United States Army Aviation Logistics School
Fort Eustis, Virginia

APRIL 1994

THIS DOCUMENT HAS BEEN REVIEWED FOR OPSEC CONSIDERATIONS

STUDENT HANDOUT

LANDING GEAR AND BRAKES

071-634-04

The proponent for this SH is USAALS

INTRODUCTION

TERMINAL LEARNING OBJECTIVE:

NOTE: Read the following terminal learning objective statement to the students.

At the completion of this lesson you will:

ACTION: Analyze landing gear and brake system malfunctions.

CONDITIONS: Given TM 55-1520-238-23 and TM 1-1520-238-T series manuals.

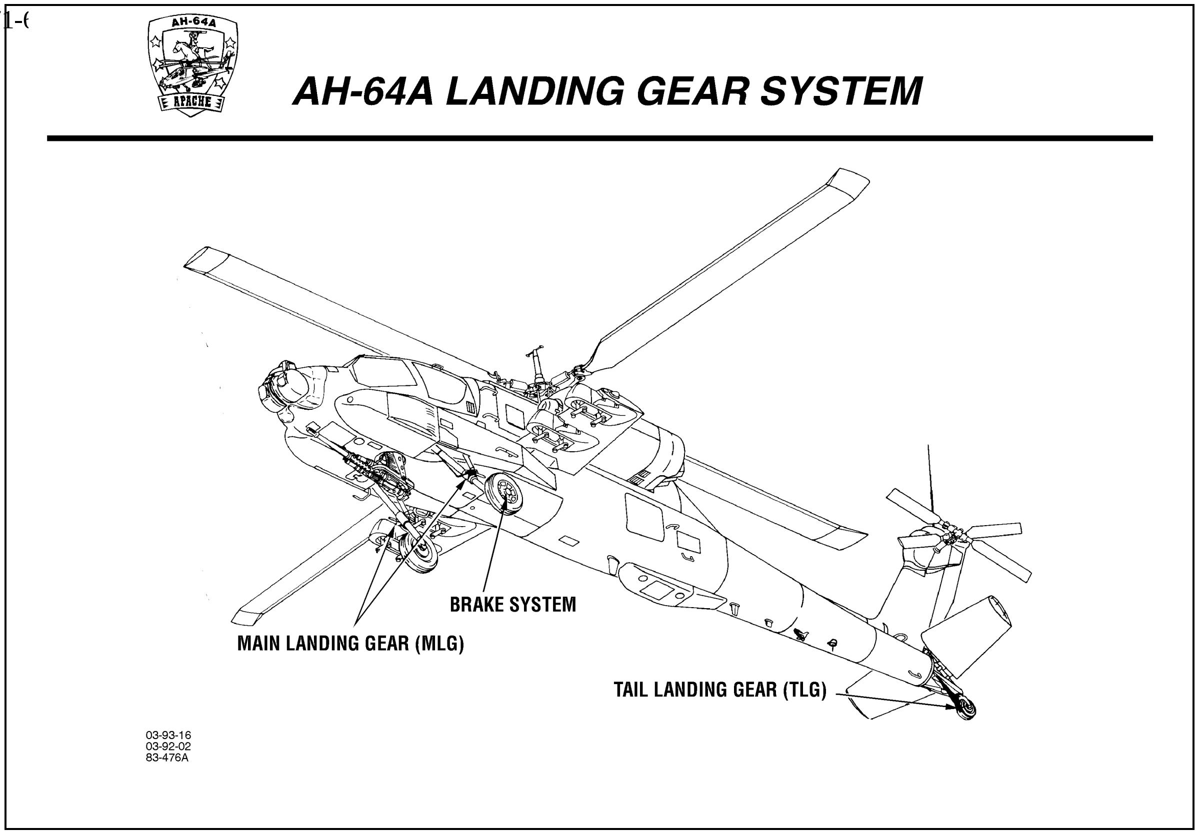
STANDARDS: Determine by selecting from a list, the corrective actions for landing gear and brake system malfunctions in accordance with TM 1-1520-238-T series and TM 55-1520-238-23 series manuals.

