, and two plugs and gaskets from top of block.

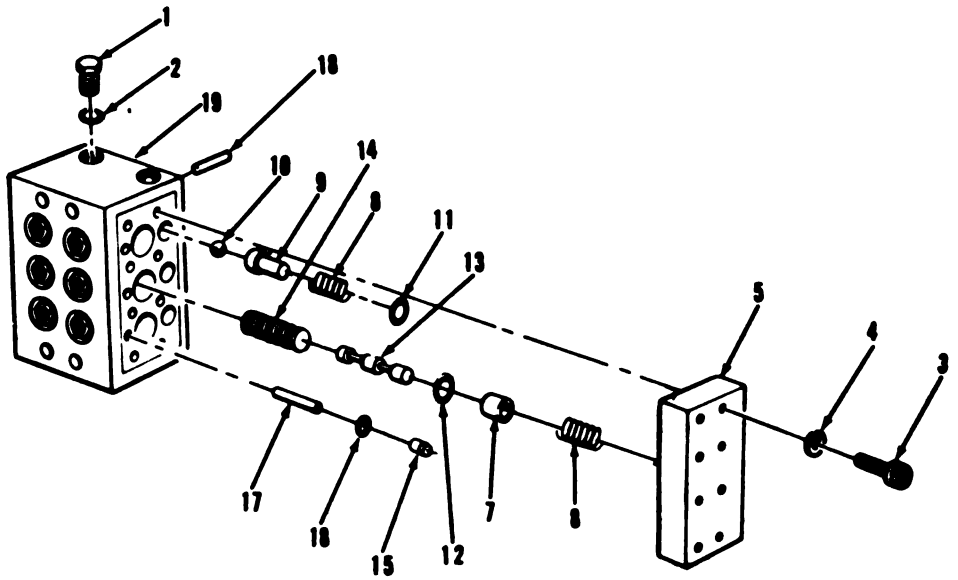


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*Figure 3-73. Elevating mechanism lock valve disassembly or assembly.*

Legend for figure 3-73:

1. Plug (2)
2. Gaskets (2)
3. Screw (16)
4. Lockwasher (16)
5. End Plate (2)
6. Spring (6)
7. Cup (6)
8. Spring (6)
9. Guide (6)
10. Ball (6)
11. Packing (6)
12. Packing (6)
13. Spool (6)
14. Sleeve (6)
15. Plug (6)
16. Packing (6)
17. Pin (6)
18. Pin (10)
19. Block

**3-176. Cleaning.** Refer to paragraph 2-9.

**3-177. Inspection and Repair.**

*a.* Inspect mating surfaces of plates and block for flatness, nicks, burrs, corrosion, scratches and pits. Check ball seat in block for roundness, size, and surface finish. Check free length of springs. Replace springs if length is less than 3/4 inch or 0.895 inch respectively.

*b.* Repair or replace defective components.

**3-178. Assembly (fig 3-73).**

*a.* Requisition repair parts kit (TM 9-2350-258-34P-2). Use all parts during assembly of elevating mechanism.

*b.* Coat all internal lock valve parts and bores with hydraulic fluid (MIL-H-46170(FRH)) during assembly of elevating mechanism.

*c.* Assemble in reverse order of disassembly (para 3-175). Use a 4-40 screw to install plug.

**3-179. Tests.** The lock valve is tested as part of the elevating mechanism.

**3-180. Installation.**

*a.* Use new packings, seals, preformed packings, gaskets, and any other component performing a sealing function. Coat all internal components, seals, preformed packing, and gaskets with hydraulic fluid (MIL-H-46170(FRH)) in installation.

*b.* Install in reverse order of removal, observing any torque values or other criteria specified during removal. Cross-tighten screws where applicable.

## Section XXVI. REPAIR OF M1 CUPOLA

**3-181. Description.** The commander's M1 cupola provides a support for the caliber .50 heavy-barrel machine gun M-2 and is mounted to a vision block adapter ring fastened to the turret. The cupola is a casting of homogeneous armor with turtle shape design and consists primarily of two parts, the body and cradle. The cradle is supported by trunnion bearings in the front end of the body assembly. The machine gun is housed within the cradle and alined with the centerline of the cupola by rear and forward mounting pins. The cradle is elevated or depressed by manual rotation of a screwjack assembly. The cupola is driven in azimuth around a ring gear fixed to the tank turret by manual operation of the gearbox assembly. An equilibrator spring within the cradle counterbalances the "nose heavy" condition of the cradle. The manually operated, friction-type azimuth travel lock assembly brakes the cupola in any desired traverse position. The manually operated interlock assembly alines the machine gun axis with that of a main gun by securing the cupola to the turret in azimuth. Three direct vision prism blocks and a periscope allow for observation of the surrounding terrain from within the tank. Also, a vision block adapter ring mounted between the turret and cupola provides additional viewing facilities. Communication and cupola power are maintained during cupola rotation by two sets of contact boards and springs which electrically connect the cupola and turret. Figure 3-74 is a view of the M1 cupola and vision block adapter ring on the cupola stand. Figure 3-75 is the vision block adapter ring on cupola stand.

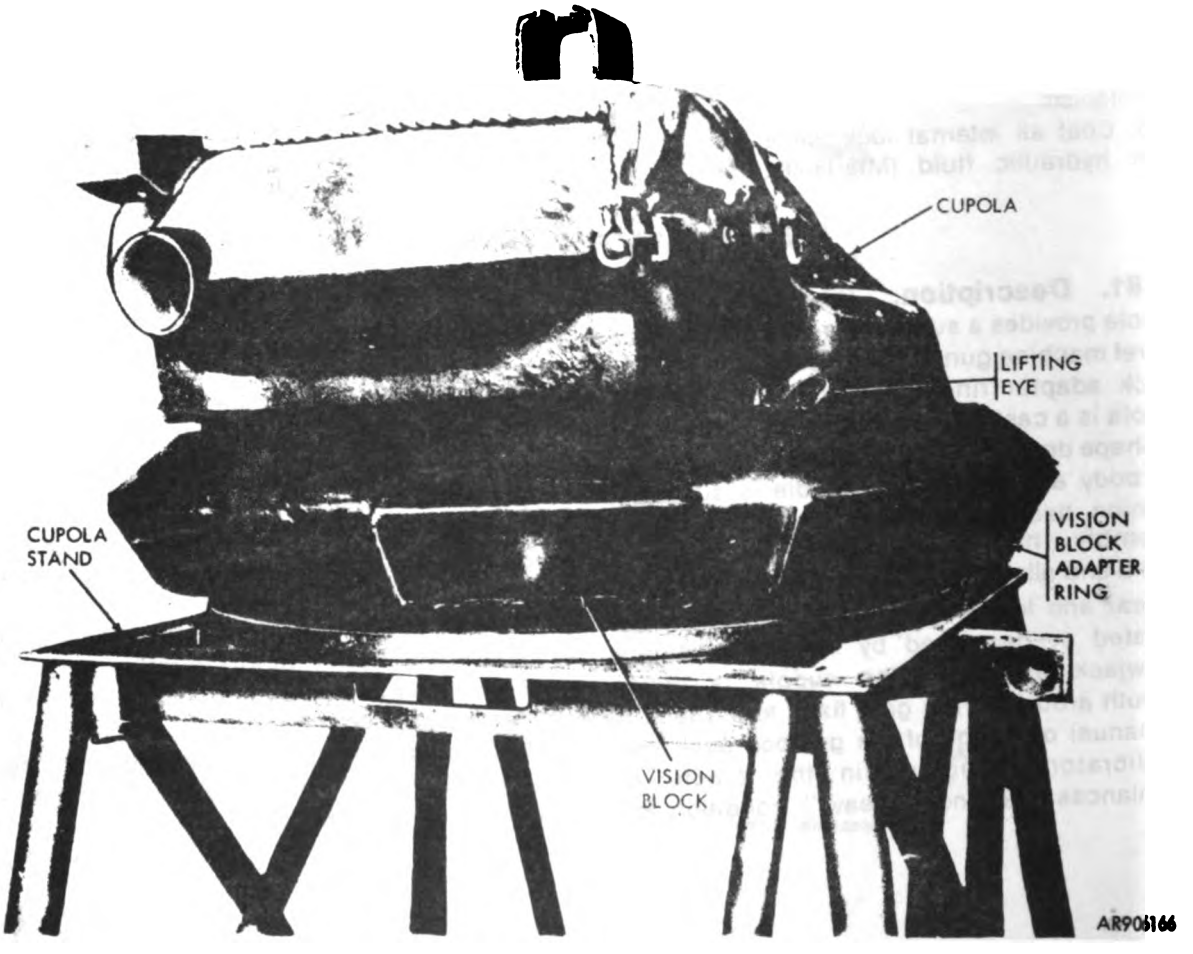



*Figure 3-74. M1 cupola and vision block adapter ring on cupola stand (vehicles serial numbered A3001 thru A3374).*

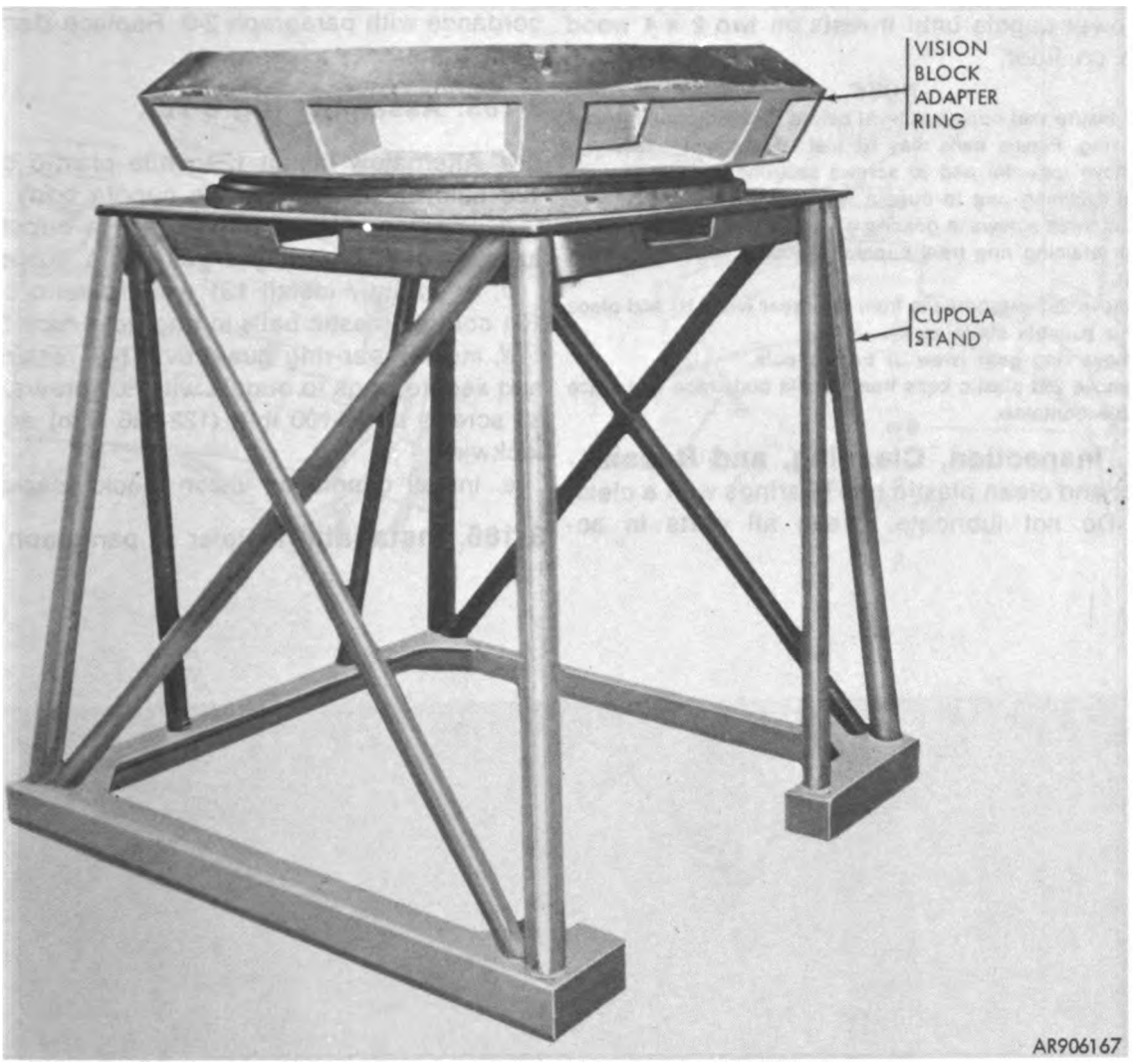



*Figure 3-75. M1 cupola vision block adapter ring on cupola stand (vehicles serial numbered A3001 thru A3374).*

**3-182. Removal.** Refer to paragraph 2-38.

**3-183. Disassembly (fig 3-76).**

*a.* Refer to applicable sections of TM 9-2350-258-20-2, and perform the following procedures:

(1) Remove cupola azimuth lock.

(2) Remove cupola azimuth interlock.

(3) Remove cupola screwjacks.

(4) Remove nine vision blocks from vision block adapter ring.

(5) Remove instrument light.

(6) Disconnect and remove communication headset.

(7) Remove six screws, lockwashers, and washers and remove backrest pad assembly.

(8) Remove lockwire and three screws securing three vision block brackets and remove brackets.

(9) Remove cupola cradle equilibrator.

*b.* Remove six screws and lockwashers securing slipring guard and rubber strip to cupola body Remove guard and strip (views A and B).

*c.* Remove 14 screws and lockwashers and remove slipring from cupola (views C, D and E).

*d.* Remove four short and eight long screws securing vision block adapter ring (view F). During installation, tighten screws to a minimum of 300 lb-ft. (406 N.m).

*e.* Attach sling (37, table 2-1) to three clevises and lift cupola from vision ring (view F). Allow vision block adapter ring to remain on cupola stand (38, table 2—1) (fig 3—75).

*f.* Lower cupola to floor.

*g.* Turn cupola over on floor using two chains of the three chain slings and a web strap.

*h.* Lower cupola until it rests on two 2 x 4 wood blocks on floor.

NOTE

Insure that cupola is level before removing ball retainer ring. Plastic balls may be lost if cupola is tilted.

*i.* Remove lockwire and 30 screws securing gear ring guard and ball retaining ring to cupola (view G).

*j.* Install three screws in gearing guard and lift gear ring guard and ball retaining ring from cupola, exposing 262 plastic balls (view G).

*k.* Remove 262 plastic balls from ring gear (view H) and place balls in a suitable container.

*l.* Remove ring gear (view J) from cupola.

*m.* Remove 258 plastic balls from cupola body race and place in suitable container.

**3-184. Inspection, Cleaning, and Repair.** - Inspect and clean plastic ball bearings with a clean cloth. Do not lubricate. Clean all parts in accordance with paragraph 2-9. Replace damaged or worn parts.

**3-185. Assembly (fig 3-76).**

*a.* Alternately install 129 white plastic balls and 129 colored plastic balls in cupola body race.

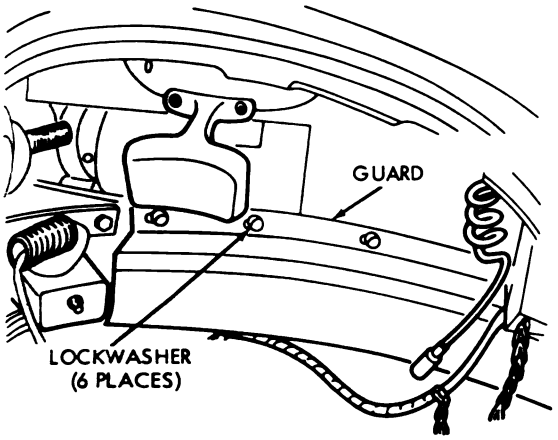
*b.* Position ring gear (view J) in cupola using azimuth gear box output gear as a guide.

*c.* Alternately install 131 white plastic balls and 131 colored plastic balls in ring gear race (view H).

*d.* Install gear ring guard over ball retaining ring and secure rings to cupola with 30 screws. Tighten 30 screws to 90-100 lb-ft (122-136 N.m) and install lockwire.

*e.* Install cupola on vision block adapter ring.

**3-186. Installation.** Refer to paragraph 2-38.

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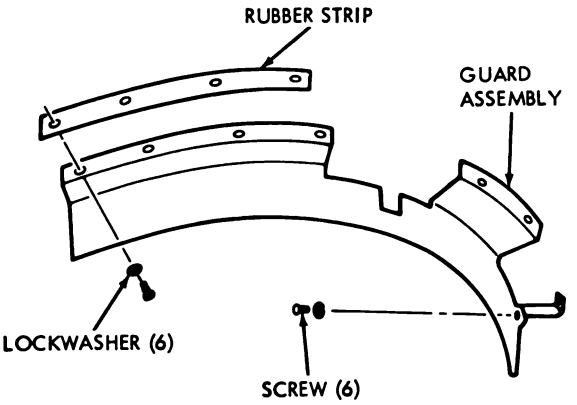


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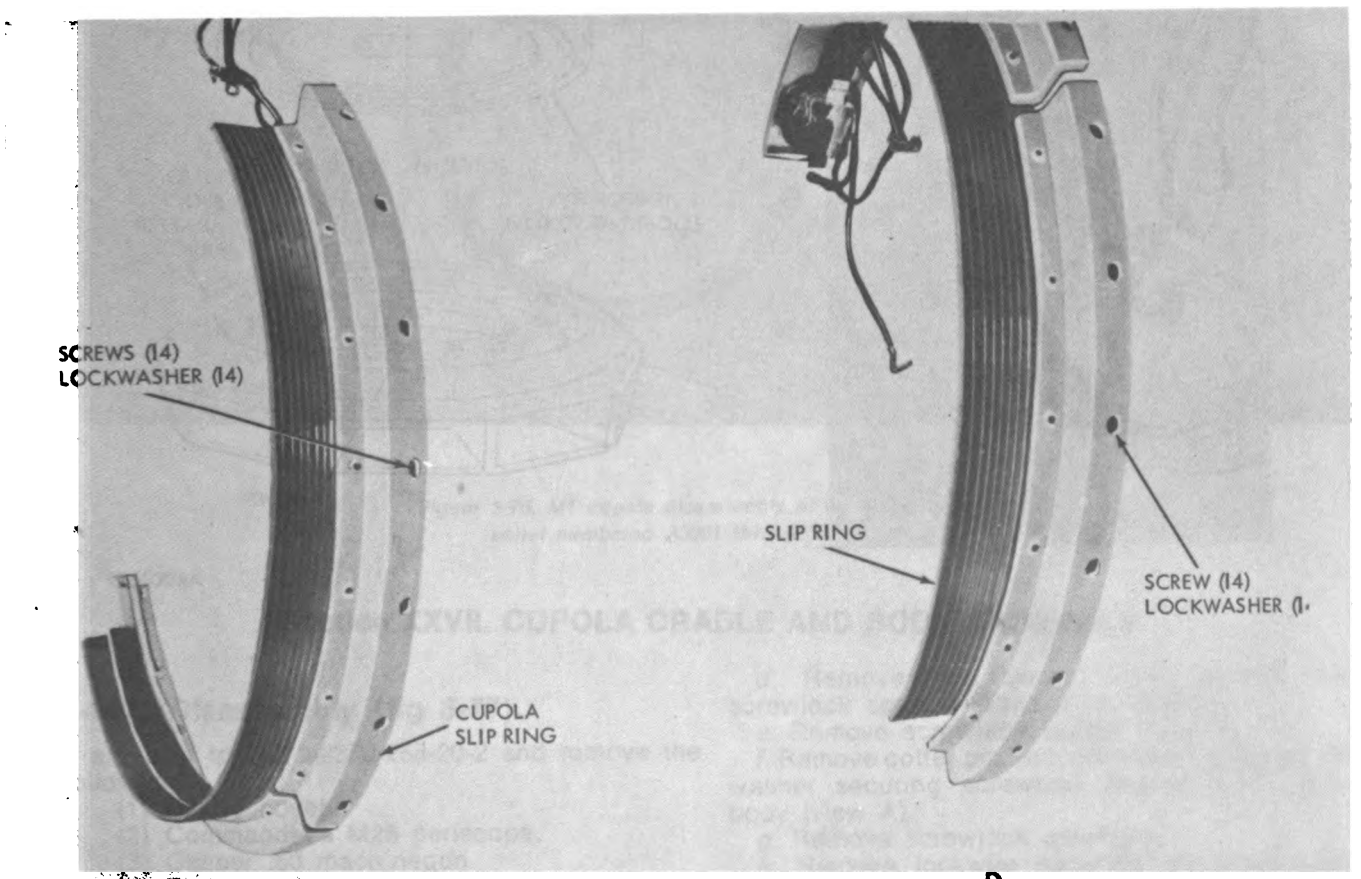


C D

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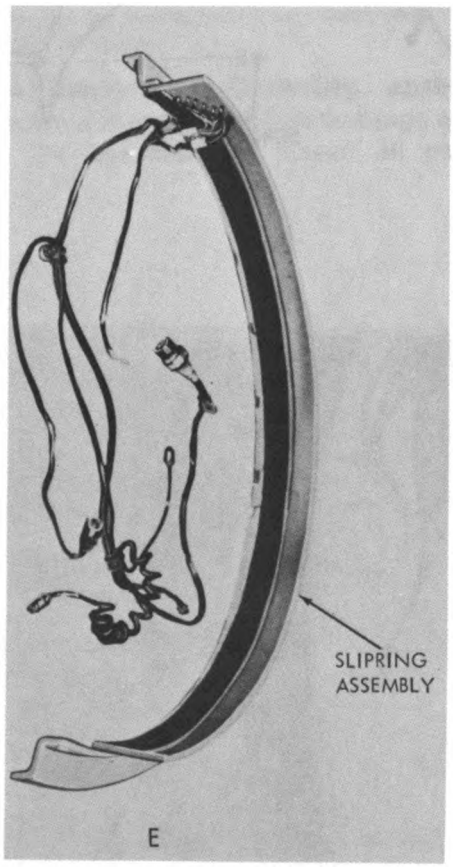
*Figure 3-76. M1 cupola disassembly or assembly (vehicles serial numbered A3001 thru A3374) (1 of 3).*



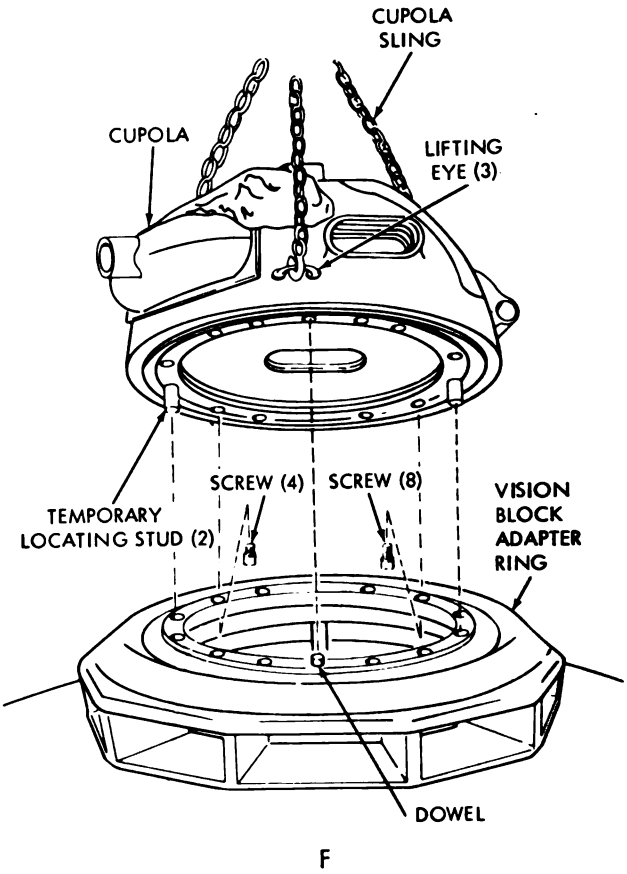




*Figure 3-76. M1 cupola disassembly or assembly (vehicles serial numbered A3001 thru A3374) (2 of 3).*

