CHAPTER 10

FUEL SYSTEM

Section I. FUEL SYSTEMS

10-1. Fuel System.

a. The fuel supply is in two interconnected cells in the fuselage, located forward and aft of the pylon. (Refer to figure 10-1.) The system is filled at right side of the forward cell. A crossover hose allows free flow to the aft cell, and has a check valve that restricts flow from aft to forward cell to avoid sudden shifting of balance in nosedown flight attitude. Each cell has a transmitter probe for the fuel quantity gage system, and a float switch for the 10% FUEL caution panels. Sump drain valves are provided on both cells; the large valve on the aft cell is also used for system defueling. Vent lines from cells are connected together and to a single overboard line. The aft cell has a connection, with a check valve, for return of fuel bled from the engine fuel control overspeed governor.

b. Electrically operated boost pumps deliver fuel from each cell to a manifold containing two directional flow check valves, with thermal relief bypass provisions. From the manifold outlet, fuel passes through an electrically operated shut-off valve to the filter, which has an outlet coupling for the engine fuel control inlet hose. Two pressure switches on the manifold have electrical circuits to FWD FUEL BOOST and AFT FUEL BOOST caution panels, and the fuel pressure gage system transmitter is connected to the outlet side of the filter.

10-2. General Maintenance – Fuel Supply System.

Observe the following general instructions and precautions in maintenance of the fuel supply system. Operational checks will be in accordance with TM 55-1520-234-10. Servicing instructions are contained in Chapter 1; electrical circuit diagrams and information are in Chapter 9 of this manual. Fuel lines and components on the engine constitute the fuel control system and will be found in TM 55-2840-229-24.

a. Conduct any defueling or drainage of fuel in accordance with applicable directives, and with extreme care to avoid fire hazards. (Refer to chapter 1.)

b. Before removing any line or hose, be sure it is properly identified and its route understood for replacement in the same manner.

c. Cap or cover any open lines, fittings or exposed openings to protect fuel system from contamination. Be sure vent lines are not obstructed.

10-3. Fuel Filter.

The filter (26, figure 10-1) is mounted on a bracket located on left side of the engine compartment deck. The filter contains a replaceable paper-type element (6) and has an internal bypass with pressure switch and electrical connection to the FUEL FILTER caution panels to warn when the filter is about to be bypassed due to clogging. Piping connections on the filter include the inlet line, drain line, pressure transmitting line, and a quick disconnect outlet coupling.

a. Removal.

(1) Open left side of engine compartment cowling.

(2) Disconnect fuel hose from outlet coupling on top of filter.

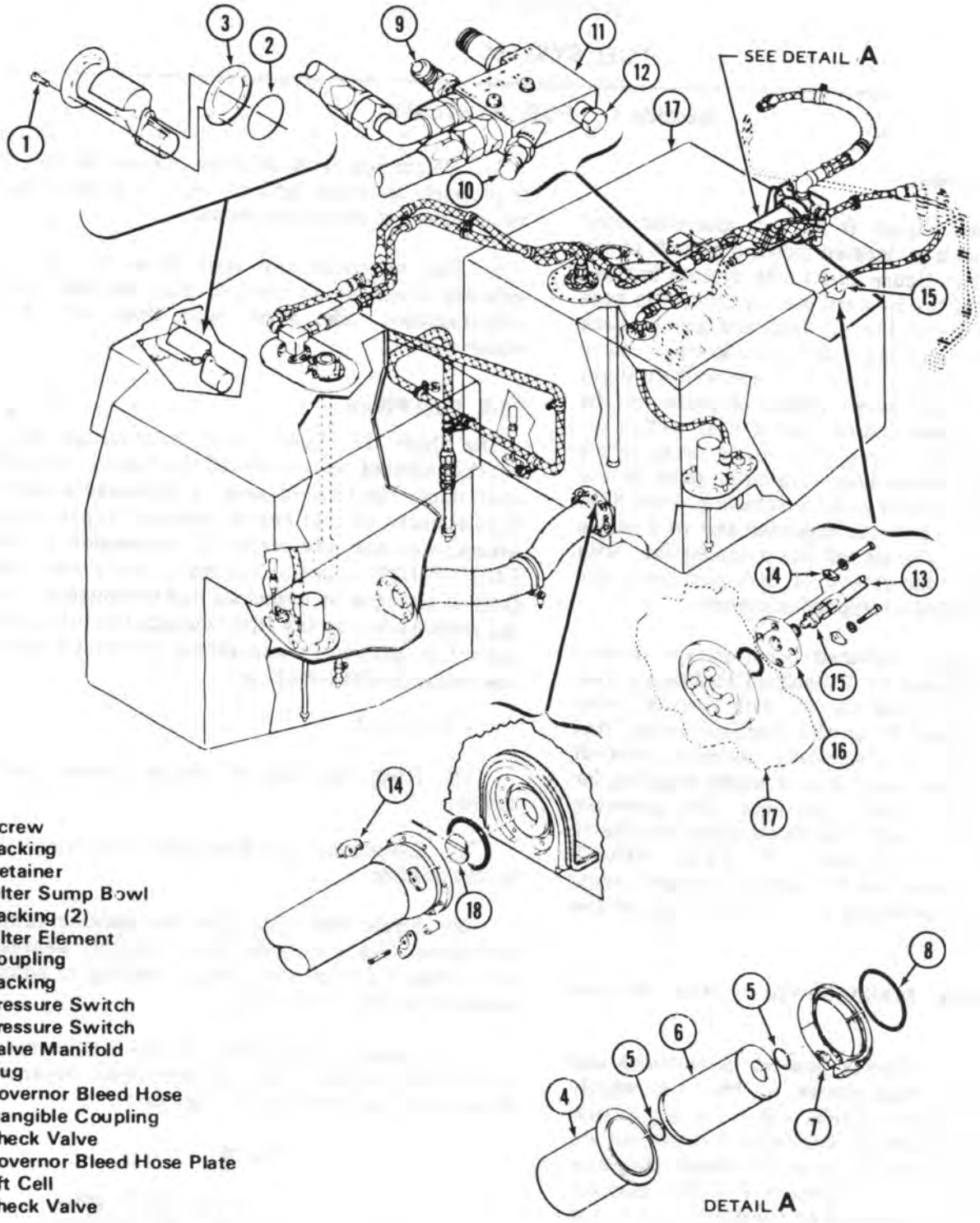
(3) Drain fuel from filter by opening drain line valve. Use a suitable tool to slightly depress self-closing valve of filter outlet coupling to admit some air and assist drainage.

(4) Open coupling clamp (7) and remove bowl (4) and filter element (6) from filter head. Separate element (6) and packings (5) from bowl.

NOTE

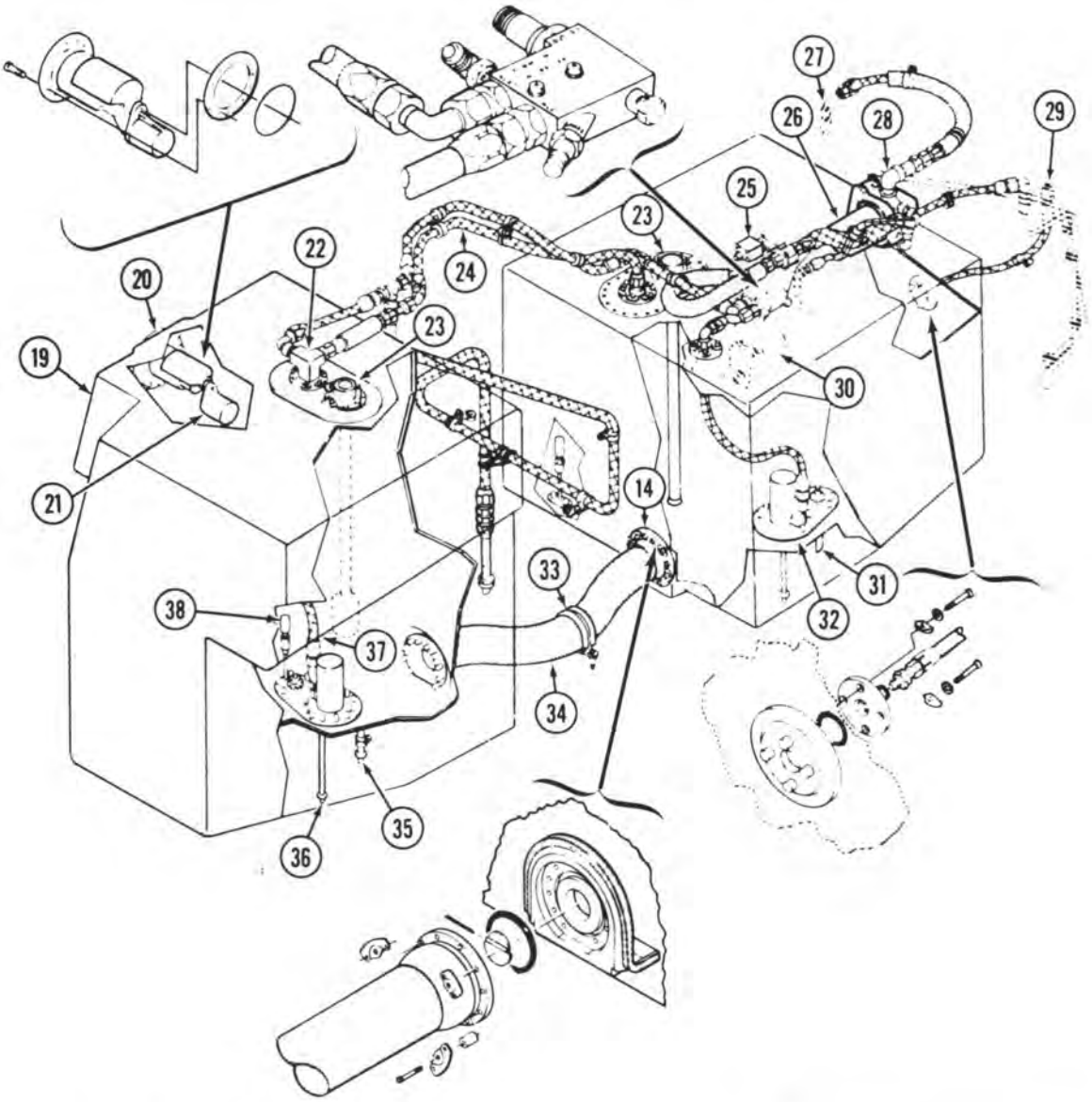
Filter head will usually be left in place, but can be removed as in the following step.

(5) Disconnect electrical cable plug, and fuel inlet, pressure, and drain lines from filter head. Detach head assembly from bracket by removing four bolts, nuts and washers.



1. Screw
2. Packing
3. Retainer
4. Filter Sump Bowl
5. Packing (2)
6. Filter Element
7. Coupling
8. Packing
9. Pressure Switch
10. Pressure Switch
11. Valve Manifold
12. Plug
13. Governor Bleed Hose
14. Frangible Coupling
15. Check Valve
16. Governor Bleed Hose Plate
17. Aft Cell
18. Check Valve

Figure 10-1. Fuel system (Sheet 1 of 2)



19. Forward Cell
20. Filler Cap
21. Closed Circuit Receiver
22. Fuel and Vent Fitting
23. Fuel Quantity Probe (2)
24. Vent Lines
25. Shut-Off Valve
26. Filter
27. Engine Drain Coupling
28. Engine Fuel Coupling
29. Governor Bleed Coupling
30. Pressure Transmitter
31. Drain and Defueling Valve
32. Boost Pump (2)
33. Fuel Crossover Clamp
34. Crossover Hose
35. Drain Valve
36. Seal Drain (2)
37. Fuel Hose
38. Low Level Float Switch

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Figure 10-1. Fuel system (Sheet 2 of 2)

b. Inspection.

(1) Filter element (6) for contamination to determine if any corrective action is needed beyond replacement of element and packings.

(2) Filter head assembly and bowl (4) for damage. Fittings and attaching parts for serviceable condition.

(3) Fuel bypass switch for leakage and obvious damage. Electrical connector and pins for damage.

c. Cleaning. Clean bowl (4), coupling (7), and exposed surfaces of head assembly with solvent (C124). Remove excess solvent before reassembly. Clean pressure switch with clean dry cloth, wiping off exposed area.

d. Repair or Replacement.

(1) Replace filter element and packings. Replace fittings and gaskets if damaged or leaking. Replace filter head assembly if malfunction or damage occurs.

(2) Replace pressure switch, if defective, as follows:

(a) Remove four mounting screws and lock washers from outer edge of switch. Remove switch.

(b) Replace switch by installing two new packings and align holes in bypass switch with holes in filter head assembly.

CAUTION

If holes are not aligned properly and a duel boost pump failure occurs, it will result in an engine failure.

(c) Install four screws and locking washers. Install electrical connector.

e. Installation.

(1) If removed, position filter head assembly on outboard side of mounting bracket. Install four bolts, secured at inboard side of bracket by nuts and washers. Connect drain, inlet, and pressure transmitter lines to fittings.

NOTE

Use a restrictor in pressure tap port of filter.

(2) Place new O-ring packing (5) on boss in bottom of filter bowl. Place new filter element (6) in bowl (4), seated firmly on boss.

(3) Install new packing (8) around lip of bowl (4), next to clamping flange.

(4) Place new O-ring packing (5) around center boss in filter head. Install bowl (4) and filter assembly (6) into head, pressing firmly to seat.

(5) Install coupling clamp (7) around mating flanges of filter head and bowl. **TORQUE NUT TO 50 INCH-POUND TORQUE.**

(6) Connect hose from engine fuel control inlet to outlet coupling on filter head. Ensure that a minimum of 1.5 inches exists between hose and engine air diffuser. Close cowling.

(7) During next ground run-up, check fuel filter and connections for leaks. Also check that FUEL FILTER caution panel segment does not light.

10-4. Fuel Shutoff Valve.

A motor-operated shutoff valve (25, figure 10-1) is used in the fuel supply system, connected between the check valve manifold and the fuel filter. The valve is mounted on front of the engine forward firewall at left side. An internal bypass valve allows thermal relief of fuel trapped on outlet side of the shutoff valve.

a. Removal.

(1) Open engine and transmission cowling doors at left side.

(2) Disconnect engine fuel inlet hose for filter outlet coupling. Open filter drain valve, and manually open shutoff valve to release trapped fuel. After short period of drainage, close both valves.

(3) Disconnect electrical connector from shutoff valve.

(4) Disconnect fuel inlet and outlet lines from valve. Cap open ends of lines.

(5) Remove four screws, nuts, and washers to detach and remove shutoff valve inlet and outlet connectors.

b. Cleaning. Clean connectors and valve with solvent, (C124). Do not allow solvent to enter electrical components.

c. Inspection.

(1) Valve for external damage and leakage.

(2) Connectors for damaged threads or mating surface.

d. Repair or Replacement.

(1) Replace damaged connectors.

(2) Replace valve assembly if malfunction or leakage occurs.

e. Installation.

(1) Assemble inlet and outlet connectors on shutoff valve.

(2) Position valve assembly to mounting holes at front of engine forward firewall, at left

side just below induction baffle. Install four mounting screws secured with nuts and washers.

(3) Connect fuel line for check valve manifold to inlet connector. Connect line from filter to valve outlet connector.

(4) Connect electrical wiring connector to receptacle on valve motor. Lockwire connector.

(5) Reconnect engine fuel inlet hose to outlet coupling of fuel filter. Ensure that a minimum of 1.5 inches exists between hose and engine air diffuser. Close cowling.

(6) At next ground run-up, check shutoff valve for proper operation and for leaks.

10-5. Fuel Check Valve Manifold.

A valve manifold (11, figure 10-1) located just ahead of engine forward firewall at left side, is connected into fuel pressure lines ahead of the shutoff valve. The manifold contains two separate check valve elements which prevent reverse flow, except through bypasses which will relieve thermal expansion of trapped fuel. One outlet port of the manifold is used, another is plugged. Two pressure switches are installed in the inlet side of the manifold, to cause lighting of FWD FUEL BOOST or AFT FUEL BOOST caution panel segments if either fuel boost pump fails to deliver normal pressure.

a. Removal.

(1) Open transmission cowling door at left side.

(2) Disconnect electrical connectors from both pressure switches on check valve manifold.

(3) Provide a small container to catch trapped fuel. Disconnect fuel lines from fittings at manifold inlets and outlet. Cap open ends of lines.

(4) Detach and remove manifold from deck by removing two screws, washer and spacers.

b. Cleaning. Clean manifold with solvent (C124). If internal flushing is required, observe direction of flow. Drain solvent from manifold after cleaning.

c. Inspection. Manifold for cracks, and fittings for damaged threads.

d. Repair or Replacement.

(1) Replace pressure switches if malfunction occurs.

(2) Replace gaskets and elbow or plug at manifold outlets if leaking or damaged.

(3) Replace manifold assembly if damaged or malfunction occurs. Transfer outlet fittings and pressure switches to replacement assembly as required.

e. Installation.

(1) Check that fittings and pressure switches are properly installed, with gaskets, in manifold assembly (See figure 10-1.)

(2) Hold manifold with flow arrows pointing aft, and outlet elbow at aft inboard side. Insert two screws, with washers under heads, downward through manifold. Place a spacer on lower end of each screw.

(3) Align manifold assembly to mounting holes in deck, and tighten screws securely.

(4) Connect fuel line from shutoff valve inlet elbow of manifold. Connect fuel pressure line and hose to manifold inlet fittings.

(5) Connect electrical connectors to pressure switches.

(6) Check for proper operation and for leaks.

10-6. Fuel Pressure Transmitter.

(Refer to Chapter 8)

10-7. Fuel Quantity Transmitters.

(Refer to Chapter 8).

10-8. Fuel Boost Pumps.

An electric motor-driven fuel boost pump (32, figure 10-1) is mounted into the bottom of each fuel cell, to deliver fuel at the rate of 990 pounds per hour at 5 to 30 psi pressure. Each pump is submerged in fuel, with its outlet connected to a hose leading to an external fuel line. Electrical leads and a seal drain line are provided on the lower exterior face of the pump.

a. Removal. Remove boost pump from forward or aft cell in the same manner, except for location and access.

(1) Drain both fuel cells through sump drain and defueling valves (31 and 35, figure 10-1).

(2) Remove screw-mounted panel from underside of fuselage below forward or aft fuel cell.

(3) Disconnect boost pump electrical leads from terminal block.

(4) Remove seal drain tube (36, figure 10-1) from fitting on pump (32).

(5) Remove 12 bolts and washers from mounting flange of pump. On crashworthy fuel systems remove the two frangible clips.

(6) Lower pump assembly enough for access to hose connections on pump discharge fitting. Disconnect hose. Remove pump and gasket. Cover open port.

b. Inspection. Connectors and fittings for damaged threads.

c. Repair or Replacement.

(1) Replace pump if malfunction occurs.

(2) Replace gasket if leaking or damaged.

d. Installation. Install boost pump in forward or aft fuel cell in same manner, except for location and access.

(1) Place gasket on mounting flange of pump. Uncover mounting port of fuel cell. Insert pump partially into port, and connect discharge hose to outlet fitting.

(2) Install frangible clips at 7 and 10 o'clock position for forward cell and at 5 and 8 o'clock position for aft cell when looking up with reference to most aft pump bolt at 12 o'clock position. Install bolts and washers. **TORQUE BOLTS 45-55 INCH POUNDS.**

(3) Connect seal drain tube to fitting on pump.

(4) Connect electrical leads from pump to terminal block. (See circuit wiring diagram in Chapter 9.)

(5) Service fuel cell and check for leaks. Check for proper operation of pump.

(6) Reinstall access panel.

10-9. Fuel Cell Fittings

Fittings on the fuel cells include a filler cap and adapter, sumps, crossover tube elbows, vents, pressure line outlets, and the governor bleed line inlet.

a. Maintenance. Any fuel cell fitting can be removed for replacement of parts to correct leaks, or for access to parts within cells. Observe the following:

(1) Replace defective seal or packing under fitting. Be sure mating surfaces are clean and free of burrs and nicks.

NOTE

Note position of frangible clips on system and reinstall in same location.

(2) If crossover hose elbow on aft cell is removed, make certain that check valve and pin are correctly reinstalled. (See figure 10-1).

NOTE

If valve does not have a locating notch, install according to AFT marking.

(3) If governor bleed return inlet fitting is removed from rear side of aft fuel cell, make certain of correct reassembly. Check valve must be installed with its direction-of-flow arrow pointing into the cell.

(4) **TORQUE BOLTS 50 TO 70 INCH-POUNDS.**

b. Inspection. Check for leakage after refilling fuel cells and during initial operation.

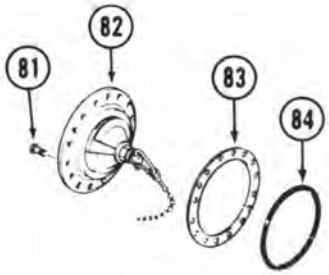
10-10. Hose and Tubing.

a. Inspection.

(1) Inspect hose for breaks, kinks, abrasions, deterioration and leaking fittings.

(2) Inspect tubes for bends, dents and leaking fittings.

b. Repair or Replacement. Replace hose and tubing if inspection requirements are not met.



DETAIL H P E

81. P E Screw
82. P E Cap and adapter assembly
83. P E Retainer
84. P E Packing

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Figure 10-2. Fuel System (Sheet 4 of 4)

NOTE

Filter head (49) will usually be left in place, but can be removed as in the following step.

f. Remove the filter head (49) by disconnecting the inlet pressure and drain lines from the filter head. Detach the head assembly from bracket by removing four bolts, nuts, and washers.

10-8. INSPECTION — FUEL FILTER.

a. Inspect filter element (45, figure 10-2) for contamination to determine if any corrective action is needed beyond replacement of element and packings.

b. Inspect filter head assembly (49) and bowl (43) for damage.

c. Inspect V-band trunnion clamp (47) for serviceable condition.

d. Inspect pressure switch (51) for cracks, broken pins, and corrosion.

10-9. CLEANING — FUEL FILTER BOWL.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

a. Clean bowl (43, figure 10-2), V-band trunnion clamp (47), and exposed surfaces of head assembly (49) with solvent (C112).

b. Remove excess solvent with clean, dry cloth.

10-10. REPAIR OR REPLACEMENT — FUEL FILTER.

a. Install new filter element (45, figure 10-2) and new packings (44, 46, and 48).

b. Replace packings (50) if damaged or leaking.

c. Replace pressure switch (51) if electrical connector is damaged.

d. Replace filter head assembly (49) and/or bowl (43) if damaged.

10-11. INSTALLATION — FUEL FILTER.

a. If removed, position filtered head assembly (49, figure 10-2) on outboard side of mounting bracket and install four bolts, nuts, and washers. Connect drain and inlet lines to fittings.

NOTE

Ensure that plug is installed in pressure tap port of filter.

b. Place new packing (44) on boss in bottom of filter bowl. Place new filter element (45) in bowl (43) and seat firmly on boss.

c. Install new packing (48) around lip of bowl (43) next to clamping flange.

d. Place new packing (46) around center boss in filter head. Install bowl (43) and filter element (45) into filter head assembly (49).

e. Install V-band trunnion clamp (47) around mating flanges of filter head and bowl. Torque nut **50** inch-pounds.

f. Connect hose from engine fuel control inlet to outlet coupling (11) on filter head. Close cowling.

g. During next ground run-up, check fuel filter and connections for leaks. Also check that FUEL FILTER caution lamp does not light.

10-12. FUEL SHUTOFF VALVE.

10-13. DESCRIPTION — FUEL SHUTOFF VALVE.

A motor-operated shutoff valve (4, figure 10-3) is installed in the fuel supply system between the check valve manifold and the fuel filter. The valve is mounted on front of the engine forward firewall at left side. An internal bypass valve allows the thermal relief of fuel trapped on outlet side of the shutoff valve. The valve is equipped with an ON-OFF lever and position indicator to allow manual operation of the valve.

10-14. REMOVAL — FUEL SHUTOFF VALVE.

a. Open engine and transmission cowling doors at left side.

b. Disconnect engine fuel inlet hose (10, figure 10-3) from filter outlet coupling. Open filter drain valve, and manually open fuel shutoff valve (4) to release trapped fuel. After short period of drainage, close both valves.

c. Perform function check of fuel shut-off valve (4) prior to removal to determine whether valve motor will open and close fuel valve.

d. Disconnect electrical connector (3) from shutoff valve (4).

e. Disconnect fuel inlet hose (1) and fuel outlet hose (8) from valve (4). Cap open ends of hoses.

f. Remove four nuts (7), washers (6), and screws (2). Remove shutoff valve inlet and outlet connectors (5 and 9).

g. Do not remove packings intalled in fuel shutoff valve (4) ports where connectors (5 and 9) were removed.

10-15. INSPECTION — FUEL SHUTOFF VALVE.

a. Inspect valve for external damage and leakage.

b. Inspect connectors for damaged threads or mating surfaces.

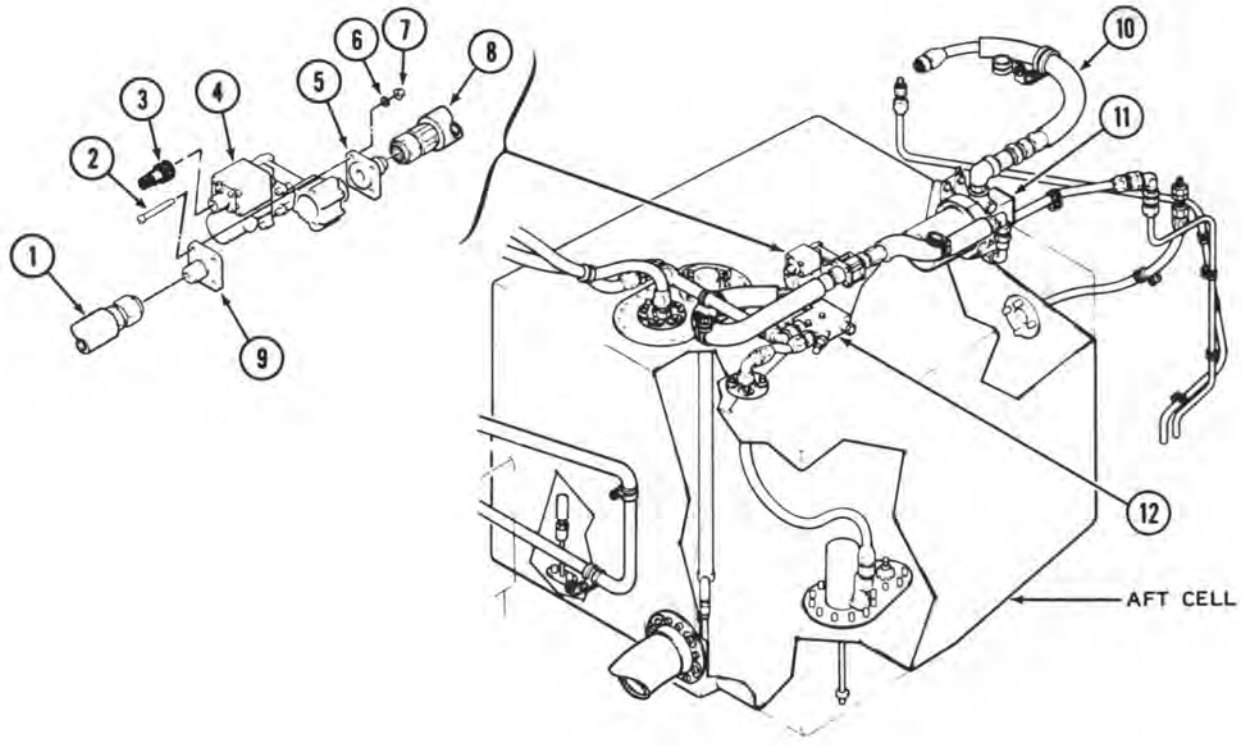
c. Inspect electrical connector for broken or bent pins.

d. Inspect packings at fuel valve inlet and outlet for damage. Replace fuel shutoff valve if either packing is damaged or missing.

10-16. REPAIR OR REPLACEMENT — FUEL SHUTOFF VALVE.

a. Replace fuel shut-off valve if motor will not open and close the valve.

b. Replace fuel shutoff valve if inspection requirements are not met.



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1. Fuel inlet hose
2. Screw (4)
3. Electrical connector
4. Fuel shutoff valve
5. Connector
6. Washer
7. Nut
8. Fuel outlet hose
9. Connector
10. Engine fuel inlet hose
11. Fuel filter
12. Check valve manifold

Figure 10-3. Fuel Shutoff Valve

10-17. INSTALLATION — FUEL SHUTOFF VALVE.

a. Install connector (5, figure 10-3) and connector (9) as follows:

(1) Inspect open ports in fuel shutoff valve (4), where connectors (5 and 9) will be installed, for presence of serviceable packings (not illustrated). If either packing is unserviceable or missing, install new packing.

(2) Identify connector (5) by threads that match fuel outlet hose (8). Identify connector (9) by threads that match fuel inlet hose (1). Position connectors (5 and 9) on fuel shutoff valve (4) and install four screws (2), washers (6), and nuts (7). Torque nuts evenly.

b. Position shutoff valve (4) on front of engine forward firewall, at left side just below induction baffle. Install four mounting screws (2), nuts (7), and washers (6).

c. Connect fuel inlet hose (1) from check valve manifold (12) to inlet connector (9).

d. Connect fuel outlet hose (8) from fuel filter (11) to valve outlet connector (5).

e. Connect electrical connector (3) to receptacle on valve motor. Lockwire connector.

f. Reconnect engine fuel inlet hose (10) to outlet coupling of fuel filter. Close cowling.

g. At next ground run-up, check shutoff valve for proper operation and for leaks.

10-18. LOW LEVEL WARNING (FLOAT) SWITCHES.

10-19. DESCRIPTION — LOW LEVEL WARNING (FLOAT) SWITCHES.

There are two low level warning (float) switches (36 and 70, figure 10-2) installed, one in the aft fuel cell and one in the forward fuel cell. The switches will cause the FUEL LOW lamps to light when less than 26 gallons of fuel remain.

10-20. REMOVAL — LOW LEVEL WARNING (FLOAT) SWITCHES (AVIM).

a. Defuel helicopter (paragraph 1-3).

b. Perform functional test of low level warning float switches to confirm that FUEL LOW worded segment in caution panel illuminates when battery switch is positioned to P ON, E M START.

c. Remove screw-mounted panel from underside of fuselage below forward and/or aft fuel cell.

d. Disconnect electrical leads at terminal board. Refer to Appendix F.

e. Remove low level warning (float) switch (36, figure 10-2) from aft fuel cell.

(1) Remove nut (42) and cover (41).

(2) Remove bolts (40).

(3) Withdraw fitting (39) from fuel cell.

(4) Remove switch (36) from fitting (39).

(5) Remove packings (37 and 38).

f. Remove low level warning (float) switch (70, figure 10-2) from forward fuel cell.

(1) Loosen clamp and remove hose (80).

(2) Remove bolts (77), washers (76), and frangible clips (75).

(3) Withdraw fitting assembly (74) from fuel cell.

(4) Remove switch (70) from fitting assembly (74).

(5) Remove packings (71 and 72).

10-21. INSPECTION — LOW LEVEL WARNING (FLOAT) SWITCHES (AVIM).

a. Inspect threads for damage.

b. Inspect electrical lead for frayed or damaged insulation.

c. Inspect sensing holes at top and bottom of switch for obstructions.

10-22. REPAIR OR REPLACEMENT — LOW LEVEL WARNING (FLOAT) SWITCHES (AVIM).

a. Replace low level warning switches that were found to be inoperative in functional check in paragraph 10-20.b.

b. Replace low level warning switches that failed to meet inspection requirements (paragraph 10-21).

10-23. INSTALLATION — LOW LEVEL WARNING (FLOAT) SWITCHES (AVIM).

a. Install low level warning (float) switch (70 figure 10-2) in forward fuel cell.

(1) Install packing (72) on switch (70) and insert electrical leads down through fitting assembly (74). Screw switch tightly onto fitting assembly.

(2) Install packings (71 and 72) and install fitting assembly (74) using frangible clips (75), washers (76), and bolts (77).

(3) Connect electrical leads to terminal board (Appendix F).

b. Install low level warning (float) switch (36) in aft fuel cell.

(1) Install packing (37) on switch (36) and insert electrical leads down through fitting (39). Screw switch tightly onto fitting.

(2) Install packing (38) and install fitting (39) using bolts (40). Install cover (41) and nut (42).

(3) Connect electrical leads to terminal board (Appendix F).

10-24. TEST PROCEDURES — LOW LEVEL WARNING (FLOAT) SWITCHES (AVIM).

Refer to paragraph 9-280 for test procedures.

10-25. FUEL BOOST PUMPS.

10-26. DESCRIPTION — FUEL BOOST PUMPS.

An electric motor-driven fuel boost pump (4, figure 10-4) is mounted into the bottom of each fuel cell, to deliver fuel at a rate up to 990 pounds per hour at 5 to 30 psi pressure. Each pump is submerged in fuel, with its outlet connected to a hose leading to an external fuel line. Electrical leads and a seal drain line are provided on the lower exterior face of the pump.

10-27. REMOVAL — FUEL BOOST PUMPS.

NOTE

Removal of boost pump from forward or aft fuel cell is the same except for location and access.

a. Drain both fuel cells (paragraph 1-3).

b. Remove screw-mounted panel from underside of fuselage below forward and/or aft fuel cell.

c. Disconnect boost pump electrical leads from terminal board (Appendix F).

d. Remove seal drain tube (12, figure 10-4) from union (11) on pump (4).

e. Remove bolts (9), washers (8), and frangible clips (7) from mounting flange of pump.

f. Lower pump assembly enough for access to hose connection (1) on pump discharge fitting (2). Disconnect hose and remove pump and gasket (3). Cover open port.

10-28. INSPECTION — FUEL BOOST PUMPS.

a. Inspect connectors and fittings for cracks and damaged threads.

b. Inspect electrical leads for frayed or damaged insulation.

10-29. REPAIR OR REPLACEMENT — FUEL BOOST PUMPS. (AVIM)

a. Replace gasket if leaking or damaged.

b. Replace pump having damaged connectors or electrical leads.

c. If pump is replaced, remove all fittings from old pump for installation on new pump.

10-30. INSTALLATION — FUEL BOOST PUMPS.

NOTE

Installation of boost pump in forward or aft fuel cell is the same except for location and access.

a. Place gasket (3, figure 10-4) on mounting flange of pump (4). Uncover mounting port of fuel cell. Insert pump partially into port and connect fuel hose (1) to outlet fitting (2).

b. Install frangible clips (7) at 2 and 5 o'clock position for forward cell, and at 5 and 8 o'clock position for aft cell. Look up with reference to most aft pump bolts as 12 o'clock position. Install bolts (9) and washers (8). Torque bolts **50 TO 70** inch-pounds.

c. Connect seal drain tube (12) to union (11) on pump.

d. Connect electrical leads from pump to terminal board. See circuit wiring diagram (Appendix F).

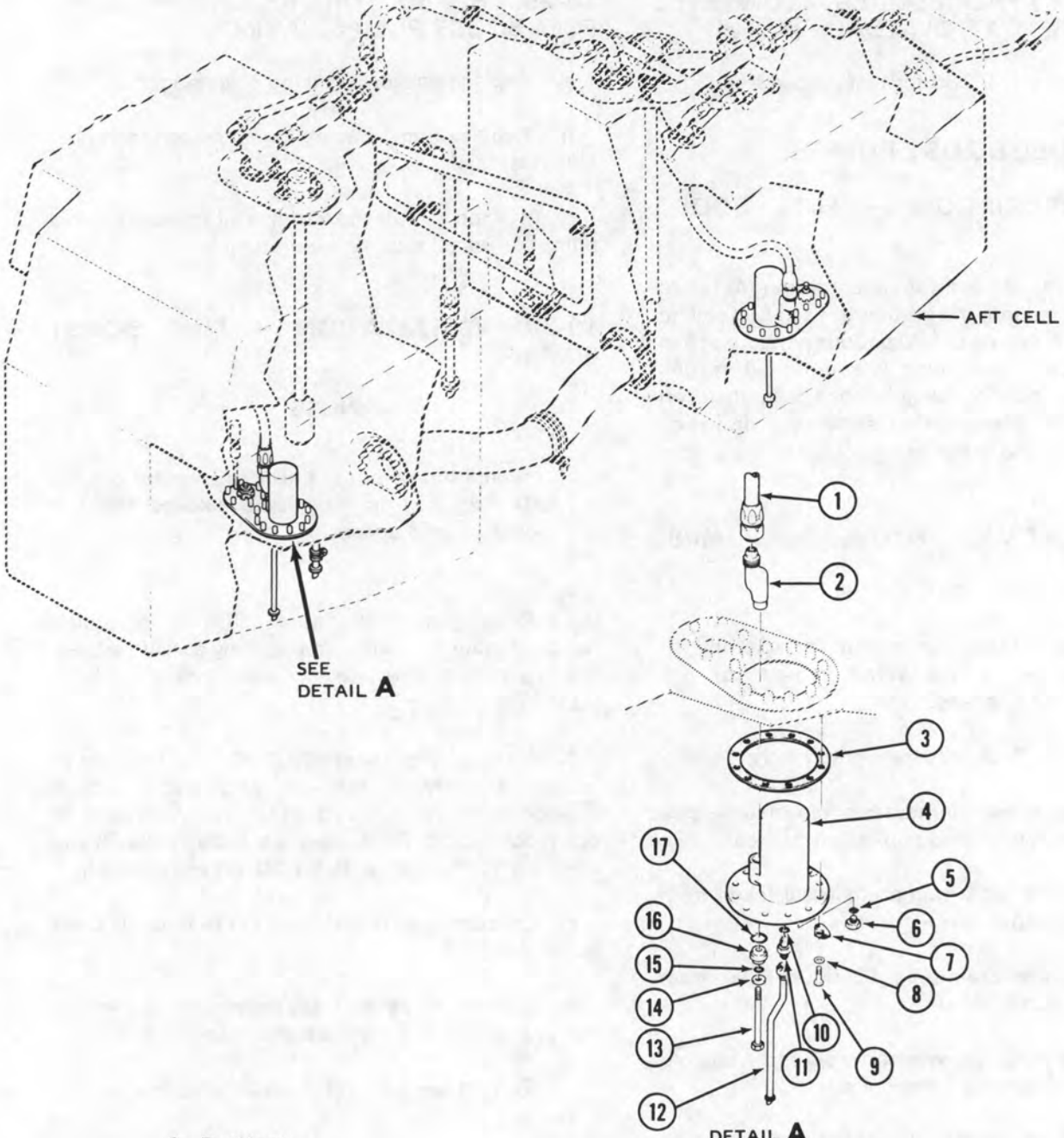
e. Service fuel cell and check for leaks (paragraph 1-3).

10-31. TEST PROCEDURES — FUEL BOOST PUMPS.

Refer to paragraph 9-358 for operational check of fuel boost pumps.

10-32. FUEL QUANTITY TRANSMITTERS.

Refer to paragraph 8-221.



DETAIL A
TYPICAL AFT CELL

1. Fuel hose
2. Fitting
3. Gasket
4. Fuel boost pump
5. Packing
6. Plug
7. Clip
8. Washer
9. Bolt
10. Packing
11. Union
12. Seal drain tube
13. Bolt
14. Washer
15. Packing
16. Plug
17. Packing

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Figure 10-4. Fuel Boost Pump

10-33. CHECK VALVE MANIFOLD.

10-34. DESCRIPTION — CHECK VALVE MANIFOLD.

A valve manifold (3, figure 10-2), located just ahead of engine forward firewall at left side, is connected into fuel pressure lines ahead of the shutoff valve. The manifold contains two separate check valve elements which prevent reverse flow, except through bypasses which will relieve thermal expansion of trapped fuel. One outlet port of the manifold is used, another is plugged. Two pressure switches are installed in the inlet side of the manifold, to cause lighting of FWD FUEL BOOST or AFT FUEL BOOST caution panel segments if either fuel boost pump fails to deliver normal pressure.

10-35. REMOVAL — CHECK VALVE MANIFOLD.

a. Open transmission cowling door at left side.

b. Disconnect electrical connectors from both pressure switches on check valve manifold.

c. Provide a small container to catch trapped fuel. Disconnect fuel lines from fittings at manifold inlets and outlet. Cap open ends of lines.

d. Remove two screws, washers, and spacers from manifold (3).

10-36. INSPECTION — CHECK VALVE MANIFOLD.

a. Inspect manifold for cracks and fittings for damaged threads.

b. Inspect pressure switches for cracks and bent or broken pins.

10-37. REPAIR OR REPLACEMENT — CHECK VALVE MANIFOLD.

a. Replace pressure switches having cracks or loose and broken pins.

b. Replace gaskets and elbow or plug at manifold outlet if leaking or damaged.

c. Replace manifold assembly if damaged or malfunction occurs. Transfer outlet fittings and pressure switches to replacement assembly as required.

10-38. INSTALLATION — CHECK VALVE MANIFOLD.

a. Check that fittings and pressure switches are properly installed, with gaskets, in manifold assembly (figure 10-2).

b. Hold manifold with flow arrows pointing aft, and outlet elbow at aft inboard side. Insert two screws, with washers under heads, downward through manifold. Place a spacer on lower end of each screw.

c. Align manifold assembly to mounting holes in deck, and tighten screws securely.

d. Connect fuel line from shutoff valve inlet arrow of manifold. Connect fuel pressure line and hose to manifold inlet fittings.

e. Connect electrical connectors to pressure switches.

f. Check for proper operation and for leaks.

10-39. M CLOSED CIRCUIT REFUELING RECEIVER.

10-40. M DESCRIPTION — CLOSED CIRCUIT REFUELING RECEIVER.

The closed circuit refueling receiver is located on the fuselage above and forward of the right wing. The receiver accepts either a closed circuit refueling nozzle or a gravity fill nozzle. The receiver is capable of accepting fuel at the rate of 100 gallons per minute (GPM). The receiver automatically shuts off when system is full, system internal pressure exceeds 2.5 PSI, or flow rate exceeds 130 GPM.

10-41. M REMOVAL — CLOSED CIRCUIT REFUELING RECEIVER.

a. Defuel as required.

b. Remove screws (24, figure 10-2) and washers (25).

c. Remove receiver assembly (26) with retainer (27), gasket (28), and packing (29).

10-42. M INSPECTION — CLOSED CIRCUIT REFUELING RECEIVER.

Inspect for damage, freedom of operation, and corrosion.

10-43. M REPAIR OR REPLACEMENT — CLOSED CIRCUIT REFUELING RECEIVER.

Replace if defects in paragraph 10-42 are noted.

10-44. M INSTALLATION — RECEIVER ASSEMBLY.

a. Position packing (29, figure 10-2), gasket (28), retainer (27), and receiver (26) into fuselage.

b. Install screws (24) and washers (25). Torque bolts evenly **50 TO 70** inch-pounds.

10-45. P E CAP AND ADAPTER ASSEMBLY.

10-46. P E DESCRIPTION — CAP AND ADAPTER ASSEMBLY.

The cap and adapter assembly (82, figure 10-2) is located at the forward right fuselage area and provides an access for fueling the helicopter.

10-47. P E REMOVAL — CAP AND ADAPTER ASSEMBLY.

a. Remove 12 screws (81, figure 10-2) securing assembly to fuselage.

b. Remove retainer (83) and packing (84).

10-48. P E INSPECTION — CAP AND ADAPTER ASSEMBLY.

a. Inspect chain attaching cap to adapter for security.

b. Inspect cap locking mechanism for proper locking function.

c. Inspect for cracks and damage that would impair operation.

10-49. P E REPAIR OR REPLACEMENT — CAP AND ADAPTER ASSEMBLY.

a. Replace assembly having faulty locking mechanism.

b. Replace assembly having faulty or insecure cap attachment.

10-50. P E INSTALLATION — CAP AND ADAPTER ASSEMBLY.

a. Position packing (84) and retainer (83) in position on fuselage.

b. Install cap and adapter assembly (82) using 12 screws (81). Tighten screws securely.

10-51. DEFUEL AND SUMP DRAIN VALVE.

10-52. DESCRIPTION — DEFUEL AND SUMP DRAIN VALVE.

A defuel and sump drain valve (60 and 62, figure 10-2) is installed on the bottom of the helicopter beneath the aft fuel cell. The valve is a two-piece valve which will automatically close the valve opening when the lower valve is removed for defueling and draining. A special fitting is required to open the upper valve for defueling and draining operations. The valve will drain fuel from both the forward and aft fuel cells.

10-53. REMOVAL — DEFUEL AND SUMP DRAIN VALVE.

a. Defuel forward and aft fuel cells (paragraph 1-3).

b. Remove access cover beneath aft fuel cell.

c. Disconnect clamp and remove hose (61, figure 10-2).

d. Cut lockwire and remove lower valve assembly (62).

e. Remove bolts (59), washers (58), frangible clips (57), and plate (56).

f. Remove nut (54) and upper valve (60). Remove packings (55, 63, and 64).

10-54. INSPECTION — DEFUEL AND SUMP DRAIN VALVE.

a. Inspect valve for cracks and damaged threads.

b. Inspect shutoff function of upper valve for damage that would allow leakage.

10-55. REPAIR OR REPLACEMENT — DEFUEL AND SUMP DRAIN VALVE.

a. Replace valve having cracks and/or damaged threads.

b. Replace valve having faulty shutoff operation.

10-56. INSTALLATION — DEFUEL AND SUMP DRAIN VALVE.

a. Place packing (64, figure 10-2) on upper valve (60), insert in plate (56), and install nut (54).

b. Install packing (63) and lower valve (62).

c. Connect hose (61) to lower valve.

d. Place packing (55) in position and install plate (56) using frangible clips (57), washers (58), and bolts (59).

e. Install access cover.

10-57. SUMP DRAIN VALVE.

10-58. DESCRIPTION — SUMP DRAIN VALVE.

The sump drain valve (79, figure 10-2) is located beneath the forward fuel cell. The valve provides a means of draining residual fuel from the forward fuel cell.

10-59. REMOVAL — SUMP DRAIN VALVE.

a. Defuel forward and aft fuel cells (paragraph 1-3).

b. Remove access cover.

c. Disconnect clamp and remove hose (80, figure 10-2).

d. Remove bolts (77), washers (76), frangible clips (75), and fitting assembly (74).

e. Remove nut (73) and valve (79). Remove packings (72 and 78).

10-60. INSPECTION — SUMP DRAIN VALVE.

a. Inspect valve for cracks and damaged threads.

b. Inspect valve for correct operation of shutoff function.

10-61. REPAIR OR REPLACEMENT — SUMP DRAIN VALVE.

a. Replace valve having cracks and damaged threads.

b. Replace valve having faulty shutoff operation.

10-62. INSTALLATION — SUMP DRAIN VALVE.

a. Place packing (78, figure 10-2) on valve (79), insert in fitting assembly (74) and install nut (73).

b. Place packing (72) in position and install fitting assembly (74) using frangible clips (75), washers (76), and bolts (77).

c. Connect hose (80) to valve (79).

d. Install access cover.

10-63. HOSES AND TUBING.

10-64. DESCRIPTION — HOSES AND TUBING.

Flexible hoses of non-fire resistant material are used in the crashworthy fuel system. The crossover hose (14, figure 10-2), engine fuel inlet hose (11), fuel and vent fitting hoses (23) and check valve manifold to shutoff valve hose are self-sealing crashworthy hoses. The hoses are secured with rubber cushioned clamps to prevent chafing. Aluminum alloy tubing is used in the system to serve as drain lines.

10-65. REMOVAL — HOSES AND TUBING.

Hold end fittings to prevent kinking or twisting of hoses and tubing when removing. Cover open ends to prevent contamination.

10-66. INSPECTION — HOSES AND TUBING.

a. Inspect tubing for kinks, dents, and deep scratches.

b. Inspect fuel crossover hose (14, figure 10-2) for:

(1) Any surface abrasion deep enough to cut outer fabric braid.

(2) Brittleness or powdering due to temperature or aging.

(3) Cracks, cuts, or tears.

(4) Hose saturated with fluid.

c. Inspect fuel crossover hose (14) for loose or damaged clamps attaching hose to end fitting. Inspect crossover hose (14) for damage.

d. Inspect vent lines (23) for:

(1) Two or more broken wires per plait or more than six broken wires per lineal foot or any broken wire where kinking is suspected.

(2) Evidence of dents, kinks, or twisting.

(3) Evidence of brittleness. Check by flexing hose.

(4) Seepage/wetness around the end fitting or any part of the hose.

e. Inspect self-sealing covered hoses (1, 8, and 10, figure 10-3).

(1) Surface abrasion deep enough to cut the outer fabric braid.

(2) Brittleness or powdering due to temperature or aging.

(3) Evidence of inner hose pulling out of the outer cover at end fittings. Inspect for reduction of inside diameter.

(4) Cracks, cuts, or tears in outer cover.

(5) Soaked outer cover, saturated with fluid.

f. Inspect self-sealing covered hoses (1, 8, and 10), for loose or damaged clamps at hose ends.

g. To check the inside diameter of a marginally kinked or dented hose for deformation, use ball size shown below and verify it will roll through the hose to indicate unrestricted flow.

Hose dash size	Ball size diameter (inches)
-3	0.080
-4	0.132
-5	0.200
-6	0.260
-8	0.350
-10	0.450
-12	0.575
-16	0.781
-20	1.015
-24	1.250
-32	1.684

h. Inspect remaining hoses for cuts, kinks, or twisted areas.

i. Inspect end fittings for damaged threads, burrs, or other damage.

10-67. REPAIR OR REPLACEMENT — HOSES AND TUBING.

a. Replace hoses with indications of defects noted in paragraphs 10-60, b., d., and e.

b. Tighten or replace loose or damaged fuel hose clamps (paragraphs 10-60, c. and f.).

c. Replace hoses having cuts, kinks, or twisted areas.

d. Replace tubing having kinks, dents, or deep scratches.

e. Replace hoses having damaged end fittings.

10-68. INSTALLATION — HOSES AND TUBING.

a. Do not try to pull hoses or tubing into position by tightening nuts. Position tubes properly between connecting points to avoid stressing.

b. Hold end fittings when installing hoses. Ensure that hoses do not become twisted during tightening of end fittings.

10-69. FUEL CELL FITTINGS.

10-70. DESCRIPTION — FUEL CELL FITTINGS.

Fuel cell fittings include P, E filler cap and adapter, M refueling receiver assembly, crossover tube

elbows, vents, pressure line outlets, fuel quantity transmitter, and governor bleed line inlet (figure 10-2).

10-71. MAINTENANCE — FUEL CELL FITTINGS.

Any fuel cell fitting can be removed for replacement of parts to correct leaks, or for access to parts within cells. Observe the following:

a. Replace defective seal or packing under fitting. Be sure mating surfaces are clean and free of burrs and nicks.

NOTE

Note position of frangible clips on system and reinstall in same location.

b. If crossover hose elbow on aft cell is removed, make certain that check valve and pin are correctly reinstalled (figure 10-2).

CAUTION

Ensure that check valve is installed with direction-of-flow arrow pointing into cell.

c. If governor bleed return inlet fitting is removed from rear side of aft fuel cell, make certain of correct reassembly. Install check valve (35, figure 10-2) with direction-of-flow arrow pointing into the cell.

d. Torque bolts **50 TO 70** inch-pounds.

10-72. INSPECTION — FUELL CELL FITTINGS.

Inspect for leakage after refilling fuell cells and during initial operation.

SECTION II. FUEL CELLS

10-73. FUEL CELLS.

10-74. DESCRIPTION — FUEL CELLS.

a. The two fuel cells are removable units contained in fuselage compartments, one forward of the pylon and one aft, between the main longitudinal beams. The cells are crashworthy, self-sealing and have a 50 caliber ballistic protection level. Openings in the cells are provided with metal fittings bonded into the laminated cell walls. Each fitting has a pattern of threaded inserts for attachment of equipment and for securing cell in position by means of frangible clips.

b. Each fuel cell is designed to retain fuel in event of crash impact. The cell is constructed of high strength multiple ply material and incorporates self-sealing compound between plies. The cell is retained in the structure by frangible clips designed to break away before crash forces rupture the cell. High strength fittings are used to attach system components to the cell. The fuel cell is sufficiently flexible to permit installation in fuselage; yet is rigid enough to eliminate need for hangers or cord lacings.

10-75. INSPECTION — ACCEPTANCE/ REJECTION CRITERIA — FUEL CELLS.

a. Defuel helicopter (paragraph 1-3).

NOTE

The access panel just ahead of the wings can be removed without removal of the wings.

b. P, E Remove 12 screws (81, figure 10-2) securing cap and adapter assembly (82) to fuselage. Remove cap and adapter assembly (82).

c. M Remove screws (24) securing refueling receiver assembly (26) to fuselage. Remove receiver (26) and retainer (27).

d. Feel the interior of the cell horizontal shelf all the way to the fuselage forward and aft vertical wall for activation (sponginess) (paragraph 10-78).

CAUTION

Use safety precautions with electrical device. Use only a sealed battery powered light.

e. A fuel cell may be questionable when inspected along the shelf area and additional inspection may be required. Additional inspection is performed by completely draining the fuel system and removing the fuel pump and frangible mounting clips around the cell fitting. The feel test is then performed inside and outside the cell bottom. In addition to any sponginess that may be detected from the inside, the cell wetness that can be felt on the bottom exterior is cause for cell removal and possible additional inspection.

Premaintenance Requirements for Fuel Cells

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	(S21)
Minimum Personnel Required	Two
Consumable Materials	(C12) (C74) (C75) (C53) (C102) (C52) (C117) (C29) (C107) (C112) (C137)
Special Enviromental Conditions	70 degrees F (21 degrees C)

f. If the fuel cells have separated or activated liner, install new fuel cell.

g. If packing (29) or packing (84) was pulled from groove in the cell, replace packing.

h. If fuel cells are acceptable, install parts that were removed in steps b and c. Torque screws **45 TO 55** inch-pounds.

10-76. REMOVAL — FORWARD FUEL CELL (AVIM).

a. Defuel system and remove access panel (paragraph 1-3).

b. Disconnect electrical leads and remove boost pump assembly (paragraph 10-27).

c. Disconnect electrical leads of low level warning (float) switch (70, figure 10-2). Disconnect drain hose (80) from valve (79). Remove two bolts (77), washers (76), and frangible clips (75), securing cell to fuselage structure. Remove four remaining bolts (77) securing sump fitting (74) to fuel cell. Remove fitting (74) with drain valve (79) and low level warning (float) switch (70) from helicopter.

d. Remove screw mounted access panel from left side of fuselage just ahead of wing.

e. Remove left and right side access panels located below wings. Loosen clamp on fuel crossover hose (14). Remove four bolts, frangible clips, washers, and spacers from bulkhead crossover flanges and fuel cell. Remove six bolts and washers from crossover and cell flange.

f. Open hydraulic compartment access doors.

g. Remove ECU (paragraph 13-9).

h. Remove fuel quantity transmitter probe (22) (paragraph 8-224).

i. Disconnect hose assemblies at vent (21) fuel fitting. Remove five bolts and frangible clips securing cell to fuselage structure. Remove remaining bolt securing fitting to fuel cell. Remove fitting from helicopter.

j. M Remove refueling receiver assembly (26, figure 10-2), packing (29), retainer (27), gasket (28), and mounting screws (24) from fuselage. P E Remove cap and adapter assembly (82), packing (84), retainer (83) and mounting screws (81) from fuselage.

k. Remove forged fitting, located on inner access panel near lower forward corner, by removing two bolts at base of fitting and four bolts and washers which secure fitting to panel. Keep bolts, radius block, and shim with fitting.

l. Remove screw-mounted inner panel from fuselage beam.

m. Remove screws which secure upper fuel cell access panel to left side of fuselage at contour. Remove panel.

n. Remove clamps and ties from structure and cable assemblies as necessary to obtain a clear area for cell removal from left side. Tie cable assemblies out of the way.

o. Collapse upper portion of fuel cell inward to clear beam. Collapse cell downward and remove from cavity.

p. Preserve fuel cell by fogging with oil (C77). Cover cell openings with barrier material (C23).

10-77. REMOVAL — AFT FUEL CELL. (AVIM)

a. Defuel system and remove lower skin panel (paragraph 1-3).

b. Remove seal drain tube and boost pump (paragraph 10-27).

c. Disconnect electrical leads of low level warning (float) switch (36, figure 10-2). Remove nut (42) and cover (41). Remove two bolts (40) securing switch fitting (39) to cell. Remove fitting (39) and switch (36) from helicopter.

d. Remove clamp and hose (61) from defuel and sump drain valve (62). Remove two bolts (59), washers (58), and frangible clips (57) securing valve, plate (56), and cell to fuselage structure. Remove four remaining bolts (59) and washers (58) securing valve and plate to fuel cell. Remove valve and plate from helicopter.

e. Remove left and right side access panels located below wings. Loosen clamp on fuel crossover hose (14). Remove four bolts, frangible clips, washers, and spacers from bulkhead crossover flanges and fuel cell. Remove six bolts and washers from crossover and cell flange.

f. Remove oil cooler intake duct from left side of fuselage for access. Disconnect bleed line from check valve (35). Remove two bolts (38), frangible clips (32), and washers (34) securing plate (31) with check valve (35) attached) and cell to structure. Remove two bolts and washers securing plate to cell.

g. Open transmission cowling. Remove induction baffles for access to top ports of aft fuel tank cell (paragraph 2-125).

h. Disconnect hose assembly (23) by removing six bolts and frangible clips securing hose fitting to fuselage structure.

i. Remove fuel quantity transmitter (probe) (22) (paragraph 8-224). Remove four cell attachment screws and washers.

j. Disconnect fuel pressure line hose from tank outlet fitting on left side of deck, behind valve manifold. Remove two bolts and frangible clips securing fitting to fuselage structure. Remove two bolts and washers securing fitting to cell. Remove fitting from helicopter.

k. Install fitting and jack at aft jack point. Raise jack only until snug against fitting.

CAUTION

Prior to removal of aft fuel cell access panel, perform procedure outlined in paragraph 2-5.

l. Remove mounting screws and aft fuel cell access panel from right side of fuselage directly behind wing attachments.

m. Collapse and remove fuel cell.

n. Preserve fuel cell by fogging with oil (C77). Cover cell openings with barrier material (C23).

10-78. INSPECTION — BOTH CELLS. (AVIM)

a. Inspect all interior and exterior surfaces for loose seams, cuts, abrasions, scuffed surfaces, tears, blisters, and for any area that appears to have become soaked with fuel (activated).

NOTE

An activated fuel cell is a cell that has absorbed fuel in the inner liner. The walls of the cell are flabby and spongy. The inner liners are separated and ballooned from the structure. It must be understood that a serviceable cell may have blemishes. These blemishes do not have a spongy feeling. These blemishes are not cause for rejection.

b. Inspect metal fittings to make certain protective finishes are intact and the coil-type inserts are installed and in good condition.

c. The following damages are prohibited for field repair and can be repaired only by an authorized fuel cell overhaul facility.

(1) Pass through holes (holes made by a projectile that enters through one surface of the fuel cell and exits through the opposite surface).

(2) Damage that extends into a corner or stepped-off area or that involves a cut longer than 2.0 inches, or that is caused by the seepage or diffusion of fuel between the fabric plies.

10-79. CLEANING — FUEL CELLS (AVIM)

a. Remove surface dirt and grime by scrubbing the fuel cell with warm, soapy water. Air dry surface.

b. Purge fuel cell thoroughly with fresh air; scrub and rinse with warm, soapy water; and rinse in clean, clear water. Air dry.

10-80. REPAIR OR REPLACEMENT — FUEL CELLS (AVIM).

WARNING

Make no repairs on the radius of a cell or in the fitting area of a cell. Cells with such damage should be forwarded to depot for repair. No damage area larger than two inches should be repaired at AVIM.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

a. Use a piece of fabric (C53) large enough to cover damage at least 2.0 inches from cut in any direction. Buff this material lightly and thoroughly with sandpaper (C102) and wash with MEK (C74) to remove buffing dust.

b. Apply two coats of cement (C29) to the buffed area. Allow each coat to dry **10 TO 15** minutes.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

c. Buff cell area to be patched lightly and thoroughly with sandpaper (C102) and wash with MEK (C74) to remove buffing dust.

d. Apply two coats of cement (C29). Allow each coat to dry **10 TO 15** minutes.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

e. Freshen cemented area of patch and cemented area of cell with MEK (C74).

f. While still tacky, apply edge of patch to edge of cemented area on the cell. With a roller or blunt instrument roll or press the patch to the cemented area on the cell. Hold part of the patch off the cemented area and roll or press it down **0.50 TO 1.0** inch across at a time so as not to trap air between patch and cell.

g. Seal coat edge of patch **0.50** inch with one coat of cement (C29) and allow the patch to remain undisturbed for **six** hours.

h. After the damaged area has been patched on the outside of the cell and the repair allowed to stand a minimum of six hours, the cell is then ready to have the patch applied on the inside of the cell.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

i. Lightly and thoroughly buff a piece of fabric (C52) large enough to cover damage at least **2.0** inches from cut in any direction. Wash buffing dust off patch with MEK (C74).

j. Apply two coats of cement (C29) to patch, opposite red fabric side. Allow each coat to dry **10 TO 15** minutes.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

k. Buff cell area to be patched lightly and thoroughly with sandpaper (C102) and then wash off buffing dust with MEK (C74).

l. Apply two coats of cement (C29) to buffed area and allow each coat to dry **10 TO 15** minutes.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

m. Freshen cemented area of patch and cemented area of cell with MEK (C74).

n. While still tacky, apply edge of patch to edge of cemented area, centering patch over cut in cell. Hold part of patch off the cemented area and roll or press it down **0.50 TO 1.0** inch across at a time so as not to trap air between patch and cell.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

o. Remove red fabric from patch by moistening with MEK (C74).

p. Seal coat patch and area **0.50** inch from edge of patch with two coats of cement (C29). Allow the first coat to dry **15** minutes and the second coat to dry **12** hours or more.

10-81. INSTALLATION — FORWARD FUEL CELL (AVIM).

a. Check fuselage cavity, including access panels, for any foreign objects or rough surfaces which could damage fuel cells.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

b. Wipe surfaces with a cloth saturated with solvent (C112) and wipe dry with a clean cloth before solvent evaporates. Use MEK (C74) on bare metal surfaces, naphtha (C75) on surfaces of other materials.

c. Remove old sealing compound from edges of access panels and mating surfaces on structure.

CAUTION

Do not fold the fuel cell if the ambient temperature of the work area is less than 70 degrees F (21 degrees C). Move cell into warm area before folding cell. Do not allow the fuel cell to remain in its folded condition for more than 30 minutes. Non-visible permanent damage to cell walls may occur. Do not use wire or other thin diameter material to restrain cell, permanent damage to self-sealing characteristics of the cell could result.

d. Partially flatten fuel cell by pushing in on sides allowing cell to collapse downward (see figure 10-5). Apply straps or large diameter ropes vertically around cell to temporarily retain this shape. Sprinkle with talc (C117) and place fuel tank cell in cavity, remove straps or ropes and allow cell to expand. Align all fittings with openings in structural panels.

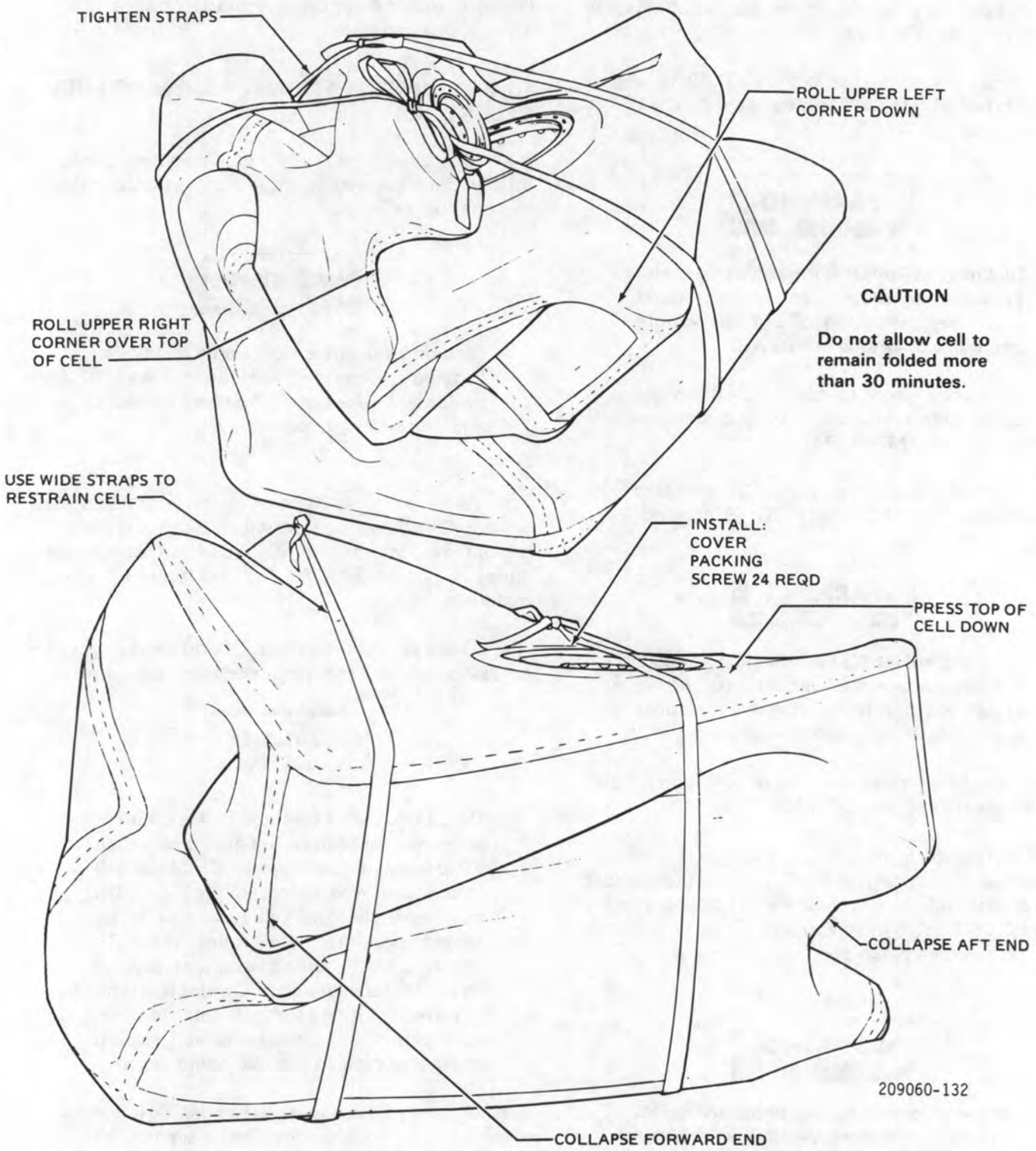


Figure 10-5. Collapsing Forward Fuel Cell

NOTE

The materials and construction features of the cells used in the crashworthy system results in fuel cells that are rigid and self-supporting. Ease of installation of the cells is related to temperatures of the cells and the work area. As a general rule a temperature above 70 degrees F (21 degrees C) is desirable in the work area when installing the cells. Heat can be applied to the cell provided a temperature of 120 degrees F (49 degrees C) is not exceeded.

NOTE

A "T" handle, fabricated per figure 10-6, can be used to align fuel cell fittings to structure openings. The tool is inserted through the hole in the structure and screwed into the fitting. Manipulate the fitting as desired by grasping the "T" handle.

NOTE

In the following instructions do not tighten bolts securing frangible clips to structure until all clips have been installed and fuel cell properly positioned. To ensure a satisfactory seal at bolted connections, alternately snug up and torque opposite bolts at each connection.

e. Install vent and fuel discharge fitting (21, figure 10-2) and hose (15) in fuel cell access cover at hydraulic compartment floor.

f. Install fuel quantity transmitter (probe) (22) (paragraph 8-226).

g. M Install retainer (27, figure 10-2), gasket (28), packing (29) and refueling receiver assembly (26) at right side of fuselage. P E Install retainer (83), packing (84), cap and adapter assembly (82) at right side of fuselage.

h. Connect fuel hose and install boost pump assembly (13) (paragraph 10-30).

i. Install drain valve and low level warning (float) switch fitting in fuel cell and helicopter structure. Lockwire drain valve (C137).

j. Install fuel crossover hose to cells and helicopter structure. Install clamp.

k. Install drain hose to valve (17). Install clamp.

l. Adjust position of cell in cavity so that all frangible clips are bearing on helicopter structure. Torque bolts securing clips to cell and structure **45 TO 55** inch-pounds.

m. Position inner access panel to opening in left main beam. Apply sealing compound (C107) to provide fume-tight seal between mating surfaces. Install screws and thin aluminum alloy washers.

n. Position forged tension fitting on matching holes near lower forward corner of beam access panel. Reinstall shim under base of fitting. Install high-tensile bolt (NAS 624-14), with radius block under head, in aft bolt hole of base. Install bolt (NAS 1304-8), with thin steel washer, in forward bolt hole of base. Install four bolts, with thin steel washers, through upright leg of fitting into inserts of panel.

o. Connect electrical leads of low level warning (float) switch, boost pump, and transmitter (Appendix F).

p. Return cable assemblies installation to original configuration at left side access panel.

q. Install outer access panel with screws on fuselage ahead of wing location.

r. Install left wing (paragraph 2-343).

s. Service fuel system and check for leaks (paragraph 1-3)

t. Install access panels below wings and on lower skin.

10-82. INSTALLATION — AFT FUEL CELL (AVIM).

a. Check fuselage cavity, including access panel for freedom from foreign objects or rough surfaces which could damage fuel cell.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

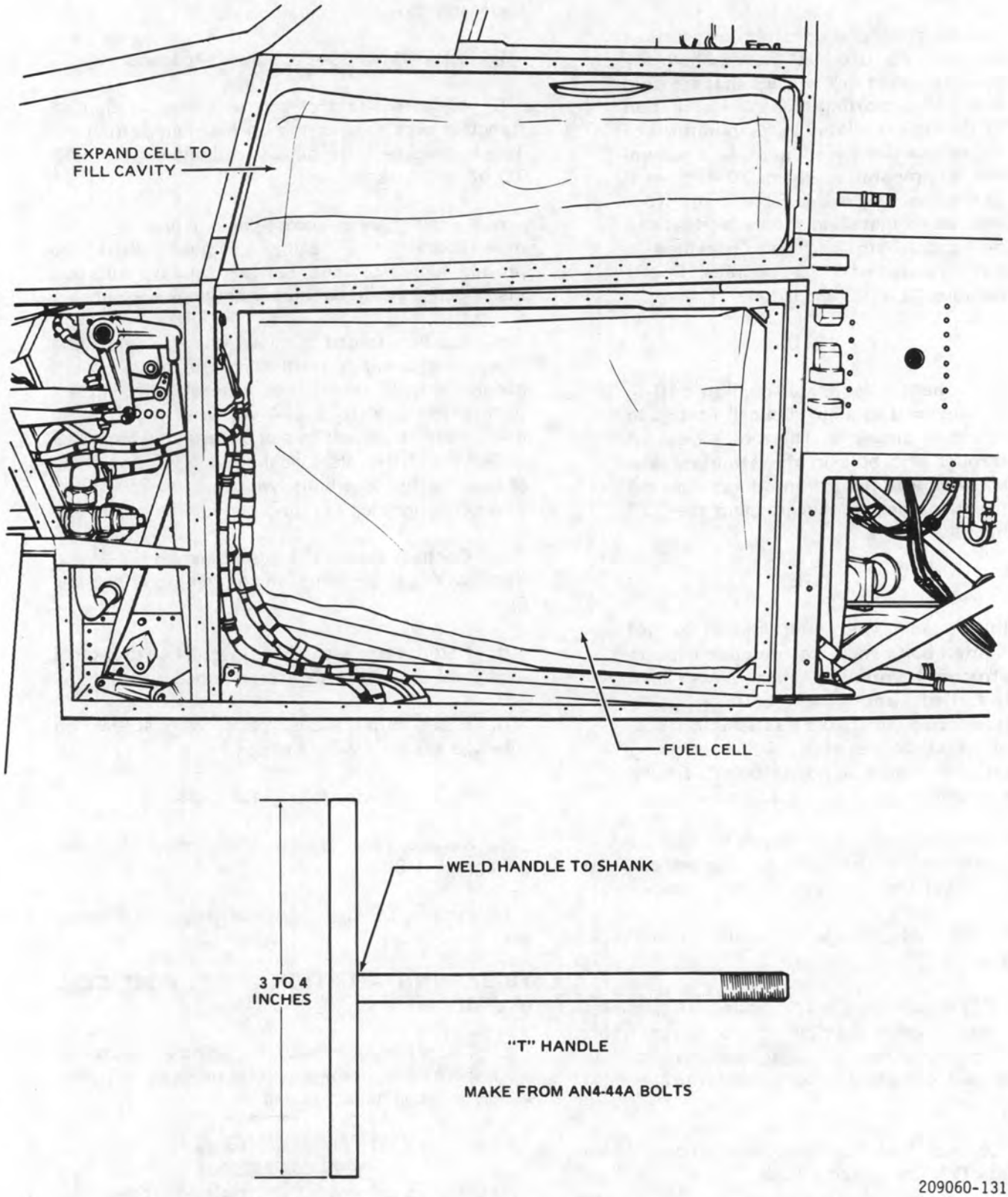


Figure 10-6. Installed Forward Fuel Cell

b. Wipe surfaces with a cloth saturated with solvent (C112) and wipe dry with a clean cloth before solvent evaporates. Use MEK (C74) on bare metal surfaces, and naphtha (C75) on surfaces of other materials.

c. Remove old sealing compound from edges of access panel and mating surface on structure.

CAUTION

Do not fold the fuel cell if the ambient temperature of the work area is less than 70 degrees F (21 degrees C). Move cell into warm area before folding cell. Do not allow the fuel cell to remain in its folded condition for more than 30 minutes. Nonvisible permanent damage to cell walls may occur. Do not use wire or other thin diameter material to restrain cell, as permanent damage to self-sealing characteristics of the cell could result.

d. Partially flatten fuel cell by pushing in on sides, allowing cell to collapse downward (figure 10-7). Apply straps or ropes vertically around cell to temporarily retain this shape. Sprinkle with talc (C117) and place fuel tank cell in cavity, remove straps or ropes and allow cell to expand. Align all fittings with openings in structural panels.

NOTE

In the following instructions do not tighten bolts securing frangible clips to structure until all clips have been positioned. To ensure a satisfactory seal at bolted connections, alternately snug up and torque opposite bolts at each connection.

e. Apply adhesive (C12) to provide fume-tight seal between mating of access panel and fuselage. Install panel with mounting screws.

f. Install vent fitting in fuel cell access cover and secure to helicopter with six bolts, washers ar ' frangible clips. Connect hose.

g. Install fuel quantity transmitter probe (paragraph 8-226).

h. Install fuel pressure line fitting in fuel cell with two bolts and washers. Secure fitting and cell to helicopter structure with two bolts, washers, and frangible clips. Connect hose.

i. Install governor bleed line check valve and plate to fuel cell with two bolts and washers. Secure plate to helicopter structure with two bolts, washers, and frangible clips. Connect hose.

j. Install boost pump and drain tube (paragraph 10-30).

k. Install low level warning (float) switch fitting with two washers and bolts. Secure fitting and cell to helicopter structure. Install nut and cover securing switch fitting to helicopter structure.

l. Install defuel and dump drain valve in fuel cell with four washers and bolts. Secure valve, plate, and cell to structure with two bolts, washers, and frangible clips. Install drain hose and clamp. Lockwire drain valve.

m. Install fuel crossover hose to fuel cell with six bolts and washers. Alternately snug up and torque opposite bolts to ensure a satisfactory seal. Install crossover hose and cell to fuselage structure with four bolts, washers, spacers, and frangible clips. (See note above.) Torque bolts **45 TO 55** inch-pounds. Install clamp on crossover hose.

n. Install induction baffles (paragraph 2-128).

o. Close left and right side access panels below wings.

p. Remove jack.

q. Refuel helicopter and check for leaks (paragraph 1-3).

CAUTION

Do not allow cell to remain folded more than 30 minutes.

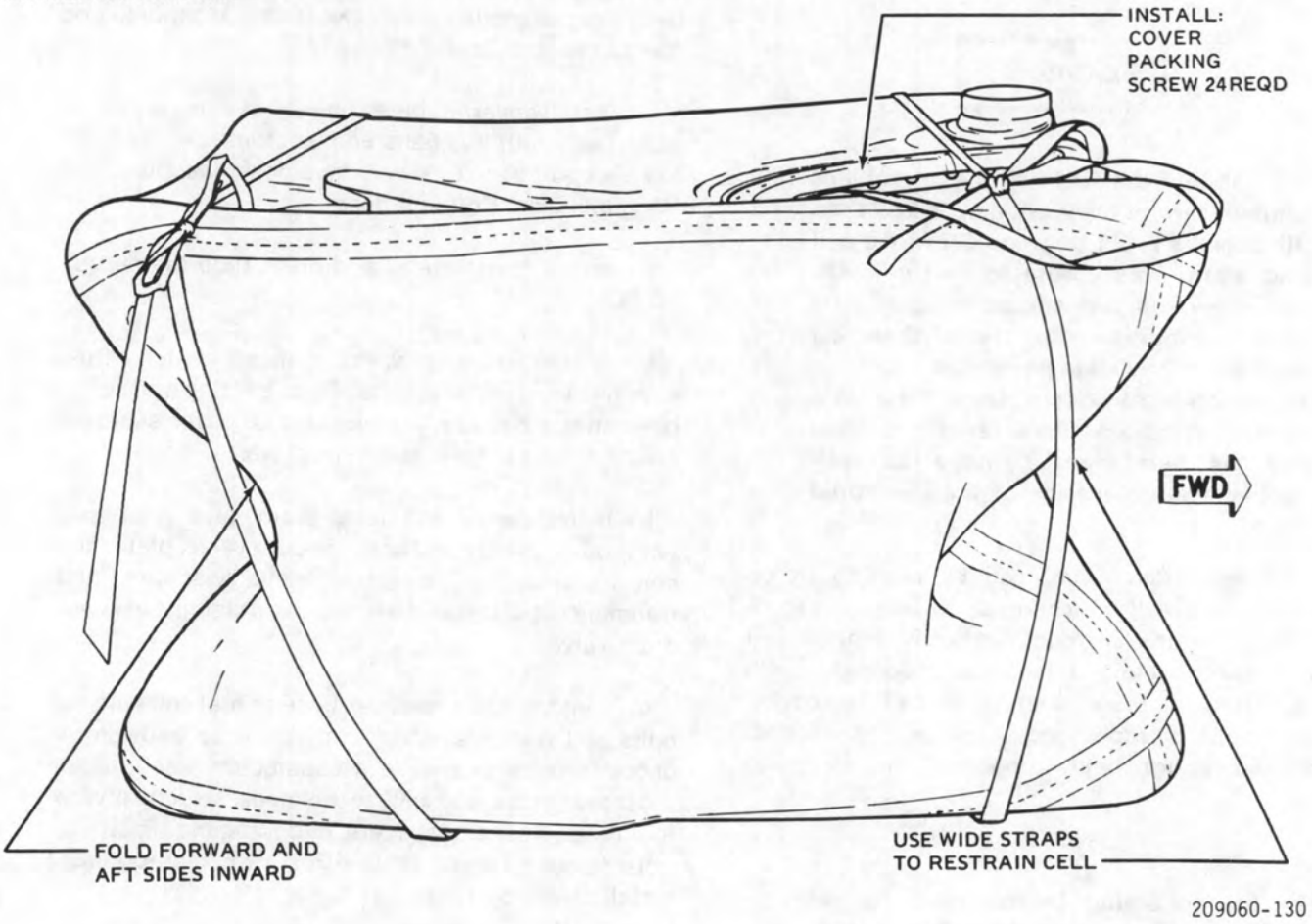


Figure 10-7. Collapsing Aft Fuel Cell

CHAPTER 11

FLIGHT CONTROLS

SECTION I. FLIGHT CONTROLS

11-1. FLIGHT CONTROL SYSTEM.

11-2. DESCRIPTION — FLIGHT CONTROL SYSTEM.

The primary flight control systems are the main rotor collective, fore-and-aft cyclic and lateral cyclic, and tail rotor controls. Each of these is a system of mechanical linkage, assisted by hydraulic cylinders, connecting the pilot and gunner control sticks and pedals to those mechanisms which rotate with and directly control the main rotor and tail rotor. Main rotor cyclic and tail rotor controls incorporate electrically operated magnetic brakes and force trims to steady the stick and pedals against movement of their own accord and to induce artificial control feel. The main rotor cyclic and tail rotor controls also incorporate a stability and control augmentation system (SCAS). The operator has the option to use the SCAS system or to turn it off at the SCAS control panel. A separate system of control linkage for operation of the synchronized elevator is attached to the fore-and-aft cyclic control at the swashplate.

11-3. TROUBLESHOOTING — FLIGHT CONTROL SYSTEM.

The following table is provided as an aid in adjusting cyclic and collective sticks for proper feel and tension.

NOTE

Before using this table, be sure all normal operational checks have been accomplished. If a malfunction is detected which is not listed in this table, notify the next higher maintenance level.

Table 11-1. Troubleshooting Flight Control System

CONDITION	TEST OR INSPECTION	CORRECTIVE ACTION
1. Collective stick light or heavy on downstroke.	STEP 1. Check balance spring on collective cylinder for proper adjustment (paragraph 11-7).	**If force is not equal, adjust balance spring (paragraph 11-7).**
	STEP 2. Check friction clamp and/or friction nut for proper adjustment (paragraph 11-16).	**If adjustments are not within limits, adjust friction clamp and nut (paragraph 11-16).**
2. Cyclic feels loose, has tendency to fall to left or right.		

Table 11-1. Troubleshooting Flight Control System (Cont)

CONDITION TEST OR INSPECTION	CORRECTIVE ACTION
STEP 1. Check friction nut adjustment.	**If friction nut is loose, adjust nut (paragraph 11-37).**
STEP 2. Check tension on force gradient spring.	**If tension is weak, replace spring (paragraph 11-68).**
3. Gunner cyclic stick will not remain in a fixed position.	
STEP 1. Check for a weak or damaged gunner longitudinal cyclic control spring in the gunner longitudinal cyclic controls.	**If spring is weak or damaged, replace spring (paragraph 11-159).**
STEP 2. Check for weak or damaged gunner lateral cyclic control springs in the gunner lateral cyclic controls.	**If springs are weak or damaged, replace springs (paragraphs 11-159).**
4. Flight controls binding.	
STEP 1. Check for obstructions or foreign objects.	**Reposition or remove obstructions. Remove foreign objects.**
STEP 2. Isolate binding component in collective system by detaching tube assemblies from bellcranks and collective sticks. Actuate each component to detect binding part.	**Remove, replace, or repair defective parts (paragraphs 11-145 and 11-148).**
STEP 3. Isolate binding component in cyclic system by detaching tube assemblies from bellcranks, cyclic sticks, magnetic brakes, and jackshaft. Actuate each component to detect binding part.	**Remove, replace, or repair defective parts (paragraphs 11-26 and 11-148).**
STEP 4. Isolate binding component in tail rotor control system by detaching tube assemblies from bellcranks and magnetic brake. Actuate each component to detect binding part.	**Remove, replace, or repair defective parts (paragraphs 11-71 and 11-148).**
STEP 5. Isolate binding component in elevator control system by detaching tube assemblies from bellcranks, walking beams and horn assembly. Actuate each component to detect binding part.	**Remove, replace, or repair defective parts (paragraphs 11-136 and 11-148).**

11-4. COLLECTIVE SYSTEM.

11-5. DESCRIPTION — COLLECTIVE SYSTEM.

The collective controls system includes gunner and pilot collective stick assemblies, tube assemblies, bellcranks, and a dual hydraulic cylinder. The hydraulic cylinder is connected to the collective lever which actuates the mast-mounted scissors and sleeve assembly to control pitch of the main rotor blades.

Premaintenance Requirements for Collective Controls

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	(S2)
Minimum Personnel Required	Two
Consumable Materials	(C43), (C138)
Special Environmental Conditions	N/A

11-6. INSPECTION — COLLECTIVE SYSTEM.

a. Inspect control system in place for secure installation, damage, chafing, and freedom of operation through full travel.

b. If required, remove components for detailed inspection. Refer to paragraphs 11-8, 11-17, and 11-145 thru 11-154.

11-7. RIGGING — COLLECTIVE SYSTEM.

a. Accomplish rigging without hydraulic power unless otherwise stated.

b. Install all components of the collective control system with the following exceptions:

(1) Leave hydraulic cylinder (2, figure 11-1) disconnected from collective lever (1).

(2) Leave tube assembly (5) disconnected from bellcrank (7).

(3) Leave tube assembly (6) disconnected from bellcrank (7).

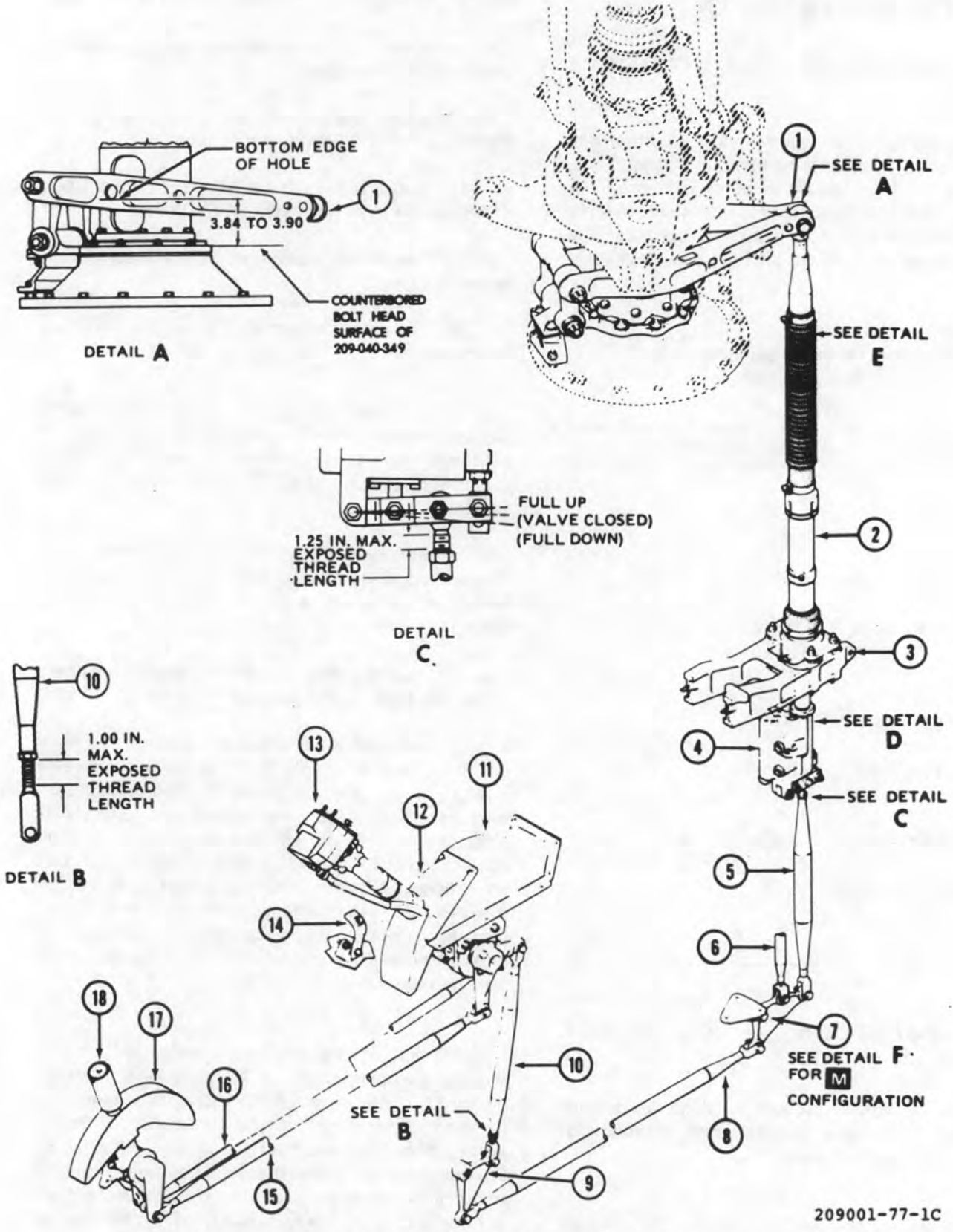
c. Adjust tube assembly (10) to length of **22.13** inches between clevis hole centers and install in helicopter. Coat clevis threads with corrosion prevention compound (C43) when adjusting tube assembly.

d. Check breakaway force on collective lever (1) and adjust friction collet on mast if required. Refer to paragraph 5-63i for correct breakaway force and procedure to adjust friction.

e. Place pilot collective control stick (13) full down and apply stick friction to hold in position.

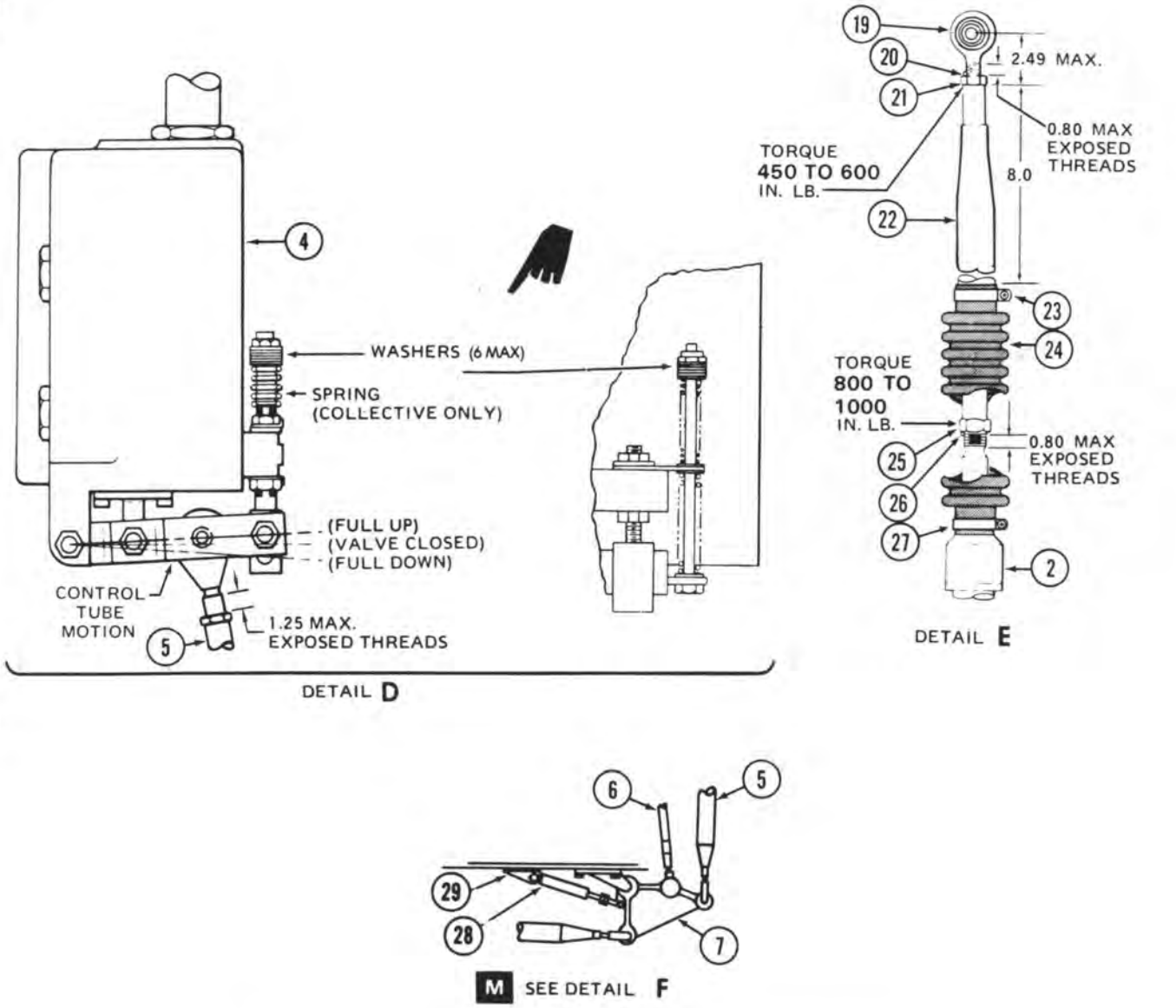
f. Loosen jamnut at upper end of tube assembly (5). Push tube assembly (5) up to bottom out valve lever in full up position (detail D). Hold pressure on tube assembly (5) to keep piston and valve lever bottomed in full up position. Bottom out piston against top of cylinder (2). Adjust length of tube to fit on bellcrank (7), then shorten length by three full turns to assure that piston will not bottom out during operation. Connect tube assembly (5) to bellcrank (7) and tighten jam nut on tube assembly. Valve lever will now be near full down position.

g. Check rod end on tube assembly (5) to ensure that there is not more than **1.25** inch exposed threads (detail C). If more than **1.25** inches of threads are exposed, adjust length of tube assembly (10). Do not exceed one inch of exposed threads on (10) (detail B). Ensure that nut and bolt that attaches control tube (5) to hydraulic cylinder valve (4) is tightened sufficiently to remove axial play only. Back off to first castellation. Do not clamp clevis. The bolt must turn freely and cotter pin must be installed.



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Figure 11-1. Collective Controls (Sheet 1 of 2)



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

1. Collective lever
2. Hydraulic cylinder assembly
3. Cylinder support
4. Hydraulic cylinder valve
5. Tube assembly
6. Droop compensator tube assembly
7. Bellcrank and support
8. Tube assembly
9. Bellcrank
10. Tube assembly
11. Cover
12. Boot
13. Pilot collective control stick
14. Down — lock strap
15. Tube assembly
16. Tube assembly
17. Boot
18. Gunner collective control stick
19. Rod end bearing
20. Lock
21. Nut
22. Extension tube
23. Clamp
24. Boot/flange assembly
25. Nut
26. Lock
27. Clamp
28. M Transducer
29. M Bracket

209001-77-2C

Figure 11-1. Collective Controls (Sheet 2 of 2)

h. Adjust extension tube (22), rod end bearing (19) and attach to collective lever as follows:

(1) Position collective lever (1, figure 11-1) to **3.84 TO 3.90** inch dimension as shown on detail A.

(2) Remove lockwire and loosen nut (21).

CAUTION

Maintain collective stick in full down position.

(3) Ensure that collective lever (1) is in position set in step (1). Push down on extension tube (22) with approximately **100** pounds of force until tube movement stops (approximately **0.060 TO 0.130** inch). Maintain this position and adjust rod end bearing (19) to fit on collective lever (1), then shorten one full turn of rod end bearing (19) to compensate for change that occurs when hydraulic power is applied.

(4) Measure exposed threads on rod end bearing (19). If lock (20) can be installed and if less than 0.80 inch of thread is exposed, torque nut (21) **450 to 600** inch-pounds, lockwire nut to lock (20) with lockwire (C138) and proceed to step (6). If there are insufficient exposed threads to install lock (20) or if exposed threads on rod end bearing (19) are in excess of 0.80 inch, make adjustment at nut (25) as outlined in step (5).

(5) If exposed threads on rod end bearing (19) were in excess of **0.80** inch in preceding step, make adjustment at nut (25) as follows:

(a) Thread rod end bearing (19) into tension tube (22) until **0.80** inch of threads are exposed. Torque nut (21) **450 TO 600** inch-pounds and lockwire to lock (20) with lockwire (C138).

(b) Loosen clamps (23) and (27). Slide boot (24) up until nut (25) is exposed. Remove lockwire and loosen nut (25).

CAUTION

Maintain collective stick in full down position.

(c) Ensure that collective lever (1) is at position set in step (1). Push down on extension tube (22) with approximately **100** pounds of force. Maintain this position and adjust extension tube (22) on hydraulic cylinder assembly (4) to length so rod end bearing (19) will fit on collective lever (1), then shorten one full turn of extension tube (22) to compensate for change that occurs when hydraulic power is applied.

(d) Tighten nut (25) and measure length of exposed threads, Maximum acceptable exposed thread is **0.80** inch.

(e) Torque nut (25) **800 TO 1000** inch-pounds and lockwire nut (25) to lock (26) with lockwire (C138).

(f) Position top of boot (24) **8.0** inches from top of extension tube (22) as shown on detail E and tighten clamp (23). Position lower end boot (24) on hydraulic cylinder assembly (2) and tighten clamp (27).

(6) Attach rod end bearing (19) to collective lever (1). Comply with procedure outlined in paragraph 7-66.

i. Check low pitch blade angle of main rotor to ensure it is within limits (paragraph 5-14).

j. Check complete collective control system for security and safetying of components.

k. Apply hydraulic power with ground test unit (S2). Check operation of controls through full range of travel. Check pilot collective control stick for correct friction adjustments (paragraph 11-16).

l. With a force gage (fish scale), check for approximate equal force required to raise or to lower collective control stick with hydraulic boost on. If necessary, adjust by adding or removing AN960-1C washers at top of spring on hydraulic cylinder valve (detail D). A maximum of six AN960-10 washers can be used.

m. Connect droop compensator tube assembly (6) to bellcrank (7).

n. Connect tube assembly (5) to bellcrank (7).

o. Connect hydraulic cylinder (2) to collective lever (1).

p. Install access covers.

WARNING

K747 main rotor blades have a tendency to attain a higher percent RPM during autorotation than B540 main rotor blades. DO NOT RIG beyond the limits established in paragraph 5-14, to obtain a lower main rotor percent RPM.

q. Perform maintenance test flight (TM 55-1520-236-MTF).