SAFETY REQUIREMENTS: In addition to the specific safety requirements of this lesson plan, aviation shop and flight line safety standards established in the applicable manuals will be reinforced. All warnings, cautions, and notes must be observed during task performance.

WARNING

HIGH PRESSURE NITROGEN

Shock struts and tires contain nitrogen under high pressure. You could get hurt from a sudden blast. To prevent possible injury, follow deflation instructions carefully. If injury occurs, seek medical aid.


AH-64A
APACHE
AH-64A LANDING GEAR SYSTEM
BRAKE SYSTEM
MAIN LANDING GEAR (MLG)
TAIL LANDING GEAR (TLG)
03-93-16
03-92-02
83-476A

NOTES

A. Landing gear and brake system

1. Provides support and ground stability for the helicopter during ground operations. Dampens takeoff and landing shocks before they can be transmitted to the airframe structure. Provides for the mounting of the hydraulic disk brakes.

2. The main landing gear is under the main fuselage, forward of the wings.

3. The brake system is installed on the trailing arms of the main landing gear.

4. The tail landing gear supports the helicopter tail boom.

5. The AH-64A landing gear system is a non-retractable, conventional configuration consisting of three major components.

    a. The two forward wheels and their support parts make up the main landing gear (MLG).

    b. A single tail wheel and its support parts make up the tail landing gear (TLG).

    c. The brake system consists of four master cylinders, two transfer valves, a parking brake valve, and two wheel brakes.

6. The landing gear assemblies include shock struts, trailing arms, wheels and tires.

7. Landing gear system features and capabilities

    a. All three (3) gear (left and right MLG, and the TLG) function independently of each other.

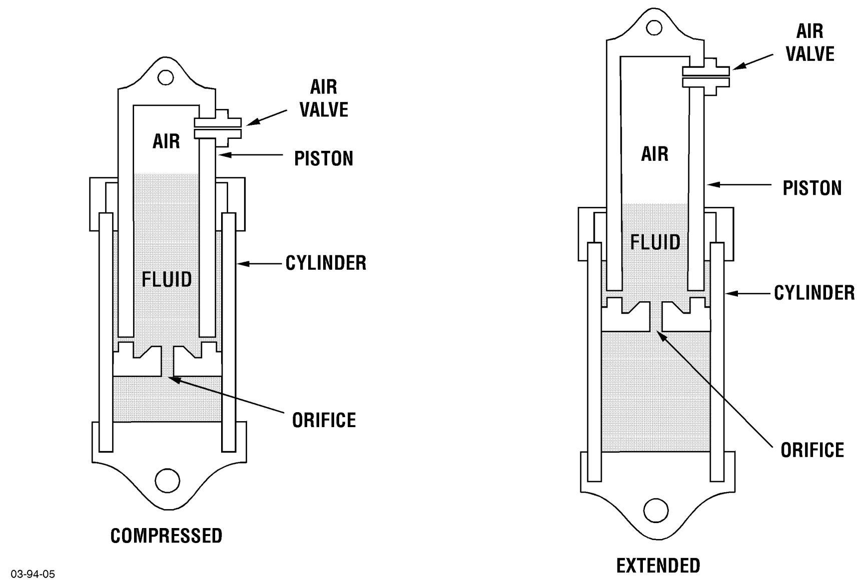
    b. The design of the landing gear, shock struts (oleo type) and tires, along with the main rotor blade elastomeric dampers, permit the aircraft to be free of mechanical instability (ground resonance) with any two (2) of the following three (3) conditions: one blade damper inoperative, one flat gear tire, or one flat main gear strut.

    c. All wheel assemblies use tubeless tires, the tail wheel has an inner tube installed to withstand side loads incurred during ground maneuvering.

    d. The MLG has hydraulically operated disk brakes for stopping, parking, and steering on the ground.

    e. The TLG wheel swivels 360º for ground steering.