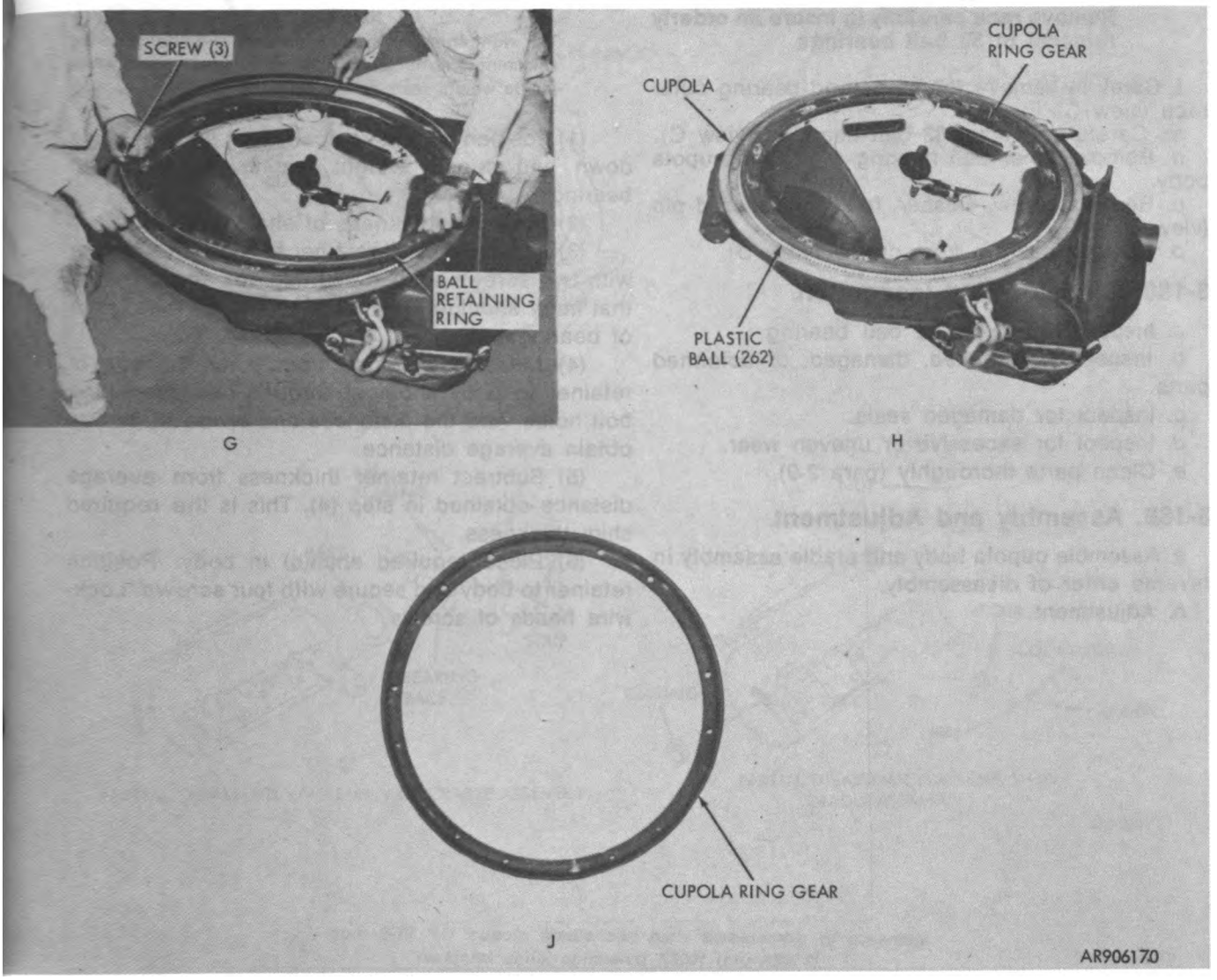



*Figure 3-76. M1 cupola disassembly or assembly (vehicles serial numbered A3001 thru A3374) (3 of 3).*

## Section XXVII. CUPOLA CRADLE AND BODY ASSEMBLY

### 3-187. Disassembly (fig 3-77).

*a.* Refer to TM 9-2350-258-20-2 and remove the following:
(1) Cradle cover.
(2) Commander's M28 periscope.
(3) Caliber .50 machinegun.
(4) Bulletproof shingle.
(5) Cupola equilibrator spring.

*b.* Remove lockwire and remove six screws securing three blocks (view A).

*c.* Remove blocks (view A).

*d.* Remove two socket head screws and screwjack spacer flange pins (view A).

*e.* Remove screwjack spacer (view A).

*f.* Remove cotter pin, nut, preformed packing, and washer securing screwjack assembly to cupola body (view A).

*g.* Remove screwjack assembly.

*h.* Remove lockwire securing six screws and washers (view B).

*i.* Remove six screws and washers securing cradle to cupola body.

*j.* Remove spring assembly from cradle (view B).

*k.* Remove cradle assembly.

**CAUTION**
**Remove race carefully to insure an orderly removal of 33 ball bearings.**

*l.* Carefully remove felt strips and bearing outer race (view C).
*m.* Carefully remove 33 ball bearings (view C).
*n.* Remove inner ball bearing race from cupola body.
*o.* Remove screw, washer, fork and tapered pin (view D).
*p.* Remove bearing from cradle (view D).

## 3-188. Cleaning and Inspection.

*a.* Inspect for deformed ball bearing.
*b.* Inspect for cracked, damaged, or deformed parts.
*c.* Inspect for damaged seals.
*d.* Inspect for excessive or uneven wear.
*e.* Clean parts thoroughly (para 2-9).

## 3-189. Assembly and Adjustment.

*a.* Assemble cupola body and cradle assembly in reverse order of disassembly.
*b.* Adjustment.

**NOTE**
The right trunnion bearing preload is established by shimming and tightening the left trunion bearing while cradle weight rests on the right bearing.

(1) Position cupola vertically with the right side down and cupola weight resting on the right bearing.
(2) Measure thickness of shaft retainer.
(3) Assemble shaft retainer to shaft and secure with two screws spaced 180 degrees apart. Insure that inner shoulder of shaft is seated on inner race of bearing.
(4) Measure distance from outer surface of retainer to body shoulder through two remaining bolt holes. Add the distances and divide by two to obtain average distance.
(5) Subtract retainer thickness from average distance obtained in step (4). This is the required shim thickness.
(6) Place required shim(s) in body. Position retainer to body and secure with four screws. Lockwire heads of screws.

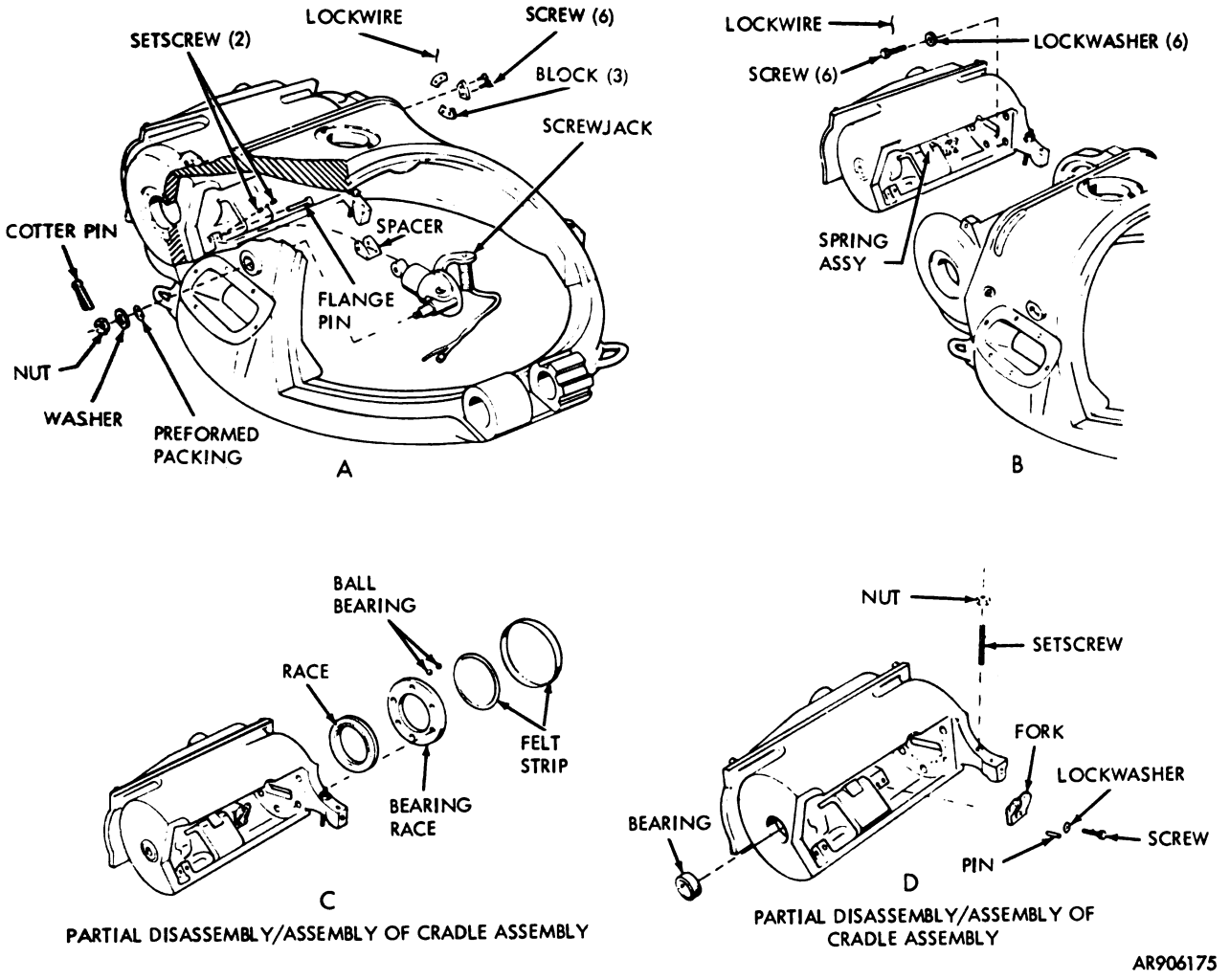



*Figure 3-77. M1 cupola cradle and body disassembly or assembly (vehicles serial numbered A3001 thru A3374).*

## Section XXVIII. REPAIR OF M1 CUPOLA AZIMUTH GEARBOX

**3-190. Description.** Refer to TM 9-2350-258-20-2.

**3-191. Removal.** Refer to TM 9-2350-258-20-2.

**3-192. Disassembly (fig 3-78).**

*a.* Remove cotter pin securing nut on worm shaft assembly (view A).

*b.* Remove nut and washer securing bearing, bushing, and worm shaft assembly in housing. Remove bearing, bushing, and worm shaft assembly (view A).

*c.* Remove cotter pin securing nut on wheel worm shaft assembly (view A).

*d.* Remove two setscrews securing bearing retaining ring in housing (view A).

*e.* Remove nut and washer securing bearing, bearing retaining ring, and wheel worm shaft assembly (view A).

*f.* Remove screw securing hand guard to hand grip and remove guard (view B).

*g.* Remove spring pin securing shoulder pin to crank. Remove shoulder pin hand grip and washer from crank (view B).

*h.* Remove spring pin securing crank to shaft. Remove crank, bearing, bushing, shaft, and worm gear (view B).

*i.* Remove spring pin securing worm gear to shaft and remove worm gear (view B).

*j.* Remove spring pin securing wheel worm gear to azimuth gear shaft. Disassemble gear and shaft (view C).

*k.* Remove spring pin securing azimuth gear to gear shaft and remove gear (view C).

*l.* Remove azimuth gear shaft bearing and bearing retaining ring from shaft.

*m.* Press bearing from retaining ring (view C).

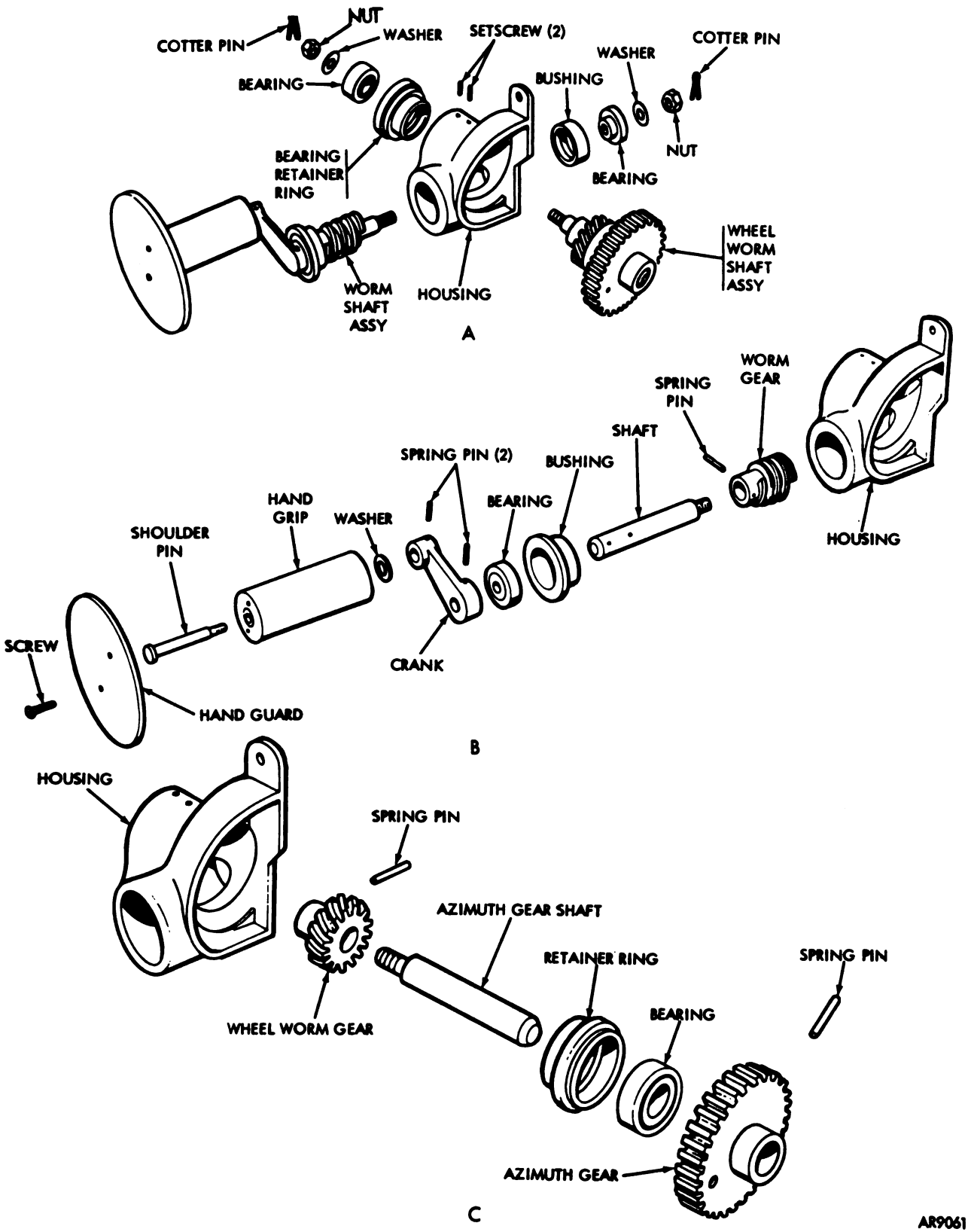



*Figure 3-78. M1 cupola azimuth gearbox disassembly or assembly (vehicles serial numbered A3001 thru A3374).*

**3-193. Cleaning.** Clean all parts in accordance with paragraph 2-9.

**3-194. Inspection and Repair.**

*a.* Inspect all threaded parts for stripped or damaged threads. Inspect all parts for wear, deformation, pits, nicks, and corrosion.

*b.* Repair or replace damaged components.

**3-195. Assembly (fig 3-78).** Install in reverse order of disassembly. Lubricate gearbox (LO 9-2350-258-12) during assembly.

**3-196. Installation.** Refer to TM 9-2350-258-20-2.

## Section XXIX. REPAIR OF CUPOLA SCREWJACK

**3-197. Description.** Refer to TM 9-2350-258-20-2.

**3-198. Removal.** Refer to TM 9-2350-258-20-2.

**3-199. Disassembly (fig 3-79).**

*a.* Remove and disassemble screwjack handle assembly (TM 9-2350-258-20-2).

*b.* Remove four screws securing cover assembly and remove cover assembly.

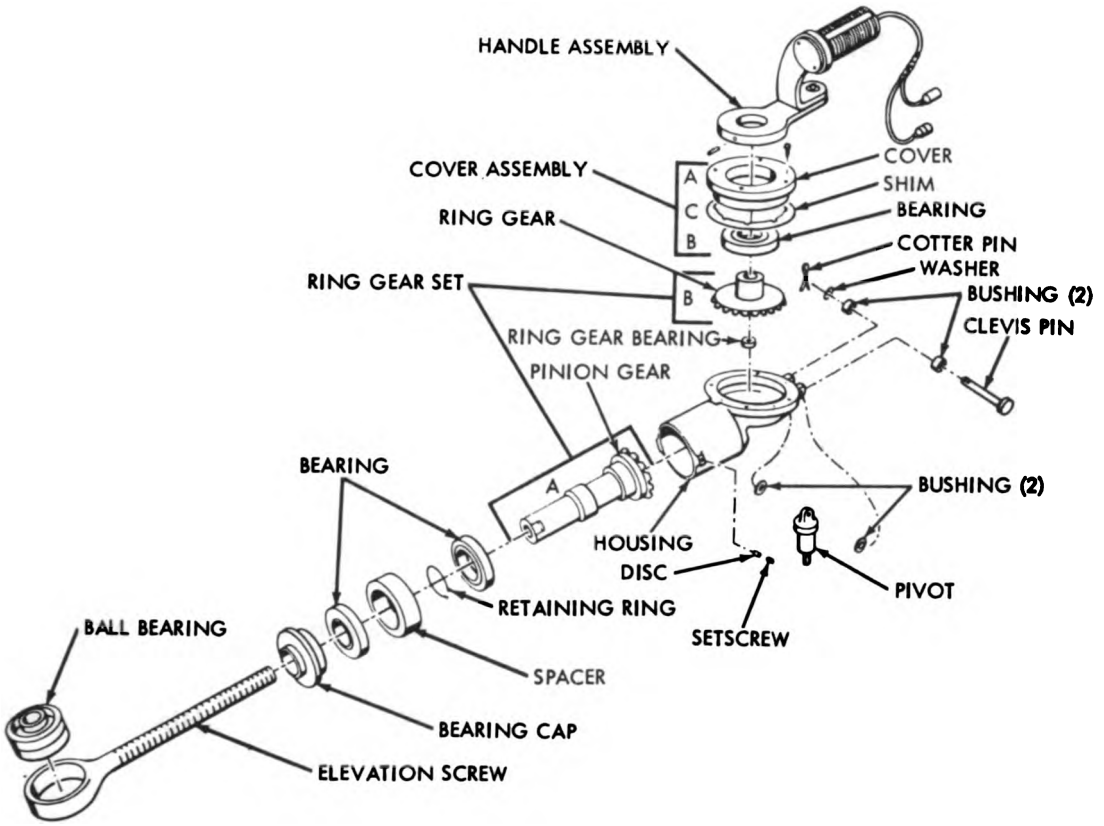
*c.* Press bearing, ring gear, and shim from cover.

*d.* Pull ring gear from bearing.

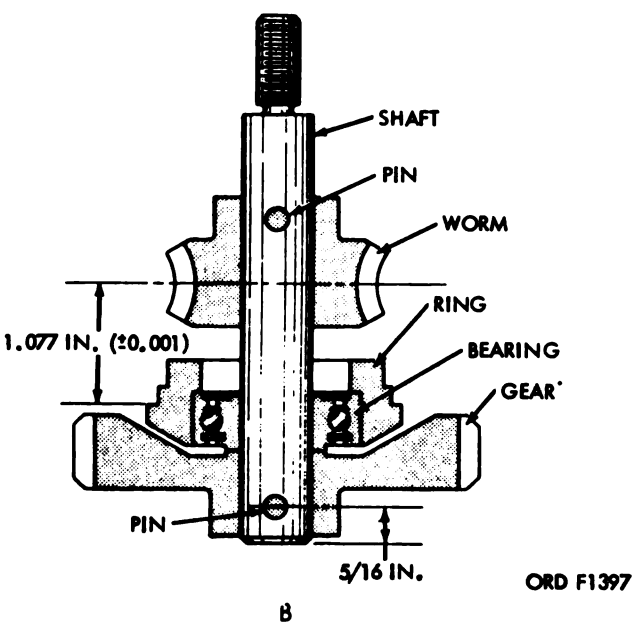
*e.* Unscrew bearing cap from housing. Remove elevation screw, bearing cap, spacer, retaining ring, bearing, and pinion gear of gear set.

*f.* Remove retaining ring and press bearing from pinion gear shaft.

*g.* Pull ring gear bearing from housing.




A




B

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*Figure 3-79. M1 cupola screwjack disassembly or assembly.*

**3-200. Cleaning.** Refer to paragraph 2-9.

**3-201. Inspection and Repair.**

*a.* Inspect all parts for pitting, corrosion, looseness, or damage.

NOTE

Ring gear and pinion gear are part of a matched gear set and must be replaced if either gear is unserviceable.

*b.* If a new gear is being installed, the three equidistant holes for the spring pins must be drilled and reamed using holes in crank as guides. If a new crank is being installed, the 5/16-inch dimension shown in view B must be observed, and the gear must be turned so that the new holes through the gear straddle the original holes.

*c.* Repair or replace defective components.

**3-202. Assembly (fig 3-79).**

*a.* Lubricate ring gear bearing (LO 9-2350-258-12). If replacement gear is used, use replacement pinion gear of gear set also.

*b.* Shrink pinion gear shaft and install bearing on shaft. Seat bearing against shoulder of shaft and install retaining ring.

*c.* Assemble pinion gear and shaft, bearing, bearing cap, and elevation screw and install in housing. Secure with bearing cap. Tighten to 10 lb-ft (13.5 N.m).

*d.* Lubricate housing and components (LO 9-2350-258-12).