11-8. PILOT COLLECTIVE STICK.

11-9. DESCRIPTION — PILOT COLLECTIVE STICK.

The pilot collective control stick is on the left side console. There is a split switch box at the top with an electrical cable extending down past the base of the stick. A support assembly at the base of the collective stick houses the collective friction shoes, a collective lever and a throttle lever. Located between the base of the stick and the top is a throttle friction nut, throttle grip, collective friction nut, and a boot and support assembly. A strap (14, figure 11-1) is provided to secure the control stick in low pitch position. The pilot collective stick has a mechanical advantage of **1.1 TO 1** ratio over the gunner collective stick.

Premaintenance Requirements for Pilots Collective Stick

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T61)
Test Equipment	None
Support Equipment	(S2)
Minimum Personnel Required	Two
Consumable Materials	(C5), (C31), (C37), (C88), (C91), (C102), (C112), (C138)
Special Environmental Conditions	None

11-10. REMOVAL — PILOT COLLECTIVE STICK (AVIM).

a. Remove cover (4, figure 11-2) with attaching screws (2) and washers (3).

b. Remove screw-mounted panel (figure 2-3) from left side of fuselage for access to lower end of stick assembly.

c. Disconnect collective system tube assemblies (8, figure 11-2) from collective lever (5) and throttle system tube assemblies (7) from throttle lever (6), by removing bolts, nuts, and washers.

d. Disconnect electrical cable connector (19).

e. Remove bolt (11), screw (12), nuts (15), washers (14), and shims (13) which secure outboard stick support (9) to structure. Measure and record thickness of shims (13). Tag shims (13) for installation in same location.

f. Remove three bolts (16), washers and shim (18) from inboard support (10). Measure and record thickness of shim (18). Tag shim for installation in same location.

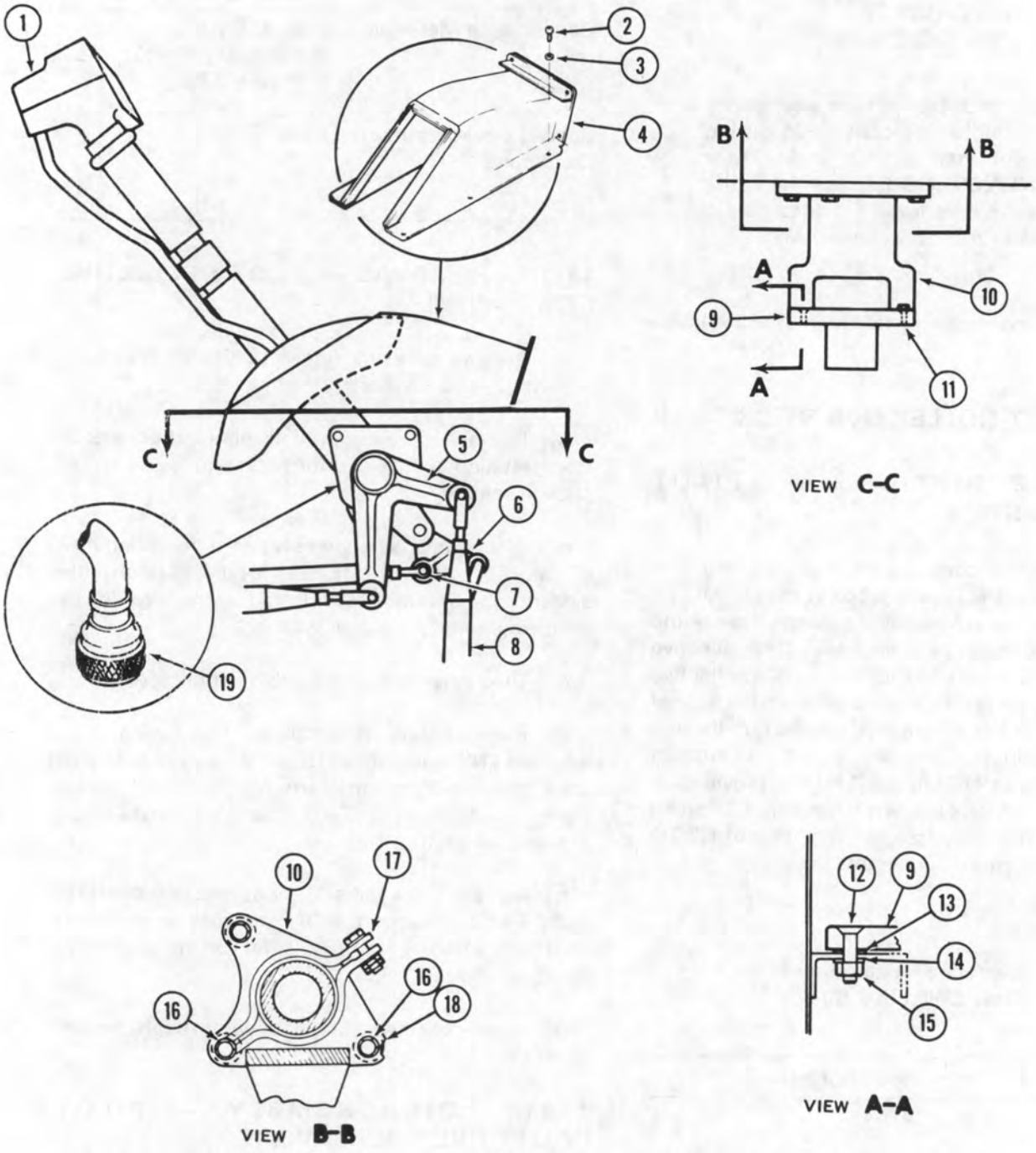
g. Move collective stick (1) down through console to remove from helicopter.

11-11. DISASSEMBLY — PILOT COLLECTIVE STICK (AVIM).

a. Remove six countersunk screws (3, figure 11-3) attaching forward and aft boots (4 and 27) to boot support assembly (25). Remove boots.

b. Remove nuts (18), washers (16 and 17), and two bolts (15) that attach collective lever assembly (19) to elbow assembly (20). Pull lever off elbow.

c. Disconnect plug in electrical harness (5).



1. Collective stick
2. Screw
3. Washer
4. Cover
5. Collective lever
6. Throttle lever
7. Throttle tube assembly
8. Collective tube assembly
9. Outboard support
10. Inboard support
11. Bolt
12. Screw
13. Shim
14. Washer
15. Nut
16. Bolt
17. Friction clamp
18. Shim
19. Cable connector

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Figure 11-2. Pilot Collective Stick Installation

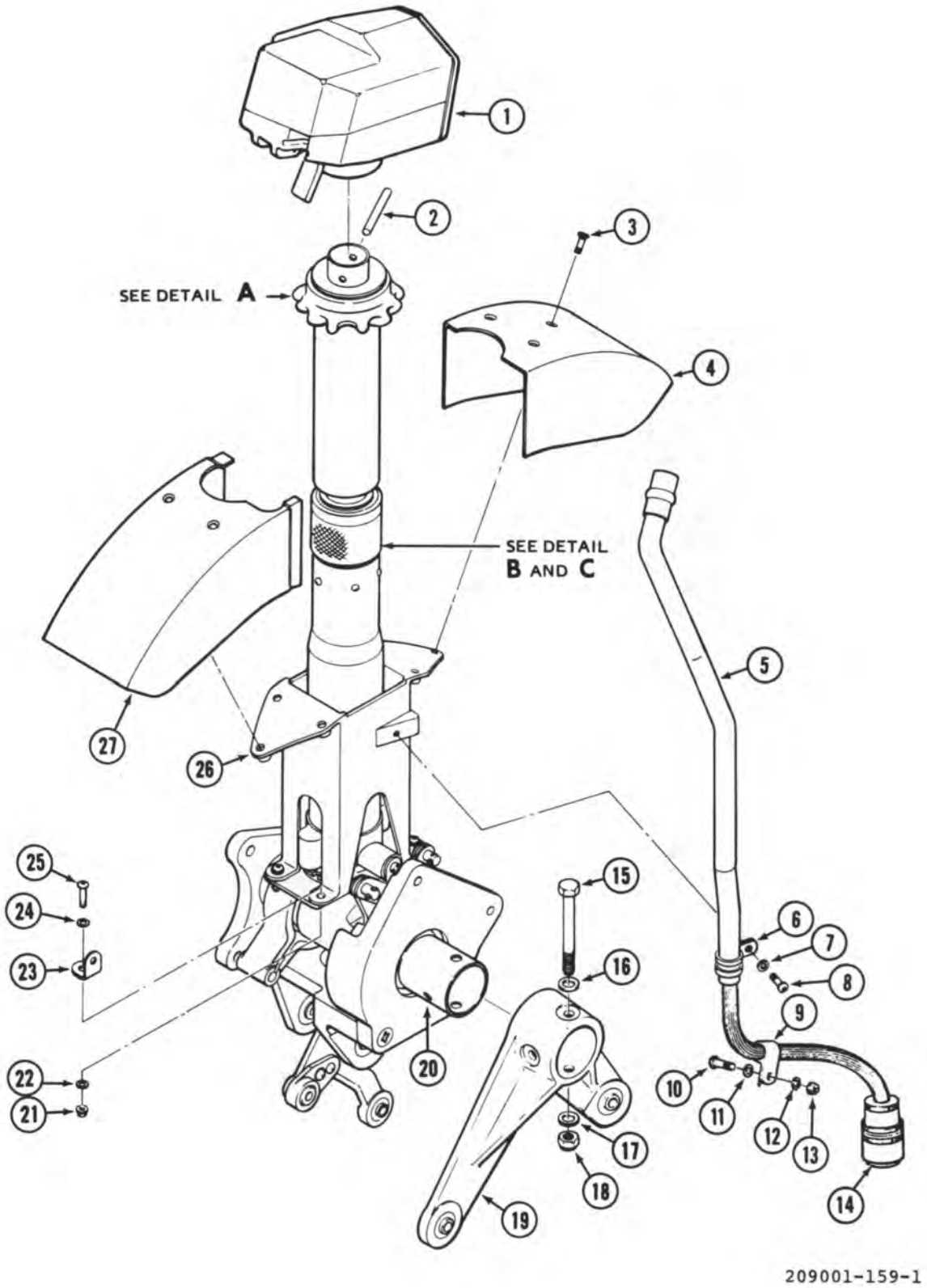
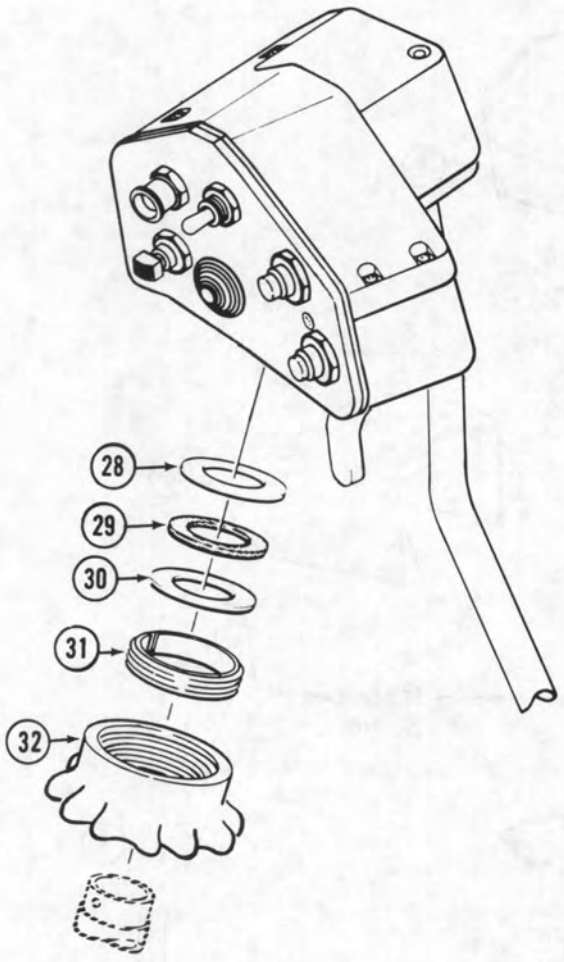


Figure 11-3. Pilot Collective Stick Assembly (Sheet 1 of 4)



DETAIL **A**

1. Control head
2. Pin
3. Screw
4. Boot, aft
5. Electrical harness
6. Clamp
7. Washer
8. Screw
9. Clamp
10. Screw
11. Washer
12. Washer
13. Nut
14. Electrical connector
15. Bolt
16. Washer
17. Washer
18. Nut
19. Lever assembly
20. Elbow assembly
21. Nut
22. Washer
23. Bracket
24. Washer
25. Screw
26. Boot support assembly
27. Boot forward
28. Washer
29. Washer
30. Washer
31. Friction screw
32. Nut

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Figure 11-3. Pilot Collective Stick Assembly (Sheet 2 of 4)

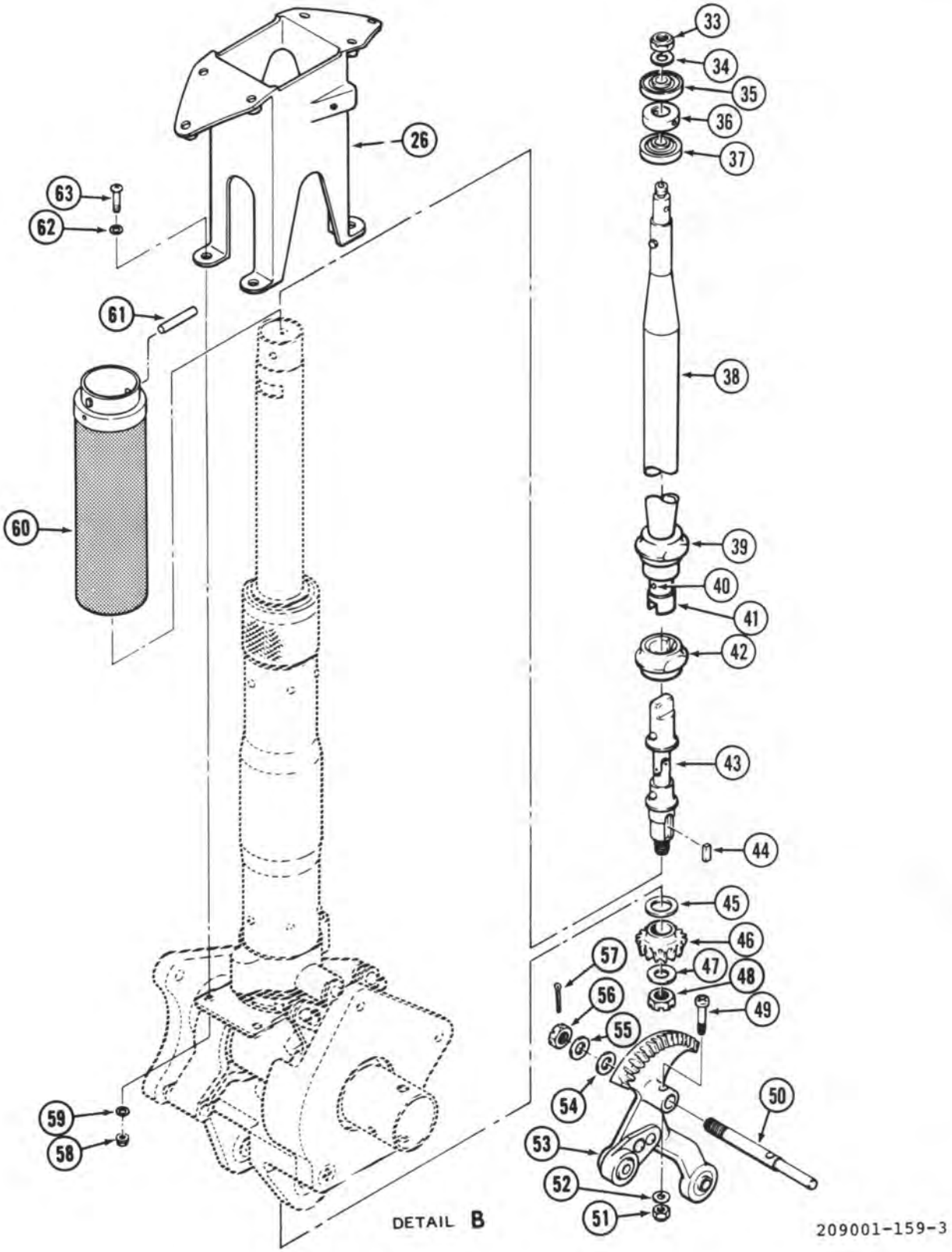
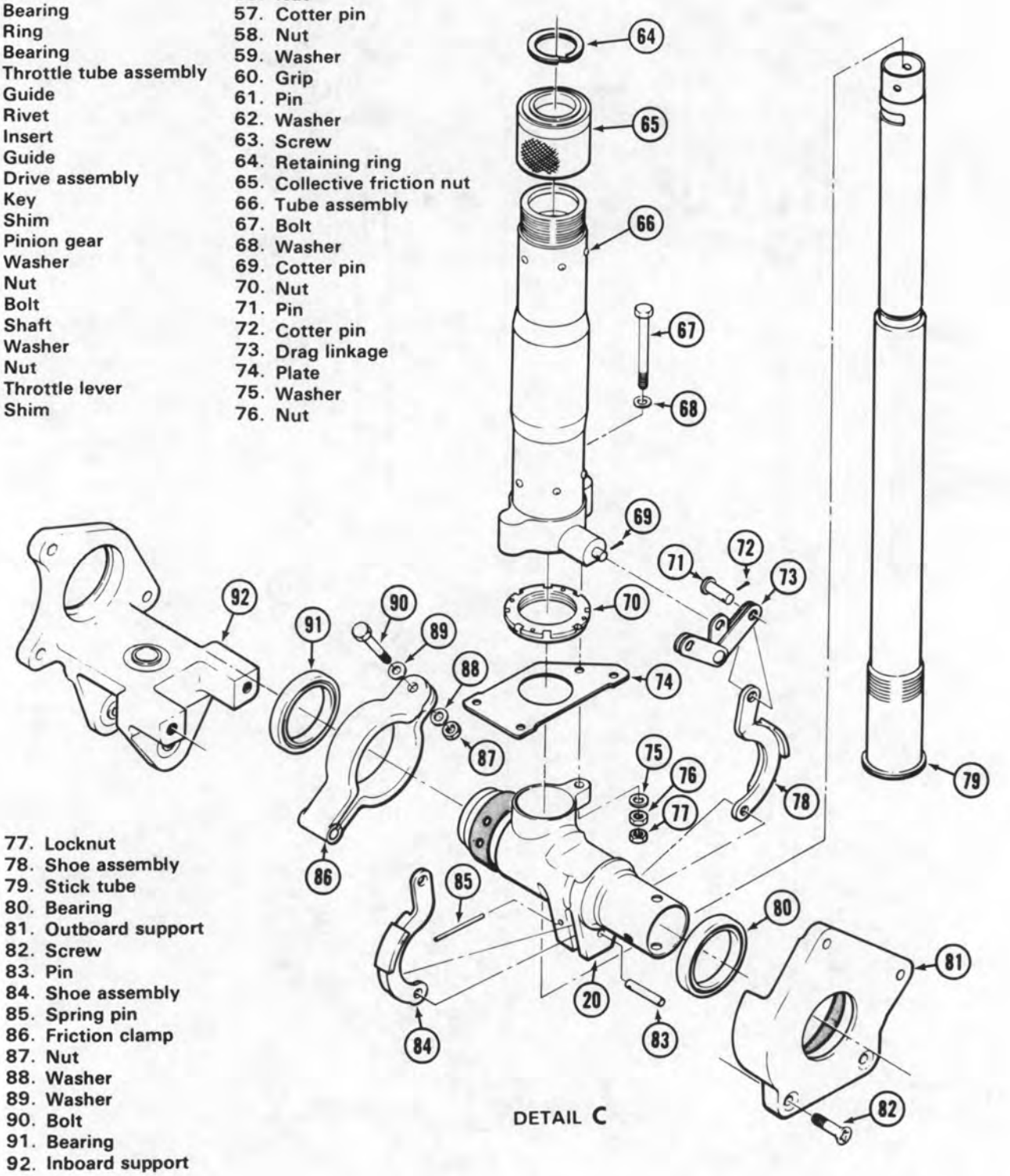


Figure 11-3. Pilot Collective Stick Assembly (Sheet 3 of 4)

33. Nut
34. Washer
35. Bearing
36. Ring
37. Bearing
38. Throttle tube assembly
39. Guide
40. Rivet
41. Insert
42. Guide
43. Drive assembly
44. Key
45. Shim
46. Pinion gear
47. Washer
48. Nut
49. Bolt
50. Shaft
51. Washer
52. Nut
53. Throttle lever
54. Shim
55. Washer
56. Nut
57. Cotter pin
58. Nut
59. Washer
60. Grip
61. Pin
62. Washer
63. Screw
64. Retaining ring
65. Collective friction nut
66. Tube assembly
67. Bolt
68. Washer
69. Cotter pin
70. Nut
71. Pin
72. Cotter pin
73. Drag linkage
74. Plate
75. Washer
76. Nut



77. Locknut
78. Shoe assembly
79. Stick tube
80. Bearing
81. Outboard support
82. Screw
83. Pin
84. Shoe assembly
85. Spring pin
86. Friction clamp
87. Nut
88. Washer
89. Washer
90. Bolt
91. Bearing
92. Inboard support

Figure 11-3. Pilot Collective Stick Assembly (Sheet 4 of 4)

d. Remove screw (10), washers (11 and 12), and nut (13) attaching electrical harness (5) to bracket (23). Remove screw (8) and washer (7) attaching electrical harness to boot support (26).

e. Remove pin (2) and lift control head (1) and electrical harness (5) from pilot collective stick.

f. Slide washers (28, 29 and 30), friction screw (31) and throttle friction nut (32) from stick tube (79).

g. Remove screw (25), washers (22 and 24), nut (21), and bracket (23).

h. Remove screw (63), washers (59 and 62), and nuts (58). Slide boot support assembly (26) from control stick.

i. Remove nut (51), washer (52), and bolt (49). Remove cotter pin (57), nut (56), washer (55), and shims (54). Measure thickness of shims and tag for installation at same location. Press shaft (50) from outboard support (81) and remove throttle lever assembly (53).

j. Remove nut (48), and washer (47), pinion gear (46), key (44) and shim (45) from drive assembly (43). Measure and record thickness of shim (45). Tag shim for installation in same location.

k. Rotate grip assembly (60) until pin (61) appears in small hole in grip assembly. Remove pin and slide grip assembly from stick tube (79).

l. Press drive assembly (43), guide (42), and throttle tube assembly (38) with attached hardware from stick tube (66). Separate drive assembly, guide and throttle tube assembly.

m. Remove nut (33), washer (34), bearings (35 and 37), and ring (36) from throttle tube assembly (38).

n. Remove two countersunk screws (82). Pull outboard support assembly (81) off elbow assembly (20). Pull inboard support assembly (92) off elbow assembly. Remove bearings (80 and 91) if bearings or supports (81 or 82) are unserviceable. Refer to TM 55-1500-204-25/1.

o. Remove nut (87), washers (88 and 89), and bolt (90) from friction clamp (86). Slide clamp off elbow assembly (20).

p. Remove spring pin (85) and pin (83). Remove cotter pin (69), drag linkage (73, and shoe assemblies (78 and 84) from tube assembly (66) and elbow assembly (20). Separate drag linkage from shoe assemblies by removing cotter pin (72) and pins (71).

q. Remove two nuts (76 and 77), washers (68 and 75), and bolt (67). Remove retaining ring (64). Separate collective friction nut (65) from tube assembly (66) and remove both items from stick tube (79).

r. Cut safety wire and remove nut (70) and plate (74) from stick tube (79). Press stick tube out through base of elbow assembly (20).

11-12. INSPECTION — PILOT COLLECTIVE STICK.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

a. Clean exposed surfaces by wiping with dry cloth dampened with solvent (C112). Do not allow solvent to enter bearings.

b. Visual inspection:

(1) All threaded areas for thread damage.

(2) Inspect all bearings in accordance with TM 55-1500-204-25/1 and for wear that exceeds **0.005** inch radial or **0.030** inch axial.

(3) All bolt holes for wear, maximum allowable **0.005** inch.

(4) All items for corrosion and mechanical damage. Maximum allowable **0.005** inch for corrosion and **0.010** inch for mechanical. Inspect for dents or distortions that would affect operation.

(5) All items for cracks or broken parts.

(6) All pins for grooving.

(7) Gears for broken or damaged teeth.

c. Fluorescent penetrant inspect to verify suspected flaws found during visual inspection of control head (1, figure 11-3), inboard support (92), outboard support (81) and elbow (20) in accordance with TM 43-0103.

d. Magnetic particle inspect to verify suspected flaw found during visual inspection of stick tube (79) in accordance with TM 43-0103.

11-13. REPAIR OR REPLACEMENT — PILOT COLLECTIVE STICK (AVIM).

a. Replace all damaged components unless covered by a specific repair.

b. Repair mechanical and corrosion damage as follows:

WARNING

The chemical film material is extremely dangerous. Contact with combustible materials will cause explosion or fire. Avoid contact with skin or eyes.

NOTE

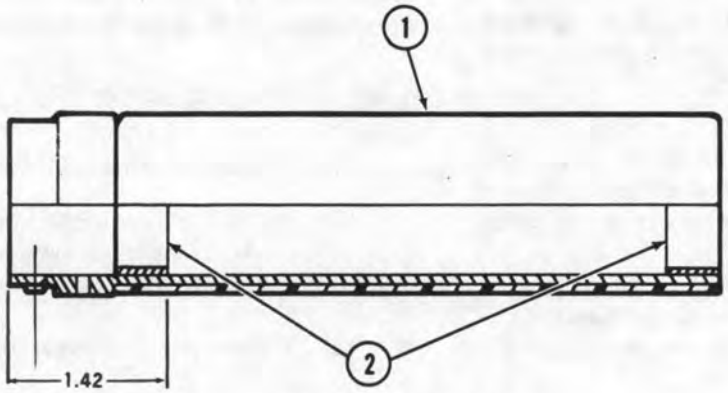
Maximum allowable repair of mechanical and/or corrosion damage within distance of one diameter from edge of hole is 25 percent of area.

(1) Use fine to medium grades of sandpaper (C102) or crocus cloth (C37). Do not use grinding wheels. Polish out mechanical damage only deep enough to remove traces of damage. Polish out corrosion damage to twice the depth of the deepest pit. Do not remove more material than necessary to blend repair smoothly into surrounding surface.

(2) Touch up repair area on aluminum parts with chemical film (C31) and primer (C88 or C91). Touch up repair area on steel parts with primer (C88 or C91).

c. Repair of throttle grip (1, figure 11-4) is limited to replacement of bearings (2). Remove and replace bearings in accordance with TM 55-1500-204-25/1. Position base upper bearing **1.42** inch from upper end of grip.

d. Repair of throttle tube is authorized at next higher maintenance level.



1. **Grip assembly**
2. **Bearings**

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

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Figure 11-4. Bearing Installation — Pilot Throttle Grip

e. Replace damaged threaded inserts in accordance with TM 55-1500-204-25/1 and as follows:

(1) Remove damaged helical coil insert with extraction tool or other suitable tool. Clear hole of all metal chips. Check threads with helical coil gage.

(2) Determine inserting tool of correct size. Install helical coil insert until top of coil of insert is one-quarter to one-half turn below start of tapped threads. Break tang with long-nosed pliers or other suitable tool. Ensure that tang is removed from hole.

(3) After repair, ensure that threads will take required torque.

f. Replace friction linings as follows (figure 11-5):

(1) Drill rivets from worn linings and remove linings (2 and 4) from support (1) or elbow (5).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

(2) Wipe bonding area on replacement linings (2 and 4), elbow (5), and support (1) with solvent (C112). Lightly sand the faying surfaces of linings, elbow, and support with 400 grit sandpaper (C102). Remove residue with solvent.

(3) Mix by weight, 6 parts of activator to 100 parts of adhesive (C5). Adhesive shall be used within **thirty** minutes after mixing.

(4) Apply mixed adhesive to faying surface of linings (2 and 4), elbow (5), and support (1). Join detail parts while adhesive is tacky and within pot life time. Ensure proper alignment of parts and avoid trapping air within the bondlines. Clean off adhesive squeeze-out prior to curing. Cure for **24** hours at **70 TO 95** degrees F (**21 TO 35** degrees C) maximum strength obtained in **7** days, or using a properly regulated source of heat, cure bond at **160 TO 170** degrees F (**71 TO 77** degrees C) for **115** minutes with firm contact to **10** psi applied to parts.

(6) Drill two No. 40 holes in each support lining (2) and three No. 40 holes in elbow lining (4). Countersink holes 100 degrees to a sufficient depth to allow rivet head to be installed **0.030** inch below surface of lining. Rivet linings (2 and 4) to elbow (5) and support (1) using MS20426AD3 rivets.

g. Replace bearing in throttle lever (2, figure 11-6) in accordance with TM 55-1500-204-25/1 and as follows:

CAUTION

Repair is limited to one time. Replace lever if second repair is required.

(1) Remove damaged bearing (1).

(2) Install new bearing.

CAUTION

Stake depth must not exceed 0.010 inch.

(3) Segment stake bearing in three places on both sides. Place new stake 60 degrees from old stake.

h. Replace bearings in collective lever as follows (figure 11-36):

NOTE

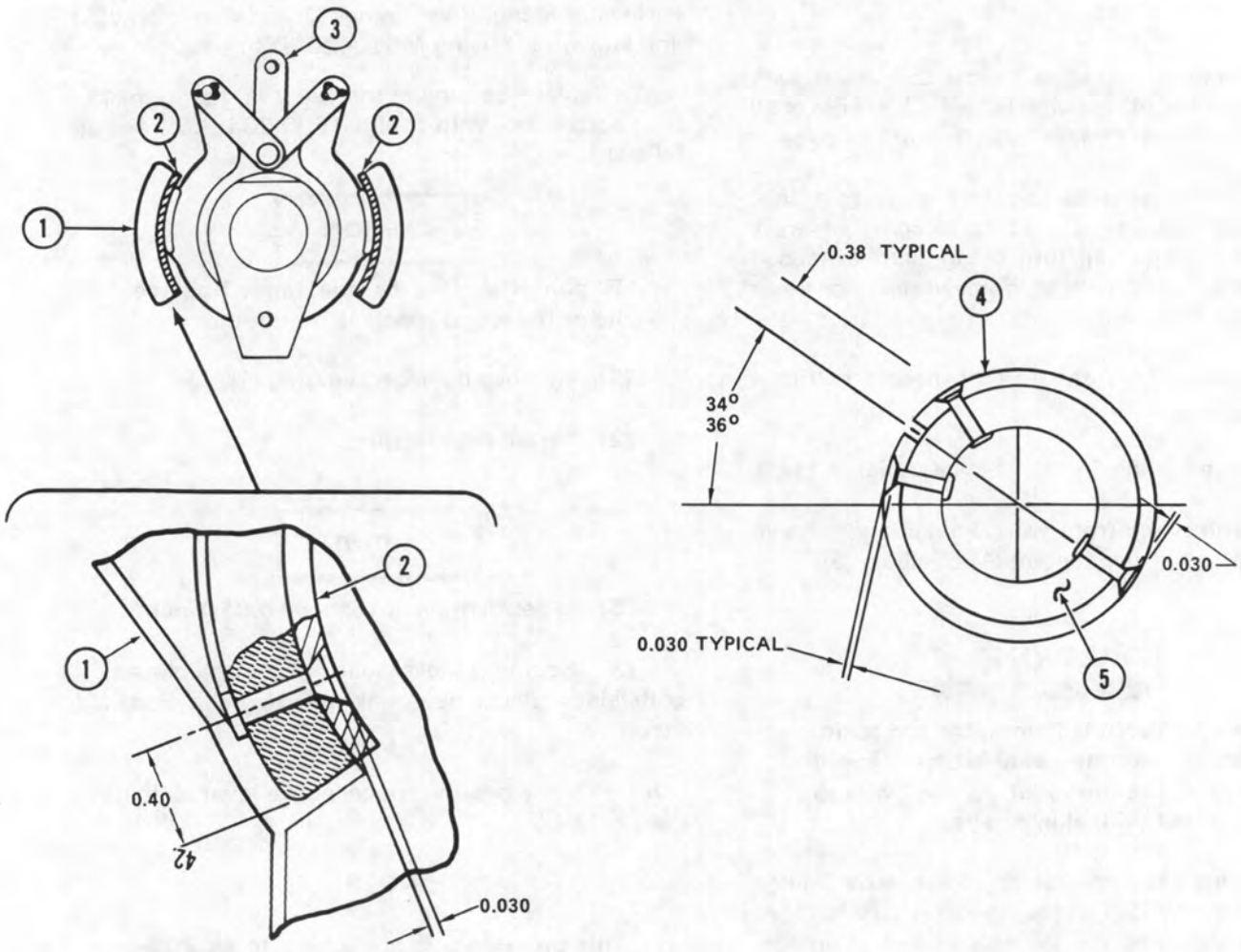
This procedure is applicable to all 209-001-051-1 bearings.

(1) Remove the staked lip from around one side of the old bearing by either filing or machining. Use care as not to damage ears of lever. Press old bearing from lever.

(2) Apply primer (C88 or C91) to outer race of new bearing and install new bearing in lever while primer is wet.

(3) Using anvil bearing staking tool set (T61) and suitable press, lay over the outer lip of the pre-grooved race onto the chamfer of the lever housing without touching the inner lip of the bearing or cause any cutting action on the outer lip.

(4) Ensure that after staking there is no more than **0.008** inch gap between the outer housing chamfer of lever and the staked lip on both side of bearing (figure 11-36).



ALL DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE NOTED.

1. Outboard support
2. Support friction lining
3. Drag link assembly
4. Elbow friction lining
5. Elbow

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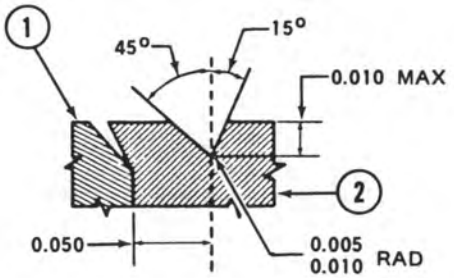
Figure 11-5. Friction Lining Repair



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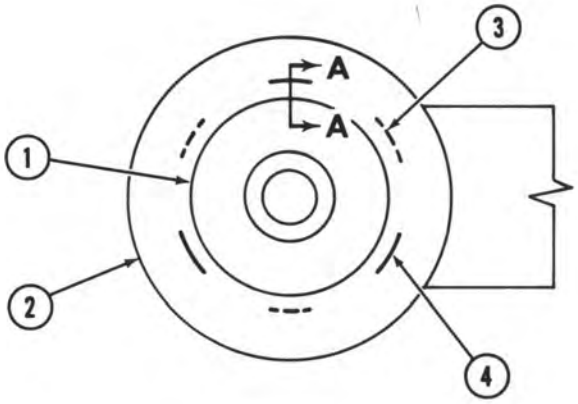

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

1. Bearing
2. Throttle lever
3. Old segment stake 120 degrees apart
4. New segment stake 120 degrees apart and 60 degrees from old segment stake

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Figure 11-6. Throttle Lever Bearing Installation

i. Collective friction tube repair is limited to replacing the connector assembly (figure 11-7).

(1) Drill out six rivets (3) attaching connector assembly (1) to tube (2).

(2) Install new connector with base **1.73** inches from centerline of rivet holes.

(3) Drill six No. 40 holes in connector using tube as template. Rivet tube to connector.

j. Replace worn or damaged nutplates on boot support assembly in accordance with TM 55-1500-204-25/1.

11-14. ASSEMBLY — PILOT COLLECTIVE STICK (AVIM).

a. Insert stick tube (79, figure 11-3) up through elbow assembly (20). Place flat spot, at base of stick tube, inboard.

NOTE

Use bolt (67) to maintain plate (74) and elbow assembly (20) alignment while tightening nut (70).

b. Install plate (74) and nut (70) on stick tube (79). Tighten nut and secure with lockwire (C138).

NOTE

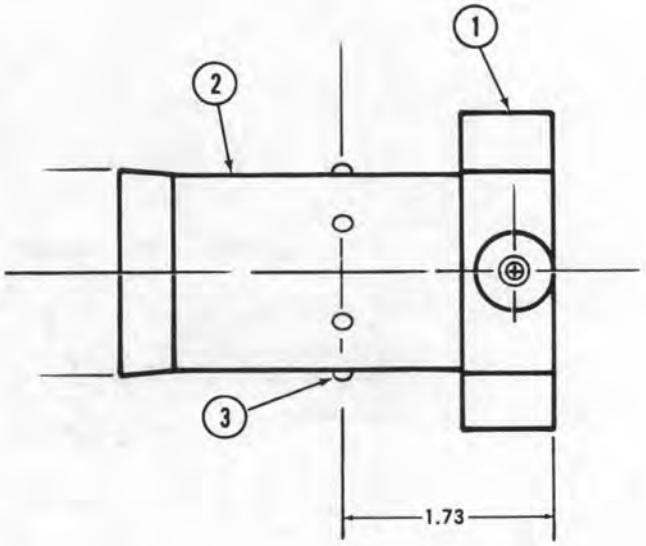
Do not tighten nuts (76 and 77). Nuts will be tightened during collective friction adjustment.

c. Screw collective friction nut (65) on tube assembly (66). Install both items and retaining ring (64) on stick tube. Align hole in base of tube assembly with hole in plate (74). Install bolt (67) with washers (68 and 75) through hole in tube assembly (66), plate (73), and elbow assembly (20). Install two nuts (76 and 77) on bolt (67).

NOTE

Pins (71) must be inserted from inboard side.

d. Attach drag link assembly (73) to shoe assemblies (78 and 84) with pins (71). Secure with cotter pins (72).



1. **Connector assembly**
2. **Tube**
3. **Rivets, MS20470B3, six each**

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

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Figure 11-7. Collective Friction Tube Repairs

e. Install drag link assembly (73) on connector at base of tube assembly (66). Secure with cotter pin (69).

f. Place shoe assemblies (78 and 84) into slot in elbow assembly (20) and secure with pin (83). Secure pin (83) with spring pin (85).

NOTE

Do not tighten nut (87). Nut will be tightened during collective friction adjustment.

g. Install bolt (90, figure 11-3), washers (88 and 89) and nut (87) on clamp (86). Place clamp on inboard side of elbow assembly (20) with bolt up and aft.

h. Install inboard support assembly (92) and outboard support assembly (81) on elbow (20). Attach outboard support to inboard support with two countersunk screws (82).

NOTE

Install bearings (80 and 91) in supports (80 and 91) if removed during disassembly.

i. Install ring (34), bearings (35 and 37), washer (34) and nut (33) on throttle tube assembly (38). Align large hole in ring with hole in throttle tube.

j. Mate drive assembly (43), guide (42), and throttle tube assembly (38). Insert mated components into stick tube (79), drive assembly first.

k. Install grip assembly (60) on stick tube (79). Align large hole in grip assembly with large hole in ring (36) and throttle tube (38). Install pin (61) through grip, ring, and throttle tube.

l. Install shim (45) tagged during disassembly, key (44), pinion gear (46), washer (47) and nut (48) on drive assembly (43).

NOTE

Check for smooth operation by rotating grip (60) through full travel.

m. Install shim (54, figure 11-3), tagged during disassembly, and throttle lever assembly (53) on shaft (50). Position throttle lever with gear teeth facing small end of shaft.

n. With throttle grip (60) set at midtravel, match centerline of throttle lever gear (53) to pinion gear (46). Install shaft (50) into inboard support assembly (92) and secure with washer (55), nut (56), and cotter pin (57). Secure throttle lever to shaft bolt (49), washer (51), and nut (52).

o. Check mating between pinion gear (11, figure 11-8) and throttle lever gear (10). Surfaces of gear teeth should be flush within **0.020** inch. If pinion gear rides too high on lever gear, remove shim from point C and add to point B. If pinion gear rides too low on lever gear, remove shim from point B and add to point C. Continue procedure until required dimension is obtained.

p. Adjust throttle breakaway force. Refer to paragraph 11-16.

NOTE

Rotate throttle grip through full travel to ensure throttle lever is centered on pinion gear.

q. Attach boot support assembly (26, figure 11-3) to plate (74) with screws, washers, and nuts (58). Position bracket (23) on left forward leg of boot support assembly, and secure with screw (25), washers (22 and 24) and nut (21).

r. Install throttle friction nut (32, figure 11-3), friction screws (31), washers (28 and 30), washer (31), and assembled control head on stick tube (79). Secure components to stick tube with pin (2).

s. Attach electrical cable (5) to boot support (25), with screw (8), washer (7), and clamp (6). Attach cable to bracket (22) with bolt (15), washers (11 and 12), nut (13), and clamp (9).

t. Install collective lever assembly (19) on elbow assembly (20) with arms down. Secure with bolts (15), washers (16 and 17) and nuts (18).

u. Attach forward and aft boots (4 and 27) to boot support (26) with six countersunk screws (3).

11-15. INSTALLATION — PILOT COLLECTIVE STICK (AVIM).

a. Install collective stick (1, figure 11-2) up through console.

b. Attach inboard support (10) to airframe with bolts (16) and washers. Lower bolt also passes through friction clamp (17). Shim (18) as required between support and airframe at upper right hand bolt.

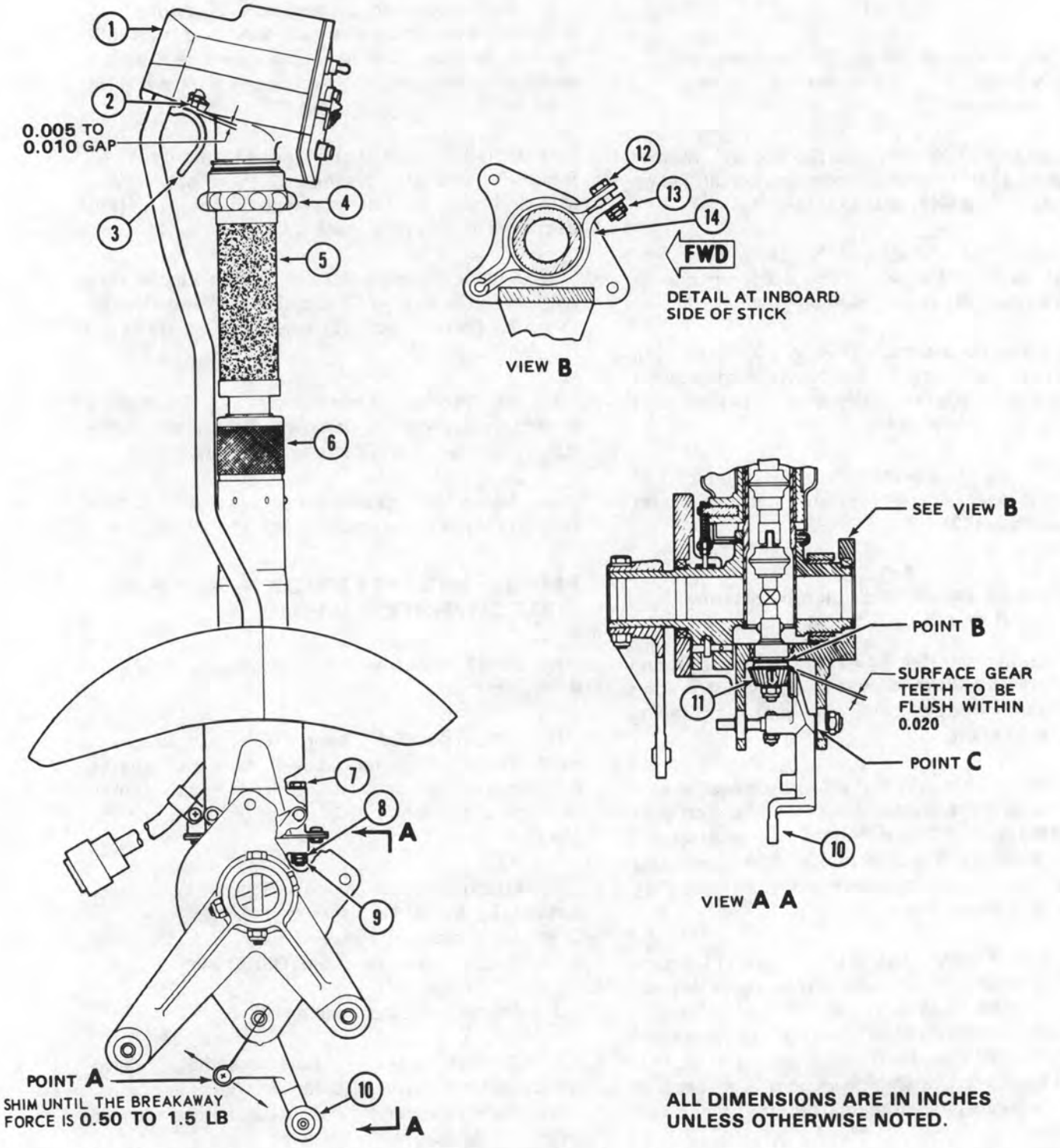
c. Attach outboard support (9) to airframe with screw (12), bolt (11), washers (14), and nuts (15). Shim (13) as required between outboard support and airframe to a maximum gap of **0.003** inch.

d. Connect electrical cable (19).

e. Connect collective tube assembly (8) to collective lever (5) with bolts, washers, and nuts. Place one washer under bolt head and one washer under nut. Secure nut with cotter pin.

f. Connect throttle tube assembly (7) to throttle lever (6) with bolt inboard, washers, and nut. Place steel washer under bolt head and stainless steel washer under nut. Secure nut with cotter pin.

g. Adjust collective friction settings (paragraph 11-16).



1. Control head
2. Plunger
3. Trigger
4. Throttle friction nut
5. Throttle grip
6. Collective friction nut
7. Tension bolt
8. Upper nut
9. Lock nut
10. Throttle lever
11. Pinion gear
12. Bolt
13. Nut
14. Friction clamp

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Figure 11-8. Pilot Collective Stick Adjustments

h. Install access panels.

i. Install collective stick cover (4).

j. Check collective rigging (paragraph 11-7).

k. Check power lever control rigging (paragraph 4-105).

l. Perform maintenance test flight (TM 55-1520-236-MTF).

11-16. ADJUSTMENT — PILOT COLLECTIVE STICK.

a. Adjust pilot collective stick friction to set minimum and maximum friction loads as follows: (figure 11-8).

(1) Apply hydraulic power with hydraulic test stand (S2).

(2) Set minimum stick friction as follows:

(a) Place pilot collective stick at approximate midtravel position.

(b) Fully loosen collective friction nut (6, figure 11-8).

(c) Attach a force gage (fish scale) to grip (5) within **0.5** inch of center and perpendicular to stick grip (check for breakaway force of **9 TO 11** pounds).

(d) If breakaway force is not within limits, remove cover and adjust bolt (12) and nut (13) on friction clamp (14) to obtain breakaway force within limits.

CAUTION

Maximum stick friction must be set within limits to ensure that the gunner collective stick can be moved when the pilot friction nut (6) is fully tightened.

(3) Set maximum stick friction as follows:

(a) Place pilot collective stick at approximate midtravel position.

(b) Loosen nuts (8 and 9) on tension bolt (7).

(c) Attach a force gage (fish scale) to stick grip within **0.5** inch of center and perpendicular to stick grip. Check for breakaway force of **14 TO 16** pounds. If breakaway force is not within limits, adjust friction nut (6) to obtain breakaway force within limits.

(d) Tighten upper nut (8, figure 11-8) on tension bolt (7) fingertight and secure with lock nut (9). Recheck breakaway force to ensure that it is within limits.

(e) Disconnect hydraulic power ground test unit.

(f) Check for security and safetying of collective control stick components.

(g) Ensure that gunner collective stick can be moved when pilot collective friction nut (6) is fully tightened.

b. Adjust throttle breakaway force as follows:

NOTE

Steps (1), (2), (7), and (8) will be followed if collective stick is installed in helicopter.

(1) Remove left side access panel.

(2) Disconnect throttle tube assembly from throttle lever (10, figure 11-8).

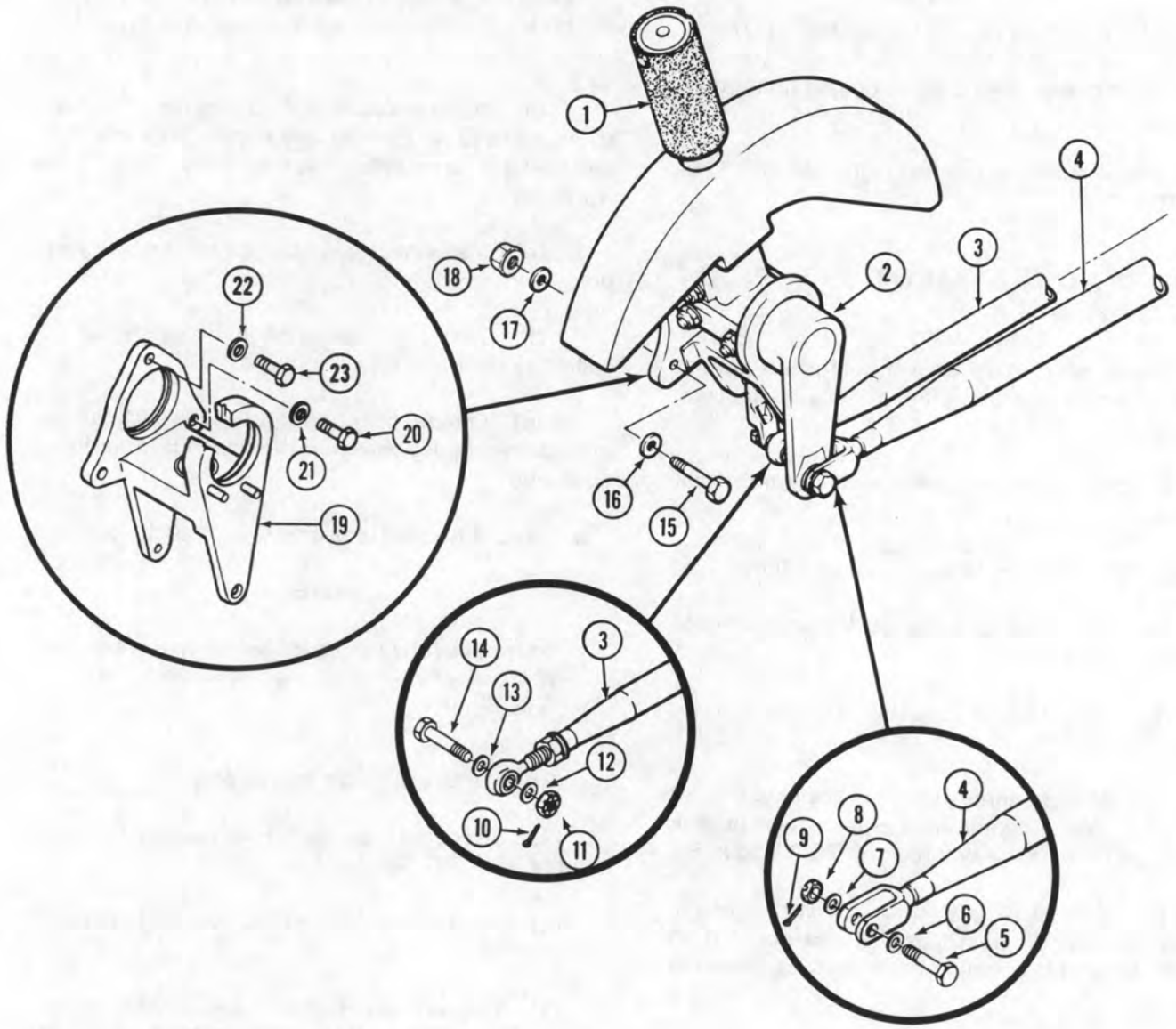
(3) Set throttle friction nut (4) to minimum friction setting.

(4) Measure breakaway force at point A on lever (10). Use a spring scale to apply force in direction illustrated by arrows.

NOTE

It is necessary to equally add or remove laminations of shims at points B and C because tooth surfaces on pinion (11) and lever (10) must remain flush within 0.020 inch.

(5) Add or remove shims at points B and C to obtain a breakaway force of **0.50 TO 1.50** pounds. Refer to paragraph 11-11 for shim removal and paragraph 11-14 for shim installation.



1. Collective stick
2. Collective lever
3. Tube assembly (throttle)
4. Tube assembly (collective)
5. Bolt
6. Washer
7. Washer
8. Nut
9. Cotter pin
10. Cotter pin
11. Nut
12. Stainless steel washer
13. Washer
14. Bolt
15. Bolt
16. Washer
17. Washer
18. Nut
19. Support assembly
20. Bolt
21. Washer
22. Washer
23. Bolt

Figure 11-9. Gunner Collective Stick Installation

(6) Repeat step (4) to determine whether breakaway force is now within tolerance. If necessary, repeat shimming procedure.

(7) Connect throttle tube assembly to throttle lever (10) (paragraph 11-15).

(8) Install access covers.

11-17. GUNNER COLLECTIVE STICK.

11-18. DESCRIPTION — GUNNER COLLECTIVE STICK.

The collective control mounted in the gunner left side console is a dual control for occasional or emergency use. It has only the essential functions of collective pitch and throttle control. There are no electrical switches. Because of the difference in length of the pilot and gunner collective stick more force (**1.1 to 1** ratio) is required to move gunner collective stick than is required to move pilot collective stick.

Premaintenance Requirements for Gunner Collective Stick

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C112), (C137)
Special Environmental Conditions	None

11-19. REMOVAL — GUNNER COLLECTIVE STICK (AVIM).

a. Remove screw-mounted panel from left side of fuselage above ammunition compartment for access to lower end of control stick.

b. Disconnect collective system tube assembly (4, figure 11-9) from collective lever (2), and throttle system tube assembly (3) from throttle lever of control stick.

c. Remove bolts (15 and 20), washers (16, 17, and 21), and one nut (18) that attach support assembly (19) to airframe. Loosen bolt (23).

NOTE

Bolt (23) and washer (22) will stay with collective stick assembly.

d. Remove collective stick by lowering it down through console.

11-20. DISASSEMBLY — GUNNER COLLECTIVE STICK (AVIM).

a. Remove nut (40, figure 11-10), screw (44), and washers that attach throttle lever (42) to shaft (39). Remove cotter pin (37), nut (36), and washer (35). Press shaft from support assembly (32) and remove throttle lever and shims (38). Measure and record thickness of shims (38). Tag shims for installation in same location.

b. Remove nut (46) and washer (47), pinion gear (48), key (13), and shim (49) from drive assembly (12). Measure and record thickness of shim (49). Tag shim for installation in same location.

c. Remove nut (7), screw (1), and washers (2, 3, 5, and 6) that attach throttle grip (26) to throttle tube (9). Remove throttle grip (26) and ring (4).

d. Remove screws (23) that attach boot (24) to elbow (18). Remove boot.

e. Remove nuts (15), bolts (21), and washers (14 and 22) from elbow (18). Remove control stick (8), throttle tube (9), guides (10 and 11) and drive assembly (12) from elbow.

f. Remove nuts (16), bolts (20), and washers (17 and 19) that attach collective lever (27) to elbow. Separate collective lever (27) from elbow (18) and elbow from support assembly (32). Remove bolt (29) and washer (30) from support assembly.

g. Remove bearings (28, 31, 33, 34, 45 and 50) if bearings or support (32) or lever (27) are unserviceable. Refer to TM 55-1500-204-25/1.

11-21. INSPECTION — GUNNER COLLECTIVE STICK.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

CAUTION

Do not allow solvent to enter bearings.

a. Clean exposed surfaces by wiping with dry cloth dampened with solvent (C112).

b. Visual inspection.

(1) All threaded areas (figure 11-10) for thread damage.

(2) All bearings in accordance with TM 55-1500-204-25/1 and for wear that exceeds **0.005** inch radial and **0.030** inch axial.

(3) All bolt holes for wear. Maximum allowable wear is **0.005** inch.

(4) All items for corrosion and mechanical damage. Maximum allowable **0.005** inch for corrosion and **0.010** for mechanical. Inspect for dents or distortions that would affect operation.

(5) All items for cracks or broken parts.

(6) All pins for grooving.

(7) Gears for broken teeth.

c. Fluorescent penetrant inspect to verify suspected flaws found during visual inspection of elbow (18), collective lever (27), and support assembly (32) in accordance with TM 43-0103.

d. Magnetic particle inspect to verify suspected flaws found during visual inspection of control stick (8) in accordance with TM 43-0103.

11-22. REPAIR OR REPLACEMENT — GUNNER COLLECTIVE STICK (AVIM).

a. Replace all damaged components unless covered by a specific repair.

b. Repair mechanical and corrosion damage (paragraph 11-13).

c. Replace unserviceable bearing (25) in throttle grip (26, figure 11-10). Remove and replace bearing in accordance with TM 55-1500-204-25/1.

d. Replace unserviceable bearing (50) in collective lever (27) (paragraph 11-12).

11-23. ASSEMBLY — GUNNER COLLECTIVE STICK (AVIM).

NOTE

If bearings (28, 31, 33, 34, 45, or 50, figure 11-11) were removed from support assembly (32), or collective lever (27), install bearings.

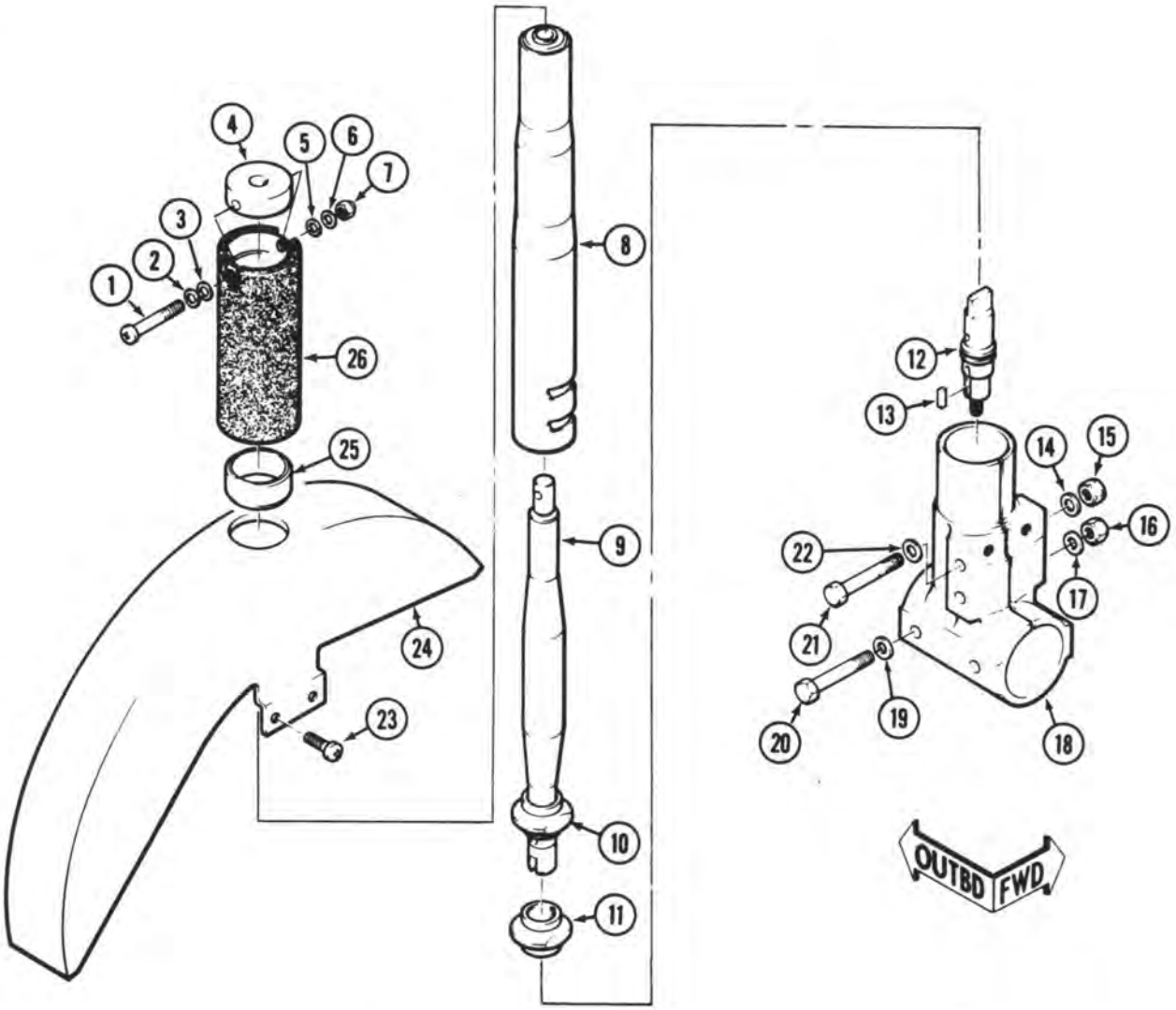
a. Install and tape bolt (29) and washer (30) in top hole of support assembly (32). Place elbow (18) into support with slot towards bolt (29). Align elbow with bearings (28 and 31) and press collective lever (27) into elbow from side opposite slot. Align bolt holes in collective lever with bolt holes in elbow and install bolts (20), washers (17 and 19) and nuts (16).

b. Assemble drive assembly (12), guide (10 and 11), and throttle tube (9). Place assembled components into control stick (8). Place control stick into elbow (18). Align slots in control stick with bolt holes in elbow. Install bolts (21), washers (14 and 22) and nuts (15).

c. Install boot (24) on elbow (18) with screws (23). Lockwire (C137) screws together. Place ring (4) on throttle tube (9). Place throttle grip (5) on control stick (8). Align holes in grip, ring, and throttle tube. Install screw (1), washers (2, 3, 5, and 6) and nut (7).

NOTE

Vary quantity of washers (2, 3, 5, and 6) under screw head to maintain 0.20 to 0.22 inch projection through nut (7).



1. Screw
2. Washer
3. Washer
4. Ring
5. Washer
6. Washer
7. Nut
8. Control stick
9. Throttle tube assembly
10. Guide
11. Guide
12. Drive assembly
13. Key
14. Washer
15. Nut
16. Nut
17. Washer
18. Elbow
19. Washer
20. Bolt
21. Bolt
22. Washer
23. Screw
24. Boot
25. Bearing
26. Throttle grip

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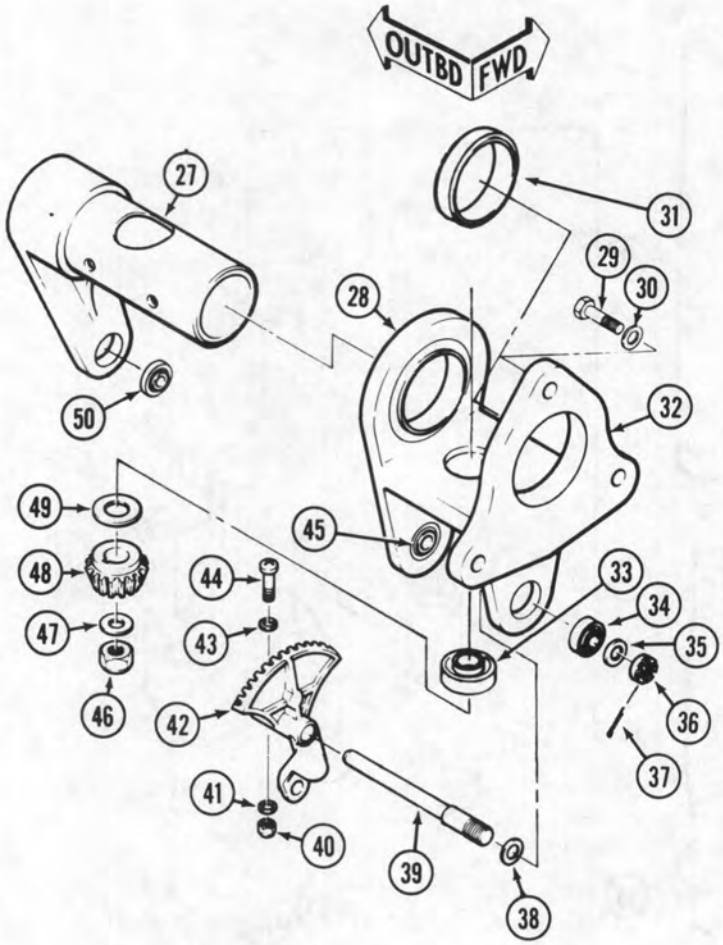
Figure 11-10. Gunner Collective Stick Assembly (Sheet 1 of 2)



27. Collective lever
28. Bearing
29. Bolt
30. Washer
31. Bearing
32. Support
33. Bearing
34. Bearing
35. Washer
36. Nut
37. Cotter pin
38. Shim
39. Shaft
40. Nut
41. Washer
42. Throttle lever
43. Washer
44. Screw
45. Bearing
46. Nut
47. Washer
48. Pinion gear
49. Shim
50. Bearing

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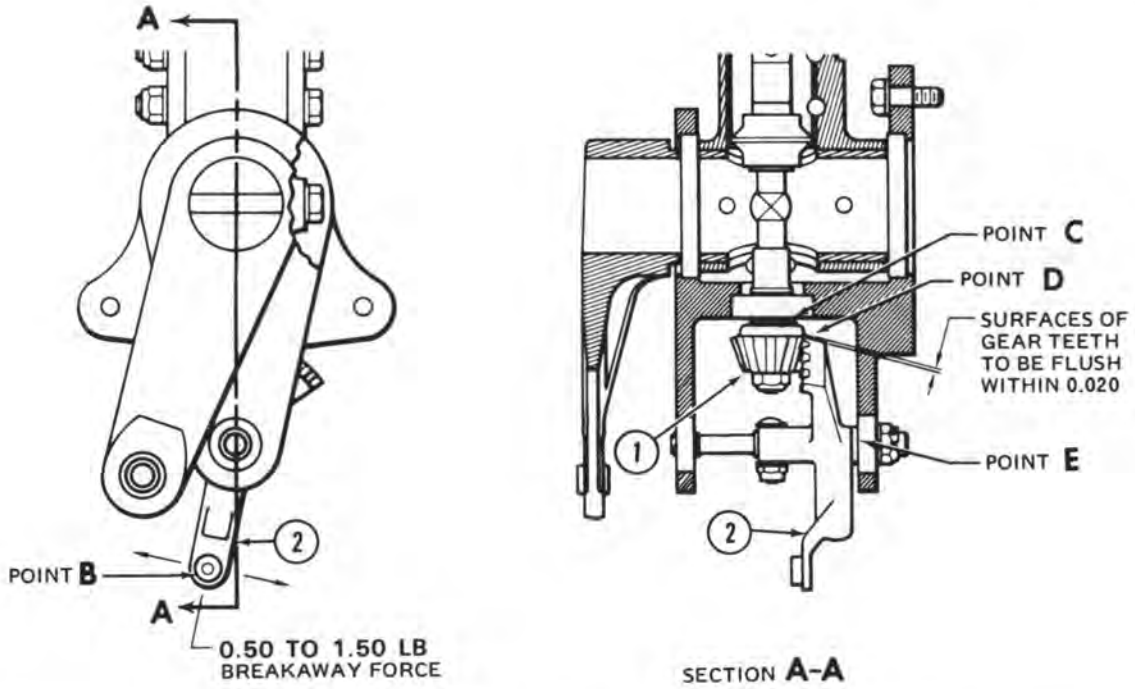
Figure 11-10. Gunner Collective Stick Assembly (Sheet 2 of 2)



1. Pinion gear
2. Throttle lever

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

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Figure 11-11. Gunner Collective Stick Adjustment

d. Install shim (49), tagged during disassembly, key (13), pinion gear (48), washer (47), and nut (46) on drive assembly (12).

NOTE

Check for smooth operation by rotating grips (26) through full travel.

e. Install shim (38), tagged during disassembly, and throttle lever assembly (42) on shaft (39). Position throttle lever with gear teeth facing small end of shaft.

f. Install shaft (39) into support assembly (32) and secure with washer (35), nut (36), and cotter pin (37). Secure throttle lever to shaft with screw (44), washer (41 and 43), and nut (40).

g. Check mating between pinion gear (1, figure 11-11) and throttle lever gear (2). Surfaces of gear teeth should be flush within **0.020** inch. If pinion gear rides too high on lever gear, remove shim from point E and add to point C. If pinion gear rides too low on lever gear, remove shim from point C and add to point E. Continue procedure until required dimension is obtained.

h. Adjust throttle breakaway force (paragraph 11-25).

i. Wire throttle lever (2) to support (3) to maintain position during subsequent handling.

11-24. INSTALLATION — GUNNER COLLECTIVE STICK (AVIM).

a. Install collective stick (1, figure 11-9) up through console and attach support assembly (19) to airframe with three bolts (15, 20, and 23), washers (16, 17, 21, and 22) and one nut (18).

b. Connect throttle tube assembly (3) to throttle lever with bolt (14), head inboard, washers (12 and 13), and nut (11). Place steel washer (13) under bolt head and stainless steel washer (12) under nut. Secure nut with cotter pin (10).

c. Connect collective tube assembly (4) to collective lever (1) with bolts (5), washers (6 and 7) and nut (8). Place one washer under nut, and one washer under bolt head. Secure nut with cotter pin (9).

d. Remove wire (paragraph 11-23).

11-25. ADJUSTMENT — GUNNER COLLECTIVE STICK.

NOTE

Steps a., b., f., and g., will be followed if collective stick is installed in aircraft.

a. Remove left side access panel (paragraph 2-59).

b. Disconnect throttle tube assembly from throttle lever (2, figure 11-11).

c. Measure breakaway force at point B on throttle lever (2). Use a spring scale to apply force in direction illustrated by arrows on lever.

NOTE

If necessary, equally add or remove laminations of shims at points C and E because tooth surfaces on pinion (1) and lever (2) must remain flush within 0.020 inch at point D.

d. Add or remove shims at points C and E to obtain a breakaway force of **0.50 TO 1.50** pounds. Refer to paragraph 11-20, a. and b., for shim removal and paragraph 11-23, d., e., and f., for shim installation.

e. Repeat step d., to determine whether breakaway force is now within tolerance. If necessary, repeat shimming procedure.

f. Connect throttle tube assembly to throttle lever (2) (paragraph 11-24, b.).

g. Install left side access panel (paragraph 2-59).

11-26. CYCLIC SYSTEM.

11-27. DESCRIPTION — CYCLIC SYSTEM.

The main rotor cyclic controls consist of interconnected control sticks in pilot and gunner compartments, and two separate systems of linkage to the swashplate. Each of the cyclic systems includes a dual hydraulic cylinder, a servo-actuator and a transducer of the SCAS (Stability and Control Augmentation System) and a force trim magnetic brake connected to control linkage through a spring-loaded force gradient assembly. The fore-and-aft cyclic controls extend aft from the control sticks to a jackshaft, then downward at right side of fuselage, then aft below the forward fuel cell, then upward to the hydraulic cylinder which is connected on the right forward horn of the swashplate (figure 11-12). The lateral cyclic controls are interconnected between control sticks at right side of the fuselage, then extend aft and to left side, then downward and aft below the fuel cell, then upward to the hydraulic cylinder which is connected on the left forward horn of the swashplate (figure 11-13).

Premaintenance Requirements for Cyclic Control System

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T46)
Test Equipment	None
Support Equipment	(S2)
Minimum Personnel Required	Two
Consumable Materials	(C43), (C138)
Special Environmental Conditions	None

11-28. INSPECTION — CYCLIC SYSTEM.

a. Inspect control system in place for secure installation, damage, and freedom of operation through full range of travel (figures 11-12 and 11-13).

b. If required; remove components for detailed inspection. Refer to paragraphs 11-40 and 11-169 for

damage limits on bellcranks and tube assemblies. Refer to paragraph 7-63 for damage limits on hydraulic cylinder assemblies.

11-29. RIGGING — CYCLIC SYSTEM.

a. Accomplish rigging without hydraulic power unless otherwise stated.

b. Install all components of the cyclic control system with the following exceptions:

(1) Leave hydraulic cylinders (4, figure 11-12) and (6, figure 11-13) disconnected from swashplate. Also, leave the elevator tube assembly (3, figure 11-12) and spring (2) disconnected.

(2) Leave tube assembly (7) disconnected from bellcrank (8) but connect to hydraulic cylinder valve lever (6).

(3) Leave tube assembly (8, figure 11-13) disconnected from bellcrank (9) but connect to hydraulic cylinder valve lever (7).

(4) Leave tube assembly (16, figure 11-12) and transducer (13) disconnected from bellcrank (11).

(5) Leave tube assembly (11, figure 11-13) and transducer (15) disconnected from bellcrank (13).

c. Check and adjust cyclic stick friction (paragraph 11-38).

d. Hold pilot cyclic control stick full right.

e. Adjust control tube (11, figure 11-13) to **14.36** inches between bolt hole centers, coat clevis threads with corrosion preventive compound when adjusting control t ·be. Connect control tube to bellcrank (13).

f. Check that aft arm of bellcrank (9) is raised to its highest travel without touching aft stop bolt (10).

CAUTION

Do not interchange tube (7, figure 11-12), and tube (8, figure 11-13).

g. Push tube assembly (8) upward to bottom out piston in top of hydraulic cylinder (6) and hold lever of valve (7) at top of travel. (See Detail A, figure 11-13). Adjust tube assembly (8) length to fit on bellcrank (9) with control stick full right, then shorten two full turns and connect tube to bellcrank. Check exposed threads to ensure that not more than **1.00** inch of thread is exposed. See Detail A. If necessary, adjust length of tube assembly (11) and repeat adjustment procedure for tube (8). Ensure that there is not more than one inch exposed threads on tube assembly (11) (detail C). Ensure that nut and bolt that attaches tube assembly (8) to hydraulic cylinder valve (7) is tightened sufficiently to remove axial play. Back off to first castellation. Do not clamp clevis. The bolt must turn freely and cotter pin must be installed.

h. Adjust stop bolts (10) for **0.005 TO 0.015** inch clearance with bellcrank at full right and full left positions.

i. Install rigging fixture (T46) on pilot cyclic control stick.

(1) Remove four screws, washers, and nuts from holes in pilot floor outboard of stick support.

(2) Open clamp of rigging fixture (T46) and place over stick with open end of clamp aft. Engage pins in mounting holes.

j. Clamp cyclic stick in aft "A" of rigging fixture (T46). Hold bellcrank (8, figure 11-12) against fixed stop (9). Adjust tube assembly (16). Coat clevis threads with corrosion preventive compound (C43) when adjusting control tube. Connect tube to bellcrank (11).

k. Push tube assembly (7) upward to bottom out piston in top of hydraulic cylinder (4) and hold lever of valve (6) at top of travel. (See detail B, figure 11-12.) Adjust tube (7) to length to fit on bellcrank (8), then shorten two full turns and connect to bellcrank (8). Check exposed threads on tube (7) to ensure that they do not exceed one inch (detail B). Ensure that bolt attaches tube (7) to hydraulic cylinder valve (6) is tightened sufficiently to remove axial play. Back off to first castellation. Do not clamp clevis. The bolt must turn freely, and cotter pin must be installed.

l. Adjust cyclic control hydraulic cylinder assemblies and attach to swashplate as follows:

(1) Clamp pilot cyclic control stick in center hole "N" of rigging fixture (T46).

(2) Fabricate a work aid as shown on figure 11-14 or use an eighteen inch scale as a measuring

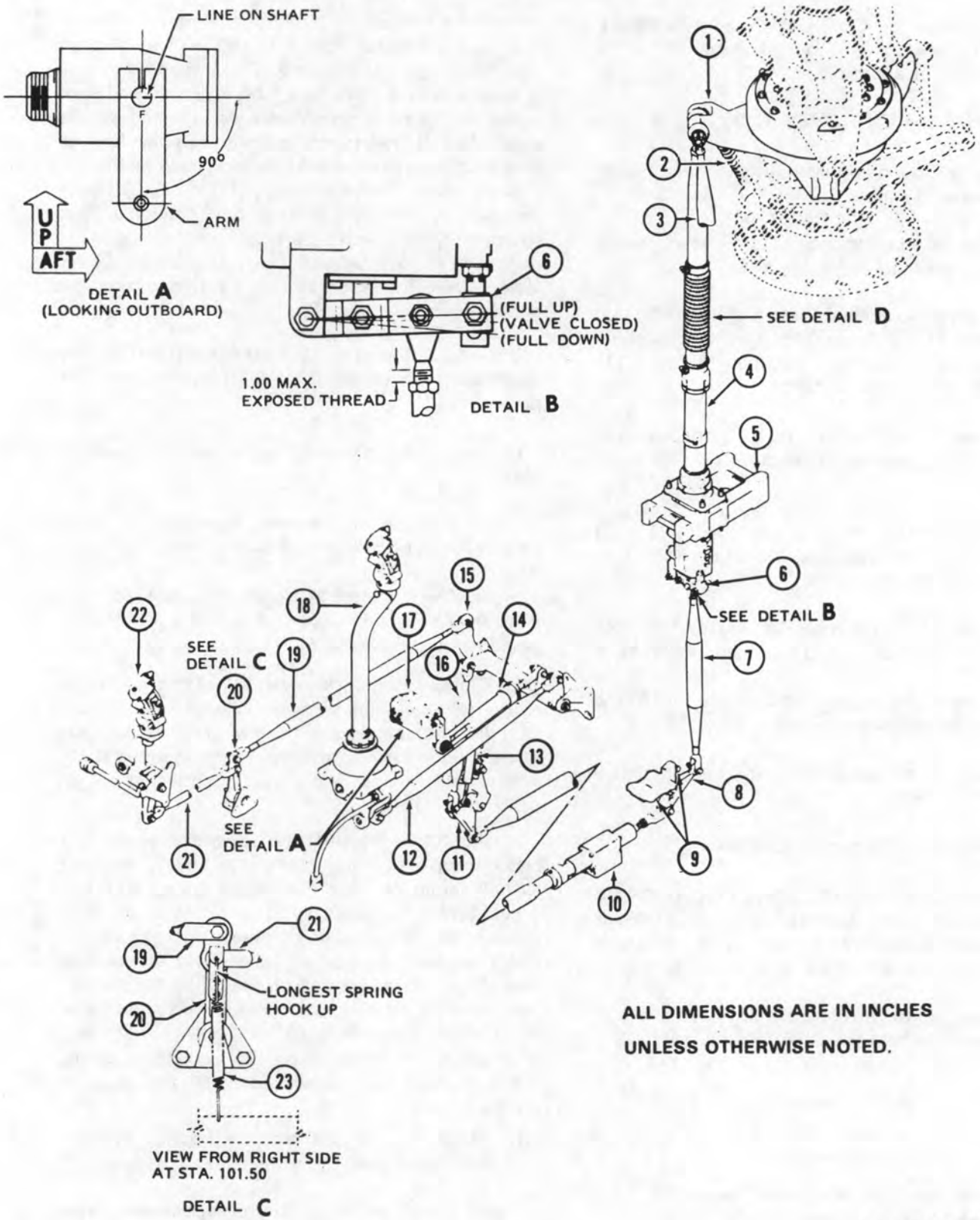
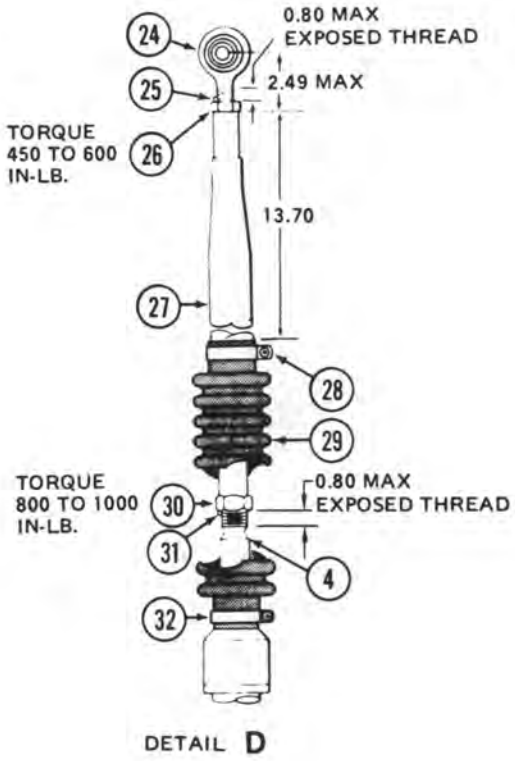


Figure 11-12. Fore-and-Aft Cyclic Controls (Sheet 1 of 2)



1. Swashplate
2. Spring
3. Elevator tube assembly
4. Hydraulic cylinder assembly
5. Cylinder support
6. Hydraulic cylinder valve lever
7. Tube assembly
8. Bellcrank
9. Fixed stops
10. Servo actuator (SCAS)
11. Bellcrank
12. Tube assembly
13. Transducer (SCAS)
14. Force gradient assembly
15. Jackshaft
16. Tube assembly
17. Magnetic brake
18. Pilot cyclic control stick
19. Tube assembly
20. Idler assembly
21. Tube assembly
22. Gunner cyclic control stick
23. Spring
24. Rod end bearing
25. Lock
26. Nut
27. Extension tube
28. Clamp
29. Boot
30. Nut
31. Lock
32. Clamp

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.

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Figure 11-12. Fore-and-Aft Cyclic Controls (Sheet 2 of 2)

instrument. Set both swashplate forward horns to **12.82** inches (figure 11-16). Measure from transmission flange to lower edges of bolt holes. Maintain right horn at **12.82** inches ±**0.06** inch and set left horn to **12.52** inches ± **0.06** inch.

(3) Adjust hydraulic cylinder assembly (4, figure 11-12) for attachment to swashplate (1) as follows:

(a) Remove lockwire and loosen nut (26).

CAUTION

When setting hydraulic cylinder valve levers to top of travel, do not cause controls below cylinder to move or misrigging will occur.

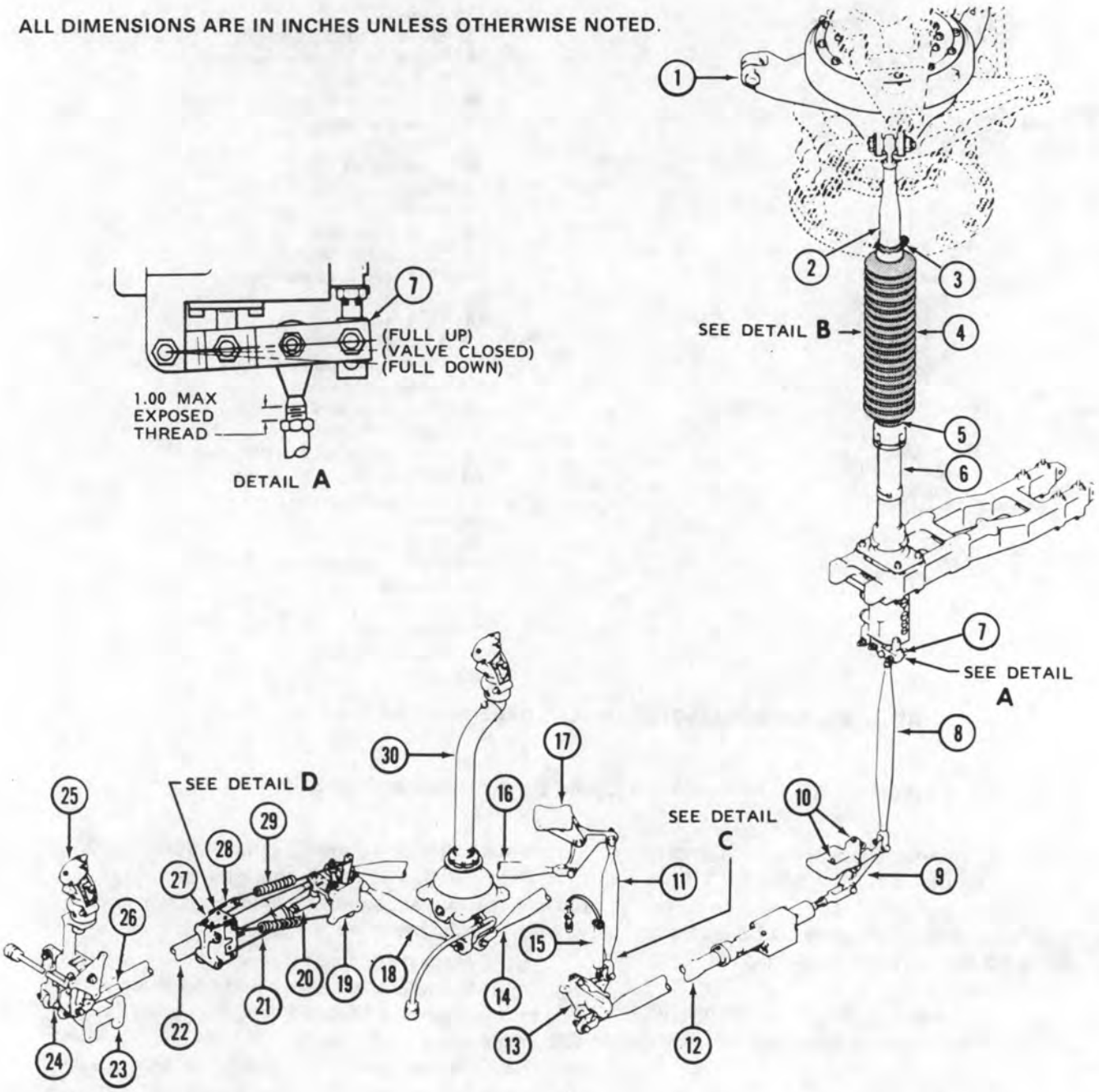
(b) Ensure that swashplate (1) is at position set in step (2). Push down on extension tube (27) with just enough force to hold lever of hydraulic cylinder valve (6) at full up position as shown on detail B. Maintain this position and adjust rod end bearing (24) to fit on swashplate (1); then shorten one full turn of rod end bearing to compensate for change that occurs when hydraulic pressure is applied.

(c) Measure exposed threads on rod end bearing (24). If lock (25) can be installed and if less than 0.80 inch of thread is exposed, torque nut (26) **450 to 600** inch-pounds, lockwire nut (26) to lock (25) with lockwire (C138) and proceed to step (4). If there are insufficient exposed threads to install lock (25) or if exposed threads on rod end bearing (24) are in excess of 0.80 inch, make adjustment at nut (30) as outlined in step (3)(d) through (i).

(d) Thread rod end bearing (24) into extension tube (27) until **0.80** inch of threads are exposed. Torque nut (26) **450 TO 600** inch-pounds and lockwire to lock (25) with lockwire (C138).

(e) Loosen clamps (28) and (32). Slide boot (29) up until nut (30) is exposed. Remove lockwire and loosen nut (30).

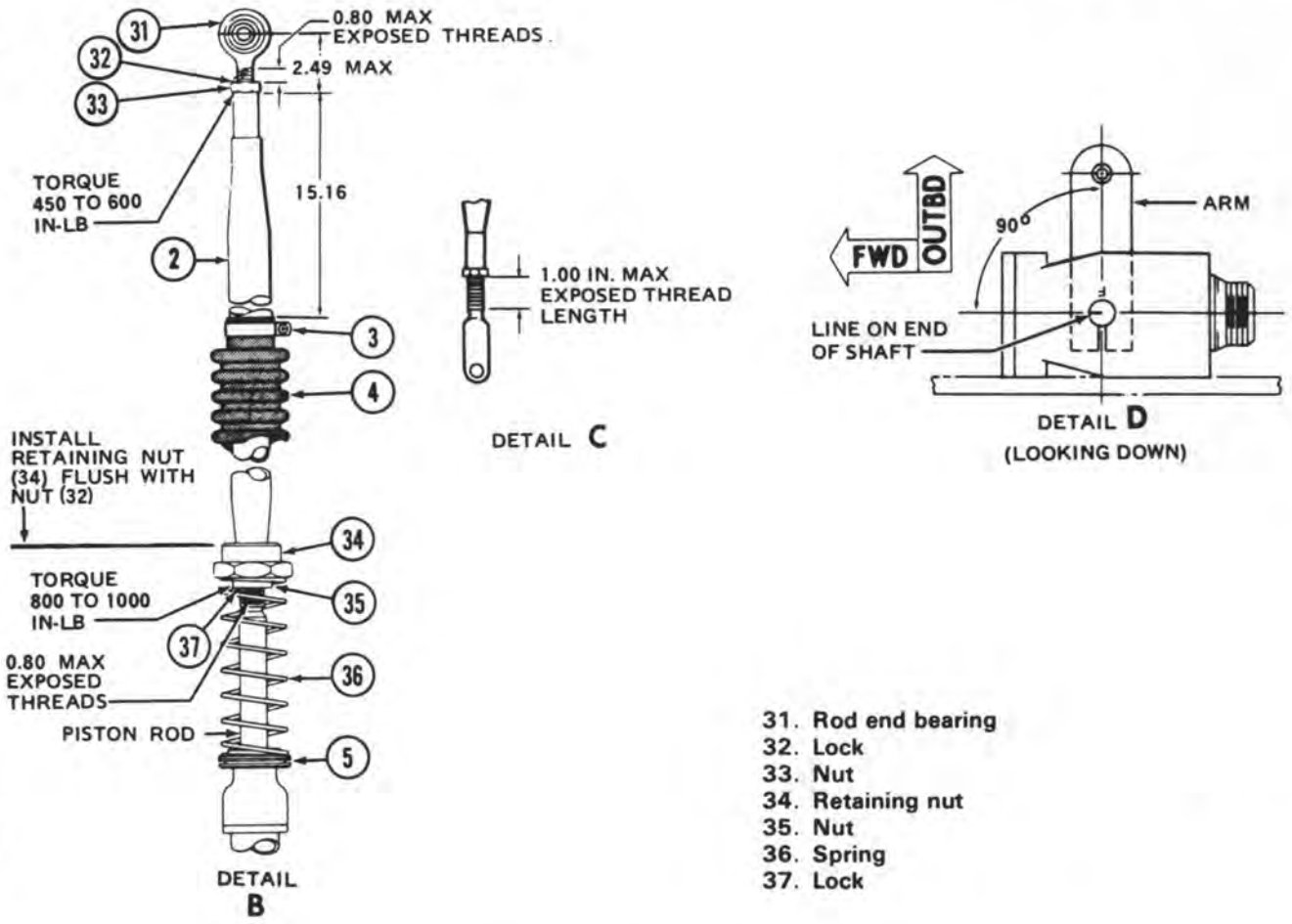
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.



1. Swashplate
2. Extension tube
3. Clamp
4. Boot
5. Base
6. Hydraulic cylinder assembly
7. Hydraulic cylinder valve lever
8. Tube assembly
9. Bellcrank and support
10. Stop bolts
11. Tube assembly
12. Servo actuator (SCAS)
13. Bellcrank and support
14. Tube assembly
15. Transducer (SCAS)
16. Tube assembly
17. Bellcrank and support
18. Tube assembly
19. Bellcrank and support
20. Rod end bearing
21. Force gradient
22. Tube assembly
23. Bellcrank and support
24. Control link
25. Gunner cylic control stick
26. Tube assembly
27. Magnetic brake
28. Plate
29. Springs
30. Pilot cyclic control stick

209001-162-1

Figure 11-13. Lateral Cyclic Controls (Sheet 1 of 2)



31. Rod end bearing
32. Lock
33. Nut
34. Retaining nut
35. Nut
36. Spring
37. Lock

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

209001-162-2

Figure 11-13. Lateral Cyclic Controls (Sheet 2 of 2)

CAUTION

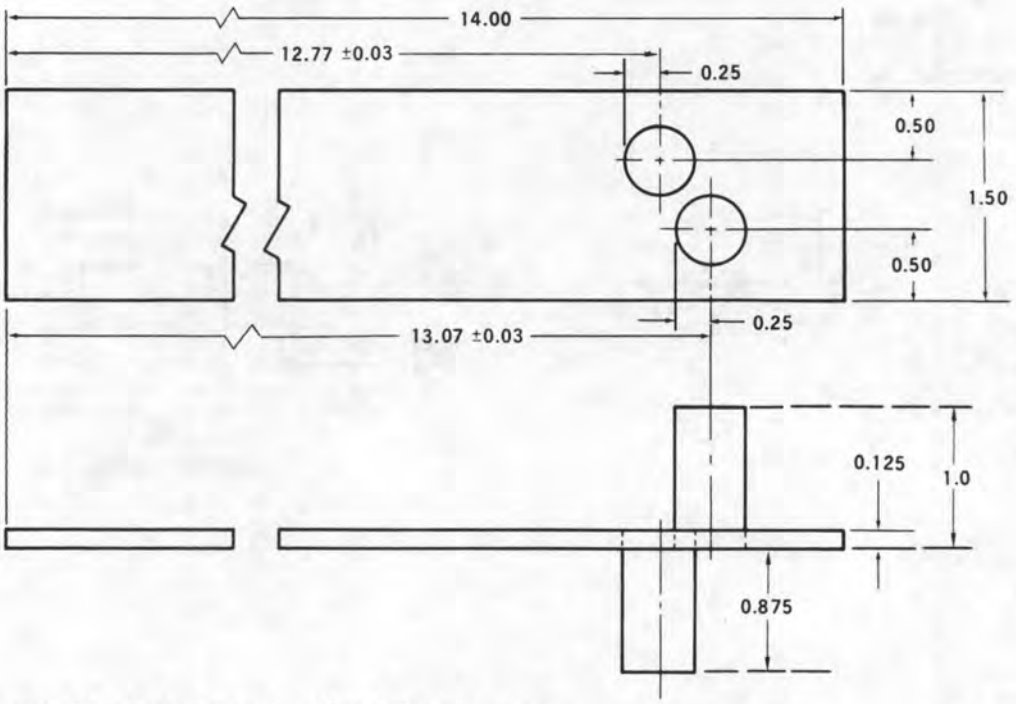
When setting hydraulic cylinder valve levers to top of travel, do not cause controls below cylinder to move or misrigging will occur.

(f) Ensure that swashplate (1) is at position set in step (2). Push down on extension tube (27) with just enough force to hold lever of hydraulic valve (6) at full up position as shown on detail B. Maintain this position and adjust extension tube (27) on hydraulic cylinder assembly (4) to length so rod end bearing (24) will fit on swashplate (1), then shorten one full turn of extension tube (27) to compensate for change that occurs when hydraulic power is applied.

(g) Measure length of exposed threads at nut (30). Maximum acceptable exposed thread is **0.80** inch.

(h) Torque nut (30) **800 TO 1000** inch-pounds and lockwire nut (30) to lock (31) with lockwire (C138).

(i) Position top of boot (29) **13.70** inches from top of extension tube (27) as shown on detail D and tighten clamp (28). Position lower end of boot (29) on hydraulic cylinder assembly (4) and tighten clamp (32).



Material: One Steel Strap 1 1/2 X 1/8 X 14 Inch
Two Steel Pins 1 Inch Long x 1/2 Inch Diameter

Drill holes in strap and install pins in strap at location illustrated with one pin on each side of strap. Solder or braze pins in position. Apply one coat of primer to prevent corrosion.

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

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Figure 11-14. Work Aid for Rigging Swashplate

(4) Attach rod end bearing (24) elevator control tube (3), and spring (2) to swashplate (1). Comply with procedure outlined in paragraph 7-66.

(5) Adjust hydraulic cylinder assembly (6, figure 11-13) for attachment to swashplate (1) as follows:

(a) Remove lockwire and loosen nut (33).

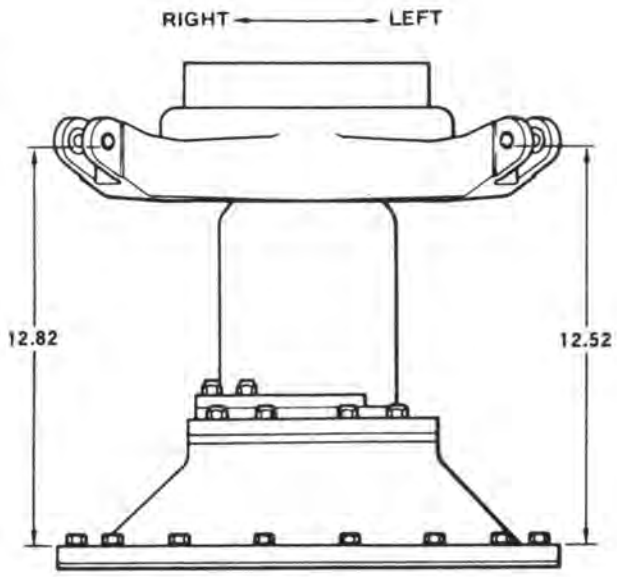
CAUTION

When setting hydraulic cylinder valve levers to top of travel, do not cause controls below cylinder to move or misrigging will occur.

(b) Ensure that swashplate (1) is at position set in step (2). Push extension tube (2) down with just enough force to hold lever of hydraulic cylinder valve (7) at full up position as shown on detail A. Maintain this position and adjust rod end bearing (31) to fit on swashplate (1); then shorten one full turn of rod end bearing to compensate for change that occurs when hydraulic pressure is applied.

(c) Measure length of exposed threads on rod end bearing (31). If less than **0.80** inch of threads are exposed, torque nut (33) **450 TO 600** inch-pounds, lockwire nut (33) to lock (32) with lockwire (C138), and proceed to step (6). If exposed threads on rod end bearing (31) are in excess of **0.80** inch, make adjustment at nut (35) as outlined in steps (d) through (1).

(d) Thread rod end bearing (31, figure 11-13) into extension tube (2) until **0.80** inch of threads are exposed. Torque nut (33) **450 TO 600** inch-pounds and lockwire to lock (32) with lockwire (C138).