SIMPLE SHOCK STRUT



NOTES

B. Shock struts (oleo struts)

1. A shock strut can be thought of as a combination suspension unit and shock absorber. The shock strut performs functions in an aircraft similar to those performed in an automobile by the chassis spring and the shock absorber. There are two major types of shock struts, the classification depending on construction and operation.

   a. Mechanical type. A rubber or spring mechanism performs the cushioning operation.

   b. Pnuedraulic type. Air (or in the case of the AH-64A, nitrogen) and hydraulic fluid perform the cushioning action.

2. Simple shock strut

   a. The basic parts of a simple shock strut are two telescoping tubes: a piston and a cylinder.

   b. A simple shock strut is installed on an aircraft with the piston upper-most and with the cylinder filled with fluid. An orifice in the piston head permits fluid to pass from one chamber to the other.

   c. For optimuim operation, a shock strut must be correctly serviced with fluid and the remaining space filled with air.

   d. When the aircraft is landing and the shock strut is compressing, fluid is forced through the orifice into the piston.

   e. The movement of fluid through the orifice, together with the compression of the air, absorbs the energy of motion of the descending aircraft.

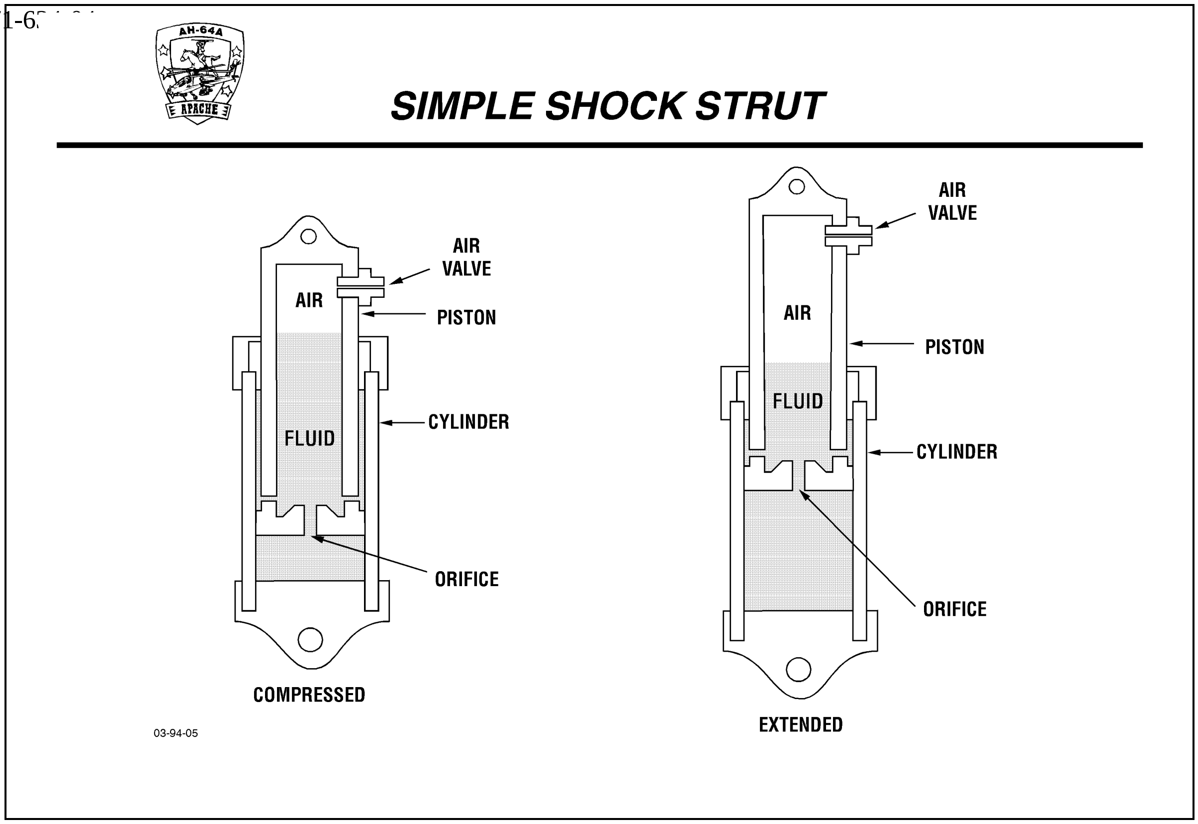
   f. When the load on the shock strut is lightened, the shock strut extends.