*e.* Press ring gear into bearing.

*f.* Position ring gear and bearing and shim on cover. Press bearing into cover.

*g.* Position cover on housing and secure with four screws.

*h.* Position bearing on elevation screw and press bearing into eye. Stake in three places.

*i.* Install screwjack handle assembly (TM 9-2350-258-20-2).

**3-203. Installation.** Refer to TM 9-2350-258-20-2.

## Section XXX. REPAIR OF LOW PROFILE CUPOLA 7.62-MM MACHINEGUN MOUNT

**3-204. Description.** Refer to TM 9-2350-258-20-2.

**3-205. Removal.** Refer to TM 9-2350-258-20-2.

**3-206. Disassembly (fig 3-80).**

*a. Lock.*

(1) Loosen retainer securing lock by turning retainer to left until retainer is completely free of cradle (view A).

(2) Turn lock assembly to left and remove lock assembly from cradle (view A).

(3) Remove pin securing handle and retainer to lock. Remove handle and retainer (view A).

*b. Locking Handle.*

(1) Drive pin securing handle, spring, and pin toward upper arm assembly (view B).

(2) Remove handle, spring, and pin from housing (view B).

*c. Scissors Mount (views C,D,E, and F).*

(1) Position scissors mount on a flat surface and secure with a C clamp (view D).

(2) Remove two locking pins and two clevis pins securing cradle assembly to upper and lower arm assemblies (view C).

(3) Separate upper and lower support arms and remove cradle assembly (view C).

**WARNING**

**Springs are under high tension. Proceed with extreme caution when removing springs and clevis pins. Position upper and lower arm assemblies as shown in view D prior to removal of clevis pins and springs.**

(4) Hold ths scissors mount with a C clamp (view D) and remove pin securing upper clevis pin and spring to upper arm assembly.

(5) Carefully remove clevis pin, spring, and upper arm assembly (view D).

(6) Remove locking pin securing lower clevis pin and spring to lower arm assembly (view E).

(7) Carefully remove clevis pin and spring from lower arm assembly and separate bracket from arm assembly (view E).

**3-207. Cleaning.** Refer to paragraph 2-9.

**3-208. Inspection and Repair.**

*a.* Inspect all parts for cracking, wear, corrosion, or damage.

*b.* Replace all damaged or defective parts.

## 3-209. Assembly (fig 3-80).

*a.* Position bracket, lower arm assembly clevis pin, and spring as shown in views F and G, and secure with pin (view F).

*b.* Install the scissors mount locking pin in the upper arm assembly (view B).

*c.* Position spring on pin and insert in housing (view B).

*d.* Position handle in pin slot and install pin to secure handle and locking mechanism in housing (view B).

**NOTE**

Prior to installing pin in slot, insure handle is alined to accept pin. Lubricate locking mechanism with oil (Spec-VV-L-800).

*e.* Position upper arm assembly on bracket with clevis pin and spring (view D and E).

*f.* Clamp upper arm assembly to bracket with a C clamp (view D).

*g.* Aline spring and clevis pin by driving clevis pin partially through bracket and spring from one side (view D).

*h.* Drive a second pin through the spring and bracket from the opposite side to aid in alinement (view H).

*i.* Drive clevis pin through upper arm assembly, spring, and bracket, driving out the second pin (view H).

*j.* Secure clevis pin with locking pin (view I).

**NOTE**

Prior to assembly of locking mechanism to cradle assembly, lubricate the lock with oil (MIL-VV-L-800).

*k.* Position the retainer on lock and secure handle to lock with pin (view A).

*l.* Screw the lock assembly into the cradle and secure with retainer (view A).

*m.* Attach upper and lower arm assemblies to cradle with two clevis pins (views I and J).

*n.* Secure clevis pin with two locking pins (views I and J).

**NOTE**

Insure that the 7.62-mm machinegun is properly installed on the scissors mount, engaging both the front and rear locking pins.

*o.* Position 7.62-mm machinegun in the scissors mount (view K).

*p.* Lock mount in place with pin to prevent movement along vertical axis (view L).

**WARNING**

**Due to extreme spring tension on scissor mount, caution must be used when extending or compressing the scissors mount to prevent injury to personnel.**

*q.* Check scissors mount for proper operation.

**3-210. Installation.** Refer to TM 9-2350-258-20-2.

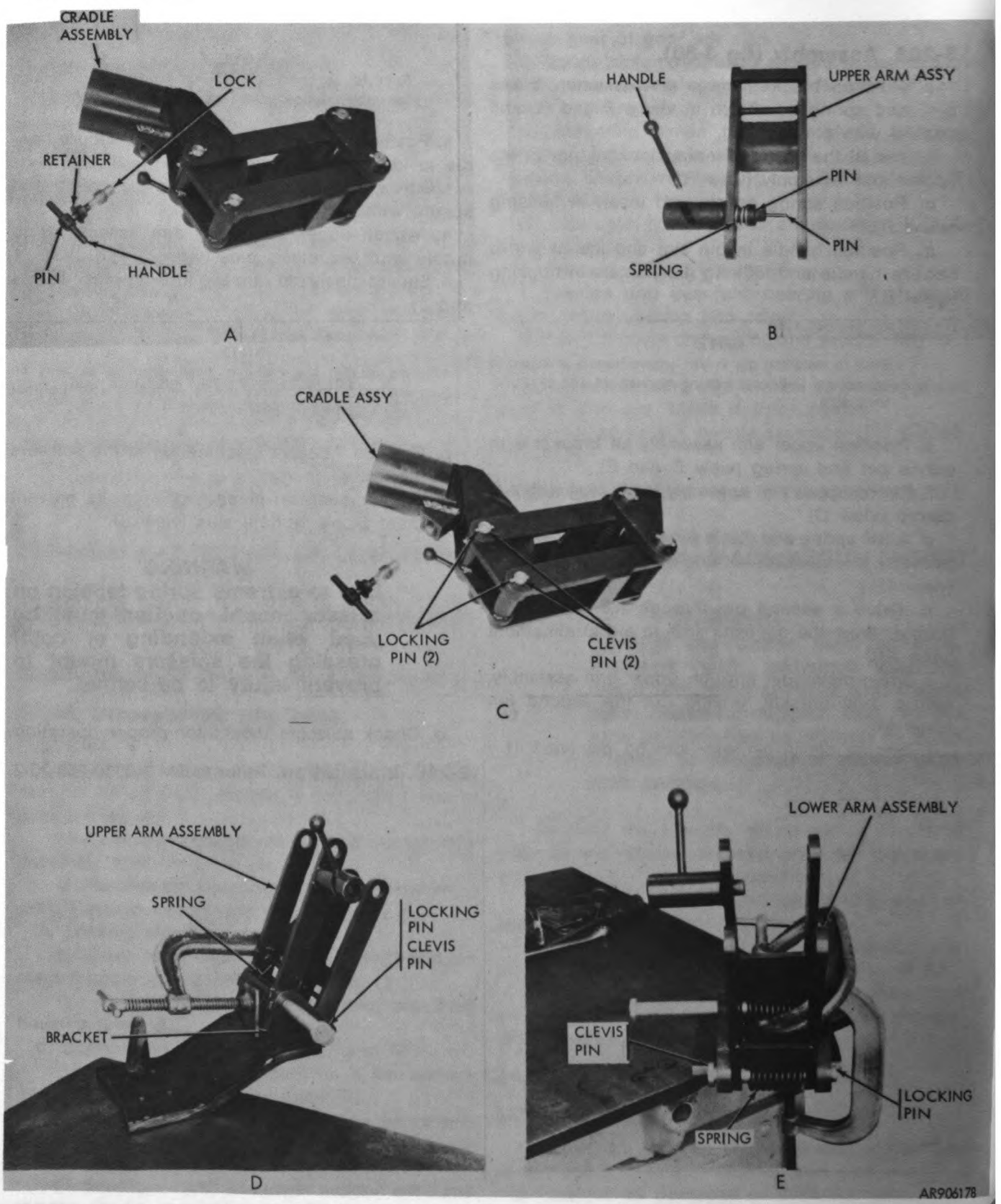



*Figure 3-80. Low-profile cupola 7.62-mm machinegun scissors mount disassembly or assembly (vehicles serial numbered A1001 thru A1999 and A3375 thru A3999) (1 of 3).*

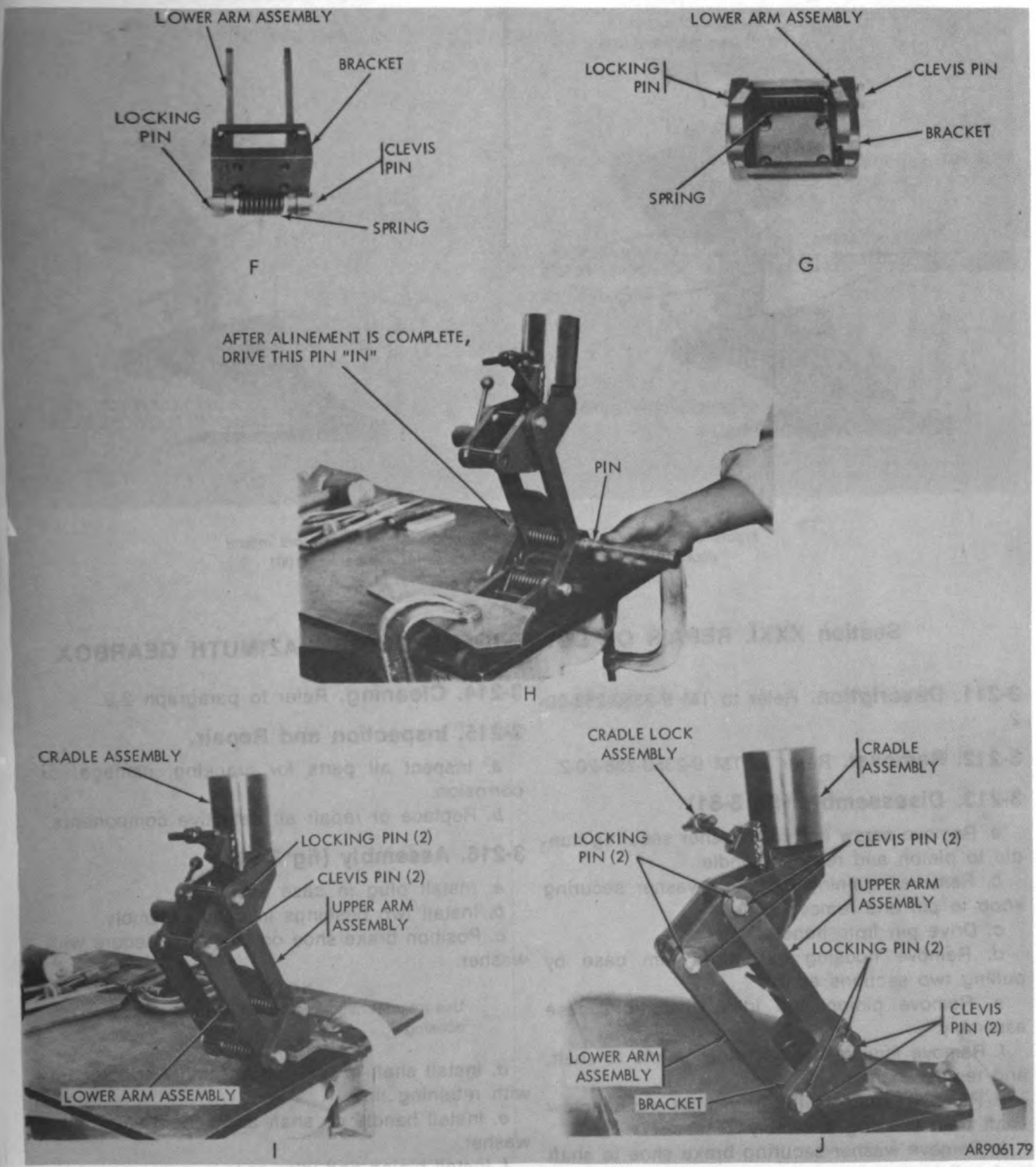



*Figure 3-80. Low-profile cupola 7.62-mm machinegun scissors mount disassembly or assembly (vehicles serial numbered A1001 thru A1999 and A3375 thru A3999) (2 of 3).*

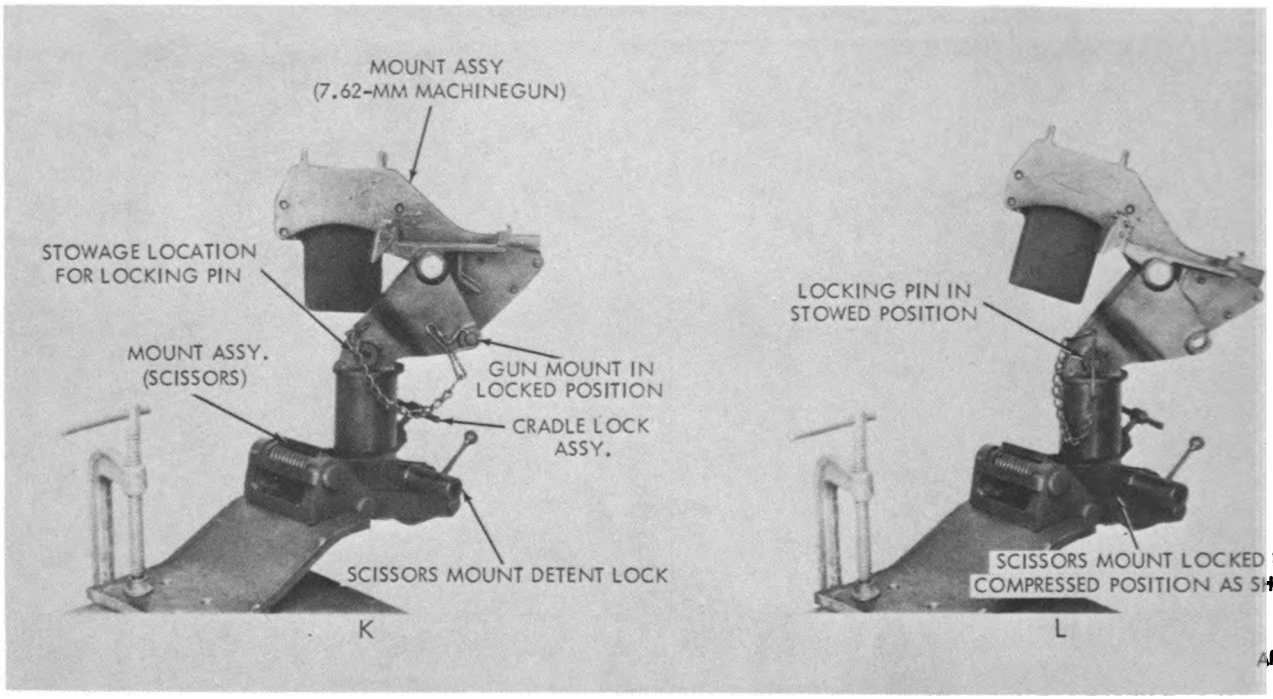



*Figure 3-80. Low-profile cupola 7.62-mm machinegun scissors mount disassembly or assembly (vehicles serial numbered A1001 thru A1999 and A3375 thru A3999) (3 of 3).*

## Section XXXI. REPAIR OF LOW-PROFILE CUPOLA AZIMUTH GEARBOX

**3-211. Description.** Refer to TM 9-2350-258-20-2.

**3-212. Removal.** Refer to TM 9-2350-258-20-2.

**3-213. Disassembly (fig 3-81)**

*a.* Remove screw and lockwasher securing handle to pinion and remove handle.

*b.* Remove retaining ring and washer securing knob to pin and remove knob.

*c.* Drive pin from handle.

*d.* Remove housing assembly from case by pulling two sections apart.

*e.* Remove pinion and idler gear from case assembly.

*f.* Remove lockwasher securing handle to shaft, and remove handle.

*g.* Remove retaining ring from shaft and unscrew shaft from housing assembly.

*h.* Remove washer securing brake shoe to shaft and pull brake shoe from shaft.

*i.* Drive two bushings from case assembly.

*j.* Remove plug from case assembly.

**3-214. Cleaning.** Refer to paragraph 2-9.

**3-215. Inspection and Repair.**

*a.* Inspect all parts for cracking, damage, or corrosion.

*b.* Replace or repair all defective components.

**3-216. Assembly (fig 3-81).**

*a.* Install plug in case assembly.

*b.* Install two bushings in case assembly.

*c.* Position brake shoe on shaft and secure with washer.

**NOTE**

Use retarder handle as an aid when screwing shaft into housing.

*d.* Install shaft in housing assembly and secure with retaining ring.

*e.* Install handle on shaft and secure with lockwasher.

*f.* Install pinion and idler gear in case assembly.

*g.* Assemble case assembly and housing assembly by fitting two sections together.

*h.* Drive pin into handle.

*i.* Position knob and washer on pin and secure with retaining ring.

*j.* Position handle on pinion and secure with screw and lockwasher.

**3-217. Installation.** Refer to TM 9-2350-258-20-2.

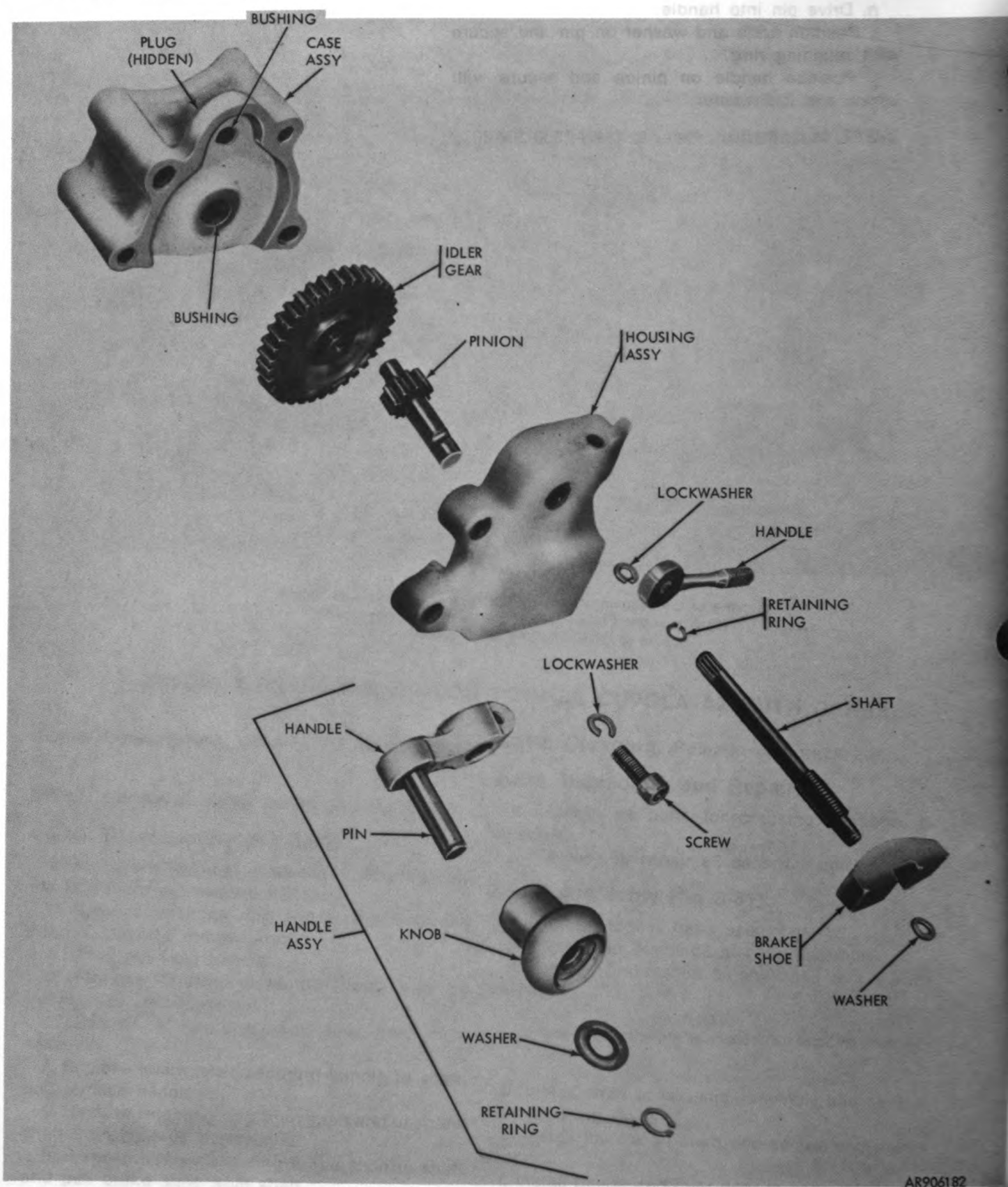



*Figure 3-81. Low-profile cupola azimuth gearbox disassembly or assembly (vehicles serial numbered A1001 thru A1999 and A3375 thru A3999).*

## Section XXXII. REPAIR OF CUPOLA BEARING ASSEMBLY

### 3-218. Removal (fig 3-82).

*a.* Remove cupola from turret (para 2-39).

*b.* Lower cupola to floor.

*c.* Using two chains of cupola sling (37, table 2-1) and strap, turn cupola upside down and lower onto wooden blocks (view A). Insure that cupola is level.

NOTE

Insure that cupola does not rest on periscope covers, handles, or torsion spring housings.

*d.* Remove cupola azimuth gearbox TM 9-2350-258-20-2.

*e.* Remove cupola traverse lock assembly (TM 9-2350-258-20-2).

*f.* Rotate cupola lower race ring to permit removal of screws securing race rings to cupola body. Remove 24 screws.

NOTE

Insure that 24-retaining screws are removed through four unthread access holes in lower race ring. Access holes are slightly larger than remaining holes.

*g.* Carefully remove upper and lower race rings from cupola body.

### 3-219. Disassembly (fig 3-82).

*a.* Remove eight ball bearing retainers (view B).

*b.* Stand race rings in vertical position on bench or table (view B).

NOTE

Tool should be of plastic material to avoid damage to ball bearings.

*c.* Using a suitable tool, move the ball bearings to the sides and bottom of lower race (view B).

*d.* Lift lower race ring until it contacts the upper race ring at the top. This provides enough space at bottom of bearing assembly for removing the 80 ball bearings. Remove ball bearings (view B).

NOTE

One man will be needed to hold the assembly while another man removes balls.

*e.* Separate lower race ring from upper race ring and strip off cupola seal (view C).

### 3-220. Cleaning.

*a.* Remove grease from inner and outer race rings.

*b.* Remove grease from 80 ball bearings.

### 3-221. Inspection.

*a.* Inspect inner and outer races for cracking, galling, scoring, or lack of lubrication.

*b.* Check ball bearing retainers for cracking or breaking.

*c.* Check ball bearings for uneven wear or flat spots.

*d.* Replace any defective components.

### 3-222. Assembly (fig 3-82).

*a.* Install new seal on lower race ring (view C).

*b.* Position lower race ring in upper race ring and stand two race rings in vertical position on surface of bench or table (view B).

*c.* Apply grease (MIL-G-10924) to lower and upper race rings. Thoroughly grease ball bearings.

NOTE

Two men should perform the following task. One man is needed to hold the assembly while the other inserts the balls.