VIEW LOOKING AFT

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

209401-2A

Figure 11-15. Swashplate Rigging Dimensions

(e) Loosen clamp (3) and remove boot (4) from base (5). Slide boot (4) up until nut (35) is exposed.

(f) Remove lockwire and remove retaining nut (34) and spring (36).

(g) Remove lockwire and loosen nut (35).

CAUTION

When setting hydraulic cylinder valve levers to top of travel, do not cause control below cylinder to move or misrigging will occur.

(h) Ensure that swashplate (1) is at position set in step (2). Push down on extension tube (2) with just enough force to hold lever of hydraulic cylinder valve (7) at full up position as shown on detail A. Maintain this position and adjust extension tube (2) on hydraulic cylinder assembly (6) to length so rod end bearing (31) will fit on swashplate (1); then shorten one full turn of extension tube (2) to compensate for change that occurs when hydraulic pressure is applied.

(i) Measure length of exposed threads at nut (35). Maximum acceptable exposed thread is **0.80** inch.

(j) Torque nut (35) **800 TO 1000** inch-pounds and lockwire nut (35) to lock (37) with lockwire (C138).

(k) Position spring (36) on base (5). Thread retaining nut (34) on nut (35) until top of retaining nut (34) is flush with top of nut (35). Lockwire retaining nut (34) to nut (35) with lockwire (C138).

(l) Position bottom of boot (4) in groove on base (5). Position top of boot (4) **15.16** inches from top of extension tube (2) as shown on detail B. Tighten clamp (3).

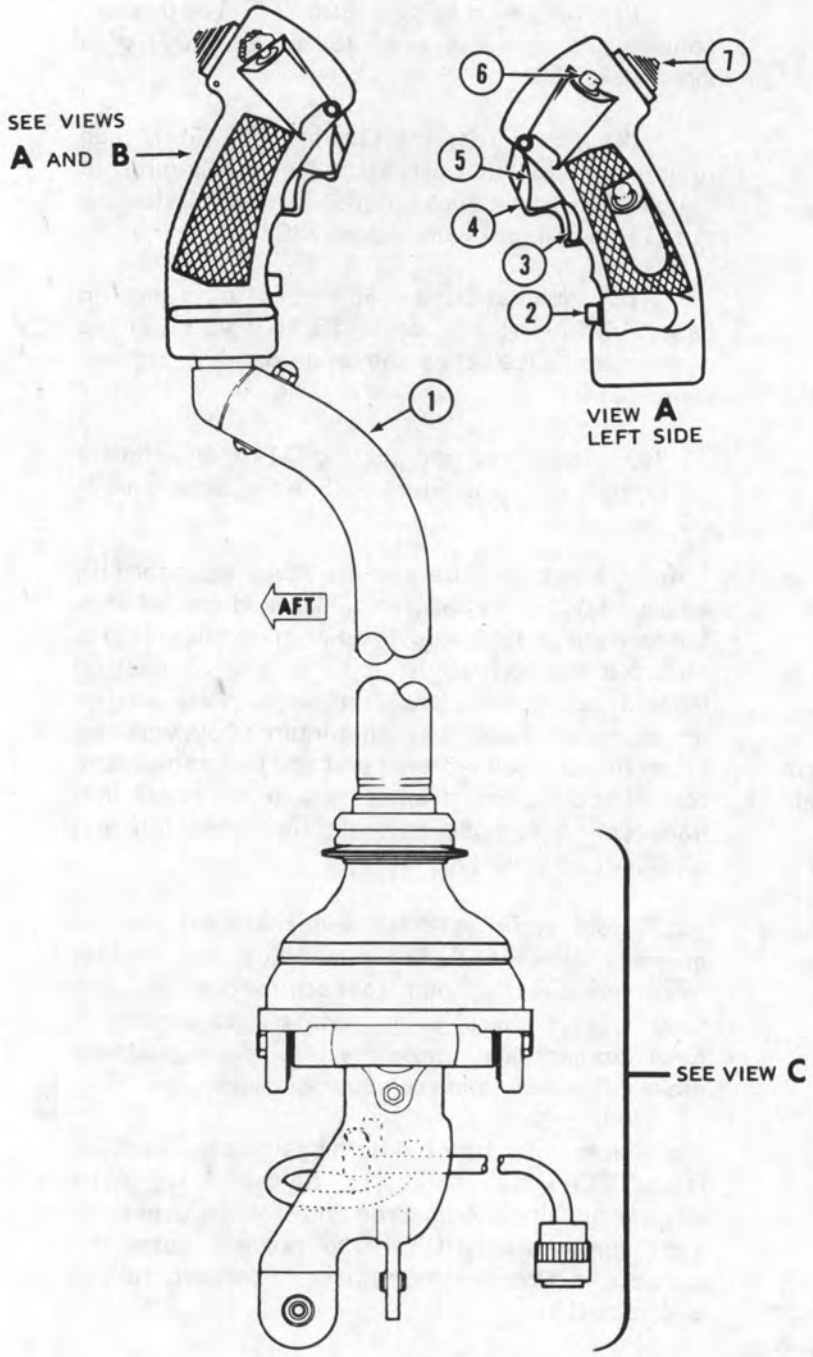
(6) Attach rod end bearing (31) to swashplate (1). Comply with procedure outlined in paragraph 7-66.

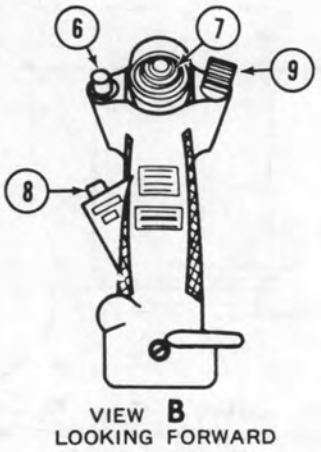
m. Disconnect fore-and-aft SCAS actuator (10, figure 11-12) from bellcrank (11). Hold control stick full forward against stop. Position transducer (13) in retracted position, adjust rod end and connect on inboard side of bellcrank. Use large safety washer under screw head and aluminum alloy washers under nut and between rod end and bellcrank. Move control stick full aft against its stop and check that transducer does not bottom out. Reconnect fore and aft SCAS actuator (10).

n. Hold cyclic stick full forward. Hold arm on magnetic brake (17) full aft. Adjust rod end of force gradient (14) and connect to arm on jack-shaft (15). If there is not enough adjustment in force gradient (14), rotate the arm of the magnetic brake (17) one serration counter-clockwise.

o. Hold cyclic stick full right against stop. Position lateral SCAS transducer (15, figure 11-13) in its retracted position. Adjust rod end of transducer to fit, then screw one-half turn to prevent bottoming transducer. Connect transducer to inboard side of bellcrank (13).

p. Clamp cyclic stick in center hole "N" of rigging fixture (T46). Hold arm of magnetic brake (27) square within 2 degrees to structural beam on which brake is mounted. Adjust force gradient rod end bearing (20) and connect on bolt at underside of forward arm of bellcrank (19). Remove rigging fixture and move cyclic stick full right and full left to ensure that magnetic brake stop is not contacted.





1. Cyclic stick
2. SAS release (SCAS)
3. Trigger action
4. Trigger guard
5. Trigger turret fire
6. Trim release
7. ICS — radio
8. Wing arm fire
9. Night vision goggle
10. Bolt
11. Washer
12. Washer
13. Nut
14. Cotter pin
15. Nut
16. Washer
17. Tube assembly (fore-and-aft)
18. Washer
19. Bolt
20. Cotter pin
21. Nut
22. Washer
23. Washer
24. Tube assembly (lateral)
25. Washer
26. Bolt
27. Electric connector

209001-163-1

Figure 11-16. Pilot Cyclic Stick Installation (Sheet 1 of 2)

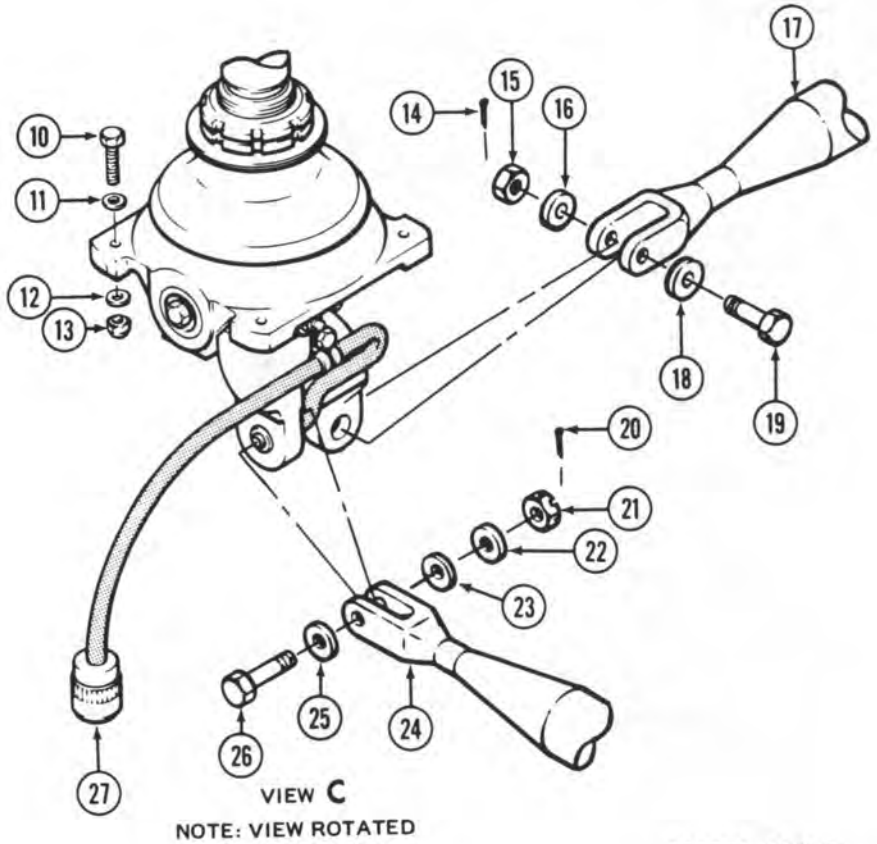


Figure 11-16. Pilot Cyclic Stick Installation (Sheet 2 of 2)

q. Check complete cyclic controls system for security and safetying of components.

r. Check operation with hydraulic power from a hydraulic test stand if available; if not available, move cyclic controls through full throw manually and ensure that there is no binding or interference.

s. Rig and connect elevator controls (paragraph 11-138).

t. Perform maintenance test flight (TM 55-1520-236-MTF).

11-30. PILOT CYCLIC STICK.

11-31. DESCRIPTION — PILOT CYCLIC STICK.

The conventional type control stick is mounted through the floor in front of the pilot seat. It is mounted through gimbal bearings in a bell-shaped support. The grip attached at top of stick is equipped with the following switches: SAS REL, TRIGGER ACTION, TRIGGER TURRET FIRE, WING ARM FIRE, TRIM REL, ICS-RADIO, and NIGHT VISION GOGGLE. Pilot cyclic stick has a mechanical advantage of 2 to 1 ratio over the gunner cyclic stick.

Premaintenance Requirements for Pilot Cyclic Stick

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	Feeler Gage

Conditions	Requirements
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C14), (C88), (C74), (C91), (C105), (C112)
Special Environmental Conditions	None

11-32. REMOVAL—PILOT CYCLIC STICK.

a. Obtain access to area below pilot floor through door in panel at top of ammunition compartment.

b. Disconnect lateral system tube assembly (24, figure 11-16) and fore-and-aft tube assembly (17) from levers on lower end of control stick.

c. Disconnect electrical cable connector (27) of control stick from the receptacle.

d. Detach stick support from floor by removing four bolts (10) with nuts (13) and washers (11 and 12).

e. Lift stick assembly out of floor opening.

11-33. DISASSEMBLY — PILOT CYCLIC STICK (AVIM).

a. Identify and tag wires of cable (42, figure 11-17) for sequence of installation in electrical connector (43); then remove connector from electrical cable (42).

b. Remove bolt (36), washer (35), and clamp (34) attaching cable assembly to lever assembly (32).

NOTE

Use care when removing grip from stick because electrical wires of grip must be removed from inside of stick.

c. Remove grip assembly (1) from elbow (2) by removing nut (45), washer (46), and screw (47), see detail A.

d. Remove elbow (2) from pilot cyclic stick (5) by removing nut (4), washers (3 and 6), and bolt (7). Remove old primer from ends of elbow with clean cloth saturated by MEK (C74).

e. Separate pilot cyclic stick (5) from lever assembly (32) by removing cotter pin (29), nut (30), washers (31 and 40), and bolt (39).

NOTE

Save shims (26) located on bolts (18) between support (17) and gimbal (22).

f. Separate support (17) from gimbal (22) by removing two cotter pins (20), two nuts (21), and two washers (19). Remove bolts (18) and shims (26).

g. Remove remaining cotter pins (23), nuts (24), and washers (25). Remove bolts (33) with shims (38) and separate lever assembly (32) from gimbal (22). Save shims (38) for reuse during installation.

h. Rotate nuts (8 and 9) counterclockwise until clear of threads on collar (15). Remove spring tension washers (10 and 11), spacer (12), and bell assembly (13).

11-34. INSPECTION — PILOT CYCLIC STICK.

a. Inspect washers (10 and 11, figure 11-17) for damage which will affect serviceability.

b. Inspect bearings (27, 37, 41 and 44) for roughness, freedom of movement, and wear in excess of **0.005** inch radial and **0.030** inch axial play.

c. Inspect lever assembly (32) and gimbal (22) using fluorescent penetrant in accordance with TM 43-0103.

d. Inspect shims (26 and 38) for wear and/or damage.

e. Inspect grip assembly (1) for cracks. Inspect switches for operation of detent and obvious damage.

f. Inspect electrical cable (42) and electrical connector (43) for loose connections, broken terminals, pins and/or soldered connections. Inspect cable for obvious damage such as chafing.

g. Inspect elbow (2) for cracks and for elongation of bolt holes.

h. Inspect collar (15) for cracks and damaged threads.

i. Inspect nuts (8 and 9) for damaged threads.

j. Inspect stick (5) for cracks.

11-35. REPAIR OR REPLACEMENT — PILOT CYCLIC STICK (AVIM).

a. Replace components that fail to meet inspection requirements of paragraph 11-34.

b. Replace elbow (2, figure 11-17) as follows:

(1) Remove nut (4), washers (3 and 6) and bolt (7).

(2) Remove elbow (2) from cyclic stick.

(3) Prime elbow with primer (C88) or (C91). Align holes in elbow with holes in cyclic stick and install.

(4) Install bolt (7), washers (3 and 6) and nut (4).

c. Replace collar (15) as follows:

(1) If installed, remove lever assembly (32) from end of cyclic stick (paragraph 11-38).

(2) Remove three rivets (3, figure 11-18), then slide collar (2) off pilot cyclic stick (1).

(3) Inspect bushing (4). If damaged, install new bushing as follows:

(a) Chill end of cyclic stick to minus **60** degrees F (minus **51** degrees C). Use suitable punch and mallet on bushing (4) to break the adhesive. Remove bushing.

(b) Ensure that old adhesive is removed from inside cyclic stick.

(c) Mix and apply adhesive (C14) to bushing. Refer to table 1-11, for adhesive, mix ratio, pot life and curing schedule.

(d) Position slot in new bushing as shown in detail B, figure 11-18, and install bushing into cyclic stick until flush with end of stick.

(e) With bushing aligned as shown in detail B, figure 11-18, drill two **0.24965 TO 0.2500** inch diameter holes to match holes in pilot cyclic stick (5) and lever assembly (32, figure 11-17).

(4) Prime area of pilot cyclic stick (1, figure 11-18) where collar (2) will be installed with primer (C88 or 91). Slide new collar onto cyclic stick (1). Position collar (2) so that flange is **3.820** inches from center of hole in end of cyclic stick (1).

(5) With collar (2) positioned as shown in detail A, figure 11-18, drill three rivet holes **118** degrees to **122** degrees apart to match with holes in pilot cyclic stick (1). Center of rivet to be **0.20** inch from end of collar as shown (figure 11-18).

(6) Install three MS20470AD4 or MS20600AD4 rivets (3).

d. Replace bearings (41 and 44, figure 11-17) if rough, binding or worn beyond limits. Refer to paragraph 11-35.

11-36. ASSEMBLY — PILOT CYCLIC STICK (AVIM).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

CAUTION

Do not allow solvent to enter bearings or electrical components.

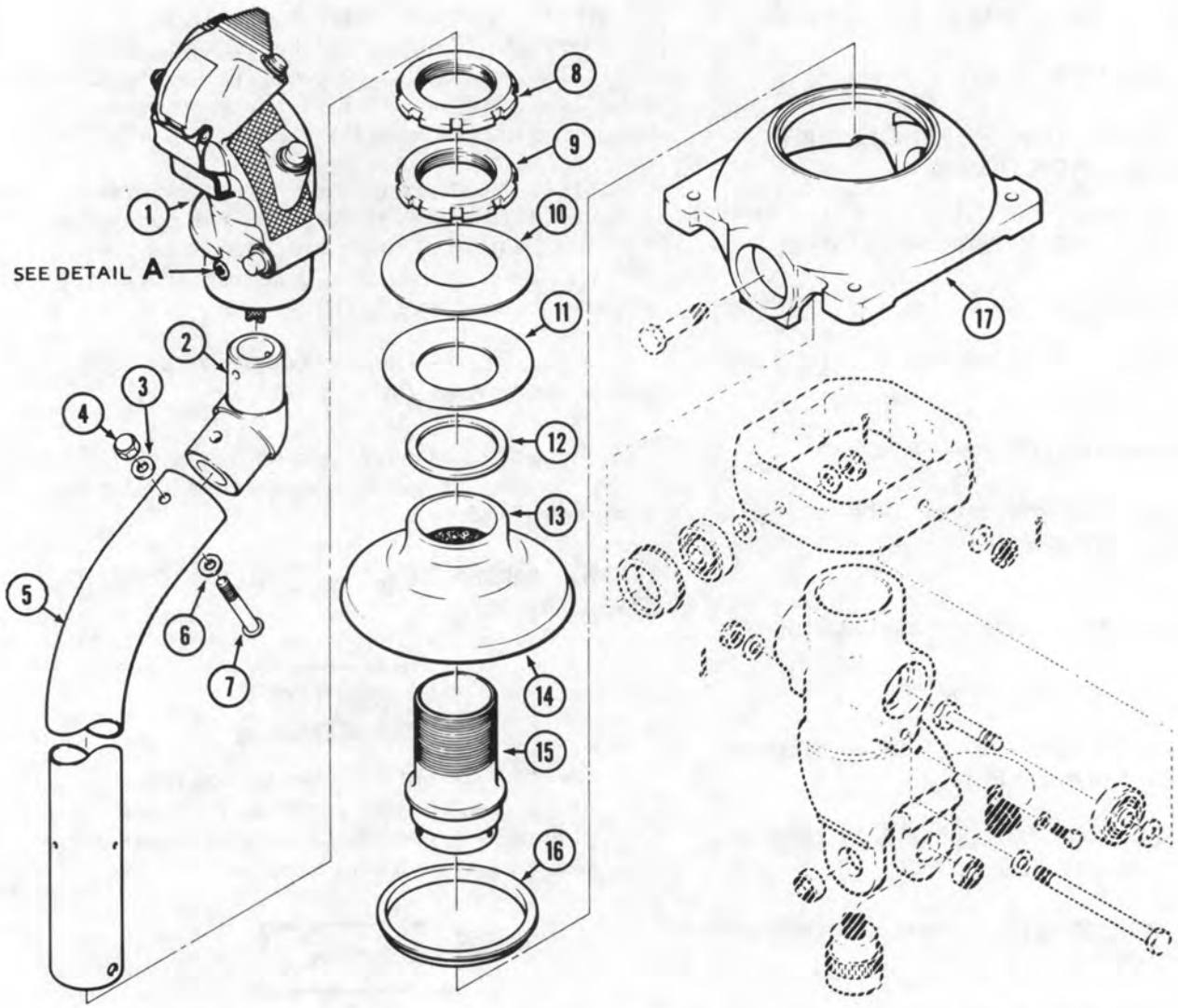
a. Clean exposed surfaces with a clean cloth dampened with dry cleaning solvent (C112).

b. Install bell assembly (13, figure 11-17), spacer (12), two washers (10 and 11) and two spanner nuts (8 and 9) over end of pilot cyclic stick (15) onto collar (15).

NOTE

Separate wires from grip assembly (1) so that the screws is between bundles.

c. Apply unthinned primer (C88 or C91) to elbow (2) and install elbow screw (47), washer (46) and



1. Grip assembly
2. Elbow
3. Washer
4. Nut
5. Pilot cyclic stick
6. Washer
7. Bolt
8. Spanner nut
9. Spanner nut
10. Spring tension washer
11. Spring tension washer
12. Spacer
13. Bell assembly
14. Liner
15. Collar
16. Sleeve
17. Support

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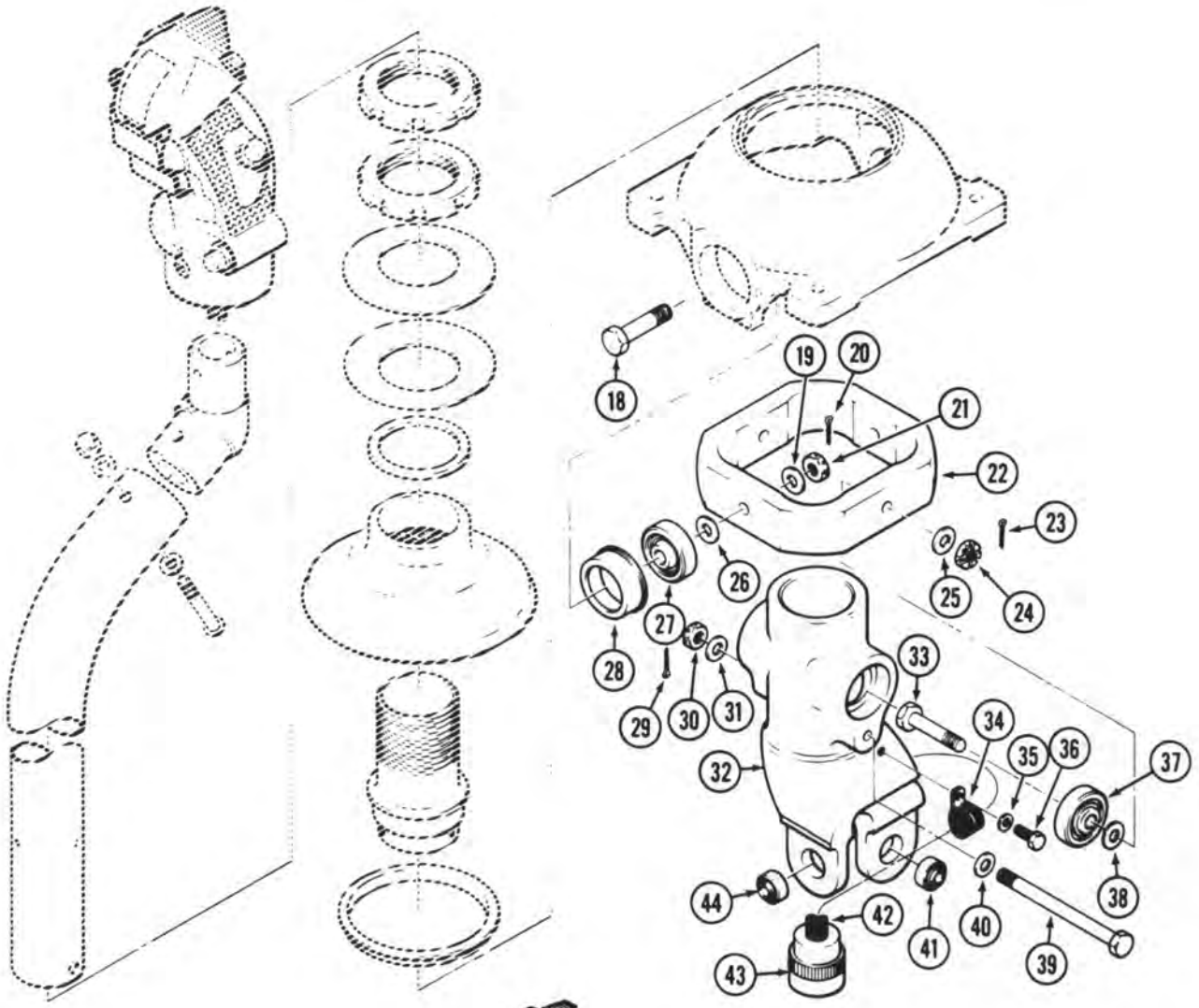
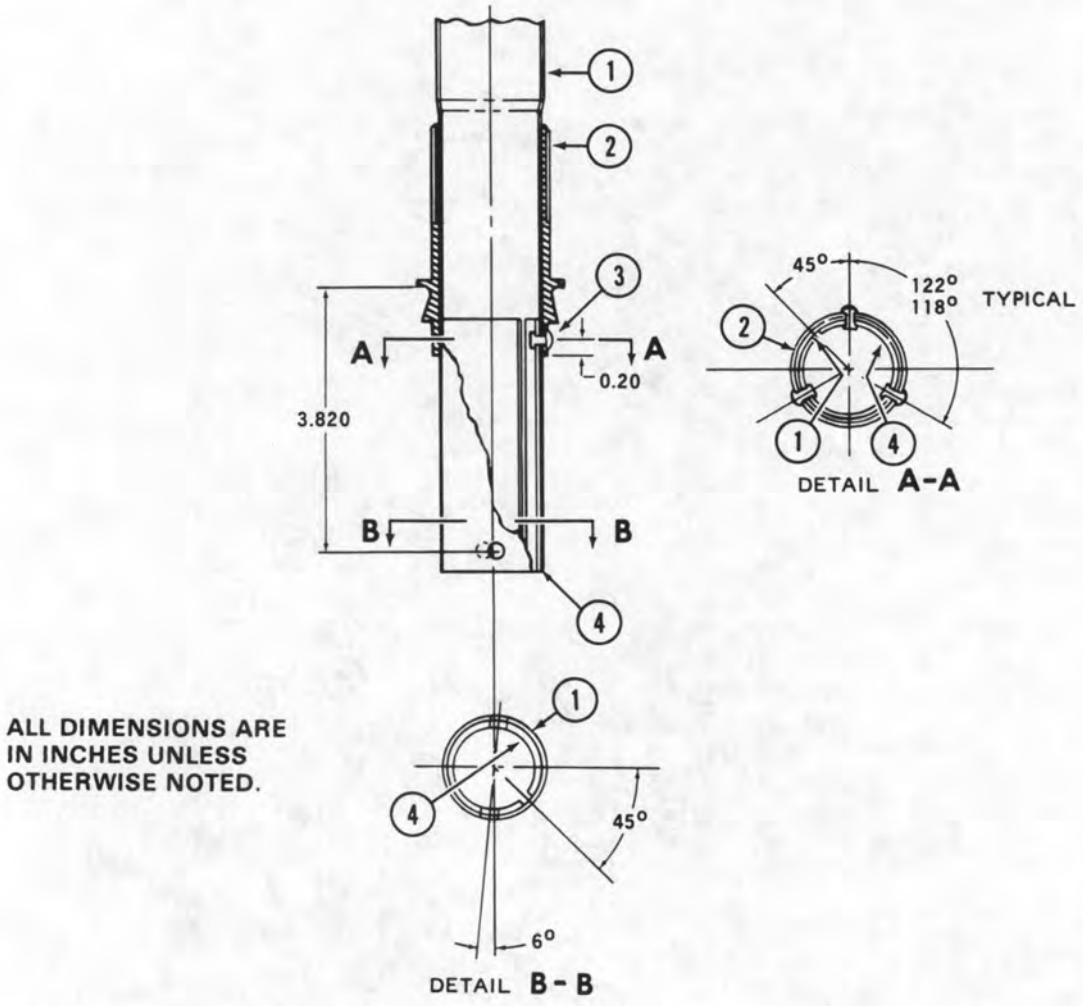
Figure 11-17. Pilot Cyclic Stick Assembly (Sheet 1 of 2)



18. Bolt
19. Washer
20. Cotter pin
21. Nut
22. Gimbal
23. Cotter pin
24. Nut
25. Washer
26. Shim
27. Bearing
28. Sleeve
29. Cotter pin
30. Nut
31. Washer
32. Lever assembly
33. Bolt
34. Clamp
35. Washer
36. Bolt
37. Bearing
38. Shim
39. Bolt
40. Washer
41. Bearing
42. Electrical cable
43. Electrical connector
44. Bearing
45. Spline nut
46. Washer
47. Screw

209001-165-2

Figure 11-17. Pilot Cyclic Stick Assembly (Sheet 2 of 2)



1. Pilot cyclic stick
2. Collar
3. Rivet (MS20470AD4)
4. Bushing

209001-111B

Figure 11-18. Collar and Bushing Installation

spline nut (45) to grip assembly (1). Route electrical cable (42) through pilot cyclic stick (5). Apply unthinned primer to end of elbow and attach elbow to pilot cyclic stick with bolt (7), washers (6 and 3) and nut (4).

d. Install two bearings (37 and 44) in lever assembly (32).

e. Assemble lever assembly (32) and gimbal (22) with sufficient shims (38) between bearing and gimbal to prevent lever side play. Distribute shims on each side so that the centerline of bore in lever is concentric within **0.005** inch with center of gimbal. Install bolts (33) from inside of lever assembly (32) to outside of gimbal (22) and secure with washer (25), nut (24), and cotter pin (23).

f. Install bearings (27) in support (17) and install support over bottom end of pilot cyclic stick.

g. Route electrical cable (42) through lever assembly (32) while inserting pilot cyclic stick (15) into lever assembly (32) as shown on figure 11-17. Align hole in lever assembly (32) with hole in pilot cyclic stick (5). Install bolt (39), washers (31 and 40), nut (30) and secure with cotter pin (29).

h. Align holes in support bearings (27) with gimbal (22). Install bolts (18) from outside through bearing (27) with sufficient shims (26) between support and gimbal to prevent side play and maintain center of support (17) concentric within **0.005** inch of gimbal center.

i. Secure bolts (18) with washer (19), nut (21), and cotter pin (20).

j. Attach electrical cable (42) to lever assembly (32), using clamp (34), bolt (36), and washer (35). Ensure that all slack is removed from wires in stick and maximum distance between electrical cable (42) and lever (32) is **0.050** inch and is snug against lever (32).

k. Remove masking tape from electrical cable (42). Install electrical connector (43) on electrical cable (42) with wires of cable installed in original plug position.

l. Adjust pilot cyclic stick friction (paragraph 11-37).

11-37. ADJUSTMENT — PILOT CYCLIC STICK.

a. Place support (17, figure 11-17) of pilot cyclic stick in a suitable device to hold it immovable with pilot cyclic stick (5) perpendicular to the support.

b. Screw lower spanner nut (9) on threads until nut is against washers (10 and 11).

c. Adjust stick friction as follows:

(1) Adjust two lower spanner nuts (figure 11-19) to obtain **2.0** ± **0.25** pounds breakaway force from neutral positions. Measure breakaway force with a force gage (fish scale) at center of stick grip.

(2) Hold lower spanner nut. Torque upper spanner nut **450 TO 500** inch-pounds. Recheck breakaway torque and readjust if required.

11-38. INSTALLATION — PILOT CYCLIC STICK.

a. Place pilot cyclic stick in mounting hole of pilot floor.

b. Align holes and install four bolts through the stick support and floor. Use thin alloy washers under bolt heads and nuts.

c. Apply sealant (C105) to fill in structure fore-and-aft of stick support and form a fillet between support and floor.

d. Connect tube assembly (12, figure 11-12). Use one washer under bolt head and one washer under nut. Secure with cotter pin.

e. Connect tube assembly (18, figure 11-13). Use one washer under bolt head and one washer under nut. Secure with cotter pin.

f. Connect electrical connector (43, figure 11-17), of stick to receptacle provided.

g. Check complete control system for security and safetying of components.

11-39. OPERATIONAL CHECK — PILOT CYCLIC STICK.

a. Check rigging of pilot cyclic stick through full range of movement (paragraph 11-29).

b. Install access panel in top of ammunition compartment.

c. Perform maintenance test flight. Refer to TM 55-1520-236 MTF.

11-40. GUNNER CYCLIC STICK.

11-41. DESCRIPTION — GUNNER CYCLIC STICK.

The gunner cyclic control stick is mounted on gunner right side console. It is attached on a support through pivot bearings which allow both fore-and-aft and lateral movements. The grip, attached at top of stick, is functionally identical to grip used on pilot cyclic stick and is equipped with identical control switches (figure 11-20). Because of the difference in the pilot and gunner cyclic systems, it requires more force (**1.63 TO 1** ratio) to move the gunner cyclic stick than it does to move the pilot cyclic stick.

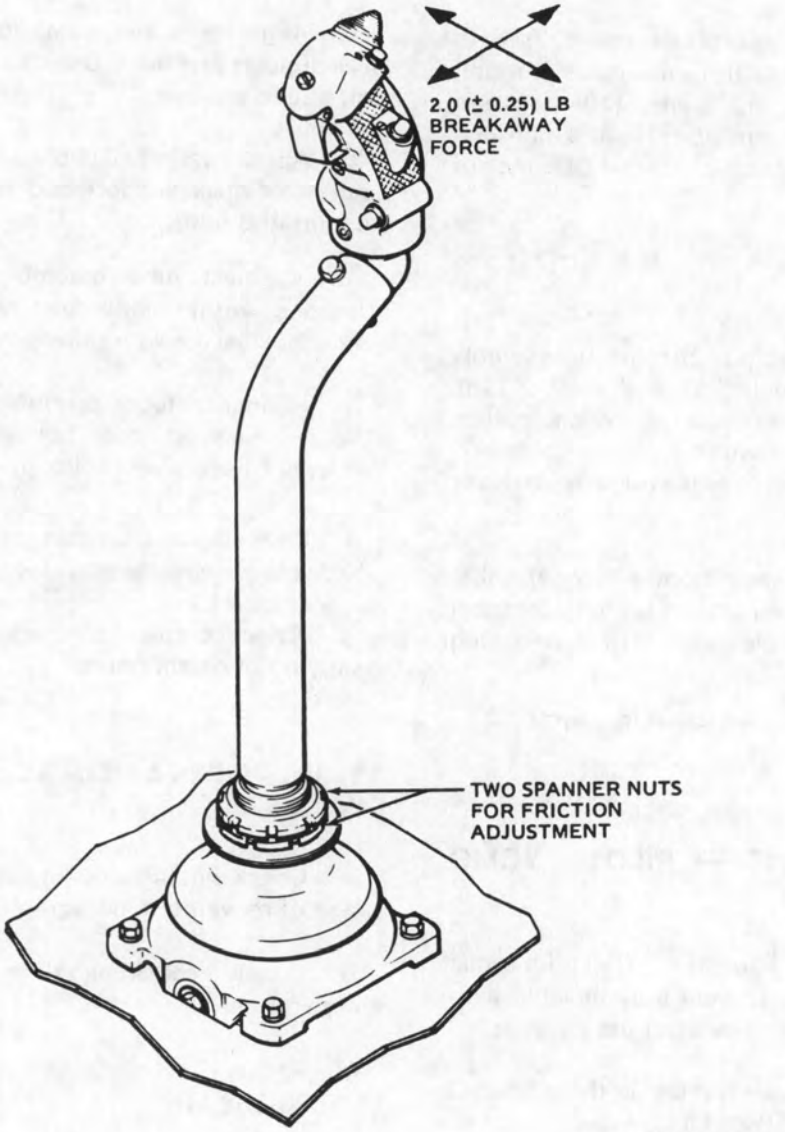


Figure 11-19. Pilot Cyclic Stick Friction Adjustment

Premaintenance Requirements for Gunner Cyclic Stick

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T48), (T61)
Test Equipment	Feeler Gage
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C112)
Special Environmental Conditions	None

11-42. REMOVAL — GUNNER CYCLIC STICK (AVIM).

a. Remove screw mounted panel from right side of fuselage above ammunition compartment for access to stick.

b. Disconnect electrical cable plug (9, figure 11-20) of stick from receptacle in console.

c. Disconnect fore-and-aft system tube assembly (13) by removing bolt (15), washers (12 and 14), nut (11), and cotter pin (10).

d. Disconnect lateral system link (21) by removing bolts (23), washers (20 and 22), nut (19), and cotter pin (18).

e. Detach boot (26) from console by removing screw (28) and washer (27) on outboard side and screw (28) and washer (27) on inboard side of stick.

f. Detach stick support from console structure by removing three bolts (24) and washers (25). Lift stick assembly out of console.

11-43. DISASSEMBLY — GUNNER CYCLIC STICK (AVIM).

a. Tag wires of electrical cable (5, figure 11-21) for identification, number and installation sequence in electrical connector (4) then remove connector plug from cable assembly.

b. Remove clamp (18) from electrical cable (5) by removing screw (20), washers (19 and 23) and nut (26).

c. Remove clamp (37) from bracket (38), by removing screw (35), washers (36 and 39) and nut (40), see detail C.

d. Remove grip (1) from uppper end of stick (31) by removing screw (17, figure 11-20) and apply gentle upward pressure on grip to prevent injury to attached cable assembly.

e. Separate stick (31, figure 11-21) from bellcrank (9) and support (10) by removing cotter pin (21), nut (22), washers (7 and 24), and bolt (6). Remove bracket 38) from bolt.

f. Separate bellcrank (9) from support (10) by removing cotter pin (17), nut (16), washers (12 and 15), and bolt (13).

g. Remove clamp support (29) by removing nut (3), washers (2 and 28), and screw (27).

11-44. INSPECTION — GUNNER CYCLIC STICK.

a. Inspect grip (1, figure 11-21) for cracks. No cracks are acceptable.

b. Inspect bellcrank (9), support (10), and cyclic control stick (31) for scratches, nicks, dents, and corrosion. Minor mechanical damage and superficial corrosion is acceptable if polished out.

c. Inspect bellcrank (9), support (10) and cyclic control stick (31) for cracks by fluorescent penetrant method (TM 43-0103). No cracks are acceptable.

d. Inspect switches for damage that could affect function of the switches.

e. Inspect cable (5) for loose connectors, broken terminals, pins, and/or soldered connections to switches in grip (1). Inspect cable wires for breaks and/or chafing.

f. Inspect bearings (8, 11, 14, 25, and 30) for roughness and wear. Maximum acceptable wear (play) is **0.005 TO 0.030** inch.

11-45. REPAIR OR REPLACEMENT — GUNNER CYCLIC STICK (AVIM).

a. Replace components that fail to meet inspection requirements of paragraph 11-44.

b. Replace defective switches or electrical cable as required (paragraph 9-20 and Appendix F).

c. Refer to paragraph 11-165 for instructions to replace bearings. If bearing (30) must be replaced, use staking tool (T48) in place of staking tool (T61).

d. Polish out minor corrosion and mechanical damage from parts in accordance with general repair procedures in paragraph 11-158.

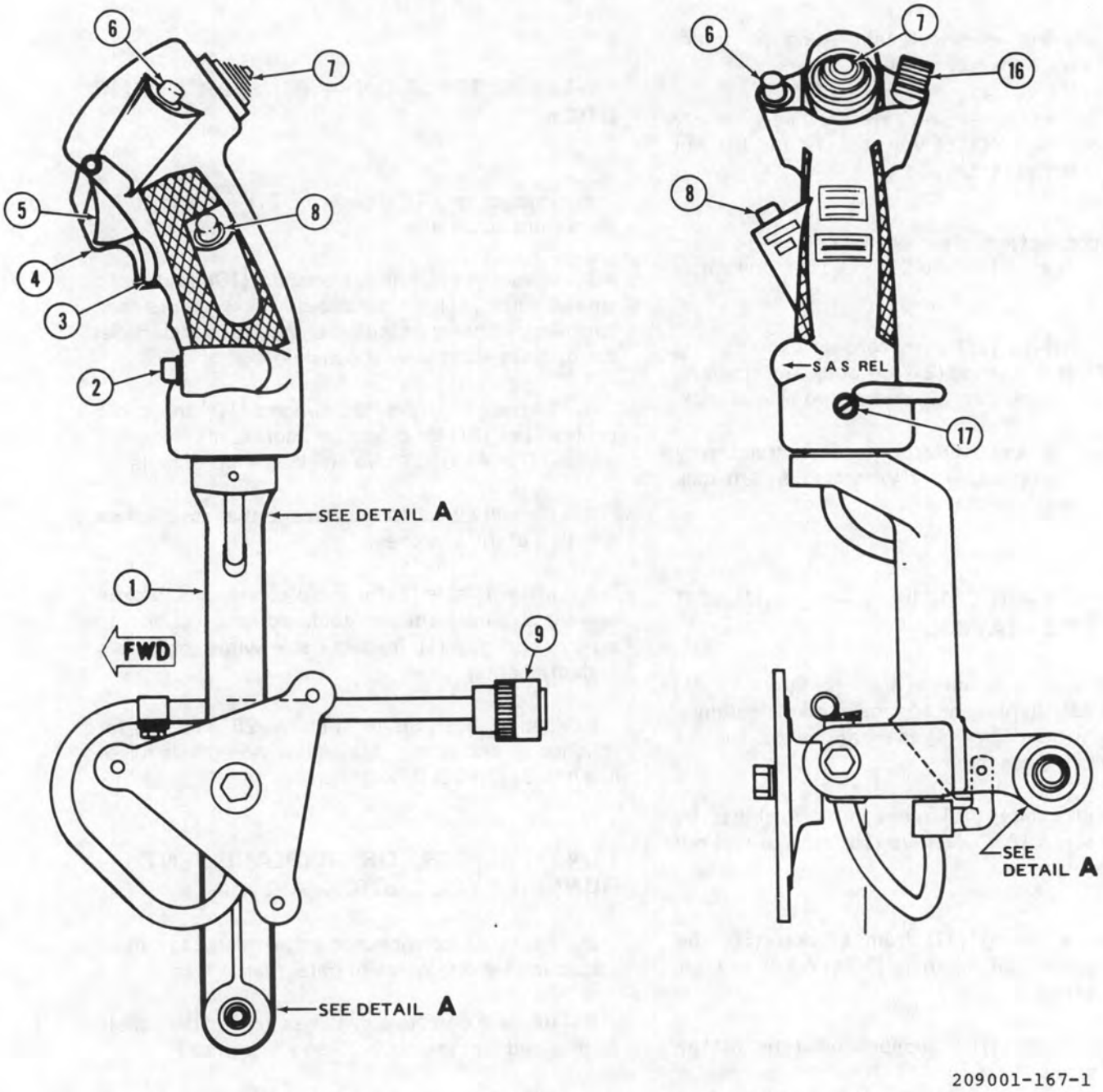
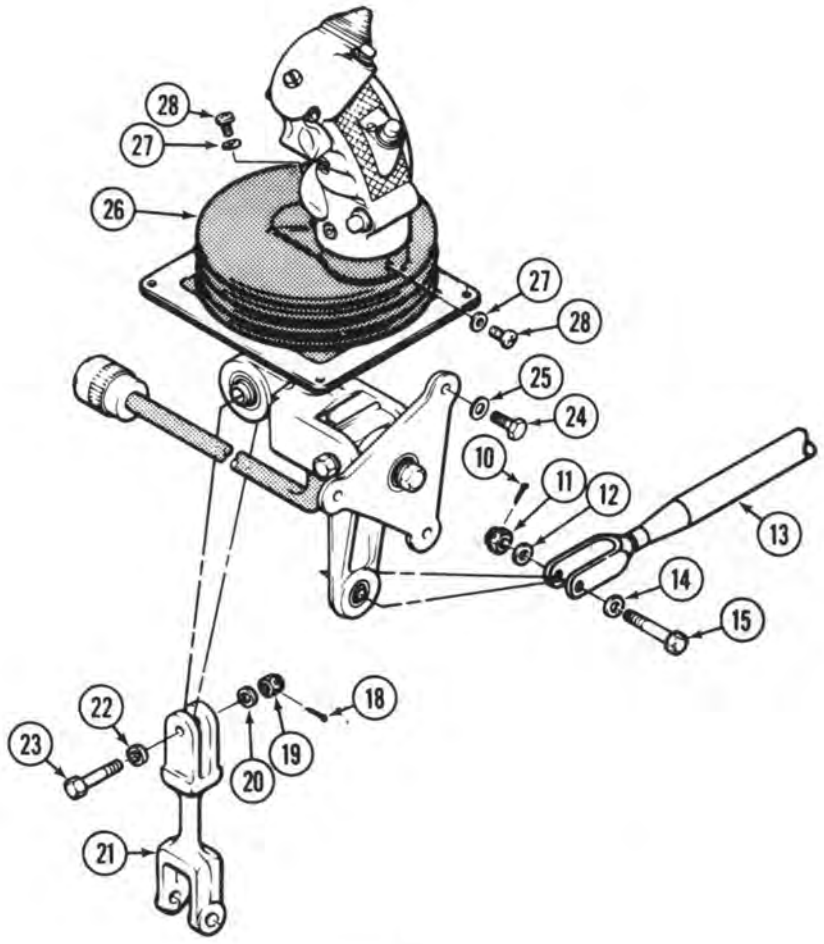


Figure 11-20. Gunner Cyclic Stick Installation (Sheet 1 of 2)



DETAIL **A**

1. Gunner cyclic stick
2. SAS release (SCAS) switch
3. Trigger guard
4. Trigger guard
5. Trigger turret fire switch
6. Trim release switch
7. ICS — radio switch
8. Wing arm fire switch
9. Electrical plug
10. Cotter pin
11. Nut
12. Washer
13. Control tube assembly
14. Washer
15. Bolt
16. Night vision goggle switch
17. Screw
18. Cotter pin
19. Nut
20. Washer
21. Link
22. Washer
23. Bolt
24. Bolt
25. Washer
26. Boot
27. Washer
28. Screw

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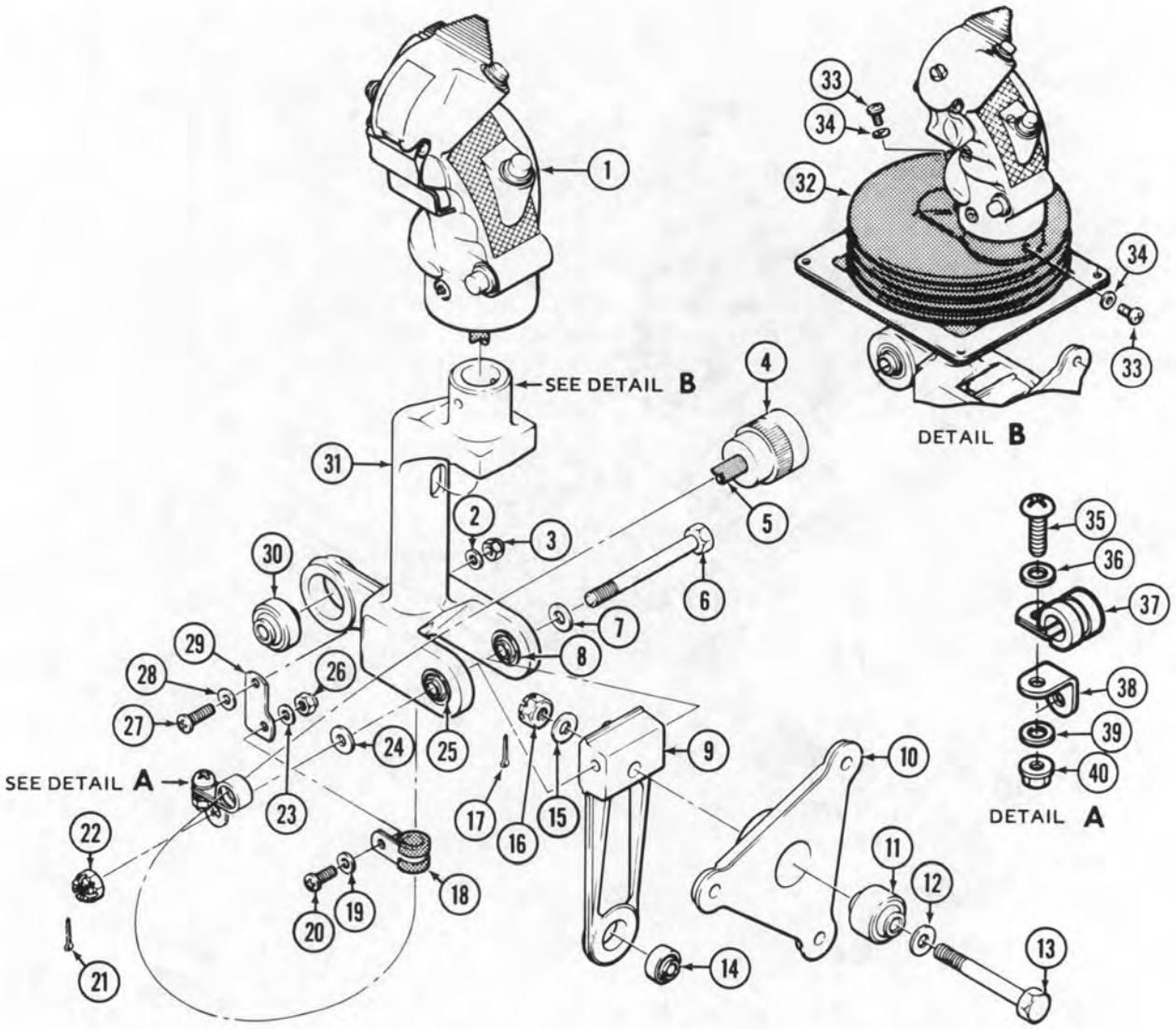
Figure 11-20. Gunner Cyclic Stick Installation (Sheet 2 of 2)



1. Grip assembly
2. Washer
3. Nut
4. Electrical connector
5. Electrical cable
6. Bolt
7. Washer
8. Bearing
9. Bellcrank
10. Support assembly
11. Bearing
12. Washer
13. Bolt
14. Bearing
15. Washer
16. Nut
17. Cotter pin
18. Clamp
19. Washer
20. Screw
21. Cotter pin
22. Nut
23. Washer
24. Washer
25. Bearing
26. Nut
27. Screw
28. Washer
29. Clamp support
30. Bearing
31. Cyclic control stick
32. Boot
33. Screw
34. Washers
35. Screw
36. Washer
37. Clamp
38. Bracket
39. Washer
40. Nut

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Figure 11-21. Gunner Cyclic Stick Assembly

11-46. ASSEMBLY — GUNNER CYCLIC STICK (AVIM).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

CAUTION

Do not allow solvent to enter bearings or electrical components.

a. Clean exposed surfaces by wiping with a cloth dampened with dry cleaning solvent (C112).

b. Place one washer (12, figure 11-21) under head of bolt (13), insert bolt through support (10) and through bellcrank (9). Secure bolt with washer (15), nut (16), and cotter pin (17).

c. Separate two wire bundles in cable (5) so that screw (17, figure 11-20) can be installed between the two wire bundles without damage to cable (5, figure 11-21).

d. Route cable (5) through top of cyclic stick and install grip (1) with holes in grip aligned with holes in cyclic stick (31). Install screw (17, figure 11-20) through grip and stick. Ensure that screw is between cable bundles (5, figure 11-21).

e. If removed, attach clamp support (29) to cyclic stick with screw (27), washers (2 and 28), and nut (3).

f. Install cable (5) in clamp (18) and attach clamp to support (29) with screw (20), washers (19 and 23), and nut (26).

g. Position bellcrank (9) with support (10) between ears of cyclic stick (31). If removed, install floating bearing (25) in one ear of cyclic stick. Align holes in bellcrank with bearings (8 and 25) and install bolt (6) with one washer (7) under head through cyclic stick and bellcrank.

h. Install cable (5) in clamp (37) and secure with screw (35), washers (36 and 39), and nut (40).

i. Install one washer (24) and bracket (38) on bolt (6). Install nut (22) and secure with cotter pin (21).

j. Ensure that cable (5) is routed as shown in figure 11-21. Install connector (4) on cable (5) in same sequence as original installation (Appendix F and paragraph 9-22).

11-47. INSTALLATION — GUNNER CYCLIC STICK (AVIM).

a. Place stick assembly into opening of console, inserting electrical cable first.

b. Align stick support to mounting holes of beam. Install three bolts (24, figure 11-20) with thin aluminum alloy washers (25) under heads.

c. Connect fore-and-aft system tube assembly (13) by installing bolt (15), washers (12 and 14), nut (11), and cotter pin (10).

d. Connect lateral system link (21) by installing bolt (23), washers (20 and 22), nut (19), and cotter pin (18).

e. Connect electrical cable connector (9) to receptacle in console.

f. Secure boot (26) to console with screw (28) and washer (27) on inboard side and screw (28) and washer (27) on outboard side.

11-48. OPERATIONAL CHECK — GUNNER CYCLIC STICK.

a. Check complete control system for security and safetying of components.

b. Check cyclic system rigging as outlined in paragraph 11-29.

c. Install access panel.

d. Perform maintenance test flight (TM 55-1520-236 MTF).

11-49. JACKSHAFT — CYCLIC CONTROLS.

11-50. DESCRIPTION — JACKSHAFT — CYCLIC CONTROLS.

The jackshaft integrates fore-and-aft cyclic control input actions from the pilot and gunner cyclic sticks into one output action and changes the direction of

movement from WL 54.76, station 146.50 down and slightly forward to a bellcrank at WL 37.88, station 144.75. Supports located at stations 146.50 and 148.50 provide for attachment of the jackshaft to the fuselage. The jackshaft rotates on bearings within the supports.

Premaintenance Requirements for Jackshaft

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T48), (T61)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C31), (C36), (C88), (C91), (C102), (C112)
Special Environmental Conditions	None

11-51. REMOVAL — JACKSHAFT — CYCLIC CONTROL.

a. Remove access panels (4, 5, 9, and 10, figure 2-3) from right side of fuselage and remove access panels (32, 33, and 34) from bottom of fuselage.

b. Open ammunition compartment door (8) and remove access panel on aft, center bulkhead inside ammunition compartment. Detach tube assembly (12, 16, and 19, figure 11-12) and force gradient (14) from levers of jackshaft (15). Refer to paragraph 11-65 for procedure.

c. Remove nut (21, figure 11-22), washers (18 and 20), and bolt (17) that attaches lower ear of support (3) to right hand beam and lower ear of support assembly.

d. Remove bolts (5) and washers (4) from remaining two ears of support (3).

e. Detach jackshaft support (8) from its attaching point by removing four bolts (10) and washers (9).

f. Carefully guide outboard lever of jackshaft (1) through the opening in right hand beam assembly and remove jackshaft from fuselage through ammunition compartment.

g. Remove cotter pin (11), nut (12), washers (13 and 14) and remove support (8) from end of jackshaft.

h. Remove support (3) from bearing surface of jackshaft and guide it off end of jackshaft over lever.

11-52. INSPECTION — JACKSHAFT — CYCLIC CONTROLS.

a. Inspect jackshaft assembly (1, figure 11-22) and support assemblies (3 and 8) for cracks, using fluorescent penetrant in accordance with TM 43-0103.

b. Inspect bearings (2, 6, 15, 19, and 22) for roughness, freedom of movement, and wear in excess of **0.005** inch radial and **0.030** inch axial play.

c. Inspect plating on bearing surface of jackshaft for wear, damage, and peeling. Minimum allowable diameter of plated bearing surfaces is **1.560** inch.

d. Inspect plug (7) for damaged threads and worn, peeled or damaged plating.

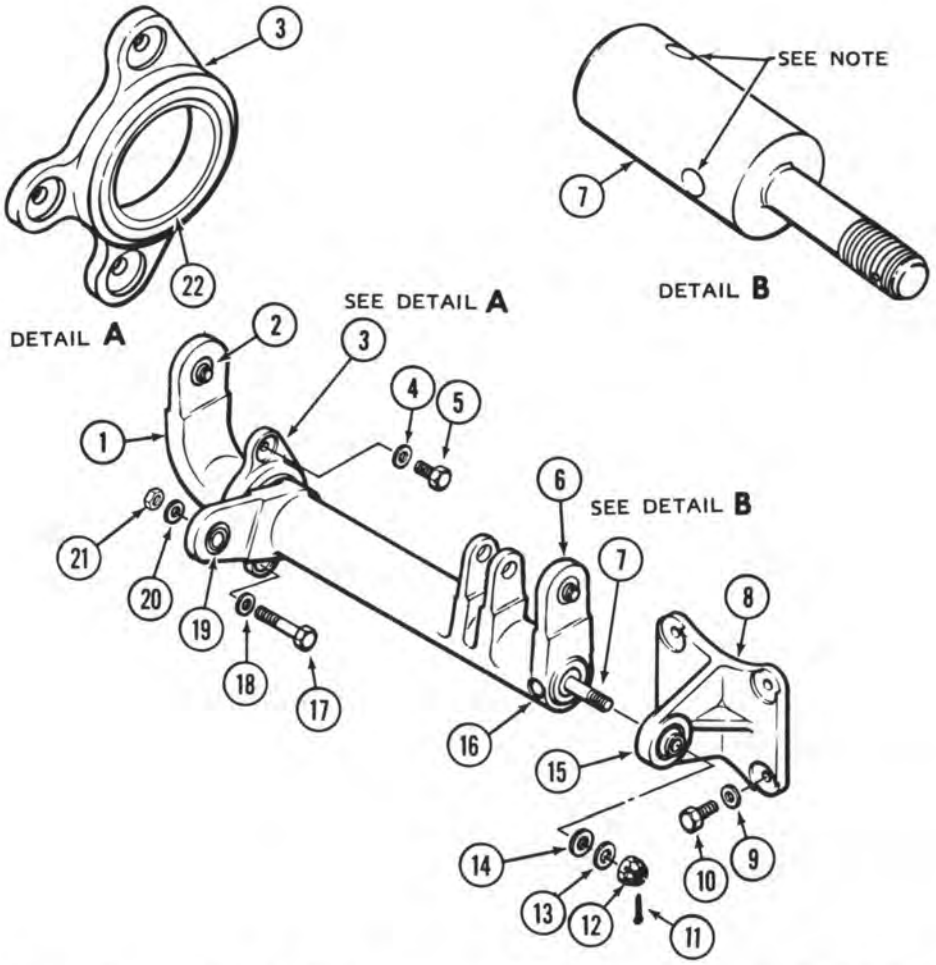
e. Inspect jackshaft (1) and supports (3 and 8) for scratches and corrosion.

11-53. REPAIR OR REPLACEMENT — JACKSHAFT CYCLIC CONTROLS.

a. Polish out all scratches and corrosion on jackshaft (1, figure 11-22) or supports (3 and 8) which do not exceed **0.005** inch depth, using 180 grit or finer sandpaper (C102). Polish to a smooth, scratch free finish with abrasive cloth (C36). Blend edges of repair into surrounding area. Apply chemical film coating (C31) to repaired areas. Prime repaired areas with primer (C88 or C91).

b. Replace jackshaft assembly (1, figure 11-19) or supports (3 and 8) if cracked.

c. Replace bearings (2, 6, and 19) when wear or damage exceeds limits of paragraph 11-52. Refer to paragraph 11-13 for replacement procedure.



NOTE: Drill two 0.191 TO 0.196 diameter holes to match with holes in jackshaft.

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

1. Jackshaft
2. Bearing
3. Support assembly
4. Washer
5. Bolt
6. Bearing
7. Plug
8. Support
9. Washer
10. Bolt
11. Cotter pin
12. Nut
13. Washer
14. Washer
15. Bearing
16. Rivet
17. Bolt
18. Washer
19. Bearing
20. Washer
21. Nut
22. Bearing

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Figure 11-22. Fore-and-Aft Cyclic Jackshaft Installation

d. Replace bearing (15) in support (8) when wear or damage limits in paragraph 11-52, step b. (Use replacement procedure in paragraph 11-13, except use staking tool (T48) instead of staking tool (T58).

e. Replace bearing (22) in support (3) when wear or damaged exceeds limits in paragraph 11-52.

(1) Carefully press bearing from support.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

(2) Clean inside of support with dry cleaning solvent (C112).

(3) Apply primer (C88 or C91) to outer race of bearing.

(4) Carefully press new bearing (22) into support while primer is wet.

f. Replace jackshaft (1) when wear and damage to plated bearing surface is in excess of limits in paragraph 11-52.

g. Inspect plug (7) in end of jackshaft. If inspection reveals any damage, send to next higher maintenance level.

11-54. INSTALLATION — JACKSHAFT — CYCLIC CONTROLS.

a. Install support (3, figure 11-22) on jackshaft (1) and position it on plated bearing surface of jackshaft.

b. Insert threaded end of plug (7) into support (8) bearing. Install two washers (13 and 14), nut (12), and cotter pin (11).

c. Carefully guide outboard lever of jackshaft (1) through opening in right hand beam assembly.

d. Align the three holes in support (3) with holes in right hand beam. Install one bolt (5) with one washer (4) through bolt hole in top and in forward ear of support (3).

e. Install bolt (17) with washer (18) through hole in bottom ear of support (3). Secure with washer (20) and nut (21).

f. Align support (8) to four holes in bulkhead and install four bolts (10), washers (9) under bolt heads.

g. Attach tube assemblies (12, 16, and 19, figure 11-12) and force gradient (14) to levers of jackshaft (15).

h. Check complete control system for security and safetying of components.

i. Check cyclic system rigging (paragraph 11-29).

j. Install access panels, (4, 5, 9, and 10, figure 2-3) and access panels (32, 33, and 34). Install access panel on aft, center bulkhead inside ammunition compartment and secure ammunition door (8).

k. Perform maintenance test flight (TM 55-1520-236 MTF).

11-55. MAGNETIC BRAKE — CYCLIC CONTROLS.

11-56. DESCRIPTION — MAGNETIC BRAKE — CYCLIC CONTROLS.

A magnetic brake assembly is installed in both the fore-and-aft and lateral cyclic control system. Each brake assembly is secured to the airframe structure. It consists of a rotary shaft which can be mechanically actuated and an electrically actuated magnetic brake that will hold the rotary shaft at any point in its travel when actuated by a switch on the cyclic stick (figures 11-12 and 11-13).

Premaintenance Requirements for Magnetic Brake

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special TOOLS	None
Test Equipment	None

Conditions	Requirements
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C88), (C91), (C102), (C112)
Special Environmental Conditions	None

11-57. INSPECTION — MAGNETIC BRAKE — CYCLIC CONTROL.

a. With electrical power off, manually rotate the rotary shaft of the magnetic brake from stop to stop. Check to ensure freedom of rotation and full range of travel.

b. Apply electrical power to actuate the magnetic brake. Check to ensure that the rotary shaft will not rotate with brake applied.

c. Check attachment bolts for security, if magnetic brake is attached to the fuselage.

d. Inspect electrical connector for mechanical damage and corrosion.

11-58. REMOVAL — MAGNETIC BRAKE — CYCLIC CONTROLS.

a. Turn electrical power off.

b. Remove access panel. For the fore-and-aft system, remove panel in top of ammunition compartment. For lateral system, remove panel on right side of fuselage above ammunition compartment.

c. Disconnect electrical connector from receptacle on magnetic brake.

d. Detach force gradient from arm of magnetic brake by removing cotter pin, nut and washer, and from bellcrank by removing cotter pin, nut, washer, and bolt.

e. On lateral system only, unhook springs (29, figure 11-13) from plates (28). Detach plates (28) by removing two bolts.

f. Detach magnetic brake assembly from structure by removing four bolts and washers.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

11-59. CLEANING — MAGNETIC BRAKE — CYCLIC CONTROLS.

Clean exposed surface of magnetic brake with clean cloth dampened with dry cleaning colvent (C112). Do not allow solvent to enter bearings or electrical components.

11-60. REPAIR OR REPLACEMENT — MAGNETIC BRAKE — CYCLIC CONTROLS.

a. Remove minor corrosion with sandpaper (C102). Prime repaired area with primer (C88 or C91). If corrosion damage is severe enough to affect function, replace the magnetic brake assembly.

b. Replace magnetic brake assembly if damaged of malfunctioning.

11-61. INSTALLATION — MAGNETIC BRAKE — CYCLIC CONTROLS.

a. Prior to installation of magnetic brake assembly, check the magnetic brake assembly to make sure arm is properly located on the shaft. Mark "F" on the arm must be 90 degrees from line on end of shaft. See detail A, figure 11-12 and detail D, figure 11-13.

b. Position magnetic brake assembly to mounting holes of structure, and install four attaching bolts with washers.

NOTE

Springs (29, figure 11-13) assist control stick movements by compensating for weight of the actuator (12) and will normally be attached in end holes of plate (28).

(1) Install magnetic brake (27) for the lateral cyclic system on the outboard side of beam in the right side console at fuselage station 105.78 with the electrical receptacle facing aft and the arm pointing outboard (to right) at midtravel. Install plate (28) on two aft bolts, on outboard side of brake body. Hook springs (29) on plate (28).

(2) Install magnetic brake (17, figure 11-13) for the fore-and-aft cyclic system on the under side of the pilot floor panel inboard of right side beam and aft of pilot control stick at fuselage station 133.76 with the electrical receptacle facing forward and the arm on the inboard side pointing down at midtravel.

c. Connect electrical connector to receptacle on magnetic brake.

d. Install force gradient (paragraph 11-70).

11-62. FORCE GRADIENT — CYCLIC CONTROLS.

11-63. DESCRIPTION — FORCE GRADIENT — CYCLIC CONTROLS.

A force gradient assembly in each of the two cyclic controls systems performs stick centering and force trim functions. The force gradient is a link equipped with an internal spring and connects the magnetic brake arm to a lever or bellcrank in the cyclic control system (figures 11-12 and 11-13).

Premaintenance Requirements for Force Gradient in Cyclic Control

Conditions	REQUIREMENTS
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C112), (C138)
Special Environmental Conditions	None

11-64. INSPECTION — FORCE GRADIENT — CYCLIC CONTROLS (AVIM).

a. Check cap (2, figure 11-23), cylinder (3), and shaft (8) thread condition.

b. Fluorescent penetrant inspect cylinder (3), shaft (8), and guides (9 and 11) in accordance with TM 43-0103, if cracks are suspected. Refer to paragraph 11-67 for disassembly of force gradient.

c. Inspect bearing (4) for binding and/OR FREEDOM OF MOVEMENT_

NOTE

Free length of spring used in tail rotor force gradient should be 4.50 TO 4.62 inches.

d. Inspect free length of spring (10) for length of **4.84 to 4.96** inches.

11-65. REMOVAL — FORCE GRADIENT — CYCLIC CONTROLS.

a. Remove access panels. Fore-and-aft gradient, remove panel in top of ammunition compartment. For lateral gradient, remove panel on right side of fuselage above ammunition compartment.

b. Detach force gradient from arm of magnetic brake by removing cotter pin, nut, and washer. Detach lateral gradient (21, figure 11-13) from bellcrank or fore-and-aft gradient (14, figure 11-12) from jackshaft by removing cotter pin, nuts, washers, and bolt.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

CAUTION

Do not allow solvent to enter bearings.

11-66. CLEANING — FORCE GRADIENT — CYCLIC CONTROLS.

Clean force gradient components with clean cloth dampened with dry cleaning solvent (C112).

NOTE

Disassembly is only required for fluorescent penetrant inspection or replacement of parts.

11-67. DISASSEMBLY — FORCE GRADIENT — CYCLIC CONTROLS (AVIM).

a. Cut lockwire and remove cap (2, figure 11-23) from cylinder (3).

b. Remove spring assembly (1) from cylinder (3).

c. Remove three nuts (5, 6, and 7) from shaft (8).

d. Remove spring guides (9 and 11) and spring (10).

11-68. REPAIR OR REPLACEMENT — FORCE GRADIENT — CYCLIC CONTROLS (AVIM).

Replace bearing, sleeve, and nuts as necessary.

a. Fluorescent penetrant inspect housing per MIL-I-6866 (reference TM 55-1500-204-25/1) after bearing removal.

b. Roll stake sleeve both sides.

a. Chamfer 0.030 inch depth x 45 degrees each side of hole in housing.

d. Coat sleeve ID and OD, bearing OD, and housing bore with wet zinc chromate primer (C91) during assembly.

11-69. ASSEMBLY — FORCE GRADIENT — CYCLIC CONTROLS (AVIM).

a. Assemble spring (10, figure 11-23) and guides (9 and 11) on shaft (8) and install one nut (7) onto shaft with edge of nut adjacent to guide (11) on threaded end of shaft.

b. Preload spring (10) on shaft (8) as follows:

(1) Apply a load of **5.5 TO 6.5** pounds on spring of gradient. Measure spring length while at this load, and record length.

(2) Tighten nut (7) against guide (11) until length of spring (7) is the same as when under load (step (1) above).

c. Install nut (6) on shaft (8) adjacent to nut (7).

d. Hold nut (7) with wrench or other suitable device and tighten nut (6) tightly against it as a jam nut.

e. Make certain preload on spring is still same as recorded in step b(1).

f. Insert spring assembly (1) into cylinder (3).

g. Slide center hole of cap (2) over end of spring shaft (1) with thread end of cap toward cylinder (3).

h. Screw cap (2) into cylinder (3) until all noticeable end play of spring assembly (1) is removed.

i. Lockwire cap (2) to cylinder (3) with lockwire (C138) as shown in figure 11-23, to eliminate motion in either direction.

j. Install remaining nut (5) onto shaft of spring assembly (1) (to be used as jam nut against rod end at installation).

11-70. INSTALLATION — FORCE GRADIENT — CYCLIC CONTROLS.

a. Install rod end on threaded end of spring shaft, with jam nut in place. Final adjustment is made in rigging procedure.

b. Connect cylinder end of force gradient assembly on arm of magnetic brake with special washer, nut, and cotter pin. Leave rod end of force gradient disconnected, to be adjusted and connected after rigging cyclic controls.

c. Attach force gradient assembly (14, figure 11-12) to jackshaft (15). Refer to paragraph 11-29 for rigging instructions of force gradient assembly.

d. Rig and install force gradient assembly (21, figure 11-13) to bellcrank (19). Refer to paragraph 11-29 for rigging instructions.

e. After final adjustment, secure rod end (figure 11-13, item 20) with jam nut (figure 11-23, item 5) torqued **150 TO 200** inch-pounds.

11-71. TAIL ROTOR CONTROL SYSTEM.

11-72. DESCRIPTION — TAIL ROTOR CONTROL SYSTEM.

The tail rotor system consists of two sets of adjustable pedals connected by tube assemblies, bellcranks, levers, servo actuator (SCAS), magnetic brake and force gradient assembly, and a hydraulic power cylinder which transmits control input from the pedals or SCAS system to the tail rotor tube assembly at tail rotor gearbox (figure 11-24).

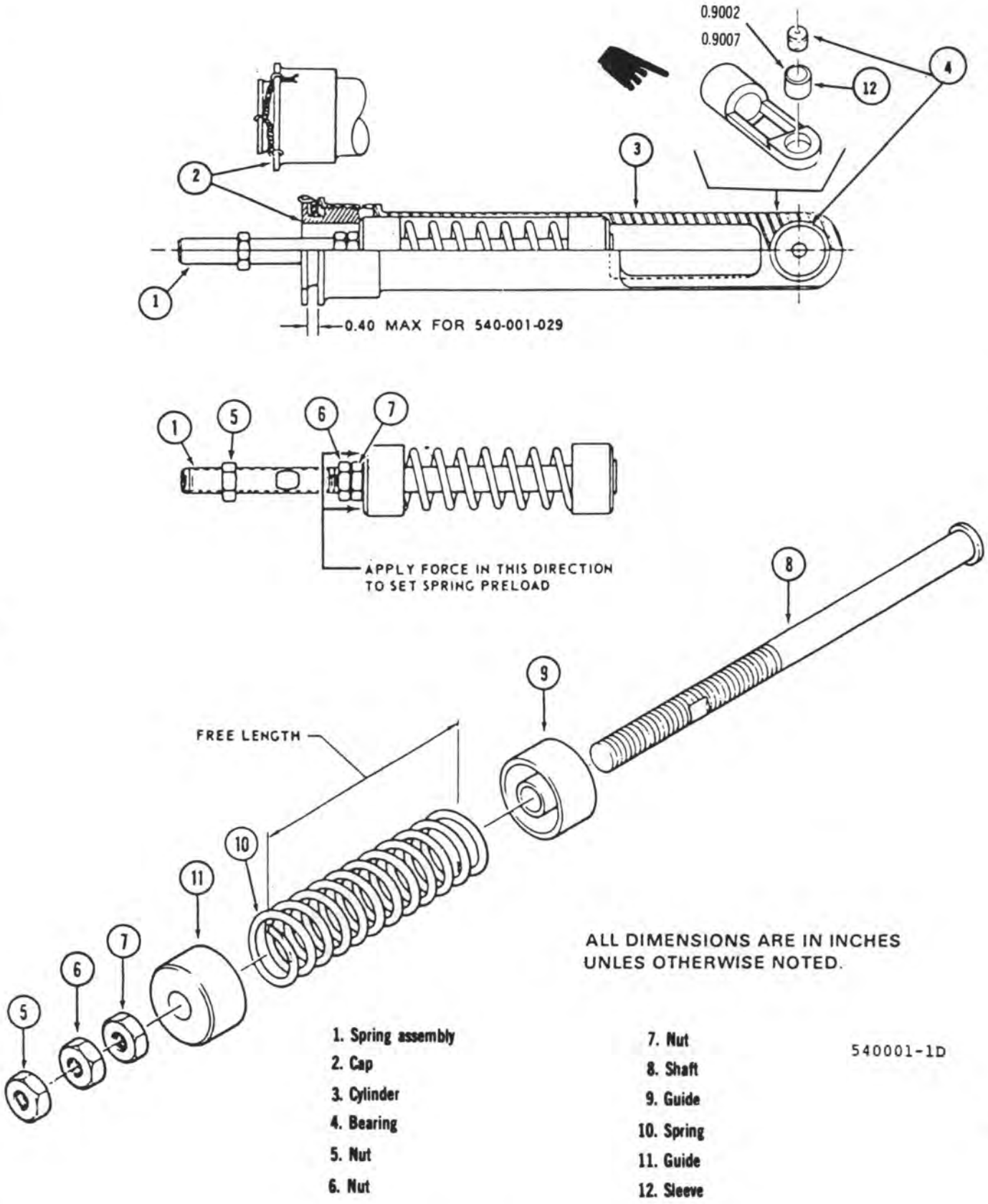


Figure 11-23. Force Gradient Assembly

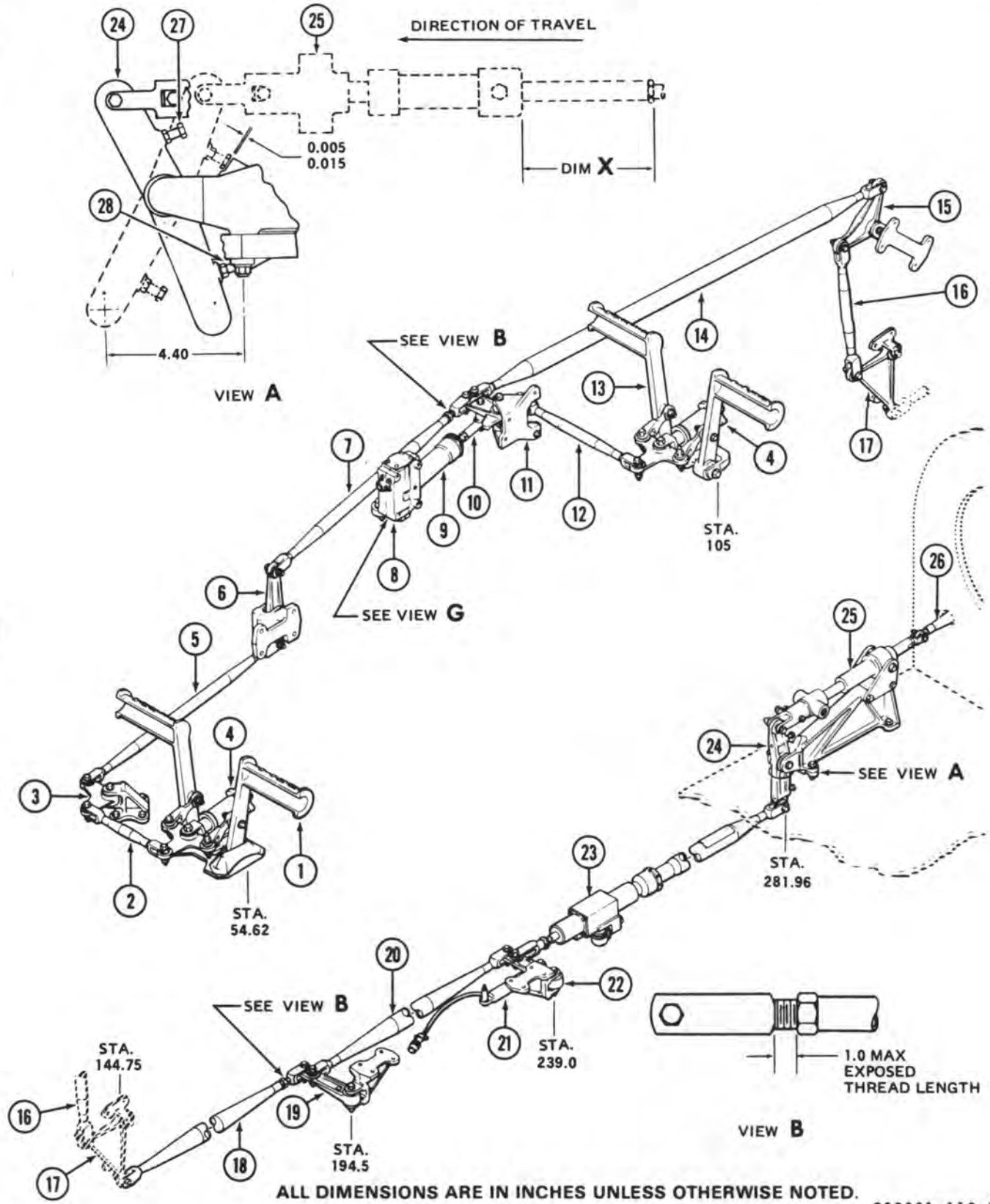
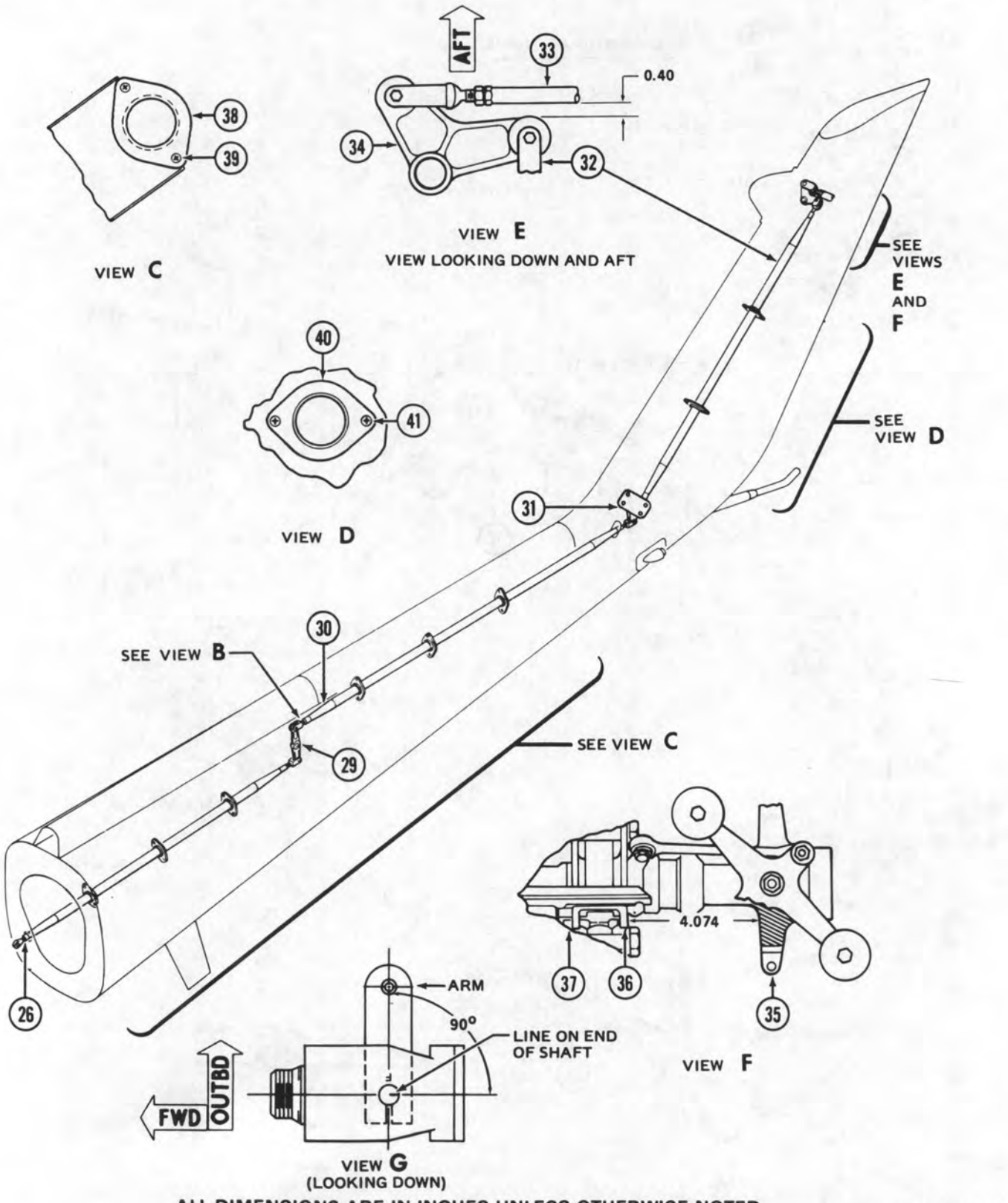


Figure 11-24. Tail Rotor Controls (Sheet 1 of 3)



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

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Figure 11-24. Tail Rotor Controls (Sheet 2 of 3)

1. Gunner control pedals
2. Tube assembly
3. Bellcrank and support
4. Adjuster knob
5. Tube assembly
6. Bellcrank assembly
7. Tube assembly
8. Magnetic brake
9. Force gradient
10. Rod end bearing
11. Bellcrank and support
12. Tube assembly
13. Pilot control pedals
14. Tube assembly
15. Bellcrank
16. Tube assembly
17. Bellcrank
18. Tube assembly
19. Lever
20. Tube assembly
21. Transducer
22. Lever
23. Servo actuator (SCAS)
24. Lever
25. Hydraulic cylinder and support
26. Tube assembly
27. Top stop bolt
28. Bottom stop bolt
29. Lever
30. Tube assembly
31. Bellcrank
32. Tube assembly
33. Tube assembly
34. Bellcrank
35. Crosshead
36. Trunnion
37. Tail rotor
38. Guide
39. Screw and washer
40. Guide
41. Screw and washer

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Figure 11-24. Tail Rotor Controls (Sheet 3 of 3)

Premaintenance Requirements For Tail Rotor Controls

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	(S2)
Minimum Personnel Required	Two
Consumable Materials	(C43)
Special Environmental Conditions	N/A

11-73. RIGGING — TAIL ROTOR CONTROL SYSTEM.

a. If installed, remove access panel (10, figure 2-2) from right side only, panel (4, figure 2-3) from bottom of fuselage, and gearbox fairing, and cover (62) from left side of tailboom.

b. Accomplish rigging without hydraulic power unless otherwise stated.

c. Install all fixed length tube assemblies in the anti-torque controls, but do not connect tube assemblies (7, 18, 30, or 33, figure 11-24). Do not connect transducer (21) to lever (22).

d. Adjust pilot and gunner pedals to approximate midposition with adjuster knobs (4).

e. Position pilot pedals even with each other. Position gunner pedals even with each other. Adjust and install tube assembly (7). Coat clevis threads with corrosion preventive compound (C43) when adjusting tube assembly. Ensure that exposed threads on tube (7) do not exceed **1.00** inch as shown on view B.

f. Push right pedal forward against stop. Position lever (24) in position shown in dashed outline in view A. Adjust and install tube assembly (18). Coat clevis threads with corrosion preventive compound (C43) when adjusting tube assembly. Ensure that exposed threads on tube assembly (18) do not exceed **1.00** inch as shown in view B. Check to ensure that right pedal is still forward against stop. Adjust top stop bolt (27) to clear support by **0.005 TO 0.015** inch as shown on detail A.

g. Check to ensure that right pedal is still forward against stop. Push forward on piston rod of hydraulic cylinder (25) to bottom valve. Measure and record dimension X shown on view A. Pivot lever (24) toward position shown by solid outline in view A until dimension X is decreased by **3.02** inches. Keep hydraulic cylinder (25) valve bottomed. Adjust bottom stop bolt (28) to touch stop.

h. Remove tail rotor blade pitch links and adjust to **6.115** ± **0.010** inch dimension. Refer to paragraph 5–104 for instructions to adjust and install tail rotor blade pitch links.

i. Push left pedal forward against stop and adjust crosshead to **4.074** inch dimensions from outboard face of trunnion as shown in view F. Adjust tube assembly (33) to obtain **0.40** inch clearance with bellcrank (34) as shown in view E.

j. Ensure left pedal is still forward against stop. Position bellcrank (34) as noted in preceding step. Push forward on piston rod of hydraulic cylinder (25) to bottom valve. Adjust tube assembly (30) to fit, then lengthen tube by adjusting clevis one turn. Install tube. Ensure that exposed threads on tube (30) do not exceed **one** inch as shown in view B.

k. Disconnect servo actuator (23) from lever (22). Connect transducer (21) to structure but disconnect from lever (22). Move pilot right pedal full forward against stop. Align transducer (21) for installation on lever and check to ensure that it does not bottom.

l. Move pilot left pedal full forward against stop. Align transducer (21) for installation on lever and check to ensure that it does not bottom. If necessary, adjust rod end on transducer and recheck to ensure that it does not bottom at either extreme position. Install transducer (21) on lever. Install servo actuator (23) on lever (22).

m. Place pilot control pedals even with each other. Position arm of magnetic brake (8) square within 2 degrees of the beam on which brake is mounted. Adjust force gradient (9) to connect to bellcrank (11) then extend length of rod end by two and one-half turns and install bolt from the top. Use thin aluminum alloy washer under bolt head and standard steel washer under nut. Tighten locknut on rod end.

n. Check complete tail rotor control system for security and safetying of components. Install access panels (4, figure 2-3 and 10, figure 2-2) and cover (62, figure 2-3).

o. Check operation with hydraulic test stand (S2) if available. If not available, move controls through full throw manually and ensure that there is no binding or interference.

p. Perform tracking check of tail rotor (paragraph 5-115).

11-74. PEDALS.

11-75. DESCRIPTION — PEDALS.

The pilot and gunner pedal installations are similar. The pedals pivot in support attached beneath the floor. The pedals are connected by short links to a bellcrank mounted on an adjuster which allows variable settings for the comfort and efficiency of crew members. A protective boot covers the openings around the pedals.

11-76. REMOVAL — PEDALS.

NOTE

This procedure is the same for both the gunner and pilot tail rotor pedals.

a. Disconnect tube assembly (1, figure 11-25) from bellcrank (19) at front of pedal assembly by removing cotter pin (18), nut (17), washers (3 and 16) and bolt (2).

b. Disconnect bellcrank links (4 and 23) from pedals (29 and 39) by removing cotter pin (11), nut (12), washers (10 and 40), and bolt (41).

c. Obtain access to area under floor. Remove cotter pin (51), nut (52), washers (45 and 50) and bolt (44) that secure pedals to support (43). Remove pedals upward from support.

d. Remove nuts (46 and 48) and washers (47 and 49) from lower ends of four bolts (31 and 35) that pass through adjuster support (37), boot retainer (38), floor panel, and pedals support (43). Remove support below floor.

Premaintenance Requirements for Pedals

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C30), (C31), (C36), (C43), (C88), (C91), (C102), (C112)
Special Environmental Conditions	None

e. Detach, bellcrank (19) from links (4 and 23) and adjuster clevis (9) by removing bolts (8 and 13), nuts (15 and 27), washers (6, 7, 22 and 25), and cotter pins (14 and 26).

f. If disassembly of adjuster is required, remove nut (34) and retaining washer (33) and unscrew knob (32) from threaded end of clevis (9). Slide clevis out of adjuster support. Handle parts with care to avoid damaging threads and mating surfaces coated with dry film lubricant.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

CAUTION

Keep solvent out of bearings.

11-77. CLEANING — PEDALS.

Clean parts with dry cleaning solvent (C112). Use care to avoid removing solid film lubrication from shank of adjuster clevis and interior surfaces of adjuster knob and housing.

11-78. INSPECTION — PEDALS.

a. If cracks are suspected, fluorescent penetrant inspect bellcrank (19, figure 11-25), links (4 and 23), clevis (9), pedals (29 and 39), and supports (37 and 43) in accordance with TM 43-0103.

b. Inspect bearings (5, 20, 21, 28 and 42) for roughness, freedom of movement, and wear in excess of **0.005** inch radial and **0.030** inch axial play.

c. Inspect clevis (9) and bellcrank (19) for corrosion, damaged threads, and elongated holes.

d. Inspect knob (32) for corrosion and damage.

e. Inspect links (4 and 23) for corrosion and worn or elongated bushings.

f. Inspect pedals (29 and 39) and support (37 and 43) for corrosion and elongated holes.

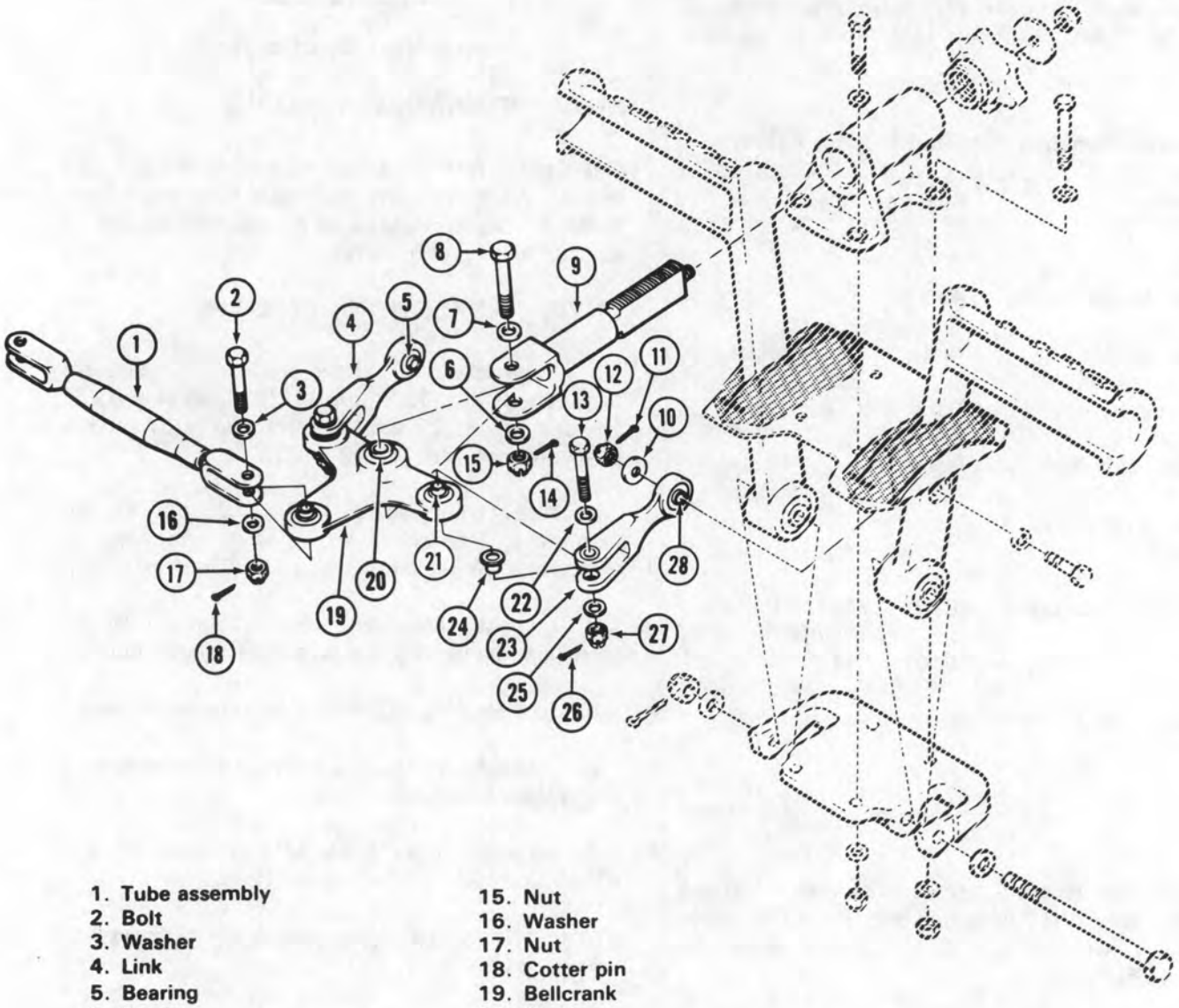
11-79. REPAIR OR REPLACEMENT — PEDALS.

a. Replace parts which fail to meet inspection requirements of paragraph 11-78.

b. Polish out all scratches and corrosion that do not exceed **0.005** inch depth, using 180 grit or finer sandpaper (C102). Polish to a smooth, scratch free finish with abrasive cloth (C36). Blend edges of repair into surrounding area. Apply chemical film cpating (C31) to repaired area. Prime repaired areas with primer (C88 or C91).

c. Refer to paragraph 11-13 for procedure to replace bearing (5, 21 and 28, figure 11-25).

d. Replace worn or elongated bushings (24) in links (4 and 23) as follows: (AVIM)



1. Tube assembly
2. Bolt
3. Washer
4. Link
5. Bearing
6. Washer
7. Washer
8. Bolt
9. Clevis
10. Washer
11. Cotter pin
12. Nut
13. Bolt
14. Cotter pin
15. Nut
16. Washer
17. Nut
18. Cotter pin
19. Bellcrank
20. Bearing
21. Bearing
22. Washer
23. Link
24. Bushing
25. Washer
26. Cotter pin
27. Nut
28. Bearing

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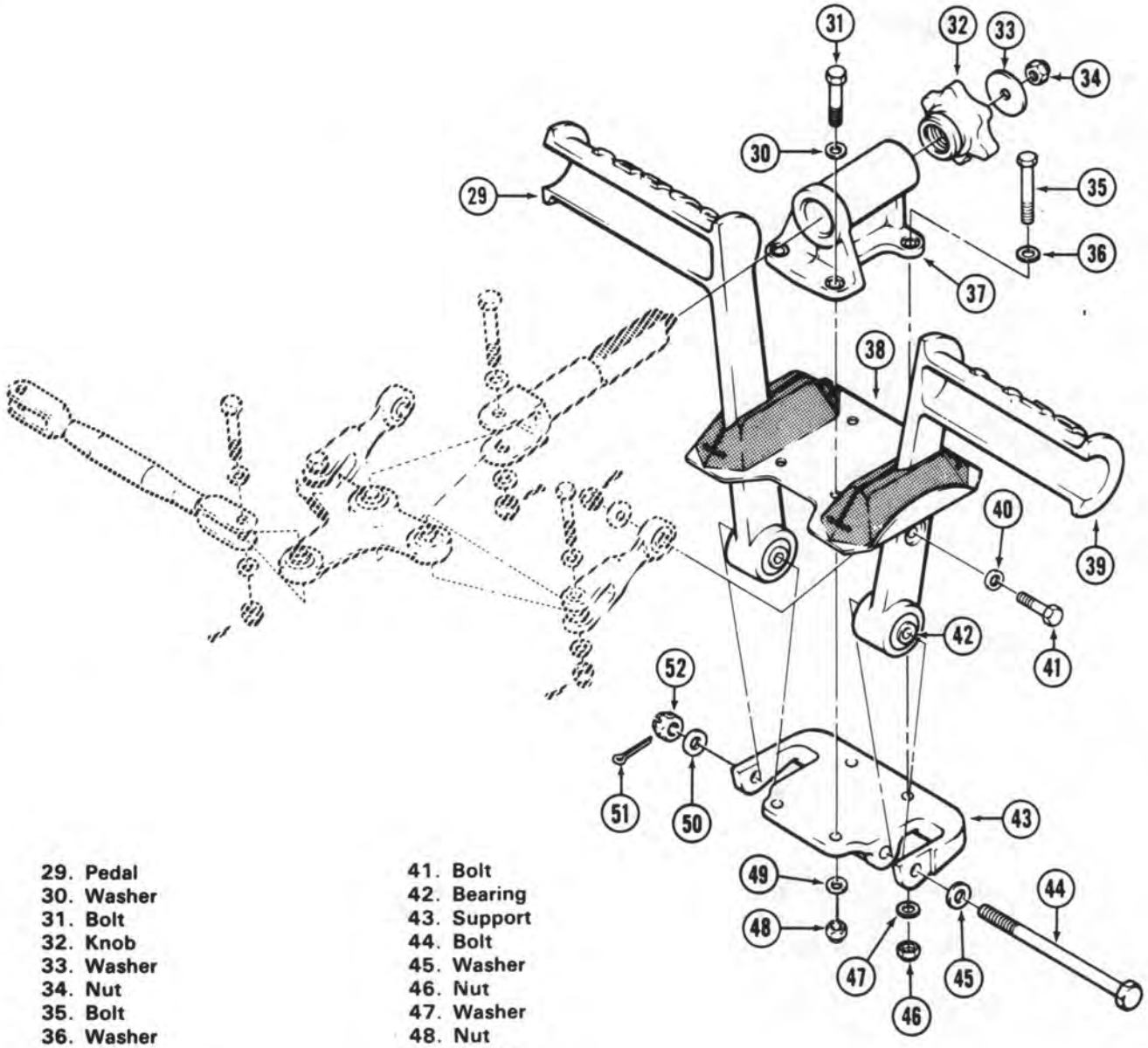
Figure 11-25. Tail Rotor Pedal Installation (Sheet 1 of 2)



29. Pedal
30. Washer
31. Bolt
32. Knob
33. Washer
34. Nut
35. Bolt
36. Washer
37. Support
38. Boot retainer
39. Pedal
40. Washer
41. Bolt
42. Bearing
43. Support
44. Bolt
45. Washer
46. Nut
47. Washer
48. Nut
49. Washer
50. Washer
51. Cotter pin
52. Nut

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Figure 11-25. Tail Rotor Pedal Installation (Sheet 2 of 2)

(1) Press old bushing from link.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

(2) Clean hole in link with clean cheese cloth (C30) dampened with dry cleaning solvent (C112).