   g. This extension is caused by the compressed air in the shock strut and, during takeoff, by the weight of the lower tube and attached landing gear.

   h. When the shock strut is extending, fluid in the piston passes through the orifice from the piston into the cylinder.

3. Complex shock strut

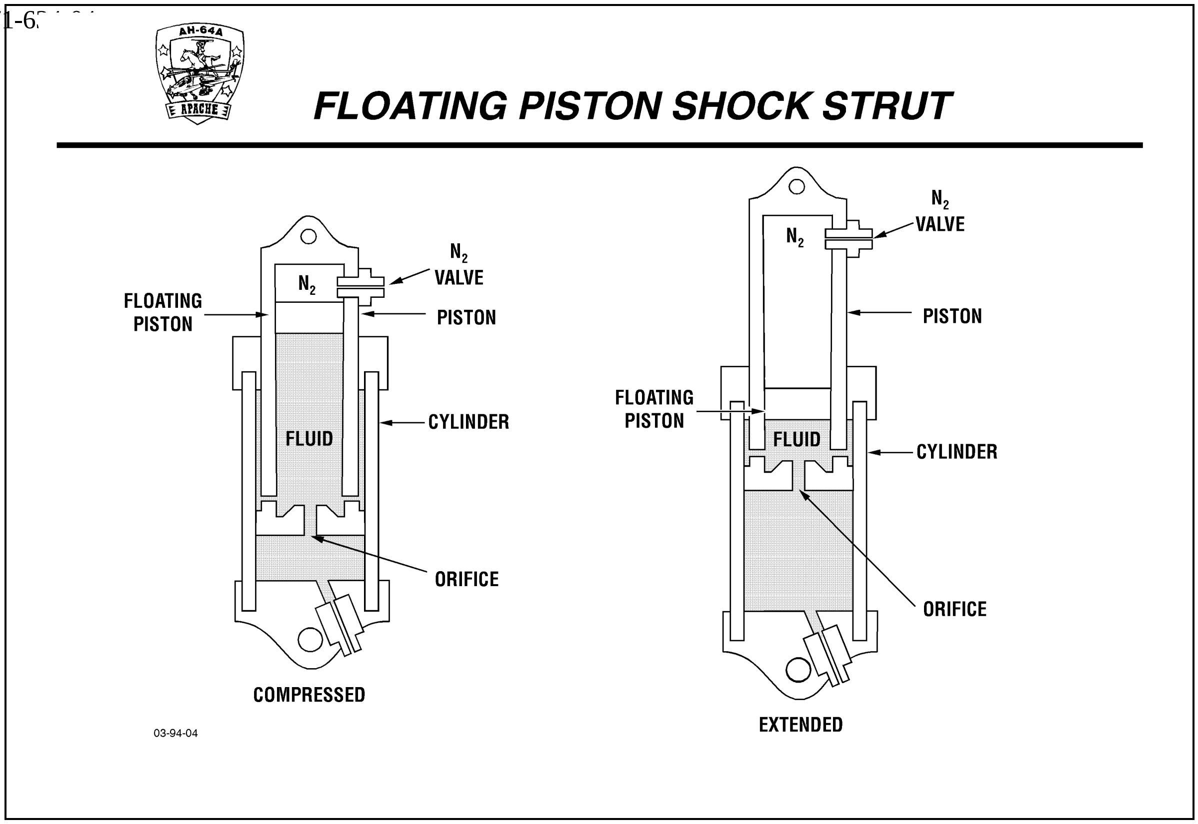
   a. Complex shock struts work in essentially the same manner as simple ones. However, they contain, in addition to two telescoping tubes, a number of parts that make for more effective damping action than is possible with simple struts.