*d.* Separate two race rings at upper edge to permit insertion of 80 ball bearings. Insert balls at top of race rings. Place race rings in horizontal position on bench or table surface and spread balls equally around circumference of race rings.

NOTE

Each ball retainer secures 10 balls.

*e.* Insert the 8 ball retainers (view B).

### 3-223. Installation (fig 3-82).

*a.* Position assembled cupola races (view B) on cupola body (view A).

*b.* Install 24 retaining screws through 4 unthreaded access holes in lower race ring. Rotate the lower race ring to aline holes as screws are installed. Tighten screws to 50 lb-ft (68 N.m) (view A).

*c.* Install cupola traverse lock assembly (TM 9-2350-258-20-2).

*d.* Install cupola azimuth gearbox (TM 9-2350-258-20-2).

**WARNING**
**Insure that cupola traverse lock is engaged.**

*e.* Use sling and straps (37, table 2-1) to lift cupola back to normally upright position.

*f.* Install cupola on turret (para 2-39).

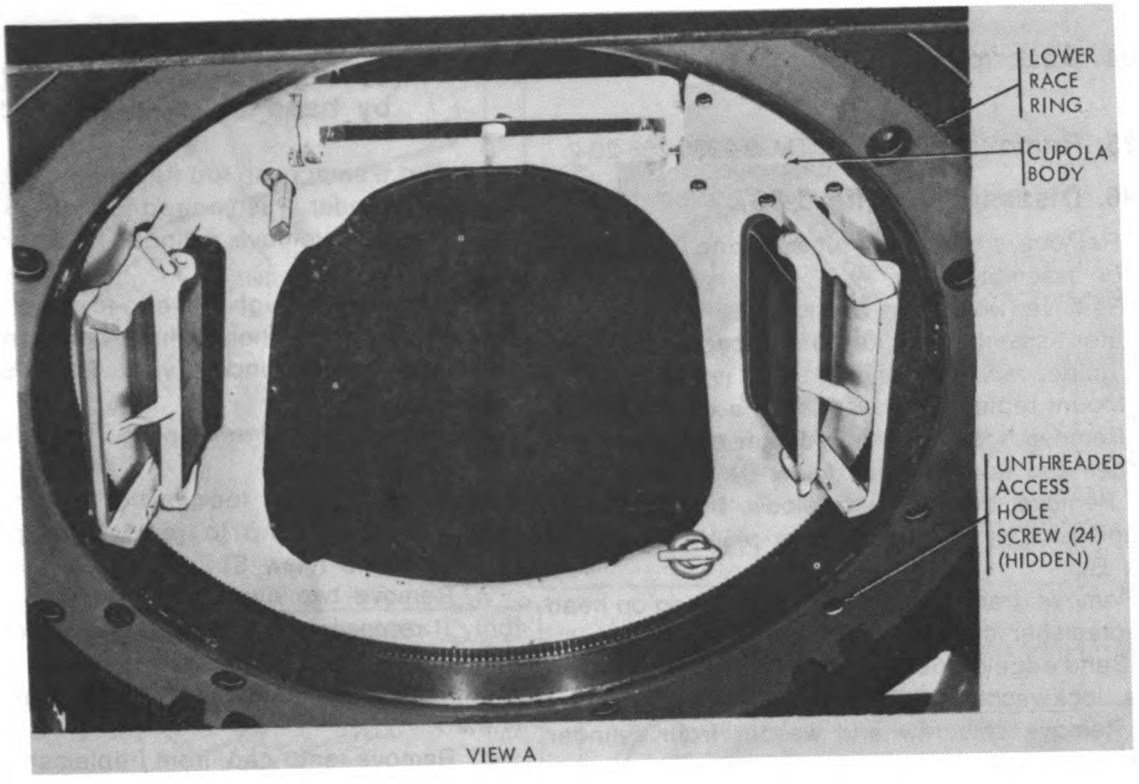



*Figure 3-82. Low-profile cupola bearing race disassembly or assembly (vehicles serial numbered A1001 thru A1999 and A3375 thru A3999).*

## Section XXXIII. REPAIR OF REPLENISHER

**3-224. Description.** Refer to TM 9-2350-258-20-2.

**3-225. Removal.** Refer to TM 9-2350-258-20-2.

**3-226. Disassembly (fig 3-83).**

*a.* Remove screw and nut securing tape in indicator assembly (view A).

*b.* Remove two screws and lockwashers securing indicator assembly bracket to end cap and remove tape guide, tape pin, and bracket (view A).

*c.* Mount replenisher cylinder in a vise (view C).

*d.* Remove hose nut from adapter on replenisher cylinder and remove hose (view B).

*e.* Remove adapter and elbow from head of replenisher cylinder and remove plug and washer (view B).

*f.* Remove drain cock from pipe coupling on head of replenisher cylinder (view D).

*g.* Bend edge of lockwasher from nut and remove valve, lockwasher, and washer (view B).

*h.* Remove setscrew and washer from cylinder (view B).

*i.* Remove plug from cylinder head only if repair is necessary (view C).

**WARNING**
**Spring is retained under tension by head of replenisher cylinder.**

*j.* Insert a steel push rod (fabricated tool (56 table 2-1) into cylinder. Push on rod to maintain pressure on piston and remove cylinder head and discard packing.

*k.* Feed tape through end cap to allow removal of piston from replenisher cylinder and remove piston and tape from cylinder (view E). Discard seal assembly.

*l.* Remove spring from replenisher cylinder (view E).

*m.* Loosen screw, lockwasher and nut bearing securing tape clamp to replenisher piston, and remove clamp (view E).

*n.* Remove two rivets securing tape to clamp (only if replacement is required), and remove tape from clamp (view E).

*o.* Remove setscrew and washer from end cap (view F).

*p.* Remove end cap from replenisher cylinder (view F).

*q.* Insure that cylinder vent hole is not plugged (view A).

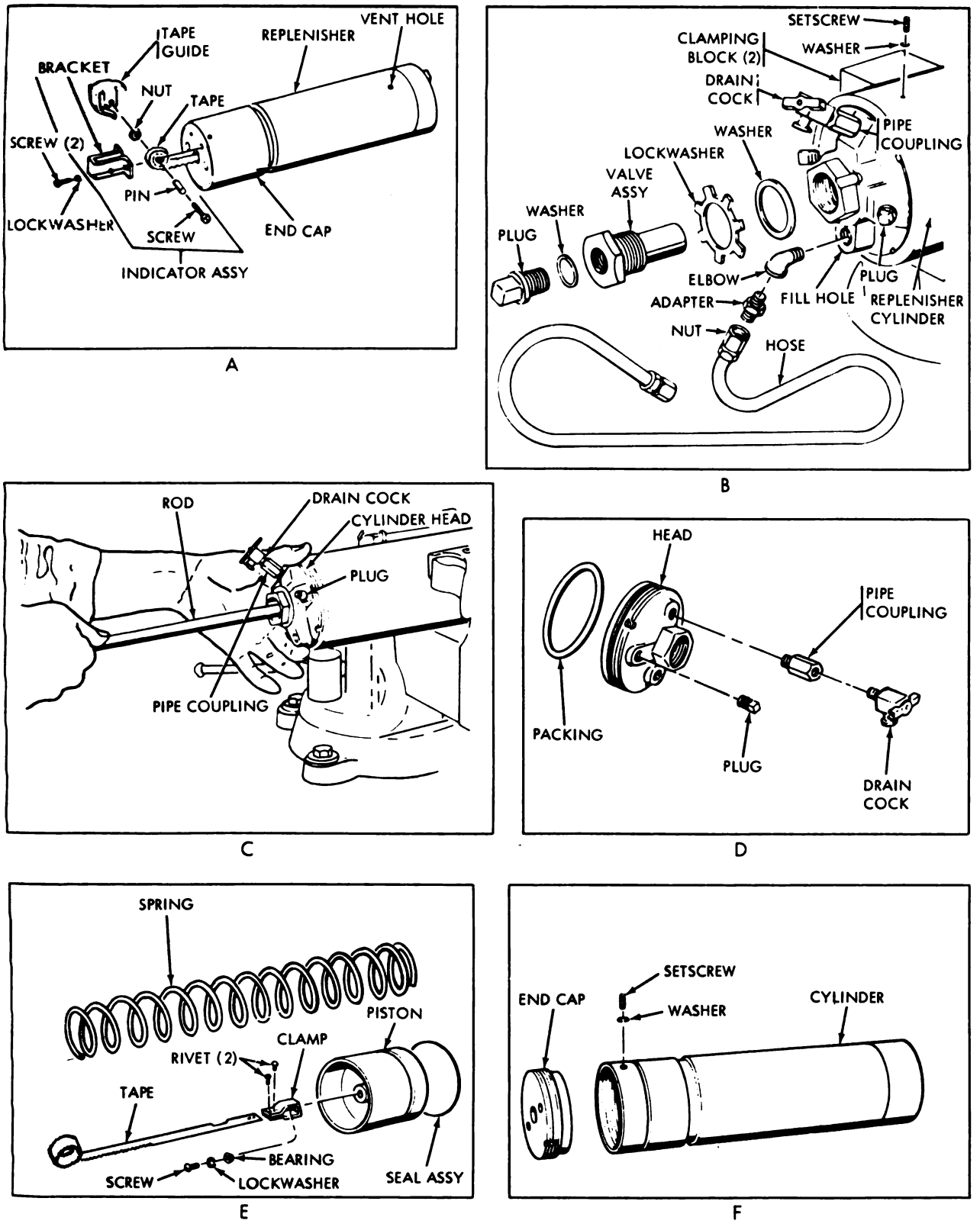
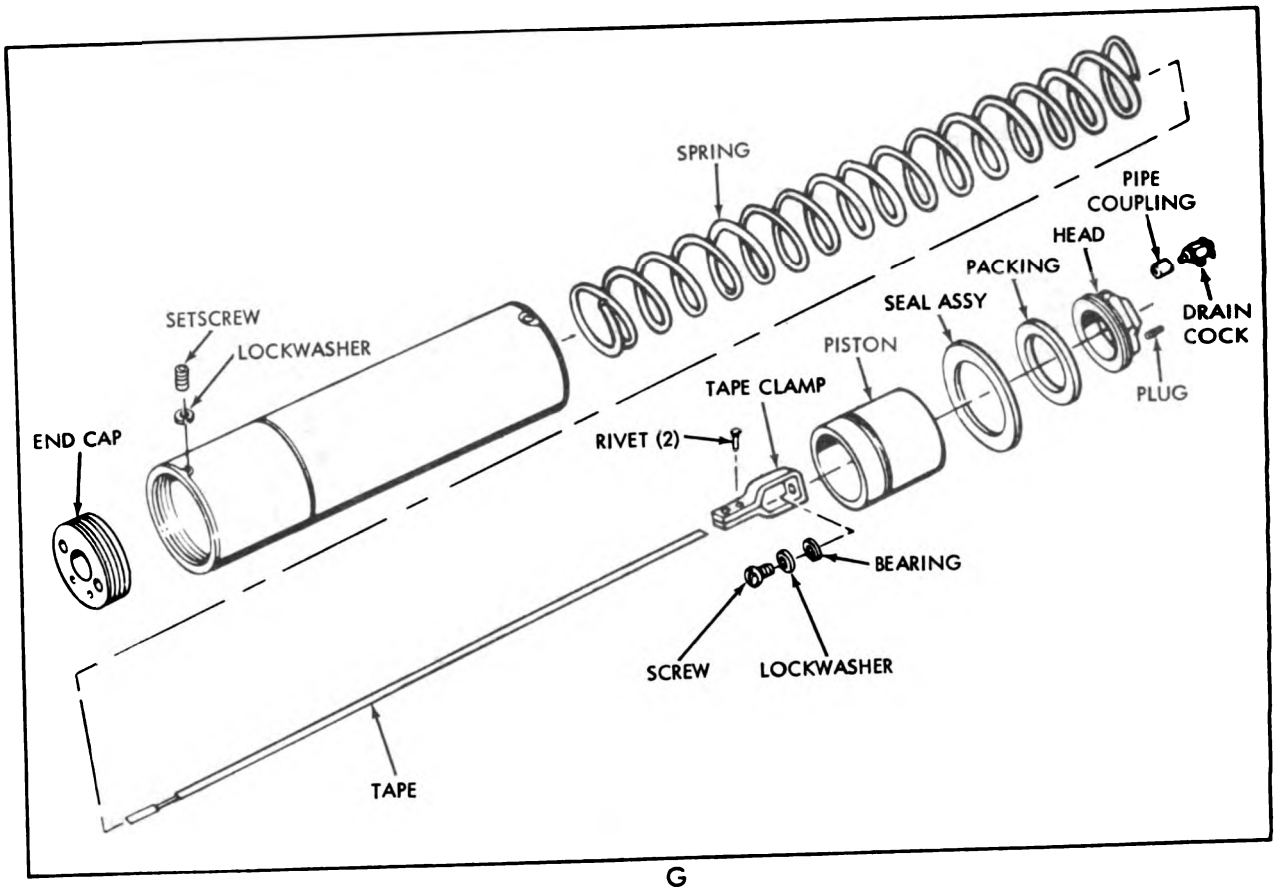



*Figure 3-83. Replenisher disassembly or assembly (1 of 3).*

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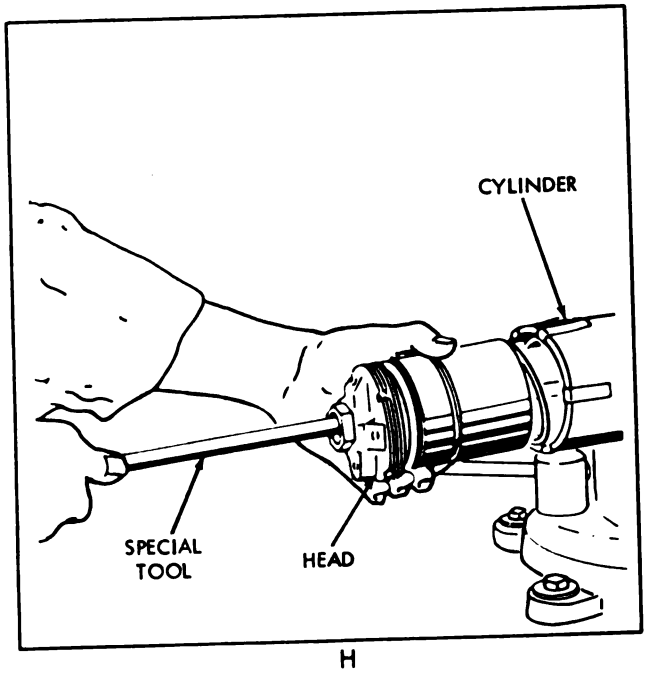


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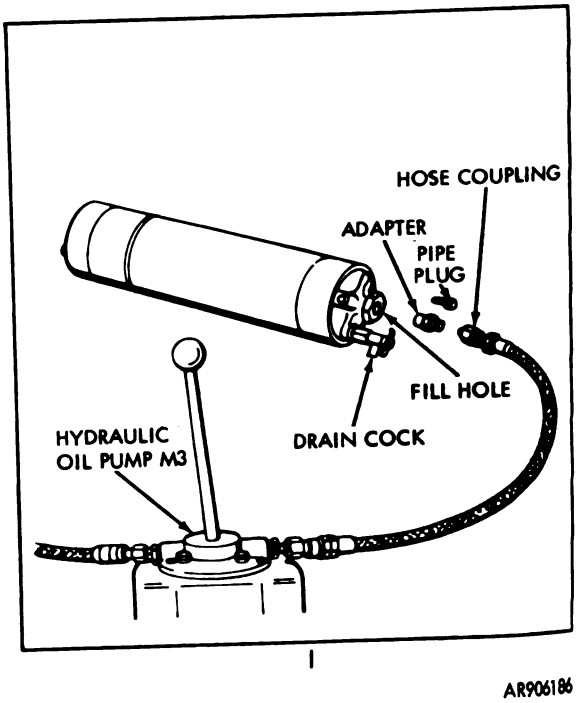


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*Figure 3-83. Replenisher disassembly or assembly (2 of 3).*

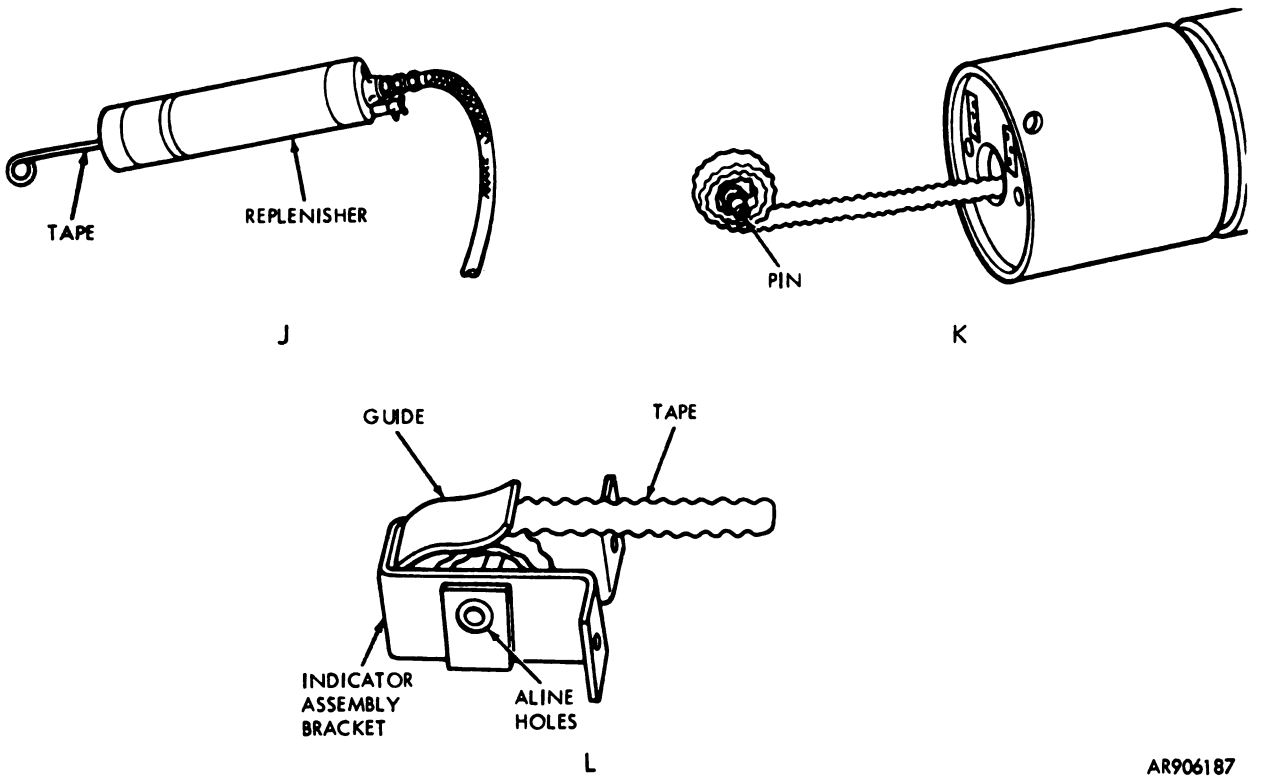



*Figure 3-83. Replenisher disassembly or assembly (3 of 3).*

**3-227. Cleaning.** Clean all parts except tape in accordance with paragraph 2-9.

## 3-228. Inspection and Repair.

*a.* Check replenisher parts for corrosion, burs, and thread damage. Inspect piston surface for scoring.

*b.* Repair or replace damaged parts.

## 3-229. Assembly (fig 3-83).

*a.* Install end cap into replenisher cylinder (flush with end of cylinder) (view F).

*b.* Install setscrew and washer into end cap end of replenisher cylinder (view F). Tighten to 2-3 lb-ft (3—4 N.m).

*c.* Install tape into clamp and secure with two rivets (view E).

*d.* Position tape clamp to piston and secure with screw, lockwasher, and bearing (view E). Tighten 2-3 lb-ft (3—4 N.m).

*e.* Mount replenisher cylinder in vise (view C).

*f.* Install spring into replenisher cylinder (views E and G).

**NOTE**

Breaks in fiber seals should be 180 degrees apart.

*g.* Install new seal assembly onto piston (view E).

*h.* Insert a steel push rod (56 table 2-1) through cylinder head and new packing, and while pushing on piston with rod, install replenisher head (view C). Tighten head until approximately flush with end of cylinder. Position endcap (view A) with three holes in cap vertical and holes for tape bracket toward right rear. Position drain cock at top of cylinder.

*i.* While feeding tape through end cap, install piston into cylinder (view H).

*j.* Remove rod.

*k.* Install setscrew and washer into head end of replenisher cylinder (view B). Tighten to 2-3 lb-ft (3—4 N.m).

*l.* Install plug into head of replenisher cylinder (view B).

*m.* Install pipe coupling into head of replenisher cylinder (view B).

*n.* Install drain cock into pipe coupling (view B).

*o.* Install valve, lockwasher, and washer into head of replenisher cylinder (view B). Bend edge of lockwasher onto valve assembly after tightening.

*p.* Install plug and washer into valve (view B).

*q.* Install special adapter into replenisher fill hole (view I).

*r.* Attach hose assembly and M3 hydraulic pump, or equivalent, to adapter (view I).

*s.* Close drain cock (view I).

*t.* Fill replenisher with oil until tape starts to show smooth edges on both sides (view J).

*u.* Insert end of tape into slot in pin (view K).

*v.* Insert screwdriver into slot in pin and wind tape into snug coil until 3 inches of tape notched on both sides is left exposed (view K).

*w.* Grip circumference of rolled tape with No. 5 snap ring pliers and insert into guide (view L).

*x.* Aline holes in tape pin, guide, and bracket and secure with screw and bearing in alined holes (views A and L). Tighten to 10-12 lb-in. (1.1—1.4 N.m).

*y.* Position indicator assembly on end cap replenisher cylinder and secure with two screw and washers (view A). Tighten to 2-3 lb-ft (3— N.m).

*z.* Remove pressure and disconnect M3 hydraul pump coupling hose from adapter (view I).

*aa.* Remove adapter from fill hole in valve assen bly (view I).

*ab.* Open drain cock and drain hydraulic flui from replenisher (view B).

*ac.* Install plug and washer in valve assembl (view B).

*ad.* Install elbow and adapter in fill hole in hea of replenisher cylinder (view B).

*ae.* Position replenisher hose nut to adapter an secure with nut (view B).

*af.* Cap open end of replenisher hose to preven contamination.

**3-230. Installation.** Refer to TM 9-2350-258-20-2.

## Section XXXIV. REPAIR OF RECOIL MECHANISM

**3-231. Description.** Refer to TM 9-2350-258-20-2.

### 3-232. Removal.

*a.* Remove cannon and combination gun mount from vehicle (para 2-41).

*b.* Remove recoil mechanism (para 3-241).

### 3-233. Disassembly (fig 3-84).

*a.* Install sling on recoil mechanism and lift recoil mechanism using a hoist with a minimum capacity of 2 tons. Adjust sling so that recoil mechanism is level (view A).

*b.* Place a 6—gallon container under recoil mechanism. Remove fill plug, drain plug, and washers, and drain recoil mechanism oil (view A).

*c.* Set recoil mechanism in a vertical position with collar up (view B).