(3) Prime outer race of bushing with primer (C88 or C91) and press new bushing into link (4 or 23).

(4) Line ream hole in bushing (24) to **0.2495 TO 0.2505** inch diameter. Polish to a smooth scratch free finish with abrasive cloth (C36).

e. Replace bellcrank (19) or pedals (29 and 39) when damage to bearings (20 or 42) exceeds limits of paragraph 11-78.

11-80. INSTALLATION — PEDALS.

NOTE

This procedure is typical for either pilot or gunner pedal and adjuster assemblies.

a. Coat clevis threads with lubricant (C43) and insert threaded end of clevis (9, figure 11-25) into adjuster support (37) from flared lower end. Position knob (32) on opposite end, with lip engaged in retaining groove. Screw knob on clevis threads. Install retaining washer (33) and nut (34) on small threaded end.

b. Align pedal interconnecting bellcrank (19) in adjuster clevis (9). Install bolt (8) from top through clevis and bellcrank. Use aluminum alloy washers (6 and 7) under bolt head and under nut. Secure nut (15) with cotter pin (14). In the same manner, attach two links (4 and 23) to bellcrank, using bolts (13), washers (22 and 25), nut (27) and cotter pin (26).

c. Position pedal support (43) under floor openings, with open sides of pedal slots forward. Place boot retainer (38) and adjuster assembly over floor openings. Align holes and install two bolts (31) and two bolts (35) through adjuster support, boot retainer, floor panel, and pedal support. Use one washer (30 and 36) under each bolt head and one washer (47 and 49) under each nut (46 and 48).

d. Insert pedals (29 and 39) down through boot slots. Align holes in support. Install bolt (44) with one washer (45), from left side through support and both pedals. Install washer (50), nut (52) and cotter pin (51).

e. Align a link (4 or 23) from bellcrank (19) to inner side of pedal. Place one washer (40) on bolt (41), and insert through pedal and link. Install safety washer (spacer) (10), nut (12), and cotter pin (11) on inboard end of bolt. Attach link to other pedals in the same manner.

f. Align tube assembly (1) on forward end of bellcrank (19). Install bolt (2), washers (3 and 16), nut (17) and cotter pin (18).

g. Check installation to ensure that all cotter pins are installed.

11-81. OPERATIONAL CHECK — PEDALS.

a. Adjust the position of pedals by rotating knob (32, figure 11-25) to set a variety of pedal positions. Actuate the pedals in each position through full range of travel and check for freedom of movement and any binding.

b. Check tail rotor rigging to ensure that rigging had not been disturbed by pedal installation (paragraph 11-73).

11-82. MAGNETIC BRAKE — TAIL ROTOR CONTROLS.

11-83. DESCRIPTION — MAGNETIC BRAKE — TAIL ROTOR CONTROLS.

A magnetic brake and force gradient assembly are connected to the linkage for force trim and control centering functions. The brake is secured on the right main beam, and has an arm on its rotary shaft which can be braked and held at any point of travel by use of a switch on the cyclic control stick.

Premaintenance Requirements for Magnetic Brake in Tail Rotor Control System

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	None
Special Tools	None
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C88), (C91), (C122)
Special Environmental Conditions	None

11-84. INSPECTION — MAGNETIC BRAKE — TAIL ROTOR CONTROLS.

Refer to paragraph 11-57.

11-85. REMOVAL — MAGNETIC BRAKE — TAIL ROTOR CONTROLS.

a. Turn electrical power off.

a. Remove access panels.

c. Disconnect electrical connector from receptacle on magnetic brake.

d. Detach force gradient (9, figure 11-24) from arm of magnetic brake by removing cotter pin, nut and washers, and from bellcrank (11) by removing cotter pin, nuts, washers, and bolts.

e. Detach magnetic brake (8) assembly from structure by removing four bolts and washers.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

CAUTION

Do not allow solvent to enter bearings or electrical components.

11-86. CLEANING — MAGNETIC BRAKE — TAIL ROTOR CONTROL.

Clean exposed surface of magnetic brake with a clean cloth dampened with dry cleaning solvent (C112).

11-87. REPAIR OR REPLACEMENT — MAGNETIC BRAKE — TAIL ROTOR CONTROLS.

a. Clean up minor corrosion and touch up with primer (C88 or C91). If corrosion damage is severe enough to affect function, replace the magnetic brake.

b. Replace magnetic brake assembly if damaged or malfunctioning.

11-88. INSTALLATION — MAGNETIC BRAKE — TAIL ROTOR CONTROLS.

a. Prior to installation of magnetic brake assembly, check the magnetic brake assembly, check the magnetic brake assembly to make sure the arm is properly located on the shaft. Mark "F" on the arm must be 90 degrees from line on end of shaft (view G, figure 11-24).

b. Position magnetic brake assembly (8) to mounting holes on outboard side of beam, in gunner right side console between walking beam and bellcrank with the electrical receptacle facing forward and arm on lower side pointing outboard (to right) at midtravel. Install four attaching bolts with thin washers.

c. Connect electrical connector to receptacle on magnetic brake (8).

d. Install force gradient (paragraph 11-97).

11-89. FORCE GRADIENT — TAIL ROTOR CONTROLS.

11-90. DESCRIPTION — FORCE GRADIENT — TAIL ROTOR CONTROLS.

A force gradient is used in the tail rotor control system for pedal centering and force trim functions. The force gradient is a link equipped with an internal spring and connects the magnetic brake arm to a bellcrank of the tail rotor controls. Although similar in appearance the lateral and fore-and-aft force gradients are different from the tail rotor force gradient and are not interchangeable.

Premaintenance Requirements for Force Gradient in Tail Rotor Control System

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C138)
Special Environmental Conditions	None

11-91. INSPECTION — FORCE GRADIENT — TAIL ROTOR CONTROLS.

Refer to paragraph 11-64.

11-92. REMOVAL — FORCE GRADIENT — TAIL ROTOR CONTROLS.

a. Remove access panels as necessary for access to force gradient (9, figure 11-24).

b. Detach force gradient rod end bearing (10) from bellcrank (11) by removing cotter pin, nut, washers, and bolt.

c. Detach force gradient from arm on magnetic brake by removing cotter pin, nut and washer.

11-93. CLEANING — FORCE GRADIENT — TAIL ROTOR CONTROLS.

Refer to paragraph 11-66.

11-94. DISASSEMBLY — FORCE GRADIENT — TAIL ROTOR CONTROLS (AVIM).

Refer to paragraph 11-67.

11-95. REPAIR OR REPLACEMENT — FORCE GRADIENT — TAIL ROTOR CONTROLS (AVIM).

Replace bearing, sleeve, and nuts as necessary.

a. Fluorescent penetrant inspect housing per MIL-I-6866 (reference TM 55-1500-204-25/1) after bearing removal.

b. Roll stake sleeve both sides.

c. Chamfer 0.030 inch depth x 45 degrees each side of hole in housing.

d. Coat sleeve ID and OD, bearing OD, and housing bore with wet zinc chromate primer (C91) during assembly.

11-96. ASSEMBLY — FORCE GRADIENT — TAIL ROTOR CONTROLS (AVIM).

a. Assemble spring (10, figure 11-23) and guides (9 and 11) on shaft (8) and install one nut (7) onto shaft with edge of nut adjacent to guide (11) on threaded end of shaft.

b. Preload spring (10) on shaft (8) as follows:

(1) Apply a load of **2.5 TO 3.0** pounds on spring of gradient. Measure spring length while at this load.

(2) Tighten nut (7) against guide (11) until length of spring (10) is the same as when under load (step (1) above).

c. Install nut (6) on shaft (8) adjacent to the nut (7) installed.

d. Hold first nut (7) with wrench or other suitable device and tighten nut (6) tightly against it as a jamnut.

e. Make certain preload on spring is still same as recorded in step b(1).

f. Insert spring assembly (1) into cylinder (3).

g. Slide center hole of cap (2) over end of spring shaft (1) with thread end of cap toward cylinder (3).

h. Screw cap (2) into cylinder (3) until all noticeable end play of spring assembly (1) is removed.

i. Lockwire cap (2) to cylinder (3) with wire (C138) as shown in figure 11-23, to eliminate motion in either direction.

j. Install remaining nut (5) onto shaft of spring assembly (1), to be used as jam nut against rod end at installation.

11-97. INSTALLATION — FORCE GRADIENT — TAIL ROTOR CONTROLS.

a. Install rod end bearing (10, figure 11-24) in threaded end of spring shaft, with jamnut in place. Final adjustment is made during rigging procedure.

b. Attach force gradient to arm on magnetic brake by installing cotter pin, nut, and washer.

c. Rig and install force gradient to bellcrank (11) (paragraph 11-73).

11-98. STABILITY AND CONTROL AUGMENTATION SYSTEM (SCAS).

11-99. P DESCRIPTION — STABILITY AND CONTROL AUGMENTATION SYSTEM (SCAS).

The SCAS is a three axis stability and control augmentation system. It is integrated into fore and aft, lateral, and directional (anti-torque) flight controls to improve stability and handling qualities of the helicopter. The system consists of electro-hydraulic servo actuator control tube assemblies, fore-and-aft cyclic, lateral cyclic, and anti-torque, control motion transducers, pitch, roll, and yaw sensor/amplifier unit, pylon compensator unit, pylon transducer and control panel. The sensor/amplifier unit produces electrical inputs to servo actuators. Servo actuators are installed as series extensible links in appropriate flight controls and provide compensating control motions to augment stability and control of the helicopter. Operation of servo actuators is not felt in pilot controls provided proper control friction is present. Servo actuators are limited to ± 12.5 percent of the pilot control authority, and center and lock in case of electrical and/or hydraulic failure. SCAS provides a highly damped airframe for external disturbances yet maintains high quality control/response characteristics for pilot inputs. Rate gyros (located in sensor/amplifier unit) provide electrical signals to airframe damping against external disturbances. A transducer mounted on the transmission tail rotor driveshaft quill (26, figure 11-26) and a bracket on the fifth mount monitors pylon pitch motion. Control motion transducers provide a compensating electrical signal to prevent system from opposing the pilot during maneuvers and to augment control/response characteristics.

11-100. E M DESCRIPTION — STABILITY AND CONTROL AUGMENTATION SYSTEM (SCAS).

The SCAS consists of the following: two circuit breakers, a control panel, sensor amplifier unit; three-axis rate sensor (three rate gyros in one unit); three servo actuators; three solenoid-controlled hydraulic valves; and three control motion transducers. The armament compensator unit supplies signals to each sensor amplifier module (SAM) when the guns are fired. All equipment is interconnected with multiconductor cable assemblies for transferring signal data and power within the system. The SCAS receives 28 Vdc power from the essential dc bus through the circuit breaker labeled SCAS PWR. When the SCAS is engaged, 28 Vdc power is also supplied by the battery so that loss of power to the essential dc bus will not disengage SCAS. AC power is supplied by the 115 Vac essential bus through the circuit breaker labeled SCAS PWR. Hydraulic power is provided to the longitudinal and lateral electrohydraulic servo actuators by the No. 2 hydraulic system while the directional electrohydraulic servo actuator is supplied by the No. 1 hydraulic system. The three servo-actuator assemblies include one control tube attached to one end of each servo-actuator and a clevis attached to the other end. The control tube and clevis provide for the mounting of the servo actuator in series in the helicopter mechanical control systems. The internal piston and shaft of the actuator is hydraulically moved in and out of the actuator case to provide for mecahnical displacement of helicopter controls. The internal centering and locking feature provides a solid link in the helicopter control linkage if hydraulic pressure to the actuator is lost or the channel is disengaged. An internal servo hydraulic valve provides for controlling hydraulic pressure to the piston in the proper direction of displacement. Servo actuators are electro-hydraulically operated and receive command signals from sensor amplifier unit

to hydraulically driven helicopter control system. Servo actuators are limited to ±**12.5** percent of total pilot control authority. Pitch and roll servo actuators control movement of the swashplate with no resultant motion of the cyclic stick as a result of external forces. Yaw servo actuator moves the tail rotor blade pitch angle in same manner as pitch and roll servo actuators mvoe helicopter swashplate. Yaw servo actuator control authority is also limited to ±**12.5** percent of control authority available to the pilot through control pedals.

Premaintenance Requirements for SCAS

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	None
Special Environmental Conditions	None

11-101. TROUBLESHOOTING AND OPERATIONAL CHECK — (SCAS).

Refer to TM 11-1520-236 series manuals.

11-102. SENSOR AMPLIFIER UNIT (SCAS).

11-103. P DESCRIPTION — SENSOR AMPLIFIER UNIT (SCAS).

Sensor Amplifier Unit located in pilot compartment left rear is operationally the center of SCAS and contains components and circuitry to implement stabilization of the AH-1S helicopter. Sensor Amplifier Unit contains rate gyros to sense helicopter rates, power circuits to power other parts of system, and compensating networks and valve drivers to provide command signals to servo actuators. The sensor amplifier unit is housed in a metal case with four holddown attach points. Front of the case contains two pushbutton switches, labeled GYRO TEST and ACTR TEST and a hinged access door held in place by two captive screws. Right side of case contains one fuse and fuseholder, one spare fuse and fuseholder, and one 41 pin connector, for transferring signal data and power within system. The aft wall of case is utilized as a common mount for three rate gyros within case. Rate signal from rate gyro and control position signal, from control motion transducers, and actuator feedback signal are summed and shaped in compensating network to provide desired helicopter control response.

11-104. E M DESCRIPTION — SENSOR AMPLIFIER UNIT (SCAS).

The sensor amplifier unit (SAU) contains three sensor amplifier modules (SAM). One SAM is used for each channel (PITCH, ROLL and YAW). They are housed in a metal case with four holddown attach points. The front of each SAM contains two pushbutton switches, labeled RATE TEST and ACTR TEST, and a NULL light. Each SAM is held in place by four captive screws. The switches isolate inputs from the rate gyros and servo actuators in conjunction with the built-in test equipment (BITE). If, after 30 seconds, a NULL lamp is lighted and the light extinguishes when the RATE TEST switch is depressed, a rate gyro or interconnecting wiring may be defective. Similarly, if a NULL lamp is lighted, and depressing the ACTR TEST switch causes the NULL lamp to extinguish, a servo actuator or interconnecting wiring may be defective. When, either No. 1 or No. 2 hydraulic pressure is lost, the No. 1 or No. 2 hydraulic pressure switch will close. This illuminates the No. 1 HYDR PRESS or the No. 2 HYDR PRESS caution light and disengages the sensor amplifier module(s) (YAW or PITCH and ROLL) relay(s) circuit, thus disengaging the affected channel servo actuator.

NOTE

Refer to TM 11-1520-236 series manuals for removal, troubleshooting, testing and replacement of sensor amplifier unit.

11-105. P INSPECTION — SENSOR AMPLIFIER UNIT (SCAS).

Inspect sensor amplifier, (4, figure 11-26) for the following conditions.

a. Loose mounting (loose mounting screws and insufficient electrical bonding).

b. Loose control channel assemblies.

c. Loose or inoperative NO-GO indicator lights.

d. Burned fuse.

e. Account for spare fuse.

f. Loose or corroded module mounts.

g. Corroded or damaged connectors, internal or external.

11-106. E M INSPECTION — SENSOR AMPLIFIER UNIT (SCAS).

Inspect sensor amplifier (4, figure 11-27) for the following conditions:

a. Loose mounting (loose mounting screws and insufficient electrical bonding).

b. Loose control channel assemblies.

c. Loose or inoperative NO-GO indicator lights.

d. Loose or corroded module mounts.

e. Corroded or damaged connectors, internal or external.

11-107. REPAIR OR REPLACEMENT — SENSOR AMPLIFIER UNIT (SCAS) (AVIM).

a. Tighten loose mounting screws or bolts.

b. Replace damaged parts. Refer to TM 11-1520-236 series manuals.

11-108. P PYLON COMPENSATION UNIT (SCAS).

11-109. P DESCRIPTION — PYLON COMPENSATION UNIT (SCAS).

The pylon compensation unit (PCU) (3, figure 11-26) is located aft and above SCAS sensor amplifier unit. Only 28 Vdc is supplied to the unit from SCAS control panel. The Pylon Compensation Unit electrically detects motion of the pylon with respect to the airframe, and operates in conjunction with SCAS to provide automatic damping. Under certain conditions of power loading, g-loading and velocity, it is possible to set up a low frequency oscillation which causes the pylon to lean or rock in a circular pattern opposite to the direction of rotor rotation. The Pylon Compensation Unit consists of a compensation network and one pylon motion transducer. The transducer measures fore and aft pylon motion relative to the airframe. The compensation network provides necessary signal shaping and phasing to apply corrective signals to the roll channel of SCAS, effectively damping the pylon suspension system to cancel undesired motion.

NOTE

Refer to TM 11-1520-236 series manuals for removal and installation of pylon compensation unit.

11-110. P INSPECTION — PYLON COMPENSATION UNIT (SCAS).

Inspect the pylon compensation unit (3, figure 11-26) for the following:

a. Loose mounting or bonding.

b. Damaged or corroded connectors.

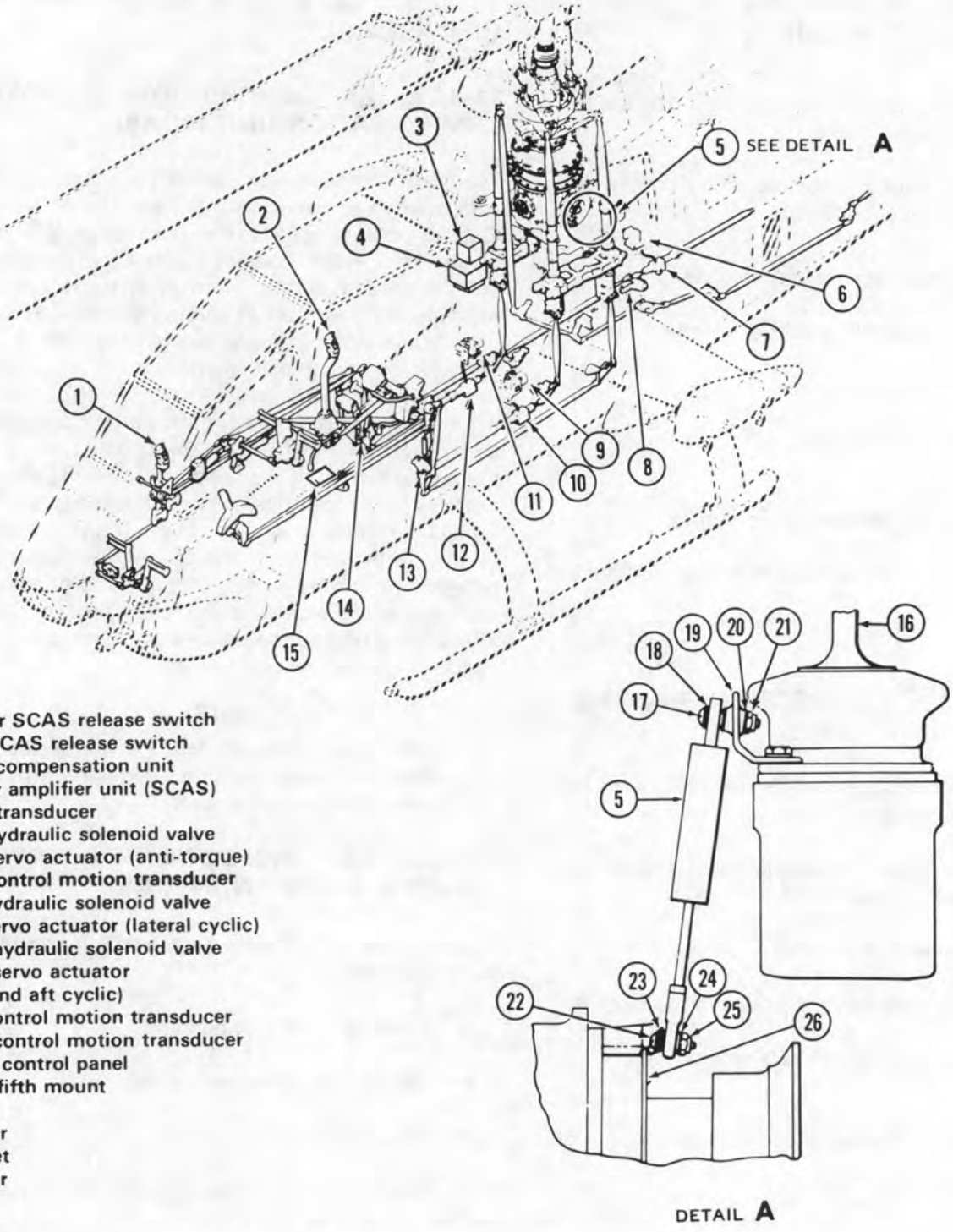
c. Case damage.

d. Proper operation. Refer to TM 11-1520-236 series manuals for procedure.

11-111. P REPAIR OR REPLACEMENT — PYLON COMPENSATION UNIT (SCAS).

a. Tighten loose connections.

b. Replace damaged parts. Refer to TM 11-1520-236 series manuals.



1. Gunner SCAS release switch
2. Pilot SCAS release switch
3. Pylon compensation unit
4. Sensor amplifier unit (SCAS)
5. Pylon transducer
6. Yaw hydraulic solenoid valve
7. Yaw servo actuator (anti-torque)
8. Yaw control motion transducer
9. Roll hydraulic solenoid valve
10. Roll servo actuator (lateral cyclic)
11. Pitch hydraulic solenoid valve
12. Pitch servo actuator (fore and aft cyclic)
13. Roll control motion transducer
14. Pitch control motion transducer
15. SCAS control panel
16. Pylon fifth mount
17. Screw
18. Washer
19. Bracket
20. Washer
21. Nut
22. Screw
23. Washer
24. Washer
25. Nut
26. Transmission tail rotor driveshaft quill

Figure 11-26. P Stability and Control Augmentation System (SCAS)

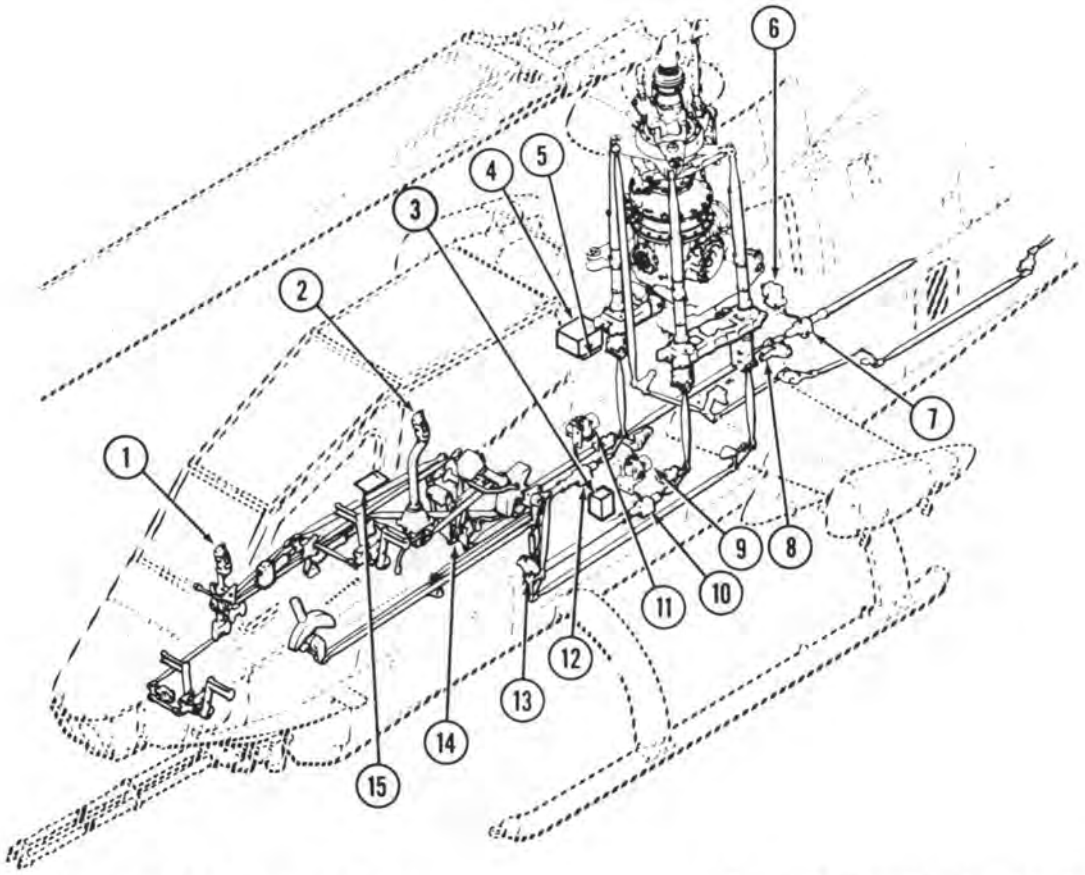
11-112. E M ARMAMENT COMPENSATION UNIT (SCAS).

11-113. E M DESCRIPTION — ARMAMENT COMPENSATION UNIT (SCAS).

The armament compensation unit (ACU) (3, figure 11-27) is located in the left side of fuselage forward of the wing. When the weapon is fired, three-axis turret position signals are applied to the ACU to provide weapon recoil damping of helicopter movement. The armament compensation unit electrically interfaces the turret system with the Stability and Control Augmentation System (SCAS). Turret position signals are applied to the armament compensation unit and, when the M197 gun is fired, output signals are applied to the SCAS servo actuators to provide recoil damping. E M The ACU receives 115 Vac power from the RECOIL COMP switch located on the pilot armament control panel. The magnitude of the ACU output signals can be set to either LO-MED-HI by using the RECOIL COMPEN selector switch located on the right side of the pilot instrument panel.

NOTE

Refer to TM 11-1520-236 series manuals for removal and installation of armament compensation unit.



1. Gunner SCAS release switch
2. Pilot SCAS release switch
3. Armament compensation unit
4. Sensor amplifier unit (SCAS)
5. Three-axis rate sensor
6. Yaw hydraulic solenoid valge
7. Yaw servo actuator (anti-torque)
8. Yaw control motion transducer
9. Roll hydraulic solenoid valve
10. Roll servo actuator (lateral cyclic)
11. Pitch hydraulic solenoid valve
12. Pitch servo actuator (fore-and-aft cyclic)
13. Roll control motion transducer
14. Pitch control motion transducer
15. SCAS control panel

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Figure 11-27. E M Stability and Control Augmentation System (SCAS)

11-114. E M INSPECTION — ARMAMENT COMPENSATION UNIT (SCAS).

Inspect the armament compensation unit for the following:

a. Loose mounting or bonding.

b. E M Damaged or corroded connectors.

c. Case damage.

d. Proper operation. Refer to TM 11-1520-236 series manuals for procedure.

11-115. E M REPAIR OR REPLACEMENT — ARMAMENT COMPENSATION UNIT (SCAS).

a. Tighten loose connections.

b. Replace damaged parts. (Refer to TM 11-1520-236 series manuals.

11-116. E M THREE-AXIS RATE SENSOR (SCAS).

11-117. DESCRIPTION — THREE-AXIS RATE SENSOR.

Three-axis rate sensor (5, figure 11-27) consists of a mounting surface and holes for four hold-down screws, one cable assembly, and one connector. Three rate gyros within the package sense helicopter rates in each of the three stabilized axis. Electrical rate signal outputs from each of the rate gyros are applied to each of the sensor amplifier modules compensation and logic networks.

NOTE

Refer to TM 11-1520-236 series manuals for removal and installation of three-axis rate sensor.

11-118. INSPECTION — THREE-AXIS RATE SENSOR (SCAS).

Inspect the three-axis rate sensor (5, figure 11-27), for the following:

a. Loose mounting or bonding.

b. Damaged or corroded connectors.

c. Case damage.

d. Proper operation. Refer to TM 11-1520-236 series manuals for procedure.

11-119. E M REPAIR OR REPLACEMENT — THREE-AXIS RATE SENSOR (SCAS).

a. Tighten loose connections.

b. Replace damaged parts. Refer to TM 11-1520-236 series manuals.

11-120. CONTROL MOTION TRANSDUCER (SCAS).

11-121. DESCRIPTION — CONTROL MOTION TRANSDUCER (SCAS).

Each control channel (pitch, roll and yaw) receives signals from an individual transducer. The signal is processed and summed with rate signals from rate gyros to provide correction signals for instantaneous control of helicopter motion. Transducer signals are one source of control of servo actuators which allow pilot to "fly" system with less effort and provide helicopter flight stabilization. Control motion transducer consists of an internal linear potentiometer, a cylindrical case, a movable shaft, two attach points (one on case and one on shaft), and an electrical connector for transferring signal data to the sensor amp unit.

11-122. REMOVAL — CONTROL MOTION TRANSDUCER (SCAS).

a. Turn all electrical power off.

b. Remove access panels.

c. Disconnect electrical connector from fore-and-aft (pitch), lateral (roll), or directional (yaw) transducer (8, 13 or 14, figure 11-26 or 11-27). Detach cylinder or transducer from fuselage structure by removing bolt, washer, spacer, and washer. Detach adjustable rod end from bellcrank by removing nut, washers, and screw.

11-123. INSPECTION — CONTROL MOTION TRANSDUCER (SCAS).

Inspect control motion transducers as follows:

a. Bearings for binding corrosion and wear in excess of **0.005** inch radial and **0.030** inch axial play.

b. Attachment for security.

c. Electrical connector for condition.

d. Threads for damage.

11-123.1. CALIBRATION — CONTROL MOTION TRANSDUCER (SCAS).

Calibrate the SCAS transducer as follows:

a. Disconnect the transducer from the aircraft wiring and airframe.

b. Support the transducer in order to measure the position of the output shaft length per figure 11-27.1.

c. Using multimeter (T-2 or T-3), measure the resistance across pins A and B.

d. The resistance (OHMS) at output shaft positions 1, 2 and 3 must be within the tolerance specified in figure 11-27.1.

11-124. REPAIR OR REPLACEMENT — CONTROL MOTION TRANSDUCER (SCAS).

a. Replace adjustable rod end when worn or binding. Nominal length of transducer in neutral position measured between centers of cylinder bearing and rod end bearing should be **6.18** inch.

b. Tighten loose attachments.

c. Replace transducer with damage in excess of that listed in paragraph 11-123.

11-125. INSTALLATION—CONTROL MOTION TRANSDUCER (SCAS).

a. Install pitch control motion transducer (13, figure 11-12).

(1) Align pitch control motion transducer cylinder housing bearing to fuselage structure with electrical wire inboard.

(2) Position stainless steel washer on bolt. Install bolt with washer through the rod end bearing, then slide spacer and washer on bolt. Align bolt to outboard side of bellcrank; then secure with bolt and nut.

NOTE

Attach rod end to bellcrank only after completion of rigging. (Refer to paragraph 11-29).

(3) Position stainless steel washer on screw. Position cylinder bearing on inboard side of bracket at fuselage. Position washer between bracket and bearing. Then install screw with washer and tighten.

b. Install roll control motion transducer (15, figure 11-13).

(1) Align roll control motion transducer cylinder housing bearing to fuselage structure with electrical wire inboard.

(2) Position stainless steel washer on bolt. install bolt with washer through the rod end bearing, then slide spacer and washer on bolt. Align bolt to outboard side of bellcrank; then secure with bolt and nut.

NOTE

Attach rod end to bellcrank only after completion of rigging (paragraph 11-29).

(3) Position stainless steel washer on screw. Position cylinder bearing on inboard side of bracket at fuselage. Position washer between bracket and bearing. Then install screw with washer and tighten.

c. Install yaw control motion transducer (21, figure 11-24).

(1) Align yaw control motion transducer cylinder housing bearing to fuselage structure.

(2) Position stainless steel washer on bolt. Install bolt with washer through the rod end bearing, then slide spacer and washer on bolt. Align bolt to outboard side of bellcrank; then secure with bolt and nut.

NOTE

Attach rod end to directional bellcrank only after completion of rigging (paragraph 11-73).

(3) Position stainless steel washer on screw. Position cylinder bearing on inboard side of bracket at fuselage. Position washer between bracket and bearing. Then install screw with washer and tighten.

11-126. TEST PROCEDURE — CONTROL MOTION TRANSDUCER (SCAS).

Refer to TM 11-1520-236 series manuals.

11-127. P PYLON TRANSDUCER (SCAS).

11-128. P DESCRIPTION — PYLON TRANSDUCER (SCAS).

Pylon transducer (5, figure 11-26) is located between pylon fifth mount and transmission tail rotor driveshaft quill as shown in figure 11-24. The transducer senses pitch motion of pylon. Output signals of transducer are inserted into pylon compensation unit where signals are summed, shaped, attentuated, and inserted into the roll channel of sensor amplifier for retardation of pylon oscillation.

11-129. P REMOVAL — PYLON TRANSDUCER (SCAS).

a. Turn electrical power off.

b. Gain access to transmission.

c. Disconnect transducer plug and protect with cover.

d. Disconnect transducer (5, figure 11-26) from transmission tail rotor driveshaft quill (26), by removing screw (22), washers (23 and 24), and nut (25).

e. Disconnect transducer (5) from bracket (19) on fifth mount (16) by removing screw (17), washers (18 and 20) and nut (21). Remove transducer.

NOTE

For inspection and repair procedures, refer to paragraph 11-123 and 11-124.

11-130. P INSTALLATION — PYLON TRANSDUCER (SCAS).

a. Install transducer (5, figure 11-26) on bracket (19), using screw (17), washers (18 and 20) and nut (21).

b. Install transducer (5) on transmission tail rotor driveshaft quill (26), using screw (22), washers (23 and 24), and nut (25).

c. Remove covers from transducer plug and receptacles. Engage and secure connector.

d. Close and secure transmission cowling.

11-131. SOLENOID VALVE (SCAS).

11-132. DESCRIPTION — SOLENOID VALVES (SCAS).

The three solenoid valves are two position valves which control hydraulic pressure to servo actuators. In de-energized position, there is not hydraulic pressure, and servo actuators are mechanically locked in center position. When solenoid valve is energized from the SCAS pitch, roll or yaw engage switch, hydraulic pressure is applied to servo actuator to unlock actuator and move actuator piston in response to command signals. Solenoid valve consists of metal case, three hydraulic ports (labeled CYL, RET, and PRESS) to provide for hydraulic connection to helicopter hydraulic system and servo actuators in the SCAS. Two attach points are provided for installation on helicopter structure. One 6 pin electrical connector is attached to case to provide electrical connection to system.

NOTE

Refer to paragraph 7-68 for removal, inspection, and installation procedures for SCAS hydraulic solenoid valves.

11-133. CONTROL PANEL (SCAS).

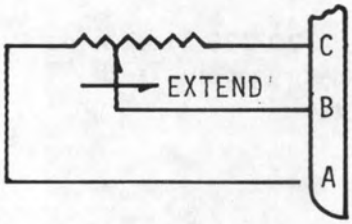
11-134. DESCRIPTION — CONTROL PANEL (SCAS).

The SCAS control panel (15, figures 11-26 and 11-27 contains a POWER switch for applying 28 Vdc (essential bus) and 115 Vac operating voltages to the system. The circuits are protected by the SCAS PWR

dc and SCAS PWR ac circuit breakers. The panel also contains three channel engage switches which energize electric solenoid valves controlling hydraulic pressure to the system. The panel has three NO-GO lights; one associated with each PITCH, ROLL, and YAW channel engage switch. These lights are illuminated during the warmup to indicate the presence of current in each associated channel actuators. When engagement is made, the NO-GO lights are locked out of the circuit and do not operate as malfunction indicators. Disengaging a channel, however, restores the associated light to operation. The NO-GO lights have a built-in press-to-test feature for ensuring that the indicator is operational. P This feature works only prior to channel engagement.

NOTE

Refer to TM 11-1520-236 series manuals for removal, repair, and installation procedures.



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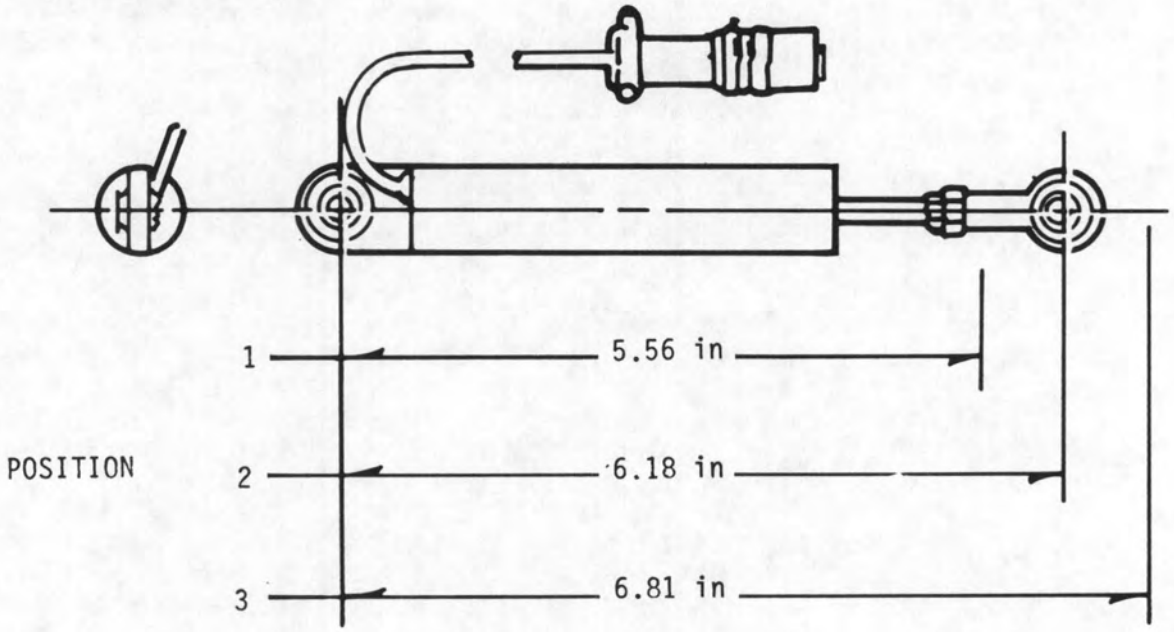


POSITION	RESISTANCE (OHMS)	TOLERANCE (OHMS)
1	0	±10
2	500	±50
3	1,000	±100

Figure 11-27.1. SCAS TRANSDUCER CALIBRATION

11-135. INSPECTION — CONTROL PANEL (SCAS).

a. Inspect control panel for security.

b. With electrical power ON, check control panel for the following:

(1) Indicator lights for operation.

(2) Switches for security and proper operation.

11-136. ELEVATOR CONTROL SYSTEM.

11-137. DESCRIPTION — ELEVATOR CONTROL SYSTEM.

The elevator control system consists of two elevator assemblies, a horn assembly and a mechanical control linkage of tube assemblies and bellcranks connected in series from the right forward swashplate horn to the elevator horn. Movement of the cyclic control stick in the fore and aft direction actuates the swashplate. This movement is transmitted through the elevator control linkage and changes the angle of attack of the elevator assemblies (figure 11-28).

Premaintenance Requirements for Elevator Control System Rigging

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	(S2)
Minimum Personnel Required	Two
Consumable Materials	None
Special Environmental Conditions	None

11-138. RIGGING — ELEVATOR CONTROL SYSTEM.

a. Rig cyclic controls if not previously accomplished (paragraph 11-29).

b. If installed, remove right side access (9, figure 2-3) and tailboom access door (21, figure 2-2). Install all components of the elevator control system, but leave tube assembly (18, figure 11-28) disconnected from swashplate inner ring (20), and tube (7) disconnected from elevator horn. Support tube assembly (18) so that control linkage can be moved during rigging procedure.

c. Adjust and attach tube assembly (7) as follows:

(1) Position elevator with trailing edge up so that there is **0.55 TO 0.65** inch clearance between forward side of stop (4) and stop (3) on horn (detail C, figure 11-28).

(2) Pull tube assembly (7) to its extreme aft position. Ensure that bellcrank (12) is dead centered with control tube (11).

(3) Adjust length of control tube (7) to fit arm on elevator horn and attach. Do not exceed 1.0 inch exposed thread (detail B, figure 11-28).

d. Adjust and attach tube assembly (18) as follows:

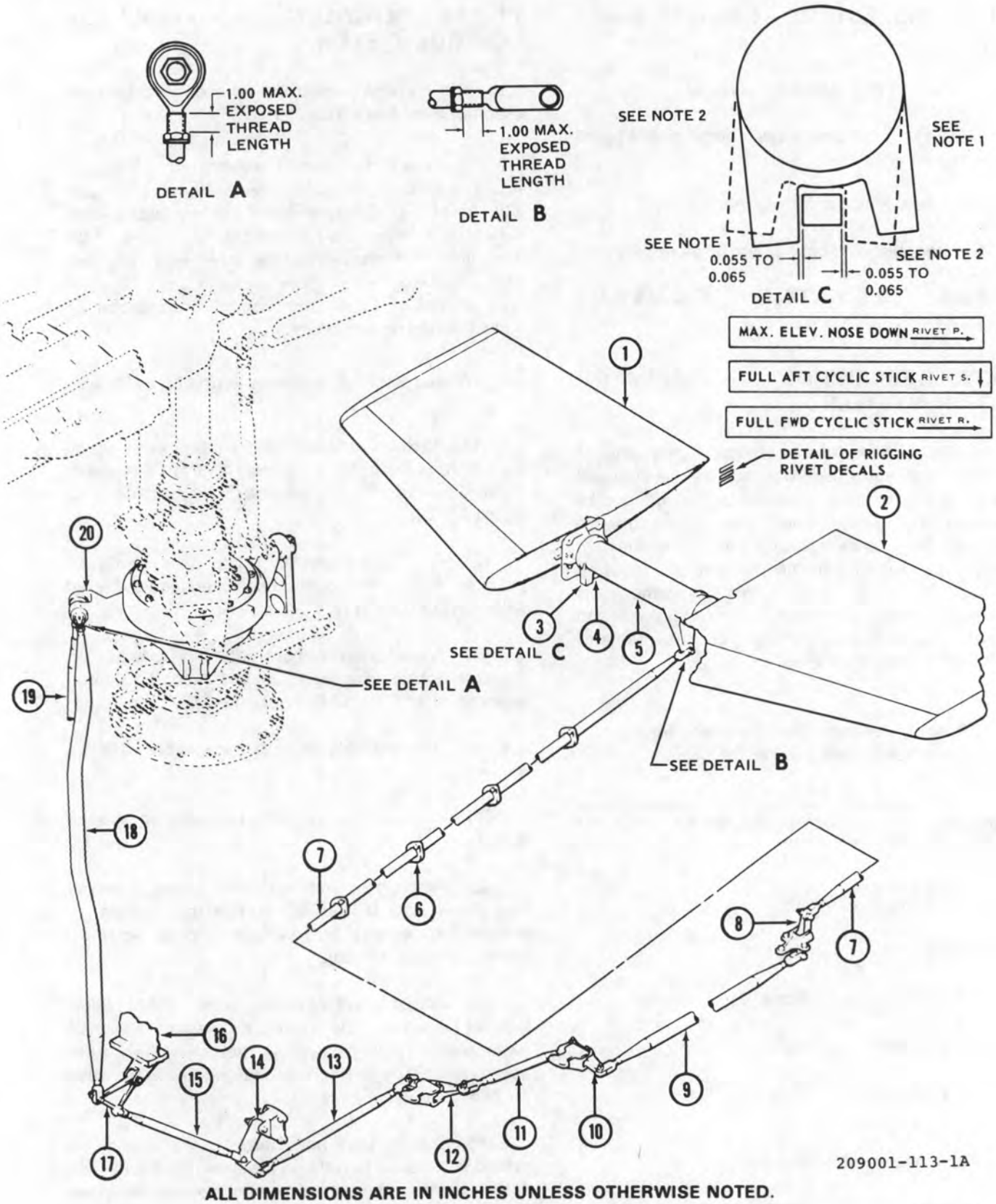
(1) Hold pilot cyclic stick full forward against stop.

(2) Position elevator with trailing edge down so that there is a **0.055 TO 0.065** inch clearance between aft side of stop (4) and stop (3) on horn, (detail C, figure 11-28).

(3) Adjust length of tube assembly (18) to fit on bolt at inboard side of right forward horn of swashplate inner ring (20), then lengthen tube assembly (18) by one turn of rod end to compensate for hydraulic valve position.

(4) Ensure that not more than one inch of thread is exposed at rod end (detail A, figure 11-28). Attach control tube bolt on horn of swashplate inner ring (20).

e. Check rigging with hydraulic boost on.



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

Figure 11-28. Elevator Control System (Sheet 1 of 2)

NOTES:

1. With elevator positioned (trailing edge up) so that there is 0.055 to 0.065 clearance between forward side of stop on horn and stop on support.

2. With elevator positioned (trailing edge down) so that there is 0.055 to 0.065 clearance between aft side of stop on horn and stop on support.

1. Right elevator
2. Left elevator
3. Stops (on horn)
4. Stop (on support)
5. Elevator horn assembly
6. Guide (4 reqd)
7. Tube assembly
8. Walking beam and support
9. Tube assembly
10. Walking beam and support
11. Tube assembly
12. Bellcrank and support
13. Tube assembly
14. Bellcrank and support
15. Tube assembly
16. Lift beam
17. Bellcrank
18. Tube assembly
19. Fore-and-aft cyclic hydraulic cylinder tube
20. Swashplate inner ring

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Figure 11-28. Elevator Control System (Sheet 2 of 2)

(1) Using hydraulic test stand, (S2) apply hydraulic power to helicopter.

(2) Position pilot cyclic stick full forward against stop. Check that trailing edge of elevator points to rivet "R" on tailboom within **0.40** inch and that there is a **0.055 TO 0.065** inch clearance between stops (3 and 4) as described in step d.(2). Adjust tube assembly (7) if necessary as described in step c.

(3) Move pilot cyclic stick aft. Check for a clearance of **0.055 TO 0.065** inch between stops (3 and 4) when bellcrank (12) passes thru dead center; also, that elevator trailing edge points to rivet "P" within **0.4** inch bellcrank (12) is at dead center as described in step c(2).

(4) Position pilot cyclic stick full aft against stop. Check trailing edge of elevator to ensure that it stops at rivet "S" within **0.4** inch.

f. Move pilot cyclic stick through full range fore-and-aft and ensure that there is no binding or interference in the elevator control system.

g. Disconnect hydraulic test stand.

h. Check complete elevator control system for security and safetying of components. Install access panel (9, figure 2-3) and tailboom access door (21, figure 2-2).

i. Perform maintenance test flight. Refer to TM 55-1520-236 MTF.

11-139. ELEVATOR INSTALLATION.

11-140. DESCRIPTION — ELEVATOR INSTALLATION.

The elevator installation consists of two elevator assemblies and a horn assembly (12, figure 11-29). Each elevator assembly is a horizontal airfoil section built up on a spar tube, which is inserted into a projecting end of the horn assembly and secured by a single bolt. The horn assembly is mounted horizontally through the sides of the tail boom, and is secured to the structure by supports, which serve as bearings for rotational movement. A control arm on the horn provides attachment for elevator control system linkage from the fore-and-aft cyclic control system at the swashplate.

Premaintenance Requirements for Elevator

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None

Conditions	Requirements
Test Equipment	Dial Indicator
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C31), (C41), (C37), (C88), (C91), (C110)
Special Environmental Conditions	None

11-141. REMOVAL — ELEVATORS AND HORN ASSEMBLY.

NOTE

Perform inspection of installed elevators and elevator control system prior to removal (paragraph 11-142).

a. Remove retaining bolt (2, figure 11-29) and washer (3). Move elevator (1) outboard until spar tube (4) is clear of horn assembly (12).

b. Remove opposite elevator in the same manner.

c. Remove horn assembly (12) as follows:

(1) Remove cotter pin (31), nut (32), washers (33 and 35) and bolt (36). Disconnect tube assembly (34) from horn assembly (12).

NOTE

If horn assembly is to be reinstalled on the same helicopter, index shims (23 and 27) for reinstallation in the same location. Support assemblies (9 and 22) are different part numbers and must be reinstalled in the same location.

NOTE

Support assemblies (9 and 22) have bearing material bonded to the surfaces that contact the horn assembly. Handle support assemblies carefully to avoid damage.

(2) Remove nuts (15 and 25), washers (16 and 26), bolts (7 and 20), and washers (8 and 21).

(3) Remove bolts (11) and washers (10). Remove upper half of support assembly (9), shim (6) and shims (17).

(4) Remove upper half of support assembly (22) in the same manner outlined in the preceding step.

(5) Remove bolts (13) and washers (14). Remove lower half of support assembly (9) and shim (6).

(6) Remove lower half of support assembly (22) in the same manner outlined in the preceding step.

(7) Move horn assembly (12) to the right through bracket (5) as far as possible, rotating the control arm as necessary to allow passage of end lug through bracket. Lower left side of horn assembly and move horn assembly inboard and toward access door while removing opposite end of horn and lug through bracket. Remove horn assembly.

11-142. INSPECTION — ELEVATORS AND ELEVATOR CONTROL SYSTEM.

a. Inspect installed elevators and elevator control system as follows:

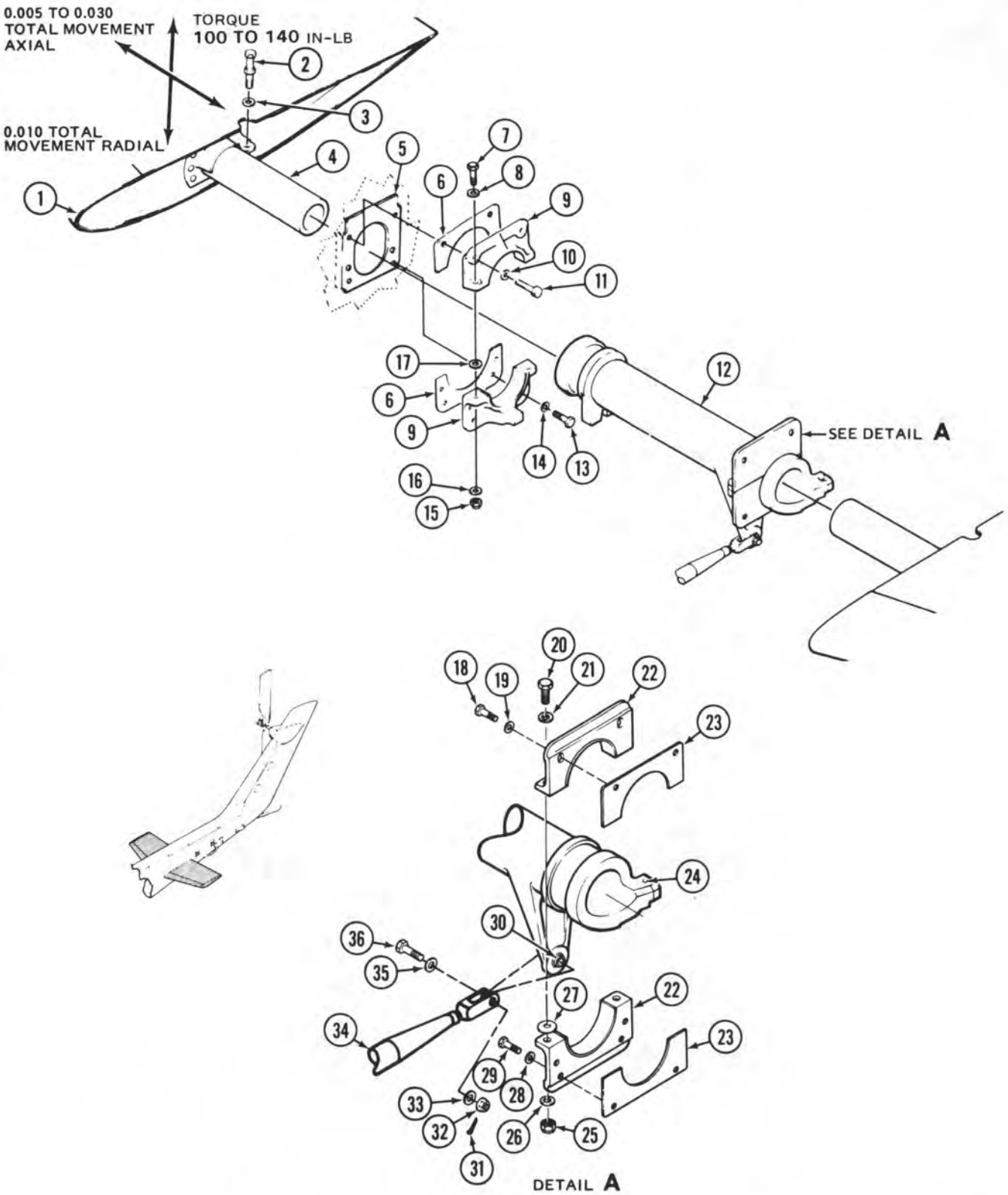
(1) Inspect elevators and elevator control system for secure installation, damage and freedom of operation through full throw.

(2) If damage is detected during accomplishment of step (1), make detailed inspection as outlined in step b.

(3) Inspect elevator support brackets (5, figure 11-28) for loose rivets. Apply enough pressure to elevator at outboard end to provide normal deflection. Inspect rivets visually and by hand contact for signs of movement. No loose or cocked rivets are acceptable. Request assistance of next higher maintenance level if any loose or cocked rivets are found.

b. Inspect elevators and elevator control system components after removal as follows:

(1) Inspect both elevators (1, figure 11-29) for scratches, dents, nicks, cracks, tears and holes. Refer to paragraph 2-330 for damage limits.



ALL DIMENSIONS ARE IN INCHES UNLES OTHERWISE NOTED.

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Figure 11-29. Elevator Installation (Sheet 1 of 2)

1. Elevator
2. Retaining bolt
3. Aluminum washer
4. Spar tube
5. Support bracket
6. Shim set
7. Bolt
8. Thin aluminum washer
9. Support assembly
10. Thin aluminum washer
11. Bolt
12. Horn assembly
13. Bolt
14. Thin aluminum washer
15. Nut
16. Thin aluminum washer
17. Shim (2)
18. Bolt
19. Thin aluminum washer
20. Bolt
21. Thin aluminum washer
22. Support assembly
23. Shim set
24. Nutplate
25. Nut
26. Thin aluminum washer
27. Shim (2)
28. Thin aluminum washer
29. Bolt
30. Bearing
31. Cotter pin
32. Nut
33. Steel washer
34. Control tube
35. Steel washer
36. Bolt

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Figure 11-29. Elevator Installation (Sheet 2 of 2)

(2) Inspect support assemblies (9 and 22, figure 11-29) for mechanical and corrosion damage. See figure 11-33 for damage limits. Inspect support assemblies for damaged and/or loose bearing material. Damaged, loose or excessively worn bearing material is not acceptable.

(3) Inspect horn assembly (12, figure 11-29) for mechanical and corrosion damage. See figure 11-33 for damage limits. Inspect horn assembly bearing in accordance with instructions in paragraph 11-164. Inspect horn assembly (12, figure 11-29) for cracks by fluorescent penetrant method (TM 43-0103). No cracks are acceptable.

(4) Inspect elevator control system tubes and links shown on figure 11-28 for mechanical and corrosion damage. See figure 11-30 for damage limits.

(5) Inspect elevator control system walking beams, supports, and bellcranks shown on figure 11-28 for mechanical and corrosion damage. See figure 11-33 for damage limits.

(6) Inspect all bearings in the elevator control system shown on figure 11-28 in accordance with instructions in paragraph 11-164.

11-143. REPAIR OR REPLACEMENT — ELEVATORS, HORN ASSEMBLY AND SUPPORT ASSEMBLIES.

a. Replace components that do not meet inspection requirements of paragraph 11-142.

b. Repair elevators with corrosion or mechanical damage that is within reparable limits. Refer to paragraph 2-336 for repair instructions.

c. Polish out mechanical and corrosion damage on horn assembly (12, figure 11-29) that is within limits shown on figure 11-32. Polish to a smooth, scratch free finish with crocus cloth (C37). Blend edges of repair into surrounding area. Apply chemical film coating (C31) to repaired areas. Prime repaired areas with primer (C88 or C91).

d. Replace faulty bearing in horn assembly (12, figure 11-33). Refer to paragraph 11-184 for procedure.

11-144. INSTALLATION — ELEVATORS AND HORN ASSEMBLY.

a. Insert horn assembly (12, figure 11-29) through access opening in tailboom with control arm toward left side of tailboom. Rotate control arm to approximate vertical position and insert lug of horn through support bracket (5) on left side of tailboom. Move horn assembly outboard as far as possible. Raise opposite end of horn assembly and rotate control arm downward as necessary to allow lug at horn assembly to pass through support bracket (5) on right side of tailboom.

b. Position lower half of shim set (6) and support assembly (9) on support bracket (5). Install bolts (13) and thin alminum washers (14). Install lower half of shim set (23) and support assembly (22) in the same manner.

c. Position upper half at shim set (6) and support assembly (9) on bracket (5). Install bolts (11) and thin aluminum washers (10). Install upper half of shim set (23) and support assembly (22) in the same manner.

d. Move horn assembly (12) from side to side and measure movement between support assembly (9) and horn assembly (12). If lateral movement is not **0.005 TO 0.030** inch, add or remove shims (6 and 23) to obtain movement within limits.

e. Coat spar tube (4) of elevator (1) with corrosion preventive compound (C41). Insert spar tube (4) of elevator (1) in horn assembly (12). Align holes of elevator fitting with horn assembly lug and install bolt (2) and aluminum washers (3), torque bolt (2) **100 TO 140** inch-pounds. Install opposite elevator in the same manner.

f. Check clearance between elevators and tailboom. If there is not adequate clearance on both sides, move shim sets (6 and 23) as required to obtain equal clearance.

g. Remove two bolts (11) and washers (10). Install two shims (17), bolts (7), thin aluminum washers (8), thin aluminum washers (16), and nuts (15). Tighten nuts (15). Install shims (27) in the same manner but do not torque nuts (25) at this time.

h. Measure amount of force required to rotate horn assembly (12). Use a force gage (fish scale) with a **0 TO 50** pound range. Attach gage at bearing (30) and pull perpendicular to control arm. Force required should be **13 TO 16** pounds. Add or remove shims (17) as required to obtain torque within limits.

i. Torque two nuts (25) that were installed in step g.

j. Measure amount of force required to rotate horn assembly as outlined in step h. The force required should now be **26 TO 32** pounds. Add or remove shims (27) as required to obtain torque within limits.

k. Install two bolts (11) and thin aluminum washers (10). Install two bolts (18) and thin aluminum washers (19).

l. Position control tube (34) on horn assembly (12). Install bolt (36), steel washers (35 and 33), nut (32), and cotter pin (31).

m. Check elevator rigging (paragraph 11-138).

SECTION II. FLIGHT CONTROL COMPONENTS

11-145. FLIGHT CONTROL COMPONENTS.

11-146. DESCRIPTION — FLIGHT CONTROL COMPONENTS.

The flight control components covered in this section are the control tubes, links, bellcranks, levers, walking beams, and supports illustrated in figure 11-31.

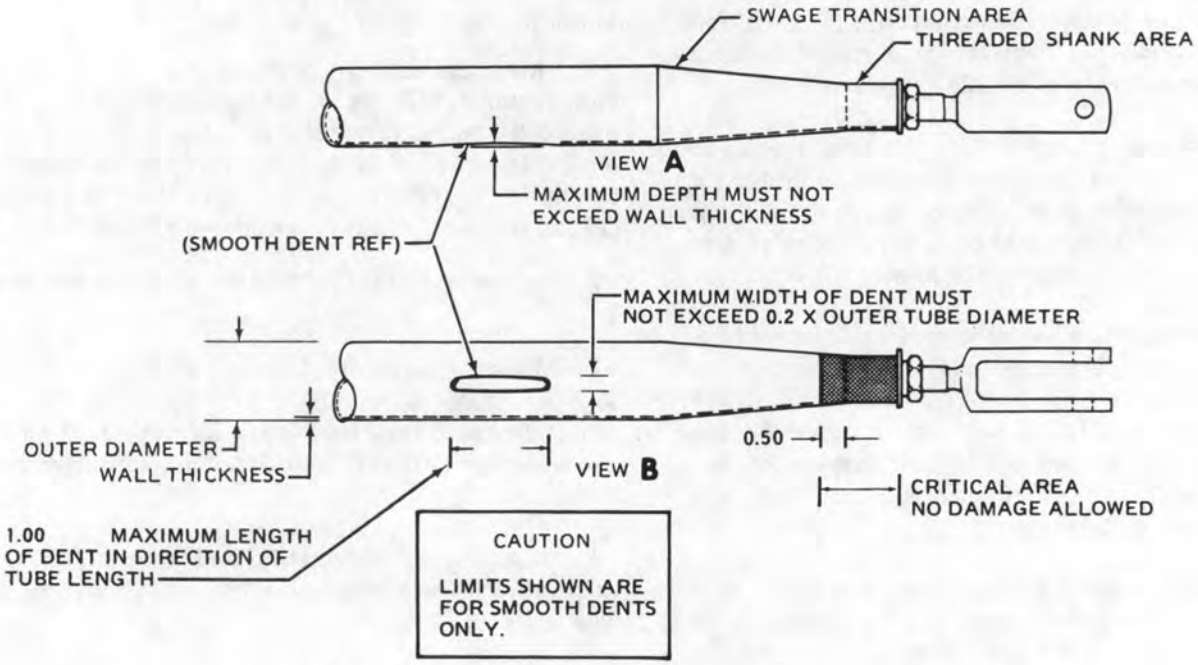
11-147. FLIGHT CONTROL TUBES AND LINKS.

11-148. DESCRIPTION — FLIGHT CONTROL TUBES AND LINKS.

The flight control system tube assemblies and links (figure 11-31) are used in all the flight control systems. Fixed length tube assemblies are used as much as possible, but adjustable lengths are required in some locations to rig the controls.

Premaintenance Requirements for Control Tubes — Cyclic, Collective Anti-torque and Synchronized Elevator System

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	Force Gage (Fish Scale)
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C31), (C36), (C88), (C102)
Special Environmental Conditions	None



FIXED LENGTH TUBES: 209-001-063-5
209-001-063-25

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

TYPE OF DAMAGE — **MAXIMUM DEPTH AND REPAIR AREAS ALLOWED**

CRACKS ALLOWED — **NONE**

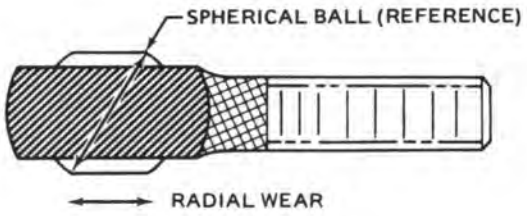
MECHANICAL AND CORROSION DAMAGE ALLOWED OTHER THAN DENTS

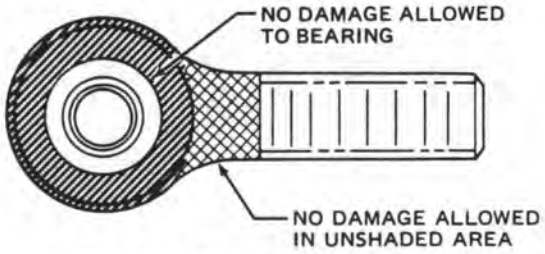
PART NUMBER	TUBE DIAMETER	WALL THICKNESS	CIRCUMFRENCIAL WIDTH OF REPAIRED AREA		
			.25 IN	25 PERCENT	50 PERCENT
209-001-063-5	.875	.035			
Before Repair			.002	.0015	.001
After Repair			.0035	.003	.002
209-001-063-25	.750	.049			
Before Repair			.0025	.002	.002
After Repair			.005	.004	.003
Remaining P/N to be added later.	Diameter to be added later.	.058			
Before Repair			.003	.002	.002
After Repair			.006	.004	.004

NOTES:
Rework parts by smoothing out scratches, nicks or corrosion with 400 grit sandpaper (C102), and finish to original surface condition. Finish in a longitudinal direction.

209001-175-1

Figure 11-30. Damage Limits — Fixed Length Flight Control Tubes and Links (Typical) (Sheet 1 of 3)





FIXED LENGTH TUBES: 209-001-063-5
209-001-063-25

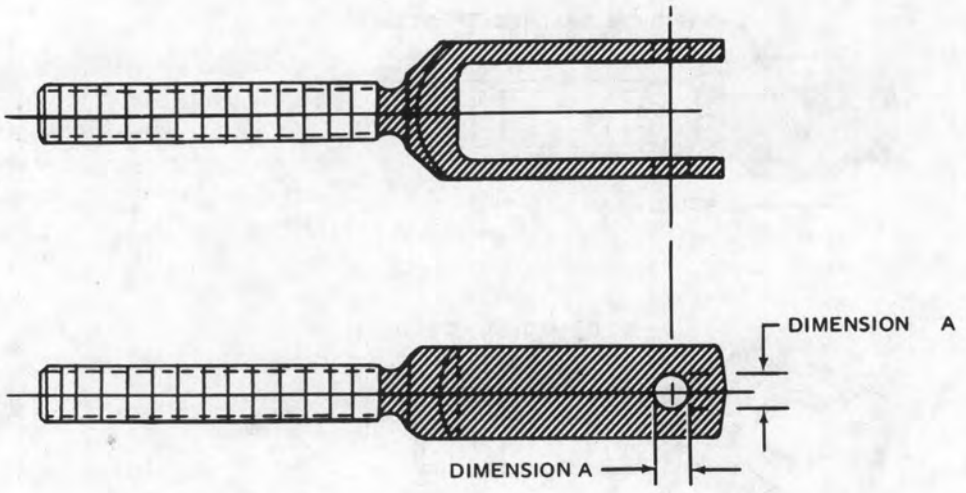
DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
CRACKS	None	None
NICKS, SCRATCHES, DENTS AND CORROSION (AFTER CLEAN UP)	None	0.007
MAXIMUM AREA PER FULL DEPTH REPAIR	None	0.10 Sq. In.
NUMBER OF REPAIRS	None	Two
EDGE CHAMFER	None	0.02 x 0.02
THREAD DAMAGE:	N/A	
DEPTH:		One-third of thread
LENGTH:		One-fourth inch
NUMBER:		Two
BEARING/RADIAL WEAR	Maximum acceptable radial play is 0.006	
BEARING/AXIAL WEAR	Maximum acceptable axial play is 0.015	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209001-175-2

Figure 11-30. Damage Limits — Fixed Length Flight Control Tubes and Links (Typical) (Sheet 2 of 3)



FIXED LENGTH TUBES: 209-001-063-5
209-001-063-25

DAMAGE LOCATION SYMBOL

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED
CRACKS ALLOWED	None
NICKS, SCRATCHES, SHARP DENTS	0.005
CORROSION	
AFTER REPAIR	0.005
MAXIMUM AREAR PER FULL DEPTH REPAIR	0.10 Sq. In.
NUMBER OF REPAIRS	One Per Segment
EDGE CHAMFER	0.020 x 0.020
THREAD DAMAGE:	
DEPTH:	One-third of thread
LENGTH:	One-quarter inch
NUMBER:	Two
RADIAL WEAR/ELONGATION OF CLEVIS HOLE (DIMENSION A)	0.005

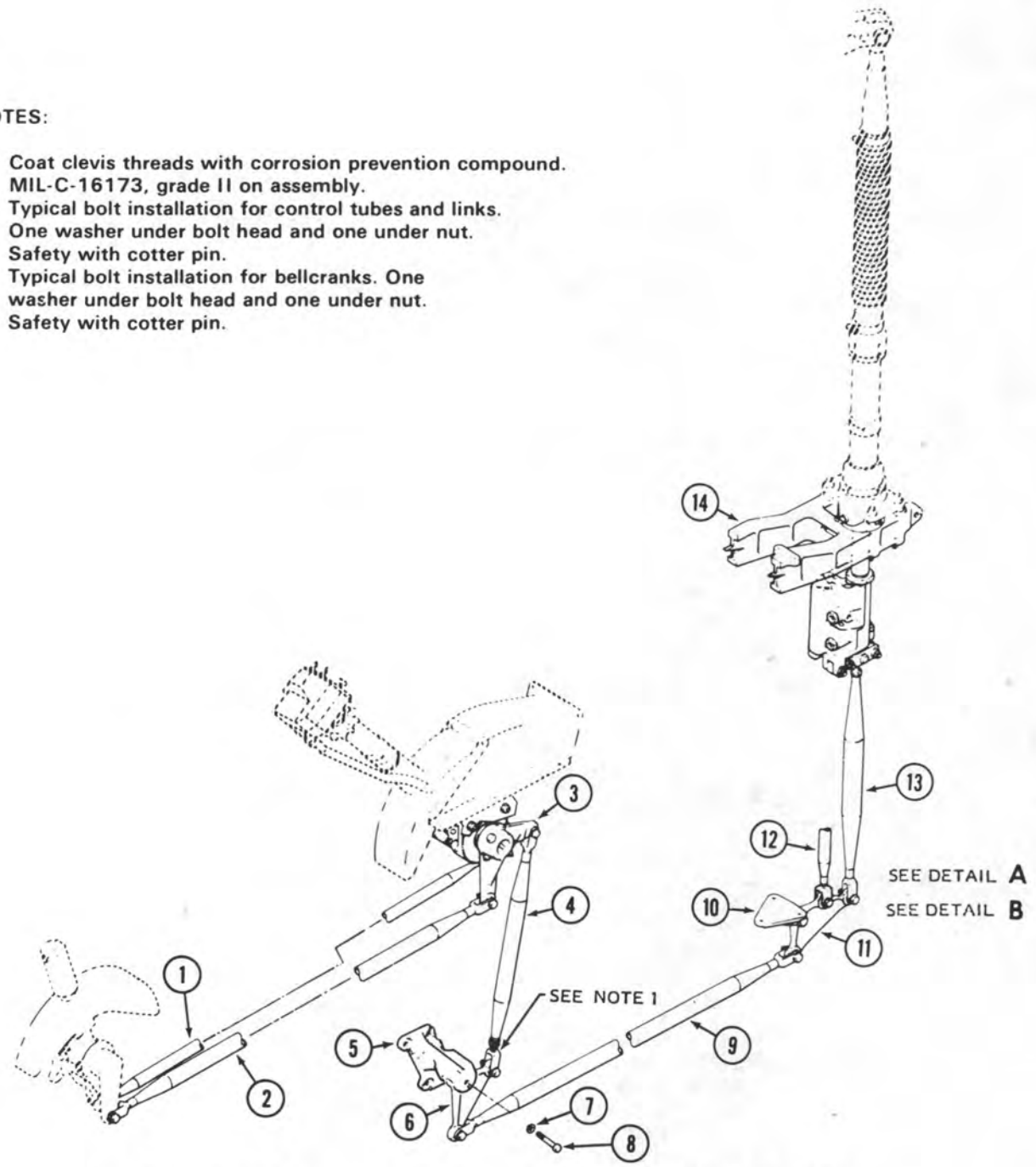
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209001-175-3

Figure 11-30. Damage Limits — Fixed Length Flight Control Tubes and Links (Typical) (Sheet 3 of 3)

NOTES:

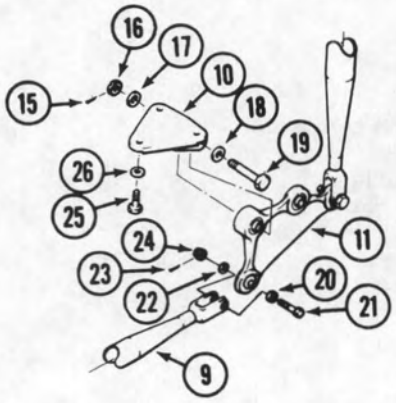
1. Coat clevis threads with corrosion prevention compound. MIL-C-16173, grade II on assembly.
2. Typical bolt installation for control tubes and links. One washer under bolt head and one under nut. Safety with cotter pin.
3. Typical bolt installation for bellcranks. One washer under bolt head and one under nut. Safety with cotter pin.



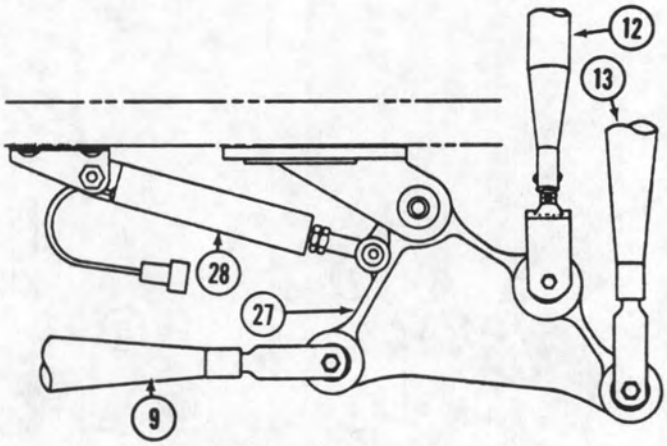
1. Tube assembly
2. Tube assembly
3. Collective lever
4. Tube assembly
5. Support
6. Bellcrank
7. Washer
8. Bolt (drilled head)
9. Tube assembly
10. Support
11. P Bellcrank
12. Tube assembly
13. Tube assembly
14. Hydraulic cylinder support

209001-171-1

Figure 11-31. Control System Linkage Installation (Sheet 1 of 7)



P E DETAIL A

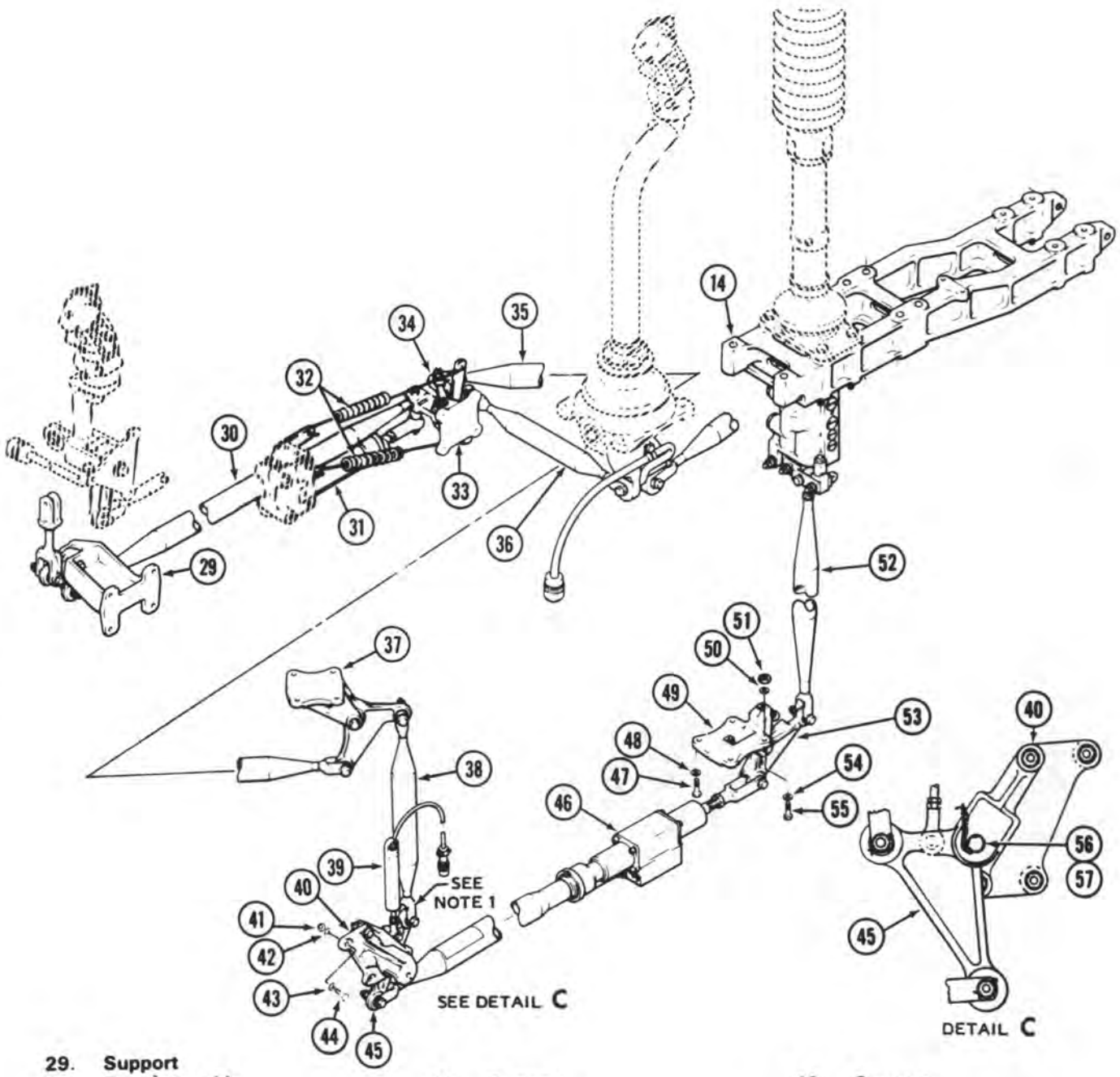


M DETAIL B

15. Cotter pin
16. Nut
17. Washer
18. Washer
19. Bolt
20. Washer
21. Bolt
22. Washer
23. Cotter pin
24. Nut
25. Bolt
26. Washer
27. M Bellcrank
28. M Transducer

209001-171-2

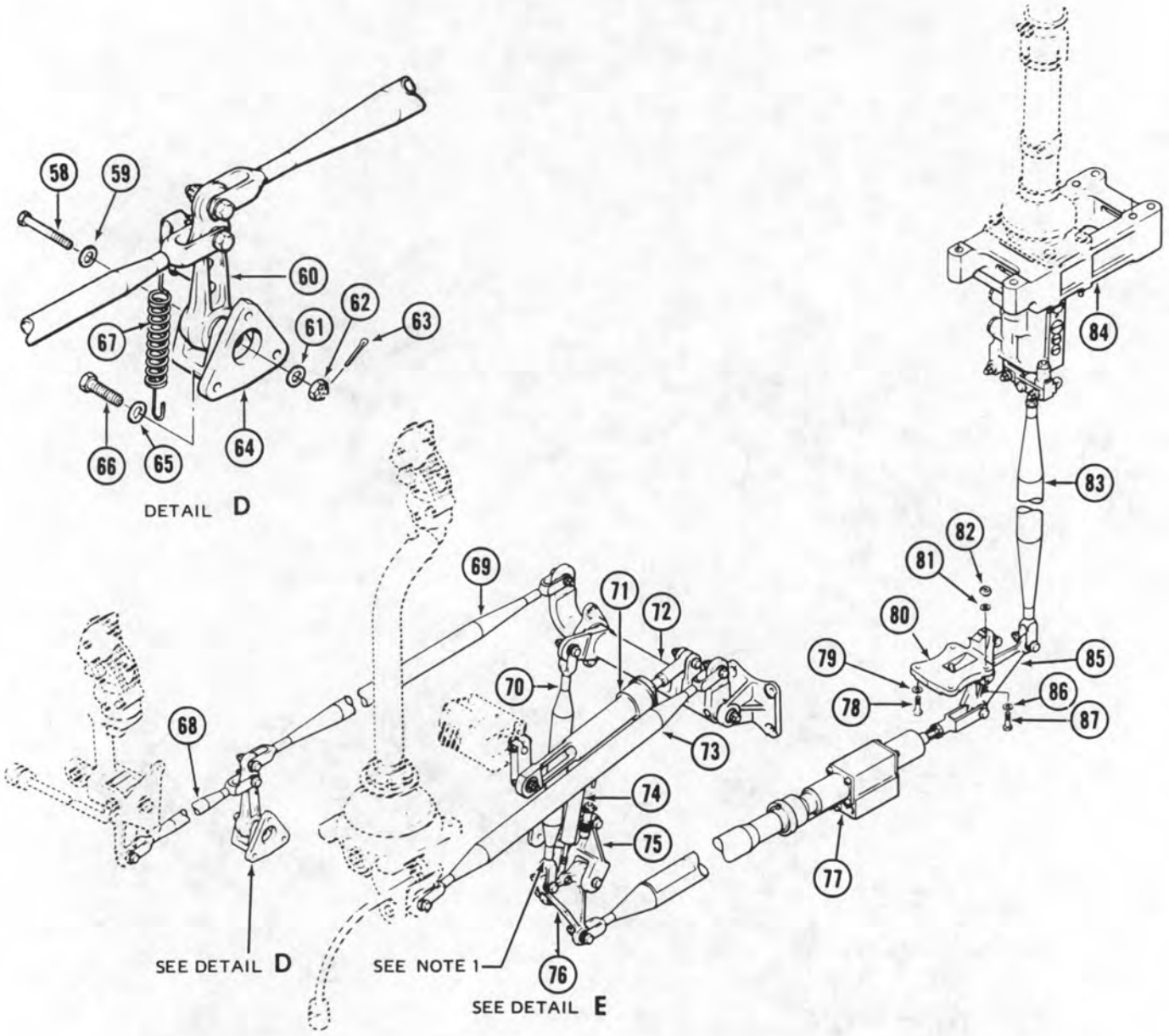
Figure 11-31. Control System Linkage Installation (Sheet 2 of 7)



29. Support
30. Tube assembly
31. Force gradient
32. Gunner lateral cyclic control springs
33. Bellcrank
34. Support
35. Tube assembly
36. Tube assembly
37. Support
38. Tube assembly
39. Lateral motion transducer
40. Support
41. Nut
42. Washer
43. Washer
44. Bolt
45. Bellcrank
46. SCAS servo actuator
47. Bolt
48. Washer
49. Support
50. Washer
51. Nut
52. Tube assembly
53. Bellcrank
54. Washer
55. Bolt
56. Washer
57. Bolt (drilled head)

209001-171-3

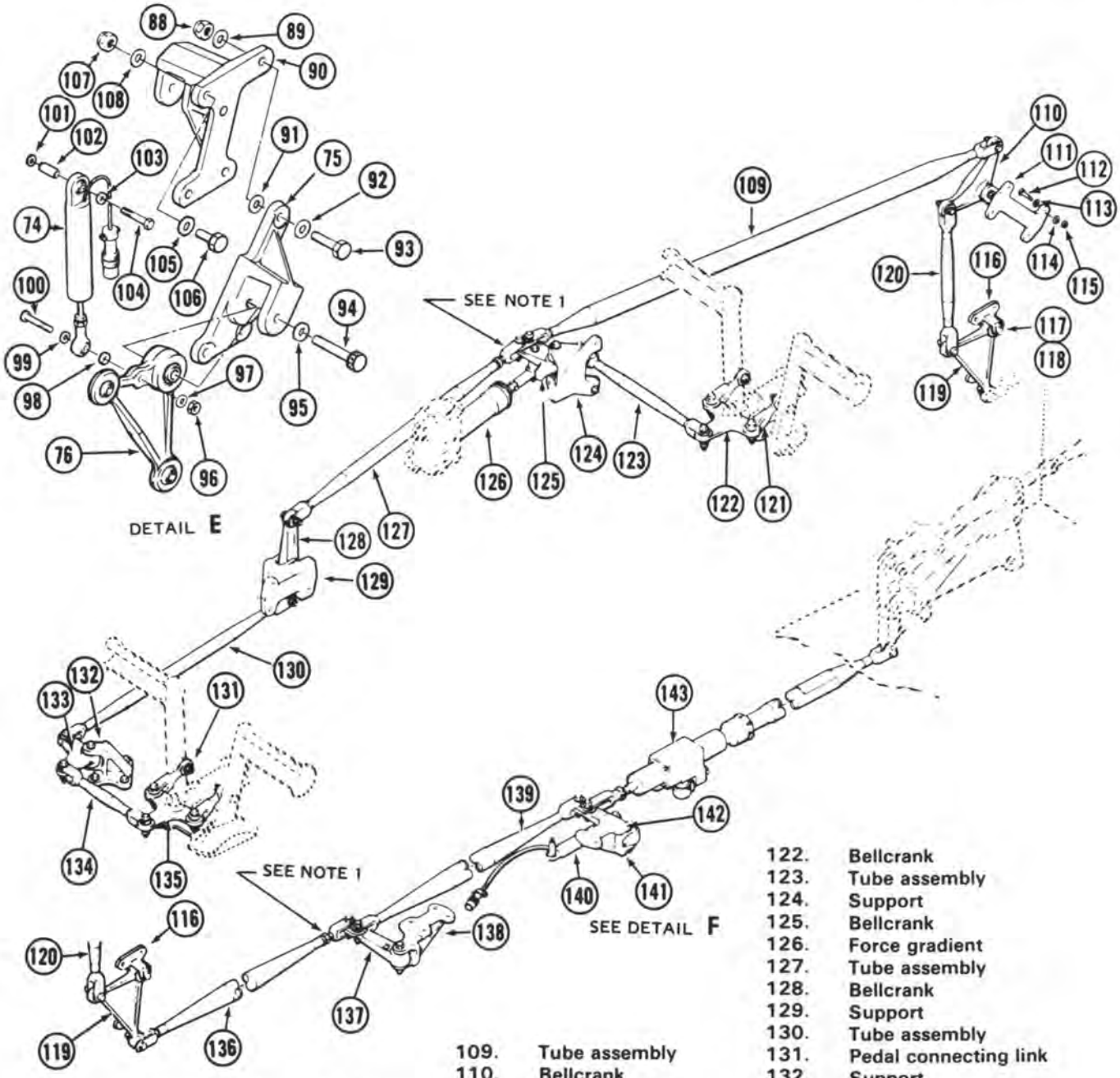
Figure 11-31. Control System Linkage Installation (Sheet 3 of 7)



58.	Bolt	69.	Tube assembly	79.	Washer
59.	Washer	70.	Tube assembly	80.	Support
60.	Idler crank	71.	Force gradient	81.	Washer
61.	Washer	72.	Jackshaft	82.	Nut
62.	Nut	73.	Tube assembly	83.	Tube assembly
63.	Cotter pin	74.	Fore-and-aft motion transducer	84.	Hydraulic cylinder support
64.	Idler support	75.	Support	85.	Bellcrank
65.	Washer	76.	Bellcrank	86.	Washer
66.	Bolt	77.	SCAS servo actuator	87.	Nut
67.	Gunner longitudinal cyclic control springs	78.	Nut		
68.	Tube assembly				

209001-171-4

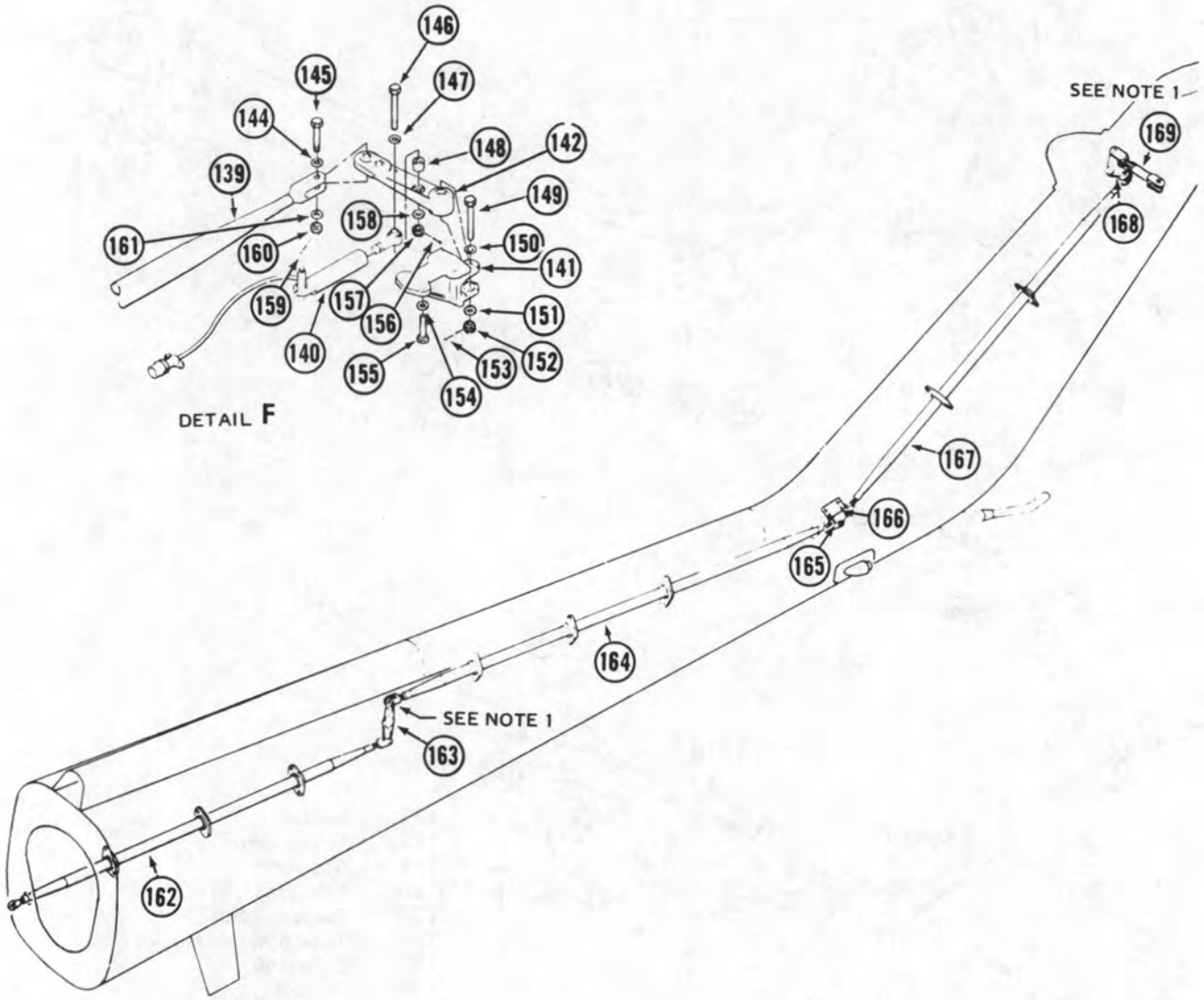
Figure 11-31. Control System Linkage Installation (Sheet 4 of 7)



88.	Nut	98.	Washer	109.	Tube assembly	122.	Bellcrank
89.	Washer	99.	Washer	110.	Bellcrank	123.	Tube assembly
90.	Support	100.	Bolt	111.	Support	124.	Support
91.	Washer	101.	Washer	112.	Bolt	125.	Bellcrank
92.	Washer	102.	Spacer	113.	Washer	126.	Force gradient
93.	Bolt	103.	Washer	114.	Washer	127.	Tube assembly
94.	Bolt	104.	Screw	115.	Nut	128.	Bellcrank
95.	Washer	105.	Washer	116.	Support	129.	Support
96.	Nut	106.	Bolt	117.	Washer	130.	Tube assembly
97.	Washer	107.	Nut	118.	Bolt (drilled head)	131.	Pedal connecting link
		108.	Washer	119.	Bellcrank	132.	Support
				120.	Tube assembly	133.	Bellcrank
				121.	Pedal connecting link	134.	Tube assembly
						135.	Bellcrank
						136.	Tube assembly
						137.	Bellcrank
						138.	Support
						139.	Tube assembly
						140.	Tail rotor motion transducer
						141.	Support
						142.	Bellcrank
						143.	SCAS servo actuator

209001-171-5

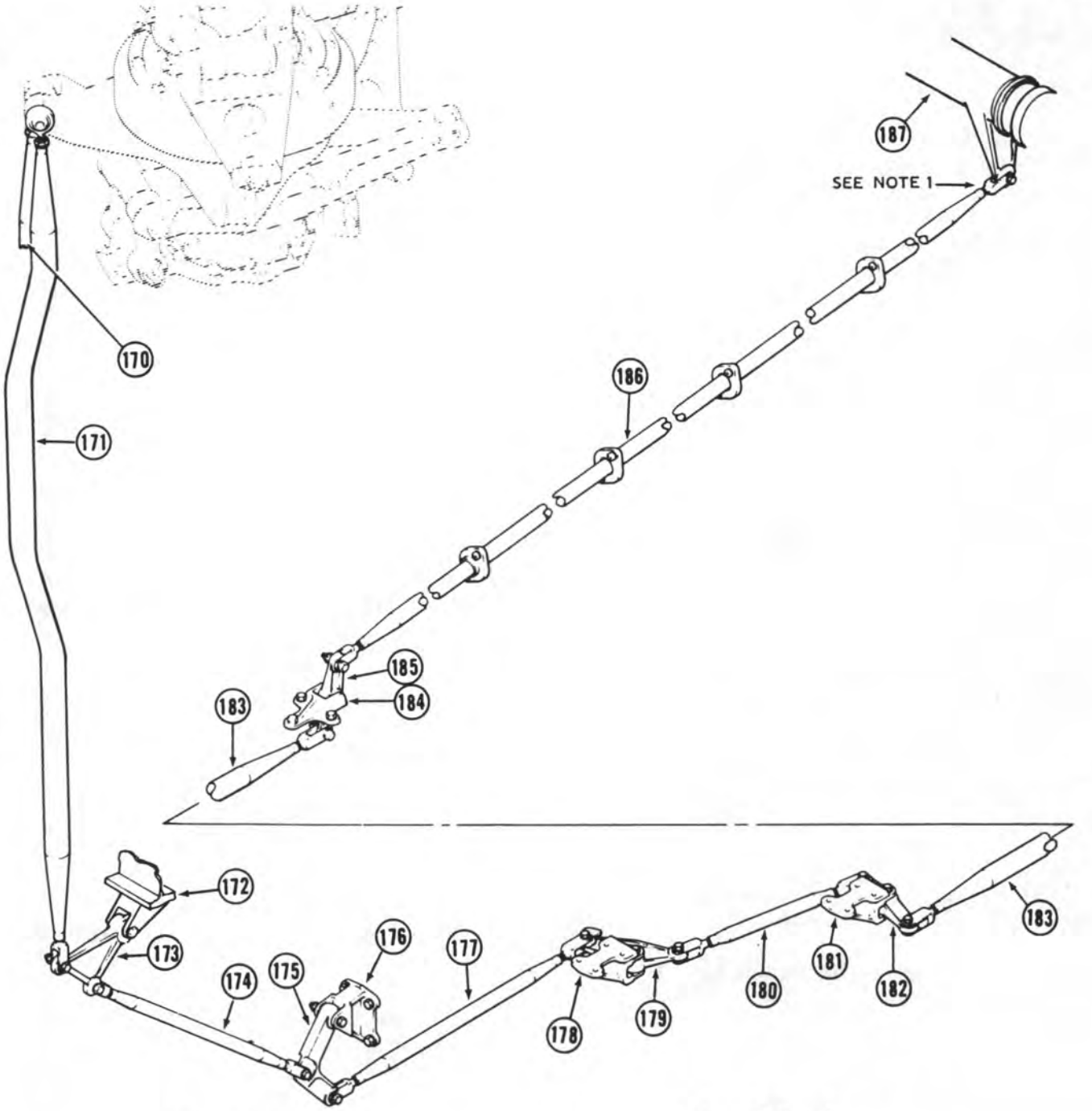
Figure 11-31. Control System Linkage Installation (Sheet 5 of 7)



144.	Washer	157.	Nut
145.	Bolt	158.	Washer
146.	Bolt	159.	Cotter pin
147.	Washer	160.	Nut
148.	Spacer	161.	Washer
149.	Bolt	162.	Tube assembly
150.	Washer	163.	Beam assembly
151.	Washer	164.	Tube assembly
152.	Nut	165.	Bellcrank
153.	Cotter pin	166.	Support
154.	Washer	167.	Tube assembly
155.	Bolt	168.	Bellcrank
156.	Cotter pin	169.	Control link

209001-171-6

Figure 11-31. Control System Linkage Installation (Sheet 6 of 7)



170.	Tube assembly	179.	Bellcrank
171.	Tube assembly	180.	Tube assembly
172.	Support	181.	Support
173.	Bellcrank	182.	Bellcrank
174.	Tube assembly	183.	Tube assembly
175.	Bellcrank	184.	Support
176.	Support	185.	Bellcrank
177.	Tube assembly	186.	Tube assembly
178.	Support	187.	Elevator horn

209001-171-7

Figure 11-31. Control System Linkage Installation (Sheet 7 of 7)

11-149. REMOVAL — FLIGHT CONTROL TUBES AND LINKS.

NOTE

Parts of control system can be removed separately as need occurs, or completely, in practical sequence. Take precautions against accidental movement of linkage while disconnected.

NOTE

Tailboom must be removed to remove elevator control tube (184, figure 11-34). Refer to paragraph 2-283.

a. Remove access covers as required.

b. Remove components as required to gain access to flight control tubes or links. Refer to chapter that pertains to obstructing component for removal procedures.

c. Remove control tubes and/or links as required.

11-150. INSPECTION — FLIGHT CONTROL TUBES AND LINKS.

a. Inspect all fixed length control tubes for dents, scratches, corrosion, friction wear, nicks and abrasions. See figure 11-30.