AH-64A
APACHE
SIMPLE SHOCK STRUT
AIR
VALVE
AIR
PISTON
FLUID
CYLINDER
ORIFICE
COMPRESSED
03-94-05
AIR
VALVE
AIR
PISTON
FLUID
CYLINDER
ORIFICE
EXTENDED

NOTES

b. Design features found singly or in combination in complex shock struts are metering pins, plungers, and floating pistons.

c. The shock strut on the AH-64A is a floating piston complex shock strut design, therefore only the operational principles of this type strut will be discussed in this lesson. For an operational description of metering pin and plunger type complex shock struts, refer to TM 1-1500-204-23-2.


AH-64A
APACHE
FLOATING PISTON SHOCK STRUT
N2
N2
VALVE
FLOATING
PISTON
PISTON
FLUID
CYLINDER
ORIFICE
COMPRESSED
03-94-04
N2
N2
VALVE
PISTON
FLOATING
PISTON
FLUID
CYLINDER
ORIFICE
EXTENDED

NOTES

NOTE: Normally, in a floating piston shock strut, the gas charge (nitrogen) is carried at the bottom of the shock strut instead of at the top. However, the AH-64A shock strut carries its nitrogen charge at the top.

4. Floating piston shock strut

a. In the floating piston type shock strut, the lower chamber of the strut decreases in size as the strut compresses. This is because compression of the shock strut forces fluid upward out of the lower chamber into the upper fluid chamber.

b. The increase in size of the upper fluid chamber, necessary for accommodating the inflow of fluid, is obtained by upward movement of the floating piston.

c. Thus, in addition to separating the nitrogen from the hydraulic fluid within the shock strut, the floating piston contributes to the movement of fluid through the orifice as the shock strut compresses and extends.

5. Uses of shock struts

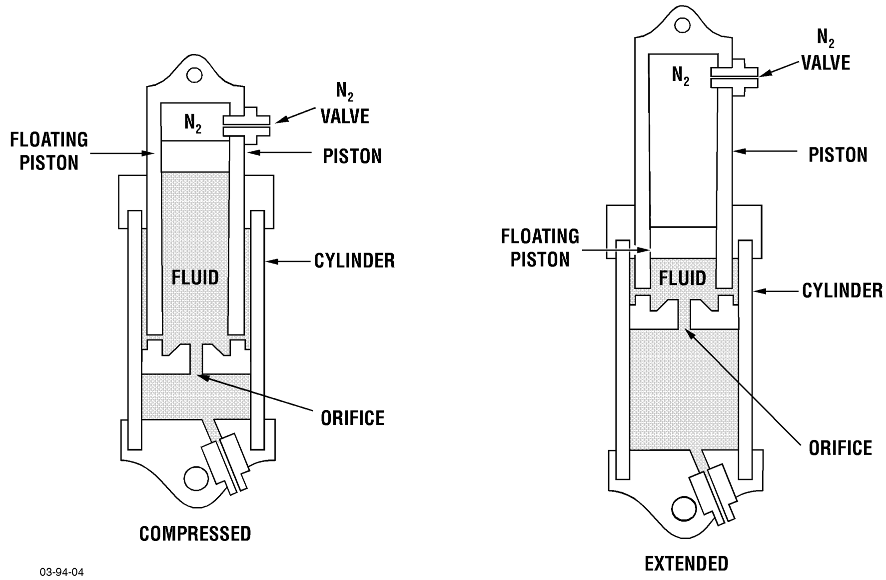
a. Shock struts support the static load of the aircraft, cushion jolts during taxiing and towing, and absorb the shock of landing.