*d.* Remove lockwire, ten screws, and ten flat washers securing collar to cover and remove collar (view B).

*e.* Install puller and lifting clamp (31, table 2-1) on collar end of recoil mechanism. Insure bosses on clamp engage holes in collar. Adjust spread of clamp as necessary (view C).

*f.* Install hook of hoist capable of lifting 1 ton in lifting eye of clamp and remove slack in chain (view C).

*g.* Turn jackscrews of clamp evenly while maintaining lifting force with hoist and remove piston assembly (view D).

*h.* Lower piston assembly to work area and remove clamp from collar (view E).

*i.* Using care not to scratch or mar piston, install recoil spring compressing fixture (33, table 2-1) (view F).

*j.* Turn jackscrew of fixture until recoil spring retainer is free of collar (view F).

*k.* Remove screw securing key to breech ring adapter and remove key (view G).

*l.* Remove breech ring adapter and collar (view H).

*m.* Install thread protector (34, table 2-1) on piston assembly and remove recoil spring compression fixture (view I).

*n.* Remove six screws securing spacer to cover and remove cover (view J).

*o.* Remove cover from piston assembly (view J).

*p.* Remove outer seal assembly, outer seal retainer, recoil spring retainer seal assembly, seat seal assembly, and recoil spring (view I), and discard seals.

*q.* Using spring pliers (29, table 2-1), remove inertia valve retaining ring and inertia valve (views K and L).

*r.* Remove four screws securing recoil spring ring to piston and remove ring (view L).

*s.* Remove and discard seal assembly from outer groove of sleeve (view M).

*t.* Turn recoil mechanism end for end (view N).

*u.* Remove tube support ring from groove in sleeve (view N).

*v.* Remove lockwire and remove eight screws securing sleeve in cradle (view N).

*w.* Secure a 2x4 x 13 inch wood block to a rope hoist. Lower into tube support sleeve (view O).

*x.* Position and center wood block in tube support sleeve. Raise hoist to sufficient height to block in position and transfer to sling (view O). Raise sling with hoist and remove tube support sleeve from cradle (view P).

*y.* Remove and discard sleeve seal assembly from cradle (view Q).

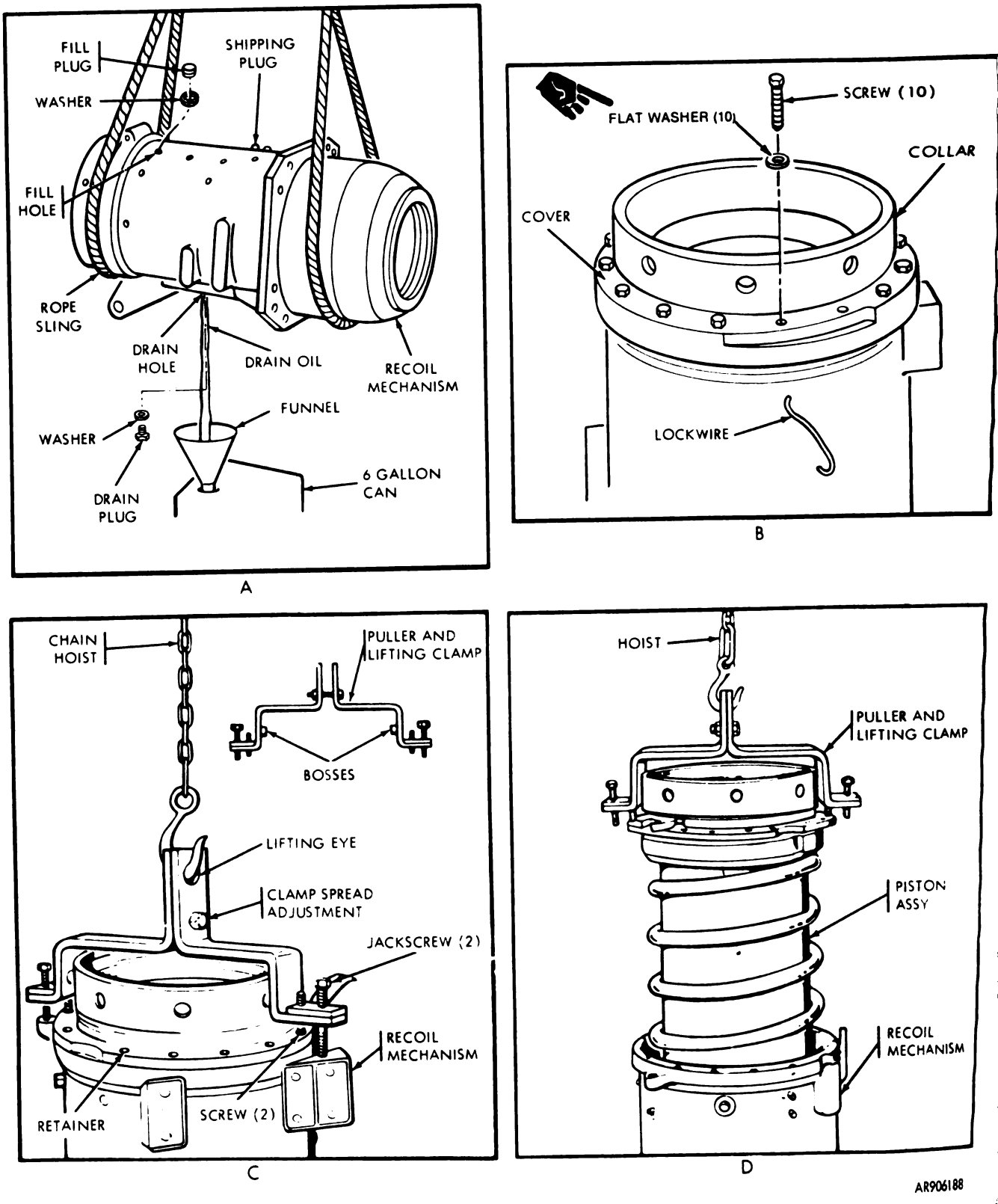



*Figure 3-84. Recoil mechanism disassembly or assembly (1 of 5).*

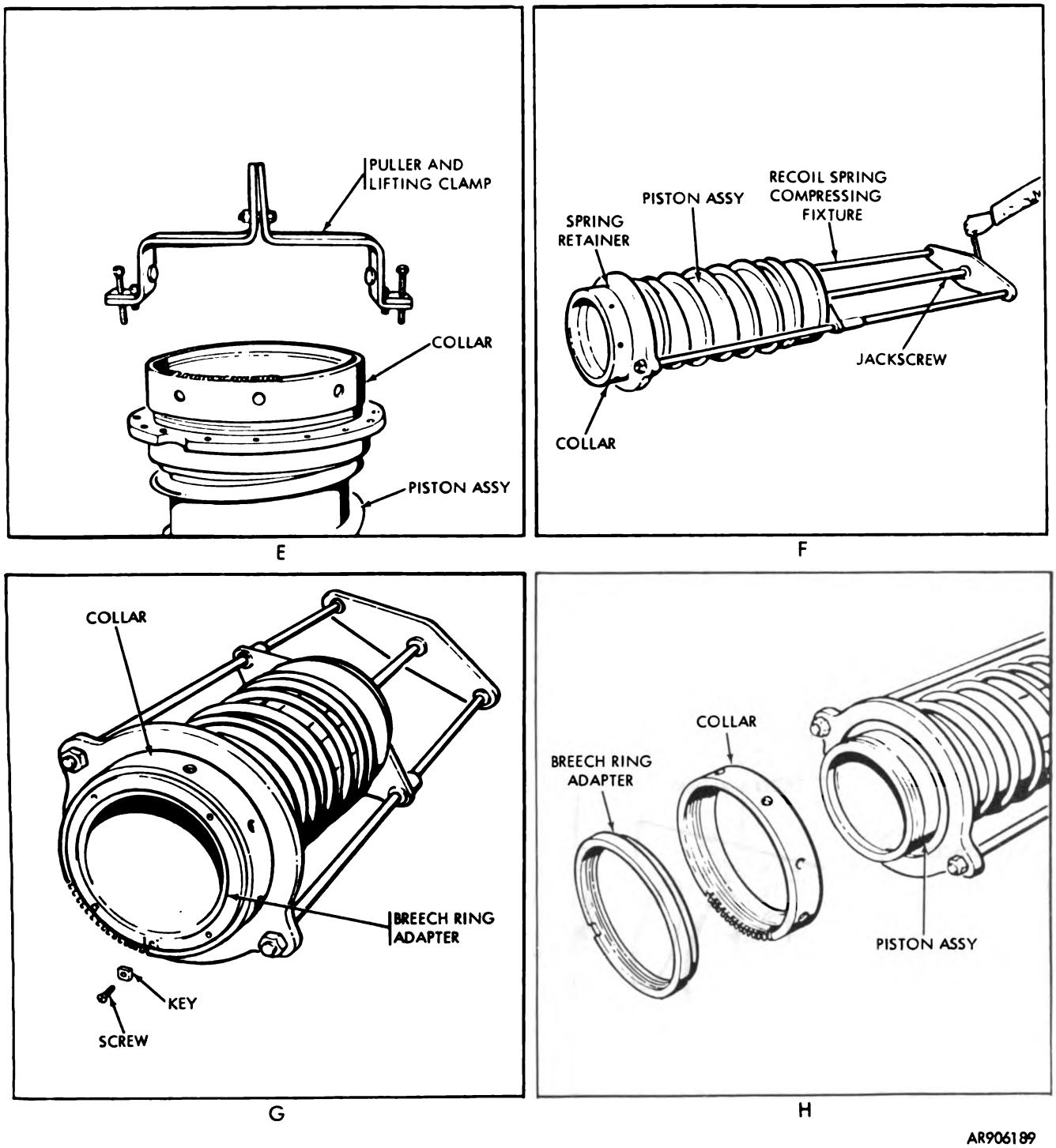
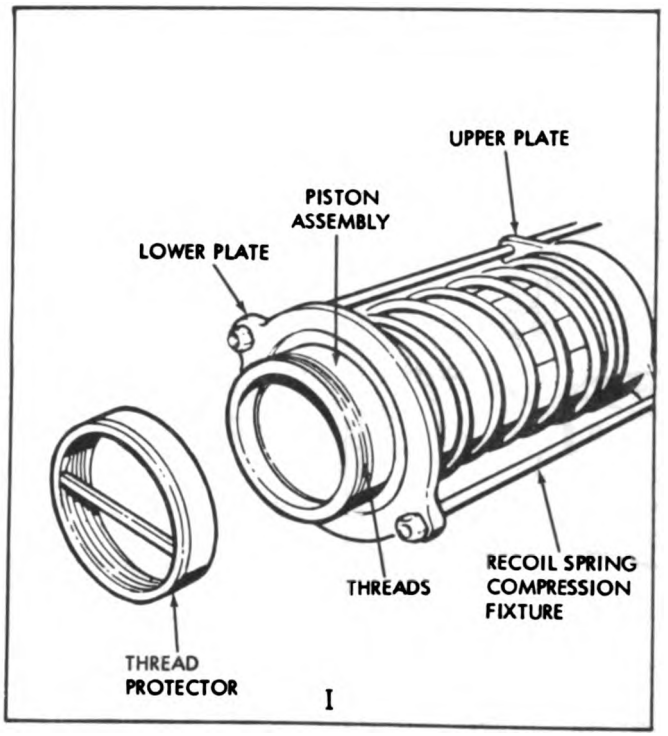



*Figure 3-8.* Recoil mechanism disassembly or assembly (2 of 5).



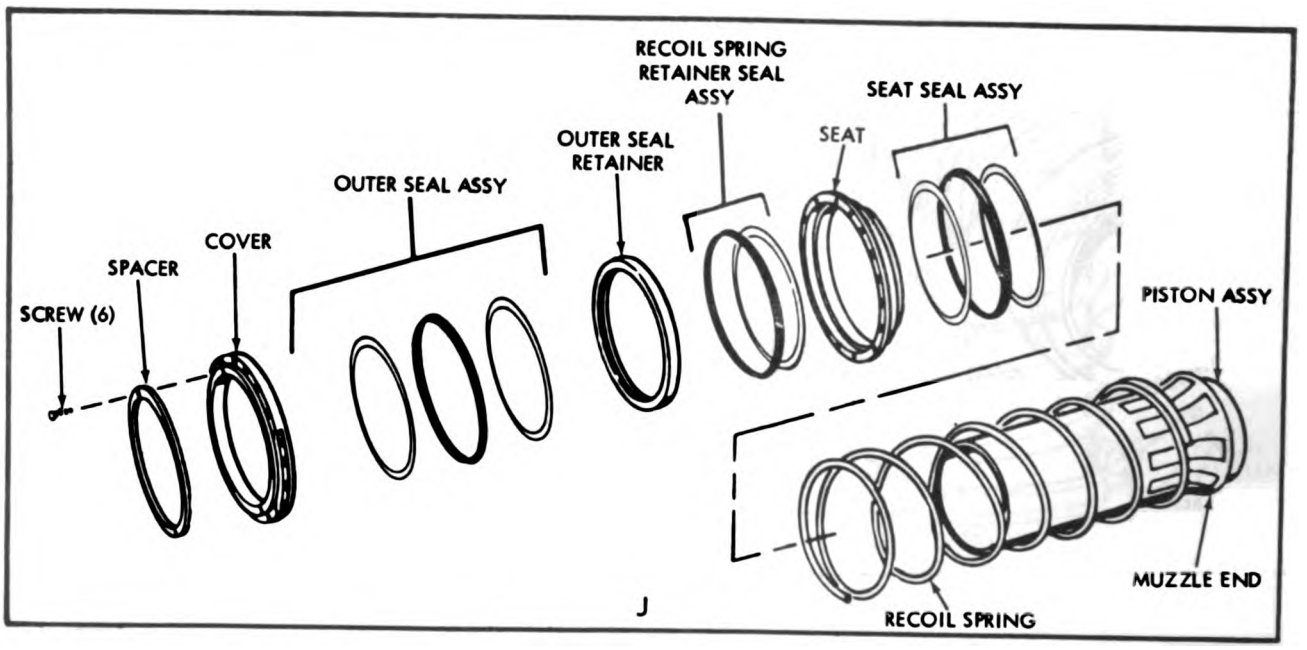




Figure 3-84. Recoil mechanism disassembly or assembly (3 of 5).

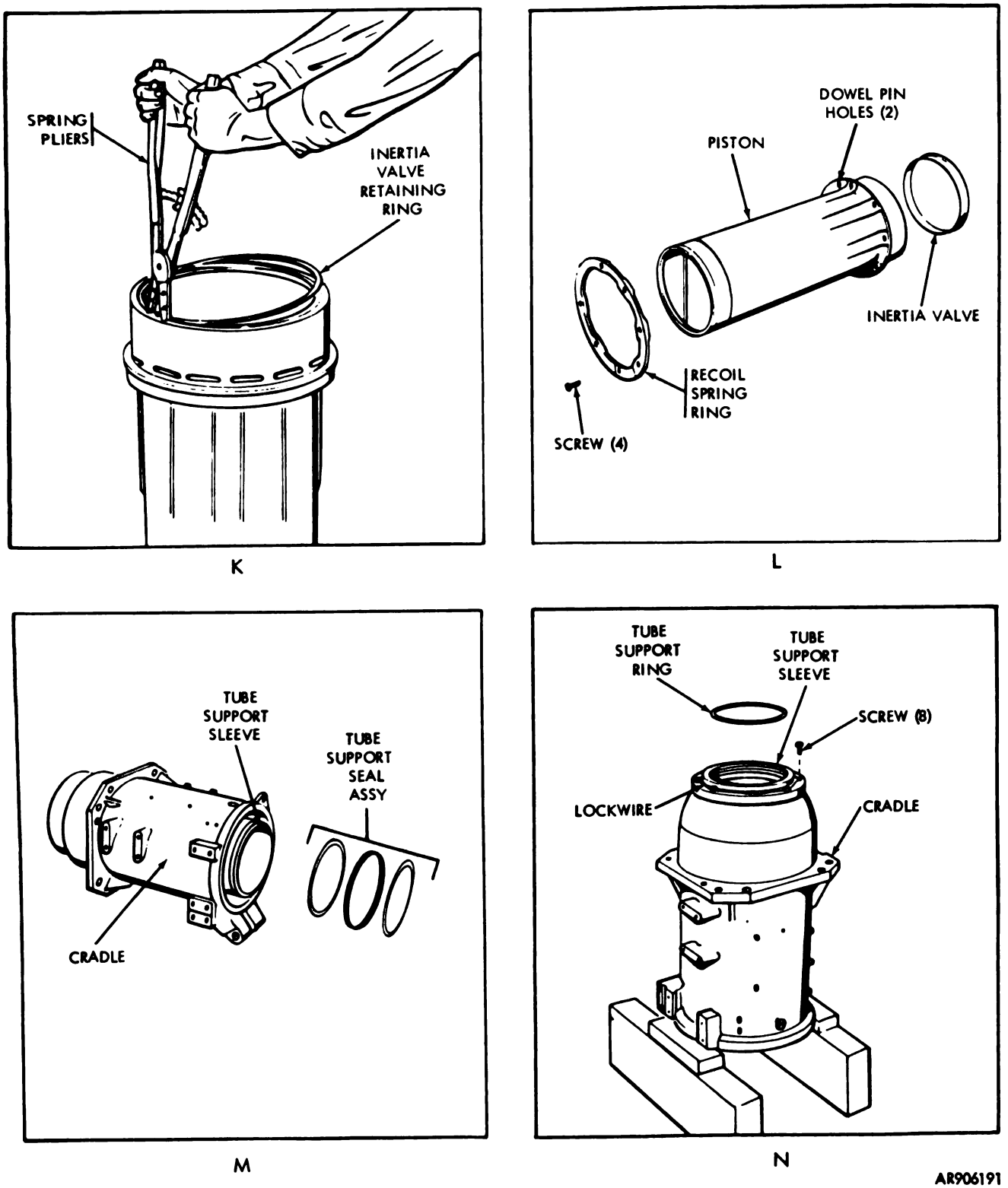
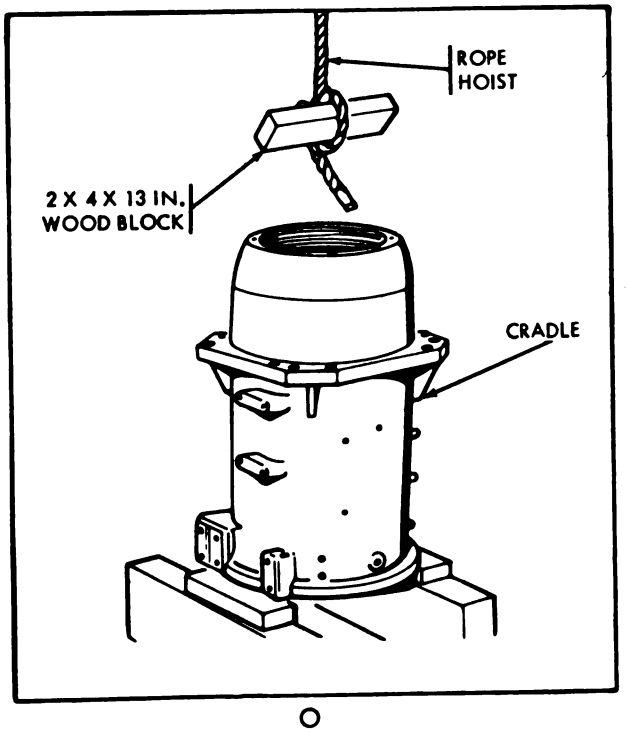



Figure 3-84. Recoil mechanism disassembly or assembly (4 of 5).

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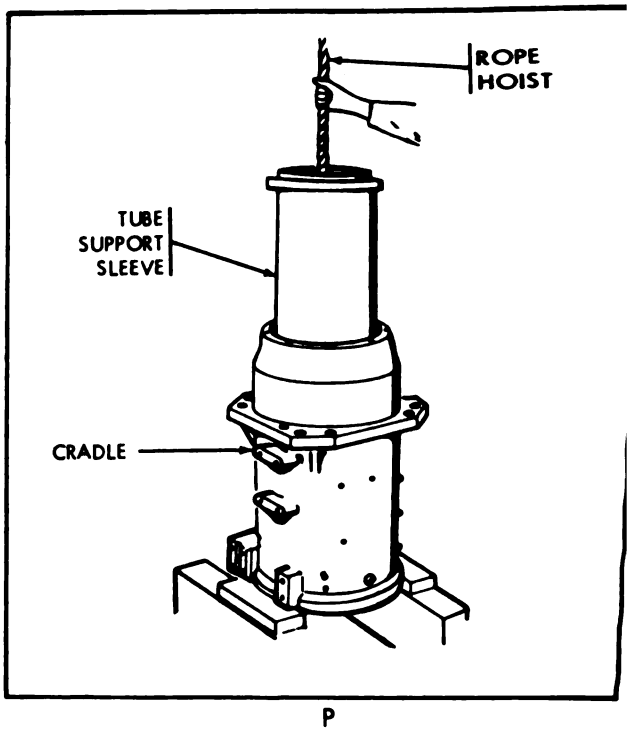


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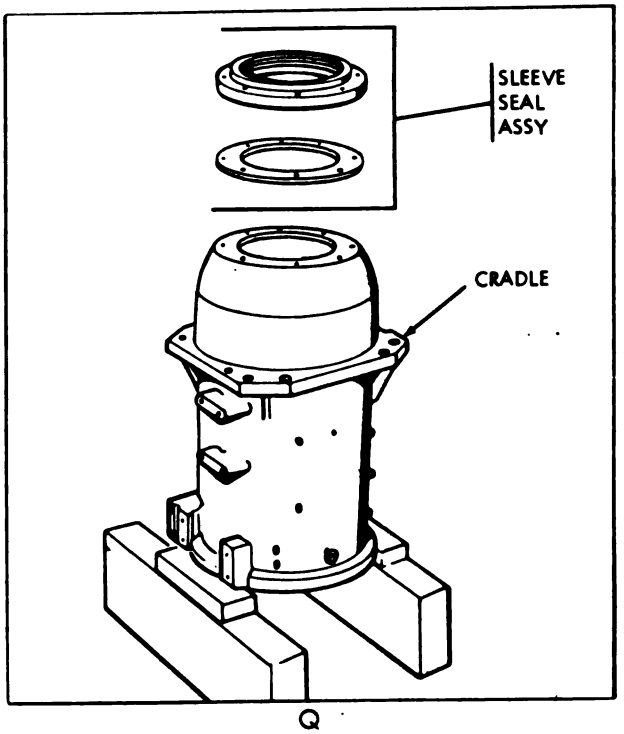


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Figure 3-84. Recoil mechanism disassembly or assembly (5 of 5).

**3-234. Cleaning.** Refer to paragraph 2-9.

**3-235. Inspection and Repair.** **Inspect all parts for burrs, cracks, chips, and deformation.** Cracks in worn area of recoil spring are normal. Inspect machined surfaces of piston and sleeve. Surfaces must be free of scoring, galling, or etching. Finish should be 63 microinch or better. Check inside diameter of outer seal retainer. If retainer diameter is not 11.508±0.003 inch, machine or replace as necessary. Replace piston and adapter as a matched set if damaged.