NOTE

A smooth dent is one that does not contain a scratch and/or a nick.

(1) The maximum allowable depth of a smooth dent is equal to the wall thickness of the tube body. See figure 11-30.

(2) The maximum allowable width of a smooth dent is equal to 20 percent of the outer tube diameter. See figure 11-30.

b. Scratches, nicks, and/or abrasions may be grouped together and reworked, provided repair areas do not exceed the limits shown in figure 11-30.

c. Inspect all rod end bearings, anti-torque pedal connecting link bearing, and bearings installed in bellcranks (paragraph 11-164). Refer to TM 55-1500-204-25/1 for additional bearing inspection information.

d. If any evidence is noted in steps a. through h. that a part is cracked, make fluorescent penetrant inspection in accordance with TM 43-0103. No cracks are acceptable.

NOTE

When chafing strips become worn through, you may rotate control tube 180° (on straight tubes). Do not turn end for end or change tube length. If this is not possible, you should replace the tube when the inspection limitations for the tube have been exceeded.

e. Inspection criteria for control tubes not listed in figure 11-30:

(1) Inspect tube portion for scratches and score marks as follows:

(a) Maximum allowable dents when scratches and scores are less than 45 degrees to lengthwise center line of tube is 0.010 inch.

(b) Maximum allowable depth when scratches and score marks are more than 45 degrees to center line of tube is 0.005 inch.

(2) Inspect tube portion for corrosion damage. Maximum allowable depth is 0.005 inch before repair and 0.010 inch after repair.

(3) Maximum allowable width of repair area at any given section of tube is one-third of tube circumference.

(4) No thread damage is acceptable. No repair to any surface is acceptable if the repair will affect threads.

(5) Inspect clevises and rod ends for nicks, scratches and corrosion. Maximum allowable depth of mechanical damage is 0.010 inch. Maximum allowable corrosion damage is 0.005 inch before repair and 0.010 after repair.

(6) Inspect bolt holes for wear. Maximum allowable wear is 0.005 inch.

(7) Inspect area on surfaces surrounding bolt holes for mechanical and corrosion damage. Maximum allowable repair of mechanical and/or corrosion damage within distance of one diameter from edge of hole is 25 percent of area.

(8) Inspect bearings for wear and/or damage in excess of limits. Refer to paragraph 11-162.

11-151. REPAIR OR REPLACEMENT — FLIGHT CONTROL TUBES AND LINKS.

a. Replace all parts that fail to meet inspection requirements of paragraph 11-150. Polish out all minor corrosion and mechanical damage that does not exceed damage limits. Do not remove more material than necessary to blend repair smoothly into surrounding surface. Use fine to medium grades of sandpaper (C102) or abrasive cloth (C36). Do not use grinding wheels. Polish out mechanical damage only deep enough to remove traces of damage. Polish out corrosion damage to twice the depth of the deepest pit.

b. Touch up repair area on aluminum parts with chemical film (C31) and primer (C88 or C91). Touch up repair area on steel parts with primer (C88 or C91).

c. Refer to paragraph 11-165 if bearings are worn beyond acceptable limits.

d. Replace worn bushings in pedal connecting links (119 and 129, figure 11-31). Refer to paragraph 11-97.

11-152. INSTALLATION — FLIGHT CONTROL TUBES AND LINKS.

a. Install bellcranks, levers, walking beams and supports if these parts were removed. Refer to paragraph 11-159 and 11-160.

b. Install fixed length tubes and links. See figure 11-34. Ensure that cotter pins are installed where applicable. See figure 11-31, detail A for typical installations.

c. Adjust (rig) and install adjustable length tubes and links. Refer to paragraphs 11-7, 11-29, 11-55, and 11-38 as applicable.

d. Install components that were removed to gain access to flight control tubes and links.

e. Ensure that all safety devices (cotter pins and lockwire) are installed in the flight control system being repaired.

f. Move controls through full throw and ensure that there is no binding or interference.

g. Install access panels.

11-153. FUNCTIONAL CHECK — FLIGHT CONTROL TUBES AND LINKS.

Perform maintenance test flight.

11-154. BELLCRANKS, LEVERS, WALKING BEAMS, AND SUPPORTS.

NOTE

Refer to paragraph 11-167 for maintenance instructions for cyclic and collective power cylinder (hydraulic cylinder assembly) supports.

11-155. DESCRIPTION — BELLCRANKS, LEVERS, WALKING BEAMS AND SUPPORTS (figure 11-31).

Bellcranks, levers and walking beams are utilized in all control systems to change direction of movement and amount of motion in the control system. Supports provide for attachment of the flight controls to the airframe.

Premaintenance Requirements for Bellcranks, Levers, Walking Beams, and Supports

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	Force Gage (Fish Scale)
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C31), (C36), (C88), (C91), (C99), (C138), (C102)
Special Environmental Conditions	None

11-156. REMOVAL — BELLCRANKS, LEVERS, WALKING BEAMS, AND SUPPORTS.

NOTE

Parts of control system can be removed separately as need occurs or completely, in practical sequence. Take precautions against accidental movement of linkage while disconnected.

a. Remove access covers as required.

b. Remove flight control tubes and links as required (paragraph 11-149).

c. Disconnect cyclic force gradient if required (paragraph 11-65).

d. Disconnect tail rotor force gradient if required (paragraph 11-92).

e. Disconnect SCAS motion transducers if required (paragraph 11-122).

f. Disconnect springs (32, figure 11-31) from lateral bellcrank (32) and spring (67) from longitudinal idler crank (59) if required.

g. Disconnect droop compensator tube assembly (12). Refer to paragraph 4-85.

h. Remove SCAS servo actuators (46, 77, and 143). Refer to paragraph 7-73.

i. Remove lockwire, cotter pins, nuts, washers, and bolts that attach bellcranks, levers, and walking beams to supports. Remove bellcranks, levers, and walking beams.

CAUTION

Lateral and collective supports (5 and 40) and tail rotor and fore-and-aft supports (75, 110, and 116) use some common hardware for airframe attachment. Immobilize both systems if either support is removed.

j. Remove collective support (5), lateral support (40), fore-and-aft support (75), and tail rotor support

(111 or 116) by removing bolts, (44, 93, 118, and 112), washers (42, 43, 89, 91, 92, 113, 114, and 117), and nuts (41, 88, and 115).

k. Remove idler crank support (64) by removing three bolts (66) and washers (65).

l. Separate idler crank (60) from support by removing cotter pin (63), nut (62), washers (59 and 61), and bolt (58).

NOTE

Lateral and fore-and-aft support (49 and 80) have nuts on aft bolts. Tail rotor supports (111 and 124) have a nut on lower bolt (58).

m. Remove remaining supports by removing bolts and washers.

11-157. INSPECTION — BELLCRANKS, LEVERS, WALKING BEAMS, AND SUPPORTS.

a. Inspect bearings for wear and/or damage. Refer to paragraph 11-164 for limits.

b. Inspect all parts for mechanical and corrosion damage. See figures 11-33 through 11-35 for limits.

c. Inspect bolt holes (bushings) for wear. Maximum acceptable elongation is **0.005** inch.

d. Inspect area on surfaces surrounding bolt holes for mechanical and corrosion damage. Maximum acceptable repair or mechanical and/or corrosion damage within distance of one diameter from edge of hole is **25** percent of area.

e. Inspect all threaded areas for damaged threads.

11-158. REPAIR OR REPLACEMENT — BELLCRANKS, LEVERS, WALKING BEAMS, AND SUPPORTS.

a. Replace damaged threaded inserts (paragraph 11-13).

b. Replace bushings that are worn beyond acceptable limits.

c. Polish out minor corrosion and mechanical damage that does not exceed inspection limits. Do not remove more material than necessary to blend repair smoothly into surrounding surface. Use fine to medium grade of sandpaper (C102) or abrasive cloth (C36). Do not use grinding wheels. Polish out mechanical damage only deep enough to remove traces of damage. Polish out corrosion damage to twice the depth of the deepest pit.

d. Touch up repair area on aluminum parts with chemical film (C31) and primer (C88 or C91). Touch up repair area on steel parts with primer (C88 or C91).

e. Refer to paragraph 11-165 for instructions to replace bearings.

11-159. INSTALLATION — BELLCRANKS, LEVERS, WALKING BEAMS, AND SUPPORTS.

a. Install bellcranks, levers, walking beams and supports that are removed. See figure 11-31, detail A for typical installations.

b. Attach lateral and collective supports (5 and 40) to airframe with bolts (44), washers (42 and 43), and nuts (41). Place one washer under bolt head and one washer under nut.

CAUTION

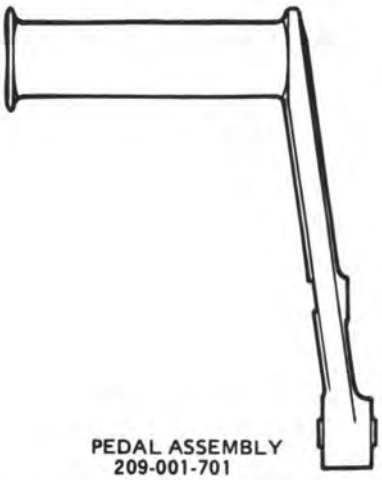
Washers (91) must be installed between tail rotor control support (90) and airframe. Failure to do so will cause binding in tail rotor controls.

c. Attach fore-and-aft and tail rotor supports (75 and 90) to airframe with bolts (93), washers (89, 91, and 92), and nuts (88). Place washers (91) between tail rotor support and airframe. Place one washer under bolt head and one under nut.

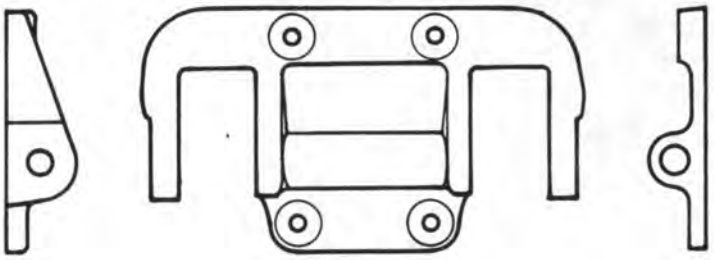
NOTE

Lateral and collective supports (5 and 40) and tail rotor and fore-and-aft supports (75, 111, and 116) use common hardware for airframe attachment.

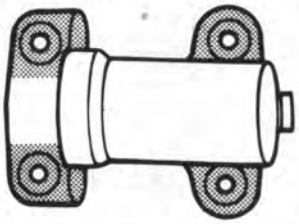
d. Install idler crank (60) in support (64) with bolt (58), washers (59 and 61), and nut (62). Place one washer under bolt head and one washer under nut.



PEDAL ASSEMBLY
209-001-701



PEDAL SUPPORT
209-001-702



PEDAL ADJUSTER SUPPORT
209-001-703

PEDAL ADJUSTER CLEVIS
209-001-704

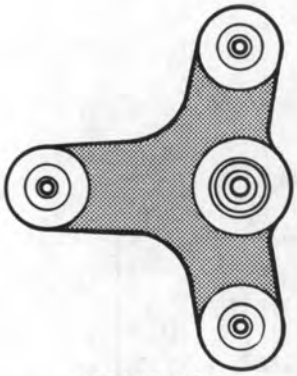
DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED		
CRACKS	None	None	None
MECHANICAL DAMAGE	0.005	0.015	0.030
CORROSION DAMAGE			
Before Repair	0.0025	0.0075	0.015
After Repair	0.005	0.015	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.1 Sq. In.	0.5 Sq. In.	1.0 Sq. In.
NUMBER OF REPAIRS	One Per Area	One Per Area	One Per Area
EDGE CHAMFER	0.02	0.04	0.06
BORE DAMAGE	0.002 for one-fourth circumference		
THREAD DAMAGE	Length 0.25 Depth 0.005 Number Three		

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

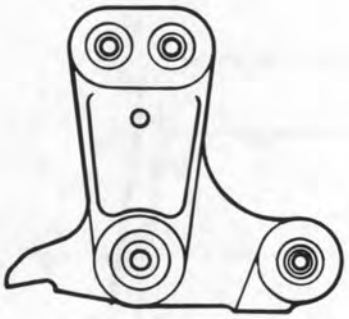
209001-124B

Figure 11-32. Damage Limits — Anti-Torque System (Sheet 1 of 7)

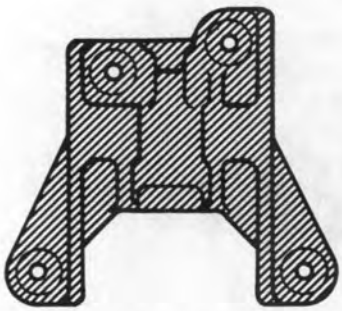


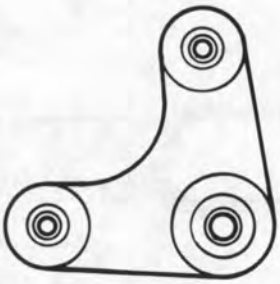
BELLCRANK
209-001-706

LINK
209-001-707

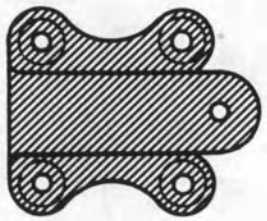


BELLCRANK
209-001-708

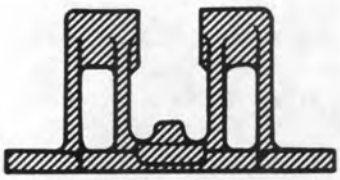




BELLCRANK
209-001-710



SUPPORT
209-001-711



SUPPORT
209-001-709

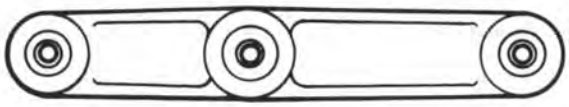
DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED		
CRACKS	None	None	None
MECHANICAL DAMAGE	0.005	0.015	0.030
CORROSION DAMAGE			
Before Repair	0.0025	0.0075	0.015
After Repair	0.005	0.015	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.1 Sq. In.	0.05 Sq. In.	1.0 Sq. In.
NUMBERS OF REPAIRS	1 Per Area	1 Per Area	1 Per Area
EDGE CHAMFER	0.02	0.04	0.06
BORE DAMAGE	0.002 for 1/4 Circumference		

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.

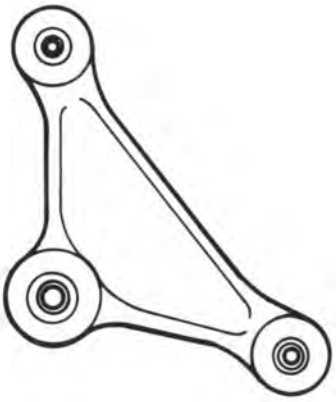
209001-127B

Figure 11-32. Damage Limits — Anti-Torque System (Sheet 2 of 7)

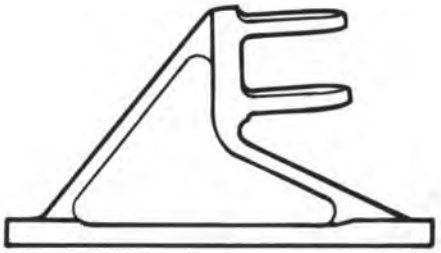


WALKING BEAM
209-001-712

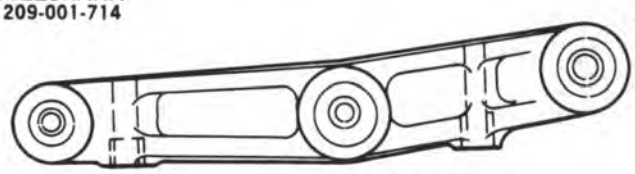
SUPPORT
209-001-713



BELLCRANK
209-001-714



SUPPORT
209-001-715

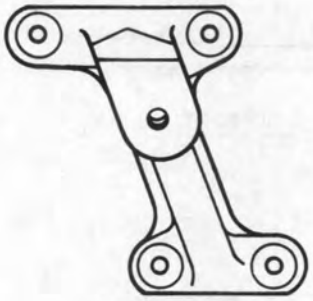


WALKING BEAM
209-001-720

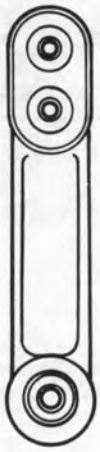
TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED
CRACKS	None
MECHANICAL DAMAGE	0.030
CORROSION DAMAGE	
Before Repair	0.015
After Repair	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	1.0 Sq. In.
NUMBER OF REPAIRS	1 Per Area
EDGE CHAMFER	0.06
BORE DAMAGE	0.002 for 1/4 Circumference

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED. 209001-126B

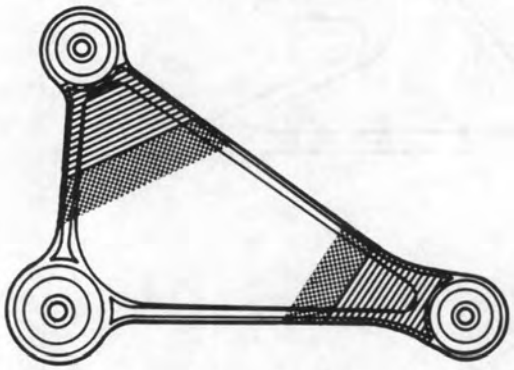
Figure 11-32. Damage Limits — Anti-Torque System (Sheet 3 of 7)



SUPPORT
209-001-717



LEVER
209-001-718



BELLCRANK
209-001-754

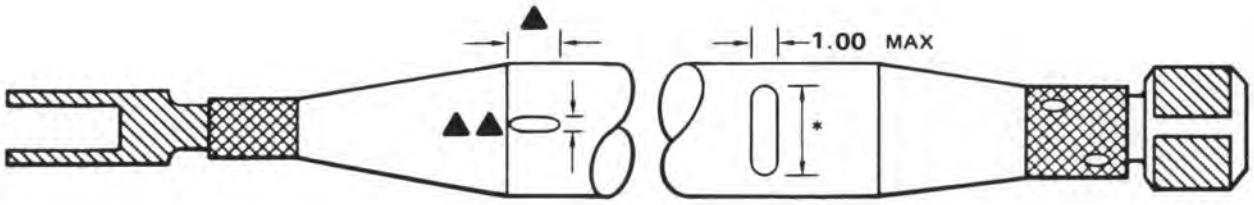
DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED		
CRACKS	None	None	None
MECHANICAL DAMAGE	0.005	0.015	0.030
CORROSION DAMAGE			
Before Repair	0.0025	0.0075	0.015
After Repair	0.005	0.015	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.1 Sq. In.	0.5 Sq. In.	1.0 Sq. In.
NUMBER OF REPAIRS	One Per Area	One Per Area	One Per Area
EDGE CHAMFER	0.02	0.04	0.06
BORE DAMAGE	0.002 for one-fourth circumference		

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209001-125B

Figure 11-32. Damage Limits — Anti-Torque System (Sheet 4 of 7)



LIMITS FOR SMOOTH DENTS ONLY

▲ 1.00 inch maximum length of dent in direction of tube length.

▲▲ Maximum diameter of dent must not exceed 0.2 times outer tube diameter.

DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED		
CRACKS	None	None	None
MECHANICAL DAMAGE	No Damage Allowed	0.005	See table below
CORROSION DAMAGE			See table below
Before Repair		0.0025	See table below
After Repair		0.005	See table below
MAXIMUM AREA PER FULL DEPTH REPAIR		0.1 Sq. In.	See table below
NUMBER OF REPAIRS	One Per Area		See table below
EDGE CHAMFER		0.02	See table below
BORE DAMAGE	0.002 for one-fourth circumference		See table below

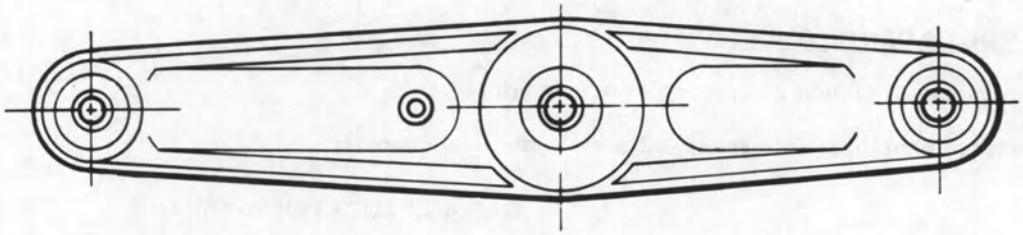
LENGTH OF CIRCUMFERENCE (*) OVER WHICH REPAIR PERMITTED	0.25	25%	50%
Maximum Depth of:			
Corrosion Damage before Cleanup (**)	0.002	0.0015	0.001
Mechanical and Corrosion Repair after Cleanup (**)	0.004	0.003	0.002

** Values shown for a 0.035 wall thickness, in no case will the mechanical and corrosion depth after cleanup exceed 10% of the tube wall thickness, nor corrosion depth before cleanup exceed 5% of the tube wall thickness.

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209001-136A

Figure 11-32. Damage Limits — Anti-Torque System (Sheet 5 of 7)



WALKING BEAM
209-001-761

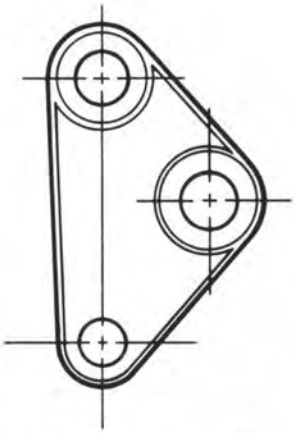
TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED
CRACKS	None
MECHANICAL DAMAGE	0.010
CORROSION DAMAGE	
Before Repair	0.005
After Repair	0.010
MAXIMUM AREA PER FULL DEPTH REPAIR	Not Critical
NUMBER OF REPAIRS	Not Critical
BORE DAMAGE	0.002 for one-fourth circumference

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209001-137A

Figure 11-32. Damage Limits — Anti-Torque System (Sheet 6 of 7)

209-001-764 BELLCRANK



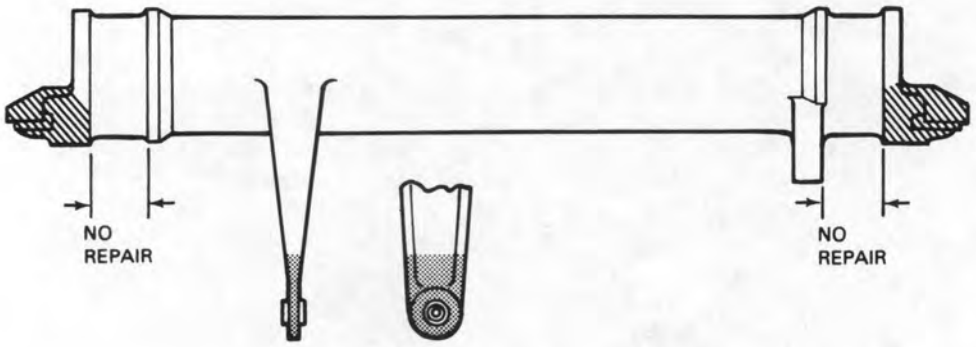
209-001-762 BELLCRANK

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED
CRACKS	NONE
MECHANICAL DAMAGE	0.020
CORROSION DAMAGE	
Before repair	0.010
After reapair	0.020
MAXIMUM AREA PER FULL DEPTH REPAIR	Not Critical
NUMBER OF REPAIRS	Not Critical
BORE DAMAGE	0.002 for 1/4 of circumference

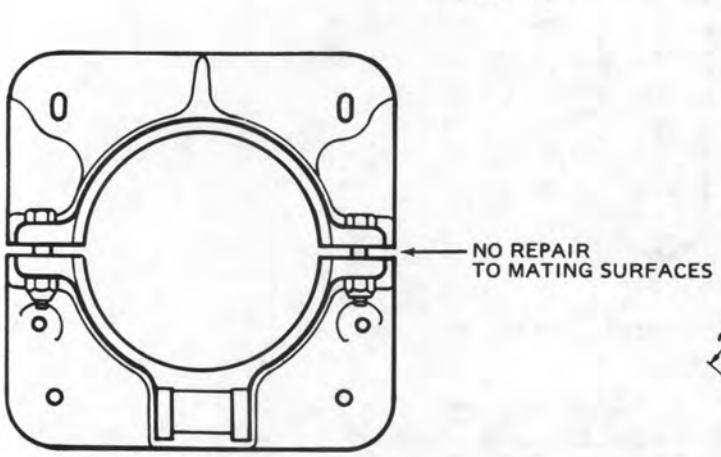
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209001-138A

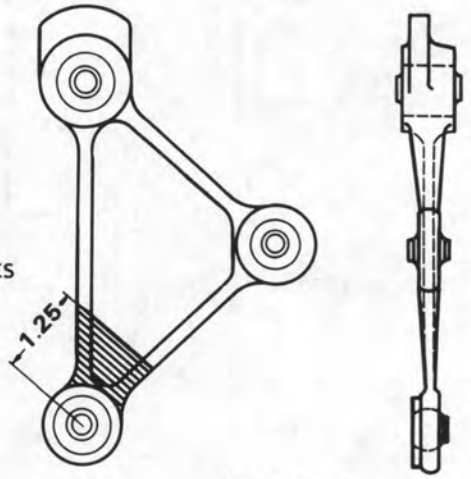
Figure 11-32. Damage Limits — Anti-Torque System (Sheet 7 of 7)



ELEVATOR HORN
209-001-908



ELEVATOR SUPPORT
209-030-834-1



BELLCRANK
209-001-900

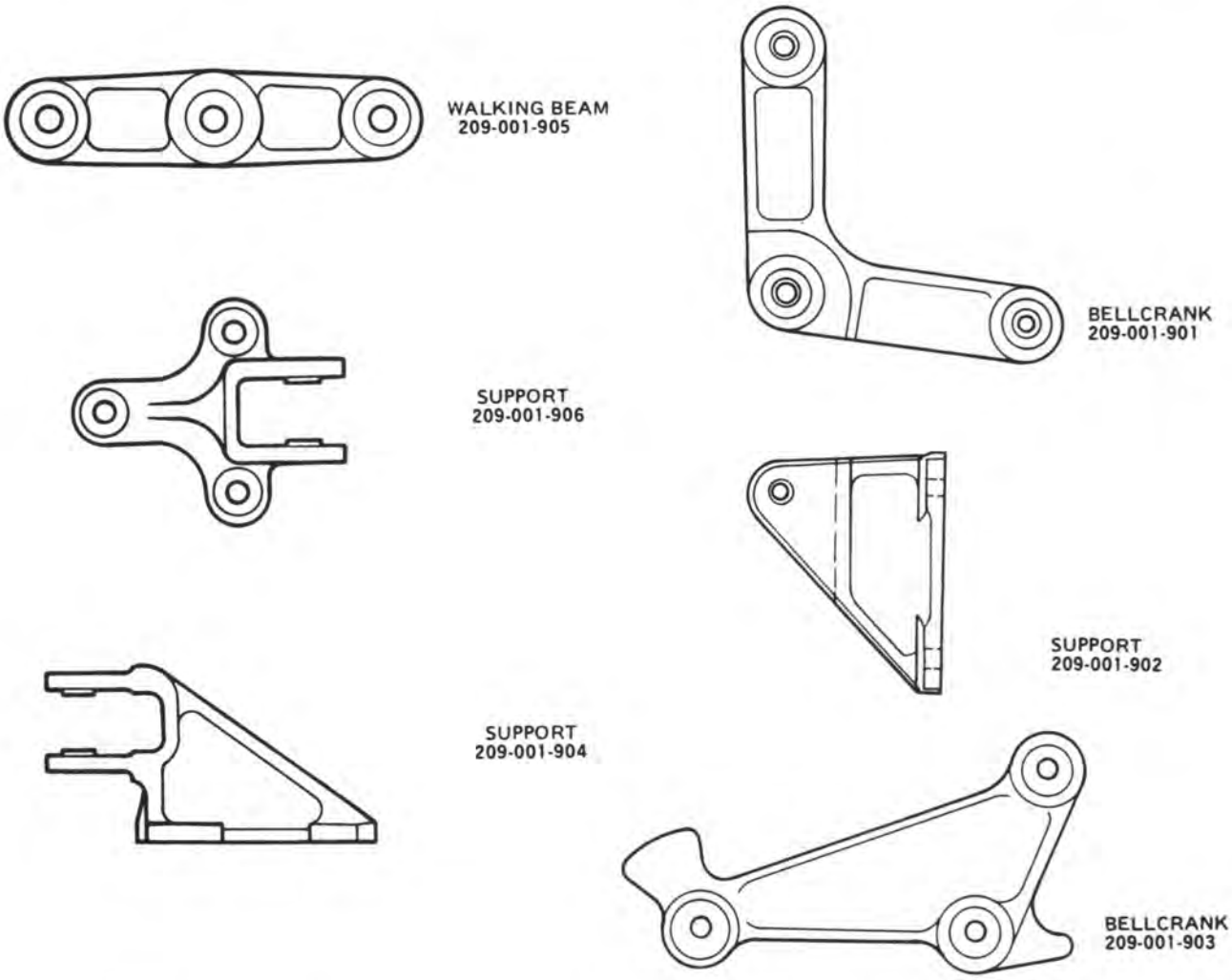
DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED		
CRACKS	None	None	None
MECHANICAL DAMAGE	0.005	0.015	0.030
CORROSION DAMAGE			
Before Repair	0.0025	0.0075	0.015
After Repair	0.005	0.015	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.1 Sq. In.	0.05 In. Sq.	1.0 In. Sq.
NUMBERS OF REPAIRS	1 Per Area	1 Per Area	1 Per Area
EDGE CHAMFER	0.02	0.04	0.06
BORE DAMAGE	0.002 for 1/4 Circumference		

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.

209001-129B

Figure 11-33. Damage Limits — Elevator Control System (Sheet 1 of 2)

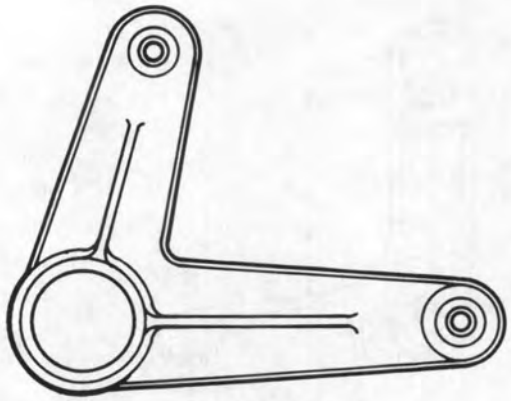


TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED
CRACKS	None
MECHANICAL DAMAGE	0.030
CORROSION DAMAGE	
Before Repair	0.015
After Repair	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	1.0 Sq. In.
NUMBER OF REPAIRS	1 Per area
EDGE CHAMFER	0.06
BORE DAMAGE	0.002 for 1/4 Circumference

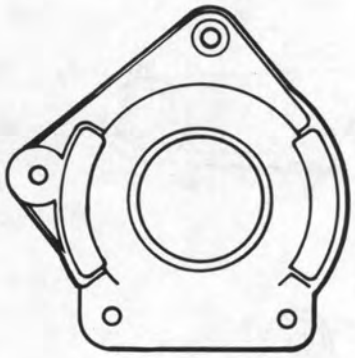
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

209001-128B

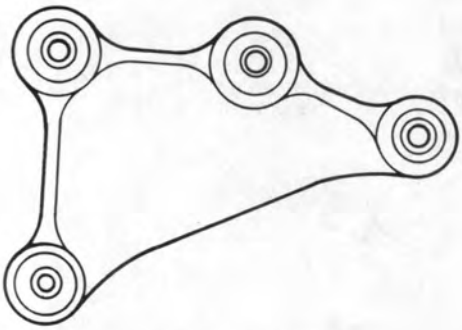
Figure 11-33. Damage Limits — Elevator Control System (Sheet 2 of 2)



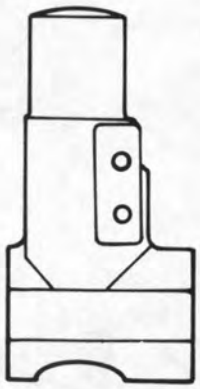
LEVER
209-001-115



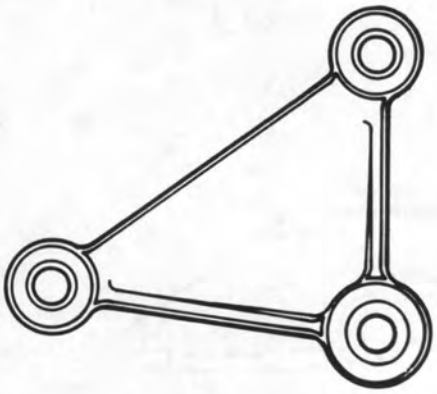
SUPPORT
209-001-103



BELLCRANK
209-001-107



ELBOW
209-001-118



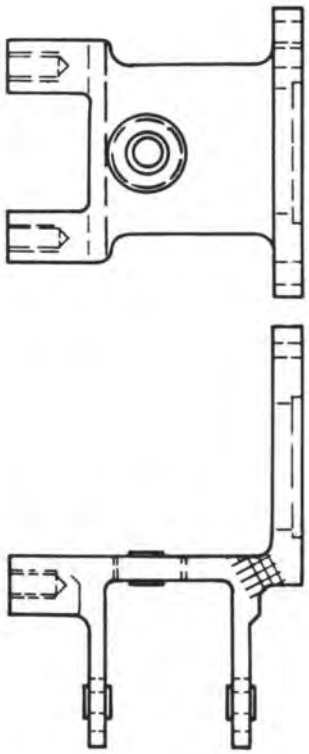
BELLCRANK
209-001-105

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED
CRACKS	None
MECHANICAL DAMAGE	0.030
CORROSION DAMAGE	
Before Repair	0.015
After Repair	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	1.0 Sq. In.
NUMBER OF REPAIRS	1 per area
EDGE CHAMFER	0.06
BORE DAMAGE	0.002 for 1/4 Circumference

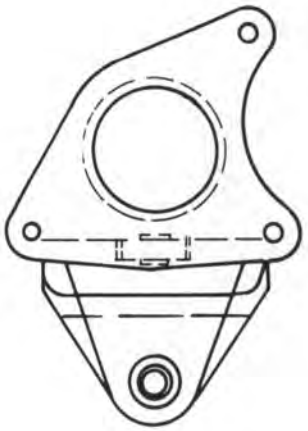
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

209001-130B

Figure 11-34. Damage Limits — Collective Control System (Sheet 1 of 6)



SUPPORT
209-001-102



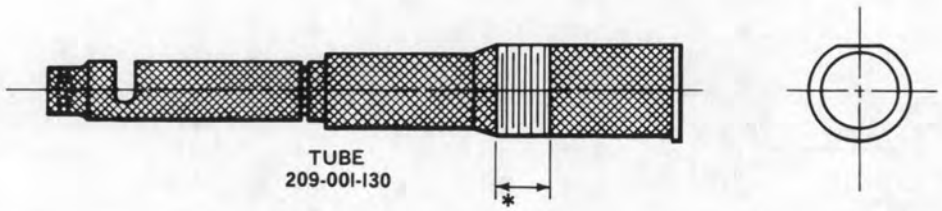
DAMAGE LOCATION SYMBOLS

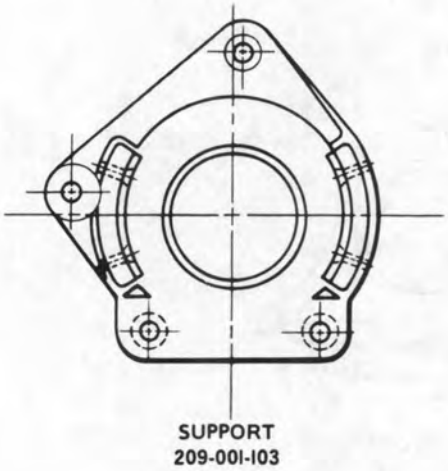
TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED		
CRACKS	NONE	NONE	NONE
MECHANICAL DAMAGE	0.005	0.015	0.030
CORROSION DAMAGE			
Before repair	0.0025	0.0075	0.015
After repair	0.005	0.015	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.1 Sq. In.	0.5 Sq. In.	1.0 Sq. In.
NUMBER OF REPAIRS		One per area	
EDGE CHAMFER	0.02	0.04	0.06
BORE DAMAGE	0.002 for 1/4 of circumference		

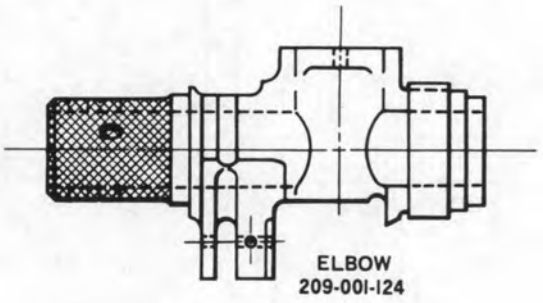
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209001-143A

Figure 11-34. Damage Limits — Collective Control System (Sheet 2 of 6)







DAMAGE LOCATION SYMBOLS

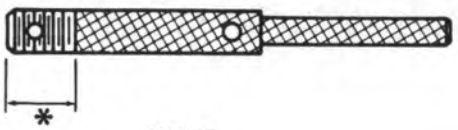
TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
CRACKS	NONE	NONE
MECHANICAL DAMAGE	0.005	0.030
CORROSION DAMAGE		
Before repair	0.0025	0.015
After repair	0.005	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.1 Sq. In.	1.0 Sq. In.
NUMBER OF REPAIRS	One per area	
EDGE CHAMFER	0.2	0.6
BORE DAMAGE	0.2 for 1/4 of circumference	

* NO THREAD DAMAGE IS ACCEPTABLE.

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209001-139A

Figure 11-34. Damage Limits — Collective Control System (Sheet 3 of 6)



SHAFT
204-001-258

DAMAGE LOCATION SYMBOLS

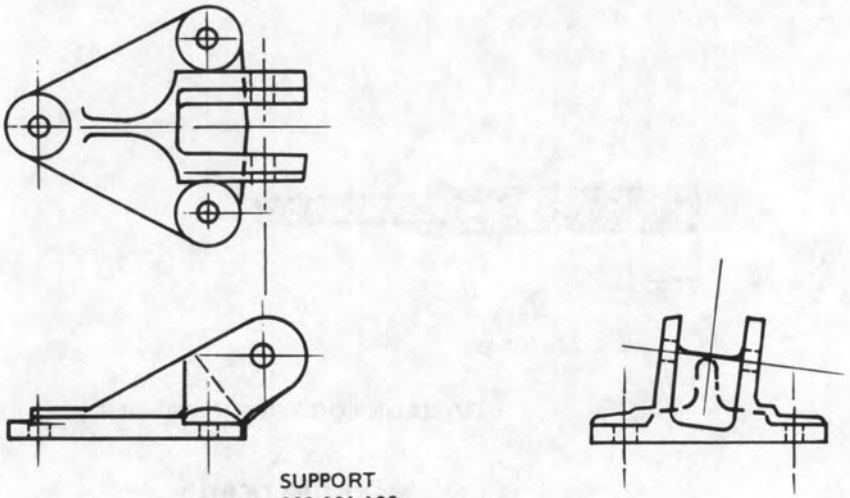
TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED
CRACKS	NONE
MECHANICAL DAMAGE	0.005
CORROSION DAMAGE	
Before repair	0.0025
After repair	0.005
MAXIMUM AREA PER FULL DEPTH REPAIR	0.1 Sq. In.
NUMBER OF REPAIRS	One per area
EDGE CHAMFER	
BORE DAMAGE	

*NO THREAD DAMAGE IS ACCEPTABLE

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209001-142A

Figure 11-34. Damage Limits — Collective Control System (Sheet 4 of 6)



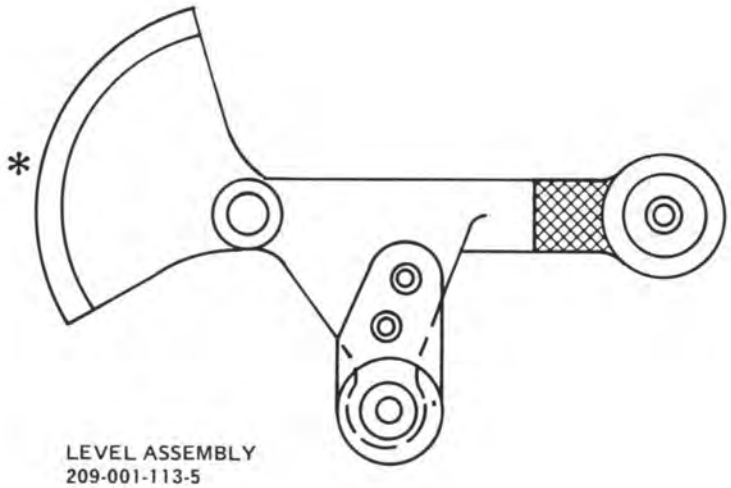
SUPPORT
209-001-108

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED
CRACKS	None
MECHANICAL DAMAGE	0.030
CORROSION DAMAGE	
Before repair	0.015
After repair	0.030
AREA OF FULL DEPTH REPAIR	1.0 Sq. In.
NUMBER OF REPAIRS	One per area
EDGE CHAMFER	0.06
BORE DAMAGE	0.002 for 1/4 of circumference

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209001-146A

Figure 11-34. Damage Limits — Collective Control System (Sheet 5 of 6)



LEVEL ASSEMBLY
209-001-113-5

DAMAGE LOCATION SYMBOLS

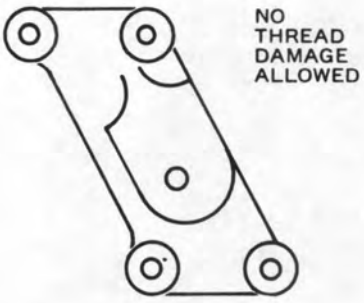
TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
CRACKS	NONE	NONE
MECHANICAL DAMAGE	0.005	0.030
CORROSION DAMAGE		
Before repair	0.0025	0.015
After repair	0.005	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.1 Sq. In.	1.0 Sq. In.
NUMBER OF REPAIRS	One per area	
EDGE CHAMFER	0.02	0.06
BORE DAMAGE	0.02 for 1/4 of circumference	

* NO THREAD DAMAGE IS ACCEPTABLE.

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

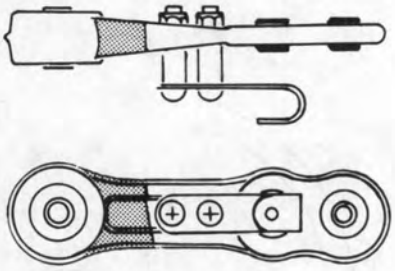
209001-145A

Figure 11-34. Damage Limits — Collective Control System (Sheet 6 of 6)

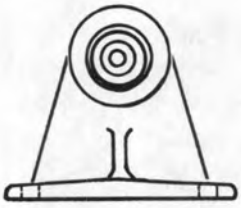


SUPPORT
209-001-106

SUPPORT
209-001-304

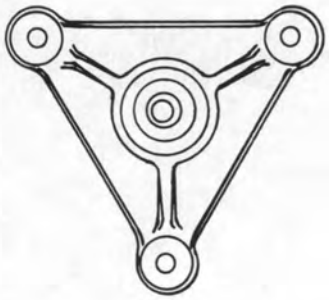


LEVER
209-001-307



SUPPORT
209-001-312

SUPPORT
209-001-313



SUPPORT
209-001-316

DAMAGE LOCATION SYMBOLS

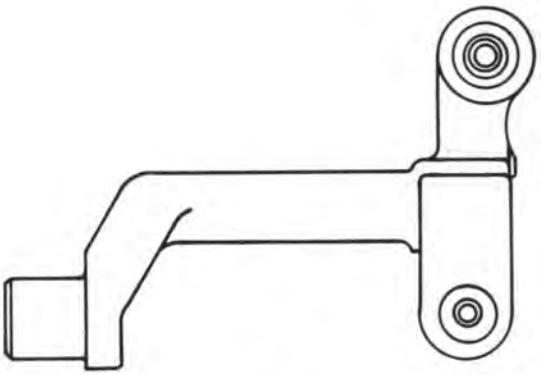
TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
CRACKS	NONE	NONE
MECHANICAL DAMAGE	0.015	0.030
CORROSION DAMAGE		
Before Repair	0.0075	0.015
After Repair	0.015	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.5 SQ IN	1.0 SQ IN
NUMBER OF REPAIRS	1 PER AREA	1 PER AREA
EDGE CHAMFER	0.04	0.06
BORE DAMAGE	0.002 For 1/4 Circumference	

ALL DIMENSIONS ARE INCHES UNLESS OTHERWISE NOTED

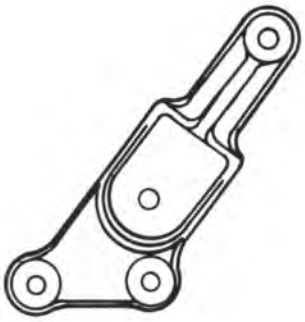
209001-131-1B

Figure 11-35. Damage Limits — Cyclic Control System (Sheet 1 of 5)

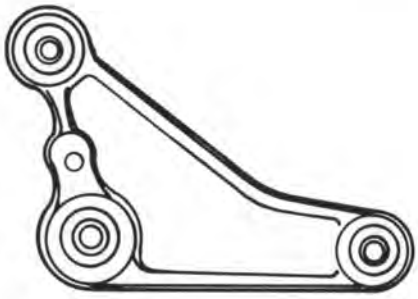
BELLCRANK
209-001-318



STICK
209-001-320



SUPPORT
209-001-322



BELLCRANK
290-001-324

LEVER
209-001-326

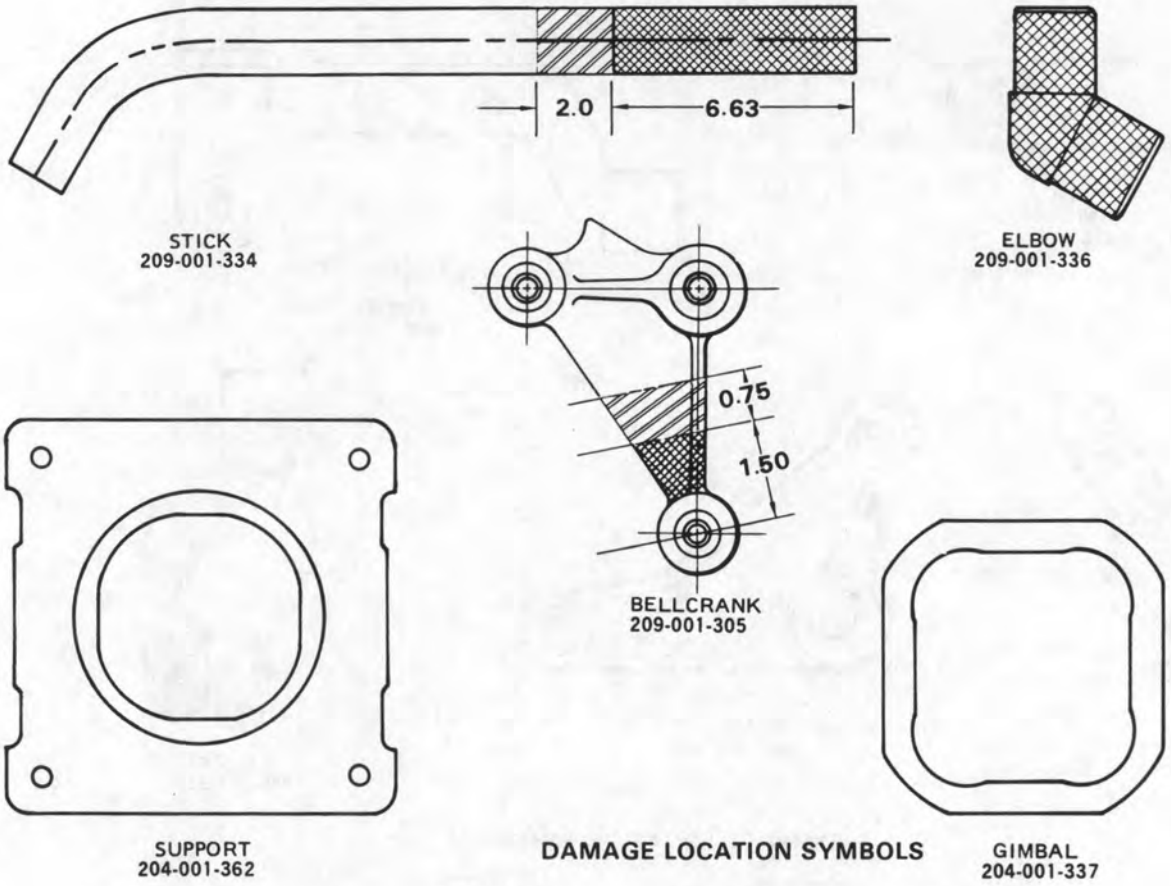
DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
CRACKS	NONE	NONE
MECHANICAL DAMAGE	0.005	0.030
CORROSION DAMAGE		
Before Repair	0.0025	0.015
After Repair	0.005	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.1 SQ IN	1.0 SQ IN
NUMBER OF REPAIRS	1 PER AREA	1 PER AREA
EDGE CHAMFER	0.02	0.06
BORE DAMAGE	0.002 For 1/4 Circumference	

ALL DIMENSIONS ARE INCHES UNLESS OTHERWISE NOTED

209001-131-2B

Figure 11-35. Damage Limits — Cyclic Control System (Sheet 2 of 5)



DAMAGE LOCATION SYMBOLS

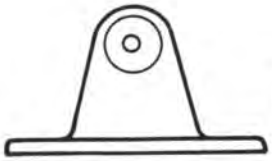
TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED		
CRACKS	NONE	NONE	NONE
MECHANICAL DAMAGE	0.005	0.015	0.030
CORROSION DAMAGE			
Before Repair	0.0025	0.015	0.015
After Repair	0.005	0.015	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.1 SQ IN	0.5 SQ IN	1.0 SQ IN
NUMBER OF REPAIRS	1 PER AREA	1 PER AREA	1 PER AREA
EDGE CHAMFER	0.02	0.04	0.06
BORE DAMAGE	0.002 For 1/4 Circumference		

ALL DIMENSIONS ARE INCHES UNLESS OTHERWISE NOTED

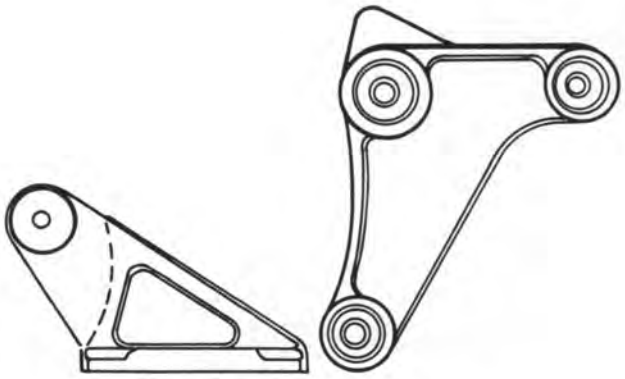
209001-131-3B

Figure 11-35. Damage Limits — Cyclic Control System (Sheet 3 of 5)

BELLCRANK
209-001-505

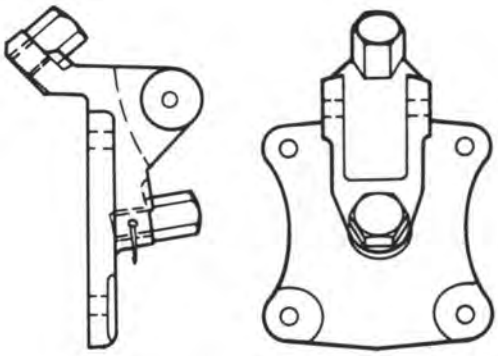


SUPPORT
209-001-507

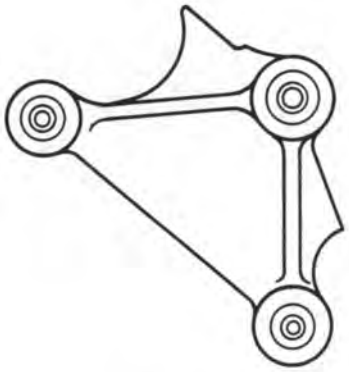


SUPPORT
209-001-508

BELLCRANK
209-001-510



BELLCRANK SUPPORT
209-001-303



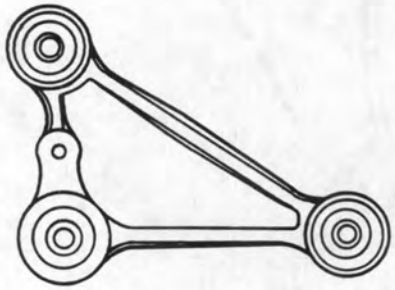
BELLCRANK
209-001-501

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED
CRACKS	NONE
MECHANICAL DAMAGE	0.030
CORROSION DAMAGE	
Before Repair	0.015
After Repair	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.1 SQ. IN.
NUMBER OF REPAIRS	1 PER AREA
EDGE CHAMFER	0.06
BORE DAMAGE	0.002 for 1/4 Circumference

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209001-131-4B

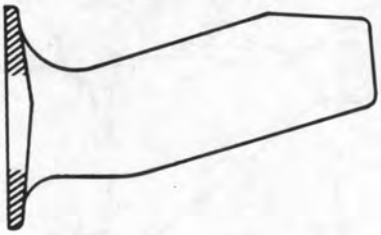
Figure 11-35. Damage Limits — Cyclic Control System (Sheet 4 of 5)



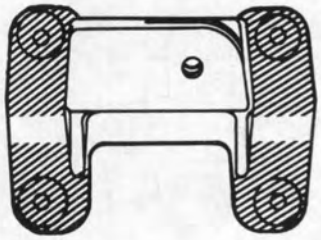
BELLCRANK
209-001-514

BELLCRANK
209-001-518

LINK
209-001-520



SUPPORT
209-001-522



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
CRACKS	NONE	NONE
MECHANICAL DAMAGE	0.005	0.030
CORROSION DAMAGE		
Before Repair	0.0025	0.015
After Repair	0.005	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.1 SQ IN	1.0 SQ IN
NUMBER OF REPAIRS	1 PER AREA	1 PER AREA
EDGE CHAMFER	0.02	0.06
BORE DAMAGE	0.002 FOR CIRCUMFERENCE	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209001-131-5B

Figure 11-35. Damage Limits — Cyclic Control System (Sheet 5 of 5)

Secure nut with cotter pin (63). Attach support to airframe with bolts (66) and washers (65). Attach longest hook of spring (23, figure 11-12) to idler crank and attach opposite end to fuselage.

e. Install remaining supports with bolts and washers.

NOTE

Lateral and fore-and-aft supports (49 and 80, figure 11-31) require nuts on aft bolts. Tail rotor supports (111 and 124) require a nut on lower bolt.

f. Install lateral bellcrank (45), fore-and-aft bellcrank (76), tail rotor bellcrank (119), and collective bellcrank (6) in supports with bolts (8, 57, and 94) and washers (7, 56, and 95). Secure bolts to supports with lockwire (C138).

g. Install remaining bellcranks, levers, and walking beams in supports with bolts, washers, and nuts. Install one washer under bolt head and one washer under nut.

h. Connect spring (67) to longitudinal idler crank (60) and springs (32) to lateral bellcrank (33).

i. Connect tail rotor force gradient (paragraph 11-97).

j. Connect cyclic force gradient (paragraph 11-87).

k. Connect SCAS transducers (paragraph 11-96).

l. Connect droop compensator control tube (12) (paragraph 4-112).

m. Install SCAS servo actuators (46, 77, and 143) (paragraph 7-74).

n. Install dual hydraulic cylinders (paragraph 7-63).

o. Install flight control tubes and links (paragraph 11-152).

p. Install components that were removed to gain access to flight controls.

q. Ensure that all safetying devices (cotter pins and lockwire) are installed in the flight control system being repaired.

r. Move controls through full throw and ensure that there is no binding or interference.

s. Install access panels.

11-160. OPERATIONAL CHECK — BELLCRANKS, CONTROL TUBES, AND LINKS.

Perform maintenance test flight.

11-161. BEARINGS — CYCLIC, COLLECTIVE, ANTI-TORQUE, AND SYNCHRONIZED ELEVATOR SYSTEMS.

11-162. DESCRIPTION — BEARINGS — CYCLIC, COLLECTIVE, ANTI-TORQUE, AND SYNCHRONIZED ELEVATOR SYSTEMS.

Bearings are installed in force gradient rod ends, bellcranks, levers, and other components of the control systems. Inspect and replace in accordance with this paragraph and with TM 55-1500-204-25/1.

Premaintenance Requirements for Bearings — Cyclic, Collective Anti-Torque and Synchronized Elevator Systems

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T61)
Test Equipment	None
Support Equipment	Drill Press, Arbor Press, Roll Staking Tool
Minimum Personnel Required	Two
Consumable Materials	(C30), (C31), (C74), (C75), (C79), (C88), (C96), (C102)
Special Environmental Conditions	None

11-163. REMOVAL — BEARINGS — CYCLIC, COLLECTIVE, ANTI-TORQUE, AND SYNCHRONIZED ELEVATOR SYSTEMS.

a. Remove the flight control system part the bearing is installed in . Refer to paragraph 11-149 or 11-156 as applicable.

b. Refer to paragraph 11-165 for procedures to remove bearing from flight control system parts.

11-164. INSPECTION — BEARINGS — CYCLIC, COLLECTIVE, ANTI-TORQUE, AND SYNCHRONIZED ELEVATOR SYSTEMS.

a. Inspect bearings visually for obvious mechanical damage, corrosion and for secure installation.

b. Rotate bearings and check for binding and roughness. Binding or roughness that can be detected by feel is cause to replace the affected bearing.

c. Inspect bearings for wear. Maximum acceptable wear (looseness) is as follows:

(1) Force gradient rod ends:

0.012 inch radial

0.030 inch axial

(2) Pivot bearings in bellcranks, levers, walking beams, and pedals.

0.005 inch radial

0.030 inch axial

(3) Rod end bearings on dual hydraulic cylinder and control tube assemblies and bearings other than pivots in bellcranks, levers, walking beams, pedal links, stick assemblies, jackshaft, and elevator horn:

0.012 inch radial

0.030 inch axial

11-165. REPAIR — BEARINGS — CYCLIC, COLLECTIVE, ANTI-TORQUE AND SYNCHRONIZED ELEVATOR SYSTEMS.

NOTE

Repair consists of replacing faulty bearings or the part containing the bearing.

a. Replace rod end bearings (figure 11-36, detail C) as the unit. If the rod end bearing is bonded to the part, replace the entire part.

b. Do not replace individual bearings that have been installed in figure 11-36, detail A. This type bearing has a chamfered outer race. Parent metal of the part the bearing is installed in is forced over the bearing chamfer by segment staking or roll staking. When bearings that have been installed by this method fail to pass inspection, replace the part containing the bearing.

c. Bearings which have been roll staked by forcing the bearing outer race or bearing sleeve over the chamfer at the part containing the bearing as shown on figure 11-36, detail B, can be replaced as follows:

(1) Place housing over suitable support with clearance for bearing. Press on outer race to remove bearing. Refer to TM 55-1500-204-25/1.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

(2) Clean housing with cheesecloth (C30) and MEK (C74).

(3) Inspect housing bore for damage. Maximum acceptable bore damage is **0.002** inch deep for one-fourth of circumference.

(4) Remove burrs and light scoring from bore and from chamfer with **320** grit or finer sandpaper (C102).

(5) Inspect housing by fluorescent penetrant method. Refer to TM 43-0103. Clean with cheesecloth (C30) and naphtha (C75).

(6) Apply chemical film (C31) to hole in housing. Allow to dry one to three minutes. Rinse with water. Dry with cloth or force dry.

CAUTION

Avoid excessive application of primer. Do not allow primer to enter bearing.

(7) Apply one coat of primer (C88 or C91) to housing hole and bearing outer race just prior to installation.

CAUTION

If extreme interference fit occurs at beginning of press operation, stop and determine cause before proceeding. Do not install bearing with extreme interference fit as it will cause bearing to bind.

(8) Press bearing into housing hole while primer is still wet. Ensure bearing is started square and not cocked.

CAUTION

Use steady hand pressure on drill during roll staking procedure. Excessive pressure may result in reduction of the outer lip metal thickness adjacent to the 0.008 inch dimension on figure 11-36, detail B.

(9) Roll or ring stake pregrooved bearings. Use tool set (T-61 or T-61.1) to stake bearings. For roll staked bearings, attach tool set to a stand-type drill press. Operate drill press **250 to 350** rpm. Support bearing on lower part of tool and roll stake outer lip of bearing race over housing. Apply reasonably steady hand pressure on drill press for a minimum of ten seconds to allow staking tool to flow metal out. Apply oil (C79) sparingly and cautiously to staking tool rolls. Remove all oil immediately after staking. Refer to TM 55-1500-322-24 for complete bearing replacement.

(10) Inspect installed bearing as follows:

(a) Inspect for gap between chamfer on housing and lip on bearing race. Maximum acceptable gap is **0.008** inch as shown in figure 11-36, detail B.

(b) Inspect bearing for cocking. The bearing must be square to the housing surface.

(c) Rotate bearing and check for binding and roughness by feel.

(d) Inspect for looseness between race and housing. There must be no evidence of bearing walking or looseness.

(e) Inspect housing by dye penetrant method. Refer to TM 43-0103.

11-166. INSTALLATION — BEARINGS — CYCLIC, COLLECTIVE, ANTI-TORQUE, AND SYNCHRONIZED ELEVATOR SYSTEMS.

a. Install bearing in or on next higher assembly part as applicable (paragraph 11-165).

b. After bearing is assembled on next higher assembly part, install the part in the helicopter. Refer to paragraph 11-144, 11-152, or 11-159 as applicable.

11-167. POWER CYLINDER SUPPORTS — LATERAL CYCLIC, FORWARD AND AFT CYCLIC, AND COLLECTIVE SYSTEMS.

11-168. DESCRIPTION — POWER CYLINDER SUPPORTS, LATERAL CYCLIC, FORWARD-AND-AFT CYCLIC, AND COLLECTIVE SYSTEMS.

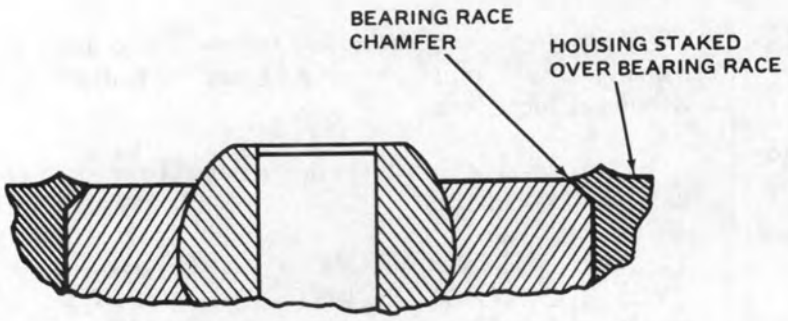
a. The lateral cyclic and collective controls power cylinder support (13, figure 11-37) is mounted at the left side of the transmission bay. It is the supporting member for the two control power cylinders (hydraulic cylinder assemblies) named above.

b. THE FORWARD AND AFT CYCLIC POWER CYLINDER SUPPORT (3, figure 11-38) is mounted at the right side of the transmission bay. It is the supporting member for the forward and aft control power cylinder (hydraulic cylinder assembly).

11-169. REMOVAL — POWER CYLINDER SUPPORTS, LATERAL CYCLIC, FORE-AND-AFT CYCLIC, AND COLLECTIVE SYSTEMS.

a. Remove lateral cyclic and collective controls power cylinder support (13, figure 11-39) as follows:

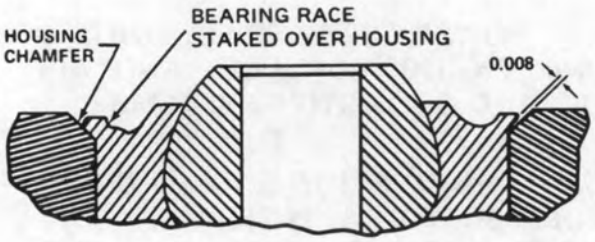
(1) Remove lateral cyclic and collective power cylinder assemblies (paragraph 7-55).



DETAIL A
BEARING WITH CHAMFER ON OUTER RACE
(TYPICAL)

NOTE

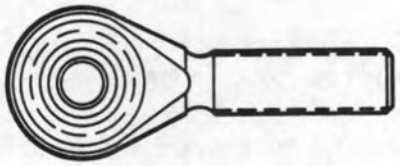
Bearing replacement
not recommended.



DETAIL B
PREGROOVED BEARING
(TYPICAL)

NOTE

Bearing may be replaced.
Refer to text.



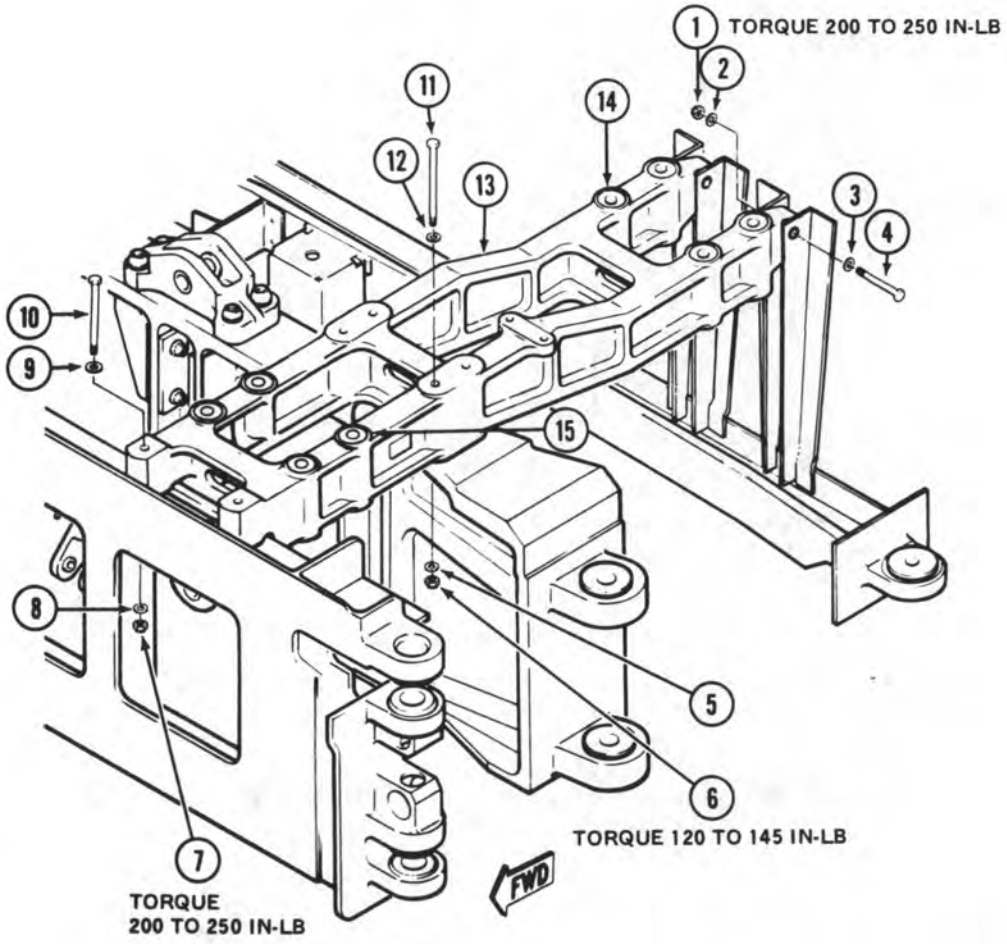
DETAIL C
ROD END BEARING
(TYPICAL)

NOTE

Typical rod end bearing
is replaced as a unit.
If bonded in, replace
next assembly.

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Figure 11-36. Flight Control System Bearings



1. Nut
2. Washer
3. Washer
4. Bolt
5. Washer
6. Nut
7. Nut
8. Washer
9. Washer
10. Bolt
11. Bolt
12. Washer
13. Support
14. Washer
15. Washer

210001-107A

Figure 11-37. Lateral Cyclic and Collective Controls Power Cylinder Support Installation

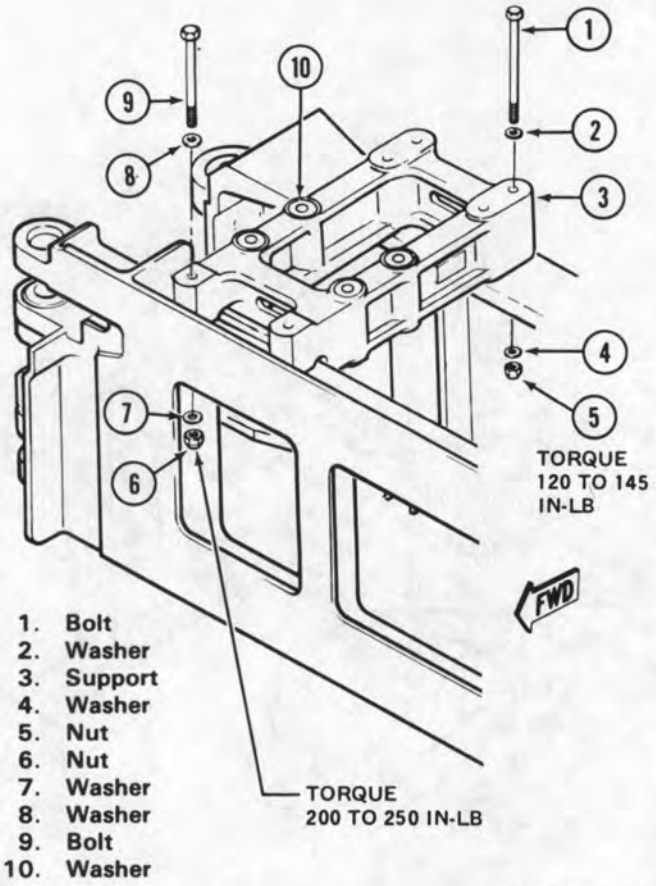


Figure 11-38. Fore-And-Aft Cyclic Controls Power Cylinder Support Installation

(2) Remove nuts (6), washers (5 and 12) and four bolts (11) that attach support to lift beam.

(3) Remove nuts (7), washers (8 and 9), and two bolts (10).

(4) Remove nuts (1), washers (2 and 3) and two bolts (4) that attach support to airframe.

(5) Remove support (13).

b. Remove fore-and-aft cyclic controls power cylinder support (3, figure 11-38) as follows:

(1) Remove fore-and-aft cyclic power cylinder assembly (paragraph 7-55).

(2) Remove System No. 2 hydraulic pump (paragraph 7-23).

(3) Remove nuts (5), washers (2 and 4), and four bolts (1) that attach support (3) to lift beam.

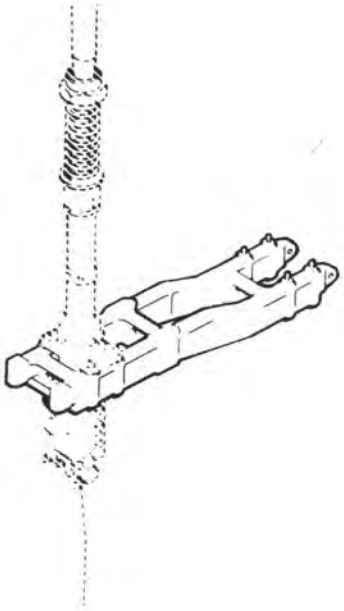
(4) Remove nuts (6), washers (7 and 8), and two bolts (9) that attach support to bulkhead fitting.

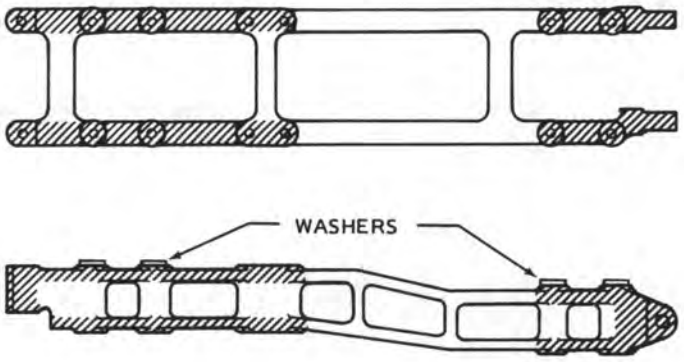
(5) Remove support (3).

11-170. INSPECTION — POWER CYLINDER SUPPORTS, LATERAL CYCLIC, FORE-AND-AFT CYCLIC, AND COLLECTIVE SYSTEMS.

a. Inspect supports for damage in excess of limits shown on figure 11-39.

b. Inspect four washers (14 and 15, figure 11-37) and (10, figure 11-38) at each cylinder installation point (total of twelve washers on both supports) for secure bonding to the supports.





SUPPORT
209-001-500-5

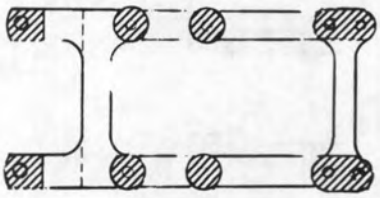
DAMAGE LOCATION SYMBOLS

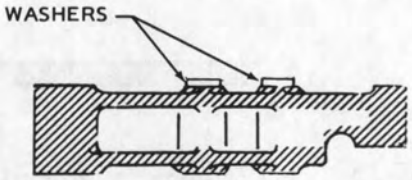
TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
CRACKS ALLOWED	None	None
MECHANICAL	0.020	0.030
CORROSION	0.010	0.015
MAXIMUM AREA PER FULL DEPTH REPAIR	0.25 Sq. In.	0.50 Sq. In.
NUMBER OF REPAIRS	Two Per Segment	
EDGE CHAMFER	0.040	0.060
BORE DAMAGE	0.002 Inch For 1/4 Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209001-155-1

Figure 11-39. Damage Limits — Power Cylinder Supports (Sheet 1 of 2)





SUPPORT
209-001-302-3

DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
CRACKS ALLOWED	None	None
MECHANICAL DAMAGE	0.020	0.030
CORROSION DAMAGE		
BEFORE CLEANUP	0.010	0.015
AFTER CLEANUP	0.020	0.030
AREA OF FULL DEPTH REPAIR		0.50 Sq. In.
NUMBER OF REPAIRS	Not Critical	Not Critical
EDGE CHAMFER	0.050	0.060
BORE DAMAGE	0.002 Inch for Full Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209001-155-2

Figure 11-39. Damage Limits — Power Cylinder Supports (Sheet 2 of 2)

11-171. REPAIR — POWER CYLINDER SUPPORTS, LATERAL CYCLIC, FORE-AND-AFT CYCLIC, AND COLLECTIVE SYSTEMS.

a. Polish out mechanical and corrosion damage that is within limits shown on figure 11-39 with abrasive paper (C102).

b. Touch up repair area with chemical film (C31) and primer (C88 or C91).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

c. (AVIM) Replace missing washers (14 and 15, figure 11-37) and (10, figure 11-38). Clean old adhesive with sandpaper (C102). Clean mating surface of washer and support with MEK (C74). Bond washer to support with adhesive (C8). Refer to table 1-11, for adhesive, mix ratio, pot life, and curing schedule.

11-172. INSTALLATION — POWER CYLINDER SUPPORTS, LATERAL CYCLIC, FORE-AND-AFT CYCLIC, AND COLLECTIVE SYSTEMS.

a. Install lateral cyclic and collective controls power cylinder support (13, figure 11-37) as follows:

(1) Attach power cylinder support (13) to lift beam with four bolts (11), washers (12 and 5) and nuts (6). Place one washer (12) under bolt head with countersunk side against head, and one washer (5) under nut. Do not tighten.

(2) Attach support (13) to forward carry-through fitting with two bolts (10), washers (8 and 9), and nuts (7). Place one washer (9) under head with countersunk side against head, and one washer (8) under nut. Attach support to aft bulkhead with bolts (4), washers (2 and 3), and nuts (1). Place one washer (3) under head with countersunk side against head, and one washer (2) under nut (1).

(3) Torque nuts (6) **120 TO 145** inch-pounds. Torque nuts (7) **200 TO 250** inch-pounds. Torque nuts (1) **200 TO 250** inch-pounds.

(4) Install lateral cyclic and collective power cylinder assemblies (paragraph 7-55).

b. Install forward and aft cyclic controls power cylinder support (3, figure 11-38) as follows:

(1) Attach power cylinder support (3) to lift beam with four bolts (1), washers (2 and 4), and nuts (5). Place one washer (2) under bolt head with countersunk side against head, and one washer (4) under nut. Do not tighten.

(2) Attach support to forward carry-through fitting with two bolts (9), washers (7 and 8), and nuts (6). Place one washer (8) under bolt head with countersunk side against head, and one washer (7) under nut (6).

(3) Torque nuts (5) **120 TO 145** inch-pounds. Torque nuts (6) **200 TO 250** inch-pounds.

(4) Install System No. 2 hydraulic pump (paragraph 7-23).

(5) Install fore-and-aft cyclic power cylinder assembly (paragraph 7-55).

CHAPTER 12

UTILITY SYSTEMS

SECTION I. FIRE DETECTION SYSTEM

12-1. FIRE DETECTION SYSTEM — ENGINE.

12-2. DESCRIPTION — ENGINE FIRE DETECTION SYSTEM.

The fire detection system consists of a control unit (10, figure 12-1), a FIRE indicator light (2), a fire detector test switch (9), and a heat sensing element (6). The FIRE light will illuminate when the engine compartment temperature reaches approximately 480 degrees F (249 degrees C). The heat sensing element exhibits high electrical resistance at normal ambient temperature, but the resistance drops rapidly when heated causing an internal relay of the control unit to activate and illuminate the FIRE light. The system is powered by the 28 Vdc essential bus and protected by the FIRE DET P , FIRE DETR E M circuit breaker (8). The FIRE DET TEST switch provides a means of testing the fire detection system. Pressing the FIRE DET TEST switch to TEST places a low resistance across the heat sensing element, simulating a fire condition, thus causing the FIRE light to illuminate.

12-3. TROUBLESHOOTING — ENGINE FIRE DETECTION SYSTEM. Refer to table 12-1.

NOTE

Before you use this table, be sure you have performed all normal operational checks. If you have a malfunction which is not listed in this table. notify the next higher level of maintenance.

Table 12-1. Troubleshooting — Engine Fire Detection System

CONDITION TEST OR INSPECTION	CORRECTIVE ACTION
FIRE light fails to illuminate when FIRE DET TEST switch is depressed to TEST.	
STEP 1. Ensure that voltage is present at pins A & H of control unit.	**If voltage is not present, check wiring (paragraph F-9) and/or replace circuit breaker (paragraph 9-23).** **If voltage is present, go to step 2.**
STEP 2. Ensure that proper resistance is present at terminal 1 of FIRE DET TEST switch.	**If resistance is not present, check wiring (paragraph F-9) and/or replace 8R2 resistor (paragraph 9-16).** **If resistance is present, go to step 3.**

Table 12-1. Troubleshooting — Engine Fire Detection System (Cont)

CONDITION TEST OR INSPECTION CORRECTIVE ACTION
STEP 3. Ensure that proper resistance is present at pin 2 of FIRE DET TEST switch. **If resistance is not present, replace switch (paragraph 9-16).** **If resistance is present, go to step 4.**
STEP 4. Ensure that approximately **245** ohms are present at terminal C of control unit. **If 245 ohms are not present, check wiring (paragraph F-9) and/or replace heat sensing element (paragraphs 12-5 and 12-8).** **If 245 ohms are present, go to step 5.**
STEP 5. Ensure that 28 Vdc is present at pin 52 of NVG PC (Night vision goggle printed circuit) board. **If voltage is not present, check wiring (paragraph F-9) and/or replace control unit (paragraph 9-16).** **If voltage is present, go to step 6.**
STEP 6. Ensure that 28 Vdc is present at pin 51 of NVG PC board. **If voltage is not present, replace NVG PC board. If voltage is present, go to step 7.**
STEP 7. Ensure that 28 Vdc is present at terminal 1 of FIRE light. **If voltage is not present, check wiring (paragraph F-9). If voltage is present, replace bulb (paragraph 9-16).**

12-4. TESTING — ENGINE FIRE DETECTION SYTEM.

a. Position BAT SWITCH to ON P. Position BATTERY switch to RUN or START E M

b. Close FIRE DET P, FIRE DETR E M circuit breaker (8, figure 12-1).

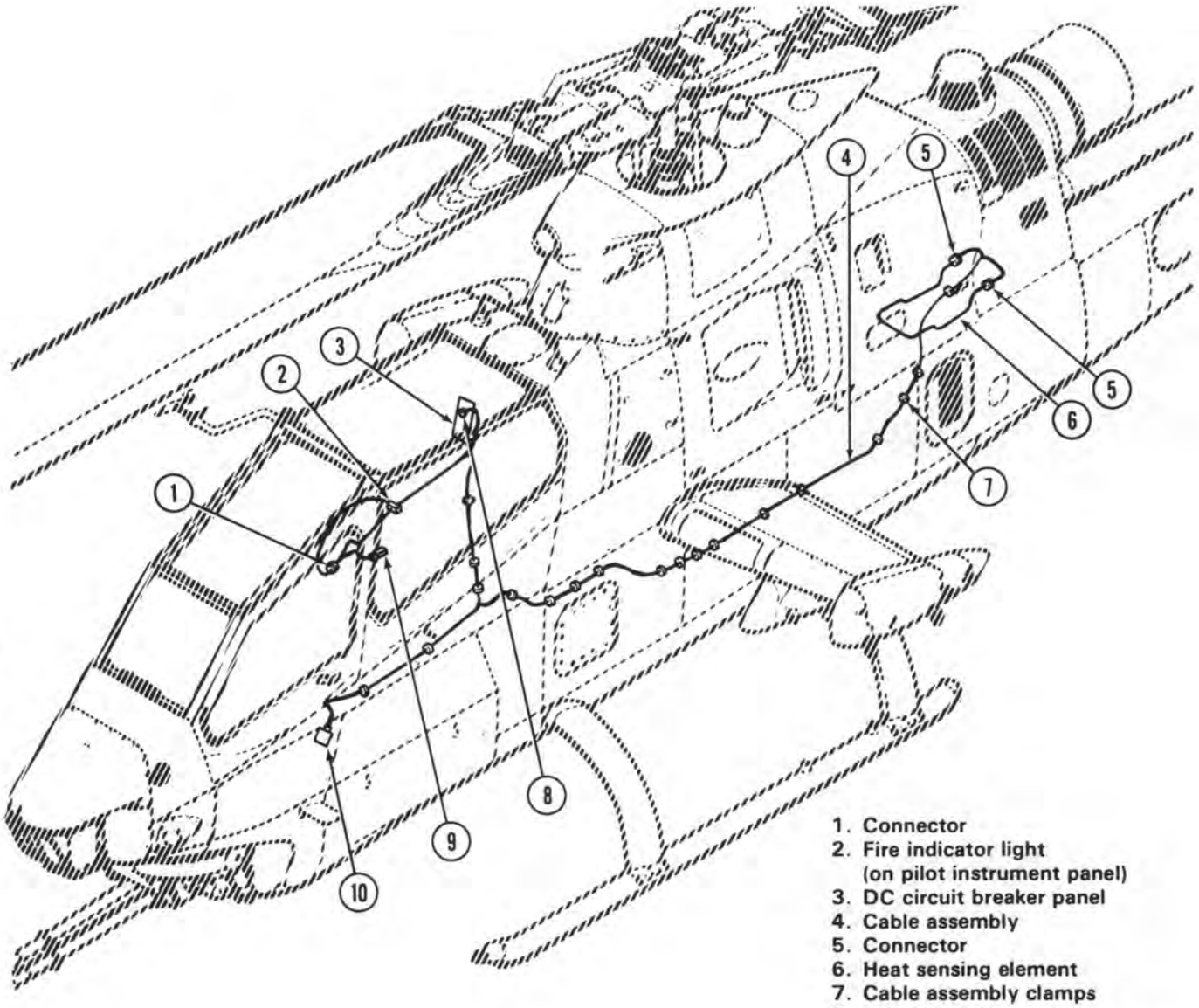
c. Depress FIRE DET TEST switch (9) to TEST. FIRE light (2) should illuminate. If light does not illuminate, troubleshoot system (paragraph 12-3).

12-5. REMOVAL — ENGINE FIRE DETECTION SYSTEM.

a. Position BAT P, BATTERY E M switch to OFF.

b. Disconnect heat sensing element (6, figure 12-1) from connectors (5) at aft firewall. Cover openings with tape (C127).

c. Remove heat sensing element (6) from 16 quick release clamps. Remove heat sensing element.



1. Connector
2. Fire indicator light (on pilot instrument panel)
3. DC circuit breaker panel
4. Cable assembly
5. Connector
6. Heat sensing element
7. Cable assembly clamps
8. Circuit breaker
9. Fire detector test switch (on pilot instrument panel)
10. Control unit (under gunner left console)

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Figure 12-1. Engine Fire Detection System

d. Remove control unit (10) as follows:

(1) Disconnect cable connector from control unit.

(2) Disconnect control unit ground cable.

(3) Remove four screws, washers, and nuts, securing control unit. Remove control unit.

12-6. INSPECTION — ENGINE FIRE DETECTION SYSTEM.

a. Inspect cable assembly (4, figure 12-1) and heat sensing element (6) for damage and wear.

b. Inspect cable assembly clamps (7) for cracks and serviceability.

12-7. REPAIR OR REPLACEMENT — ENGINE FIRE DETECTION SYSTEM.

a. Replace cable assembly (4, figure 12-1) and heat sensing element (6) if damaged or worn.

b. Replace cable assembly clamps (7) if broken, cracked, or unserviceable.

c. Replace control unit (10) if case is cracked or damaged.

12-8. INSTALLATION — ENGINE FIRE DETECTION SYSTEM.

a. Route heat sensing element (6, figure 12-1) to position.

b. Connect heat sensing element (6) to connectors (5).

c. Secure heat sensing element (6) with 16 quick release clamps.

d. Install control unit (10) with four screws, washers, and nuts.

e. Connect cable connector to control unit (10) and secure ground cable to structure.

SECTION II. RAIN REMOVAL SYSTEM

12-9. RAIN REMOVAL SYSTEM.

NOTE

A rain removal system incorporated in the environmental control system is used in lieu of windshield wipers. Refer to Chapter 13.

SECTION III. DEFROSTER SYSTEM

12-10. DEFROSTER.

NOTE

A defroster system is incorporated in the environmental control system. Refer to chapter 13.

CHAPTER 13

ENVIRONMENTAL CONTROL SYSTEM

SECTION I. HEATING SYSTEM

13-1. ENVIRONMENTAL CONTROL SYSTEM.

13-2. DESCRIPTION — ENVIRONMENTAL CONTROL SYSTEM.

The environmental control system (ECS) (figure 13-1) provides ventilating air at ambient temperature, or at controlled temperatures, to air distribution ducts and outlets in pilot and gunner compartments. Air is drawn in through a screen on the pylon fairing and delivered to the distribution ducts by a transmission-driven blower operating continuously when the engine is running. Heating and cooling at controlled settings is provided by an environmental control unit (ECU) using bleed air from the engine compressor (figure 13-2). The ECU will provide comfort in ambient air temperatures from -65 degrees F (-54 degrees C) to 125 degrees F (52 degrees C). A rain removal subsystem also uses engine bleed air to clear the windshield of moisture or ice.

13-3. MODES OF OPERATION — ENVIRONMENTAL CONTROL SYSTEM.

a. Airflow to crew compartments is controlled by a HEAT OR VENT AIR PULL control knob on the pilot instrument panel. Each crew seat also has a manual valve controlling airflow through seat cushions. The gunner instrument panel has two butterfly valve outlets. Defog and ventilation outlets on the pilot pedestal have manual control handles.

b. Cool air is provided by the environmental control unit when the HTR/OFF/RAIN RMV switch is at HTR and the ECS COOL/WARM selector is at a COOL setting (figure 13-1). Air for the ECU is bled from the engine compressor through a venturi which restricts the flow. Bleed air pressure is reduced to 35 psi at the pressure regulator and shutoff valve. In the ECU, bleed air is cooled almost to ram air temperature in the heat exchanger, and further cooling is accomplished in the reheater-condenser by recirculating cold turbine discharge air. The bleed air is then expanded through the turbine to complete the cooling cycle. Air flows from the ECU past a control-sensor which is manually set by the temperature selector and regulates output air temperature.

c. Heated air is provided by the ECU when the temperature selector is turned to a WARM setting while the ECS switch is at HTR. Interconnections to the control/sensor, temperature control valve, and vent air control valve regulate output air temperature to the air distribution ducts. A thermal probe (overheat) switch in the duct protects against excessive heat in event of malfunction and would cause the ECU to cycle off and on until trouble is corrected.

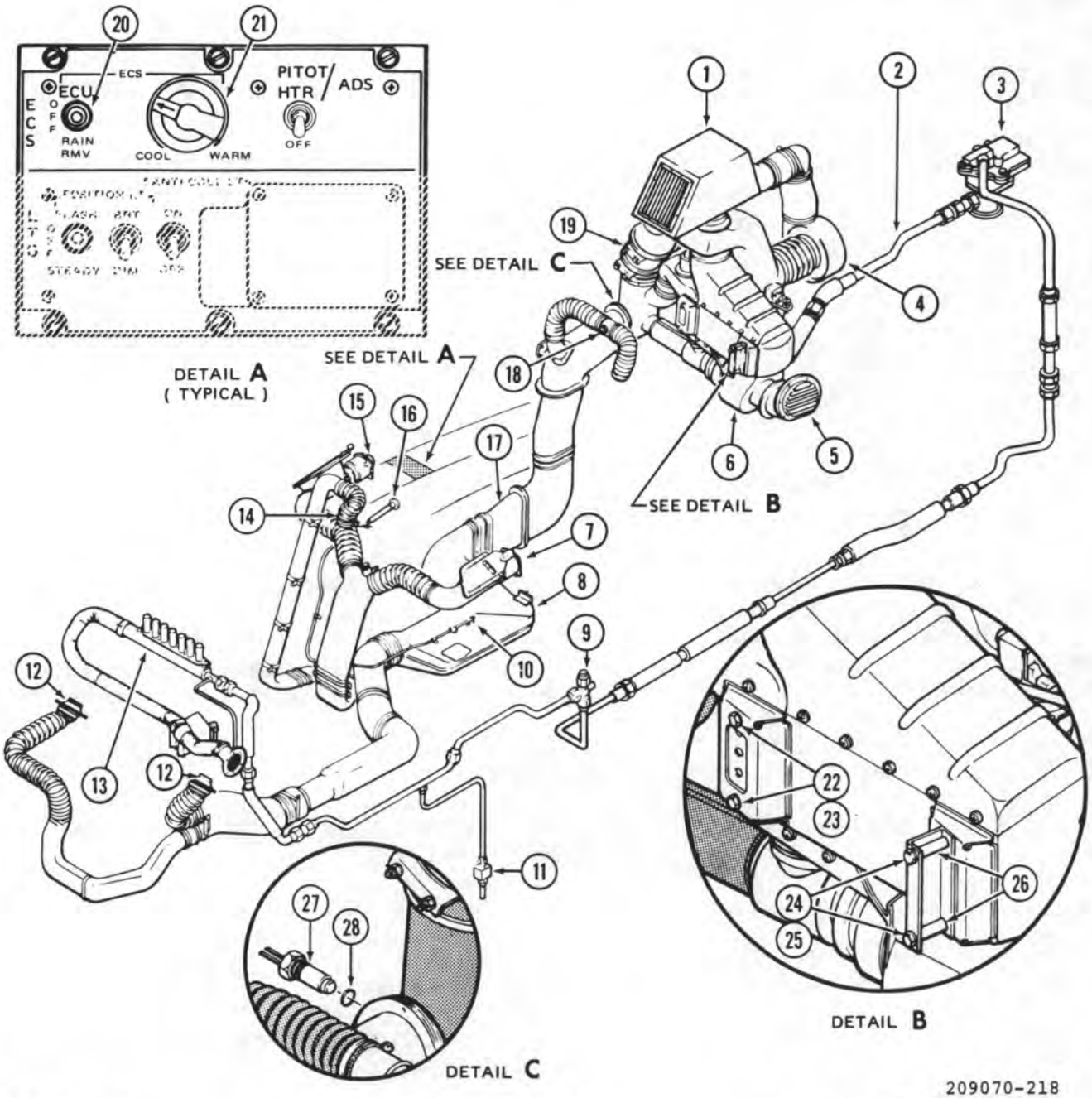
13-4. TROUBLESHOOTING — ENVIRONMENTAL CONTROL SYSTEM.

Accomplish troubleshooting of the environmental control system according to table 13-1.

NOTE
Before using this table, ensure all normal operational checks have been performed. If a malfunction occurs which is not listed in this table, notify the next higher level of maintenance.

Table 13-1. Troubleshooting ECU

CONDITION TEST OR INSPECTION	CORRECTIVE ACTION
1. No airflow from outlets with HEAT OR VENT AIR PULL control full out.	
STEP 1. Check position of flapper valve lever on air distribution valve.	**Adjust control cable connection to obtain valve opening.**
STEP 2. Place ECS switch to OFF. Check for airflow.	**If no airflow and shaft driven blower is operating, replace vent air control valve (paragraph 13-66).**
STEP 3. Place ECS switch to HTR. If no airflow, check pressure regulator and shutoff valve for valve stroked open and escaping air from relief valve. If no such signs, disconnect electrical connector from valve, check for 28 Vdc at pin 3 and for ground at pin 6.	**If no power or ground, check and repair wiring circuit.** **If power and ground are correct, replace valve (paragraphs 13-39 and 13-44).**
2. Airflow from outlets does not become cool when ECS switch is positioned at HTR and temperature selector is positioned COOL.	
STEP 1. Disconnect electrical connector from control/sensor. Connect ohmmeter (set at highest resistance) to pins F and G of electrical plug. Rotate temperature selector, observing change in resistance. If meter shows no change, replace temperature selector. Reconnect control/sensor.	
STEP 2. Disconnect regulated supply air line from magnetic actuator (figure 13-4) on temperature control valve of ECU.	**If valve closes (goes to cold condition), replace magnetic actuator (paragraph 13-29).** **If magnetic actuator is operative and valve remains open, replace valve (paragraph 13-22).**
3. Airflow does not become warmer when ECS switch is at HTR and temperature selector turned to WARM.	
STEP 1. If all preceding checks have been made, replace control/sensor (paragraph 13-15).	
STEP 2. If all preceding checks have been made and all components found operative, replace environmental control unit (paragraph 13-8).	



1. Ram air inlet
2. Bleed air line
3. Pressure regulator and shutoff valve
4. Blower
5. Ram air outlet
6. Environmental control unit
7. Defog outlet
8. Duct
9. Rain removal valve
10. Air control valve
11. Drain valve
12. Gunner air outlets
13. Rain removal manifold
14. Gunner cushion air valve
15. Pilot air outlets
16. Heat or vent air pull control
17. Duct
18. Pilot cushion air valve
19. Vent air control valve
20. Selector switch
21. Temperature control
22. Bolt
23. Washer
24. Bolt
25. Washer
26. Spacer
27. Overheat switch
28. Packing

Figure 13-1. Environmental Control System

13-5. ENVIRONMENTAL CONTROL UNIT.

13-6. DESCRIPTION — ENVIRONMENTAL CONTROL UNIT.

The environmental control unit (ECU) is the heating and cooling unit for the pilot and gunner. The environmental control system (ECS) is basically composed of a heat exchanger, a reheater-condenser, an expansion turbine, and a jet pump (figure 13-2).

13-7. INSPECTION — ENVIRONMENTAL CONTROL UNIT.

a. Refer to table 13-1 for functional check.

b. ECU for visible damage or evidence of leakage.

c. ECU for security of attachment.

d. Check to see if interference exists between turbine housing of the ECU and hydraulic compartment floor. Clearance minimum is **0.06** inch. When minimum is exceeded request assistance from next higher maintenance level.

13-8. REPAIR OR REPLACEMENT — ENVIRONMENTAL CONTROL UNIT.

a. Replace ECU if ECU fails to meet inspection requirements.

b. Replace if damaged or leakage is evident.

c. Tighten hardware if not securely attached.

13-9. REMOVAL — ENVIRONMENTAL CONTROL UNIT.

a. Open hydraulic compartment doors on left and right side.

b. Disconnect ducts and tubes (1, 5, 10, 12, and 18, figure 13-2) to ECU.

c. Disconnect electrical plugs from control/sensor (9) and magnetic actuator (2).

d. Remove bolts (22 and 24, figure 13-1), washers (23 and 25), and spacers (26) attaching ECU to bulkhead in cockpit behind pilot headrest and remove ECU.

13-10. INSTALLATION — ENVIRONMENTAL CONTROL UNIT.

a. Position ECU in hydraulic compartment and align ducts.

b. Secure ECU to bulkhead with bolts (22 and 24, figure 13-1), washers (23 and 25) and spacers (26). Do not tighten mounting bolts.

c. Connect ducts and tubes (1, 5, 10, 12, and 18, figure 13-2) to ECU.

d. Connect electrical plugs to control/sensor (9) and magnetic actuator (2).

e. Tighten mounting bolts.

NOTE

Ensure minimum clearance between ECU and hydraulic compartment floor is 0.06 inches. Where clearance cannot be obtained, request assistance from next higher maintenance level.

f. Connect the fitting connecting bleed air duct (1) to ECU. Torque fitting to **17** foot-pounds and lockwire.

13-11. TEMPERATURE CONTROL/ SENSOR.

13-12. DESCRIPTION — TEMPERATURE CONTROL/SENSOR.

The temperature control/sensor (9, figure 13-2) is manually set by positioning the rheostat on the pilot ECS control panel, marked COOL WARM. It regulates the output temperature.