(1) Supporting static loads. The normal load of a parked aircraft is static; that is, the force or load on the strut is constant. The pressure of nitrogen and hydraulic fluid within a shock strut tends to keep the shock strut fully extended. However, nitrogen pressure in a shock strut is not enough to keep the strut fully extended while supporting the static load of the aircraft. Therefore, a shock strut gives under load and compresses until the nitrogen pressure builds enough to support the aircraft.

(2) Cushioning during taxiing. As an aircraft ground taxies, the unevenness of the terrain surface causes the aircraft to bob up and down. The inertia of the aircraft fuselage in opposition to the up and down movements causes the force of the taxi load to fluctuate. The bouncing motion is held within limits by the damper like action of the shock strut. This dampening results from resistance created by the back-and-forth flow of fluid through the orifice as the shock strut extends and compresses.

(3) Reducing shock during landing. The aircraft will continue to descend at a high rate when landing, even after the wheels touch the ground. In the few remaining inches that the fuselage can move toward the ground after the wheels touch, the descent of the aircraft must be stopped. To perform this task, the shock strut must remove a great amount of energy from the downward movement of the aircraft. The impact force is very great compared to the force exerted by the mere weight of the aircraft. The shock strut removes

FLOATING PISTON SHOCK STRUT



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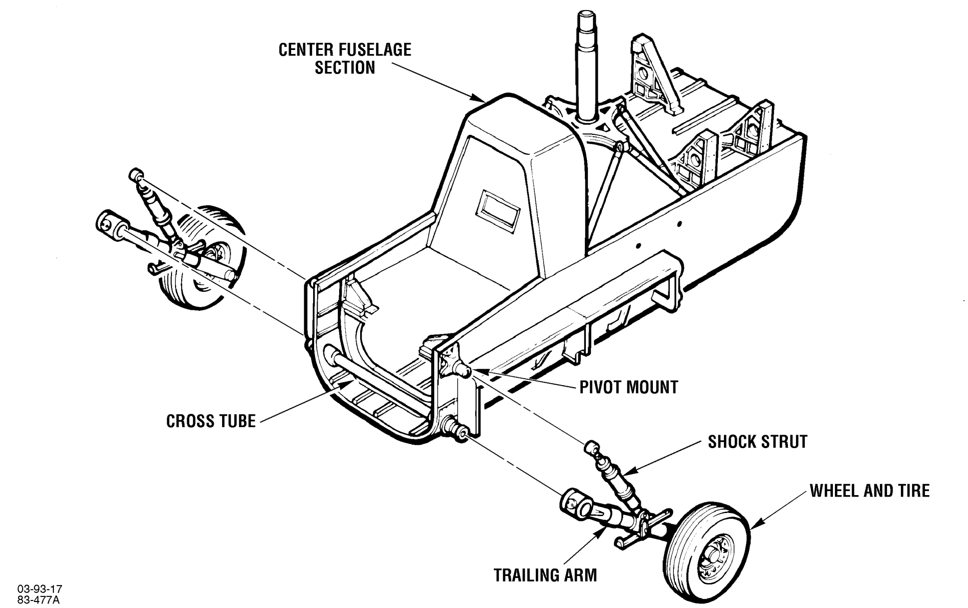
some of the energy of motion, and thus some impact force, by converting energy into heat and dissipating the heat into the atmosphere. The resistance to fluid flow offered by the orifice is the principle means of developing the heat. Also, the temperature of the nitrogen inside the strut rises as the nitrogen is compressed.

(a) Strut extension. The speed of a descending aircraft while landing causes over-compression of the nitrogen in the shock strut. As a result, the nitrogen pressure is greater than that needed to support the static load of the aircraft. The excess pressure tends to extend the shock strut and to bounce the aircraft back into the air. For reasons of comfort and control of the aircraft, this rebound has to be held to the lowest level possible. On the AH-64A shock struts, rebound is controlled by a valve assembly.