**3-236. Assembly.**

*a.* Requisition repair parts kit (TM 9-2350-258-34P-2). All repair parts must be used during assembly. Coat piston assembly tube support sleeve inside of cradle and seals with hydraulic fluid (MIL-H-46170(FRH)) in assembly.

*b.* Install new sleeve seal assembly in cradle (view Q).

*c.* Use sling to lower sleeve into cradle. Block flange on sleeve with a 2x4 wood block. Remove sling from hoist and secure a 2x4x13 wood block on a rope hoist. Lower 2x4x13 block into tube support sleeve. Raise sleeve and remove block. Lower sleeve in cradle (view P).

*d.* Position tube support sleeve on cradle and secure with eight screws. Tighten to 50-60 lb-ft (68-81 N.m) and secure with lockwire. Remove wood block and rope hoist (view N).

*e.* Install tube support ring in internal groove of sleeve (view N).

*f.* Use sling and hoist to set recoil mechanism in vertical position with collar end at top.

*g.* Install new tube support seal assembly in outer groove of tube support sleeve (view M).

**WARNING**

**Recoil spring ring and piston are matched machined set. If replacement of ring is necessary, drill dowel pin holes in pad 90 degrees opposite from those in piston. Replacement of ring in excess of two times requires replacement of complete adapter and piston assembly. Return assembly through normal supply channels.**

*h.* Position recoil spring ring on dowel pins on piston and secure with four new screws. Tighten screws to 13-15 lb-ft (18-20 N.m) and stake (view L).

*i.* Install inertia valve in piston and secure with retaining ring (views K and L).

*j.* Place recoil spring on piston. Position spring so that end displaying an M is located at muzzle end of piston (view J).

*k.* Install new seal assembly on seat (view J).

*l.* Install two new seal assemblies and retainer in cover (view J).

*m.* Install cover in seat.

*n.* Position spacer to cover and secure with six screws. Tighten to 5-6 lb-ft (7-8 N.m).

*o.* Using care not to scratch or mar piston, install recoil spring compression fixture on piston assembly with cover, spacer and seat assemblies behind lower plate of fixture.

*p.* Tighten jackscrew on fixture until retainer clears threads (view 1).

*q.* Remove thread protector (view I).

**WARNING**

**Adapter and piston assembly are a machined set. Do not interchange adapter or piston with parts from other sets as serious injury to personnel may result.**

*r.* Position collar on piston and secure with adapter (view H). Adapter surface must be flush to 0.010 inch below piston surface.

*s.* Install key in adapter and secure with screw. Tighten between 5-7 lb-ft (7—9 N.m) (view G).

*t.* Loosen jackscrew of fixture until spring retainer bears on collar (view F).

*u.* Using care not to scratch or mar piston, remove fixture from piston assembly.

*v.* Prepare puller and lifting clamp for use.

*w.* Install hook of hoist in eye of clamp.

*x.* Install clamp on collar and raise assembly (views D and E).

*y.* Lower piston assembly into recoil mechanism. Align indentations and holes in flanges and mate piston assembly to recoil mechanism (view C).

*z.* Remove hook of hoist from clamp and remove clamp (view B).

*aa.* Secure collar to recoil mechanism with ten new screws. Tighten to 90-110 lb-ft (122-149 N.m) (view B).

*ab.* Install drain plug and washer in bottom of recoil mechanism (view A).

*ac.* Install sling to support recoil mechanism in a level position during filling of mount with hydraulic fluid (view A).

*ad.* Lift recoil mechanism in horizontal position with hoist to sufficient height to allow filling (view A).

*ae.* Fill mount with hydraulic fluid (MIL-H-46170(FRH)).

*ag.* Install shipping plug in top of recoil mechanism (view A).

**3-237. Tests.** Recoil mechanism is tested when assembled with cannon and combination gun mount.

**3-238. Installation.** Install in reverse order of removal.

## Section XXXV. REPAIR OF CANNON AND COMBINATION GUN MOUNT

### 3-239. Description.

*a. 105 MM M68 Cannon.* Refer to TM 9-2350-258-20-2.

*b. Combination Gun Mount.* Refer to TM 9-2350-258-20-2.

**3-240. Removal.** Refer to paragraph 2-41.

### 3-241. Disassembly (fig 3-85).

*a.* Position cannon and combination gun mount on sawhorses and support with sling and hoist or overhead crane capable of lifting 3 tons (view A).

*b.* Remove bore evacuator and gun shield cover if present (TM 9-2350-258-10).

*c.* Remove eight nuts securing gun shield and mount to recoil mechanism (view B). Tighten nuts to 600-660 lb-ft (813-894 N.m) during assembly. Remove two expansion plugs from recoil mechanism using Allen wrench (36, table 2-1) (view B).

*d.* Remove eight screws and lockwashers securing gun tube ring guard to gun shield and remove ring guard (view C). Tighten screws to 70—80 lb-ft (95-108 N.m) during assembly.

*e.* Lift gun shield and mount slightly, and carefully move toward muzzle end of gun. Do not gouge or mar machined surface of gun tube. Readjust sling for level lift if necessary.

*f.* With gun shield and mount clear of machined surface, lift gun shield, mount, and cannon tube slightly, and reposition sawhorse at muzzle end of gun tube to allow removal of gun shield and mount. Remove gun shield and mount.

*g.* Remove screw and lockwasher securing breech lock to breech and remove breech lock (view D). Tighten screw to 30-45 lb-ft (41-61 N.m) during assembly.

*h.* Loosen collar using spanner wrench (30, table 2-1) (view E). Using torque wrench adapter (35, table 2-1), tighten collar to a minimum of 500 lb-ft (678 N.m) during assembly. Back off slightly to engage lock, if necessary.

*i.* Support recoil mechanism with sling and move toward machined surface. Do not gouge or mar machined surface (view F).

*j.* Lift recoil mechanism and cannon slightly and reposition sawhorse at muzzle end of tube to allow removal of recoil mechanism (view F).

*k.* Lift recoil mechanism and slide toward muzzle of gun tube. Readjust sling for a level lift, if necessary, and remove recoil mechanism from gun tube (view F).

*l.* Before installing recoil mechanism, apply grease (MIL-G-81322) to machined surfaces on gun tube.

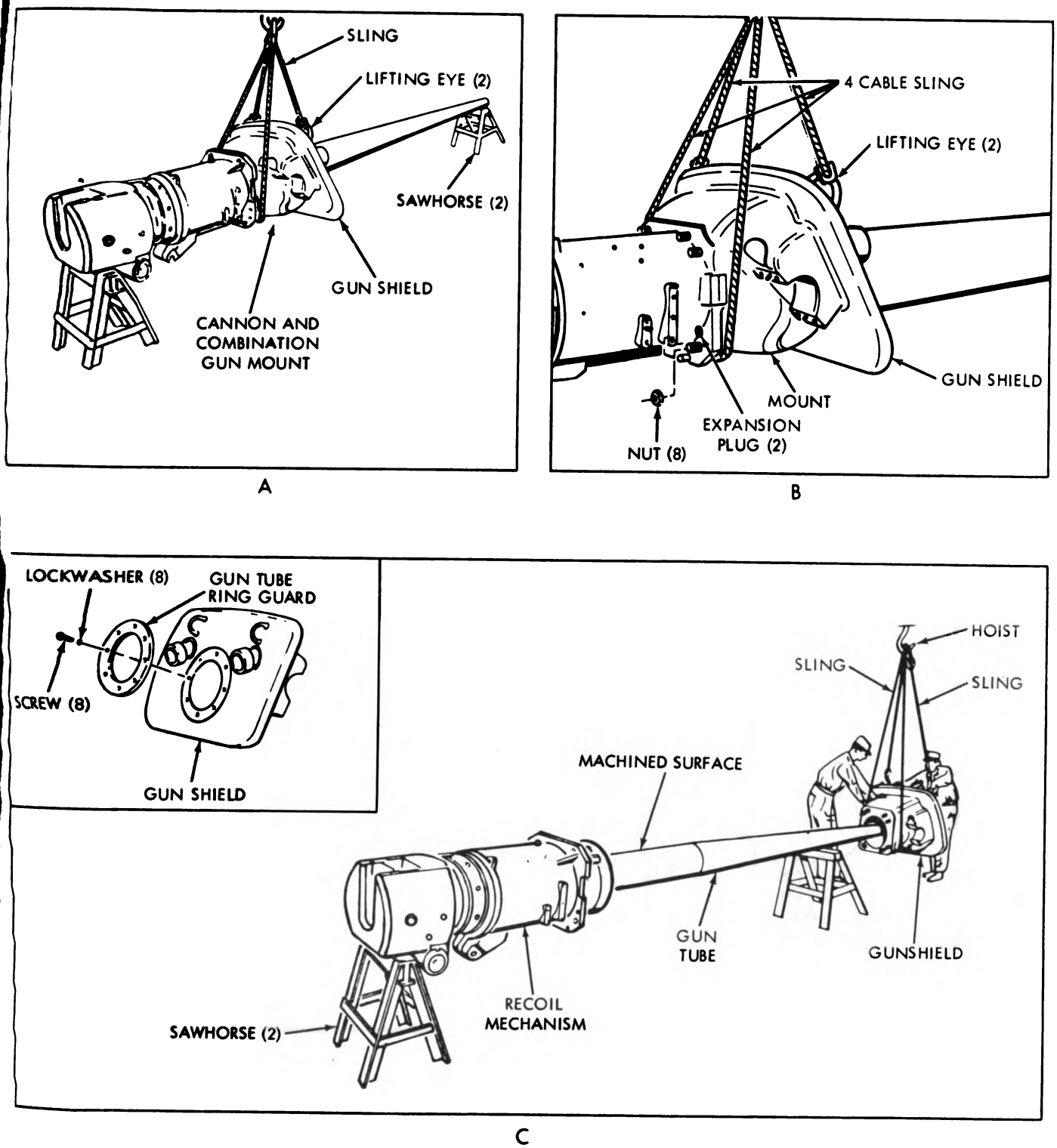



*Figure 3-85. Cannon and combination gun mount disassembly or assembly (1 of 2).*

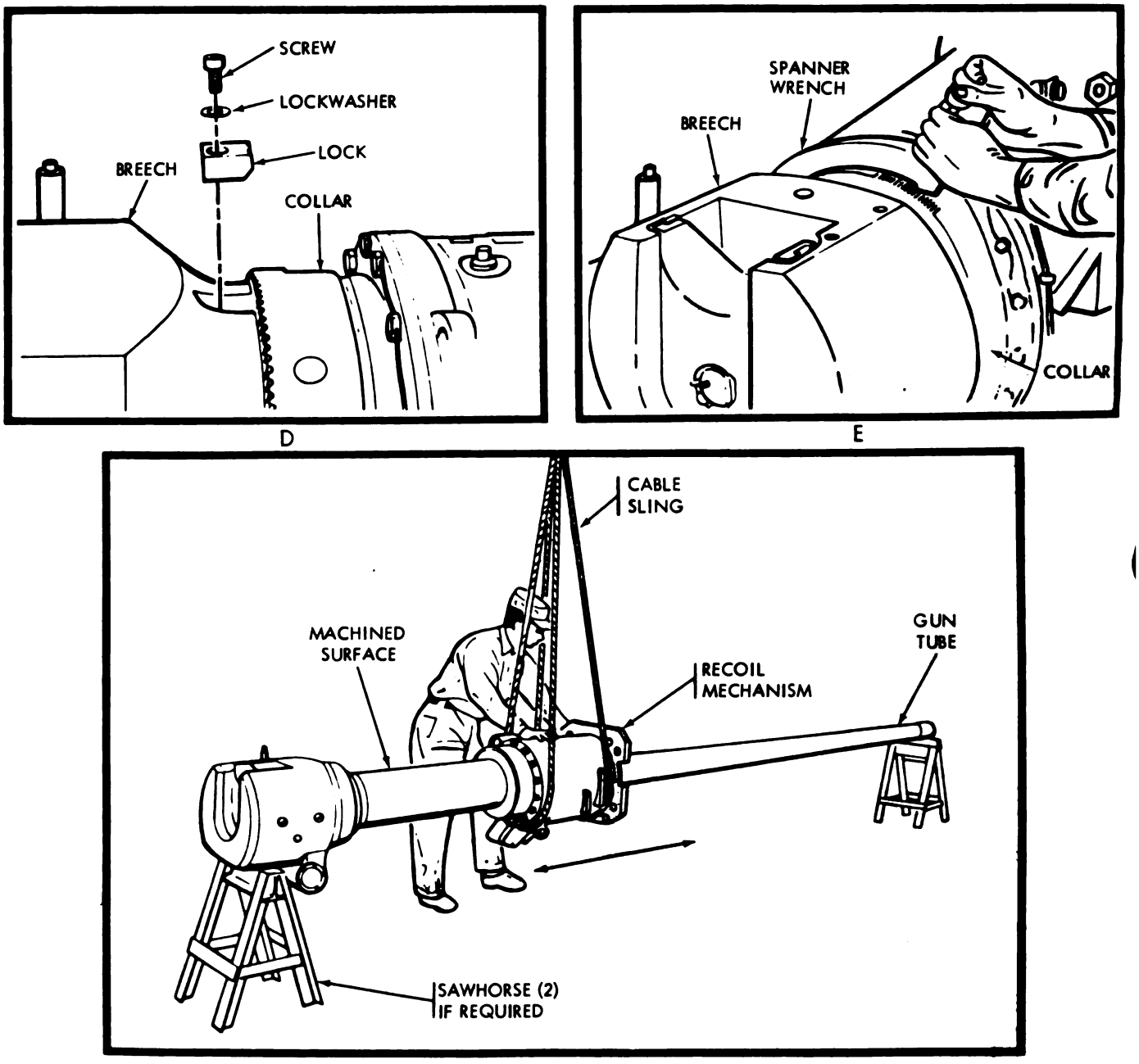



*Figure 3-85. Cannon and combination gun mount disassembly or assembly (2 of 2).*

**3-242. Inspection and Repair.** Refer paragraph 3-268.

**3-243. Testing (fig 3-86).**

*a.* Install recoil mechanism testing fixture (27, table 2-1) (view A). Adjust fixture to allow twelve ches of recoil.

*b.* Remove fill plug and washer from top of ca non mount (view A).

*c.* Screw tee 4730-00-708-1491 into fill hole in top of cannon mount (view B).

*d.* Screw pressure gage 6686-00-965-1364 into top of tee (view B).

*e.* Connect M3 hydraulic pump to tee through a 10-foot hose (views C and D).

*f.* Remove shipping plug and washer from top of cannon mount (view E).

*g.* Lower breech end of gun and purge air from mount by pumping hydraulic fluid (MIL-H-46170(FRH)) until steady stream flows from shipping plug hole in top of cannon mount (view E).

*h.* When purging is complete, replace shipping plug and washer in top of cannon mount and lower to sawhorses (view C).

*i.* Pump hydraulic fluid (MIL-H-46170(FRH)) into gun mount cylinder until pressure gage indicates 2500 psig and hold for 5 minutes (view F).

*j.* Check recoil mechanism for leakage. Repair leaking recoil mechanisms (view F).

*k.* Remove pressure.

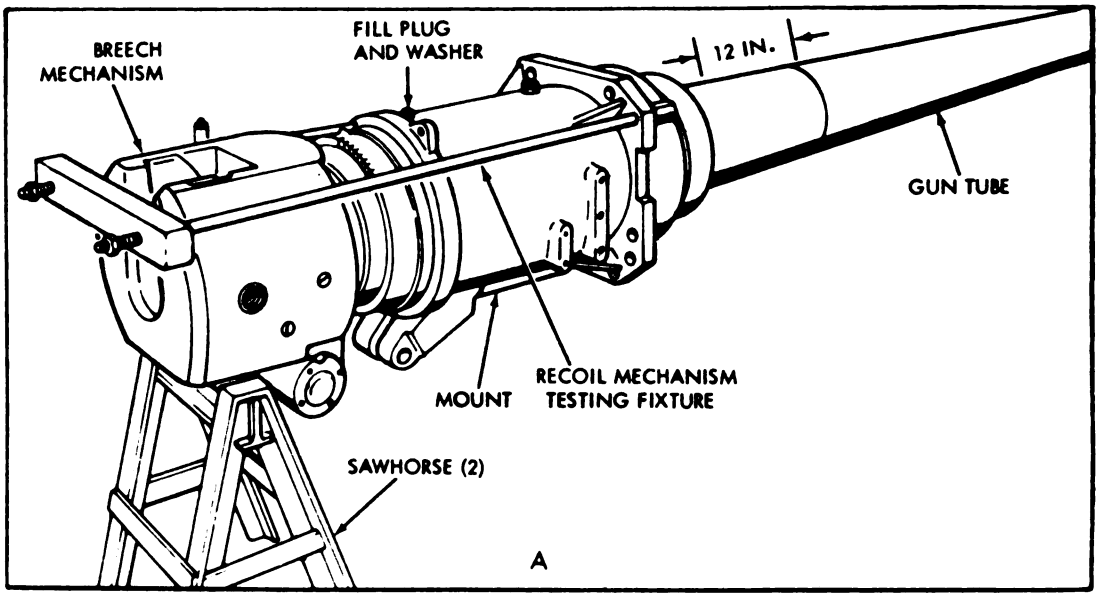
*l.* Disconnect hose from tee (view C).

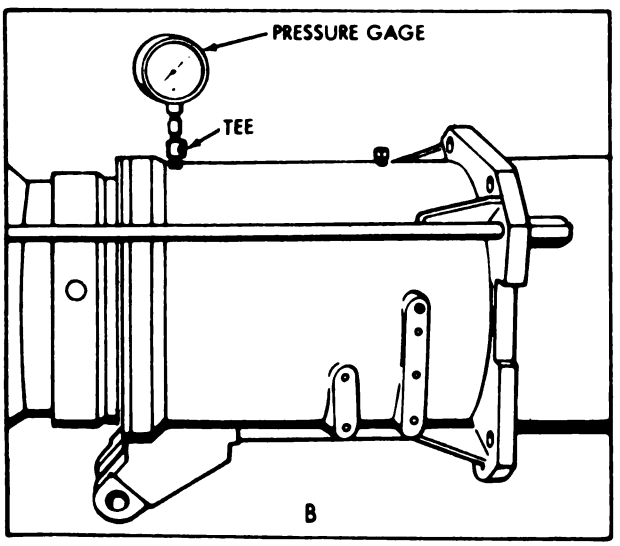
*m.* Remove pressure gage (view B).

*n.* Remove tee from fill hole (view B).

*o.* Install fill plug and washer in fill hole (view A).

*p.* Remove recoil mechanism testing fixture (view A).



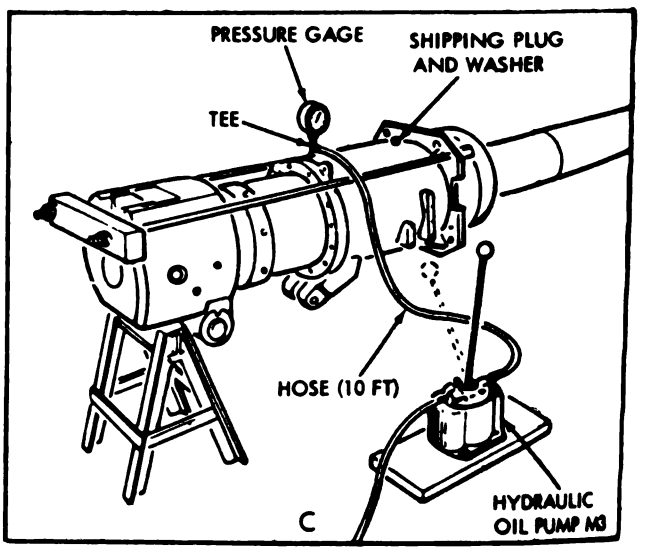




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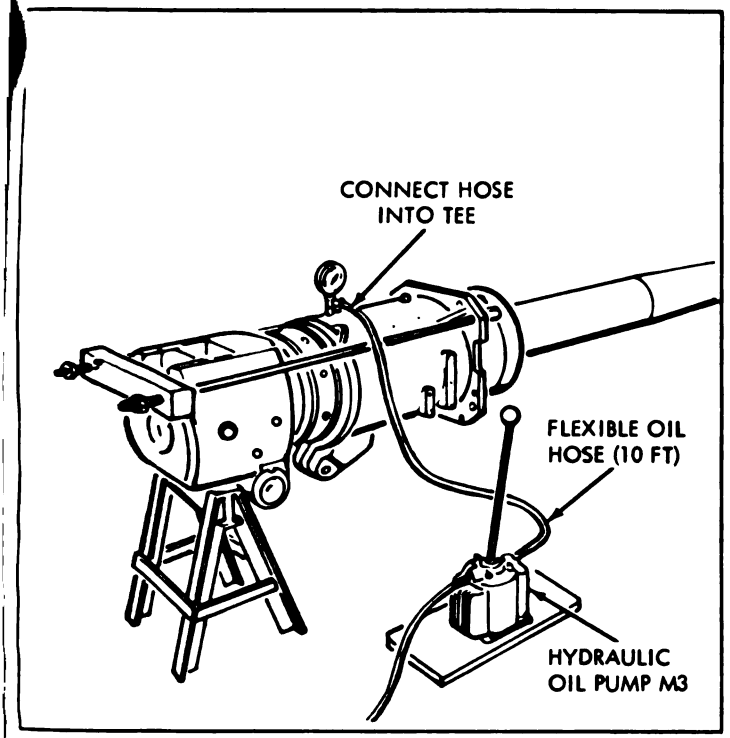
*Figure 3-86. Combination gun mount testing (1 of 2).*

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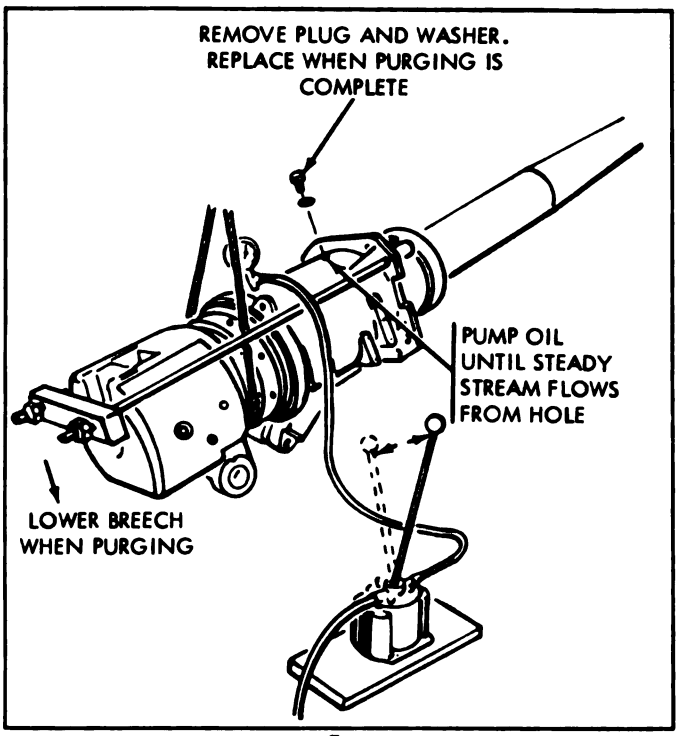