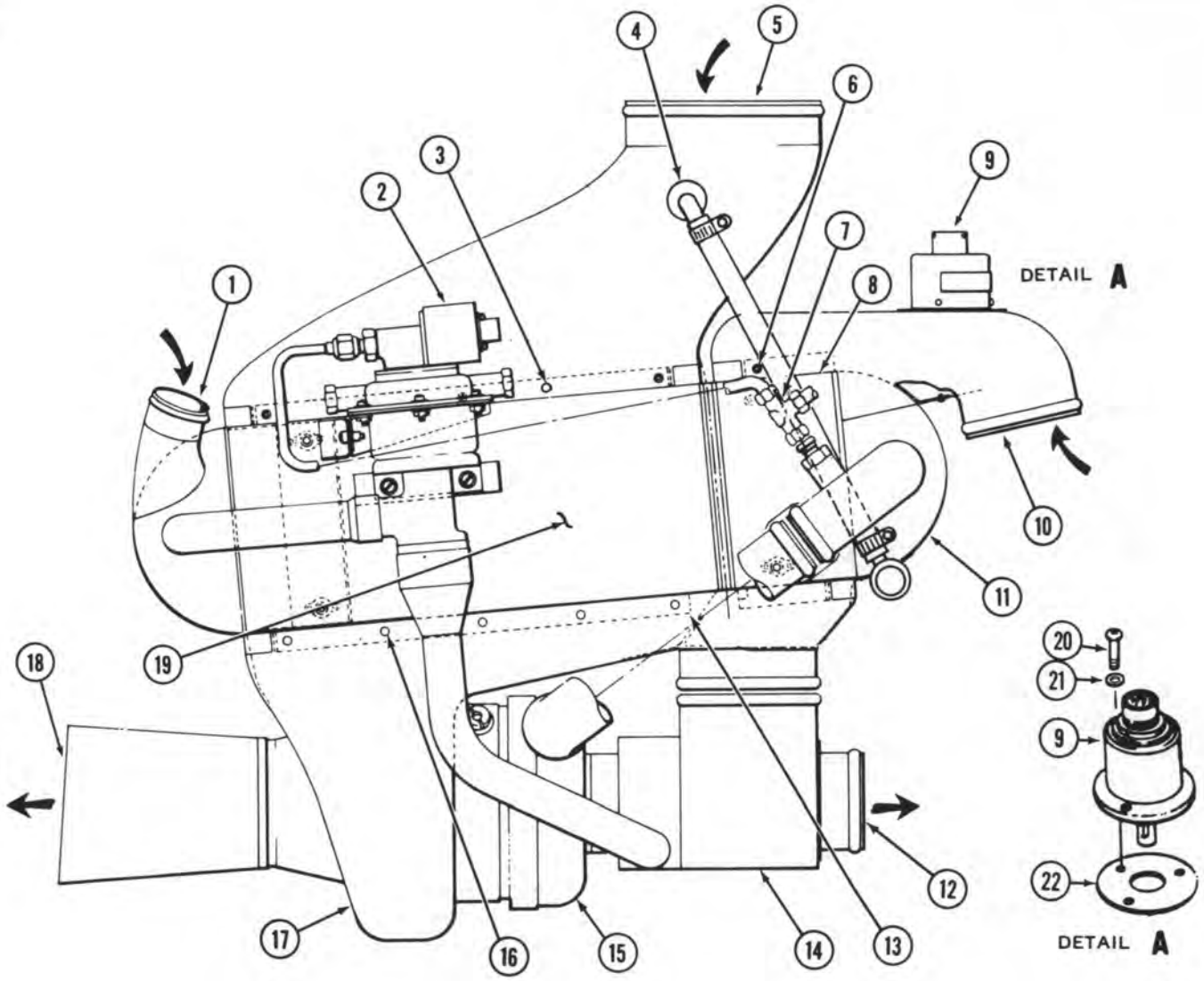
13-13. INSPECTION — TEMPERATURE CONTROL/SENSOR.

Visually inspect for cracks, dents, and external damage.

13-14. REMOVAL — TEMPERATURE CONTROL/SENSOR

a. Disconnect electrical wiring from control/ sensor (9, figure 13-2).

b. Remove screws (20) and washers (21). Then remove control/sensor (9) and gasket (22) from duct (10).



*1. Bleed air inlet duct
*2. Temperature control valve and magnetic actuator
*3. Screw and clamp
4. Water injector
*5. Ram air inlet duct
*6. Screw and clamp
*7. Tee
8. Reheater condenser
*9. Temperature control/sensor
*10. Recirculated air inlet duct
11. Water separator
*12. Conditioned air outlet duct
*13. Bracket clamp and screw
14. Jet pump
15. Cooling turbine
*16. Screw
17. Fan
18. Ram air outlet
*19. Heat exchanger
20. Screw
21. Washer
22. Gasket

*Disconnect points for ECU removal

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Figure 13-2. Environmental Control Unit

13-15. REPAIR OR REPLACEMENT — TEMPERATURE CONTROL/SENSOR. (AVIM)

Replace temperature control/sensor if it does not meet inspection requirements.

13-16. INSTALLATION — TEMPERATURE CONTROL/SENSOR.

a. Position temperature control/sensor (9, figure 13-2) and gasket (22) on duct (10). Install control/sensor (9), using washers (21) and screws (20).

b. Connect electrical plug to control/sensor (9).

13-17. TEMPERATURE CONTROL VALVE — ECU.

13-18. DESCRIPTION — TEMPERATURE CONTROL VALVE.

Output air from the ECU is supplied to the magnetic actuator on the temperature control valve. This enables the magnetic actuator to control the temperature control valve and allow the correct amount of hot bleed air to bypass the turbine. The hot bleed air is mixed with conditioned air to maintain the desired temperature in the cabin.

Premaintenance Requirements for Temperature Control Valve

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	(T7)
Support Equipment	(S12) (S15)
Minimum Personnel Required	One
Consumable Materials	(C112) (C26) (123) (C79) (C80) (C17)
Special Environmental Conditions	None

13-19. INSPECTION — TEMPERATURE CONTROL VALVE.

a. All threads on parts for damage, crossing, cracks, or breakage.

b. Check all valve parts for excessive wear or damage.

13-20. TESTING — TEMPERATURE CONTROL VALVE. (AVIM)

Refer to figures 13-4 and 13-5.

NOTE

Perform all tests on helicopter if possible. Equipment required for testing the temperature control valve is listed in premaintenance requirements.

a. Connect a pressure gage (T7) to the test port (4, figure 13-4). Plug opposite port.

b. Connect a controlled pressure of **15 TO 16** psig to the magnetic actuator inlet (1).

c. Connect a pneumatic source of **32 TO 38** psig with maximum flow of **14.5 TO 15.5** lbs per minute to valve air flow inlet (7).

d. Connect a variable source of **28** Vdc (S12) to pins L and M of the magnetic actuator (2). Slowly increase current until the valve starts to open and a flow is observed. The actuation pressure on the gage should read **4 TO 6** psig.

e. Slowly increase current until valve strokes full open. The actuation pressure on the gage should read **14** psig minimum.

f. Remove voltage supply from magnetic actuator (2).

g. Increase inlet pressure. Check for excessive leakage. Check valve seat for damage or obstruction causing excessive leakage.

NOTE

A small amount of leakage is acceptable.

h. Decrease inlet pressure to zero and disconnect pressure source from magnetic actuator inlet (1).

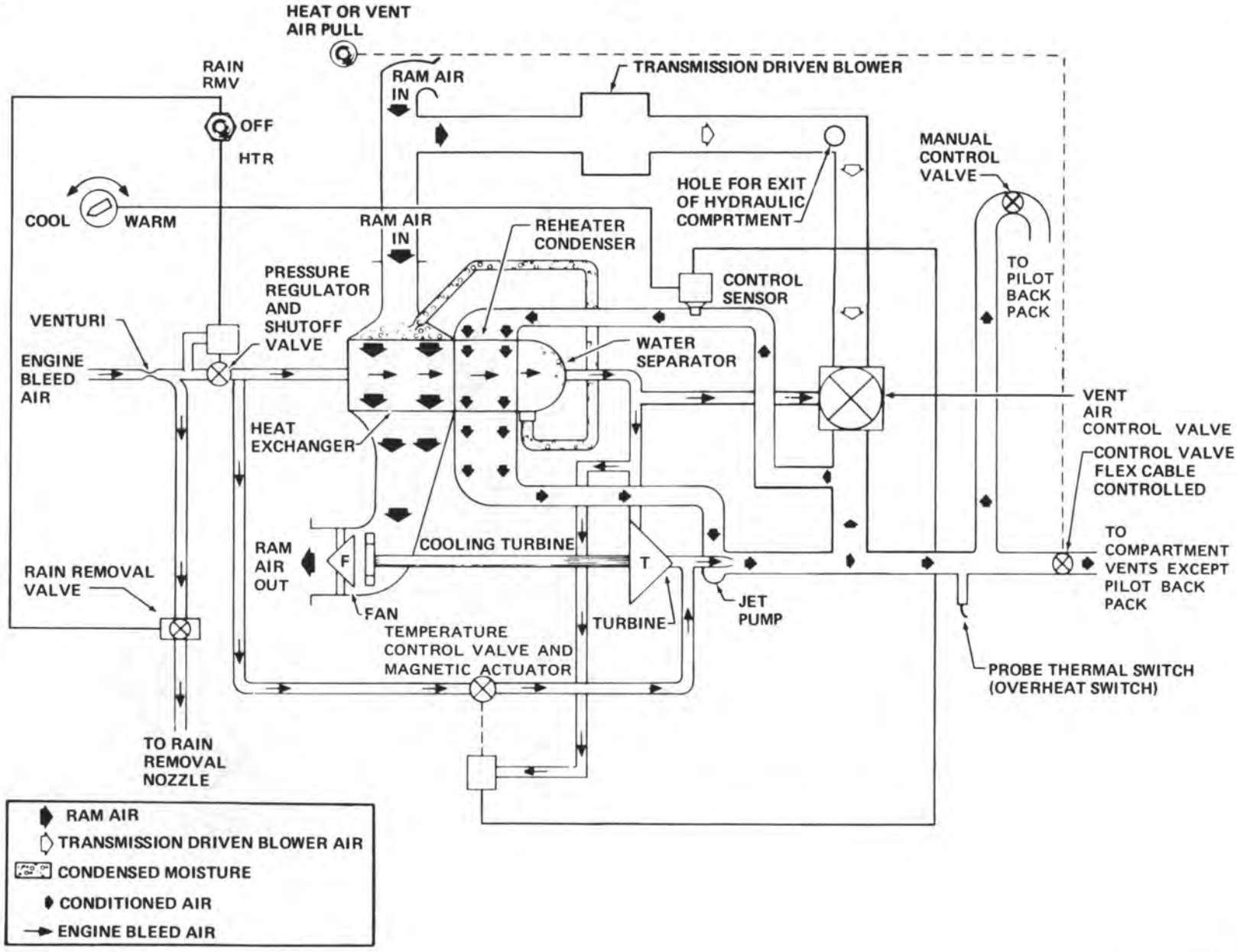
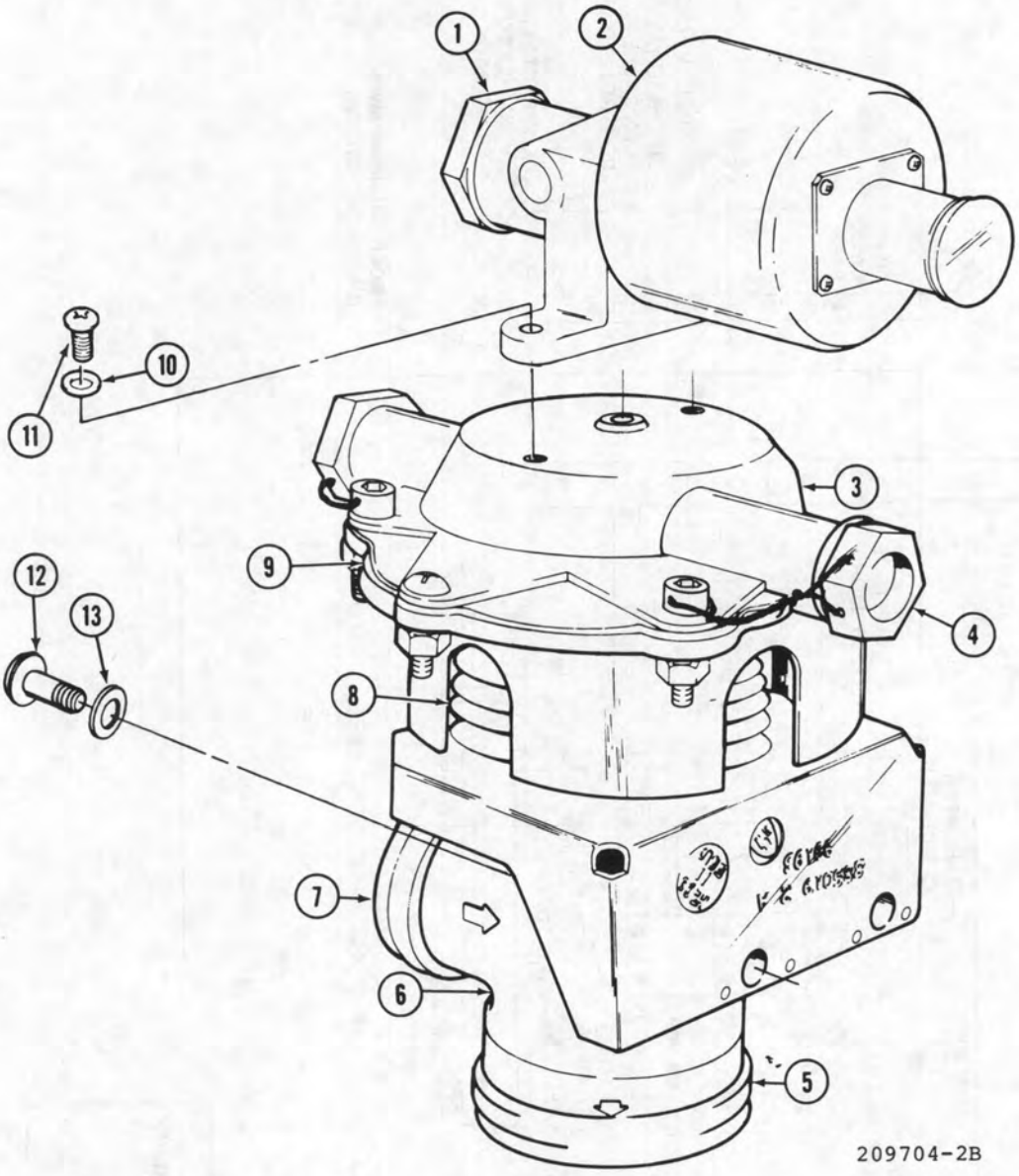


Figure 13-3. Environmental Control System Schematic



1. Magnetic actuator inlet
2. Magnetic actuator
3. Actuator cover
4. Test port plug
5. Air flow outlet
6. Valve body
7. Air flow inlet
8. Closing spring
9. Diaphragm
10. Washer
11. Screw
12. Screw
13. Washer

Figure 13-4. Temperature Control Valve

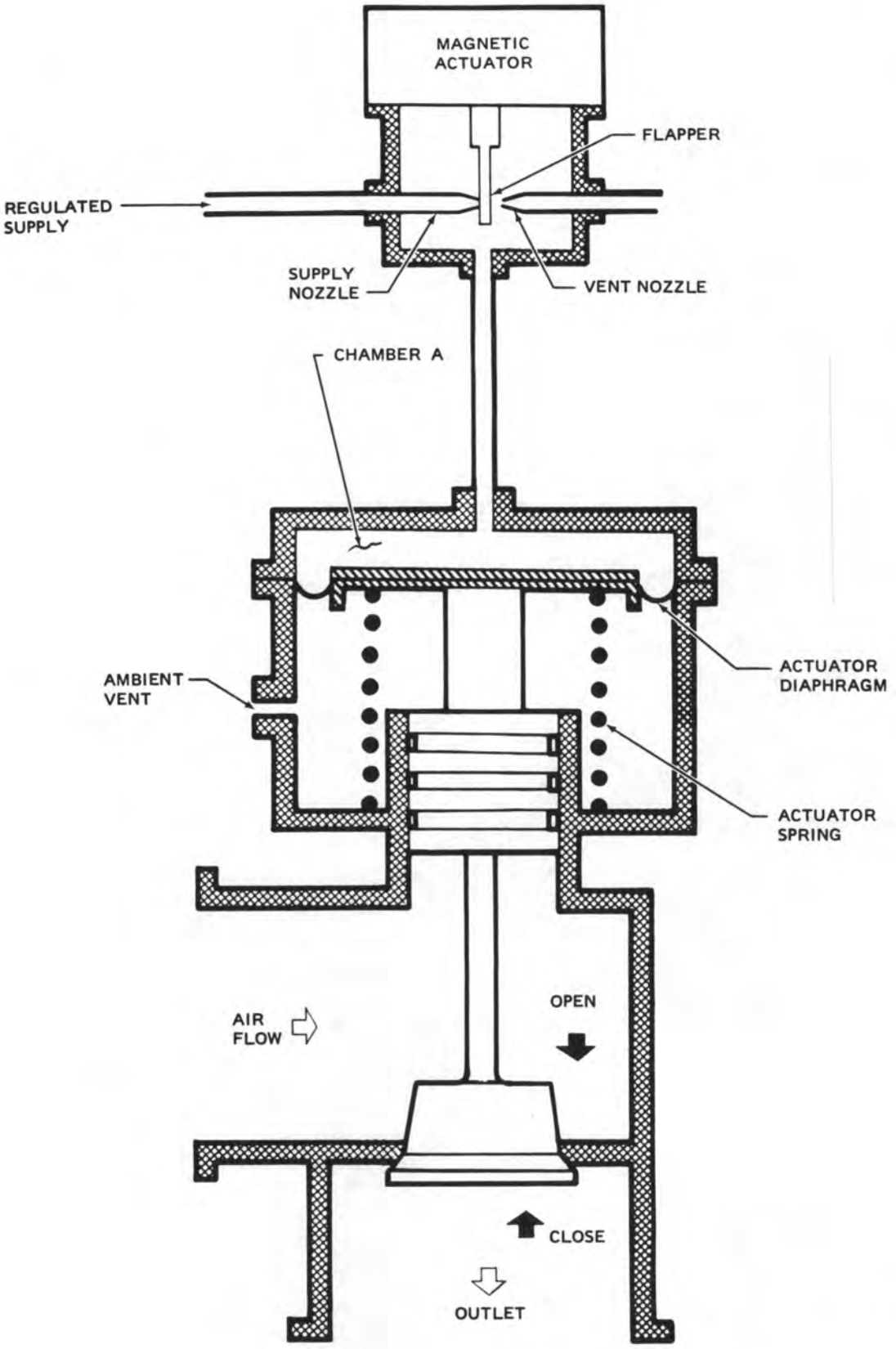


Figure 13-5. Temperature Control Valve Schematic

i. Disconnect pressure gage (T7) from test port (4).

j. Disconnect pneumatic source from airflow inlet (7).

k. Replace the temperature control valve if it does not operate within limits noted above.

13-21. REMOVAL — TEMPERATURE CONTROL VALVE.

a. Disconnect electrical plug from magnetic actuator (2, figure 13-4).

b. Remove attaching hardware and disconnect duct at inlet air port (7).

c. Remove attaching hardware and disconnect duct at outlet air flow port (5).

d. Disconnect tube at regulated pressure supply port (1).

e. Remove screw (12) and washer (13) attaching valve to bracket. Remove valve from helicopter.

13-22. REPAIR OR REPLACEMENT — TEMPERATURE CONTROL VALVE. (AVIM)

a. Replace valve if damaged, crossed, cracked or broken threads are found.

b. Replace valve if excessive leakage is detected or seat is damaged.

13-23. INSTALLATION — TEMPERATURE CONTROL VALVE.

a. Position valve and secure to bracket with screws (12, figure 13-4) and washers (13).

b. Connect tube to magnetic actuator inlet port (1).

c. Position duct to inlet air port (7) and secure with attaching hardware.

d. Position duct to outlet air port (5) and secure with attaching hardware.

e. Connect electrical plug to magnetic actuator (1).

13-24. MAGNETIC ACTUATOR.

13-25. DESCRIPTION — MAGNETIC ACTUATOR.

The magnetic actuator is attached to the upper part of temperature control valve. As the electrical power to the magnetic actuator is increased, the valve will start to open and allow the passage of air.

13-26. INSPECTION — MAGNETIC ACTUATOR.

Inspect for damage and security.

13-27. REMOVAL — MAGNETIC ACTUATOR (figure 13-4).

a. Disconnect electrical connector on magnetic actuator.

b. Disconnect tube at magnetic actuator inlet (1, figure 13-4).

c. Remove screws (11) and washers (10).

d. Remove magnetic actuator from temperature control valve.

13-28. CLEANING — MAGNETIC ACTUATOR.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

a. Clean magnetic actuator with a clean lint-free cloth moistened with solvent (C112).

b. Dry with a clean lint-free cloth.

13-29. REPAIR OR REPLACEMENT — MAGNETIC ACTUATOR.

Replace magnetic actuator if it is damaged or fails to meet inspection requirements.

13-30. INSTALLATION — MAGNETIC ACTUATOR (FIGURE 13-4).

a. Position magnetic actuator on temperature control valve and secure with washers (10) and screws (11).

b. Connect tube at magnetic actuator inlet (1).

c. Connect electrical connector to magnetic actuator.

13-31. ECU COOLING TURBINE.

13-32. DESCRIPTION — ECU COOLING TURBINE.

The cooling turbine is an integral part of the ECU. The purpose of the cooling turbine is to take the cool high-pressure bleed air leaving the reheater-condenser and expand it, causing its temperature to be reduced by the extraction of energy from the air. The shaft energy produced in the turbine is transmitted through the common shaft to a fan which, in turn, loads the turbine and induces ram air across the heat exchanger. The cooling turbine consists of a straight bladed radial inflow turbine wheel mounted on a common shaft with an axial flow fan. The rotating assembly is supported on ball bearings and is lubricated by wool-felt wicks leading to the shaft from a cotton-packed oil sump.

13-33. INSPECTION — ECU COOLING TURBINE.

a. Inspect for unusual noises while operating.

b. Inspect for binding rotating assembly, rough operation, or binding bearings and rubbing of turbine blades in scroll.

c. Do not perform any maintenance on the ECU cooling turbine except the inspection.

13-34. REMOVAL — ECU COOLING TURBINE.

a. Remove environmental control unit (ECU) (6, figure 13-1) (paragraph 13-9).

b. Remove cooling turbine.

(1) Remove housing assembly (8, figure 13-6) and nozzle (9) by loosening clamps (5) and (7) and removing housing assembly (8), with nozzle (9), and hose (6).

(2) If housing assembly (8), nozzle (9), or hose (6) requires replacement, remove retainer (10); cut out adhesive between housing assembly (8), nozzle (9), and hose (6). Separate parts.

(3) Remove packing (11) from cooling turbine (12). Replace packing regardless of condition.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

(4) Wash all parts with solvent (C112) and dry parts with compressed air.

(5) If housing assembly (8) and nozzle (9) are separated, cut out adhesive residue on mating surfaces. Inspect housing assembly and nozzle for cracks. Inspect duct of housing assembly for loose cement joints.

(6) Loosen couplings (19) and disconnect valve (23) with couplings and sleeve (20).

(7) Remove screw (17) and washer (16) and duct assembly (18) from cooling turbine (12) and remove packing (15). Replace packing (15) regardless of condition.

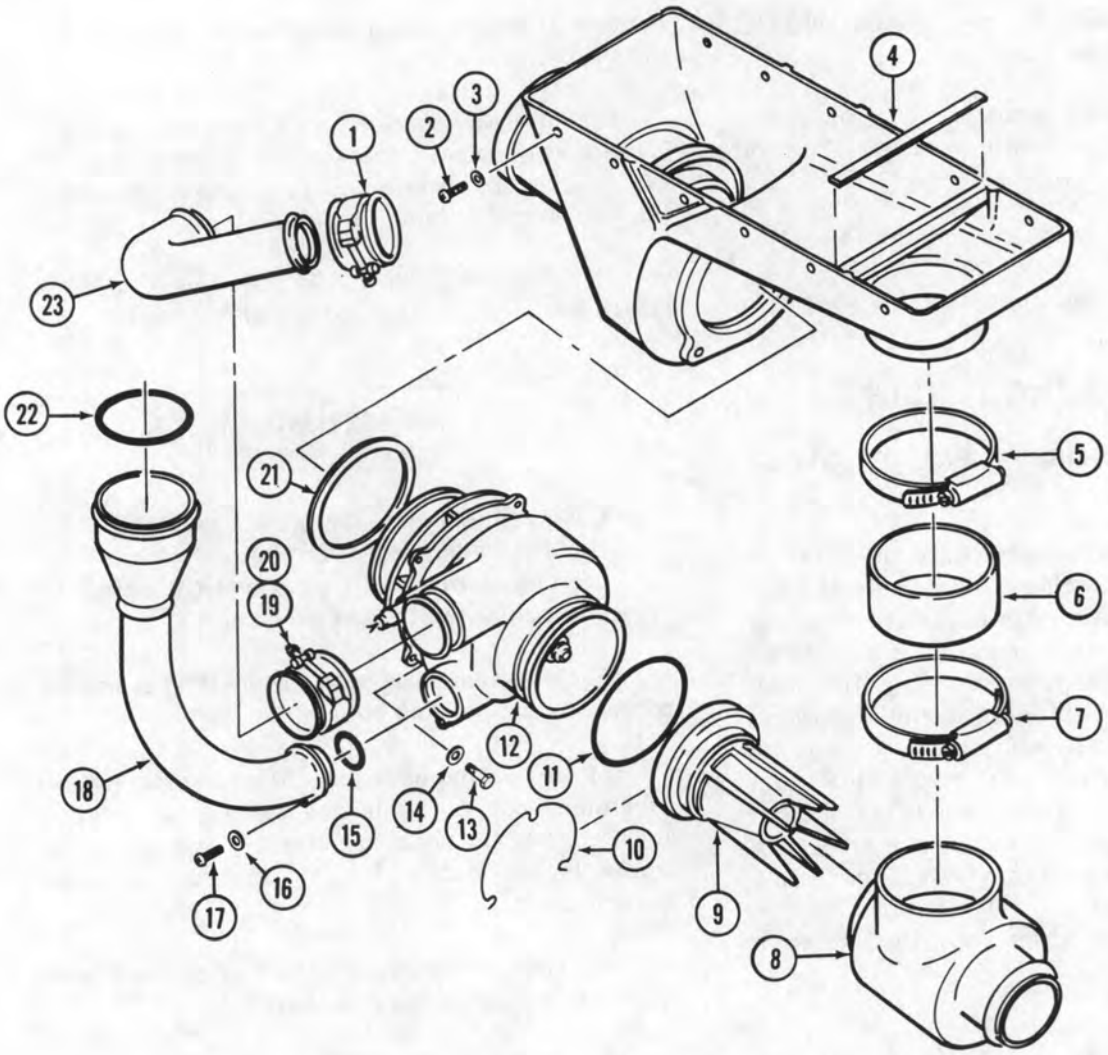
(8) Remove bolts (13) washers (14), and cooling turbine (12).

(9) Remove washer (21).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

(10) Wipe exterior surfaces of turbine with a clean, lint-free cloth moistened with solvent (C112).



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1. Coupling
2. Screw
3. Washer
4. Duct assembly
5. Clamp
6. Hose
7. Clamp
8. Housing assembly
9. Nozzle
10. Retainer
11. Packing
12. Turbine
13. Bolt
14. Washer
15. Packing
16. Washer
17. Screw
18. Duct assembly
19. Coupling
20. Sleeve
21. Washer
22. Packing
23. Tube

Figure 13-6. ECU Cooling Turbine

(11) Install moisture and dust seal protective cap over impeller outlet. Also place masking tape (C123) over impeller inlet.

(12) Install moisture and dust seal protective cap (P/N FC300) (FSCM 1581) over turbine outlet.

(13) Install protective cap (26) over turbine inlet.

(14) Install protective plug (NAS816-123) in turbine inlet port.)

13-35. REPAIR OR REPLACEMENT — ECU COOLING TURBINE.

Replace ECU cooling turbine if it fails to meet inspection requirements.

13-36. INSTALLATION — ECU COOLING TURBINE.

a. Install washer (21, figure 13-6) in outlet of duct assembly (4), position turbine (12) against washer (21) and align bolt holes. Install bolts (13) and washers (14).

b. Apply lubricating oil (C79 or C80) on packing (11), and install packing on groove of turbine scroll.

c. Mix adhesive and activator (C17), and apply to joining surfaces of hose (6), housing assembly (8), and nozzle (9); then install hose (6) on housing assembly (8). Insert nozzle (9) into housing assembly (8). Position housing assembly (8) and nozzle (9) on turbine scroll. Install retainer (10). Position hose (6) on duct assembly (4). Install clamps (5 and 7) to secure hose (6) on duct assembly (4) and housing assembly (8). Tighten upper clamp (5) on hose but snug lower clamp (7) lightly to prevent squeezing out adhesive. Check that nozzle (9) is aligned in turbine scroll.

d. Install sleeve (20) over each end of tube (23). Position duct and sleeves in place and install couplings (1 and 19).

e. Install packing (15) in groove of turbine scroll.

f. Insert duct assembly (18) in turbine scroll and install screw (17) and washer (16).

13-37. PRESSURE REGULATING AND SHUTOFF VALVE.

13-38. DESCRIPTION — PRESSURE REGULATING AND SHUTOFF VALVE.

The pressure regulating and shutoff valve is located in the engine compartment and limits the flow of bleed air to the ECU. It also acts as an ON-OFF valve for the ECS.

Premaintenance Requirements for Pressure Regulating and Shutoff Valve

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	(T7)
Support Equipment	(S12) (S15)
Minimum Personnel Required	Two
Consumable Materials	(C112)
Special Environmental Conditions	None

13-39. REMOVAL — PRESSURE REGULATING AND SHUTOFF VALVE.

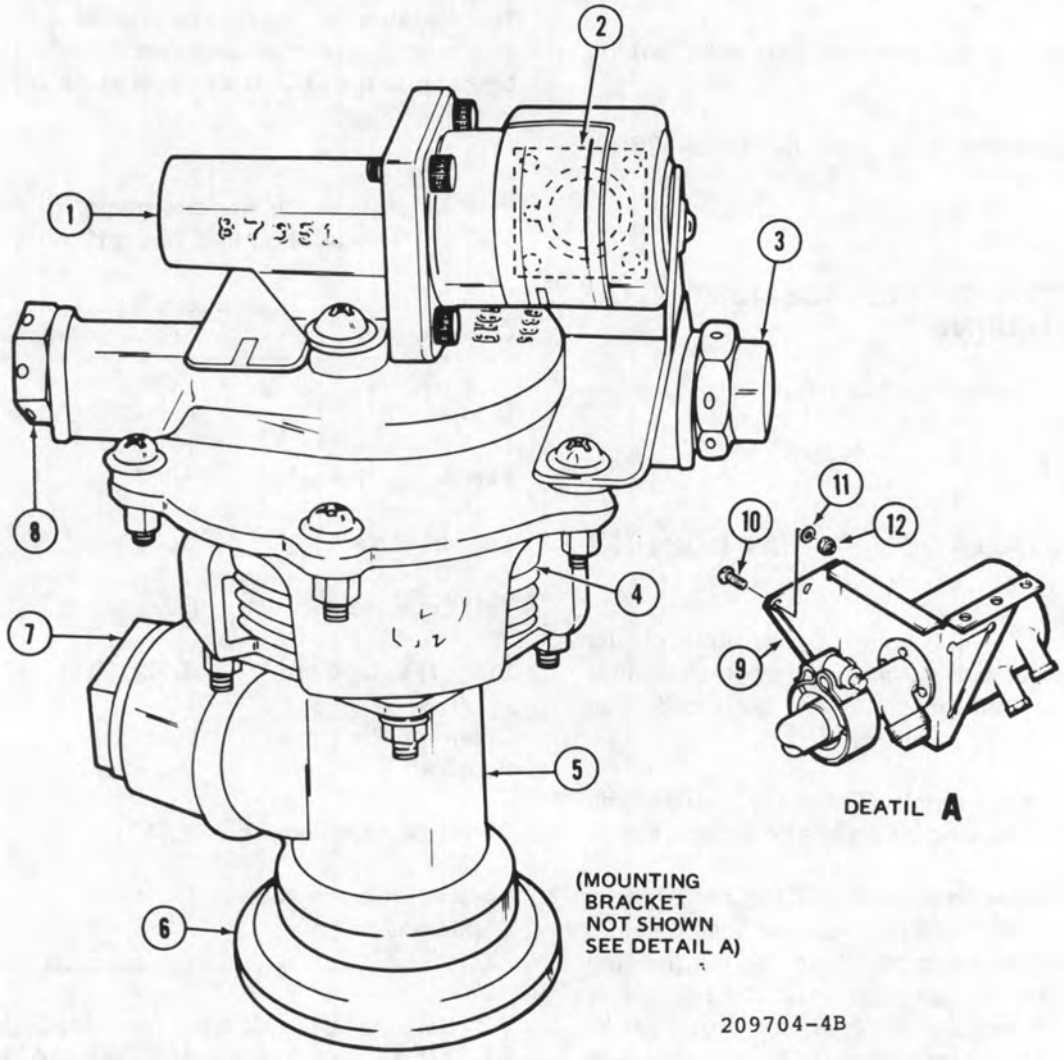
a. Open engine cowling on left side, and disconnect electrical plug from solenoid (2, figure 13-7).

b. Disconnect supply pressure tube at supply inlet port (1).

c. Disconnect duct at air flow outlet (6).

d. Disconnect tube at air flow inlet (7).

e. Remove screws (10), washers (11), and nuts (12), holding bracket (9) to structure and remove valve (5).



1. Supply inlet
2. Solenoid
3. Relief valve
4. Closing spring
5. Valve body
6. Air flow outlet
7. Air flow inlet
8. Test port
9. Bracket
10. Screw
11. Washer
12. Nut

Figure 13-7. Pressure Regulator and Shutoff Valve

13-40. CLEANING — PRESSURE REGULATING AND SHUTOFF VALVE.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

a. Clean pressure regulator and shutoff valve with solvent (C112).

b. Wipe dry with a clean lint-free cloth.

13-41. INSPECTION — PRESSURE REGULATING AND SHUTOFF VALVE.

a. Visually inspect all threaded parts for crossed, broken, or cracked threads.

b. Inspect for excessive wear or damage and leaking.

13-42. REPAIR OR REPLACEMENT — PRESSURE REGULATING AND SHUTOFF VALVE.

a. Replace valve if damaged, cracked, crossed, or broken threads are found.

b. Replace valve if excessive leakage is detected or seat is damaged. (Refer to troubleshooting chart, table 13-1, for operational check).

13-43. TESTING — PRESSURE REGULATING AND SHUTOFF VALVE (FIGURES 13-7 and 13-8). (AVIM)

NOTE

Perform all tests on helicopter if possible. Equipment required for testing the pressure regulating and shutoff valve is listed in the premaintenance requirements.

a. Connect regulated air to supply inlet (1, figure 13-7).

b. Connect pressure gage (T7) to test port (8).

c. Apply **28** Vdc power (S12) to pins 3 and 6 to energize solenoid (2). Confirm that solenoid shifts position by audible click when the power is applied.

d. Increase inlet pressure to **20** psig.

e. If valve fails to stroke open, replace solenoid (2).

f. Actuator head pressure should be between **7** and **8** psig. Relief valve (3) should relieve at **7 TO 8** psig. If pressure exceeds **8** psig or no valve action is seen, replace relief valve.

g. Set downstream flow control gate to flow maximum of **14.5 TO 15.5** lbs per minute at **35** psig during test.

h. Reduce inlet pressure to **40** psig. Valve should regulate to **32 TO 38** psig. If valve fails to regulate, replace valve.

i. De-energize solenoid (2). Valve should close.

j. Energize solenoid (2). Valve should open and regulate **32 TO 38** psig.

k. De-energize solenoid (2) and increase inlet pressure. Check for leakage. Check valve seat for damage or obstruction causing excessive leakage.

NOTE

Some leakage is acceptable.

l. Decrease inlet pressure to zero and disconnect from valve.

m. Disconnect pressure gage.

n. Disconnect electrical power source.

o. Replace pressure regulating and shutoff valve if it fails to meet the inspection requirements.

13-44. INSTALLATION — PRESSURE REGULATING AND SHUTOFF VALVE.

a. Secure valve to structure with bracket (9, figure 13-7), using screws (10), washers (11), and nuts (12).

b. Position tube to airflow outlet (6) and secure with attaching hardware.

c. Position duct to supply inlet (1) and secure with attaching hardware.

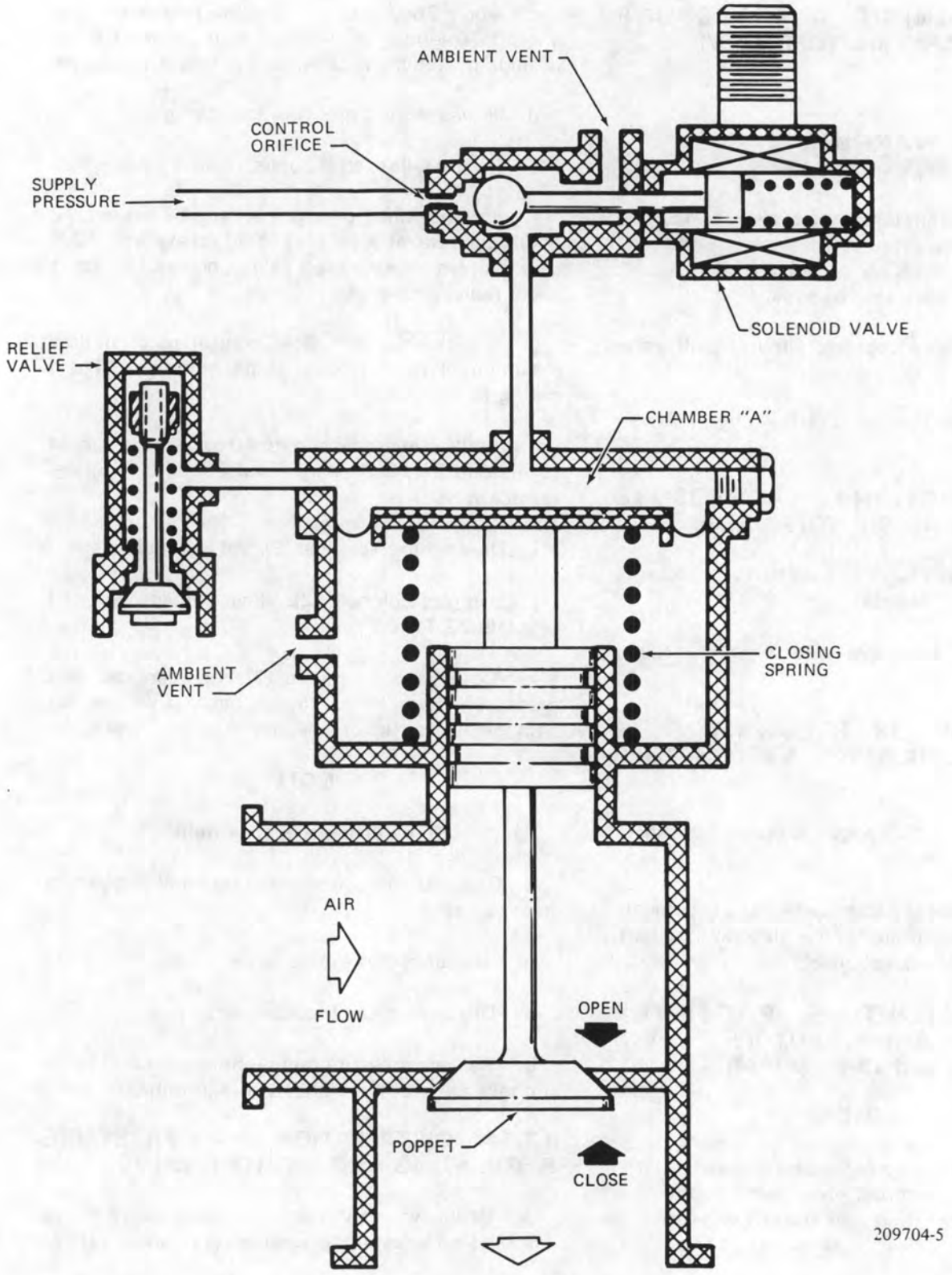


Figure 13-8. Pressure Regulator and Shutoff Valve Schematic

d. Connect electrical plug to solenoid on valve (2).

e. Install engine cowling on left side of helicopter.

13-44.1. AIR DISTRIBUTION PRESSURE REGULATOR VALVE SOLENOID FILTER.

13-44.2. DESCRIPTION — AIR DISTRIBUTION PRESSURE REGULATOR VALVE SOLENOID FILTER.

The solenoid filter is located in the supply pressure port of solenoid valve. The purpose of the filter is to filter supply air to the pressure solenoid.

13-44.3. REMOVAL — AIR DISTRIBUTION PRESSURE REGULATOR VALVE SOLENOID FILTER.

Remove the pressure supply line and remove filter assembly from solenoid.

13-44.4. CLEANING — AIR DISTRIBUTION PRESSURE REGULATOR VALVE SOLENOID FILTER.

Disassemble filter and clean with solvent (C112). Dry with compressed air.

13-44.5 INSPECTION — AIR DISTRIBUTION PRESSURE REGULATOR VALVE SOLENOID FILTER.

Inspect filter for cleanliness and deformation Reassemble filter.

13-44.6. INSTALLATION — AIR DISTRIBUTION PRESSURE REGULATOR VALVE SOLENOID FILTER.

Install filter assembly into solenoid and connect air supply line.

13-45. THERMAL PROBE SWITCH.

13-46. DESCRIPTION — THERMAL PROBE SWITCH.

A thermal probe switch is installed in a duct in the outlet side of the ECU to prevent excessively hot air from entering the distribution system. If excessive heat reaches the overheat switch, the switch opens, actuating the solenoid valve to shut off the flow of bleed air to the ECU.

13-47. REMOVAL — THERMAL PROBE SWITCH.

a. Remove electrical wiring.

b. Remove thermal switch (27, figure 13-1) and packing (28) from duct.

13-48. INSPECTION — THERMAL PROBE SWITCH.

Inspect thermal switch for corrosion and condition.

13-49. REPAIR OR REPLACEMENT — THERMAL PROBE SWITCH.

Replace switch if it fails to meet inspection or operational requirements.

13-50. INSTALLATION — THERMAL PROBE SWITCH.

a. Place packing (28, figure 13-1) on thermal probe switch (27) and install switch in duct.

b. Connect electrical wiring.

13-51. AMBIENT AIR BLOWER.

13-52. DESCRIPTION — AMBIENT AIR BLOWER.

A continuously operated transmission drive blower (4, figure 13-1) is mounted on a pad provided on the forward side of the transmission.

Premaintenance Requirements for Blower

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None

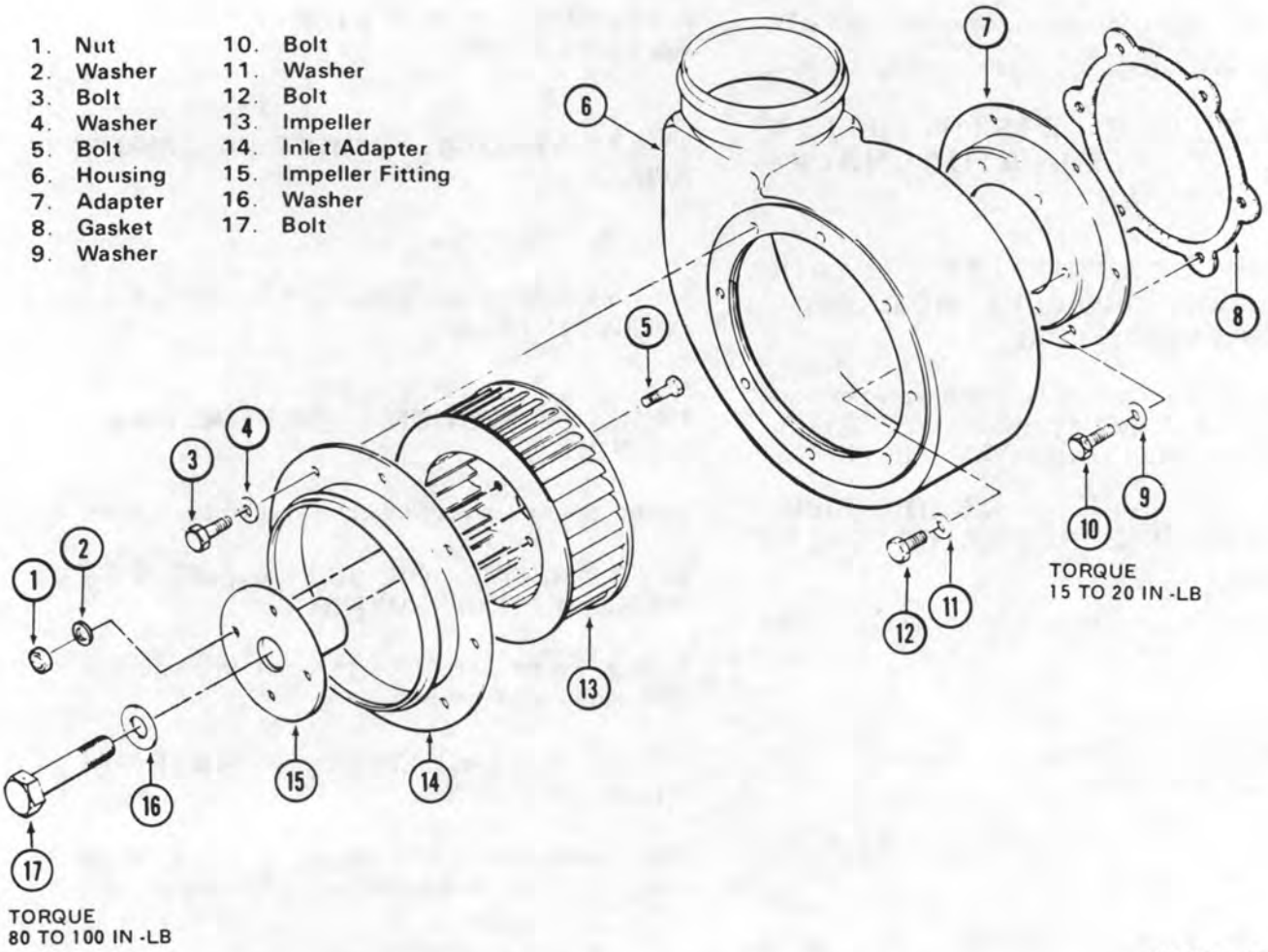


Figure 13-9. Blower Impeller Assembly

Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C36) (C88) (C91) (C112) (C138)
Special Environmental Conditions	None

13-53. REMOVAL — AMBIENT AIR BLOWER.

a. Open hydraulic compartment door on right side of helicopter and remove right side transmission cowling to gain access to blower area.

b. Remove intake and exhaust ducts by removing clamps and hardware.

c. Remove eight attaching bolts (3, figure 13-9), washers (4), and remove inlet adapter (14).

d. Cut lockwire and remove bolt (17) and washer (16).

e. Separate housing (6) from transmission pad by cutting lockwire and removing bolts (10) and washers (9).

13-54. DISASSEMBLY — AMBIENT AIR BLOWER.

a. Move impeller (13, figure 13-9) forward to clear housing (6) then remove housing and gasket (8).

b. Remove impeller and separate impeller fitting (15) from impeller (13) by removing nuts (1), washers (2), and bolts (5).

c. Remove bolts (12) and washers (11) and separate adapter (7) from housing (6).

13-55. CLEANING — AMBIENT AIR BLOWER.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

a. Clean disassembled parts with solvent (C112).

b. Dry with a clean lint-free cloth.

13-56. INSPECTION — AMBIENT AIR BLOWER.

Inspect blower assembly components as follows: (figure 13-9).

a. **Adapters.** Inspect adapters (7 and 14) for cracks or breaks in material and for corrosion damage.

b. Housing. Inspect blower housing (6) for dents and deformity, cracks, and corrosion damage.

c. Impeller Fitting. Inspect impeller fitting (15) for cracks, damaged internal splines, and corrosion damage.

d. Impeller. Inspect impeller (13) for deformity, broken welds, cracked or damaged blades, and corrosion damage.

13-57. REPAIR OR REPLACEMENT — AMBIENT AIR BLOWER.

a. Adapters.

(1) Replace adapter (7 and 14, figure 13-9) if cracked.

(2) Cleanup minor corrosion damage with abrasive cloth (C36), and touch up with primer (C88 or C91). If corrosion damage is severe enough to affect function, replace the adapter.

b. Housing.

(1) Replace blower housing (6) if cracked.

(2) Clean up minor corrosion damage with abrasive cloth (C36), and touch up with primer (C88 or C91). If corrosion damage is severe enough to affect function, replace the housing.

c. Impeller Fitting.

(1) Replace impeller fitting (15) if cracked or for damaged internal splines.

(2) Clean up minor corrosion damage with abrasive cloth (C36) and touch up with primer (C88 or C91). If corrosion damage is severe enough to affect function, replace the impeller fitting.

d. Impeller.

(1) Replace impeller (13) with deformed or cracked blades, or broken welds.

(2) Clean up minor corrosion damage with abrasive cloth (C36) and touch up with primer (C88 or C91). If corrosion damage is severe enough to affect function, replace the impeller fitting.

13-58. ASSEMBLY — AMBIENT AIR BLOWER.

a. Attach impeller fitting (15, figure 13-9) to impeller (13) with four bolts (5), aluminum washers (2) and nuts (1).

b. Attach adapter (7) to housing (6) with bolts (12) and aluminum washers (11).

13-59. INSTALLATION — AMBIENT AIR BLOWER.

a. Position impeller (13) in opening in firewall.

b. Place gasket (8) and housing (6) on transmission pad; install six bolts (10) with aluminum washers (9). Torque bolts (10) **15 TO 20** inch-pounds. Secure bolts with lockwire (C138).

c. Position impeller (13) in housing (6).

d. Place washer (16) under head of bolt (17), and install bolt through fitting (15). Torque bolt (17) **80 TO 100** inch-pounds and lockwire to shank of bolt (5). Use lockwire (C138).

e. Install intake and exhaust ducts with clamps and attaching hardware.

f. Close hydraulic compartment door and transmission cowling.

13-60. VENT AIR CONTROL VALVE.

13-61. DESCRIPTION — VENT AIR CONTROL VALVE.

The vent air control valve located between the transmission-driven blower and the ducts distributing air to the crew compartment is an on-off valve. When the ECS is functioning, the valve is normally closed. Lack of bleed air pressure against the valve permits the valve to open, allowing the transmission driven blower to force ambient air into the crew compartment (figure 13-1).

Premaintenance Requirements for Vent Air Control

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	(T18)
Support Equipment	(S12) (S14) (S15)
Minimum Personnel Required	Two
Consumable Materials	(C17) (C63) (C73) (C112) (C124)
Special Environmental Conditions	None

13-62. REMOVAL — VENT AIR CONTROL VALVE.

a. Remove hydraulic compartment access door located on right side of helicopter and aft of pilot door.

b. Disconnect hose assembly (3, figure 13-10) from regulator (4), loosen nut on opposite end of hose assembly (3), and rotate tube away from regulator.

c. Remove screw (6), washer (7), and nuts (8). Slide clamp (9) up on flex duct (5) until it is clear of bracket (10).

d. Remove screw (19), washer (20), and nut (21). Slide clamp (18) up on coupling (17).

e. Use a round-edged probe to separate coupling (17) from duct assembly (22) and flex duct (5) from valve (11).

f. Remove screw (14), washer (15), and nut (16). Slide clamp (12) off bracket (13). Lift valve (11), regulator (4), and coupling (17) out of the compartment.

g. Cover open ends of hose assembly (3) and ducts (5 and 22) to prevent entry of foreign material.

h. Remove coupling (17) from valve (11).

i. Loosen nut (2) and remove regulator (4) from union (1). Remove union from valve (11).

13-63. DISASSEMBLY — VENT AIR CONTROL VALVE.

a. Remove nuts (12, figure 13-11), screws (1), washers (11), and cover (3).

b. Remove cotter pin (27) and pin (24) to disconnect links (22 and 25) from rod end connector (8).

c. Remove diaphragm (6) with assembled plate (5) and rod end connector (8). Remove spring (9).

d. Remove screw (4), rod end connector (8), plate (5), and cup (7).

e. Remove links (22 and 25) from butterfly assembly (20).

f. Remove screws (19), stiffener (18), and butterfly assembly (20).

g. Slide shaft (21) out of body and remove spacer (19), bearing (15), special washer (16), and spacer (18) from both sides of body assembly (10).

13-64. CLEANING — VENT AIR CONTROL VALVE.

a. Clean bearings (15, figure 13-11) with a clean, lint-free cloth.

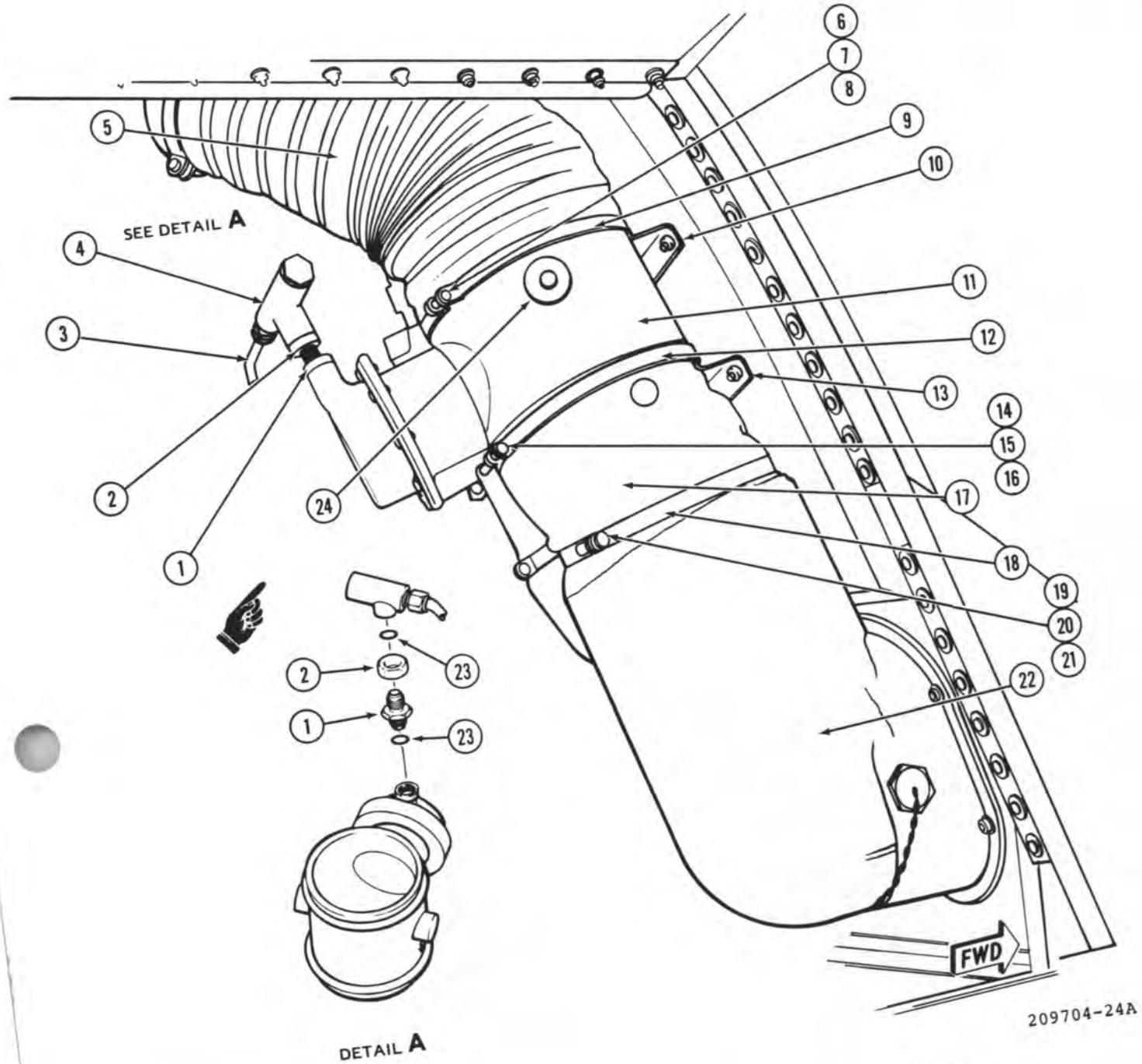
WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

b. Clean all parts except bearings with solvent (C112). Dry parts with filtered compressed air at **20 TO 25** psig. Do not spin or dry bearings with compressed air.

13-65. INSPECTION — VENT AIR CONTROL VALVE.

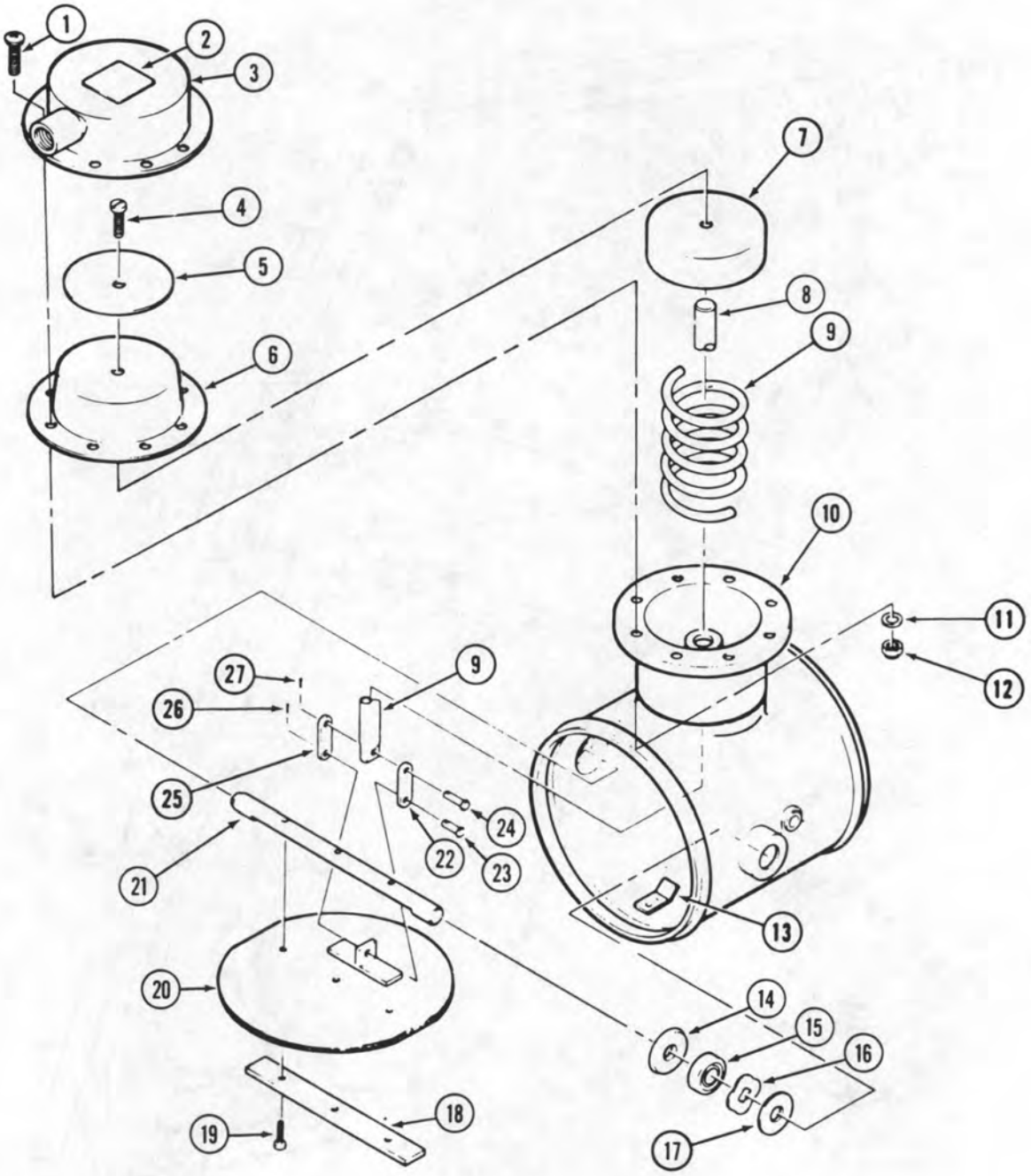
a. Inspect cover assembly (3, figure 3-11) for damaged threads in port.



DETAIL A

1. Union
2. Nut
3. Tube assembly
4. Regulator
5. Flex duct
6. Screw
7. Thin aluminum washer
8. Nut
9. Clamp
10. Bracket
11. Vent air control valve
12. Clamp
13. Bracket
14. Screw
15. Thin aluminum washer
16. Nut
17. Coupling
18. Clamp
19. Screw
20. Thin aluminum washer
21. Nut
22. Duct assembly
23. Packing
24. Boss

Figure 13-10. Vent Air Control Valve — Installation



1. Screw
2. Identification plate
3. Cover
4. Screw
5. Plate
6. Diaphragm
7. Cup
8. Rod end connector
9. Spring
10. Body assembly
11. Flat washer
12. Self-locking nut
13. Stop
14. Spacer
15. Bearing
16. Special washer
17. Spacer
18. Stiffener
19. Screw
20. Butterfly assembly
21. Shaft
22. Link
23. Pin
24. Pin
25. Link
26. Cotter pin
27. Cotter pin

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Figure 13-11. Vent Air Control Valve

b. Inspect rod and connector (8) for damaged threads and for wear. Minimum diameter is **0.370** inch.

c. Inspect plate (5) and cup (7) for distortion. Also check diameter of cup. Maximum outside diameter is **2.312** inches.

d. Inspect diaphragm (6) for tears, cracks, and distortion.

e. Inspect spring (9) for deformation and for free length of **3.06** inch. Check spring tension. The weight required to compress the spring to **2.25** inches must be **10.4 TO 12.4** pounds. The weight required to compress the spring to **0.95** inch must be **26.6 TO 32.6** pounds.

f. Inspect holes in links (22 and 25) for wear. Manufacturing tolerance is **0.1245 TO 0.1255.** Center to center dimension is **0.745 TO 0.755** inch. No distortion is allowed.

g. Inspect stiffener (18) for deformation.

h. Inspect butterfly (20) for distortion and wear. Minimum diameter is **4.893** inches. Minimum dimension across flats is **4.770** inches.

i. Inspect shaft (21) for deformation and for damaged threads. Check diameter. Minimum diameter is **0.3740** inch.

j. Inspect body assembly (10) for damaged bushings. No scoring is allowed. Inspect stop (13) for secure installation.

k. Inspect bearings (15) for galling and scoring. None allowed.

l. Inspect identification plate (2) for legibility and secure attachment.

13-66. REPAIR OR REPLACEMENT — VENT AIR CONTROL VALVE.

Do not attempt to repair any parts of the control valve. Replace any parts which fail to pass inspections described in paragraph 13-65.

13-67. ASSEMBLY — VENT AIR CONTROL VALVE.

a. Lubricate bearings (15, figure 3-11) with lubricant (C73).

b. Slide shaft (21) partially into body (10) and position spacer (17), special washer (16), bearing (15), and spacer (14) on shaft in sequence illustrated. Install spacer (14) with the beveled side toward bearing (15). Position these parts in boss of body (10) and install corresponding bearing spacers and washer on opposite side.

c. Install links (22 and 25) on butterfly assembly (20) with pin (23) and cotter pin (26).

d. Position butterfly assembly on shaft (21) in same relative position illustrated so that it will be on the correct side of stop (13) when assembly is complete. Secure butterfly assembly to shaft (21) with stiffener (18) and three screws (19). Move the butterfly assembly manually to ensure that it moves freely through full range of travel.

e. Assemble rod end connector (8), cup (7), diaphragm (6), plate (5), and screw (4) in same relative positions illustrated. Install screw (4) snug but do not torque.

f. Make trial installation of parts assembled in preceding step. Align holes in diaphragm with holes in body (10) and insert three screws (1) to maintain alignment. Rotate rod end connector (8) so that it will align with links (22 and 25) and tighten screw (4). Remove diaphragm (6) and attached parts from body assembly.

g. Position spring (9) in body assembly (10) and install diaphragm (6) with attached parts. Secure links (22 and 25) to rod end connector (8) with pin (24) and cotter pin (27). Check diaphragm to ensure that the holes line up with the holes in the body without twisting the diaphragm. Position cover assembly (3) on body assembly with threaded boss oriented with the body assembly (10) and stop (13) as illustrated. Install screws (1), washers (11), and nuts (12).

13-68. TESTING — VENT AIR CONTROL VALVE (FIGURES 13-11 AND 13-12).

a. If the test set-up shown on figure 13-12 is not available, perform functional check on helicopter after installation, paragraph 13-69.

b. If the test set-up shown on figure 13-12 is available, install the vent air control valve as illustrated.

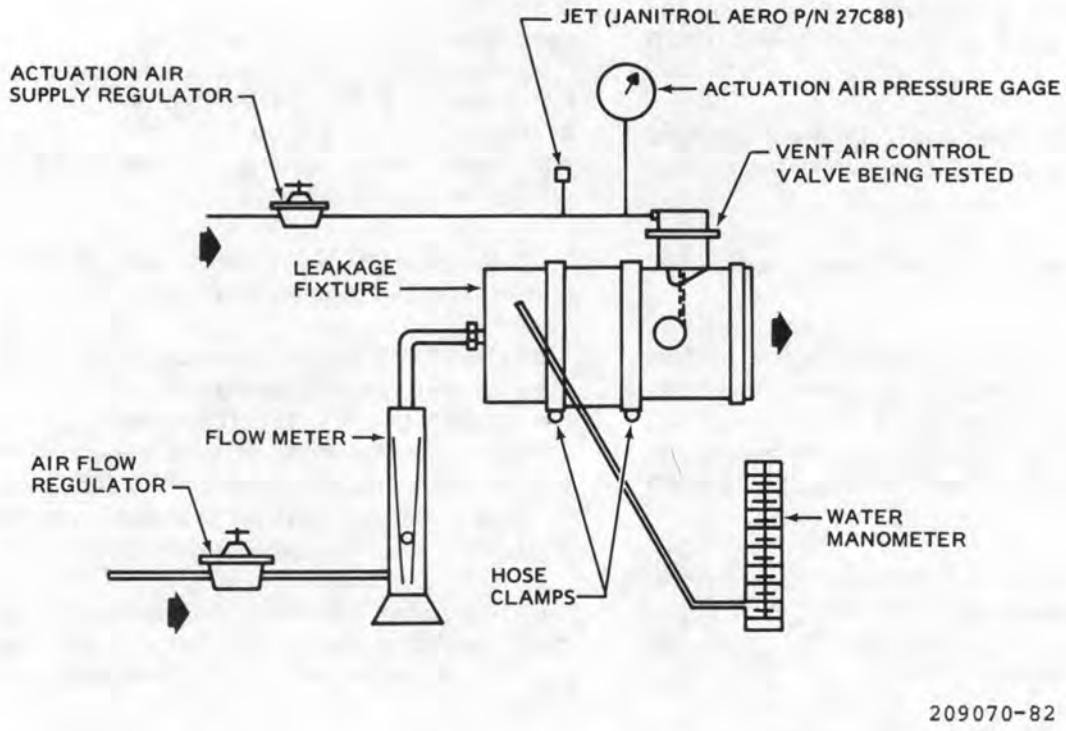


Figure 13-12. Vent Air Control Valve Test Set-up

c. Adjust pressure at actuation air supply regulator (T18) to apply **7.0 ± 0.5** psig pressure to the vent air control valve. The butterfly assembly should move to full closed.

d. Decrease pressure to vent air control valve to zero. The butterfly assembly (20), figure 13-11) should move to full open.

e. Repeat steps c. and d. except apply **25 ± 1.0** psig pressure to the vent air control valve. The butterfly assembly (20) should be full open while pressure is applied and full closed when pressure is removed.

f. Adjust pressure at the actuation air supply regulator (T18) to apply **7.0 ± 0.5** psig pressure to the vent air control valve and maintain pressure to keep butterfly assembly (20) closed. Adjust air flow regulator to increase pressure until reading on the water manometer (S14) is **27.0** inches. Check the flowmeter and record the leakage rate across the butterfly assembly. If the leakage rate is more than five cubic feet per minute, remove the vent air control valve from the test set-up and remove one special washer (16, figure 13-11). Reassemble the vent air control valve and repeat the tests.

g. If the vent air control valve fails to pass the tests in steps b. through f., forward the assembly to next higher level of maintenance.

13-69. INSTALLATION — VENT AIR CONTROL VALVE.

a. Thread nut (2, figure 13-10) on union (1). Lubricate two packings (23) lightly with hydraulic fluid (C63) or other suitable lubricant and position packings on union (1). Install union (1) on valve (11) and install regulator (4) on union (1). Do not tighten nut (2) at this time.

b. Apply a light coat of adhesive (C17) to lower flange of valve (11). Position coupling (17) on valve. Install clamp (12) with screw (14), thin aluminum washer (15), and nut (16) but do not tighten at this time.

c. Place clamp (18) on duct (22) and place clamp (9) on flex duct (5).

d. Position valve (11) in the right side of the hydraulic compartment with the boss (24) uppermost as illustrated. Slide clamp (12) over bracket (13).

e. Apply a light coat of adhesive (C17) to upper flange of valve (11). Position flex duct (5) on valve (11) and slide clamp (9) into position on the flex duct and also on bracket (10). Install screw (6), thin aluminum washer (7), and nut (8), but do not tighten at this time.

f. Attach tube assembly (3) to regulator (4). Turn the regulator or union (1) and/or rotate valve (11), if required to obtain alignment with hose assembly (3). Tighten nuts at each end of hose assembly (3) and also nut (2).

g. Check clamps (9, 12, and 18) to ensure that they are properly positioned on the ducts and valve and that the two upper clamps are positioned properly on the brackets. Tighten the nuts and screws on each of the three clamps.

h. If the helicopter is operational, perform a functional check of the vent air control valve.

NOTE

The vent air control valve is normally open and is closed by bleed air pressure.

(1) Ground run the helicopter. Position the HTR/RAIN RMV (ECU) switch to OFF. Open one of the air outlet nozzles in the pilot compartment. There should be a flow of air at ambient temperature. Move the ECU COOL/WARM selector to full WARM and check temperature of air flowing from outlet by feel. Move temperature selector to full COOL and check temperature of air flowing from outlet. The temperature should not change.

(2) Position the HTR OFF, RAIN RMV (ECU) switch to HTR. Repeat the check of the temperature of air flow from outlet nozzle with the temperature selector at full WARM and at full COOL as outlined in step (1). The vent air control valve should be closed and the temperature of the air should change when the temperature selector is changed.

13-70. VENTILATING DUCTS.

13-71. DESCRIPTION — VENTILATING DUCTS.

The ducts transport air from the inlet duct into the cabin and are of two types, rigid and flexible. They are attached to components by couplings and clamps (figure 13-1).

13-72. REMOVAL — VENTILATING DUCTS.

Remove insulation, attaching hardware and /or clamps and remove components.

13-73. INSPECTION — VENTILATING DUCTS.

a. Ducting and insulation for damage, chafing, or leakage.

b. Clamps and connections for security and for leakage around clamps.

c. Intake screen for obstruction.

13-74. REPAIR OR REPLACEMENT — VENTILATING DUCTS.

a. Replace damaged or leaking ducts.

b. Clean intake screen if clogged, using compressed air.

c. Tighten clamps or connection if loose or leaking.

d. Repair insulation if torn or damaged.

13-75. INSTALLATION — VENTILATING DUCTS.

a. Position ducts and secure with hardware and/or clamps.

b. Install insulation and secure with tape (C134).

13-76. AIR CONTROL VALVE.

13-77. DESCRIPTION — AIR CONTROL VALVE.

An air control valve (figure 13-1) is operated by a cable control from the pilot instrument panel. The valve regulates the amount of air entering the distribution system. When fully closed, all air to crew compartment is shut off, except to pilot seat cushion. When cabin air is desired, the control should be full out and air control valve full open.

13-78. REMOVAL — AIR CONTROL VALVE.

a. Remove cotter pin, washer, and pin from clevis end of control cable at control valve and duct assembly.

b. Remove screws, washers, and nuts from clamps, brackets, and supports securing heat or vent air pull control (16, figure 13-1) to fuselage and ducting.

c. Loosen locknut from control valve housing. Remove control from helicopter.

13-79. INSPECTION — AIR CONTROL VALVE.

a. Inspect control valve (10, figure 13-1) for locking in all positions. Lock should hold a load of **8** pounds without slippage. Apply **8** pounds pressure using a force gage (fish scale).

b. Inspect control, housing, cable, and clevis for damage and corrosion.

c. Inspect valve in duct assembly for freedom of operation and range of travel.

d. Control valve assembly is nonrepairable and must be replaced if it fails to meet inspection requirements.

13-80. INSTALLATION — AIR CONTROL VALVE.

a. Route heat or vent air pull control (16, figure 13-1) through instrument panel opening through fuselage structure to air control valve and duct assembly.

b. Secure assembly with previously removed screws, washers, clamps, brackets, and supports.

c. Attach clevis end of heat or vent air pull control (16) to lever on air control valve and duct assembly. Secure with pin, washers, and cotter pin.

d. Check heat or vent air pull control (16) for freedom of movement and locking in intermediate position.

e. With heat or vent air pull control (16) pushed full in, check that lever on valve and duct assembly is approximately perpendicular to surface of duct. With control full out, lever on valve should be approximately horizontal to surface of duct.

13-81. AIR OUTLET VALVES.

13-82. DESCRIPTION — AIR OUTLET VALVES.

The outlet valves (7, 12, and 15, figure 13-1) are located in gunner and pilot compartments or at left and right sides of instrument panels. The air outlet valves are adjustable to direct flow and/or amount of conditioned air, as desired. The defog outlets (7, figure 13-1) are located in the pilot compartment at right and left sides of instrument panel console. The defog outlets consist of a tab slider mounted to plenum assembly. Adjustment of slider directs conditioned air to defog canopy.

13-83. REMOVAL — AIR OUTLET VALVES.

Remove attaching screws and washers and remove air outlet valves.

13-84. INSPECTION — AIR OUTLET VALVES.

a. Inspect air outlet valves (7, 12, and 15, figure 13-1) for condition and operation.

b. Inspect defog outlets slider tab and plenum for wear and damage.

c. Inspect connecting ducts for serviceability.

13-85. REPAIR OR REPLACEMENT — AIR OUTLET VALVES.

Replace valves that do not meet inspection requirements.

13-86. INSTALLATION — AIR OUTLET VALVE.

a. Position air outlet valves on connecting ducts.

b. Install attaching screws and washers.

13-87. RAIN REMOVAL SYSTEM.

13-88. DESCRIPTION — RAIN REMOVAL SYSTEM (FIGURE 13-13).

The rain removal system consists of a series of tubes from the engine compressor section to the nozzle next

to upper center window and is vented to the windshield. This nozzle provides air to force moisture from the outer surface of windshield in a standard pattern (figure 13-15). Seven small nozzles are grouped together and distribute the air from the nozzle assembly. A selector switch on the pilot instrument panel allows bleed air to flow through the tubes and out the vent to the windshield. A drain valve (16) is provided to prevent the collection of moisture in tube system.

13-89. RAIN REMOVAL MANIFOLD.

13-90. DESCRIPTION — RAIN REMOVAL MANIFOLD.

There are seven small nozzles which are grouped together in line and direct the flow of air from the manifold assembly to the windshield.

13-91. REMOVAL — RAIN REMOVAL MANIFOLD.

a. Remove the following components from the gunner instrument panel.

(1) Gyro horizon

(2) Airspeed indicator

(3) Tow control set

(4) P E ARC 14 Radio

M Doppler Navigation Set

b. Disconnect tube (12, figure 13-13) from manifold assembly (4).

c. Remove lockwire (11), loosen ring (10), and disconnect bleed air tube from manifold.

d. Remove four screws (6) and washers (7). Separate manifold from helicopter structure.

e. Loosen nut (23) and remove duct assembly (22) from manifold. Remove manifold from helicopter.

13-92. INSPECTION — RAIN REMOVAL MANIFOLD.

Inspect manifold assembly (4, figure 13-13) for cleanliness and damage.

13-93. REPAIR OR REPLACEMENT — RAIN REMOVAL MANIFOLD.

Replace rain removal manifold assembly if damaged. No repairs are acceptable.

13-94. INSTALLATION — RAIN REMOVAL MANIFOLD.

a. If not previously accomplished, remove components listed in paragraph 13-91, a.

b. Position rain removal manifold (4, figure 13-13) in helicopter and position duct assembly (22) on the manifold. Tighten nut (23).

c. Hold rain removal manifold next to helicopter structure and install four screws (6) and washers (7).

d. Position bleed air tube on left end of manifold and tighten ring (10), lockwire ring (10) with lockwire (C137).

e. Install tube (12) on left end of manifold assembly.

f. Install the following components in the gunner instrument panel.

(1) Gyro horizon

(2) Airspeed Indicator

(3) Tow control set

(4) P E ARC 14 Radio

M Doppler Navigation Set

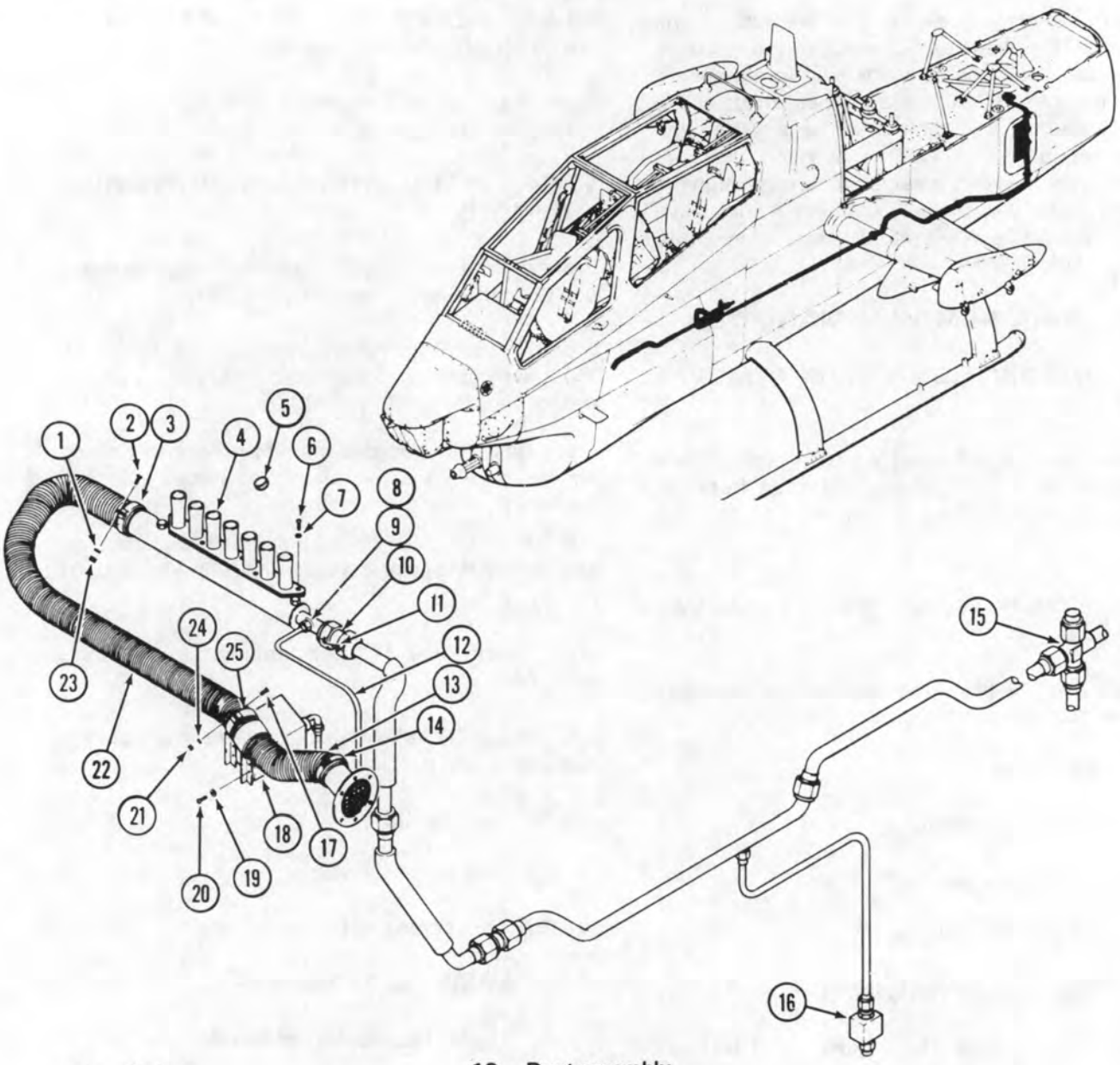
g. Perform functional check of components installed in step f.

h. Perform operational check of rain removal system.

13-95. TEMPERATURE CONTROL VALVE.

13-96. DESCRIPTION — TEMPERATURE CONTROL VALVE.

A windshield clearing temperature control valve (18), figure 13-13) is located at F.S. 46 and W.L. 67.00 in the ambient air line to the manifold. The valve is



1. Washer
2. Screw
3. Clamp
4. Manifold assembly
5. Thermal switch
6. Screw
7. Washer
8. Union
9. Packing
10. Ring
11. Lockwire
12. Tube
13. Duct assembly
14. Clamp
15. Air distribution valve
16. Drain valve
17. Screw
18. Temperature control valve
19. Washer
20. Screw
21. Nut
22. Duct assembly
23. Nut
24. Washer
25. Clamp

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Figure 13-13. Rain Removal Manifold

actuated by bleed air pressure and controlled by a solenoid. The valve is normally open to supply ambient air to the manifold (4). A thermal switch (5), imbedded in the windshield, controls valve operation. When the system is turned on, the valve closes. The valve remains closed and bleed air is supplied to the nozzle assembly until the thermal switch opens at **125** degrees F (**52** degrees C), de-energizing the valve solenoid. The valve then opens and supplies ambient air to the manifold. The cooler ambient air mixes with bleed air flow as it is distributed through nozzles to the windshield.

13-97. REMOVAL — TEMPERATURE CONTROL VALVE.

a. Disconnect electrical plug at temperature control valve (18, figure 13-13).

b. Disconnect one end of tube (12) at temperature control valve (18).

c. Remove screws (20) and washers (19).

d. Remove nuts (21), washers (24), screws (17), and clamps (14 and 25) from each end of temperature valve. Remove temperature control valve from ducts (13 and 22) and helicopter.

13-98. INSPECTION — TEMPERATURE CONTROL VALVE.

a. Inspect temperature control vaive for damage.

b. Apply **12** Vdc power (S12) to determine if part is operating properly.

13-99. REPAIR OR REPLACEMENT — TEMPERATURE CONTROL VALVE.

Replace temperature control valve if damaged or inoperative. No repairs are acceptable.

13-100. INSTALLATION — TEMPERATURE CONTROL VALVE.

a. Install washers (19, figure 13-13) and screws (20) to attach temperature control valve (18) to structure.

b. Slip end of ducts (13 and 22) over ends of temperature control valve and install clamp (14), screws (17), washers (24), and nuts (21).

c. Connect one end of tube (12) to temperature control valve.

d. Connect electrical plug to temperature control valve (18).

13-101. RAIN REMOVAL THERMAL SWITCH.

13-102. DESCRIPTION — RAIN REMOVAL THERMAL SWITCH.

A thermal switch mounted in the windshield (figure 13-14) provides thermal protection to the windshield. When rain removal air exceeds preset limits, the switch opens and actuates temperature control valve (18, figure 13-13) to prevent overheating the windshield.

13-103. INSPECTION — RAIN REMOVAL THERMAL SWITCH.

Switch should open at **125** ±**5** degrees F (**52** ±**3** degrees C) and close at **100** ±**5** degrees F (**38** ±**3** degrees C).

13-104. REMOVAL — RAIN REMOVAL THERMAL SWITCH (FIGURE 13-14).

Press thermal switch (figure 13-14) from windshield and disconnect wiring.

13-105. INSTALLATION — RAIN REMOVAL THERMAL SWITCH.

a. Scrape old sealant from windshield and clean area by using crocus cloth (C37) and damp cloth to remove old adhesive from windshield.

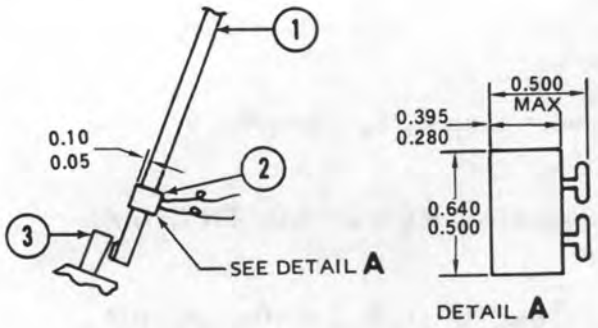
b. Prepare adhesive (C14) according to manufacturer's instructions.

NOTE

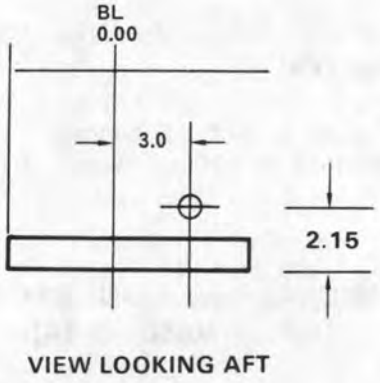
Pot life of adhesive at room temperature is approximately 30 minutes.

c. Apply light coat of adhesive (C14) to outer surface of switch and press into opening in windshield. Allow adhesive to cure in accordance with table 1-11.

d. Connect electrical wiring (Appendix F).



1. Windshield
2. Thermoswitch
3. Windshield frame



VIEW LOOKING AFT

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.

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Figure 13-14. Rain Removal Thermal Switch — Installation

13-106. RAIN REMOVAL TUBING.

13-107. DESCRIPTION — RAIN REMOVAL TUBING.

A series of tubes is located from the engine compressor section to the rain removal manifold assembly. Also, a drain tube is provided to prevent the collection of moisture in tube system.

13-108. REMOVAL — RAIN REMOVAL TUBING.

a. Remove panel on left side of helicopter below windshield.

b. Remove panels (28, 30, 32, 33, 36, and 37, figure 2-3) in order to gain access to tubing.

c. Remove attaching hardware and/or clamps and couplings, and remove components.

13-109. INSPECTION — RAIN REMOVAL TUBING.

a. Inspect tubing for security, damage, and leaks (figure 13-1).

b. Inspect couplings for leakage and security.

c. Check drain valve (16, figure 13-13) for proper operation.

13-110. REPAIR OR REPLACEMENT — RAIN REMOVAL TUBING.

a. Tighten couplings if loose or leaking.

b. Replace drain valve (16, figure 13-13) if damaged or inoperative.

c. Replace tubing if damaged.

13-111. INSTALLATION — RAIN REMOVAL TUBING.

a. Install hardware and/or clamps and couplings to attach tubing.

b. Install panels (28, 30, 32, 33, 36, and 37, figure 2-3).

c. Install panel left side of helicopter below windshield.

13-112. RAIN REMOVAL VALVE.

13-113. DESCRIPTION — RAIN REMOVAL VALVE.

The rain removal valve (9, figure 13-1) serves to route a portion of engine bleed air to the helicopter windshield rain removal nozzle. When the pilot ECS switch is positioned to RAIN RMV, the solenoid

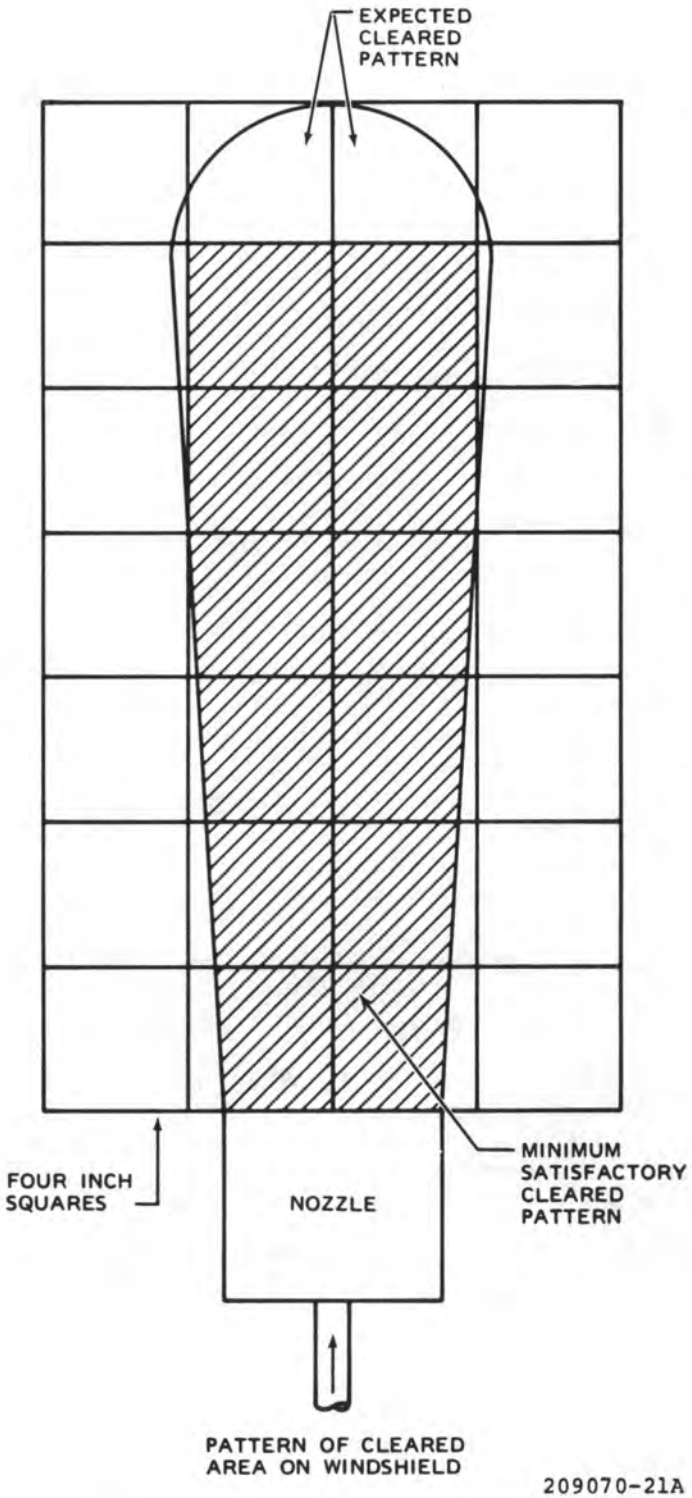


Figure 13-15. Rain Removal Nozzle and Cleared Air Pattern

actuated pilot valve allows a small amount of bleed air to vent through a series of flow-control orifices to atmosphere. This creates a pressure imbalance which causes line pressure to lift the poppet assembly off the seat inside the body. This allows bleed air to flow to the rain removal nozzle located at the base of the windshield.

13-114. ADJUSTMENT — RAIN REMOVAL VALVE.

Premaintenance Requirements for Inspection and Adjustment of Rain Removal Valve

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T76) (T2)
Test Equipment	None
Support Equipment	(S12) (S15)
Minimum Personnel Required	Two
Consumable Materials	(C32) (C36) (C37) (C59) (C112) (C137)
Special Environmental Conditions	None

13-115. FUNCTIONAL TEST — RAIN REMOVAL VALVE.

NOTE

If there are any malfunctions during this test, refer to Troubleshooting Chart, paragraph 13-116.

a. Attach solenoid leads to a source of 18-30 Vdc electrical power (S12) that is controlled by a switch.

b. Cap one of the open ports on the valve body and attach a source of **100** psig compressed air (S15) to the opposite port. Turn the air pressure on and regulate to **100** psig.

c. Cycle the valve ten times and record time required to open and close. The tolerance is **0.5 to 2.0** seconds. After last actuation, measure leakage at the normally closed port. Maximum allowable leakage is **0.05** pounds per minute.

13-116. TROUBLESHOOTING — RAIN REMOVAL VALVE.

NOTE

Before using this table, ensure all normal operational checks have been performed. If a malfunction occurs which is not listed in this table, notify the next higher maintenance level.

Table 13-2. Troubleshooting Rain Removal Valve

CONDITION TEST OR INSPECTION	CORRECTIVE ACTION
1. Valve does not open when energized.	
STEP 1. Perform solenoid coil resistance test. Refer to paragraph 13-120 b.	**If resistance is not within limits, replace solenoid (paragraph 13-123).**

Table 13-2. Troubleshooting Rain Removal Valve (Cont)

CONDITION TEST OR INSPECTION CORRECTIVE ACTION
2. Valve does not open or close within allowable time limits (**0.5 to 2.0** seconds).
STEP 1. Check for excessive friction on Teflon lip seal or roughness on sliding surfaces (paragraph 13-120).
Disassemble the valve, polish out burrs, relubricate, and reassemble (paragraph 13-121).
3. Valve leaks excessively in closed position.
STEP 1. Inspect poppet assembly seat seal to determine if damaged or worn (figure 13-17).
If surface of seat seal is slightly damaged, dress off surface. If damage is deep, replace the poppet assembly (paragraph 13-121).
STEP 2. Inspect seal lip in valve body to determine if pitted or scratched (figure 13-17).
If seal lip is pitted or scratched, replace valve body (paragraph 13-123).

13-117. REMOVAL — RAIN REMOVAL VALVE.

a. Remove left panel (9, figure 2-3).

b. Disconnect electrical connector to solenoid assembly (1, figure 13-16) from valve adapter (6).

c. Disconnect lines and remove the valve.

13-118. DISASSEMBLY — RAIN REMOVAL VALVE.

a. Index adapter (6, figure 13-16), gasket (9), cap (11), and body (17) with indelible ink marker so that these parts can be reassembled in the same relative position.

b. Remove lockwire and remove solenoid (1), spring (2), and armature (3).

c. Hold nuts (19) and remove bolts (4) and washers (5 and 18).

d. Remove adapter (6), packing (7), spacer (8), gasket (9), and cap (11). Remove packing (12) from cap (11).

e. Remove spring (13) and poppet (16). Remove seal (14) from poppet.

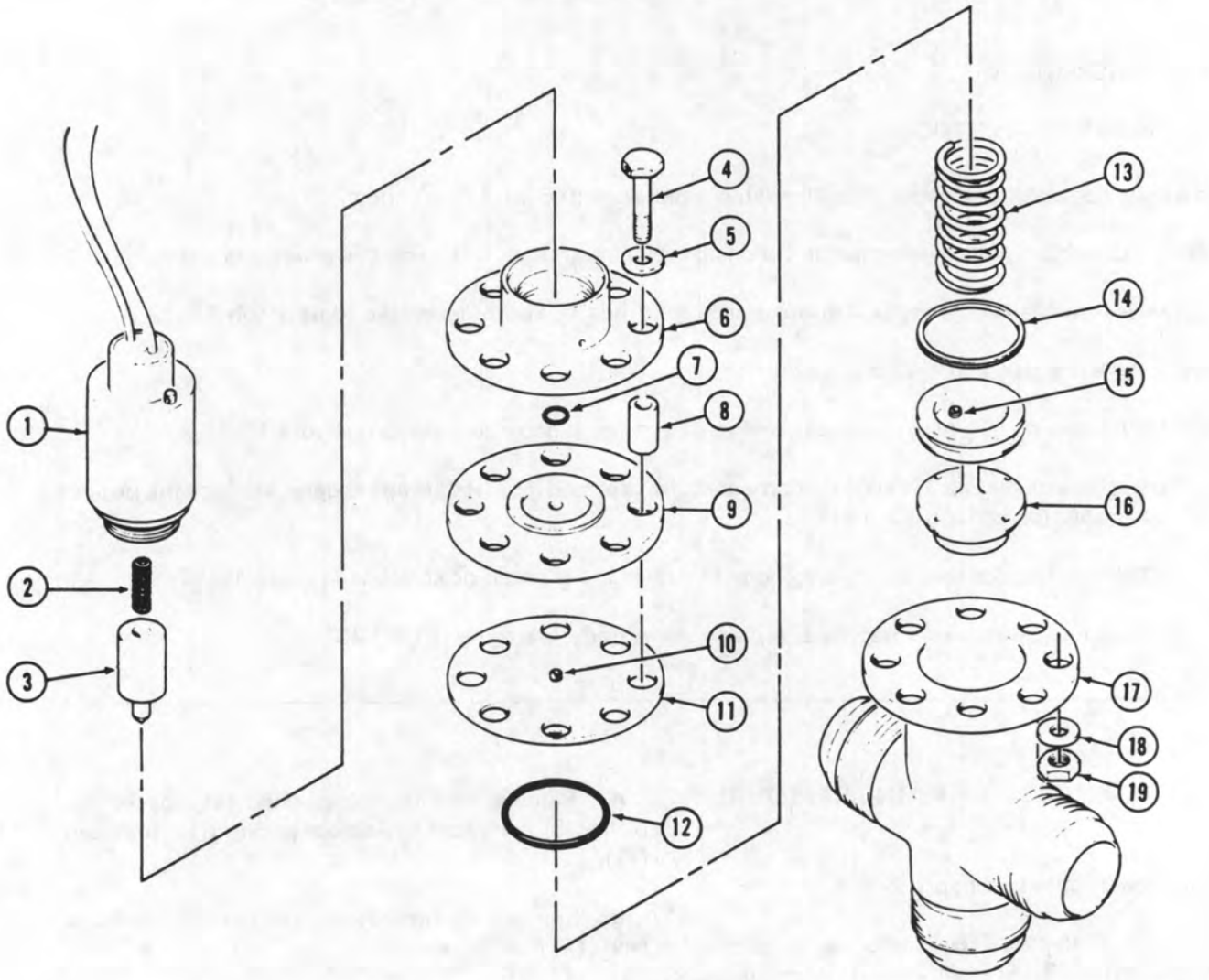
13-119. CLEANING — RAIN REMOVAL VALVE.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

a. Clean disassembled parts with solvent (C112).

b. Dry with a clean lint-free cloth.