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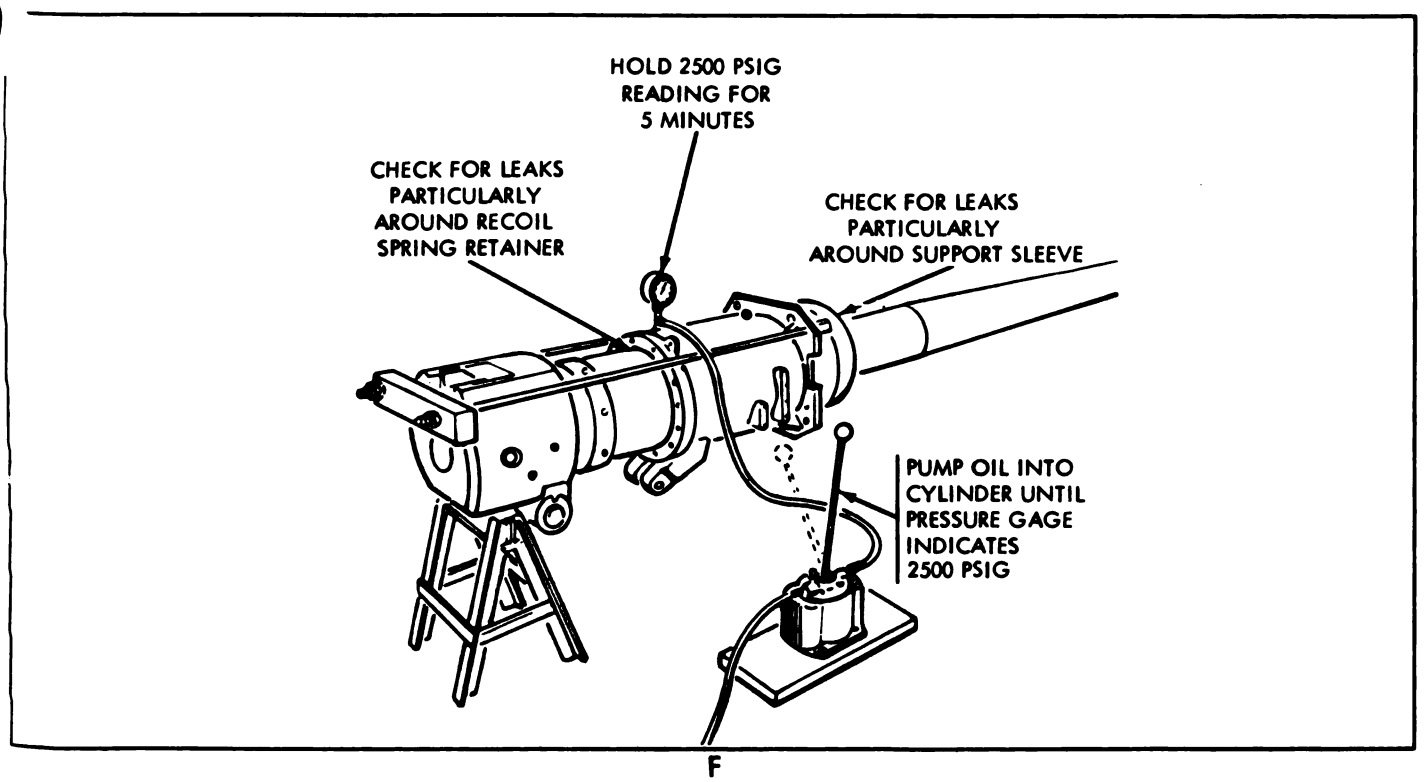


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*Figure 3-86. Combination gun mount testing (2 of 2).*

**3-244. Assembly (fig 3-85).**

*a.* Assemble in reverse order of disassembly.

*b.* Lubricate cannon and combination gun mount (LO 9-2350-258-12).

**3-245. Installation.** Refer to paragraph 2-41.

## Section XXXVI. REPAIR OF FIRE CONTROL COMPONENTS

**3-246. Gunner's M32 Periscope.** Refer to TM 9-2350-313-34.

**3-247. Telescope Mount M114.** Refer to TM 9-1240-285-35.

**3-248. Light Source Control.** Refer to TM 9-1240-262-34.

**3-249. Periscope Mount 104A2.** Refer to TM 9-6175.

**3-250. Ballistics Drive M10A6.** Refer to TM 9-1220-220-34.

**3-251. Fire Control Quadrant M1A1.** Refer to TM 9-1290-200-14.

**3-252. Infrared Periscope M24.** Refer to TM 9-6650-216-34.

**3-253. Commander's M28 Periscope.** Refer to TM 9-1240-239-35.

**3-254. Gunner's M118 Periscope Mount.** - Refer to TM 9-1240-271-35.

**3-255. Infinity Sight 8635466.** Refer to TM 9-1240-322-35.

**3-256. Instrument Lamp M50.** Refer to TM 9-1240-262-34.

**3-257. Instrument Light M30.** Refer to TM 9-1290-232-35.

**3-258. Ballistics Computer.** Refer to TM 9-1220-203-34.

**3-259. Fire Control (Elevation) Quadrant M13B1.** Refer to TM 9-1290-232-35.

**3-260. Rangefinder.** Refer to TM 9-1240-258-34.

**3-261. Telescope.** Refer to TM 9-1240-262-34.

**3-262. Azimuth Indicator.** Refer to TM 9-1290-263-34.

**3-263. Searchlight Control Box.** Refer to TM 9-6230-219-35.

## Section XXXVII. REPAIR OF M68 CANNON

**3-264. Description.** The M68 cannon is composed of a gun tube, bore evacuator chamber, and breech mechanism assembly. The gun tube is machined from solid material and is rifled to provide initial twist for the 105-mm projectile. The breech mechanism contains the firing pin, spent cartridge extractor, and breech operating lever. The gun tube is attached to the breech mechanism by a special chamfered buttress thread which requires only one-eigth turn (45 degrees) for removal or installation. The gun tube can be replaced by the quick-change method (para 2-42) without removal of the combination mount. Four retubings of the breech mechanism are allowed before replacement. The number of previous retubings is stamped on the upper machined surface of the breech. The bore evacuator chamber releases excess gas pressures during firing.

**3-265. Removal.** Refer to paragraph 2-42.

**3-266. Disassembly (fig 3-87).**

*a.* Remove bore evacuator, gun shield, and recoil mechanism, paragraph 3-241.

*b.* Install breech lifting tool (32, table 2-1) and cannon tube support ropes. Remove slack from lifting tool chain and support ropes (views A and C).

**WARNING**

**Remain clear of the operating lever while in the unlatched position.**

*c.* Place breech operating lever in the unlatched (down) position.

*d.* Remove setscrew securing locking pin into breech (view B).

*e.* Thread a 3/8 16-UNF 2A screw into locking pin and remove pin (view B). Using girth wrench, rotate tube slightly to free pin, if necessary.

*f.* Install girth wrench or equivalent (strap wrench) on muzzle end of gun tube (view C).

*g.* Turn girth wrench counterclockwise (left) 1/8 turn (45 degrees) as viewed from muzzle end and, using care not to damage buttress threads, remove gun tube (view D).

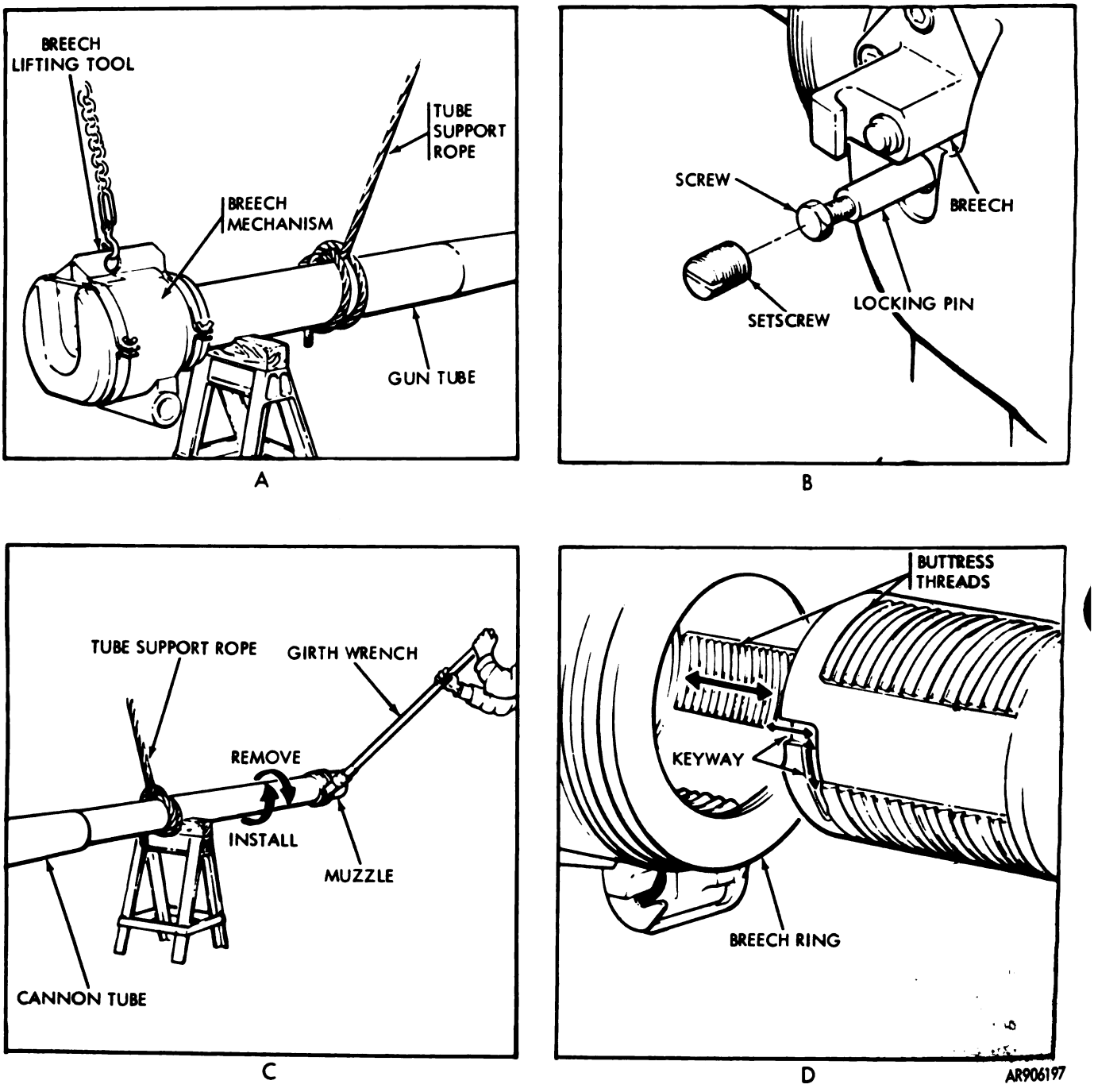


*Figure 3-87. Cannon disassembly or assembly.*

**3-267. Cleaning.** Clean and lubricate gun tube in accordance with LO 9-2350-258-12. Do not overclean. Normal color of breech mechanism is black. Disassemble and clean breech mechanism components (TM 9-2350-258-20-2).

NOTE

Decoppering by means of wire brush, scraping, or similar means is prohibited.

## 3-268. Inspection and Repair.

*a. Gun Tube.* Inspect external surface of gun tube for scratches, gouges, and chipped areas. Remove scratches from machined area in accordance with paragraph 2-13. Gouges in nonmachined areas must not exceed 1/4 inch in depth. Inspect gun tube bore for burred, chipped, peeled, or spalled lands. Remove burrs, chips and peels and dress lands with a file. Refer to TM 9-1000-202-14 for detailed bore inspection and allowable repair and replacement data. Inspect bore for wear 25.25 inches from breech face. Wear must not exceed 0.075 inch. Perform a pullover gage inspection (TM 9-4933-200-35). Check Weapon Record Data (DA Form 2408-4) for numbering of firings and effective full charge (EFC) rounds remaining. Replace cannon tubes whose EFC lift remaining is less than ten percent. If gun tube has not been removed or replaced for maintenance service within a period of two years (See REMARKS column of DA Form 2408-4 in the equipment log book.), perform the following:

(1) Depress tube slightly below 0 mil and drain replenisher (TM 9-2350-258-20-2).

WARNING

**Block breech ring to support weight.**

(2) Disconnect replenisher from gun mount and install M3 oil pump in its place. Pump gun out of battery approximately 12 inches (fig 3-86).

(3) Remove breech lock and adapter collar from breech ring (fig 3-85).

(4) Return piston halfway to battery position.

(5) Inspect thread of adapter collar, breech ring, and abutting surfaces of recoil piston and breech ring for rust and corrosion. Clean thoroughly and lubricate lightly with GAA lubricant. Remove key (fig 3-84, view G).

CAUTION

**Do not remove adapter to perform check. Check for diametrical movement of adapter in relation to piston. Diametrical movement may not exceed 0.018 inch (0.460 mm). Replace defective component if excess movement is detected. Ensure adapter is properly positioned before replacing key.**

(6) Move piston out of battery until it contacts breech ring, install adapter collar and breech lock, and return gun to battery.

(7) Remove gun tube (para 2-42).

(8) Inspect exterior machined surface of gun tube and interior surfaces of support sleeve visually for rust and corrosion.

NOTE

Pitting, due to corrosion, is acceptable to a maximum depth of 0.020 inch (0.510 mm) and up to a maximum of fifty percent of the total surface area.

Condemn cannon tube when rust or pitting of the tube surface under the bore evacuator exceeds 80 percent of the surface area or when an individual pit exceeds a depth of 1/8 inch (0.125 inch) (3.180 mm). Condemn cannon tube when evidence of gas leakage from beneath the bore evacuator sealing surfaces is detected. Ensure both preformed tube chamber packings are in serviceable condition.

(9) Remove rust, corrosion, pits, and all sharp surfaces in pitted areas.

(10) Inspect tube support ring (fig 3-84, view N) and replace if necessary.

(11) Lubricate unpainted portions of gun tube support sleeve lightly with GAA lubricant.

(12) Install gun tube in mount and secure it (para 2-42 b).

(13) Record data of above maintenance in the REMARKS column of DA Form 2408-4 in the equipment log book.

*b. Breech Mechanism.* Inspect and repair breech mechanism (TM 9-2350-258-20-2). Replace breech mechanisms that have been retubed four times or have cracked bodies.

**3-269. Assembly (fig 3-87).** Assembly in reverse order of disassembly.

**3-270. Testing.** Refer to paragraph 3-237.

**3-271. Installation.** Refer to paragraph 2-42 for installation in the vehicle. Refer to paragraph 3-244 for assembly with combination gun mount.

## Section XXXVIII. REPAIR OF TURRET RACE

**3-272. Description.** The turret race consists of an inner and outer race containing 180 ball bearings and 180 separator springs. The outer race is bolted to the hull and meshed with the traversing gearbox output gearing. The inner race is bolted to the turret and traversing gearbox housing. The outer opening between the inner and outer race is covered by a rubber seal.

**3-273. Removal.** Refer to paragraph 2-23.

**3-274. Disassembly (fig 3-88).**

*a.* Thread three eyebolts (3, table 2-1) into inner race mounting screw holes as shown in view A, figure 3-88.

*b.* Support inner race with a sling and hoist to relieve weight from balls (view A).

*c.* Remove lockwire and three screws securing plug to inner race. Using two jackscrews, remove plug (view B).

*d.* Remove 180 balls and 180 springs from race (view B).

*e.* Lift inner race from outer race (view C).

*f.* Remove seal from inner race only if replacement is required (view D).

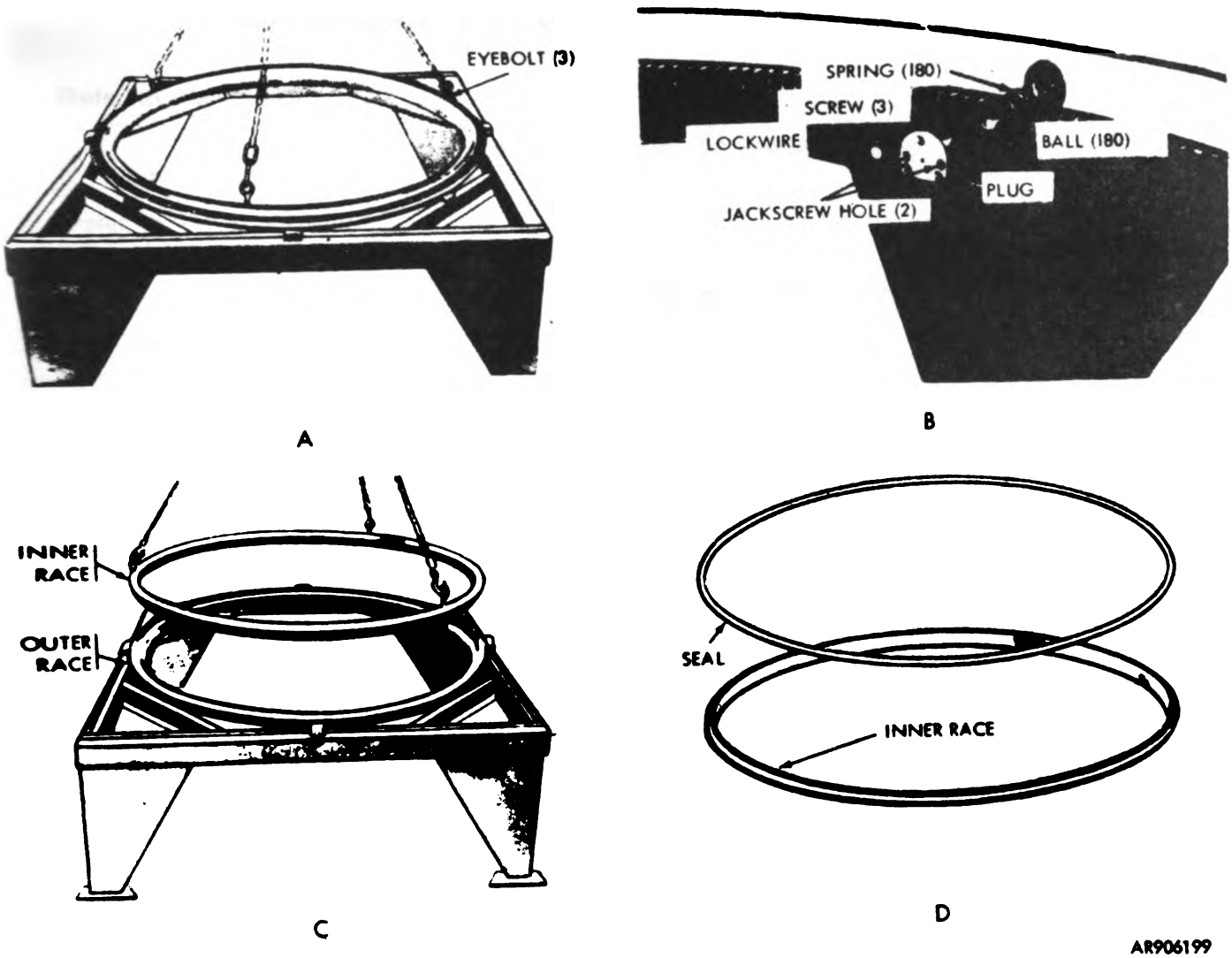


*Figure 3-88. Turret race disassembly or assembly.*

**3-275. Cleaning.** Refer to paragraph 2-9.

**3-276. Inspection.** Inspect races for cracks, nicks, burrs, and damaged threads. Inspect springs for distortion and free length of 0.812 to 0.842 inch. Inspect balls for pitting or scores. Inspect seal for tears or brittleness.

**3-277. Repair.**

*a.* Replace any balls or springs found detective. Remove minor nicks or burrs from inner and outer race with a fine stone or crocus cloth that has been saturated in drycleaning solvent (PD-680). Replace race assembly if cracked or if bearing grooves are excessively scored or burred. Replace seal if defective in any way.

*b.* Repair or replace other damaged components.

**3-278. Assembly (fig 3-88).**

*a.* Cement seal securely to inner race with adhesive (type II, MIL-A-5092) (view D, fig 2-33).

*b.* Evenly coat grooves, balls, and races with 1/2-pound of grease (MIL-G-10924).

*c.* Lower inner race into outer race until ball grooves are alined (view C).

*d.* Alternately install 180 balls and 180 springs (view B).

*e.* Install plug and secure with three screws (view B). Torque screws to 100 lb-in (11.3 N.m) and install lockwire.

*f.* Remove sling and eyebolts (view A).

*g.* Lubricate race in accordance with LO 9-2350-258-12.

**3-279. Installation.** Refer to paragraph 2-23.

## Section XXXIX. REPAIR OF GAS PARTICULATE FILTER UNIT

Refer to TM 9-2350-258-20-2.

## Section XL. REPAIR OF RADIO SETS

Refer to TM 11-5820-401-35.

## Section XLI. REPAIR OF CUPOLA INTERCONNECTING BOX

**3-280. Tests, Visual and Electrical (fig 3-89).** These tests are conducted to verify that no physical damage is evident to the interconnecting box assembly case or to its electrical wires or components.

### 3-281. Visual Tests.

*a.* Visually inspect the box for damage.

*b.* Inspect for bent or broken pins within the connectors.

### 3-282. Electrical Continuity Tests (fig 3-89).

**NOTE**
In the following tests ohmmeter polarity is not critical.

*a.* Measure continuity between points shown below.

*b.* Set ohmmeter on RX1 scale.

*c.* Resistance should be less than 0.5 ohms.

| FROM | TO | |
|---|---|---|
| Interphone connector | LH Contact board connector | RH Contact board connector |
| PIN | PIN | PIN |
| A | C | C |
| B | GH | GH |
| C | A | A |
| F | F | F |
| J | D | D |
| K | E | E |

| FROM | TO | |
|---|---|---|
| Turret power connector | LH Contact board connector | RH Contact board connector |
| PIN | PIN | PIN |
| A | G | G |
| B | B | B |

### 3-283. Isolation Tests (fig 3-89).

**NOTE**
In the following tests, ohmmeter polarity is not critical.

*a.* Connect an ohmmeter between pins A and B of the turret power connector. Resistance measure should be a minimum of 5 megohms.

*b.* Remove test lead from pin A of the connector and connect it to the box case. Resistance measured should be a minimum of 5 megohms.

*c.* Remove test lead from pin B of turret power connector and connect it to pin A. Resistance measured should be a minimum of 5 megohms.

*d.* Remove test lead A from the interconnecting box case. Connect it in succession to each of the pins on the interphone connector. Test the RH contact board connector and LH contact board connector individually. Resistance measured should be a minimum of 5 megohms, except at pin B of the interphone connector, pins G and H of the RH contact board connector, and pins G and H of the LH contact board connector where it should be less than 0.5 ohms.

*e.* Remove ohmmeter lead from pin A of the turret power connector and connect it to pin B of the same connector and repeat step *(d)*. A minimum of 5 megohms should be measured, except at pin B of the RH contact board connector and pin B of the LH contact board connector which should be less than 0.5 ohm.

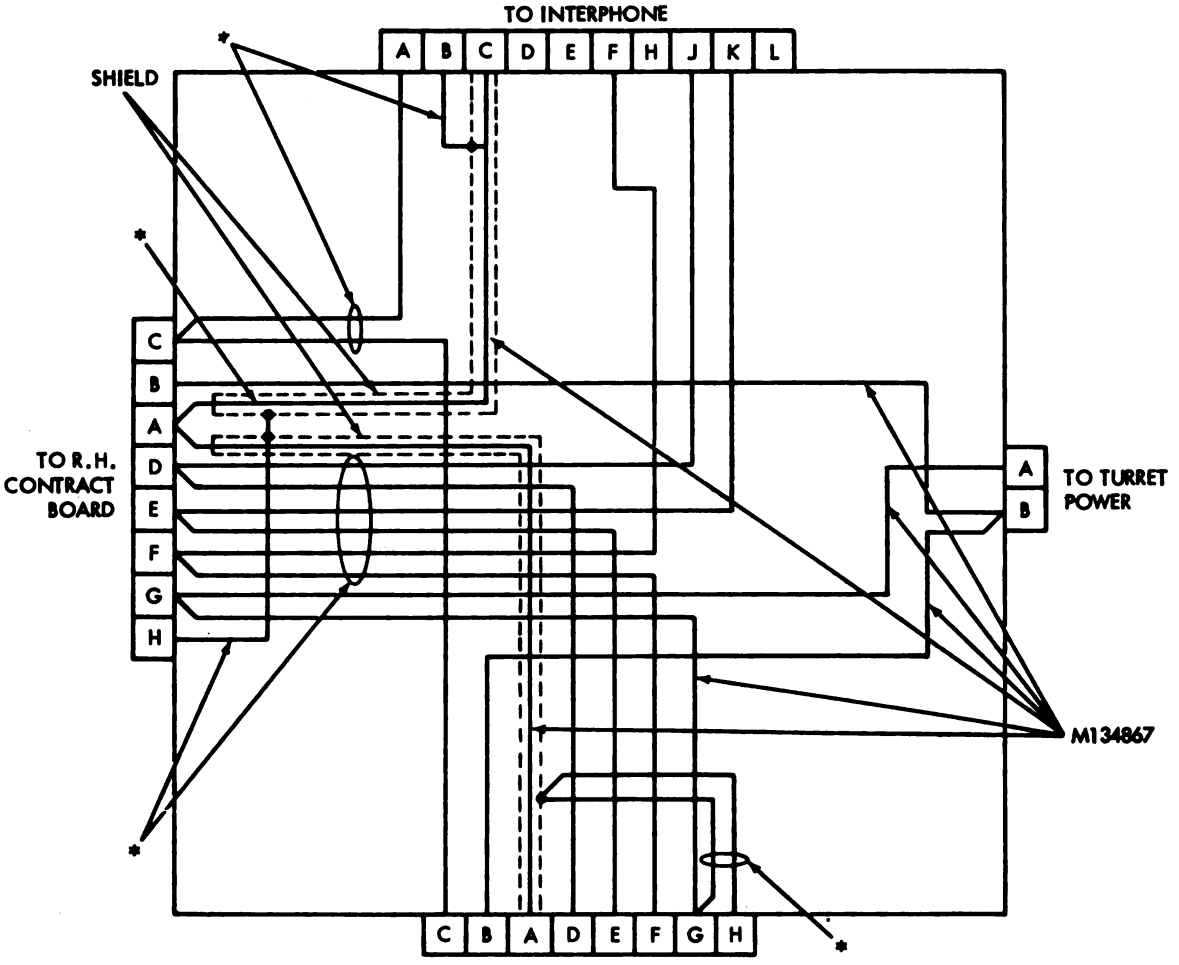


*Figure 3-89. M1 cupola interconnecting box.*

## Section XLII. REPAIR OF CUPOLA CRADLE COVER

**3-284. Removal.** Refer to TM 9-2350-258-20-2.

**3-285. Disassembly (fig 3-90).**

*a.* Remove left rear cover support from cover.
*b.* Remove left front cover support from cover.
*c.* Remove right front cover support from cover.
*d.* Remove right rear cover support from cover.

**3-286. Cleaning.** Refer to paragraph 2-9.

**3-287. Inspection and Repair.** Rips, tears, or deteriorated fabric must be repaired so cover is compact and waterproof. Stitching must not be loose. Cover must not be torn. Repair if practical. Cover supports must not be bent or broken.

**3-288. Assembly (fig 3-90).** Assemble in reverse order of disassembly.

**3-289. Installation.** Refer to TM 9-2350-258-20-2.

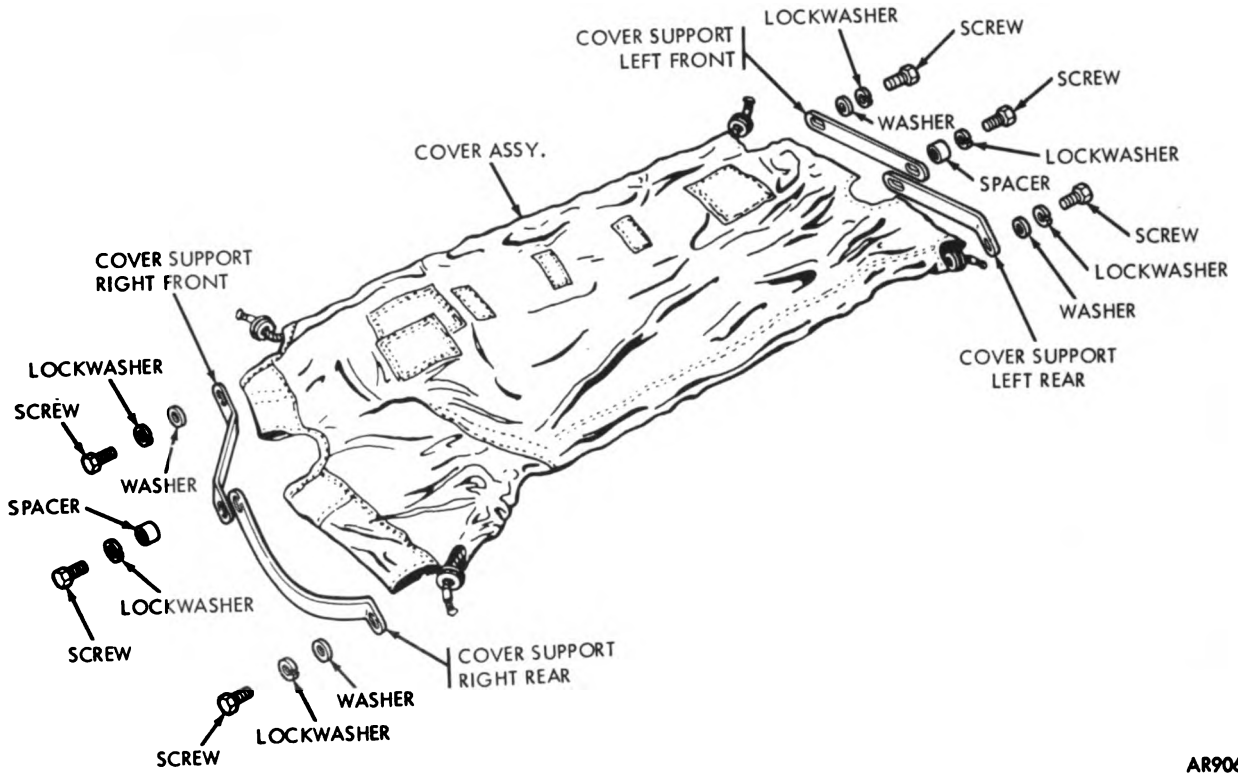


*Figure 3-90. M1 cupola cradle cover disassembly or assembly (vehicles serial numbered A1001 thru A1999 and A3375 thru A3999).*

## Section XLIII. REPAIR OF TURRET PLATFORM

**3-290. Cleaning.** Refer to paragraph 2-9.

**3-291. Inspection and Repair.**

*a.* Inspect cast parts for cracks or fractures. Cracks or fractures detrimental to serviceability of components requires component replacement. Inspect sheet metal items for damaged parts, broken parts, cracked parts, and bent parts. Repair turret platform parts if practical.

*b.* Repair or replace damaged components.

# CHAPTER 4
# FINAL INSPECTION

**4-1. General.** A final inspection will be performed on all items repaired or replaced to determine whether all necessary work has been accomplished and to determine whether repairs have been performed satisfactorily. This inspection involves visual checks, checks with test instruments, operational checks, safety checks, or any combination thereof necessary to insure that the equipmment has been restored to a completely serviceable condition for return to the user or to stock.

**4-2. Specific Procedures.** Specific checks to be performed on items repaired or replaced are contained, where necessary, in the component repair or installation instructions.

# APPENDIX A
# REFERENCES

## A-1. Publication Indexes.

The following indexes should be consulted frequently for latest changes or revisions of references given in this Appendix and for new publications relating to material covered in this Technical Manual:

| | |
|---|---|
| DA PAM 310-1 | Index of Administrative Publications. |
| DA PAM 310-2 | Index of Blank Forms. |
| DA PAM 310-4 | Index of Technical Manuals, Technical Bulletins, Supply Manuals, Supply Bulletins, and Lubrication Orders. |
| DA PAM 310-6 | Index of Supply Catalogs and Supply Manuals. |
| DA PAM 310-7 | U. S. Army Equipment Index of Modification Work Orders. |

## A-2. Publication References.

The following is a list of publications and forms referenced in this manual and/or likely to be required by the manual user:

| | |
|---|---|
| DA Form 2028 | Recommended Changes to Publications. |
| DA Form 2408-4 | Record of Cannon Maintenance. |
| DD Form 1397 | Processing and Deprocessing Record for Shipment, Storage, and Issue of Vehicles |
| TM 9-214 | Inspection, Care, and Maintenance of Antifriction Bearings. |
| TM 9-237 | Operator's Manual: Welding Theory and Application. |
| LO 9-2350-258-12 | Tank, Combat, Full-Tracked, 105-MM Gun M48A5. |
| TM 9-2350-258-10 | Operator's Manual-Hull: Tank, Combat, Full-Tracked, 105-MM Gun M48A5. |
| TM 9-2350-258-20-2 | Organizational Maintenance Manual—Turret: Tank, Combat, Full-Tracked, 105-MM Gun M48A5. |
| TM 9-2350-258-20P-1 | Organizational Repair Parts and Special Tools List-Hull: Tank, Combat, Full-Tracked, 105-MM Gun M48A5. |
| TM 9-2350-258-20P-2 | Organizational Repair Parts and Special Tools List — Turret: Tank, Combat, Full-Tracked, 105-MM Gun M48A5. |
| TM 9-2350-258-34P-1 | DS, GS Repair Parts and Special Tools List — Hull: Tank, Combat, Full-Tracked, 105-MM Gun M48A5. |

Telescope Mount M114.

| | |
|---|---|
| TM 9-1240-262-34 | Light Source Control. |
| TM 9-6175 | Periscope Mount 104A2. |
| TM 9-1000-202-35 | M68 Cannon. |
| TM 9-1220-220-34 | Ballistics Drive M10A6. |
| TM 9-1220-200-14 | Fire Control Quadrant M1A1. |
| TM 9-6650-216-34 | Infrared Periscope M24. |
| TM 9-1240-239-35 | Commander's M28 Periscope. |
| TM 9-1240-271-35 | Gunner's M118 Periscope Mount. |
| TM 9-1240-322-35 | Infinity Sight 8635466 |
| TM 9-1240-262-34 | Instrument Lamp M50. |
| TM 9-1290-232-35 | Instrument Light M30. |
| TM 9-1220-203-34 | Ballistics Computer. |
| TM 9-1290-232-35 | Fire Control Elevation Quadrant M13B1. |
| TM 9-1240-258-34 | Rangefinder. |
| TM 9-1240-262-34 | Telescope. |
| TM 9-1290-263-34 | Azimuth Indicator. |
| TM 9-6230-219-35 | Searchlight Control Box. |
| TM 11-6230-219-35 | Searchlight Repair AN/VSS-1. |

# INDEX

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| PAGE NO. | PARAGRAPH | FIGURE NO. | TABLE NO. |
|---|---|---|---|
| 143 | | | 3-10 |
| 170 | 3-93 | | |

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

The referenced figure 3-26 in this table does not correspond to figure 3-26.

Title of paragraph 3-93 is installation of Gunner's Hydraulic Control Valve. The paragraph referenced of 3-104 is for disassembly of power pack filter.

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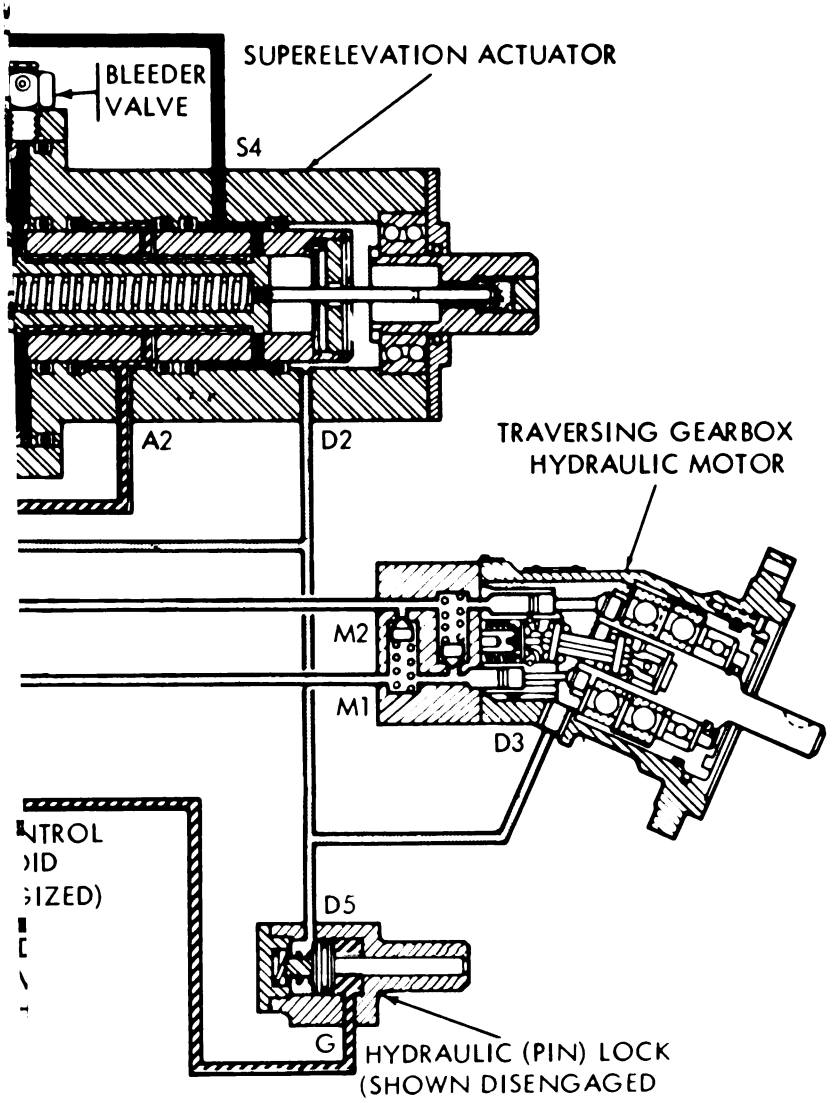

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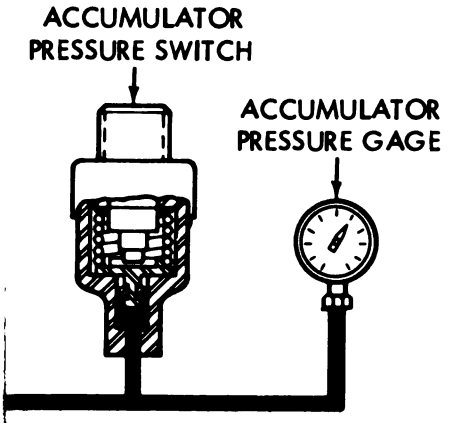


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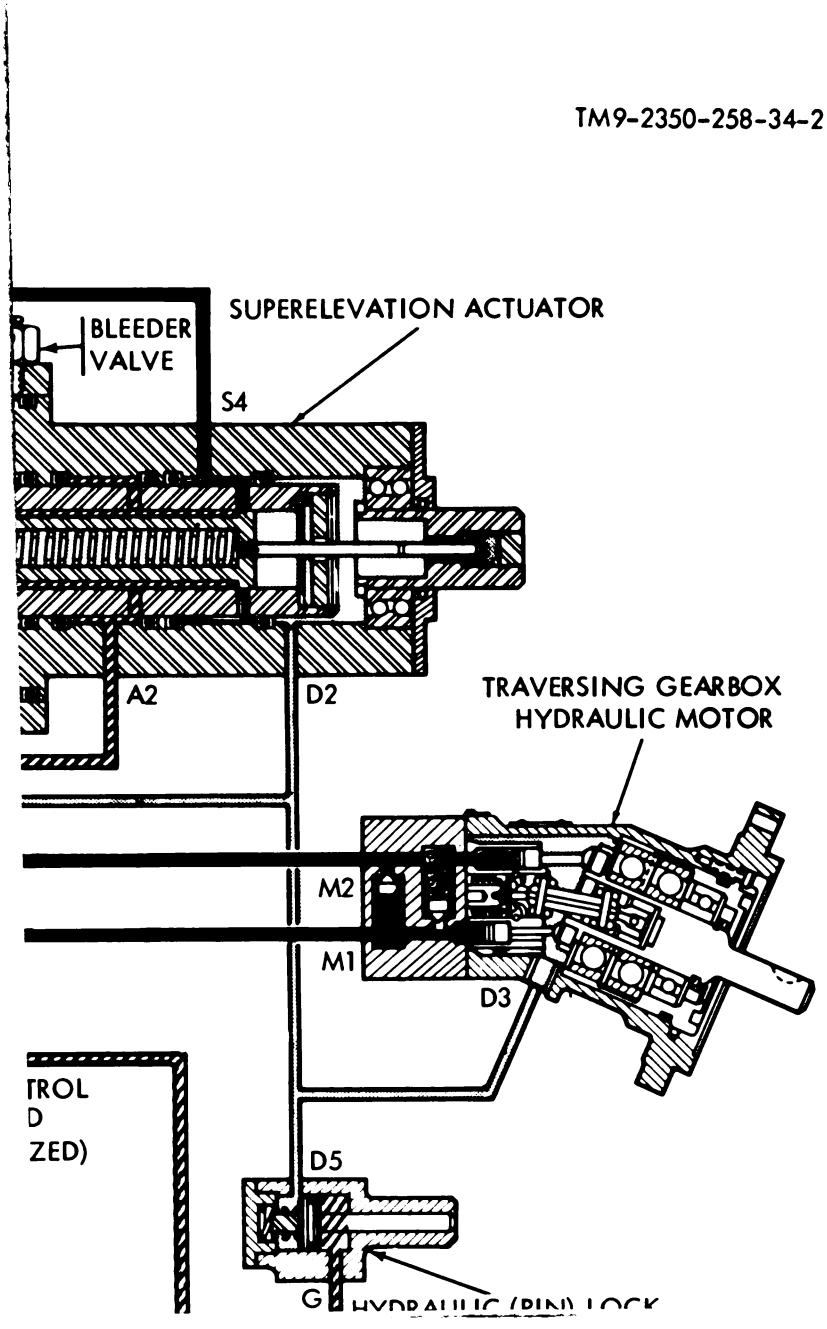

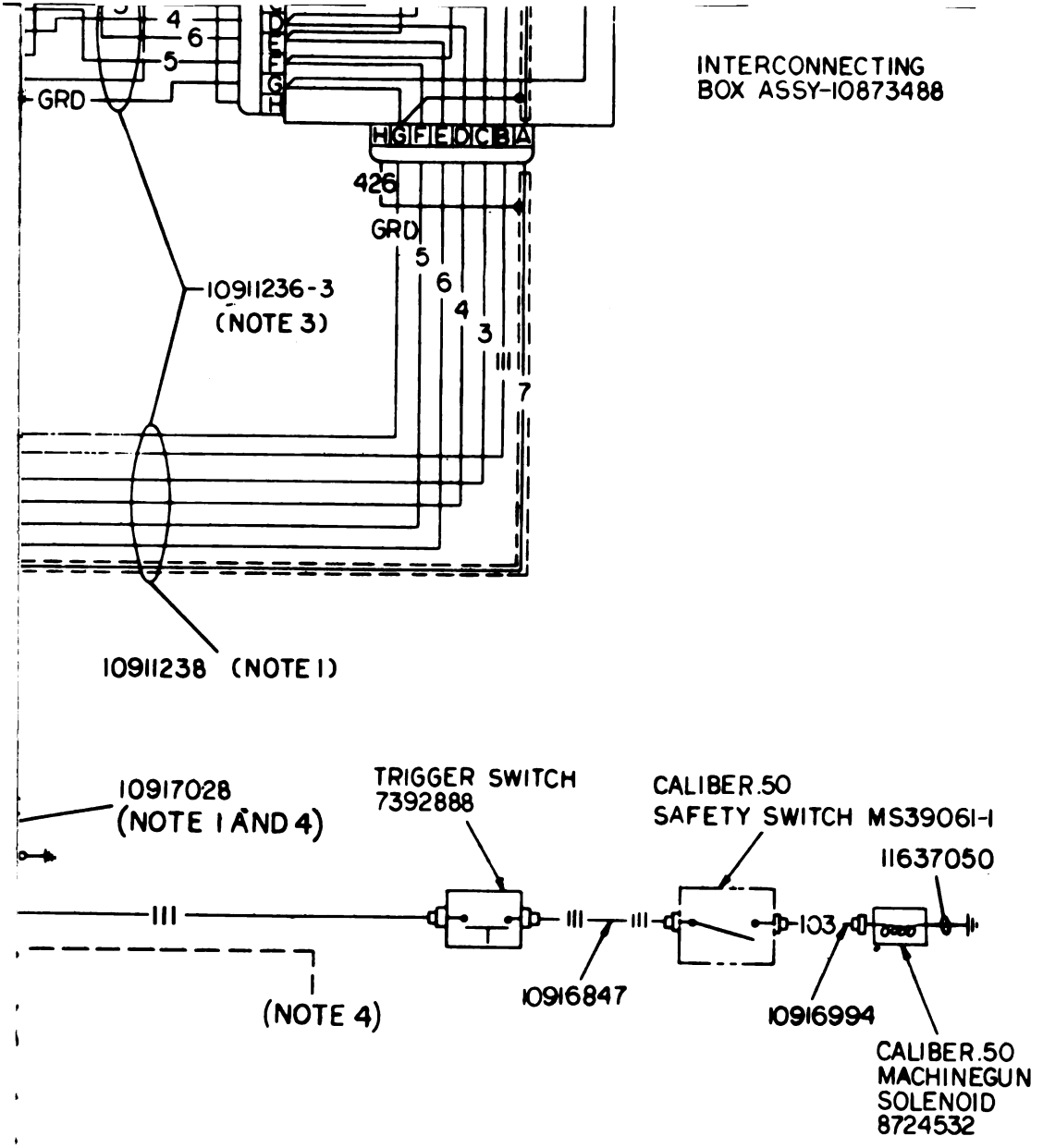


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