1. Solenoid assembly
2. Spring
3. Armature
4. Bolt
5. Thin steel washer
6. Adapter
7. Packing
8. Spacer
9. Graphite filled teflon gasket
10. Orifice
11. Cap
12. Packing
13. Spring
14. Teflon lip seal
15. Orifice
16. Poppet assembly
17. Body
18. Thin steel washer
19. Nut

Figure 13-16. Rain Removal Valve

13-120. INSPECTION — RAIN REMOVAL VALVE.

a. Use a strong light and magnifying glass to perform visual inspections in the following steps.

b. Inspect solenoid (1, figure 13-16) for evidence of leakage and deterioration at seams. Inspect electrical wires and threads for damage. Check electrical resistance of the solenoid with a multimeter (T2). Attach a lead from multimeter (T2) to each solenoid wire. Read resistance on RX1 scale. If the reading does not fall between **35 and 38** ohms, replace solenoid.

c. Inspect adapter (6) for damaged threads, corrosion, mechanical damage, and distortion.

d. Inspect spacer (8), cap (11), spring (2), and spring (13) for corrosion, mechanical damage and distortion. Inspect orifice (10) for damage and for secure installation in cap.

NOTE

The seat seal referred to in step e. is installed in the poppet with a sleeve guide and then the lip of the poppet is spin-formed to retain these parts. See the sectional view of the poppet on figure 13-17 adjacent to index (7). The area between the poppet and the sleeve guide is sealed pressure tight with high temperature epoxy. The seat seal cannot be removed and replaced without destroying the holding lip, but minor damage can be dressed out. Refer to paragraph 13-121.

e. Inspect poppet (16, figure 13-16) for nicks in grooves of seal (14). Inspect sliding surface for galling and scoring. Inspect orifice (15) for damage and secure installation in poppet. Inspect seat seal in the end of poppet that contacts seat surface in body bore (7, figure 13-17) for scratches and nicks.

f. Inspect gasket (9, figure 13-16) for breaks and distortion in the thin wall sections adjacent to bolt holes. Inspect the pilot seat surface (3, figure 13-17) for radius of **0.007** inch or more which would require replacement. Replace gasket if nicks or scratches are found in the seat surface.

g. Inspect armature (3, figure 13-16) at taper and seat area for roughness and wear.

h. Inspect body (17) for damaged threads. Inspect the sliding surfaces for scoring or scratches. Check seat surface (7, figure 13-17) for radius of **0.020** or more which would require replacement of the body. Replace seat surface if nicked or pitted.

i. Inspect spring rate for springs (1 and 5) for rate within limits shown.

j. Inspect armature to poppet bore (2) for wear in excess of tolerance shown.

k. Inspect poppet to body bore (6) for wear in excess of tolerance shown.

13-121. REPAIR OR REPLACEMENT — RAIN REMOVAL VALVE.

a. Install packings (7 and 12, figure 13-15) and Teflon lip seal (14) when the valve is assembled.

b. Replace all parts which fail to pass inspections described in paragraph 13-120.

c. Polish out minor damage on the seat seal on poppet (16, figure 13-16). If the seat seal is nicked or damaged, replace the entire poppet (16).

d. Polish out minor scoring, nicks, and burrs on outside areas. Work area until surface is smooth but do not alter concentricity. Use abrasive cloth (C36) on aluminum parts and then touch up with chemical film (C31). Use crocus cloth (C37) on other parts.

13-122. FUNCTIONAL TEST — RAIN REMOVAL VALVE.

Refer to paragraph 13-115.

13-123. ASSEMBLY — RAIN REMOVAL VALVE.

a. Position tool (T76) on poppet (figure 13-18).

b. Lubricate Teflon lip seal with a thin film of silicone grease (C59) and position on tool with open end facing down as illustrated. Slide the seal down the tapered wall of the tool and into the groove on the poppet.

c. Allow the Teflon lip seal to stabilize for five minutes, and then use a round toothpick, or similar non-metallic blunt-ended rod, to work the lip of the

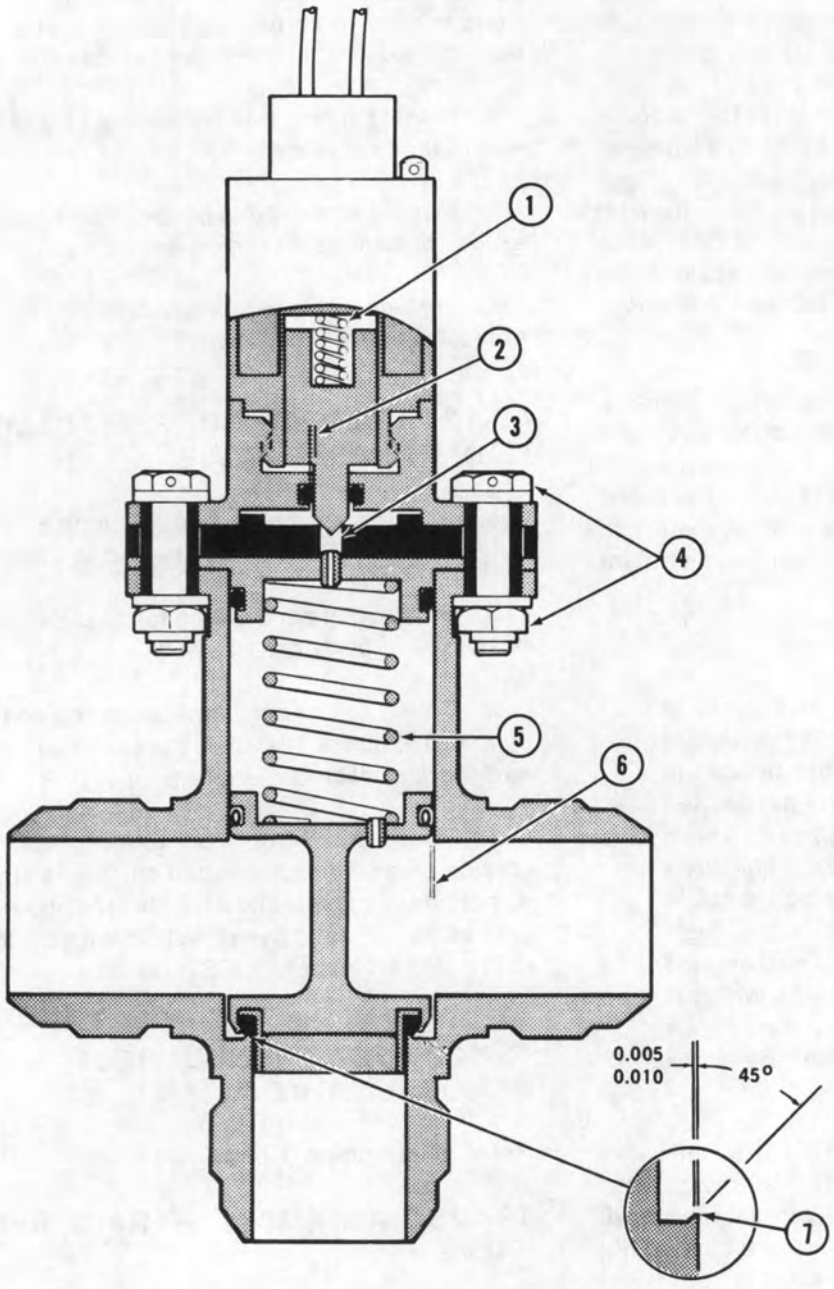


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Figure 13-17. Limits Chart — Air Distribution Valve
(Sheet 1 of 2)

ITEM	NOMENCLATURE	MIN.	MAX.	REPLACE
1	Armature Spring rating	58 IN-LB	71 IN-LB	Below or Above
2	Armature Poppet to Adapter bore	0.003	0.006	0.008
3	Seat Surface on Gasket bore (formation of seat surface to pointed poppet is permissible)	0.002R	0.005R	0.007R
4	Bolt to Nut torque	15 IN-LB	17 IN-LB	N/A
5	Poppet Spring rating	0.62 IN-LB	0.78 IN-LB	Below or Above
6	Sliding surfaces of Poppet to body bore	0.124	0.127	0.130
7	Seat surface in body bore	0.005R	0.010R	0.020R

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

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Figure 13-17. Limits Chart — Air Distribution Valve (Sheet 2 of 2)

seal out until it extends past the surface of the poppet equally on all sides.

d. Lubricate sliding surfaces of poppet (16, figure 13-16) and body (17) with a thin film of grease (C59). Slide poppet into position in body and place spring (13) on top of poppet.

e. Lubricate packing (12) with grease (C59) and install packing on cap (11).

f. Observe index marks made on adapter (6), gasket (9), cap (11), and body (17) at time of disassembly and install these parts with the index mark aligned and with spacers (8) in place. Install bolts (4), washers (5 and 18) and nuts (19). Hold nuts and tighten bolts evenly in small increments until a torque of **15 ±2** inch-pounds is applied to each bolt.

g. Lubricate packing (7) and sliding surface of armature (3) with silicone grease (C59) and install packing in adapter (6). Install armature (3), spring (2) and solenoid (1). Lockwire solenoid from drilled hole in lug near leads to one of drilled head bolts (4) with lockwire (C137).

13-124. INSTALLATION — RAIN REMOVAL VALVE.

a. Install electrical connector to the valve.

b. Connect lines to the valve.

c. Install left panel (9, figure 2-3).

SECTION II. AIR COOLING SYSTEMS

13-125. AMBIENT AND CONDITIONED COOLING.

13-126. DESCRIPTION — AMBIENT AND CONDITIONED COOLING (Section I).

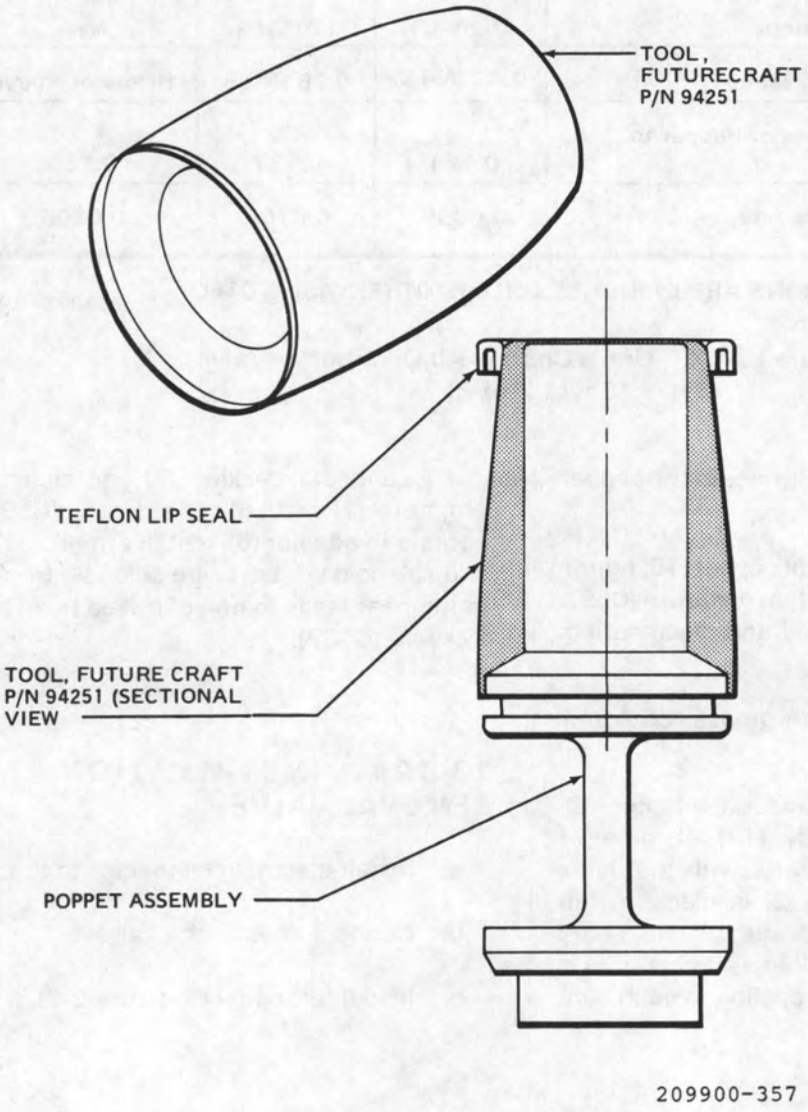


Figure 13-18. Tool Application — Teflon Lip Seal Installation

CHAPTER 14

HOISTS AND WINCHES

(Not Applicable)

CHAPTER 15

AUXILIARY POWER PLANTS

(Not Applicable)

CHAPTER 16

MISSION EQUIPMENT

16-1. GENERAL.

This chapter contains maintenance instructions for the fire control subsystems and the armament subsystems.

16-2. FIRE CONTROL SUBSYSTEMS.

16-3. DESCRIPTION— FIRE CONTROL SUBSYSTEMS.

a. The fire control subsystems provide a means for accurately acquiring and tracking targets, and for firing of the turret subsystem, 2.75 inch folding fin aerial rockets and TOW missile subsystem. The fire control subsystems include the following:

P E Pilot reflex sight
Helmet sight subsystem
Stabilized telescopic sight unit
M Airborne laser tracker
M Head Up Display
M Fire control computer
M Air data subsystem
Gunner controls and indicators
Pilot controls and indicators
Interface control unit
Rocket management subsystem

b. Refer to chapter 9 in this manual for further information and maintenance data on all fire control subsystems except as indicated in paragraphs 16-4 through 16-9 below.

16-4. P E PILOT REFLEX SIGHT.

16-5. P E DESCRIPTION — PILOT REFLEX SIGHT.

The pilot reflex sight assembly M73 is located above the pilot instrument panel. It provides an illuminated, projected reticle image for pilot use when firing the wing stores, or turret weaponry during fixed forward mode of fire. P For the wing stores, the pilot reads ballistic data cards for information used to adjust the elevation/depression knob, E or estimates range to adjust elevation using short medium or long range switch. For turret weaponry, the range potentiometer is used to obtain correct gun elevation.

16-6. P E MAINTENANCE — PILOT REFLEX SIGHT.

Refer to TM 9-1090-203 series manuals for additional information and maintenance procedures. Refer to paragraph F-6 in this manual for airframe armament electrical equipment list, and paragraph F-9 (turret system) for airframe wiring diagrams.

16-7 M HEAD UP DISPLAY.

16-8. M DESCRIPTION — HEAD UP DISPLAY.

The pilot Head Up Display is located above the pilot instrument panel. It provides illuminated symbology for pilot use when firing the wing stores or turret weaponry during fixed forward mode of fire, display navigation information, range to target, and TOW launch window.

16-9. MAINTENANCE — HEAD UP DISPLAY.

Refer to TM 9-1270-220-13 and TM 9-1270-220-13P manuals for additional information and maintenance procedures. Refer to paragraph F-6 in this manual for airframe armament electrical equipment list, and paragraph F-9 (turret system) for airframe wiring diagrams.

16-10. HELMET SIGHT SUBSYSTEM.

16-11. DESCRIPTION — HELMET SIGHT SUBSYSTEM.

a. The helmet sight subsystem (HSS) M136 is interfaced with the turret weapons subsystem and the telescopic sight unit (TSU) through the interface control unit (IFCU) to provide a hands-off sighting system. This system enables the gunner or pilot to aim the turret weapons, and allows the gunner or pilot to quickly acquire a target for the TSU.

b. The HSS consists of two helmet sight assemblies, one each for pilot and gunner, mounted on the SPH-4 helmets; two linkage assemblies, one each for pilot and gunner, mounted to the cockpit left

canopy side frame; and an electronic interface assembly mounted on the rear cockpit bulkhead.

16-12. MAINTENANCE — HELMET SIGHT SUBSYSTEM.

Refer to TM 9-1270-212-14 manual for additional information and maintenance procedures. Refer to paragraph P 9-414 or E M 9-498 in this manual for airframe armament system circuitry information and maintenance procedures. Refer to paragraph F-6 for airframe armament electrical equipment list, and paragraph F-9 for airframe wiring diagrams.

16-13. ARMAMENT SUBSYSTEMS.

16-14. TURRET WEAPONS SUBSYSTEM.

16-15. P DESCRIPTION — Turret Weapons Subsystem M28A3.

The turret weapons subsystem M28A3 is an electrohydraulic dual weapon system providing rapid and voluminous fire power. The turret weapons subsystem consists of a pilot control panel, gunner control panel, turret assembly, M134 7.62mm machine gun, 40mm grenade launcher, ammunition feed system, electronic components, and a pilot reflex sight. All necessary electrical and hydraulic disconnects are installed on a shelf in the forward ammunition compartment. The turret weapons subsystem interfaces with the M136 helmet sight subsystem (HSS) and the turret control portion of the stabilized telescopic sight unit (TSU) of the M65 TOW missile subsystem.

16-16. P MAINTENANCE — TURRET WEAPONS SUBSYSTEM M28A3.

Refer to TM 9-1090-203 series manuals for additional information amd maintenance procedures. Refer to paragraph 9-414 in this manual for airframe armament system circuitry information and airframe electrical component maintenance procedures. Refer to paragraph F-6 for airframe armament electrical equipment list, and paragraph F-9 for subsystem airframe wiring diagrams.

16-17. E M DESCRIPTION — TURRET WEAPON SUBSYSTEM M97E1.

The turret weapon subystem M97E1 provides high performance capability to sight, position, feed, and fire the M197 20mm automatic gun. The subsystem consists of a pilot control panel, gunner control panel, turret assembly, 20mm automatic gun, 20mm ammunition feed system and electronic components. Sighting is accomplished using the E M pilots reflex sight or the M Head Up Display. All necessary electrical disconnects are installed forward of the ammunition compartment, two on each side of the turret. The turret weapon subsystem interfaces with the M136 helmet sight subsystem (HSS) and the stabilized telescopic sight unit (TSU) of the M65 TOW missile subsystem for sight functions.

16-18. E M MAINTENANCE — TURRET WEAPON SUBSYSTEM M97E1.

Removal and installation instructions for the turret assembly are given below. Refer to TM 9-1090-206 series manuals for additional information and maintenance procedures. Refer to paragraph 9-444 in this manual for airframe armament system circuitry information and airframe component maintenance procedures. Refer to paragraph F-6 for airframe armament electrical equipment list, and paragraph F-9 for subsystem airframe wiring diagrams.

16-19. E M REMOVAL — TURRET ASSEMBLY.

Premaintenance Requirements for Maintenance of Turret Assembly

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	T65, T71
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	Chalk
Special Environmental Conditions	None

WARNING

To prevent injury to personnel, ensure that all weapon systems are unloaded and all armament circuit breakers are OFF or out before starting any maintenance procedures.

a. Preparation for Maintenance.

(1) Disconnect helicopter battery.

(2) Ensure that no external electrical or hydraulic power is applied to helicopter.

(3) Ensure that gun, feeder, gun drive, and recoil attenuation system have been removed from turret.

WARNING

Do not attempt to remove the turret unless the gun, feeder, gun drive, and recoil attenuation system have been previously removed from the turret.

b. Removal Procedures.

(1) Remove left and right panels (1, figure 16-1) above turret fairings from helicopter.

(2) Remove left and right fairings (2) above turret from helicopter.

(3) Open left and right ammo bay doors (3).

(4) Disconnect and cap connector W4P2 (7) from helicopter.

(5) Disconnect and cap connectors W1P3 (5) and W3P1 (4) from turret.

(6) Disconnect and cap connectors W1P16 (6) and W1P15 (8).

(7) Disconnect and cap connectors W1P22 (9), W1P7 (10) and W1P5 (11).

(8) Remove two screws (12) and washers (13) securing stow switch/azimuth tachometer bracket (14) to azimuth drive (15).

(9) Remove bolt (26) and washer (25) securing clamp (23) to bottom of azimuth resolver (22) and remove clamp (23).

(10) Remove remaining four bolts (26) and washers (25) on bottom of azimuth resolver (22) and remove bottom cover (24).

(11) Reinstall all mounting hardware for storage.

CAUTION

Do not rotate turret after installing allen wrench or tie wrap in resolver gear tension hole.

(12) Rotate turret by hand as necessary to install a 3/32-inch allen wrench or plastic tie wrap in resolver gear tension hole (27). Tape wrench or tie wrap in place.

(13) Using a piece of chalk, place an alignment mark (30) on the resolver gear (28) and azimuth ring gear (29) where the two gears mesh.

(14) Remove four bolts (21) and washers (20) and remove azimuth resolver (22). Reinstall bolts and washers for storage. Tape two shims (19) in place on turret.

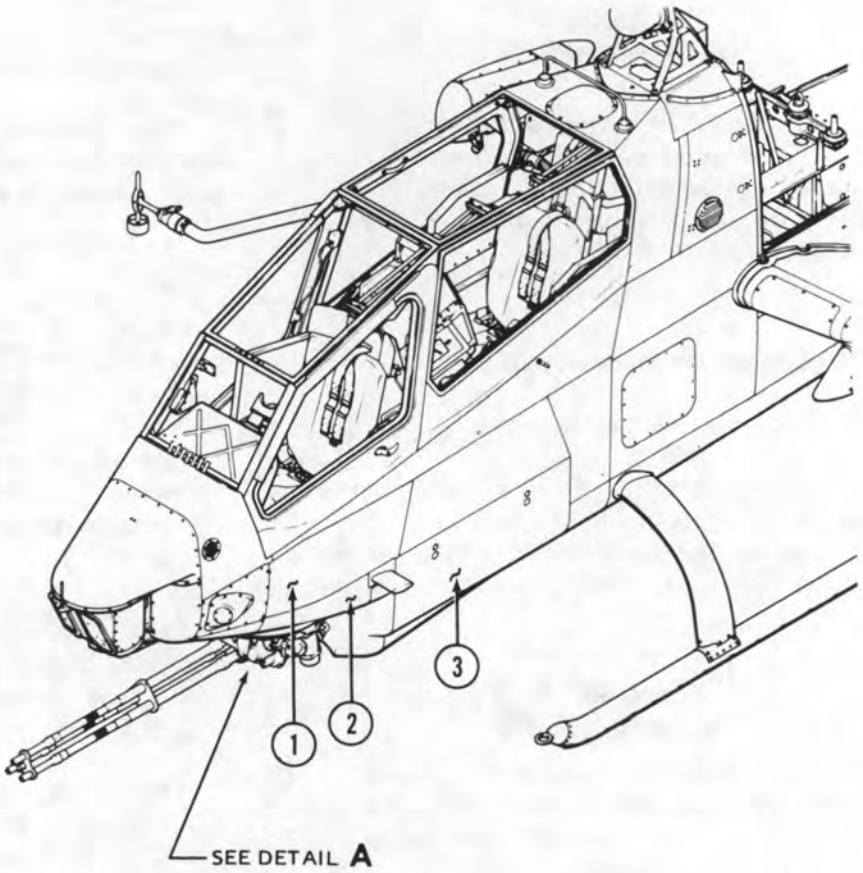
(15) Loosen four azimuth drive mounting bolts (18) as required to obtain clearance for removal of turret.

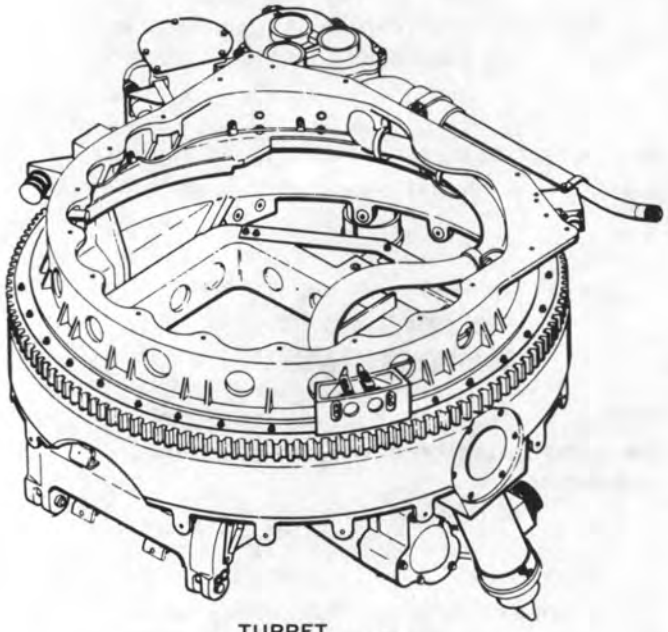
WARNING

Before proceeding, ensure that four turret mounting bolts (31) are installed and secure.

(16) Remove twelve turret mounting nuts (39), four bolts (36), four washers (37), eight bolts (40) and aluminum washers (38).

(17) Place turret handling adapter (T65) in position under turret using lift truck (T71).





1. Left panel
   Right panel (opp)
2. Turret left fairing assembly
   Turret right fairing assembly (opp)
3. Left ammo bay door
   Right ammo bay door (opp)

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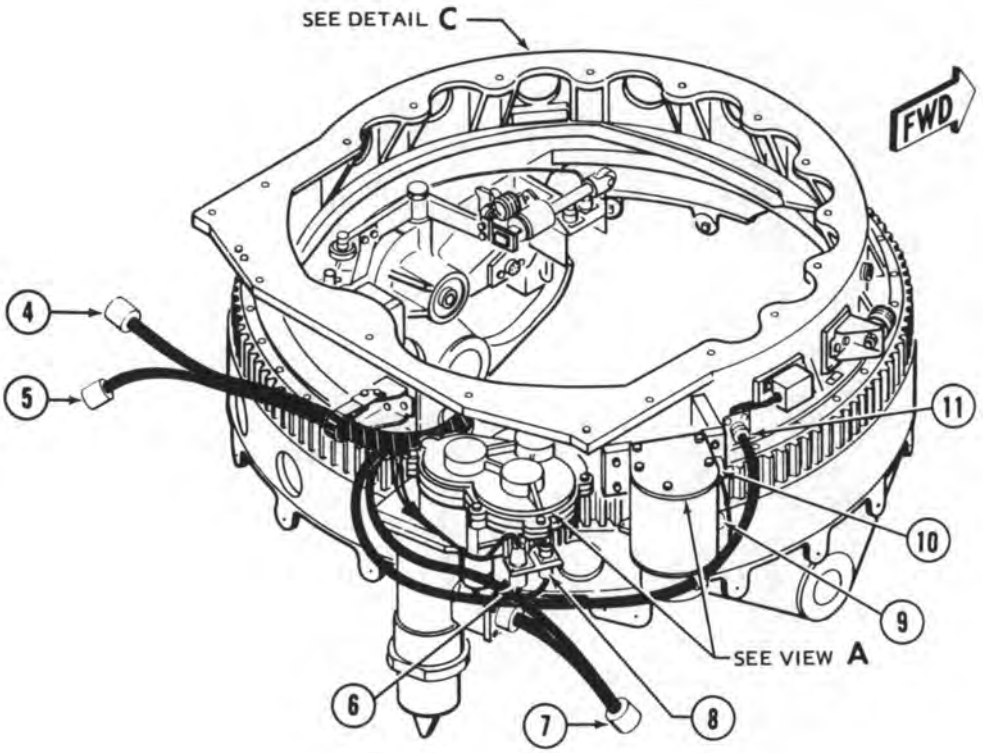
Figure 16-1. E M Turret Installation (Sheet 1 of 4)



4. Connector W3P1 (mates with helicopter J1)
5. Connector W1P3 (mates with helicopter J3)
6. Connector W1P16 (mates with azimuth limit switch A7J13)
7. Connector W4P2 (mates with helicopter J2)
8. Connector W1P15 (mates with azimuth tachometer A7J12)
9. Connector W1P22 (mates with azimuth stow switch A7J23)
10. Connector W1P7 (mates with azimuth resolver A7J4)
11. Connector W1P5 (mates with azimuth buffer amplifier A7J2)

DETAIL B (Rotated 180°)

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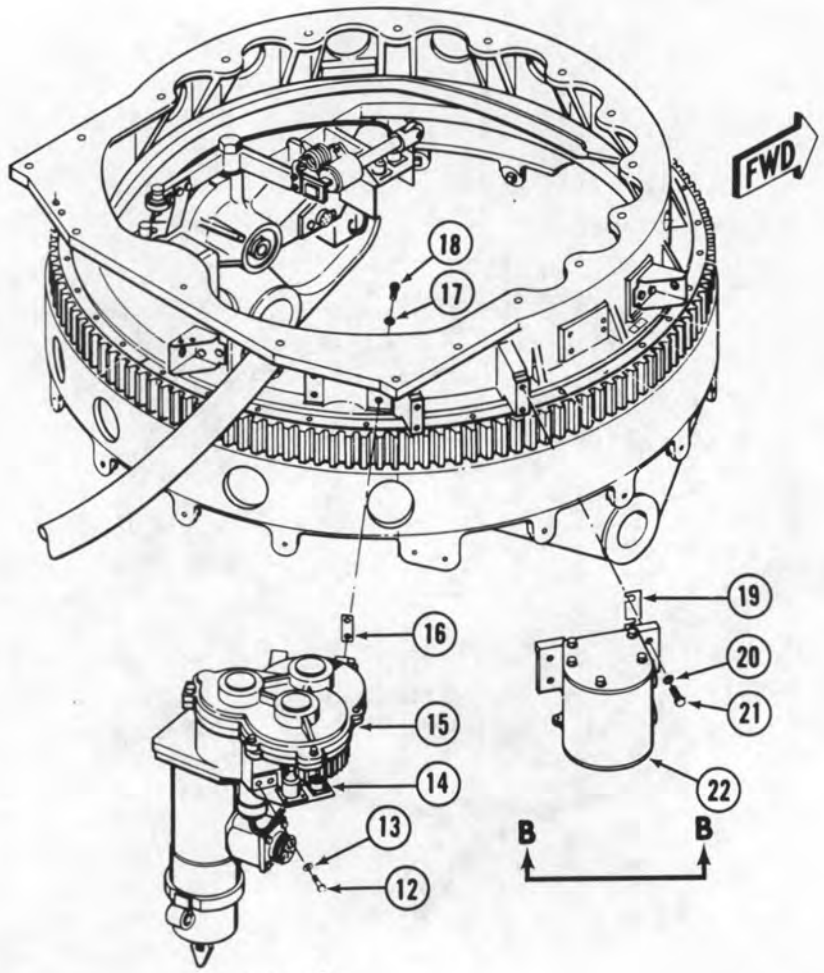
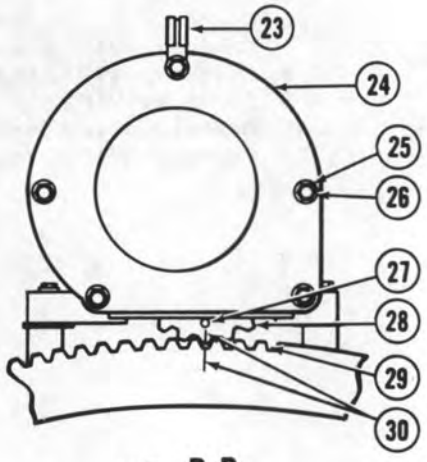
Figure 16-1. E M Turret Installation (Sheet 2 of 4)



VIEW **A**

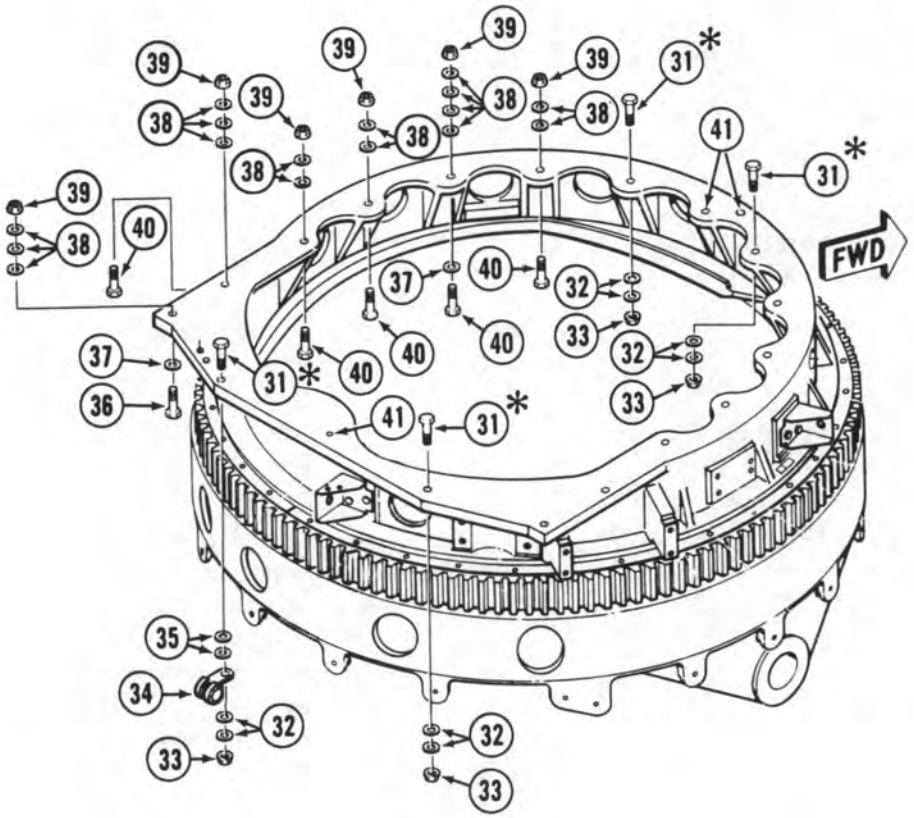
12. Screw (2)
13. Washer (2)
14. Bracket
15. Azimuth drive
16. Shim
17. Washer
18. Bolt
19. Shim
20. Washer
21. Bolt
22. Azimuth resolver
23. Clamp
24. Bottom cover
25. Washer
26. Bolt
27. Tension hole
28. Resolver gear
29. Azimuth ring gear
30. Alignment mark



VIEW **B-B**

209071-443-3

Figure 16-1. E M Turret Installation (Sheet 3 of 4)



DETAIL C

31. Bolt
32. Aluminum washers (see note)
33. Nut
34. Clamp assembly
35. Aluminum washers
36. Bolt
37. Washer
38. Aluminum washers (see note)
39. Nut
40. Bolt
41. Locating pin hole

***WARNING**

Before proceeding, ensure that four turret mounting bolts (31) are installed and secure. These four bolts are not to be removed until tool (T65) is installed.

NOTE

Number of aluminum washers shown is typical; utilize number required to obtain proper thread engagement with nuts.

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Figure 16-1. E M Turret Installation (Sheet 4 of 4)

WARNING

The turret weighs approximately 200 pounds. Exercise care when performing following step to prevent injury to personnel and avoid damage to turret and/or helicopter components. Personnel should be positioned on all sides of turret to watch for any possible interference or damage as turret is being lowered and removed from helicopter.

(18) While supporting turret with turret handling adapter (T65) and lift truck (T71), remove last four mounting nuts (33), four bolts (31), aluminum washers (32), clamp assembly (34) and two alumnimum washers (35). Access to forward bolts is through gunner cockpit, and access to aft bolts is through access hole in forward panel of ammo box compartment.

(19) Lower and remove turret from helicopter.

16-20. M E INSTALLATION — TURRET ASSEMBLY.

a. Preparation for Maintenance.

(1) Disconnect helicopter battery.

(2) Ensure that no external electrical or hydraulic power is applied to helicopter.

NOTE

If installed on turret, remove azimuth resolver in accordance with instructions contained in paragraph 16-16.

b. Installation Procedures.

(1) If installed, remove left and right fairings (1, figure 16-1) above turret from helicopter.

(2) Open left and right ammo bay doors (3).

WARNING

The turret weighs approximately 200 pounds. Exercise care when performing following steps to prevent injury to personnel and to avoid damage to turret and/or helicopter components. Personnel should be positioned on all sides of turret to watch for any possible interference or damage as turret is being raised and installed in helicopter.

(3) Install turret on turret handling adapter (T65).

(4) Using lift truck (T71) place turret in position under helicopter.

(5) Align fore and aft locating pin holes (41) in turret with corresponding helicopter positioning pins and carefully raise turret into position on helicopter.

CAUTION

Failure to install mounting hardware as specified in following steps will result in damage to equipment.

(6) Install four turret mounting bolts (31), two aluminum washers (35), clamp assembly (34) and number of aluminum washers (32) required to obtain proper thread engagement with four nuts (33). Torque nuts **150 TO 190** inch-pounds.

(7) Move turret handling adapter (T65) and lift truck (T71) away from helicopter.

(8) Install four washers (37), four bolts (36), eight bolts (40) and number of aluminum washers (38) required to obtain proper thread engagement with twelve nuts (39). Torque nuts **150 TO 190** inch-pounds.

(9) Secure azimuth drive (15) in position by tightening four bolts (18).

(10) Remove tape from two azimuth resolver shims (19).

(11) Place azimuth resolver (22) in position on turret with alignment marks (30) on resolver gear (28) and azimuth ring gear (29) aligned, and secure with four washers (20) and bolts (21).

(12) Remove allen wrench or plastic tie wrap from resolver gear tension hole (27).

(13) Install clamp (23) on bottom of azimuth resolver (22) with washer (25) and bolt (26).

(14) Place stow switch/azimuth tachometer bracket (14) in position on azimuth drive (15) and secure with two washers (13) and screws (12).

(15) Connect connector W1P22 (9) to A7J23, connector W1P7 (10) to A7J4 and connector W1P5 (11) to A7J2 (all on turret).

(16) Connect connectors W1P16 (6) to A7J13 and W1P15 (8) to A7J12 (all on turret).

(17) Connect connectors W1P3 (5) to helicopter J3 and W3P1 (4) to helicopter J1.

(18) Connect connector W4P2 (7) to helicopter J2.

(19) Perform turret system checkout in accordance with applicable TM 9-1090-206 series manual.

(20) Boresight turret system in accordance with applicable TM 9-1090-206 series manual.

(21) Install cover (24) on bottom of azimuth resolver (under clamp) and secure with five washers (25) and bolts (26). Use longest bolt to attach clamp.

(22) Close and secure left and right ammo bay doors (3).

(23) Install left and right fairings (2) above turret on helicopter.

(24) Install left and right panels (1) above turret fairings.

(25) Connect helicopter battery.

16-21. TOW MISSILE SUBSYSTEM.

16-22. DESCRIPTION — TOW MISSILE SUBSYSTEM.

The TOW Missile subsystem M65 is utilized as a heavy anti-tank/assault weapon. The system utilizes an optical means of tracking a target and guiding a TOW missile to the target. The system consists of a sight hand control (SHC), telescopic sight unit (TSU), P E pilot steering indicator (PSI), M Head Up Display (HUD), TOW control panel (TCP), electronic components, and TOW missile launchers. Electrical harnesses connect the electronic units together. One or two TOW missile launchers can be mounted on each outboard wing stores pylon. Each TOW missile launcher carries two TOW missiles.

16-23. MAINTENANCE — TOW MISSILE SUBSYSTEM.

Refer to TM 9-1425-473 series manuals for additional information and maintenance procedures. Refer to paragraph P 9-427 or E 9-464 M 9-524 in this manual for airframe armament system circuitry information and maintenance procedures. Refer to paragraph F-6 for airframe armament electrical equipment list, and paragraph F-9 for airframe wiring diagrams.

16-24. WING STORES ROCKET LAUNCHER SUBSYSTEM.

16-25. P DESCRIPTION — ROCKET CONTROL SUBSYSTEM.

The rocket control subsystem utilizes 2.75 inch folding fin aerial rockets (FFAR) as a light anti-personnel/assault weapon. The subsystem consists of a pilot rocket control panel, two intervalometers (one for inboard rocket pods, one for outboard rocket pods), interconnecting electrical components, and rocket launchers (seven tube or nineteen tube). Rocket launchers can be mounted on each of the inboard and outboard wing stores pylons.

16-26. P MAINTENANCE — ROCKET CONTROL SUBSYSTEM.

Refer to TM 9-1055-460-14 for additional information and maintenance procedures. Refer to paragraph 9-439 in this manual for airframe armament system circuitry information and airframe electrical component maintenance procedures. Refer to paragraph F-6 for airframe armament electrical equipment list, and paragraph F-9 (wing stores) for subsystem airframe wiring diagrams.

16-27. E M DESCRIPTION — ROCKET MANAGEMENT SUBSYSTEM M138.

The rocket management subsystem (RMS) utilizes 2.75 inch folding fin aerial rockets (FFAR) as a light anti-personnel/assault weapon. The subsystem consists of a pilot control and display unit, four operations units (one at each wing stores station), interconnecting electrical components, and rocket launchers (M158A1, M158A1RC, or LWL-7 seven tube, and M200A1, M227, or LWL-19 nineteen tube). The RMS provides the capability to select fire zone for

firing. The zone containing the desired warhead may be selected and programmed for the rate, mode and quantity of rockets to be fired, and the range for airburst of M439 type fuse or penetration of forest canopy for M433 type fuse. Rocket launchers can be mounted on each of the inboard or outboard wing stores pylons.

16-28. E M MAINTENANCE — ROCKET MANAGEMENT SUBSYSTEM M138.

Refer to TM 9-1270-207-13 and TM 9-1270-207-13P for additional information and maintenance procedures. Refer to paragraph E 9-477 or M 9-539 in this manual for airframe armament system circuitry information and maintenance procedures. Refer to paragraph F-6 for airframe armament electrical equipment list, and paragraph F-9 (wing stores) for subsystem airframe wiring diagrams.

16-29. 7.62 MM GUN POD (M-18, M18E1).

16-30. DESCRIPTION — 7.62MM GUN POD.

The wing stores 7.62mm gun pod is a self-contained unit housing a 7.62mm machine gun, its own electrical system, a battery recharging system, and a maximum of 1500 rounds of ammunition. The gun is capable of firing six second bursts at 2000 or 4000 rounds per minute. The 7.62mm gun pod can be mounted on each inboard wing stores pylon.

16-31. MAINTENANCE — 7.62MM GUN POD.

Refer to TM 9-1005-257-12 manual for additional information and maintenance procedures. Refer to paragraphs P 9-438 E 9-488 M 9-548 for airframe armament system circuitry information and maintenance procedures. Refer to paragraph F-6 for airframe armament electrical equipment list, and paragraph F-9 (wing stores) for subsystem airframe wiring diagrams.

16-32. IMPULSE CARTRIDGES.

16-33. DESCRIPTION — IMPULSE CARTRIDGES.

Impulse cartridges are used as a power source to force the rack suspension hooks open and actuate a downward force on the ejector foot to eject stores clear of the helicopter. Each ejector rack contains two cartridges that can be fired electrically by the jettison switches. Electrical firing of one cartridge automatically detonates the other cartridge.

WARNING

To prevent injury to personnel, ensure that all weapon systems are unloaded and all armament circuit breakers are OFF or out before starting any maintenance procedures or tests.

WARNING

Remove impulse cartridges from ejector rack breech prior to placing helicopter in a hangar, to prevent injury to personnel and damage to equipment.
Exception: Removal is not necessary when helicopter is to be stored in hangar for short-term, providing all three jettison circuit breakers (P one on AC/ARMT circuit breaker panel and two in aft electrical compartment, or E M all three on AC/ARMT circuit breaker panel are open (OFF)), ground safety pins installed, jettison switches are OFF, and warning signs indicate that helicopter has an armed jettison system.

16-34. REMOVAL — IMPULSE CARTRIDGES.

a. Outboard Ejector Rack Impulse Cartridges.

Refer to paragraph 16-41 for removal procedures. (Accomplish 16-41 a. through 16-41 b. (4).)

b. Inboard Ejector Rack Impulse Cartridges.

Refer to paragraph 16-49 for removal procedures. (Accomplish 16-49 a through 16-49 b.

16-35. INSPECTION — IMPULSE CARTRIDGES.

a. Inspect cartridges for damage and corrosion.

b. Inspect cartridges for service life requirements (see NOTE below).

NOTE

A cartridge is considered unserviceable after ten insertions and removals from ejector rack. Each time a cartridge is removed, place a radial mark on the base of the cartridge with indelible ink. Monitor the service life by a record of inked markings and expiration date on cartridge case.

c. Inspect cartridges for shelf life (storage life) requirements. See NOTE below.

NOTE

The maximum shelf life for a cartridge is eight years from date of manufacture stamped on the cartridge. Cartridge must be used within 12 months from date of opening hermetically sealed shipping container. When opening a container, the service life expiration date (month and year) shall be marked on the side of the cartridge with indelible ink.

16-36. INSTALLATION — IMPULSE CARTRIDGES.

WARNING

Ensure that no external electrical power is applied to helicopter and that battery is disconnected before installing impulse cartridges.

Premaintenance Requirements For Installation of Impulse Cartridges

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	T66
Test Equipment	T77
Support Equipment	None

Premaintenance Requirements for Installation of Impulse Cartridges (Cont)

Conditions	Requirements
Minimum Personnel Required	One
Consumable Materials	None
Special Environmental Conditions	None

a. Using multimeter (T77), set for testing voltage, attach one lead to breech assembly and attach other lead to first one cartridge cavity firing contact, then the other. If no voltage is measured, proceed to step b. If voltage is measured, trace jettison circuitry (figure **P** F-28, **E** F-64, **M** F-111, wing stores wiring diagram) to locate and correct problem before proceeding.

WARNING

Ensure that no external electrical power is applied to helicopter and that battery is disconnected before installing impulse cartridges.

b. Visually inspect ejector rack and perform ground check, as required, to determine rack condition.

c. Install ground safety pin (1, figure 16-2).

d. Pull ejector piston out of housing to extend as far as possible.

e. Place a cartridge into each of two cartridge retainers (18, figure 16-3), or (9, figure 16-6) and screw into breech assembly. Torque retainers **40 TO 60** foot-pounds and lockwire (C137) cartridge retainers together.

f. Push ejector piston back into housing and seat.

16-37. EJECTOR RACKS.

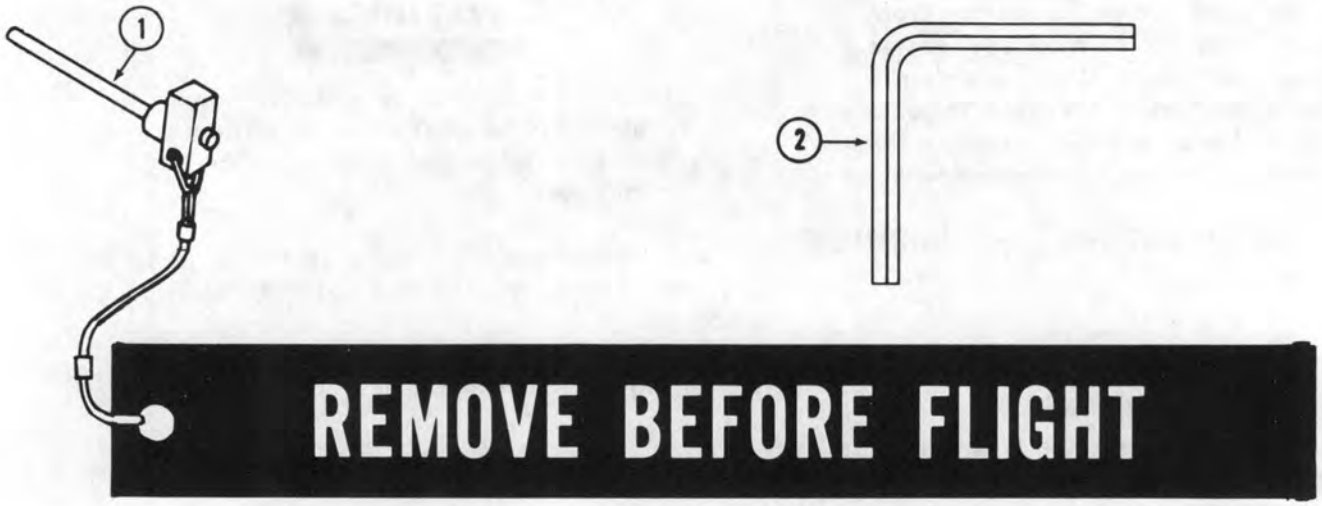
16-38. DESCRIPTION — EJECTOR RACKS.

Each rack has a pair of hooks for attachment of an armament pod or other stores, and incorporates a cartridge-fired ejector device for emergency jettison

of stores. The outboard ejector rack is adjustable in elevation by means of a hydraulic actuator. Each ejector rack contains two cartridges which can be fired electrically by pilot or gunner jettison switches. The ejector, when activated, automatically opens the hooks and forcibly ejects the pylon stores clear of the helicopter. During operations, stores are loaded or unloaded on the racks with a special wrench (T66)(2, figure 16-2) inserted into the HOOK MANUAL RELEASE and turned according to arrow markings. A special ground safety pin (1, figure 16-2) must be inserted into the GROUND SAFETY PIN HOLE of each rack when the helicopter is on the ground. The rack hooks will not open with the ground safety pins installed if the jettison mechanism is fired; however, the attached stores may be damaged by the ejector piston.

16-39. FUNCTIONAL TEST — EJECTOR RACKS.

Refer to paragraph P 9-438 or E 9-475 M 9-535 and perform wing stores jettison circuitry test.



1. Ground safety pin
2. Rack release wrench

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Figure 16-2. Special Tools For Ejector Racks

16-40. TROUBLESHOOTING — EJECTOR RACKS.

Refer to table P 16-1 or table E M 6-2.

NOTE

Before using tables, ensure all normal operational checks have been performed. If a malfunction is found which is not listed in tables notify the next higher level of maintenance.

Table 16-1 P Troubleshooting Ejector Racks

CONDITION TEST OR INSPECTION	CORRECTIVE ACTION
1. With WING STORES JTSN circuit breaker closed, the appropriate wing stores are not jettisoned when JETTISON SELECT switch is positioned to either INBD or OUTBD and pilot JETTISON switch is pressed.	
STEP 1. Check for defective wiring.	**Repair wiring (figure F-28).**
STEP 2. Check for defective WING STORES JTSN circuit breaker.	**Replace circuit breaker (paragraphs 9-27 and 9-29).**
STEP 3. Check for defective pilot JETTISON switch.	**Replace switch (paragraphs 9-20 and 9-22).**
STEP 4. Check for defective JETTISON SELECT switch.	**Replace switch (paragraphs 9-20 and 9-22).**
STEP 5. Check for defective diode between terminals 3 and 4 or 5 and 6 on terminal board (ITB13).	**Replace diode (paragraphs 9-20 and 9-22).**
STEP 6. Check for defective inboard or outboard jettison select relay (21K3).	**Replace relay (paragraphs 9-20 and 9-22).**
2. The appropriate wing stores are jettisoned on one side, but not the other when JETTISON SELECT switch is positioned to either INBD or OUTBD, and pilots JETTISON switch is pressed.	
STEP 1. Check for defective or improperly installed ejector rack cartridge.	**Replace cartridges and tighten retainers to specified torque (paragraph 16-41).**

Table 16-1. P Troubleshooting Ejector Racks (Cont)

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

STEP 2. Check for defective wiring.

Repair wiring (figure F-28).

STEP 3. Check for defective wing disconnect connectors.

(21J1-21P1, 21J3-21P3) or (21J2-21P2, 21J4-21P4) on the side which does not jettison.

Replace connector (paragraphs 9-20 and 9-22).

STEP 4. Check for defective pilot jettison switch relay (21K3).

Replace relay (paragraphs 9-20 and 9-22).

STEP 5. Check for defective JETTISON or JETTISON SELECT switch.

Replace switch (paragraphs 9-20 and 9-22).

3. With WING STORES JTSN circuit breaker closed, wing stores are not jettisoned when gunner WING STORES JETTISON switch is positioned to up position.

STEP 1. Check for defective wiring.

Repair wiring (figure F-28).

STEP 2. Check for defective WING STORES JTSN circuit breaker.

Replace circuit breaker (paragraphs 9-27 and 9-29).

STEP 3. Check for defective gunner WING STORES JETTISON switch.

Replace switch (paragraphs 9-20 and 9-22).

STEP 4. Check for continuity between pins B2 and B3 of jettison control relay (21K2) when WING STORES JETTISON switch is positioned to up position. Next check for required continuity between pins B2 and B1 of relay.

Replace relay if it fails check (paragraphs 9-20 and 9-22).

STEP 5. Check for defective jettison control relay (21K2) (inboard only).

Replace relay (paragraphs 9-20 and 9-22).

STEP 6. Check for defective firing circuit in rack.

Test continuity from rack connector to firing pin using multimeter (paragraph 9-438).

Replace rack if defective (paragraphs 16-41, 16-44, 16-49, and 16-52.)

Table 16-1. P Troubleshooting Ejector Racks (Cont)

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

4. Outboard ejector rack pylon fails to activate in elevation or depression.

STEP 1. Check that LCHR BORESIGHT SWITCH (in ammo compartment) is in proper position.

Position switch to OFF.

STEP 2. Defective hydraulic actuator.

Replace hydraulic actuator (paragraph 16-43).

STEP 3. Defective resolver.

Replace resolver (paragraphs 16-41 a. through 16-41 b. (5) and 16-44 f. and h.

STEP 4. Check for defective wiring between TSU and ejector rack pylon.

Repair wiring (figure F-28.)

5. Excessive torque required for manual release.

STEP 1. Dirty linkage in the release system.

Clean the rack (paragraph 16-47 or 16-53).

STEP 2. The hook pivot bolt may be damaged.

Replace the rack (paragraphs 16-41 and 16-44 or paragraphs 16-49 and 16-52).

STEP 3. The rack side plates may be distorted.

Replace the rack (paragraphs 16-41 and 16-44 or paragraphs 16-49 and 16-52).

CAUTION

Adjustment of sway brace bolts may affect boresighting. Sway brace bolts must be adjusted by armament personnel.

STEP 4. Sway brace bolts not unloaded.

Back off sway brace bolts.

Table 16-2. E M Troubleshooting Ejector Racks

CONDITION TEST OR INSPECTION	CORRECTIVE ACTION
1. With WING STORE PLT JETT circuit breaker closed (up), the appropriate wing stores are not jettisoned when JETTISON SELECT switch is positioned to either INBD or OUTBD and pilot JETTISON switch is pressed.	
STEP 1. Check for defective wiring.	**Repair wiring, Figure E F-64, M F-111.**
STEP 2. Check for defective WING STORE PLT JETT circuit breaker.	**Replace circuit breaker (paragraphs 9-27 and 9-29).**
STEP 3. Check for defective pilot JETTISON switch.	**Replace switch (paragraphs 9-20 and 9-22).**
STEP 4. Check for defective JETTISON SELECT switch.	**Replace switch (paragraphs 9-20 and 9-22).**
STEP 5. Check for defective pilot jettison switch relay (21K3).	**Replace relay (paragraphs 9-20 and 9-22).**
2. The appropriate wing stores are jettisoned on one side, but not the other when JETTISON SELECT switch is positioned to either INBD or OUTBD and pilot JETTISON switch is pressed.	
STEP 1. Check for defective or improperly installed ejector rack cartridge.	**Replace cartridges and tighten retainers to specified torque (paragraph 16-41).**
STEP 2. Check for defective wiring.	**Repair wiring Figure E F-64, M F-111.**
STEP 3. Check for defective wing disconnect connectors (21J1-21P1) or (21J2-21P2) on the side which does not jettison.	**Replace connector (paragraphs 9-20 and 9-22).**
STEP 4. Check for defective pilot jettison switch relay (21K3).	**Replace relay (paragraphs 9-20 and 9-22).**
STEP 5. Check for defective JETTISON or JETTISON SELECT switch.	**Replace switch (paragraphs 9-20 and 9-22).**

Table 16-2 E M Troubleshooting Ejector Racks (Cont)

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

3. With WING STORES GNR JETT circuit breaker closed (up), wing stores are not jettisoned when JTSN SEL switch is positioned to either INBD or OUTBD and gunner WING STORES JETTISON switch is positioned to up position.

STEP 1. Check for defective wiring.

Repair wiring Figure E F-64, M F-111.

STEP 2. Check for defective WING STORE GNR JETT circuit breaker.

Replace circuit breaker (paragraphs 9-27 and 9-29).

STEP 3. Check for defective gunner WING STORES JETTISON switch.

Replace switch (paragraphs 9-20 and 9-22).

STEP 4. Check for defective JTSN SEL switch.

Replace switch (paragraphs 9-20 and 9-22).

STEP 5. Check for defective jettison control relay (21K2) (inboard only).

Replace relay (paragraphs 9-20 and 9-22).

STEP 6. Check for defective firing circuit in rack.

Test continuity from rack connector to firing pin using multimeter (paragraph 9-492). Replace rack if defective (paragraphs 16-41, 16-44, 16-49, and 16-52).

4. Outboard ejector rack pylon fails to activate in elevation or depression.

STEP 1. Check that LCHR BORESIGHT SWITCH (in ammo compartment) is in proper position.

Position switch to OFF.

STEP 2. Defective hydraulic actuator.

Replace hydraulic actuator (paragraph 16-43 d.)

STEP 3. Defective resolver.

Replace resolver (paragraphs 16 41 b(5) and 16-44 f and h.

STEP 4. Check for defective wiring between TSU and ejector rack pylon.

Repair wiring Figure E F-64, M F-111.

Table 16-2. E M Troubleshooting Ejector Racks (Cont)

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

5. Excessive torque required for manual release.

STEP 1. Dirty linkage in the release system.

Clean the rack (paragraph 16-47 or 16-53).

STEP 2. The hook pivot bolt is damaged.

Replace the rack (paragraphs 16-41 and 16-44 or paragraphs 16-49 and 16-52).

STEP 3. The rack side plate is distorted.

Replace the rack (paragraphs 16-41 and 16-44 or paragraphs 16-49 and 16-52).

CAUTION

Adjustment of sway brace bolts may affect boresighting. Sway brace bolts must be adjusted by armament personnel.

STEP 4. Sway brace bolts not unloaded.

Back off sway brace bolts.

16-41. REMOVAL — OUTBOARD EJECTOR RACKS.

Premaintenance Requirements For Maintenance of Outboard Ejector Racks

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	T13, T66, T67, T82, T83
Test Equipment	T77
Support Equipment	S2, S12
Minimum Personnel Required	One
Consumable Materials	C19, C37, C58, C112, C113, C137
Special Environmental Conditions	None

Premaintenance Requirements For Maintenance of Outboard Ejector Racks (Cont)

WARNING

To prevent injury to personnel, ensure that all weapon systems are unloaded and all armament circuit breakers are OFF or out before starting any maintenance procedures or tests.

WARNING

Serious injury can result from accidental ground jettison of outboard ejector racks.

a. Preparation for Maintenance.

(1) Disconnect battery.

(2) Position all armament circuit breakers and switches to OFF.

WARNING

Ensure all stores are properly supported before removing ground safety pin (1, figure 16-2).

(3) Remove stores from rack using special rack release wrench (T66) (2, figure 16-2) for manual release.

b. Removal Procedures.

(1) Remove wing tip fairings from rack and outboard leading edge of wing.

(2) Disconnect electrical connectors from components on rack.

(3) Cut and remove lockwire from retainers (18, figure 16-3).

(4) Remove cartridge retainers (18) and cartridges from breech of ejector rack.

(5) Remove resolver and bracket (14) from outboard side of rack (21).

(6) Disconnect and remove accelerometer (17).

(7) Remove bolt (37), washers (36 and 35) nut (34), and cotter pin (33) connecting actuator (1) to sway brace assembly (22).

(8) Remove three nuts (39), three washers (38), three washers (31) and three bolts (32) connecting forward sway brace assembly (22) to forward end of rack (21)

(9) Remove three nuts (40), three washers (41), three washers (42) and three bolts (43) connecting aft sway brace assembly (10) to aft end of rack (21).

NOTE

Do not remove threaded shaft (5) from bolt on fitting assembly (2).

(10) Remove nut (13), washer (12) and cotter pin (11) from bolt on fitting assembly (2) and lift rack (21) outboard.

CAUTION

Take care not to damage threaded shaft (5) during removal and subsequent handling of fitting assembly (2).

(11) Remove fitting (2) from wing pylon.

(a) Disconnect hydraulic line from actuator (1).

(b) Remove two bolts (4) and two washers (3).

(c) Remove bolt (7) and washer (6), bolt (9), washer (8), bolt (19) and washer (20) and lift fitting (2) from wing pylon.

16-42. INSPECTION — OUTBOARD EJECTOR RACKS.

a. Visually inspect hydraulic actuator (1, figure 16-3) for leakage or damage.

b. Inspect electrical cables for fraying or damaged electrical connectors.

c. Visually inspect accelerometer (17) and resolver (14) for evidence of mechanical damage, binding, or misalignment.

d. Inspect for cracks, external corrosion, and cleanliness. If rack has been used to jettison stores, perform cleaning and inspection of ejector parts. (Refer to paragraphs 16-46 and 16-47).

e. The liners on the sway braces (10 and 22, figure 16-3) are subject to normal wear and tear and will be replaced at depot if worn excessively or if there is a high level of vibration.

(1) The clearance between the groove on the fitting assembly (2) and the tongue of the sway braces (10 or 22) must not exceed 0.020 inch. Remove fairings and disconnect servo actuator from fitting (2), and then move fitting (2) full up or full down. The clearances can be obtained by using a feeler gauge with all the components installed on the aircraft or by measuring the differences between the tongues and the grooves.

(2) If there is a high level of vibration transmitted into the aircraft due to excessive clearance, the sway braces will be returned to depot for repair.

16-43. REPAIR — OUTBOARD EJECTOR RACKS.

a. Replace any cracked, damaged or unserviceable hydraulic fittings or flexible lines.

b. Replace fairings if unserviceable.

c. Remove external superficial corrosion from rack by using crocus cloth (C37) or phosphoric solution (C19).

d. Replace rack hydraulic actuator (1, figure 16-3, if unserviceable.

(1) Disconnect electrical connectors to actuator (1).

(2) Remove hydraulic lines from actuator (1).

(3) Cap open hydraulic lines.

(4) Remove hydraulic fittings from inlet and outlet ports of actuator (1). Retain fittings for reinstallation.

(5) Cap inlet and outlet ports of actuator (1).

(6) Remove cotter pin (33), nut (34), washers (35 and 36), and bolt (37), securing lower end of actuator (1) to forward sway brace assembly (22).

(7) P Remove screw (30), washer (29), and spacer (27) from bracket (28) and actuator (1).

(8) Remove cotter pin (26), nut (25), washer (24), and bolt (23), securing upper end of actuator (1) to fitting assembly (2).

(9) Remove actuator (1) from helicopter.

NOTE

Rack hydraulic actuator is factory adjusted for proper length. Adjustment of actuator will be accomplished during final adjustment and boresighting of system.

(10) Remove caps (if installed) from inlet and outlet ports of actuator (1).

(11) Install hydraulic fittings in inlet and outlet ports of actuator (1).

(12) Position actuator (1) on fitting assembly (2) and forward sway brace assembly (22).

(13) Install bolt (23), washer (24), nut (25) and cotter pin (26) in upper end of actuator (1).

(14) P Install spacer (27), washer (29), and screw (30) on bracket (28) and actuator (1) as shown in view A.

(15) Install bolt (37), washers (36 and 35), nut (34), and cotter pin (33) in lower end of actuator (1).

(16) Install hydraulic lines on fittings of actuator (1).

(17) Connect electrical connectors to actuator.

(18) Bleed hydraulic system.

(a) P paragraph 7-3.

(b) E M paragraph 7-143.

(19) Perform alignment test (paragraph 16-45).

16-44. INSTALLATION — OUTBOARD EJECTOR RACKS.

a. Install fitting (2, figure 16-3) on end of wing.

(1) Position fitting (2) on wing pylon and connect hydraulic lines to actuator (12).

(2) Install two bolts (4) and two washers (3). Install washers with countersink toward head of bolt. Torque bolts **300 TO 333** inch-pounds. Lockwire (C137) bolts.

(3) Install bolt (19) and washer (20). Install washer with countersink toward head of bolt. Torque bolt **120 TO 160** inch-pounds. Lockwire (C137) bolt.

(4) Install bolt (7) and washer (6). Install washer with countersink toward head of bolt. Torque bolt **75 TO 95** inch-pounds. Lockwire (C137) bolt.

(5) Install bolt (9) and washer (8). Install washer with countersink toward head of bolt. Torque bolt **468-516** inch-pounds. Lockwire (C137) bolt.

b. Install rack (21) on bolt of fitting (2) and install washer (12), nut (13) and cotter pin (11).

c. Install sway forward brace assembly (22) on end of rack (21) with three bolts (32), three washers (31), three washers (38) and three nuts (39). Install washers with countersink side toward bolt head. Torque nuts **120 TO 160** inch-pounds.

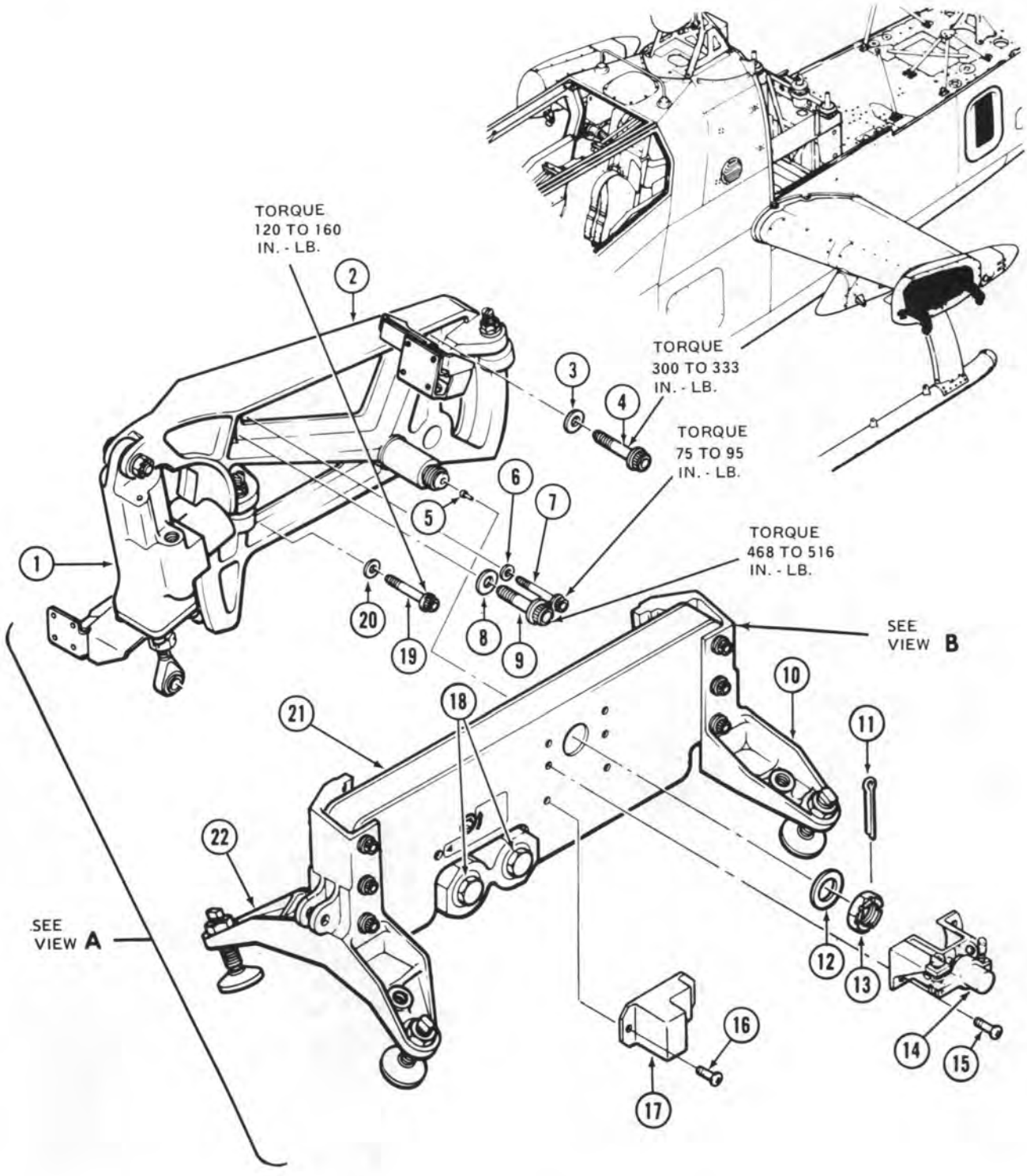
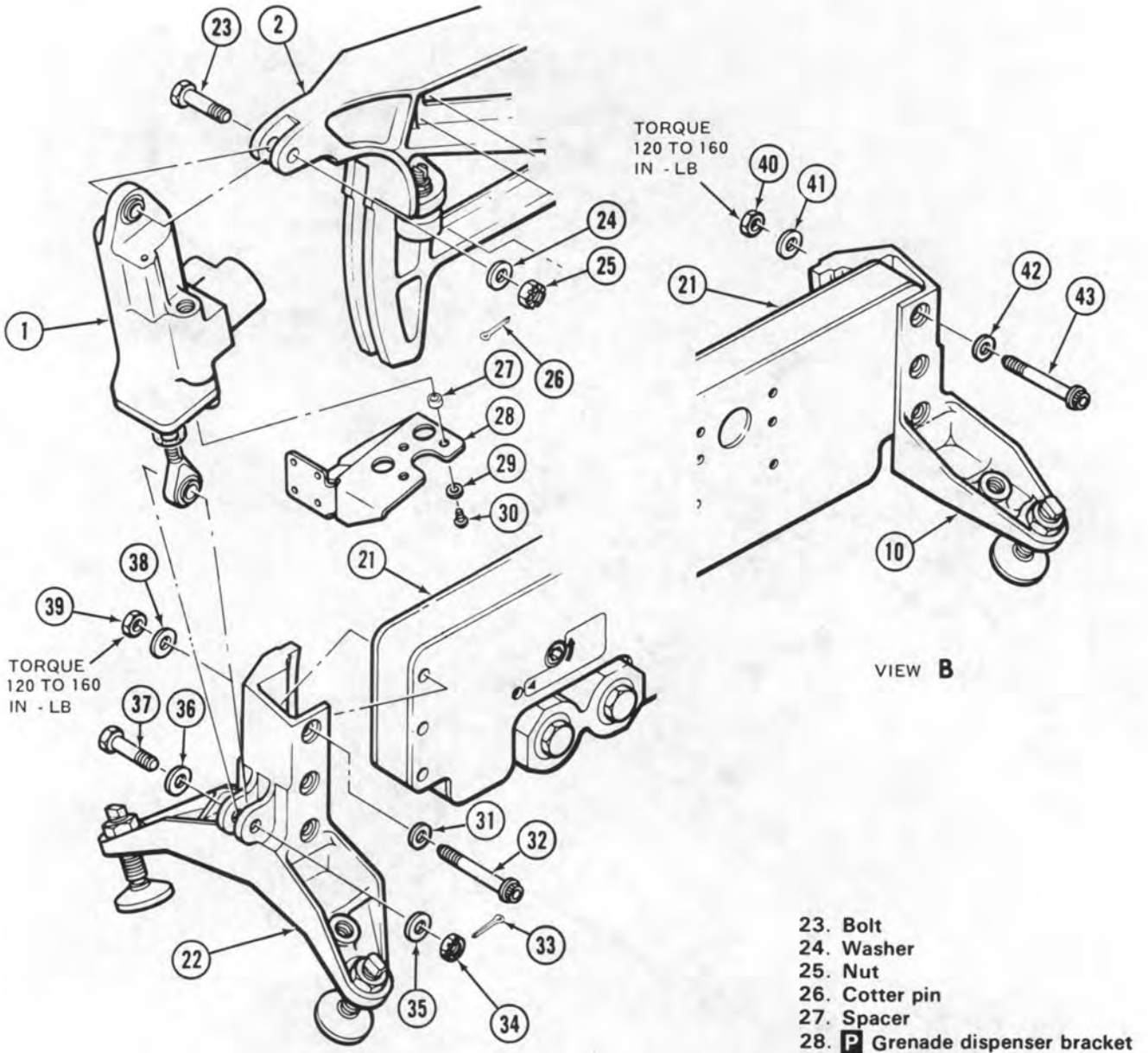


Figure 16-3. Outboard Ejector Rack Installation (Sheet 1 of 2)



1. Hydraulic actuator
2. Fitting assembly
3. Washer
4. Bolt
5. Threaded shaft
6. Washer
7. Bolt
8. Washer
9. Bolt
10. Aft sway brace assembly
11. Cotter pin
12. Washer
13. Nut
14. Resolver and bracket
15. Screw
16. Screw
17. Accelerometer
18. Cartridge retainer
19. Bolt
20. Washer
21. Rack
22. Forward sway brace assembly
23. Bolt
24. Washer
25. Nut
26. Cotter pin
27. Spacer
28. P Grenade dispenser bracket
29. Washer
30. Screw
31. Washer
32. Bolt
33. Cotter pin
34. Nut
35. Washer
36. Washer
37. Bolt
38. Washer
39. Nut
40. Nut
41. Washer
42. Washer
43. Bolt

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Figure 16-3. Outboard Ejector Rack Installation (Sheet 2 of 2)

d. Install aft sway brace assembly (10) on end of rack (21) in same manner. Install washers with countersink side toward bolt head. Torque nuts **120 TO 160** inch pounds.

e. Connect actuator (1) to forward sway brace (22) with bolt (37) washers (36 and 35) and nut (34). Install cotter pin (33).

f. Install resolver and bracket (14) with four screws (15).

g. Install accelerometer (17) with two screws (16).

h. Connect all electrical connectors.

WARNING

Do not install ejector cartridges in the ejector rack prior to alignment.

i. Perform alignment test (paragraph 16-45).

16-45. ALIGNMENT TEST — OUTBOARD EJECTOR RACKS.

The alignment test consists of adjusting the mechanical stops, pylon actuator and pylon resolvers.

a. Test Preparations.

Remove TSU nose fairing and outboard portions of outboard pylon fairings.

b. Elastomeric Stop Adjustment.

The following procedure is used to set the mechanical stops to allow a total of **12** degrees of ejector rack travel:

(1) Install TSU boresight device (T83) on pitch and roll pads of TSU.

(2) Loosen sway brace pads and install ejector rack alignment fixture (T82) on ejector rack hooks. Finger tighten sway brace pads.

(3) Disconnect hydraulic actuator (1, figure 16-4) from sway brace assembly (7) by removing bolt (8) from rod end of actuator.

(4) Position hydraulic actuator (1) so that ejector rack assembly (6) can be manually rotated without interference with actuator.

(5) Place gunner quadrant (T13) on TSU boresight device, level the bubble, and record the angle. (Note the nose-up or nose-down attitude.)

(6) Transfer gunner quadrant to ejector rack alignment fixture.

(7) Manually rotate ejector rack assembly (6) toward a nose-up attitude. Adjust forward mechanical stop (3) until the maximum pitch-up attitude of ejector rack assembly is **124.4** TO **128.8** mils (**7** degrees to **7** degrees, **15** minutes) greater than the angle recorded on TSU boresight device (step (5) and figure 16-4). Tighten forward locknut (2).

(8) Manually rotate ejector rack assembly (6) toward a nose-down attitude. Adjust aft mechanical stop (5) until the maximum pitch-down attitude of ejector rack assembly is **88.9** to **93.3** mils (**5** degrees to **5** degrees, **15** minutes) less than the angle recorded on TSU boresight device (step (5) and figure 16-4). Tighten aft locknut (4).

(9) Manually rotate ejector rack assembly toward a nose-up attitude. Adjust hydraulic actuator rod end until the nose-up attitude of the ejector rack is **71.1 (± 8.9) mils (4 ±(0.5) degrees) greater than the angle recorded on TSU boresight device (step (5) and figure 16-4).**

NOTE

One complete turn of hydraulic actuator rod end equals approximately 4 mils (0.25 degrees) elevation of the ejector rack.

(10) Reconnect hydraulic actuator (1) to sway brace assembly (7).

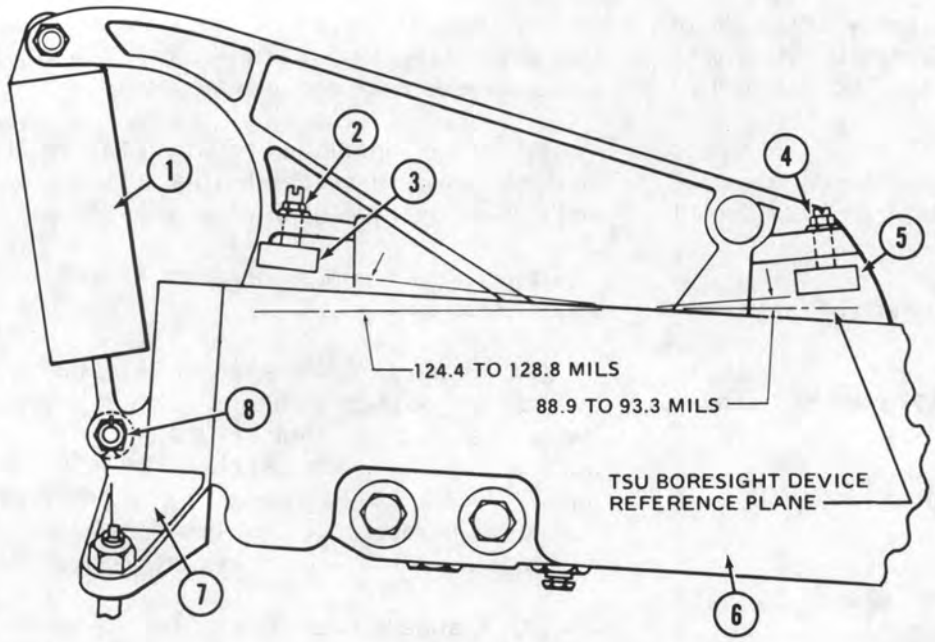
(11) Transfer ejector rack alignment fixture (T82) to the opposite pylon and repeat steps (2) through (10).

c. Control Switch Positions.

Position following switches as indicated:

(1) Pilot Armament Control Panel:

MASTER ARM	OFF
WPN CONT	GUNNER



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1. **Hydraulic actuator**
2. **Forward lock nut**
3. **Forward mechanical bumper stop**
4. **Aft lock nut**
5. **Aft mechanical bumper stop**
6. **Ejector rack assembly**
7. **Sway brace assembly**
8. **Bolt and nut**

Figure 16-4. Ejector Rack Alignment

(2) Electrical Power.

Check that helicopter battery is connected, then apply 28 Vdc power from electrical auxiliary power unit (S12).

(3) Circuit Breakers.

Engage the following circuit breakers:

(a) P

AC/ARMT CB PANEL	DC CB PANEL
WPN CONT	
WPN FIRE	CAUT LT
TURRET CONT	PLT INSTR LT
REF XFMR	DC VM
TOW PWR	INV MAIN
AC/ARMT CB PANEL	DC CB PANEL
28 VAC XFMR	INV STBY
SECU	

(b) E M

AC/ARMT CB PANEL	DC CB PANEL
WPN CONTR	
WPN FIRE	CAUT LT
E TURRET CONTR	PLT INST LT
M ARMT CONTR	
REF XFMR	DC VM
TMS PWR	INV
28 VAC XFMR	
SECU PWR	

(4) Power Switch Positions.

Position the following switches as shown:

(a) P

INV	MAIN
BAT	OFF
NON-ESNTL BUS	MANUAL
ELECT PWR/EMER OFF	ELEC PWR

(b) E M

BATTERY	RUN
NON-ESNTL BUS	MANUAL
ELEC PWR/EMER OFF	ELEC PWR
MASTER ARM	STBY

(5) Hydraulic Power.

Place pilot (or gunner) EMER HYDR PUMP switch to BORESIGHT position. (This applies limited hydraulic power to P turret and outboard pylon.)

d. Alignment Procedures.

(1) Turn MODE SELECT switch on the TCP to ARMED MAN.

(2) Position HI/LO MAG switch on left hand grip (LHG) to HI and verify that ACQ/TRK/STOW switch on sight hand control (SHC) is in the STOW position.

(3) Install ejector rack alignment fixture (T82) on ejector rack hooks.

(4) Activate left or right launcher with LCHR BORESIGHT switch, located in left ammo bay on the aft wall.

WARNING

Before turning pilot MASTER ARM switch to ARM position, keep hands clear of articulating outboard ejector rack assembly. Racks may move rapidly up or down.

(5) Position MASTER ARM switch to ARM.

(6) Loosen four setscrews on ejector rack resolver mount assembly.

(7) Place gunner quadrant (T13) on TSU boresight device, level the bubble, and record pitch angle. (Note the nose-up or nose-down attitude.)

(8) Transfer gunner quadrant to ejector rack alignment fixture, maintaining same fore and aft orientation as measured on TSU boresight device.

(9) Adjust fine adjustment screw on resolver mount assembly until the angle of ejector rack alignment fixture is **17.8** mils **±1.78** mils **(1 ±0.1)** degrees greater than the angle recorded on TSU boresight device.

NOTE

If proper adjustment is achieved, proceed to step (12). If proper adjustment cannot be achieved, return fine adjustment screw to the mid position and proceed to steps (10) and (11).

(10) Loosen resolver coarse adjustment screw and rotate body of resolver until approximate desired angle is achieved.

NOTE

If pylon will not stop at approximate desired angle, resolver may be out-of-phase. Rotate resolver 180 degrees and repeat step (10).

(11) Tighten resolver coarse adjustment screw and repeat step (9).

(12) Tighten four setscrews on resolver mount assembly.

(13) Check that the **17.8** mil difference did not change after tightening setscrews.

(14) Deactivate and activate the LCHR boresight switch several times to ensure rack will stow and lock.

NOTE

If rack will not lock in the stow position, determine which direction to adjust the hydraulic actuator rod end to ensure proper locking. (e.g., If downward pressure on aft end of rack alignment fixture will cause actuator to lock; the actuator rod end should be extended until the stowing mode will lock the rack.)

(15) Transfer ejector rack alignment fixture to opposite ejector rack hooks and repeat steps (4) through (13).

WARNING

Do not install cartridges in ejector racks prior to continuity test.

e. Using multimeter (T77), perform electrical continuity test of wing stores jettison circuits (paragraph P 9-438, E 9-492 or M 9-552).

NOTE

Adjust ejector foot pad (16, figure 16-7) to snugly fit the specific armament weapon installed.

f. Install cartridges in breech assembly (paragraph 16-36).

16-46. DISASSEMBLY FOR CLEANING AFTER JETTISON — OUTBOARD EJECTOR RACKS.

As soon as possible after ejector rack has been used to jettison stores, perform cleaning procedure as follows:

a. Remove outboard ejector rack (paragraph 16-41).

WARNING

To prevent injury to personnel, ensure that all weapon systems are unloaded and all armament circuit breakers are OFF or out before starting any maintenance procedures.

To prevent injury to personnel, make certain no live cartridges are installed in the breech prior to disassembly.

b. Remove two cartridge retainers (16, figure 16-5) to ensure no live cartridges are installed. Remove and discard any fired cartridges. Dispose of live cartridges in accordance with prescribed ordnance procedures.

CAUTION

When sideplate is removed from remainder of ejector rack, shackles and linkage will fall out if remaining assembly is inverted. During disassembly, remove required screws from right (bottom) sideplate first so that rotation will not be required after left sideplate is loosened.

c. Remove three screws (33) from right sideplate (13) (two from aft closeout and one i.. cylinder cap)

d. Cut lockwire and remove retainer (26) with piston (21) and spring (19) from breech.

e. Pull piston (21) out of retainer (26), then remove and discard packings (20, 28 and 29).

f. Remove ejection cylinder (7), ejection piston (5), foot (18) and packing (17) from breech as an assembly.

g. Unscrew foot (18) from ejection piston (5) and push ejection piston (5) up out of ejection cylinder 7). Remove and discard packing (17) from inside lower end of ejection cylinder (7).

h. Remove nut (31), two washers (30 and 2) and bolt (1); then place ejector rack on a clean workbench with the left sideplate (24) up for remainder of disassembly.

i. Remove nut (23), washer (22) and screw (25) from forward end of breech and left sideplate (24).

j. Remove four screws (27) securing left sideplate (24) to four spacers (14).

k. Remove four screws (32) securing left sideplate (24) to mounting column.

l. Remove four screws (34) securing left sideplate (24) to two bumper pads and forward closeout, then remove remaining screw (23) from cylinder cap (8).

m. Carefully lift left sideplate (24) off remainder of assembly, tapping sideplate at openings where linkage, shackles, and spring retainers fit into bushings. Ensure that left sideplate (24) separates

from shackles and linkage trunnions that must remain seated in right sideplate (13).

n. Move cylinder cap (8) out slightly away from right sideplate (13) to clear pin from bushing and lift cylinder cap (8) off gas tube (4). Remove and discard packing (6) from inside cylinder cap (8).

o. Pull gas tube (4) out of breech; then remove and discard two packings (3).

p. Clamp cylinder cap (8) in a vise that has padded jaws. Cut lockwire and remove orifice holder (9) from cylinder cap (8). Remove and discard packings (10 and 11) and backup ring (12)

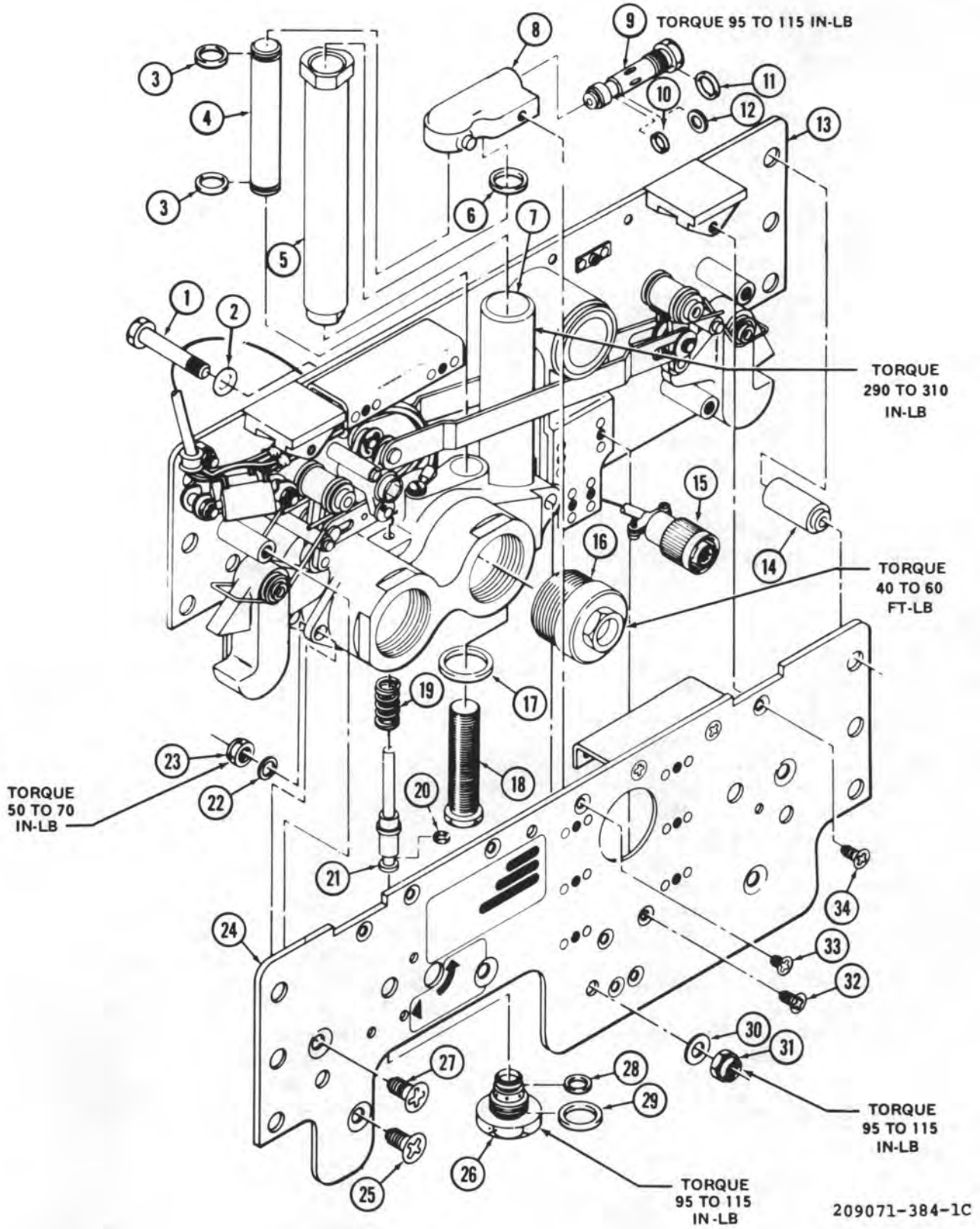

Figure 16-5. Outboard Ejector Rack Assembly (Sheet 1 of 2)

1. Bolt
2. Washer
3. Packing
4. Gas tube
5. Ejection piston
6. Packing
7. Ejection cylinder
8. Cylinder cap
9. Orifice holder
10. Packing
11. Packing
12. Back-up ring
13. Right sideplate
14. End spacer
15. Electrical plug
16. Cartridge retainer
17. Packing
18. Foot
19. Spring
20. Packing
21. Piston
22. Washer
23. Nut
24. Left sideplate
25. Screw
26. Retainer
27. Screw
28. Packing
29. Packing
30. Washer
31. Nut
32. Screw
33. Screw
34. Screw

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Figure 16-5. Outboard Ejector Rack Assembly (Sheet 2 of 2)

16-47. CLEANING/INSPECTION — OUTBOARD EJECTOR RACKS.

NOTE

After removal from the ejector rack, the ballistic components and the breech and ejection cylinder in the partially assembled ejector rack are cleaned to remove residue from the fired cartridges and then visually inspected for evidence of damage. The opening in the orifice is critical and must be checked for size as well as carefully cleaned. When visual inspection indicates evidence of wear or damage, send ejector rack to next higher maintenance level.

a. Clean components of the ballistic system using a warm solution of warm water and detergent (C113), and a soft bristle brush to loosen any caked residue.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

b. Rinse parts using dry cleaning solvent (C112) to remove moisture.

WARNING

To prevent injury to eyes, wear eye protection when using compressed air.

c. Dry all parts, particularly passages in breech and retainers, using a clean, lint-free cloth and filtered, low pressure air.

d. Ensure all loose matter is removed after cleaning and drying.

CAUTION

The sizes of openings in orifice holder (9, figure 16-5) are critical, and sharp objects such as drill bits shall not be used for cleaning out these openings. An increase in the 0.0370 ±0.005 inch diameter of center orifice will increase thrust applied to the ejector piston. An increase of 0.002 inch above maximum can increase the thrust as much as 20 percent.

NOTE

When necessary, use the shank of a drill bit 0.0370 inch in diameter to open center orifice (and the shank of a drill bit 0.060 inch in diameter for side orifices).

e. Use a soft wire (copper or brass) approximately **0.0370** inch in diameter to clean orifice in orifice holder (9). Ensure center and side openings are clear (approximately **0.060** inch diameter).

f. Inspect parts as follows:

(1) Visually examine all parts for cleanliness, evidence of corrosion, cracks and damaged threads.

(2) Visually examine openings in orifice holder (9) for obstruction and obvious distortion such as dents or cuts in area around openings. If damage is suspected, send ejector rack to next higher level of maintenance.

(3) Roll spring (19) across a flat surface to check for distortion.

(4) If dimensional or thread damage is suspected, send ejector rack to next higher level of maintenance.

16-48. ASSEMBLY — OUTBOARD EJECTOR RACKS.

NOTE

Exercise care in handling partially disassembled ejector rack during assembly to prevent accidental disassembly of shackles, linkage, and spring retainer spacers from bushings in right sideplate. Parts are spring loaded and if loosened from bushings, will fall out of partially assembled ejector rack causing additional assembly.

NOTE

Apply a light coating of silicone grease (C59) to all packings and back-up rings prior to installation.

a. Apply a light coating of silicone grease (C59) to packings (10 and 11, figure 16-5) and back-up ring (12) and install on orifice holder (9) in sequence shown in figure 16-5.

b. Install assembled orifice holder (9) in cylinder cap (8). Clamp cylinder cap in a vise to permit tightening and torque orifice holder (9) **95 TO 115** inch pounds. Lockwire (C137) cylinder cap (8) to orifice holder (9).

c. Install lubricated packing (6) inside groove in cylinder cap (8) to seal ejection cylinder (7).

d. Install lubricated packing (3) on each end of gas tube (4) and insert gas tube in opening in cylinder cap (8). Ensure packing (3) remains seated in groove.

e. Position cylinder cap (8) and gas tube (4) in partially assembled ejector rack, inserting end of gas tube in breech and trunnion of cylinder cap in bushing of right sideplate (13).

f. Install lubricated packing (17) in groove inside lower end of ejection cylinder (7), and insert ejection piston (5) inside ejection cylinder, extending end of piston out through end of cylinder. Do not bottom out piston in cylinder.

g. Holding ejection piston (5) at wrenching flats on end of piston, thread foot (18) into end of ejection piston (5). Do not bottom out foot to piston.

h. Install lubricated packings (28 and 29) in grooves in retainer (26).

i. Install lubricated packing (20) in groove in piston (21) and insert base of piston into opening in retainer (26).

j. Place spring (19) over piston (21) and install spring, piston and retainer (26) into breech. Do not tighten at this time.

k. Apply a light coating of grease (C58) to the exposed trunnions of the two shackles, the two shackle locking link-trunnions, and the hexagon release wrench trunnion. Ensure all six end spacers (14) are in bushings in right sideplate.

l. Position left sideplate (24) over partially assembled ejector rack, and, using a punch or other blunt object, align shackle, linkage trunnions and spring retainer spacer to bushing of left sideplate.

Install four screws (27) in sideplate and four bushings to retain sideplate while aligning the trunnions and spacers to bushings.

NOTE

The spring retainer spacers can be aligned by inserting a blunt screwdriver in opening at bottom of ejector rack to carefully move spacers.

m. After two shackle trunnions, three linkage trunnions and two spring retainer spacers are into bushings in right and left sideplates, check springs to ensure coils are not between shoulder of trunnions and sideplate, and tighten the four screws (27).

n. Install and tighten screw (35), four screws (34) and four screws (32).

o. Install bolt (1), two washers (30 and 2) and nut (31), placing one washer under head of bolt and one under nut. Torque nut (31) **95 TO 115** inch-pounds.

p. Install screw (24), washer (22) and nut (23). Torque nut on screw through both sideplates **50 TO 70** inch-pounds.

q. Install assembled ejection cylinder (7), ejection piston (5), packing (17) and foot (18) into breech, inserting end of cylinder into cylinder cap (8).

r. Torque retainer (26) in breech **95 TO 115** inch-pounds.

s. Torque ejection cylinder (7) in breech **290 TO 310** inch-pounds and lockwire (C137) ejection cylinder (7) to retainer (26).

t. Install two cartridge retainers (16) in breech. Tighten the two cartridge retainers finger tight. Do not install lockwire at this time.

16-49. REMOVAL — INBOARD EJECTOR RACKS.

Premaintenance Requirements For Maintenance of Inboard Ejector Racks

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All

Premaintenance Requirements For Maintenance of Inboard Ejector Racks (Cont)

Conditions	Requirements
Special Tools	T13, T66
Test Equipment	T77
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	C19, C37, C60, C78, C112
Special Environmental Conditions	None

WARNING

To prevent injury to personnel, ensure that all weapon systems are unloaded and all armament circuit breakers are OFF or out before starting any maintenance procedures or tests.

Serious injury can result from accidental ground jettison of inboard ejector racks.

a. Preparation for Maintenance.

(1) Disconnect battery.

(2) Position all armament circuit breakers and switches to OFF

WARNING

Ensure all stores are properly supported before removing ground safety pin (1, figure 16-2).

(3) Remove stores from rack using special rack release wrench (T66) (2, figure 16-2) for manual release.

b. Removal Procedures.

(1) Remove fairings (1, figure 16-6) from rack (12) and inboard leading edge of wing.

(2) Disconnect rack electrical cable (15) from connector in wing.

(3) Cut and remove lockwire from two cartridge retainers (9).

(4) Remove two cartridge retainers (9) and cartridges from breech assembly.

(5) Remove bolt (14), nut and washers to detach fork (13) of elevation adjustment fitting from front of rack. Do not change length of fitting.

(6) Remove two bolts (3), two nuts and washers to detach two turnbuckles (16) from fittings (2) on wing. Do not change length of turnbuckles.

(7) Remove lockwire and eight bolts, with washers and shims, to detach rack fittings (4) and remove rack assembly from wing. Observe locations of any shims for reinstallation.

NOTE

If rack is being removed to clean ejector, steps (8) and (9) are not required.

(8) Remove bolts (5, 6 and 10) to detach fittings from rack. Keep any shims found on bolts (5 and 10) for reinstallation.

(9) When necessary, remove attaching nuts and screws to separate inboard fittings and brace.

16-50. INSPECTION — INBOARD EJECTOR RACKS.

a. Visually inspect all fittings for cracks, damage, and serviceable condition.

b. Inspect sway brace pads (11, figure 16-6), for security and ensure that locknut is securely in place.

c. Inspect fairing (1) for damage and serviceable condition.

d. Inspect ejector rack for corrosion, distortion of any parts, and evidence of damage.

e. Inspect electrical cable (15) for fraying or damaged connector.

f. Inspect rack for cleanliness. If rack has been used to jettison stores, perform cleaning and inspection of ejector parts (paragraph 16-53).

16-51. REPAIR — INBOARD EJECTOR RACKS.

a. Replace any cracked, damaged, or unserviceable fittings.

b. Replace fairing (1) if unserviceable.

c. Remove corrosion from rack by using crocus cloth (C37) or phosphoric solution (C19).

16-52. INSTALLATION — INBOARD EJECTOR RACKS.

a. Assemble fittings (4, figure 16-6) if removed, on ejector rack (12) with bolts (5, 6 and 10). Ensure that original shims are in place between fittings on bolts (5 and 10). Use thin steel washers under bolt heads and nuts (do not fully tighten bolts at this time).

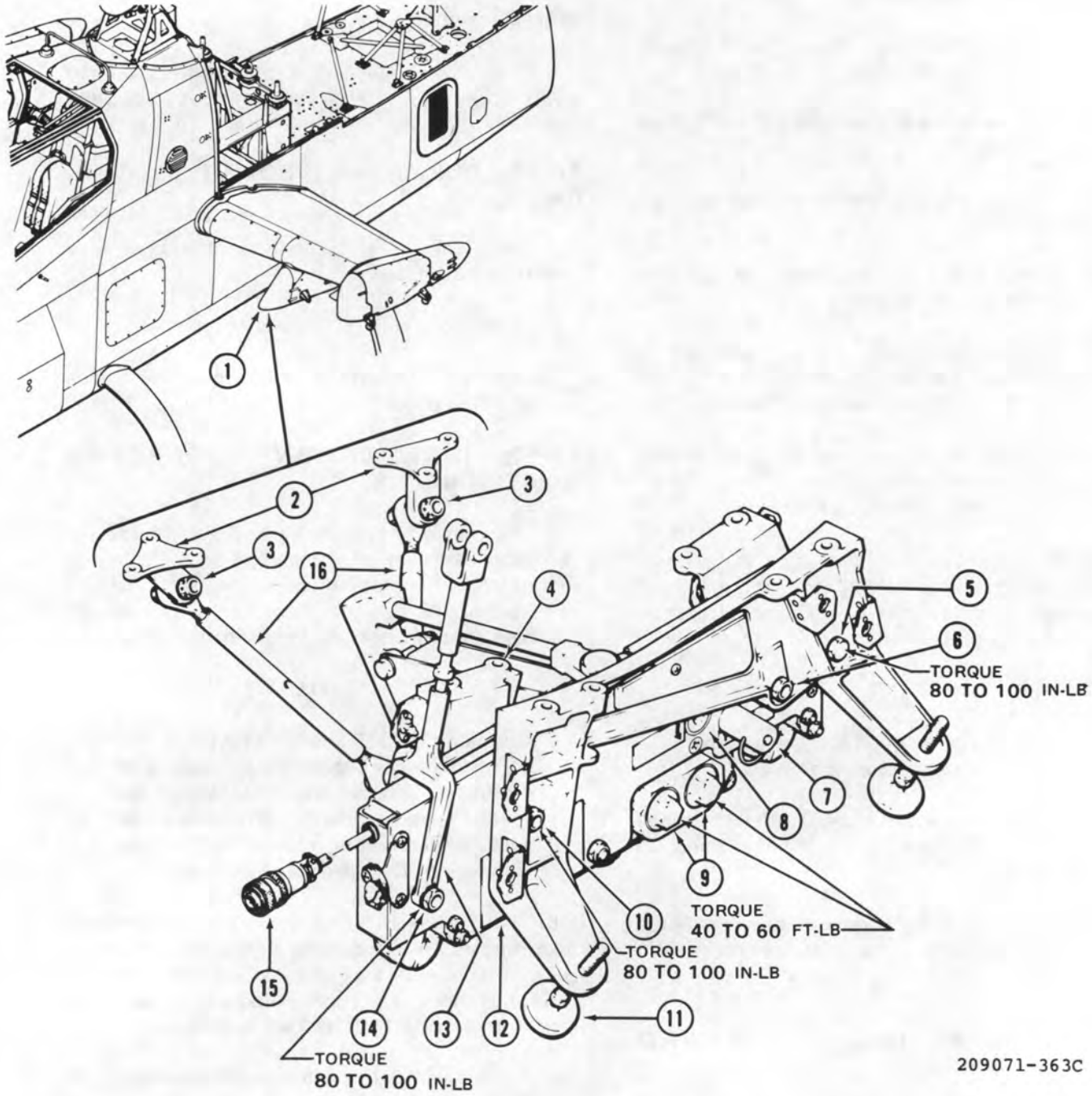
NOTE

Shims on bolts (5 and 10) provide 1.375 to 1.380 inches between inside bosses of fittings at hole for bolt (6). If shims are lost or mixed, assemble fittings without rack and prepare shims for correct dimension, then proceed with step b.

b. Lift rack and fitting assemblies in position. Align fittings (4) to mounting holes and install four pairs of bolts with washers, using shims between wing and fittings at locations noted during removal of rack. Torque bolts **100 TO 140** inch-pounds.

c. Align fork (13) to forward hook pivot of rack, and install bolt (14) with thin steel washers under head and nut. Align two turnbuckles (16) to fittings (2), and install two bolts (3) with thin washers under heads and nuts. If bolts do not fit freely, change or add shims between wing and fittings (4) to obtain alignment. Use no more than one shim per bolt.

d. Using gunner quadrant (T11), check rack for nose-up elevation of **71.1** (**±8.9**) mils (**4** (**±0.5**) degrees) with respect to fore and aft attitude of helicopter. If necessary to adjust rack, remove bolt (14) and adjust length of fork (13). Reinstall fork (13) to



1. Fairing
2. Fitting
3. Bolt
4. Fitting
5. Bolt
6. Bolt
7. Quick release pin
8. Manual release
9. Cartridge retainer
10. Bolt
11. Sway brace pad
12. Rack
13. Fork
14. Bolt
15. Cable
16. Turnbuckle

Figure 16-6. Inboard Ejector Rack Installation

(14), washers and nuts, and check for required angle Repeat as necessary to achieve required angle.

e. When alignment of rack is satisfactory, lockwire (C137) bolts attaching fittings to wing in pairs. Torque bolts (6, 10 and 14) **80 TO 100** inch-pounds. Tighten bolt (5).

NOTE

Adjust ejector foot pad (16, figure 16-7) to snugly fit the specific armament weapon installed.

f. Check manual release (8) operation of rack.

WARNING

Do not install cartridges in rack prior to continuity test.

g. Connect rack electrical cable (15) to connector in leading edge of wing. Using multimeter (T77), perform electrical continuity test of wing stores jettison circuits (paragraph P 9-438, E 9-492 or M 9-552).

h. Install impulse cartridges (9) and cartridge retainers (10) (paragraph 16-36).

i. Install fairings (1) on wing leading edge and ejector rack (12).

16-53. CLEANING AFTER JETTISON — INBOARD EJECTOR RACKS.

Perform cleaning procedure as soon as possible after ejector rack has been used to jettison stores.

NOTE

Inboard ejector rack must be removed from wing, but fittings can remain attached to rack (paragraph 16-49).

a. Remove slave piston (12, figure 16-7) and compression spring (11) by removing retaining plug (15) and packings (14, 5 and 13).

NOTE

Pins (8) are not used in this rack installation. Cartridge retainers (10) and cartridges (9) will have been removed during removal of rack.

b. Remove plug (6) and breech plug (22).

c. Remove gas tube retainer (4) and gas tube assembly (3).

d. Remove piston retainer (18) and piston (21).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prlonged breathing of solvent vapors and contact with skin or eyes.

e. Clean all internal surfaces of piston block and piston housing (1) with solvent (C112), using bore brushes to clean gas passages. Clean all removed parts with same solvent.

CAUTION

To avoid excessive wear, clean firing contacts with a cloth and solvent only. Ensure that no dirt or portions of old cartridges remain in cartridge cavity.

f. Coat all cleaned surfaces and parts with a very light coating of oil (C78). Parts should be almost dry. Cartridge cavity shall be left dry.

g. Coat all packings with grease (C60).

h. Replace any unserviceable parts.

NOTE

Gas tube retainer (4) should be alternated between right and left inboard racks after each firing to minimize concentration of gas erosion on beveled surface at bottom of retainer. Retainer shall be replaced if erosion of beveled surface reaches center hole.

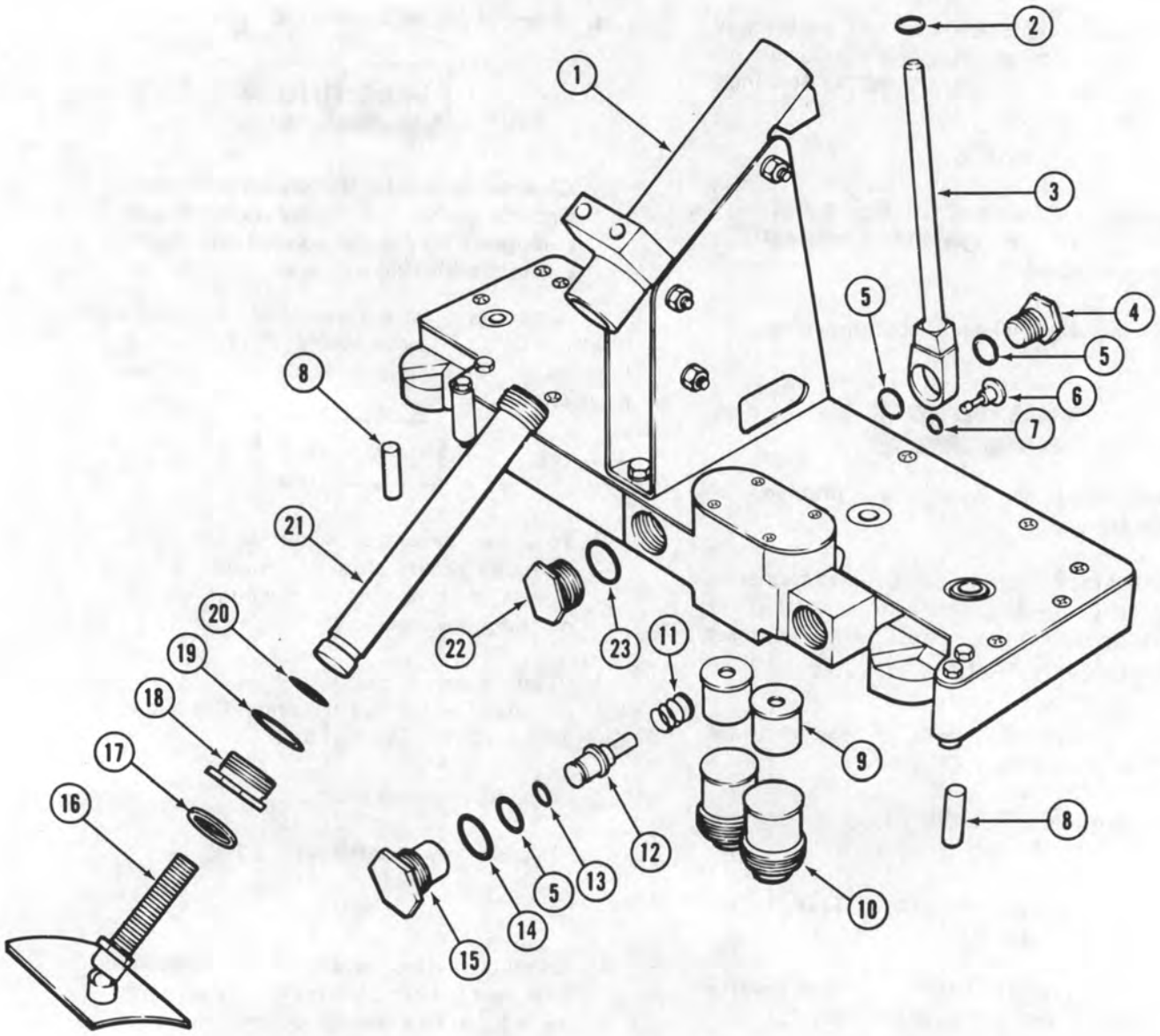
i. Reassemble rack.

(1) Position packing (19) on piston (21) and insert piston into piston housing (1).

(2) Install packing (19) on piston retainer (18). Install piston retainer.

(3) Install packing (2) on gas tube assembly (3). Install packings (5) and gas tube retainer (4).

(4) Install packing (23) on breech plug (22) and install plug.



1. Piston housing
2. Packing
3. Gas tube assembly
4. Gas tube retainer
5. Packing
6. Plug
7. Packing
8. Pin
9. Cartridge
10. Cartridge retainer
11. Compression spring
12. Slave piston
13. Packing
14. Packing
15. Retaining plug
16. Ejector foot pad
17. Retaining ring
18. Piston retainer
19. Packing
20. Packing
21. Piston
22. Breech plug
23. Packing

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Figure 16-7. Inboard Ejector Rack Assembly

(5) Install packing (7) on plug (6) and install plug.

(6) Install packings (5 and 14) on retaining plug (15).

(7) Install packing (13) on slave piston (12).

(8) Install compression spring (11), slave piston (12), and retaining plug (15).

j. Reinstall rack assembly on pylon (paragraph 16-52.)

16-54. EJECTOR RACK FAIRINGS.

16-55. INSPECTION — EJECTOR RACK FAIRINGS.

Inspect inboard and outboard fairings (figure 16-8) for cracks, damage and serviceable condition.

16-56. REMOVAL — EJECTOR RACK FAIRINGS.

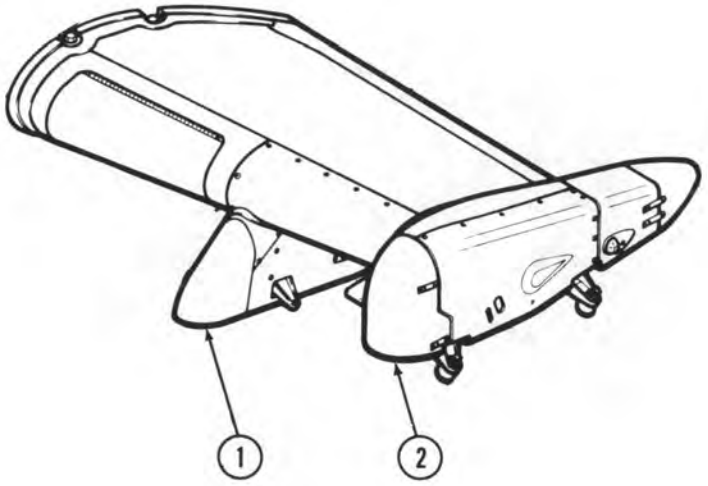
Remove inboard and outboard fairings (figure 16-8) from rack and leading edge of wing by removing screws and releasing the fasteners.

16-57. REPAIR — EJECTOR RACK FAIRINGS.

Replace any fairings that are damaged severely enough to prohibit proper functioning of ejector rack. Repair inboard and outboard fairings per TM 55-1500-204-25/1.

16-58. INSTALLATION — EJECTOR RACK FAIRINGS.

Install inboard and outboard fairings (figure 16-8) to the wing by locking fasteners and adding screws.



1. **Inboard ejector fairing**
2. **Outboard ejector fairing**

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Figure 16-8. Wing stores pylon and fairings

CHAPTER 17

EMERGENCY EQUIPMENT

17-1. CANOPY REMOVAL SYSTEM.

17-2. DESCRIPTION — CANOPY REMOVAL SYSTEM.

The canopy removal system (CRS) consists of two window cutting assemblies (WCAs), two hinge cutting assemblies, two thrusters, two pin pullers, two arming/firing mechanisms (A/F), twelve interconnecting lines, and two inert manifolds (figure 17-1). Manual operation of any one of the two A/F mechanisms will cause explosive energy to be generated and routed by the shielded mild detonating cords (SMDCs) through the manifold to all other CRS components. The system then functions such that the two WCAs sever the gunner right and pilot left fixed window acrylic material around each window's periphery. Two linear shaped charge assemblies (LSCAs) sever both door hinges, the thrusters release both door match mechanisms and the pin pullers release both door counterpoise struts. The result is complete jettisoning of both doors and both fixed window transparencies.

WARNING

Ensure that both the pilot and gunner arming/firing mechanism handles are secured with safety pins (37 and 38, figure 17-1) prior to entry into the cockpit area.

17-3. WINDOW CUTTING ASSEMBLY.

17-4. DESCRIPTION — WINDOW CUTTING ASSEMBLY.

The window cutting assemblies (1 and 20, figure 17-1) are mounted to the pilot and gunner window frames as shown in figure 17-1.

Premaintenance Requirements For Window Cutting Assembly

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C74), (C75), (C105), (C137)
Special Environmental Conditions	None

WARNING

Ensure that both the pilot and gunner arming/firing mechanism handles are secured with safety pins (37 and 38, Figure 17-1) prior to entry into the cockpit area.

17-5. INSPECTION — WINDOW CUTTING ASSEMBLY.

Inspect window cutting assemblies (1 and 20, figure 17-1) for cracks.

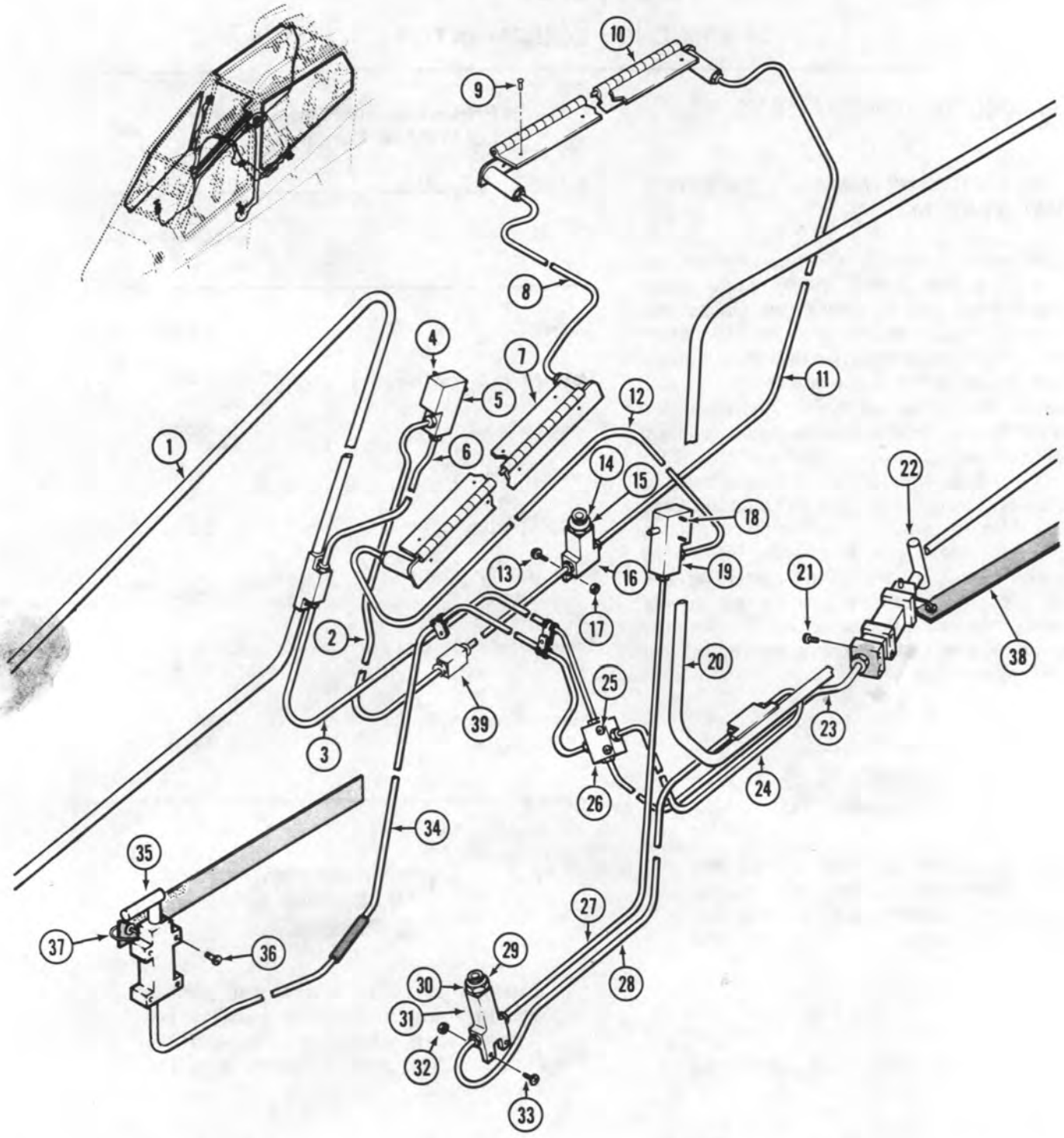

Figure 17-1. Canopy Removal System (Sheet 1 of 2)

1. Window cutting assembly
2. Pin puller interconnect line
3. Window cutter interconnect line
4. Screw
5. Pin puller
6. Window cutter interconnect line
7. Linear shaped charge assembly
8. Linear shaped charge assembly interconnect line
9. Rivet
10. Linear shaped charge assembly
11. Linear shaped charge assembly interconnect line
12. Linear shaped charge assembly interconnect line
13. Screw
14. Jamnut
15. Shim
16. Thruster
17. Nut
18. Screw
19. Pin puller
20. Window cutting assembly
21. Screw
22. Arming/firing mechanism
23. Arming/firing mechanism interconnect line
24. Window cutter interconnect line
25. Screw
26. Junction manifold
27. Pin puller interconnect line
28. Window cutter interconnect line
29. Shim
30. Jamnut
31. Thruster
32. Nut
33. Screw
34. Arming/firing mechanism interconnect line
35. Arming/firing mechanism
36. Screw
37. Ground safety pin
38. Ground safety pin
39. In-line connector

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Figure 17-1. Canopy Removal System (Sheet 2 of 2)

17-6. REMOVAL — WINDOW CUTTING ASSEMBLY. (AVIM).

a. Disconnect interconnect lines (3 and 6, or 24 and 28, figure 17-1) from adapter on window cutting assembly (1 or 20). Cap lines.

b. M Disconnect and remove air data subsystem wiring at aft upper corner of window cutting assembly (1).

c. Remove screws securing window transparency and window cutting assembly to window frame and remove cutting assembly.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

CAUTION

Do not allow any ketone-type solvents to contact window transparencies. These solvents will damage the transparencies by attacking the plastic materials.

d. Use a putty knife or other suitable tool to loosen sealant. Clean sealant from window transparency with naphtha (C75), and from frame with MEK (C73).

17-7. REPAIR OR REPLACEMENT — CRACKED WINDOW CUTTING ASSEMBLY.

Replace window cutting assembly if cracked or damaged.

17-8. INSTALLATION — WINDOW CUTTING ASSEMBLY. (AVIM)

a. Position window cutting assembly (1 or 20, figure 17-1) in place between window transparency and door frame.

b. Use holes in window frame as a guide and drill holes through window cutting assembly and window glass using a hole finder. Use fasteners as holes are drilled to maintain alignment.

c. After all holes are drilled remove glass and window cutting assembly from frame and clean all cuttings from parts.

d. Apply sealant (C105) to faying surfaces of window cutting assembly.

e. Place window cutting assembly (1 or 20) and glass on window frame and install mounting screws.

f. Ⓜ Route and connect air data subsystem wiring at aft upper corner of window cutting assembly (1).

g. Connect interconnect line end fitting (3 and 6 or 24 and 28) to window cutting assembly. Torque nut **30 TO 45** inch-pounds.

17-9. LINEAR SHAPED CHARGE ASSEMBLY.

17-10. DESCRIPTION — LINEAR SHAPED CHARGE ASSEMBLY.

The linear shaped charge assemblies (7 and 10, figure 17-1) are mounted to the canopy frame inboard of the top of the pilot and gunner doors. In case of an emergency the charge assembly will sever the door hinge.

WARNING

Ensure that both the pilot and gunner arming/firing mechanism handles are secured with safety pins (37 and 38, figure 17-1) prior to entry into the cockpit area.

17-11. INSPECTION — LINEAR SHAPED CHARGE ASSEMBLY.

Inspect linear shaped charge assembly (7 or 10, figure 17-1) and plastic covering for the following:

a. Security.

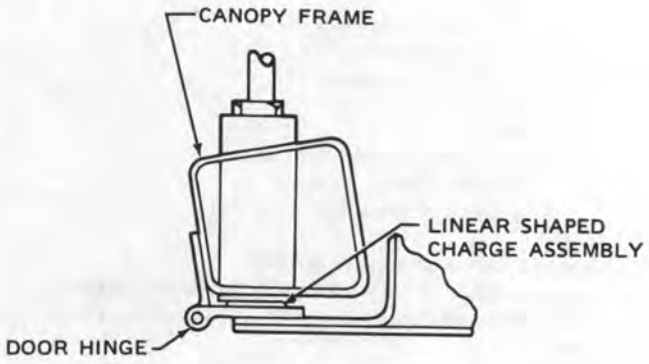
b. Nicks, dents, scratches, and corrosion in accordance with figure 17-2.

c. Inspect linear explosive for damage or cracks.

17-12. REMOVAL — LINEAR SHAPED CHARGE ASSEMBLY (AVIM).

a. Remove door from helicopter (paragraph 2-131).

b. Disconnect interconnect lines (8 and 11 or 12, figure 17-1) from each end of linear shaped charge assembly (7 or 10). Cap lines.



VIEW A

1. **Nicks, dents, scratches, and corrosion are acceptable along entire length of linear shaped charge assembly or plastic covering if depth does not exceed 0.010 inch when polished out to remove damage.**
2. **Cuts, breaks, or tears in plastic tube covering are not acceptable.**

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Figure 17-2. Damage Limits — Linear Shaped Charge Assembly

c. Remove rivets (9) securing linear shaped charge assembly to door frame and disengage assembly from frame.

17-13. INSTALLATION — LINEAR SHAPED CHARGE ASSEMBLY. (AVIM).

a. Position linear shaped charge asembly in place on canopy frame.

b. Using a hole finder drill holes in linear shaped charge assembly (7 or 10, figure 17-1) to match holes in door frame and install rivets (9).

c. Connect interconnect lines (8 and 11 or 12) at each end of charge assembly. Torque nut **30 TO 45** inch-pounds.

d. If charge assembly has been fired, install new hinge on door.

e. Install door (paragraph 2-137).

17-14. SIGNAL TRANSMISSION SUBSYSTEM.

17-15. DESCRIPTION — SIGNAL TRANSMISSION SUBSYSTEM.

The signal transmission subsystem consists of interconnecting lines of detonating cord with threaded connections for attachment to window cutting assembly and linear shaped charge assembly adapters, junction manifolds, and an arming/firing mechanism. The arming/firing mechanism is activated when the handle is rotated 90 degrees counterclockwise to arm, then pulled to fire primer charge. The junction manifolds are used to connect the systems together.

17-16. INSPECTION — SIGNAL TRANSMISSION SUBSYSTEM.

WARNING

Ensure that both the pilot and gunner arming/firing mechanism handles are secured with safety pins (37 and 38, figure 17-1) prior to entry into the cockpit area.

a. Inspect all interconnect lines (figure 17-1) for nicks, dents, scratches, and for secure installation.

b. Inspect arming/firing mechanism (22 and 35) for nicks, dents, scratches, and for secure installation.

17-17. REMOVAL — SIGNAL TRANSMISSION SUBSYSTEM. (AVIM)

a. Interconnecting Lines.

(1) Remove clamps as necessary to detach line from structure.

(2) Cut lockwire and disconnect each end of line from junction manifold (26, figure 17-1), in line connector (39), window cutting assembly (1 or 20), arming/firing mechanism (22 or 35), linear shaped charge assembly (7 or 10), thruster (16 or 31) or pin puller (5 or 19).

(3) Install protective caps and plugs.

b. Arming/Firing Mechanism.

(1) Cut lockwire and disconnect interconnect line (23 or 34) from arming/firing mechanism (22 or 35).

(2) Install protective cap and plug.

(3) Remove four screws (21 or 36) to detach mechanism from bracket.

c. Junction Manifold.

(1) Cut lockwire and disconnect interconnect lines (3, 23, 24, and 34) from junction manifold (26).

(2) Install protective caps and plugs.

(3) Remove two screws (25) to detach manifold from bracket.

d. Pin Puller.

(1) Cut lockwire and disconnect interconnect lines (2 and 6 or 12 and 27) from pin puller (5 or 19).

(2) Install protective caps and plugs.

(3) Remove two screws (4 or 18) to detach pin puller (5 or 19) from canopy frame.

e. Thruster.

(1) Cut lockwire and disconnect interconnect lines (2 and 11 or 27 and 28) from thruster (16 or 31).

(2) Install protective caps and plugs.

(3) Remove two screws (13 or 33) and two nuts (17 or 32) securing thruster (16 or 31) to structure.

(4) Remove jamnut (14 or 30) and shims (15 or 29) from thruster (16 or 31) and detach thruster from bracket.

17-18. INSTALLATION — SIGNAL TRANSMISSION SUBSYSTEM. (AVIM)

a. Interconnecting Lines.

(1) Remove protective caps and plugs.

(2) Connect each end of line to junction manifold (26, figure 17-1), in-line connector (39), window cutting assembly (1 or 20), arming/firing

mechanism (22 or 35), linear shaped charge assembly (7 or 10), thruster (16 or 31), or pin puller (5 or 19). Torque nuts **30 TO 45** inch-pounds.

(3) Lockwire (C137) nuts.

(4) Secure lines in place on structure with applicable clamps.

b. Arming/Firing Mechanism.

(1) Secure mechanism (22 or 35) to bracket with four screws (21 or 36).

(2) Remove protective cap and plug.

(3) Connect interconnect line (23 or 34) to mechanism (22 or 35). Torque nut **30 TO 45** inch-pounds.

(4) Lockwire (C137) nut.

c. Junction Manifold.

(1) Secure manifold (26) to bracket with two screws (25).

(2) Remove protective caps and plugs.

(3) Connect interconnect lines (3, 23, 24 and 34) to manifold (26). Torque nuts **30 TO 45** inch-pounds.

(4) Lockwire (C137) nuts.

d. Pin Puller.

(1) Secure pin puller (5 or 19) to canopy frame with two screws (4) or 18).

(2) Remove protective caps and plugs.

(3) Connect interconnect lines (2 and 6 or 12 and 27) to pin puller (5 or 19). Torque nuts **30 TO 45** inch-pounds.

(4) Lockwire (C137) nuts.

e. Thruster.

(1) Place thruster (16 or 31) through hole in bracket and attach with shims (15 or 29) and jamnut (14 or 30).

(2) Secure thruster (16 or 31) to structure with two screws (13 or 33) and two nuts (17 or 32).

(3) Remove protective caps and plugs.

(4) Connect interconnect lines (2 and 11 or 27 and 28) to thruster (16 or 31). Torque nuts **30 TO 45** inch-pounds.

(5) Lockwire (C137) nuts.

17-19. FIRST AID KIT.

17-20. DESCRIPTION — FIRST AID KIT.

The first aid kit is fastened with snap fasteners behind the pilot seat.

17-21. REMOVAL — FIRST AID KIT.

Pull outward on kit to release fasteners.

17-22. INSPECTION — FIRST AID KIT.

Refer to TM 55-1500-328-25.

17-23. INSTALLATION — FIRST AID KIT.

Position kit on fasteners and push to engage fasteners.

17-24. FIRE EXTINGUISHER.

17-25. DESCRIPTION — FIRE EXTINGUISHER.

The fire extinguisher is installed on the floor of a bracket in front of gunner seat.

WARNING

When helicopter is to be parked where ambient temperature equals or exceeds 90 degrees F (32 degrees C), the fire extinguisher shall be removed until the next mission.

Should an extinguisher inadvertently be left in the helicopter during a high temperature period, the extinguisher shall be weight checked prior to the next mission.

WARNING

Exposure to high concentrations of monobromotrifluoromethane (CF3br) extinguishing agent or decomposition products should be avoided. The liquid should not be allowed to come into contact with the skin, as it may cause frostbite, low-temperature burns, or severe irritation of eyes and nose.

17-26. REMOVAL — FIRE EXTINGUISHER.

a. Unlatch holding strap and lift extinguisher from bracket.

b. Remove retaining screws and washers and remove bracket from floor panel.

17-27. INSPECTION — FIRE EXTINGUISHER.

a. Inspect fire extinguisher for obvious physical damage.

b. Inspect handle for security.

c. Check that handle safety pin is installed and secure.

d. Weigh fire extinguisher every six months (as recorded on inspection label) and ensure that it weighs no less than four ounces below fully charged gross weight stamped on nameplate.

e. Inspect fire extinguisher mounting bracket for damage and security.

17-28. REPAIR — FIRE EXTINGUISHER.

a. Replace fire extinguisher that is damaged or does not meet fully charged weight requirements.

b. Repair or replace damaged mounting bracket as applicable.

17-29. INSTALLATION — FIRE EXTINGUISHER.

a. Attach bracket to floor panel with screws and washers.

b. Place extinguisher in bracket and latch in place with holding strap.

17-30. SURVIVAL KIT.

17-31. DESCRIPTION — SURVIVAL KIT.

Provisions for the customer furnished survival kit are installed on the bulkhead aft of the pilot.

APPENDIX A

REFERENCE

The following references of the issue in effect, are required for use by aviation unit and intermediate maintenance personnel in performance of their duties.

NUMBER	TITLE
AR 95-1	Army Aviation General Provisions and Flight Regulations
AR 95-16	Weight and Balance, Army Aircraft
AR 95-5	Aircraft Accident Prevention and Investigation
AR 310-50	Authorized Abbreviations and Brevity Codes
AR 750-50	Aircraft Cannibalization
AR 755-15	Disposal of Unwanted Radio-active Material
FM 10-68	Aircraft Refueling
FM 10-69	Petroleum Handling and Operation
FM 55-413	Aerial Recovery of Aircraft
MIL-L-6866	Penetrant Method of Inspection
MIL-L-6868	Magnetic Particle Inspection Process
TB MED 251	Noise and Conservation of Hearing
TB 746-93-2	Painting and Marking of Army Aircraft
TB 750-126	Use of Material Condition Tags and Labels on Army Aeronautical and Air Delivery Equipment
TB 750-25	Maintenance of Supplies and Equipment: Army Metrology and Calibration System
TB 55-1500-334-25	Conversion to Fire Resistant Hydraulic Fluid
TB 55-1560-276-24/1	Polish Kit, Glass, Part Number: RS-69, NSN: 1560-00-450-3622
TB 55-9150-200-24	Engine and Transmission Oils, Fuels, and Additives for Army Aircraft
TM 1-7R1-3-1-1	Cleaning, Testing, and Corrosion Treatment of Air Cooled Aluminum, Brass and Copper Type Oil Coolers
TM 10-1101	Petroleum Handling and Operation (superseded by FM 10-69)

NUMBER	TITLE
TM 11-1520-236-20	Organizational Maintenance Manual: Electronic Equipment Configurations (AH-1S)
TM 11-1520-236-34	Direct and General Support Maintenance Manual: Electronic Equipment Configurations (AH-1S)
TM 11-6125-220-12	Organizational Maintenance Manual: Motor-Generator PU-543/A (Modified), PU-543 A/A (modified), PU-543 B/A, PU-543 C/A, and PU543 D/A.
TM 11-6130-385-34	Direct Support and General Support Maintenance Manual: Inverter, Static Power PP-7274/A
TM 11-6140-203-14-2	Operators, Organizational, Direct Support, General Support, and Depot Maintenance Manual for Aircraft Nickel-Cadmium Batteries
TM 3-220	Chemical, Biological and Radiological (CBR) Decontamination
TM 38-750	Army Maintenance Management Systems (TAMMS)
TM 43-0103	Non-Destructive Inspection Methods
TM 43-0105	Corrosion Control for Army Aircraft
TM 55-1500-204-25/1	General Aircraft Maintenance Manual
TM 55-1500-220-PM	Phased Maintenance Checklist
TM 55-1500-220-PMD	Preventive Maintenance Daily Checklist
TM 55-1500-322-24	Organizational, Direct, and General Support Maintenance Manual: Cleaning Procedure for Army Aircraft
TM 55-1500-326-24	General Aircraft Maintenance Manual: Standards of Serviceability for Transfer of Aircraft.
TM 55-1500-328-25	Aeronautical Equipment Maintenance Management Policies and Procedures
TM 55-1500-333-24	Organizational, Direct Support, and General Support Maintenance Manual: Cleaning Procedure for Army Aircraft
TM 55-1520-236-MTF	Aircraft Maintenance Test Flight Manual for AH-1S (Prod) Aircraft
TM 55-1520-236-T	Aviation Unit and Intermediate Maintenance Level Troubleshooting Instructions; Integrated Armament and Fire Control Systems; AH-1S (MC).
TM 55-1520-236-10	Operators Manual: Army Model (AH-1S)
TM 55-1520-236-23P	Aviation Unit and Intermediate Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools); Helicopter, Attack, AH-1S (Prod)
TM 55-1650-312-40	General Support Maintenance Manual; Hydraulic Servo Cylinder, Part Number 1660 Series
TM 55-2620-200-24	Inspection, Maintenance Instructions, Storage and Disposition of Aircraft Tires and Inner Tubes

NUMBER	TITLE
TM 55-2840-229-24	Organizational, Direct Support, and General Support Maintenance Manual: Engine, Shaft Turbine
TM 55-405-9	Army Aviation Maintenance Engineering Manual: Weight and Balance
TM 55-4920-201-14	Operators, Organizational, Direct Support, and General Support Maintenance Manual: Including Repair Parts and Special Tools List: Balancing and Adapter Kits
TM 55-4920-244-14	Operators, Organizational, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tools List) for Tester, Exhaust Gas Temperature, Model: BH 112JA-36.
TM 740-90-1	Administrative Storage of Equipment
TM 9-1055-460-14	Operator, Organizational, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tool Lists with Depot Maintenance Allowance): 2.75 Inch Aircraft Rocket Launchers M158A1, M200 and M200A1
TM 9-1090-203-12	Operator and Organizational Maintenance Manual for Armament Subsystem, Helicopter 7.62 Millimeter, 40mm Gernade Launcher: M28A1
TM 9-1270-212-14	Operator, Organizational, Direct Support, and General Support Maintenance Manual for M128 and M136 Helmet-Sight Subsystem (HSS)
TM 9-1270-217-13&P	Operators, Aviation Unit and Intermediate Maintenance Manual with Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Rocket Management Subsystem, Inventory-Deployment, XM138
TM 9-1270-218-13	Aviation Unit and Aviation Intermediate Maintenance Manual for Fire Control Computer Subsystem XM22.
TM 9-1270-219-13	Operator Aviation Unit and Aviation Intermediate Maintenance Instructions
TM 9-1270-220-13	Aviation Unit and Aviation Intermediate Maintenance Manual for Head-Up Display, Subsystem XM76
TM 9-1425-473-20	Organizational Maintenance Manual for Armament Subsystem, Helicopter, TOW Guided Missle XM65
TM 9-1425-473-34	Direct and General Support Maintenance Manual, Armament Subsystem, Helicopter, TOW Guided Missle XM65

APPENDIX B

MAINTENANCE ALLOCATION CHART

SECTION I. INTRODUCTION

B-1. MAINTENANCE ALLOCATION CHART

a. This Maintenance Allocation Chart (MAC) assigns maintenance functions in accordance with the Three Levels of Maintenance concept for army aircraft. These maintenance levels, Aviation Unit Maintenace (AVUM); Aviation Itermediate Maintenance (AVIM) and Depot Maintenance are depicted on the MAC as:

AVUM which corresponds to the O Code in the RPSTL
AVIM which corresponds to an F Code in the RPSTL
DEPOT which corresponds to a D Code in the RPSTL

b. The maintenance to be performed below depot and in the field is described as follows:

(1) Aviation Unit Maintenance (AVUM) activities will be staffed and equipped to perform high frequency "On-Aircraft" maintenance tasks required to retain or return aircraft to a serviceable condition. The maintenance capability of the AVUM will be governed by the Maintenance Allocation Chart (MAC) and limited by the amount and complexity of ground support equipment (GSE), facilities required, and number of spaces and critical skills available. The range and quantity of authorized spare modules/components will be consistent with the mobility requirements dictated by the air mobility concept. (Assignments of maintenance tasks to divisional company size aviation units will consider the overall maintenance capability of the division, the requirement to conserve personnel and equipment resources and air mobility requirements.)

(a) Company Size Aviation Units: Perform those tasks which consist primarily of preventive maintenance and maintenance repair and replacement functions associated with sustaining a high level of aircraft operational readiness. Perform maintenance inspections and servicing to include preflight, daily, intermediate, periodic, and special inspections as authorized by the MAC or higher headquarters. Identify the cause of equipment/system malfunctions using applicable technical manual troubleshooting instructions, built-in-test equipment (BITE), installed aircraft instruments, or easy to use/interpret diagnostic/fault isolation devices (TMDE). Replace worn or damaged modules/components which do not require complex adjustments or system alignment and which can be removed/installed with available skills, tools and equipment. Perform operational and continuity checks and make minor repairs to the electrical system. Inspect, service, and make operational, capacity, and pressure checks to hydraulic systems. Perform servicing, functional adjustments, and minor repair/replacement to the flight control, propulsion, power train, and fuel systems. Accomplish air frame repair which does not require extensive disassembly, jigging, or alignment. The manufacture of air frame parts will be limited to those items which can be fabricated with tools and equipment found in current air mobile tool and shop sets. Evacuate unserviceable modules/components and end items beyond the repair capability of AVUM to the supporting AVIM.

(b) Less than Company Size Aviation Units: Aviation elements organic to brigade, group, battalion headquarters, and detachment size units are normally small and have less than ten aircraft assigned. Maintenance tasks performed by these units will be those which can be accomplished by the aircraft crew chief or assigned aircraft repairman and will normally be limited to preventive maintenance, inspections, servicing, spot painting, stop drilling, application of nonstress patches, minor adjustments, module/component fault diagnosis, and replacement of selected modules/components. Repair functions will normally be accomplished by the supporting AVIM unit.

(2) Aviation Intermediate Maintenance (AVIM) provides mobile, responsive "One Stop"

maintenance support. (Maintenance functions which are not conducive to sustaining air mobility will be assigned to depot maintenance). Performs all maintenance functions authorized to be done at AVUM. Repair of equipment for return to user will emphasize support or operational readiness requirements. Authorized maintenance includes replacement and repair of modules/components and end items which can be accomplished efficiently with available skills, tools, and equipment. Established the Direct Exchange (DX) program for AVUM units by repairing selected items for return to stock when such repairs cannot be accomplished at the AVUM level. Inspects, troubleshoots, test diagnoses, repairs, adjusts, calibrates, and aligns aircraft system modules/components. AVIM units will have capability to determine the serviceability of specified modules/components removed prior to the expiration of the Time Between Overhaul (TBO) or finite life. Module/component disassembly and repair will support the DX program and will normally be limited to tasks requiring cleaning and the replacement of seals, fittings, and items of common hardware. Airframe repair and fabrication of parts will be limited to those maintenance tasks which can be performed with available tools and test equipment. Unserviceable reparable modules/components and end items which are beyond the capability of AVIM to repair will be evacuated to Depot Maintenance. This level will perform aircraft weight and balance inspections and other special inspections which exceed AVUM capability. Provides quick response maintenance support, including aircraft recovery and air evacuation, on-the-job training, and technical assistance through the use of mobile maintenance contact teams. Maintains authorized operational readiness float aircraft. Provides collection and classification services for serviceable/unserviceable material. Operates a cannibalization activity in accordance with AR 750-50. (The aircraft maintenance company within the maintenance battalion of a division will perform AVIM functions consistent with air mobility requirements and conservation of personnel and equipment resources. Additional intermediate maintenance support will be provided by the supporting nondivisional AVIM unit).

B-2. USE OF THE MAINTENANCE ALLOCATION CHART.

a. The Maintenance Allocation Chart assigns maintenance functions based on past experience and the following consideration:

(1) Skills available.

(2) Time required.

(3) Tools and test equipment required and/or available.

b. The assigned levels of maintenance authorized to perform a maintenance function is indicated.

c. A maintenance function assigned to a lower maintenance level will automatically be authorized to be performed at any higher maintenance level.

d. A maintenance function that cannot be performed at the assigned level of maintenance for any reason may be evacuated to the next higher maintenance organization. Higher maintenance levels will perform the maintenance functions of lower maintenance levels when required or directed by the appropriate commander.

e. The assignment of a maintenance function will not be construed as authorization to carry the associated repair parts in stock. Information to requisition or otherwise secure the necessary repair parts will be as specified in the Repair Parts, Special Tools List.

f. Normally there will be no deviation from the assigned level of maintenance. In cases of operational necessity, maintenance functions assigned to a higher maintenance level may, on a one-time basis and at the request of the lower maintenance level, be specifically authorized by the maintenance officer of the higher level of maintenance to which the function is assigned. The special tools, equipment, etc. required by the lower level of maintenance to perform this function will be furnished by the maintenance level to which the function is assigned. This transfer of a maintenance function to a lower maintenance level does not relieve the higher maintenance level of the responsibility of the function. The higher level of maintenance will provide technical supervision and inspection of the function being performed at the lower level.

g. Maintenance of the US Army Communications and Electronics Materiel Readiness Command equipment will be performed by designated US Army CERCOM personnel.

h. Changes to the Maintenance Allocation Chart will be based on continuing evaluation and analysis by responsible technical personnel and on reports received from field activities.

B-3. DEFINITIONS.

Maintenance functions. Maintenance functions will be limited to and defined as follows:

a. **Inspect.** To determine the serviceability of an item by comparing its physical, mechanical and/or electrical characteristics with established standards through examination.

b. **Test.** To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. **Service.** Operations required periodically to keep an item in proper operating condition, i.e. to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. **Adjust.** To maintain, with prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. **Align.** To adjust specified variable elements of an item to bring about optimum or desired performance.

f. **Calibrate.** To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. **Install.** The act of emplacing, seating, or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. **Replace.** The act of substituting a serviceable like type part, subassembly, or module, (component or assembly) for an unserviceable counterpart.

i. **Repair.** The application of maintenance services or other maintenance actions to restore serviceability to an item by correcting specific damage, fault, malfunctions or failure in a part, subassembly, module (component or assembly), end item, or system.

j. **Overhaul.** That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e. DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. **Rebuild.** Consists of those service actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild in the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipments/components.

B-4. STANDARD GROUPS.

The standard groupings shown below are used, as applicable, throughout this MAC Maintenance manuals and RPSTLs reflect these standard groupings as individual chapters with sections in each chapter relative to the individual complete systems, subsystems, modules, components, assemblies, or specific parts noted.

B-5. SYMBOLS.

The letters "AVUM, AVIM and DEPOT" as placed on the Maintenance Allocation Chart indicate the level of maintenance responsible for performing the particular maintenance function based upon assigned skills, tools, and test equipment and time required to accomplish maintenance.

AIRFRAME ITEMS

GROUP NUMBER	DESCRIPTION
00	Aircraft System
01	Aircraft General Servicing, handling, inspection requirements, lubrication requirements, overhaul and retirement requirements, cleaning, mooring, towing, jacking, hoisting, preservation requirements, weight and balance requirements, spot painting, complete painting, and subassembly painting requirements.
02	Airframe Fuselage, empennage, pylons, wings mounts (engine and transmission), armor, seats, ramps, decks, and tiedowns.
03	Alighting Gear Landing gear, skids, floats, skis, struts, wheel brakes, and mechanical mechanisms.
04	Power Plant Installation Removal, installation, cooling systems, air induction, exhaust, oil systems, components, ignition systems, power control, harnesses, carburetors, fuel controls, pumps (engine driven), filters/particle separators, and Quick Change Assemblies (QCA). (See Power Plant Items, figure 2, for more detailed functions.)
05	Propellors/Rotors Systems Propellors, governors, rotors (main and tail), hubs, blades, dampeners, stabilizer bars, and swashplates.
06	Drive Train Systems Transmission, gearboxes, clutches, shafting, oil systems, bearings, hangers, oil tanks, and freewheeling units.
07	Hydraulic and Pneumatic Systems Pumps, filters, reservoirs, cylinders, valves, servos, motors, starters, and accumulators.
08	Instrument Systems Flight instruments, navigation instruments, engine instruments, miscellaneous instruments (i.e. clocks) sending units, panels, and flow meters.
09	Electrical Systems Motors, actuators, regulators, generators, starters, batteries, lighting, caution and warning lights, inverters, fault isolation systems, rotor brakes, and avionics provisions.
10	Fuel Systems Tanks, cells, filters, pumps, valves, auxiliary fuel systems, and refueling systems.
11	Flight Controls System Control sticks, pedals, cables, pulleys, push-pull rods, torque tubes, quadrants, force gradients, control surfaces bellcranks, and trim actuators (mechanical).
12	Utility Systems Fire detecting/extinguishing systems, oxygen systems, windshield wiper systems, mirrors, and de-ice/anti-ice systems.

GROUP NUMBER	DESCRIPTION
13	Environmental Control Systems (ECS) Heaters, air conditioners, defrosters, control mixing valves, and ducts.
14	Hoists and Winches Cargo/rescue hoists, winches, hooks slings, loading systems, and emergency release systems.
15	Auxiliary Power Plants (APP) Fuel, exhaust, and ducting.
16	Mission Equipment Spraying equipment, stores, racks, armament, reconnaissance, photography pods, and litters.
17	Emergency Equipment Ejection seats, canopies, jettison system, portable fire extinguishers, axes, and first aid kits.
18	Installed Avionics Components Communications and Navigational Black Boxes

B-6. WORK TIME.

In the Maintenance Category column by the listing of a "work time" figure in the appropriate subcolumn(s), levels of maintenance authorized to perform the function are specified. This figure represents the active time (Man-hours) required to perform the specified function. The number of man-hours specified represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized.

NOTE: The times indicated in the Maintenance category columns were arrived at by simulated time study. Actual time required to perform the specified maintenance function on the helicopter may not necessarily be the same. As the -23 Maintenance manual is addressed to AVUM & AVIM maintenance levels the DEPOT column may be disregarded.

B-7. TOOLS AND TEST EQUIPMENT (SECTION III)

Special tools, test, and support equipment required to do maintenance functions are listed with a reference number to permit cross-referencing to column 5 in the MAC. In addition, the maintenance category authorized to use the device is listed along with the item National Stock Number and if applicable, the number to aid in identifying the tool/device.

B-8. REMARKS (SECTION IV)

Column 6 of the MAC contains alphabetic reference codes which are explained in Section IV of this appendix.

SECTION II. MAINTENANCE ALLOCATION CHART

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
	NOTE The extent of maintenance to be performed by AVUM as indicated in this MAC is governed by the size of the unit and the tools authorized (Refer to paragraph B-1 b(1) a. and b). Specific notes are given to further identify or describe the extent or limit of maintenance to be performed.						
0100	Aircraft System (End Article Vehicle System)						
0100	Aircraft General						
0101	Clean		2.0			100,102	
0102	Moor		1.0			100,102	
0103	Tow		1.0			100,102	
0104	Jack		1.0			100,102	
0105	Hoist		1.0			100,102	
0106	Preservation		1.0			100,102	
0107	Weight and Balance			1.0		102,118	
0108	Spot Paint		1.0			100,102	
0109	Complete Painting				24.0		
0110	Sub-assembly Painting			4.0		102,118	
0111	Service		2.0			100,102	
0200	Airframe	Overhaul			100.0		
0201	Tailboom Assy	Inspect	2.0				
		Replace	2.0			100,102	A
		Repair	4.0			100,102, 103	
				8.0		102,117	
		Overhaul			60.0		

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0202	Fuselage	Inspect	4.0				
		Repair	4.0			100,102, 103	A
				8.0		103,107	
0202 01	Sheet Metal for Structural Members and Honeycomb Panels not requiring Jigs and Fixtures	Inspect	1.0				
		Replace	2.0			100,102, 103	A
				4.0		102,103	
		Repair	2.0			100,102, 103	A
				4.0		103,117	
0202 02	Sheet Metal for Structural Members and Honeycomb Panels that require Jigs and Fixtures	Inspect	1.0				
		Replace			4.0		
		Repair			8.0		
0202 03	Honeycomb Panels	Inspect	1.0				
		Replace	2.0			100,102	
		Repair	2.0			100,102, 103	A
				4.0		103,117	C
0202 04	Wings	Inspect	1.0				
		Replace	4.0			100,102	
		Repair	2.0			100,102, 103	
0202 05	Transmission Mounts	Inspect	1.0				
		Align	1.0			100,36, 32	
		Replace	2.0			100,102	
		Repair				100,102	
0202 05	Transmission Mount Dampers	Inspect	1.0				
		Replace	2.0			100,102	D
		Repair		2.0		102,103	
0202 06 (02)	Windshield	Inspect	1.0				
		Replace	8.0			101,102	S
		Repair	1.0			101,102	D
				4.0		102,103	

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0202 07	Doors	Inspect	1.0				
		Adjust	1.0			100,102	
		Replace	3.0			100,102	
		Repair	2.0			100,102, 103	
0202 07	Window Assembly	Inspect	1.0				
		Replace	12.0			101,102, 103	S
		Repair	1.0			101,102	
				4.0		102,103	
0202 07 (02)	Striker Assembly	Inspect	1.0				
		Replace	2.0			100,102	
		Repair	2.0			100,102	
0202 07 (03)	Handle Assembly	Inspect	1.0				
		Replace	1.0			100,102	
		Repair	1.0			100,402	
0202 08	Seat Installation, Pilot and Gunner	Inspect	1.0				
		Repair	2.0			100,102	
0202 08 (01)	Seat Belts and Shoulder Harness	Inspect	1.0				
		Replace	2.0			100,102	
0202 08 (03)	Shoulder Harness Reel	Inspect	1.0				
		Replace	2.0			100,102	
		Repair	1.0			100,102	
0202 08 (03)	Seat Assembly	Inspect	1.0				
		Replace	6.0			100,102	
		Repair	4.0			100,102	
0202 08 (03) (01)	Armor	Inspect	1.0				
		Replace	2.0			100,102	
		Repair	1.0			100,102	
0202 09	Blanket Assembly, Soundproofing	Inspect	1.0				
		Replace	3.0			100,102	
		Repair	1.0			100,102	

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0202	Dock Assembly, Engine	Inspect	1.0				
10		Align		2.0		102	
		Replace		4.0		102	
		Repair		4.0		117	
0202	Mount Assembly	Inspect	1.0				
11		Align	1.0			100	
		Replace	4.0			100,102	
		Repair	2.0			100,102	A
				4.0		102	
0202	Cowl Assmeblies	Inspect	1.0				
12		Replace	4.0			100,102	
		Repair	4.0			100,102, 103	
0202	Firewall Assembly	Inspect	1.0				
13		Replace	4.0			100,102, 103	
		Repair	2.0			101,102, 103	
0202	Heatshield Assembly	Inspect	1.0				
14		Replace	4.0			101,102, 103	
		Repair	2.0			101,102, 103	
0202 15	Mount Installation, Engine						
0202 15 (01)	Support Arms (Brace Rods, Tripod, and Bipod)	Inspect	1.0				
		Replace	3.0			101,102	
		Repair	2.0			101,102	
0202 15 (02)	Pillow Block Assembly	Inspect	1.0				
		Replace	1.0			102	
		Repair	1.0			100,102	
0202 17	Map and Data Case	Inspect	1.0				
		Replace	1.0			100,102	
0300	Alighting Gear Assembly						
0301	Cross Tubes	Inspect	1.0			100,102	

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0301 (Cont)	Cross Tubes (Cont)	Replace	4.0			100,102	
		Repair	2.0			100,102, 103	A
				4.0		102	
0302	Skid Tubes	Inspect	1.0				
		Replace	4.0			100,102	
		Repair	2.0			100,102	A
				4.0		102	
0303	Skid Shoes	Inspect	1.0				
		Replace	2.0			100,102	
		Repair	2.0			100,102	A
				2.0		102,120	
0304	Skid Saddles	Inspect	1.0				
		Replace	2.0			100,102	
0305	Ground Handling Wheels	Inspect	1.0				
		Repair	4.0			100,102	
				4.0		102	
		Service	1.0			100,102	
0305	Pump Assembly	Inspect	1.0				
		Test	1.0			100,102	
		Replace	1.0			100,102	
		Repair		4.0		102,104, 111	
0305 02	Cylinder Assembly	Inspect	1.0				
		Replace	1.0			100,102	
		Repair		1.0		102,111	
0305 03	Wheel Assembly	Inspect	1.0				
		Replace	1.0			100,102	
		Repair	2.0			100,102	
		Service	1.0			100,102	
0306	Skid Installation Tail	Inspect	1.0				
		Replace	2.0			100,102	
		Repair	2.0			100,102	
0400	Power Plant Installation						
0401	Engine (Complete Assembly)	Inspect	2.0				

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0401 (Cont)	Engine (Complete Assembly) (Cont)	Test	4.0			100,102	
				4.0		102,108, 118,119	H
		Service	2.0			100,102	
		Replace	30.0			100,102, 108,21, 40	
		Repair	8.0			100,102, 108	G
				16.0		112,118, 119	G
		Overhaul			50.0		
0401 01	Tail Pipe	Inspect	1.0				
		Replace	2.0			100,102	
		Repair	1.0			100,102	A
				4.0		102,120	
0401 02	Oil Strainers	Inspect	1.0				
		Replace	1.0			100,102	
0401 03	Droop Compensator	Inspect	1.0				
		Adjust	1.0			100,102	
		Replace	2.0			100,102	
		Repair	1.0			100,102	
0401 04	Actuator, Linear	Inspect	1.0				
		Adjust	1.0			100,102	
		Replace	2.0			100,102	
		Repair	1.0	24.0		100,102	V
0401 05	Hoses, Fittings, Couplings, and Tubing	Inspect	1.0				
		Replace	1.0			100,102	
0402	Particle Separator	Inspect	1.0				
		Replace	2.0			100,102	
		Repair	1.0			100,102	
				4.0		102,103, 112,117, 120	
0403	Controls, Power Lever	Inspect	1.0				
		Adjust	1.0			100,102	
		Replace	2.0			100,102	

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0403 (Cont)	Controls, Power Lever (Cont)	Repair	4.0			100,102	
0404	Oil Tank, Engine	Inspect	1.0			100,102	
		Test	1.0			100,102	
		Service	1.0			100,102	
		Replace	2.0			100,102	
		Repair	2.0			100,102	
				4.0		120	
0405	Hoses, Fittings, and Tubing	Inspect	1.0				
		Replace	1.0			100,102	
0406	Oil Cooler, Engine	Inspect	1.0				
		Test		4.0		102	
		Replace	2.0			100,102	
		Repair	4.0			100,102	
0407	Oil Cooler Shut-Off Valve	Inspect	1.0				
		Replace	1.0			100,102	
0408	Oil Cooler Blower, Turbine	Inspect	1.0				
		Replace	1.0			100,102	
		Repair		2.0		102,112, 118,119, 120	
0409	Chip Detector, Engine	Inspect	0.5				
		Test	1.5			100,102	
		Replace	1.0			100,102	
0410	Valves, Breakaway	Inspect	1.0				
		Replace	2.0			100,102	
0500	Rotor Systems						
0501	Pylon Assembly, External Components	Inspect	1.0				
		Replace	2.0			100,102	
		Repair	2.0			100,102, 103	
0502	Hub and Blade Assy, Main Rotor	Inspect	1.0				
		Adjust	2.0			101,102, 44,51	I

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0502 (Cont)	Hub and Blade Assy, Main Rotor (Cont)	Align	3.0			101,102, 26,30,31, 34,41,59	
		Replace	4.0			101,102, 13,14, 21,59	
0502	Hub Assembly	Inspect	1.0				
01		Align	2.0			101,102, 14,21,59	J
		Replace	4.0			101,102, 109,13, 14,21,59	
		Repair	2.0	4.0		101,102 102,105, 109,113, 114,45, 47	
		Overhaul			40.0		
0502	Drag Brace Assembly	Inspect	1.0				
01		Replace	1.0			101,102,	
(01)						109	
		Repair	2.0			101,102, 109	
0502	Grip Assembly	Inspect	1.0				
01		Replace		3.0		102,118	
(02)		Repair		2.0		102,109, 112,113, 118	
0502	Housing Assembly	Inspect		1.0			
01		Replace		2.0		102,109	
(03)		Repair		2.0		102,109, 112,113, 118	
0502	Defector, Sand	Inspect	0.5				
01		Replace	1.0			100,102,	
(04)						109	
0502	Pitch Horn Assembly	Inspect	1.0	1.0			
01		Replace	2.0			101,102	
(05)		Repair	1.0			101,102	D

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0502 01 (05) (Cont)	Pitch Horn Assembly (Cont)			2.0		102,109, 112,113, 118	
0502 01 (06)	Extension Assembly	Inspect	1.0				
		Replace		4.0		102,109	
		Repair	1.0			101,102	
				4.0		102,109, 112,113, 118	
0502 01 (07)	Strap Assembly Tension	Inspect		1.0			
		Replace		4.0		102,112, 113,118	
0502 01 (08)	Bolt Assembly, Blade Retention	Inspect	1.0				
		Replace	1.0			101,102, 109	
		Repair	1.0			101,102, 109	
0502 01 (09)	Yoke Assembly	Inspect	1.0				
		Replace		4.0			
		Repair	1.0			101,102	D
				2.0		102,109, 112,113	
0502 01 (10)	Trunnion Assembly	Inspect	1.0	1.0			
		Replace		3.0			
		Repair	1.0			101,102	D
				2.0		102,109, 112,113, 118	
0502 01 (11)	Housing Assembly Trunnion	Inspect	1.0	1.0			
		Replace		3.0		102,109	
		Repair	1.0			101,102, 109	D
				2.0		102,104	
0502 02	Blade Assembly, Main Rotor	Inspect	1.0				
		Adjust	1.0			101,41,51	
		Replace	3.0			101,102, 109	

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0502 02 (Cont)	Blade Assembly, Main Rotor (Cont)	Repair	1.0			101,102, 109	
				4.0		*121*	*W*
		Overhaul			60.0		
0503	Scissors and Sleeve Assembly	Inspect	1.0				
		Replace	4.0			101,102, 109	
		Repair	1.0			101,102	
				4.0		102,109, 112,118, 10,110,27, 28,35,87, 88	
0503 01	Link Assembly, Scissors	Inspect	1.0				
		Replace	1.0			101,102, 109	
		Repair	1.0			101,102	D
				2.0		102,109, 112	
0503 02	Scissors Assembly	Inspect	1.0				
		Replace	2.0			101,102, 109	
		Repair	1.0			101,102	D
				4.0		102,109, 112	
0503 03	Hub Assembly	Inspect	1.0	1.0			
		Replace			4.0		
		Repair	1.0			101,102	D
				2.0		102,109, 113	
0503 04	Sleeve, Collective	Inspect	1.0				
		Replace			4.0		
		Repair	1.0			101,109	D
0504	Swashplate and Support Assembly	Inspect	1.0				
		Replace	4.0			101,102, 109	
		Repair	2.0			101,102	D
				4.0		102,109	
		Overhaul			40.0		

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0505	Rotor Installation, Tail	Inspect	1.0				
		Replace	4.0			101,102, 109	
		Repair	2.0			100,102, 109	
0505 01	Link Assembly	Inspect	1.0				
		Replace	1.0			100,102, 109	
		Repair	1.0			100,102, 109	
0505 02	Crosshead	Inspect	1.0				
		Replace	2.0			100,102, 109	
		Repair	2.0			100,102, 109	
0505 03	Hub and Blade Assembly	Inspect	1.0				
		Adjust	1.0			100,102	I
		Align	1.0			100,102, 109,82	J
		Replace	4.0			100,102 109,90	
		Repair	2.0			100,102, 109	
				4.0		102,109, 90	
0505 03 (01)	Blade Assembly	Inspect	1.0				
		Replace	2.0			100,102	
		Repair	1.0			100,102	
				4.0		102,109	
0505 03 (02)	Hub Assembly	Inspect	1.0				
		Service	1.0			100,102	
		Adjust	2.0			100,102	
		Replace	4.0			100,102, 109	
		Repair	1.0			100,102, 109	
				4.0		102,109	

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0600	Drive Train System						
0601	Intermediate and Tail Rotor Drive Gearboxes	Inspect	1.0				
		Service	1.0			100,102	
		Replace	4.5			100,102	
		Repair	1.5			100,102	
		Overhaul			22.5		
0601	Intermediate and Tail Rotor Drive Gearbox Quills	Inspect	1.5				
		Service	1.5			100,102	
		Replace	2.0			101,102, 23,25,24, 38,39,58	T
		Repair	1.5			23,24,25, 38,39,58	
		Overhaul			5.0		
0602	Tail Rotor Drive Shaft	Inspect	1.0				
		Replace	3.4			100,102	
		Repair	1.5			100,102	T
					2.0	102,109	
0603	Tail Rotor Drive Shaft Hanger Assemblies	Inspect					
		Service	1.0			102	
		Align	4.5			100,102	
		Replace	2.5			100,102	
		Repair	1.5			100,102, 109	M
				3.0		113	
0604	Main Transmission	Inspect	1.0				
		Service	2.0			102	
		Replace	6.5			101,105, 17	
		Repair	1.2			101,105, 17	
				2.5		102,105, 109,17	
		Overhaul			82.5		
0604	Drive Quill Assemblies	Inspect	1.5				
		Service	2.5			100,102	
		Replace	4.5			101,109, 24	

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0604 (Cont)	Drive Quill Assemblies (Cont)	Repair	2.5			101,109, 24,46	M
		Overhaul			5.5		
0605	Main Drive Shaft (Engine to Transmission)	Inspect	1.0				
		Service	1.5			100,102	
		Align	1.0			100,109, 32,36	
		Replace	4.5			100,102, 109	
		Repair	1.5			100,22,33	
		Overhaul			6.5		
0606	Lines, Manifolds and Fittings	Inspect	1.0				
		Replace	2.0			100,102	
		Repair	1.0			100,102	
0607	Sight Gages	Inspect	0.5				
		Replace	0.5			100,102	
		Repair	0.5			100,102	
0608	Oil Jets	Inspect	1.0				
		Replace	1.5			100,102	
		Repair	1.0			100,102	
0609	Filters, Filter Housings and Screens	Inspect	1.0				
		Replace	2.5			100,102	
		Repair	1.5			100,102	
0610	Transmission Oil Cooler Assembly	Inspect	1.0				
		Replace	1.0			100,102	
		Repair	1.0			100,102	
0611	Bypass Valve Assembly	Inspect	1.0				
		Replace	1.5			100,102	
		Repair		2.0		52,53, 54,55	
0612	Oil Pump	Inspect	1.0				
		Test		1.0		100,102	
		Replace	2.5			100,102	
		Repair		1.5		102	
		Overhaul			4.5		

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0613	Mast Assembly	Inspect	1.0				
		Replace	5.6			101,102, 13,14	
		Repair	1.0			101,109, 113,12,91	
		Overhaul			16.5		
0614	Friction Collet	Inspect	0.5				
		Adjust	6.5			101,109, 89	
		Replace	6.5			101,109	
		Repair	1.0			101,109	
0700	Hydraulic and Pneumatic Systems						
0701	Pumps	Inspect	1.0				
		Replace	2.5			100,102	
		Repair	1.5			100,102, 104	
		Overhaul			12.0		
0702	Reservoirs	Inspect	1.0				
		Service	1.0			100,102	
		Replace	2.5			100,102, 104	
		Repair	1.5			100,102, 104	
0703	Valves	Inspect	1.0				
		Replace	1.5			101,102, 104	
		Repair		2.0		104,111	

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0705	Solenoid Valve	Inspect	1.5				
		Replace	1.5			101,102, 104	
		Repair		1.0		102,104, 111	
0706	Hose, Tubing, and Fittings	Inspect	1.0				
		Replace	1.5			102,104	
0707	Hydraulic Module	Inspect	1.5				
		Replace	2.4			101,102, 104	
		Repair		1.5		102,104, 111	
		Overhaul		4.6			V
0708	Hydraulic Servo Cylinders	Inspect	1.5				
		Replace	2.0			100,104, 23	
		Repair		1.5		102,104, 111	
		Overhaul		15.5			V
0709	Hydraulic Accumulator	Inspect	1.0				
		Test		0.5		104,111	
		Service	0.5			100,104	
		Replace	2.1			100,104	
		Repair		1.0		104,111	
0710	Accumulator Air Press Gage	Inspect	1.0			100,104	
		Replace	1.0				
0711	SCAS Servo Actuators	Inspect	1.5				
		Test		2.1		104,111	
		Replace	2.5			100,104	
		Repair		3.5		104,111	
		Overhaul			9.5		

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0800	Instrument Systems						
0801	Instrument Panels	Inspect	2.5				
		Replace		3.5		106	
		Repair		2.1		106	
0801 01	Miscellaneous Instruments						
0801	Clock	Inspect	1.5				
		Replace	1.5			100,106	
		Overhaul			3.0		
0801 0102	Free Air Temperature Gage	Inspect	1.0				
		Test	1.0			101,106	
		Replace	1.0			101,106	
0801 0103	Volt, Load and Ammeter	Inspect	1.0				
		Adjust	1.0			100,107	
		Replace	1.5			100,107	
0801 02	Fuel Quantity Indicator System						
0801 0201	Fuel Quantity Indicator and Amplifier	Inspect	1.0				
		Test	2.5			101,110	U
		Adjust		2.5		110	
		Replace		2.5		106	
		Overhaul			8.0		
0801 0202	Tank Sensor, Probes and Units	Inspect		1.0			
		Test		1.5		110	
		Replace		2.5		106	
0801 03	Flight Instruments						
0801 0301	Vertical Velocity Indicator	Inspect	0.5				
		Test	1.0			100,106	
		Replace	1.5			100,106	
		Overhaul			8.0		
0801 0302	Standby Compass	Inspect	0.5				
		Adjust	0.5			100,106	
		Replace	1.0			100,106	

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NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0801 0303	Airspeed Indicator	Inspect	1.0				
		Test	1.0			100,106	
		Replace	2.0			100,106	
		Overhaul			7.5		
0801 0304	Altimeter	Inspect	1.0				
		Test	1.0			100,106	
		Replace	2.0			100,106	
		Overhaul			9.5		
0801 0305	Attitude Indicator	Inspect	0.5				
		Replace	0.5			100,106	
		Overhaul			8.5		
0801 0306	Turn and Slip Indicator	Inspect	0.5				
		Replace	0.5			100,106	
		Overhaul			8.5		
0801 0307	Pitot System	Inspect	0.5				
		Test	1.5			100,106	
		Calibrate		2.0		110	
		Repair	1.5			100,106	
0801 04	Engine Instruments						
0801 0401	Engine and Rotor Tachometer	Inspect	1.0				
		Test		2.0		110	
		Replace	1.0			100,106	
		Overhaul			11.5		
0801 0402	Turbine Gas, Temperature	Inspect	0.5				
		Test		1.5		110	
		Calibrate		2.0		110	
		Repair	1.5			100,106	
		Overhaul			6.5		
0801 0403	Engine Oil Temperature Gage	Inspect	0.5				
		Replace	1.0			100,106	
		Overhaul			4.0		

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACH, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
1400	Hoist and Winches (Not Applicable)						
1500	Auxiliary Power Plants (APP) (Not applicable)						
1600	Mission Equipment Armament (Aircraft Components)						
				NOTE			
		Organizational maintenance of the armament system will be performed by Aircraft Armament Sub-system Repairmen.					
1601	Turret Weapons System						
1601 01	Pilot Gun Sight	Inspect	0.5				
		Replace					R
1601 02	Pilot Gunner's Control Panels	Inspect	0.5				R
		Test					R
		Replace					R
		Repair					R
1602	External Stores						
1601 01	Emergency Jettison System	Inspect	1.0				
		Adjust	0.5			101,102	
		Replace	7.5			101,102	
		Repair	3.0			101,102	
		Test	1.5			101,102	
1602 02	Ejector Rack	Inspect	0.5				
		Adjust	5.0			100,102	
		Replace	2.0			100,102	
		Repair	1.0			100,102	
		Overhaul			12.0		
1602 03	Grenade Dispenser	Inspect	0.5				
		Replace	1.0			100,102	

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
1308	Temperature Control/ Valve	Inspect	0.5				
		Replace	1.5			100,107	
		Repair	2.0			100,107	
		Overhaul			10.0		
1308 01	Torque Motor	Inspect	0.5				
		Replace	1.0			100,102	
		Overhaul			8.0		
1308 02	Turbine Assembly	Inspect	0.5				
		Replace	7.0			101,102	
		Overhaul			18.0		
1308 03	Nozzles, Cockpit Outlet	Inspect	0.5				
		Replace	1.0			100,102	
1309	Pressure Regulating and Shut-off Valve	Inspect	0.5				
		Test		1.5		110,107	
		Replace	2.0			100107	
		Overhaul			12.0		
1309 01	Solenoid Valve	Inspect	0.2				
		Replace	0.5			100,107	
		Overhaul			6.0		
1309 02	Pressure Relief Valve	Inspect	0.2				
		Replace	0.5			100,107	
1309 03	Temperature Selector	Inspect	0.5				
		Replace	0.5			100,102	
1310	Rain Removal System	Inspect	1.5				
		Replace	3.0			100,102	
		Repair	2.0			100,102	
1311	Hot Air Valve	Inspect	2.0				
		Replace	1.0			100,102	
		Overhaul			8.0		

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
1200	Utility Systems						
1201	Fire Detector System—Engine	Inspect	0.5				
		Replace	1.5			100,102	
1202	Anti-Icing System	Inspect	0.5				
		Replace	1.5			100,102	
1300	Environmental Control System (ECS)						
1301	Bleed Air Heater System	Inspect	0.5				
		Repair	2.0			100,102	
1302	Control Valves	Inspect	1.5				
		Replace	2.5			100,102	
		Repair		1.5		107,110	
		Test		1.5		107,110	
1303	Vent Blower	Inspect	2.0				
		Replace	2.0			100,102	
		Repair	2.0			100,102	
1304	Ventilating Ducts, Inlet Door, and Control	Inspect	1.0				
		Adjust	1.0			100,102	
		Replace	1.5			100,102	
		Repair	1.0			100,102, 103	
1305	Environmental Control Unit	Inspect	1.0				
		Service	1.0			100,102	
		Replace	3.0			101,102	
		Repair	1.0			101,102	
		Overhaul			45.0		
1306	Heater Exchanger	Inspect	0.5				
		Replace	2.0			100,102	
		Repair	2.0			100,102	
1307	Temperature Control/ Sensor	Inspect	0.5				
		Replace	1.0			100,107	
		Repair		2.0		107,110	
		Overhaul			10.0		

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NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
1107 (Cont)	Tail Rotor Pedal Assy (Cont)	Replace	8.0			101,102	
		Repair	3.0			101,102	
1108	Pedal Adjusting Assembly	Inspect	1.5				
		Adjust	1.5			100,102	
		Replace	2.5			101,102	
		Repair	2.0			101,102	
1109	Tail Rotor Pitch Control Linkage	Inspect	1.5				
		Adjust	2.0			100,102	
		Replace	2.5			101,102	
		Repair	1.0			101,102	
1110	Tail Rotor Pitch Control Mechanism	Inspect	2.0			100,102	
		Adjust	3.0			101,102	
		Replace	2.0			101,102	
		Repair	2.0			101,102	
1111	Tail Rotor Pitch Change Rods and Links	Inspect	1.0				
		Adjust	1.5			100,102	
		Replace	2.0			101,102	
		Repair	1.0			101,102	
1112	Stabilization Equipment						
1112 01	Control Panel	Inspect	0.5				
		Replace					F
		Repair					F
1112 02	Control Box	Inspect	0.2				
		Test					N
		Replace	0.5			100,102	
		Repair					N
1112 03	Solenoid Valves, Hoses, Connectors	Inspect	1.0				
		Replace	1.5			100,102	
1112 04	Transducers	Inspect	0.5				
		Replace	1.0			100,102	

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NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
1004	Valves and Fittings	Inspect	0.5				
		Replace	1.0			100,102	
1005	Filter Assembly	Inspect	0.5				
		Replace	1.5			100,102	
		Repair	0.5			100,102	
1006	Hoses, Tubing and Filler Caps	Inspect	0.5				
		Replace	1.5			100,102	
1100	Flight Control Systems						
1101	Main Rotor Control Tubes and Rod Ends	Inspect	3.5				
		Adjust	2.5			100,102	
		Replace	4.0			101,102	
		Repair	2.5			101,102	
1102	Force Gradient Assembly	Inspect	0.5				
		Adjust	3.0			100,102	
		Replace	1.0			101,102	
		Repair		2.0		102	
1103	Control Stick (Collective and Cyclic	Inspect	1.0				
		Adjust	2.0			100,102	
		Replace		2.5		102,46	
		Repair	2.0	4.0		102,107	
1104	Synchronized Elevator	Inspect	2.0				
		Adjust	3.0			100,102	
		Replace	4.0			101,102	
		Repair	2.0			101,103	
1105	Magnetic Brake	Inspect	0.5				
		Adjust	0.5			100,102	
		Replace	1.0			101,102	
		Repair		4.0			
1106	Collective and Cyclic Linkage	Inspect	2.0				
		Adjust	5.0			100,102	
		Replace	2.0			101,102	
		Repair	1.0			101,102	
1107	Tail Rotor Pedal Assy Linkage	Inspect	3.0				
		Adjust	5.0			100,102	

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0909	Alternator	Inspect	0.5				
		Replace	2.5			100,107	
		Repair	1.5			100,107	
		Overhaul			8.0		
0910	Navigation, Instrument, Interior Cabin, Anti-Collision, and Flasher Units	Inspect	1.0				
		Replace	1.5			100,102	
		Repair	1.5			100,102	
0911	Search Light Assembly	Inspect	0.5				
		Replace	0.5			100,107	
		Repair	1.5			100,107	
		Overhaul			5.5		
0912	Caution Panels	Inspect	0.5				
		Test	0.5			107,100	
		Replace	1.0			100,107	
		Repair	1.5			107,110	
0913	RPM Warning Control Box	Inspect	1.5				
		Adjust	3.5			100,106	
		Replace	1.5			100,106	
		Repair		0.5		106,110	
		Overhaul			9.5		
0914	Chip Detector System	Inspect	0.5				
		Replace	1.0			100,107	
1000	Fuel System						
1001	Main Fuel Tanks, both crashworthy and non-crashworthy	Inspect	1.5				
		Service	0.5			100,102	
		Replace		8.5		102	
		Repair		6.5		102,117	
1002	Fuel Low Level Warning System	Inspect	0.5				
		Test		2.0		100,102	
		Replace		4.5		100,102	
1003	Boost Pumps	Inspect	1.5				
		Replace	2.0			101,102	
		Repair		5.5			

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HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0900	Electrical Systems						
0901	Inverters	Inspect	0.5				
		Replace	1.5			100,107	N
		Repair	2.0			100,107	
0902	Relays, Rheostats Switches, Circuit Breakers, Plugs, Leads, Connectors, Conduits, Receptacles, Shunts, and Circuit Boards	Inspect	0.5				
		Test		0.5		110	
		Replace	1.0			100,107	
		Repair		0.5		107,110	
0903	Wiring	Inspect	4.5			100,107	
		Test	8.5			100,107	
		Replace	1.0			100,107	
		Repair	10.5			100,107	
0904	Regulator	Inspect	0.5				
		Adjust	0.5			100,107	
		Replace	1.0			100,107	
		Overhaul			8.0		
0905	Battery	Inspect	0.5				
		Test					O
		Service					O
		Replace	1.0			100,102	
		Repair					O
0906	Starter Generator	Inspect	1.5				
		Test		2.0		107,110	
		Replace	2.0			100,107	
		Repair		2.5		107,110	P
0907	Cooling Blower	Inspect	0.5				
		Replace	1.5			100,107	
		Repair	0.5			100,107	
		Overhaul			10.5		
0908	Lights	Inspect	0.5				
		Replace	0.5			100,107	

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(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
0801 0404	Engine Oil Pressure Transmitter and Indicator	Inspect Replace Overhaul	0.5 1.5		 3.5	 100,106	
0801 0405	Fuel Pressure Indicator and Transmitter	Inspect Test Replace Overhaul	0.5 1.0	 1.0 	 2.5	 110 100,106	
0801 0406	Torquemeter and Transmitter	Inspect Replace Overhaul	0.5 1.0		 2.5	 100,106	
0801	Tachometer, Generators	Inspect Replace	0.5 1.0			 100,106	
0801 05	Engine Instruments						
0801 0501	Gas Producer Tachometer	Inspect Test Replace Overhaul	0.5 1.5	 1.0 	 3.0	 110 100,106	
0801 06	Transmission Instruments						
0801 0601	Oil Temperature Gage	Inspect Replace Overhaul	0.5 0.5		 3.5	 100,106	
0801 0602	Oil Pressure Gage and Transmitter	Inspect Replace Overhaul	0.5 1.5		 2.5	 100,106	
0801 0603	Temperature Bulbs	Inspect Test Replace	0.5 0.5	 0.5 	 	 110 100,106	

MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS

HELICOPTER, ATTACK, AH-1

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
1602 04	Accelerometer Resolver	Inspect	0.2				
		Adjust	0.5			100,102	
		Replace	0.5			100,102	
		Repair	8.0			101,102	
1602 05	Servo-electronic Control Unit	Inspect	0.5				
		Adjust	1.0			101,107	
		Replace	2.0			101,107	
		Repair	1.0	2.0		101,107	
		Overhaul			24.0		
1602 06	Hydraulic Power Cylinder	Inspect	0.5				
		Replace	1.0			101,102	
		Repair	3.0			101,104	
		Overhaul			16.0		
1700	Emergency Equipment						
1701	Canopy Removal System	Inspect	0.5				
		Replace		5.0		102	
		Repair		10.0		102	
1800	Installed Avionics Components						
				NOTE			
		TM 11-1520-221-30 contains maintenance instructions for avionics.					

SECTION III. TOOLS AND TEST EQUIPMENT REQUIREMENTS

TOOL OR TEST EQUIPMENT	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NO.
5	O	Bit, Screwdriver	5120-00-863-4941	HTS-6
6	O	Socket, Adapter	5120-00-937-8481	HTS-10
10	F	Stand Assy, Scissors and Sleeve		PD 1468
11	F	Socket, Wrench, Face Spanner		PD1469
12	O	Socket, Splined	5120-00-619-9773	PD 2658
13	O	Socket, Mast Nut	5120-00-619-9779	PD 2659
14	O	Adapter, Reaction	5120-00-619-9776	PD 2660
17	F	Transmission Adapter	4920-00-676-2307	SWE13852-40
21	O	Sling, Aircraft Maint	1730-00-099-8099	T100220
22	O	Wrench, Transmission	4920-00-797-3672	T101306
23	O	Wrench, Tail Rotor	4920-00-718-6533	T101307
24	O	Jack Screw Set	4920-00-710-7946	T101308
25	O	Jack Screw Set	4920-00-765-4410	T101338
26	O	Build Up Bench	4920-00-678-5431	T101356
27	F	Support Scissors and Sleeve	4920-00-786-1756	T101369
28	F	Ram Adapter, Scissors & Sleeve	4920-00-713-5555	T101382
30	O	Scope Assy Blade Alignment	4920-00-718-6674	T101401
31	O	Socket, Wrench, Face Spanner	5120-00-044-1426	T101414
32	O	Tool Set, Alignment	5120-00-894-6540	T101419
33	O	Fixture, Holding Shaft	4920-00-876-0103	T101420

TOOL OR TEST EQUIPMENT	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NO.
34	O	Plate	4920-00-898-0015	T101421
35	O	Bar, Bearing Removal	4920-00-876-0102	T101424
36	O	Jack Set	4920-00-805-5123	T101440
38	O	Socket, Wrench, Face, Spanner	5120-00-967-7699	T101449
39	O	Plate Assy	4920-00-967-7651	T101455
40	O	Hoisting Unit, Engine	1730-00-073-9258	T101452
41	O	Support, Main Rotor	4920-00-907-7649	T101467
44	O	Bending Gage, Trim	5210-00-919-2374	T101485
45	O	Installation Tool, Seal	5120-00-925-5085	T101487
46	F	Wrench, Input Quill	5120-00-932-3670	T101488
47	F	Puller, Bearing	5120-00-999-5306	T101491
50	O	Fixture, Rigging, Stick Cycle	4920-00-848-4930	T101524
51	O	Tab Bender, Main Rotor Blade	5120-00-844-7757	T101525
52	O	Fixture, Holding	4920-00-176-3708	T101549
53	O	Disassembly Tool, Valve	5120-00-176-3698	T101550
54	O	Puller, plug	5120-00-400-7724	T101551
55	O	Tool Set, Plunger Assy	5180-00-176-3701	T101553
57	O	Staking Tool	5120-00-409-9524	T101577
58	O	Wrench, Spanner	5120-00-412-7401	T101600
59	O	Lock Grip, Main Rotor	5120-00-451-2956	T101864
60	F	Sealing Tool, Pylon Damper	4920-00-423-5239	1570-EG-00
82	O	Plate Adapter	4920-00-437-5112	7HELO74
87	F	Socket Collective Sleeve Bearing		PD 1470
88	F	Extension, Socket Wrench	5120-00-033-2112	PD 1471

TOOL OR TEST EQUIPMENT	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NO.
89	O	Scale Dial Indicator	6670-00-246-0347	AAAS133
90	O	Crowfoot Attachment	5120-00-184-8413	GGGW641
91	F	Socket, Splined Reaction	5120-00-619-9774	PD 2657
92	O	Key Socket Head	5120-01-016-5635	GGGK275
100	O	Tool Set, Avum, Set No. 1	4920-00-159-8727	
101	O	Tool Set, AVUM, Set No. 2	4920-00-567-0476	
102	O	Tool Kit, Aircraft Mechanics, General	5180-00-323-4692	
103	O	Tool Kit, Airframe Repairmans	5180-00-323-4876	
104	O	Tool Kit, Hydraulic Repairmans	5180-00-323-4891	
105	O	Tool Kit, Prop and Rotor Repairmans	5180-00-323-4909	
106	O	Tool Kit, Instrument Repairmans	5180-00-323-4913	
107	O	Tool Kit, Electrical Repairmans	5180-00-323-4915	
108	O	Tool Kit, Eng Repair	5180-00-323-4944	
109	O	Tool Kit, Power Train Repairmans	5180-00-003-5267	
110	F	Shop Set, AVIM, Electrical Instrument	4920-00-165-1453	
111	F	Shop Set, AVIM, Hydraulic	4920-00-165-1454	
112	F	Shop Set, AVIM, Machine Shop	4920-00-405-9279	
113	F	Shop Set, AVIM, Powertrain	4920-00-001-4132	
116	F	Shop Set, AVIM, Rotor Shop	4920-00-405-9270	
117	F	Shop Set, AVIM, Sheet	4920-00-166-5505	
118	F	Shop Set, AVIM, Tool Crib	4920-00-472-4183	
119	F	Shop Set, AVIM, Turbine Engine	4920-00-224-3684	
120	F	Shop Set, AVIM, Welding	4920-00-163-5093	
121	***F***	***Repair Kit, Rotor Blade***	***4920-01-035-0324***	***K747-401***

SECTION IV. REMARKS

REFERENCE CODE	REMARKS
A	Limited to airframe repairman's tool kit and portable hand tools
B	Not including build up
C	Epoxy
D	Removal of nicks and scratches
E	Limited to hand stitching only
F	Refer to TM 11-1520-236-23 for removal and repair instructions
G	Refer to TM 55-2840-229-24
H	METS — Modular Engine Test System
I	Track
J	Balance
K	Seal and Coupling Replacement
L	Scratch Blending
M	Seal Replacement
N	Refer to TM 11-1520-221-20
O	Refer to TM 11-6140-203-35-2
P	Based on distribution of generator test stand
Q	Replacement of worn or elongated bushings
R	Refer to TM 9-1090-203 for Maintenance Instructions
S	Requires 2 people and excessive time
T	Restricted to AVUM units with 10 or more aircraft. Use extreme care in removal.
U	If electronic test is required, accomplish with AVIM support.
V	***Limited to Non-Divisional AVIM only***
W	***Limited to blade plug repair on K747 (AVIM)***

APPENDIX C
AIRCRAFT INVENTORY MASTER GUIDE

C-1. INTRODUCTION.

C-2. SCOPE.

Appendix C lists those items of installed or loose equipment required by and authorized for using organizations to accomplish their primary or alternate mission. This list will serve to standardize present inventory procedures, using the inventory master guide to determine the inventoriable items of installed and loose equipment. Insofar as possible, items of equipment are listed in the sequence of their physical location within the helicopter area.

C-3. CHANGES TO INVENTORY.

Aircraft inventory is subject to change as a result of authorized changes (MWO's), addition or deletions of property for special missions requirements; therefore, the selection of items of inventory from the inventory master guide may or may not provide a complete inventory list. When it is known that the master guide does not provide a complete inventory list, it will be necessary to research authorized changes (MWO's) and local command directives in order to compile an accurate and exact inventory list.

C-4. INVENTORY FORMS AND RECORDS.

Refer to TM 38-750 for applicable forms and records.

C-5. REQUIREMENTS.

C-6. SECURITY.

It is desired that inventory records be unclassified. Therefore, when equipment bearing a security classification or the installation of unclassified equipment is of a confidential or secret nature, accomplishment of the classification will be in accordance with security regulations.

C-7. INVENTORIABLE ITEMS.

The selection of inventoriable items is without regard to the agency, governmental or contractual, furnishing the items.

a. Items to be listed:

(1) Items essential to the execution of the designated mission of the helicopter, such as electronic, photographic, armament, special mission instruments, and safety and comfort equipment.

(2) Loose equipment delivered with the helicopter and items subject to pilferage or readily converted to personal use.

(3) Modification kits which are issued or distributed to using organizations for installation and which are not immediately placed in work will be recorded on the affected aircraft's DA Form 2408-17 (Aircraft Inventory Record) and identified as loose equipment until modification is completed.

(4) Equipment required for operation in special environment.

b. Items to be excluded:

(1) Nonaccountable items coded as expendable in the applicable stock lists.

(2) Personal issue or furnished on unit allowance or other authority.

(3) Items or components considered as basic or integral parts of the helicopter or basic helicopter such as engines, propellers, wheels, and standard instruments.

(4) Equipment publications, check lists, and aircraft forms.

C-8. PERIODS OF INVENTORY.

Inventoriable items will be checked against the Aircraft Inventory Record (DA Form 2408-17) at the following periods:

a. Upon receipt of the helicopter.

b. Prior to transfer of the helicopter to another organization.

c. Upon placing helicopter in storage and upon removing from storage. Helicopter need not be inventoried while in storage.

d. Twelve months elapsed time since last inventory.

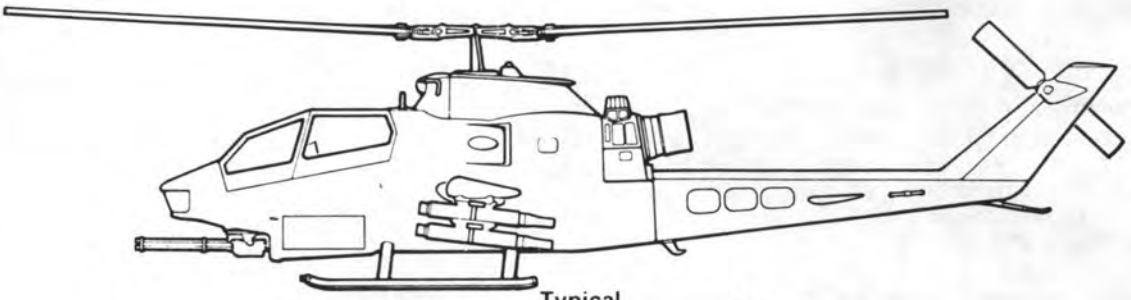
e. Loose equipment shipped under separate cover is inventoried upon transfer by the sending activity and immediately upon receipt by the receiving activity.

C-9 INVENTORY ITEMS LISTED.

Refer to figure C-1.

NOTE

Only those items listed which are installed or assigned to a particular aircraft are to be listed on a DA Form 2408-17 (Aircraft Inventory Record) for aircraft.



NOMENCLATURE	AIRCRAFT SERIES AND NUMBER OF ITEMS NORMALLY INSTALLED AH-1S	REMARKS
Forward Section (Pilot/Gunner Compartment)		
Ignition Key	2	
Canopy Key	2	
Aircraft Manufacturer's Data Plate (100-030-1)	1	
Seat Belt and Shoulder Harness, Pilot	1	
Seat Belt and Shoulder Harness, Gunner	1	
Clock	1	
Compass, Magnetic, Pilot Standby	1	
First Aid Kit	1	
Fire Extinguisher	1	
Electronic Control Subassembly, 7.62MM Gun P (1169L622)	1	
Electronic Control Subassembly, 20 MM Gun E	1	
C-6533/ARC, Control, Intercommunication	2	
Audio Threshold 1021-D001	1	
Indicator, ID-2103/A Horizontal Situation (209-075-660)	1	
Indicator, ID-2104/A Attitude Direction (209-075-661)	1	
Indicator, ID-2105/A Radio Magnetic Compass (212-070-180)	1	
Control C-10048/ARN-123(V)	1	
Compass C-6347/ASN Control	1	
Control C-1053/APX-100(V) M	1	
AN/ARC-116 or AN/ARC-164	1	
RT-1167 UHF Command Communication System	1	
AN/ARC-115 Radio Set	1	
Control C-8157/ARC	1	
AN/ARC-114A Radio Set	1	
APN-209 RT-1115 Radar Altimeter	1	
Control HG1001AD01 Proximity Warning	1	
Control, Navigational Select (209-077-081)	1	
Computer Display Unit, CP-1252/ASN-128 M	1	
Helmet, Sight System	2	
Control C-6208/APX-72 P	1	
Telescopic Sight Unit (M-65)	1	
Sight Hand Control (M-65)	1	
TOW Control Panel (M-65)	1	
Missile Status Panel (M-65)	1	(AH-1S mod only)
Pilot Steering Indicator (M-65)	1	(all except AH-1S MC)

Figure C-1. Inventory Item List (Sheet 1 of 2)

NOMENCLATURE	AIRCRAFT SERIES AND NUMBER OF ITEMS NORMALLY INSTALLED AH-1S	REMARKS
Forward Section (Electronics Compartment)		
AN/ARN-89B Directional Finder (ADF)	1	
CN-998/ASN-43 Gyro Directional	1	
AN/ARN-89B, R-1496A Receiver	1	
AN/ARN-89B, C-7392A Control	1	
AN/ARN-89A, AM-4859A Amplifier	1	
Forward Section (General)		
Cover, Low Air Speed Sensor M	1	
Cover, Pitot Tube	1	
Cover, Canopy	1	
Shield, Engine Inlet	2	
Cover, Tail Pipe/IR Suppressor	1	
Fitting, Jack	4	
Armament Subsystem, M-197 E M	1	
Ammunition Storage Box E M	1	
Panel, Armor	11	
Armament Subsystem, M28A1 E P	1	
TOW Missile Launcher (M-65)	4	
Aft Section		
Main Rotor Tie-Down (130-013-3)	1	
Tail Rotor Tie-Down (204-070-450-19)	1	
Mount, MT-3802/ARC	1	
Mount, MT-3949A/U	1	
RT-859A/APX-72 Receiver Transponder P E	1	
Mount, MT-3809/APX-72 P E	1	
Test Set TS-1843A/APX-72 P E	1	
Mount, MT-3513/APX-72 P E	1	
RT 1157/APX100(V) Receiver Transponder M	1	
MT-4811/APX-100(V) Mount M	1	
Transmitter, Induction Compass T-611/ASN	1	
Compensator, CN-405/ASN, Magnetic Flux	1	
Receiver, R-1838 ( ) APR-39	1	
Receiver, R-2023/ARN-123(V)	1	
Mount, MT-4834/ARN-123(V)	1	
Receiver/Transmitter, RT-1193 ( )/ASN-128 M	1	
Signal Data Converter, CV-3338 ( )/ASN-128 M	1	
Mount, MT-4980/ARN-123(V) E	1	
Electronic Power Supply (M-65)	1	
Missile Command Amplifier (M-65)	1	
Stabilization Control Amplifier (M-65)	1	

Figure C-1. Inventory Item List (Sheet 2 of 2)

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By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Organizational Maintenance requirements for AH-1S (PROD) aircraft.

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RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

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PFC JOHN DOE
COA, 3d ENGINEER BN
FT. LEONARD WOOD MO 63108

DATE

PUBLICATION NUMBER	DATE	TITLE
TM 55-1520-236-23-2	8 May 1980	AVIM/AVUM Maint Manual - AH-1S (PROD), (ECAS), (MODERNIZED COBRA)

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.
81		4-3		Callout 16 on figure 4-3 is pointing at a bolt. In the key to fig. 4-3, item 16 is called a shim. Please correct one or the other.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered so the NSN is wrong. Please give me a good NSN.

SAMPLE

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER
JOHN DOE, PFC (268) 317-7111

SIGN HERE:
John Doe

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DRSTS-M Overprint 1, 1 Nov 78

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TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = . 39 inch
1 decimenter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = . 15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigrams = . 035 ounce
1 dekagram = 10 grams = . 35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = . 34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 38.82 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = . 155 sq. inch
1 sq. decimenter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = . 386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = . 06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.365	metric tons	short tons	1.102
pound-inches	newton-meters	.11375			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C