(b) Strut retraction. Compression of the shock strut forces fluid from the cylinder chamber into the piston chamber. On the AH-64A shock struts, the transfer of fluid takes place through orifices in the valve assembly. The fluid moves with some resistance, the resistance varying with the size of the orifices. The valve assembly allows fluid to flow more freely during shock strut compression than shock strut extension.

MLG MAJOR COMPONENTS



NOTES

A. Main landing gear

1. MLG supports most of the weight of the helicopter during all modes of ground operations.

2. The MLG can be kneeled to reduce the height of the helicopter for transport on aircraft, vessels, and trucks.

3. Wheel and tire assemblies permit helicopter ground movement and aid in cushioning landing shocks.

4. The assemblies also provide mounting and support for hydraulically operated disk brakes.

5. The left and right MLG assemblies are attached to upper pivot mounts on the cross tube assembly located in the lower center fuselage at fuselage station (FS) 120.00.

6. The main landing gear can absorb 57% of total kinetic energy of vertical impact of 42 feet per second (12.8 meters per second).

7. MLG major components

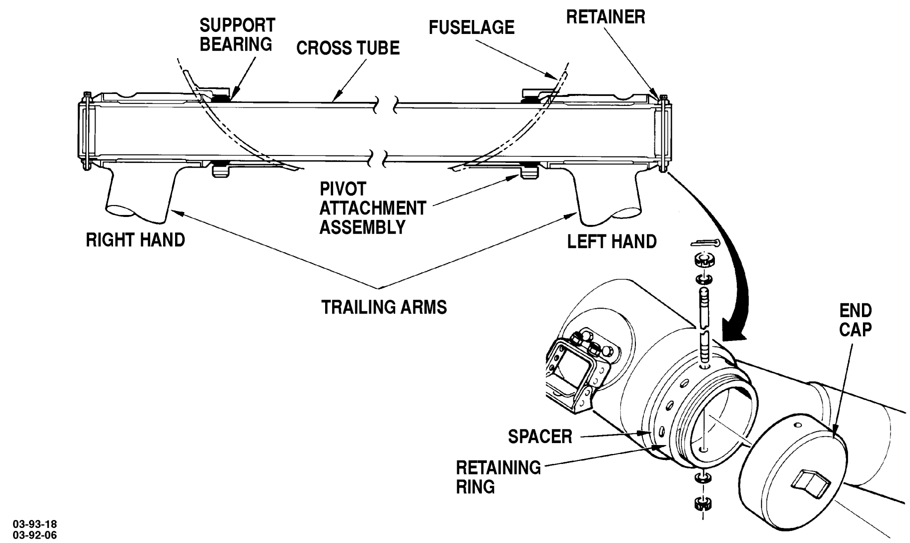
   a. Cross tube

   b. Trailing arm (left and right)

   c. Shock strut (left and right)

   d. Wheel and tire (left and right)

MLG CROSS TUBE



NOTES

8. MLG cross tube

a. Provides an interconnecting pivot mount for the left and right MLG trailing arms.

b. Transmits landing loads from the trailing arm to the fuselage and provides load-bearing support for the aircraft.

c. The MLG cross tube is mounted through the lower portion of the center fuselage at FS 120.00 and waterline (WL) 108.50. The cross tube is supported by bearings that allow for flexing during landing.

d. The cross tube is heat treated, machined steel with an average wall thickness of 0.450 inch (1.1 centimeters) and a diameter of 4.498 inches (11.42 centimeters). The length is 58.84 inches (149.45 centimeters).

e. The interior and exterior of the cross tube, with the exception of the threaded ends, are shot peened.

f. The shot peen process induces compressive stresses on the surfaces to increase fatigue strength or reduce stress-corrosion cracking.

g. Each end is threaded for installation of trailing arm retaining rings.

h. There are two (2) holes located at each end of the tube (in line) for installation of a threaded stud to retain the end caps.

i. Each end of the cross tube (approximately 12.12 inches [30.78 centimeters]), where the trailing arms attach and the support bearings contact, is chrome-plated for wear resistance.

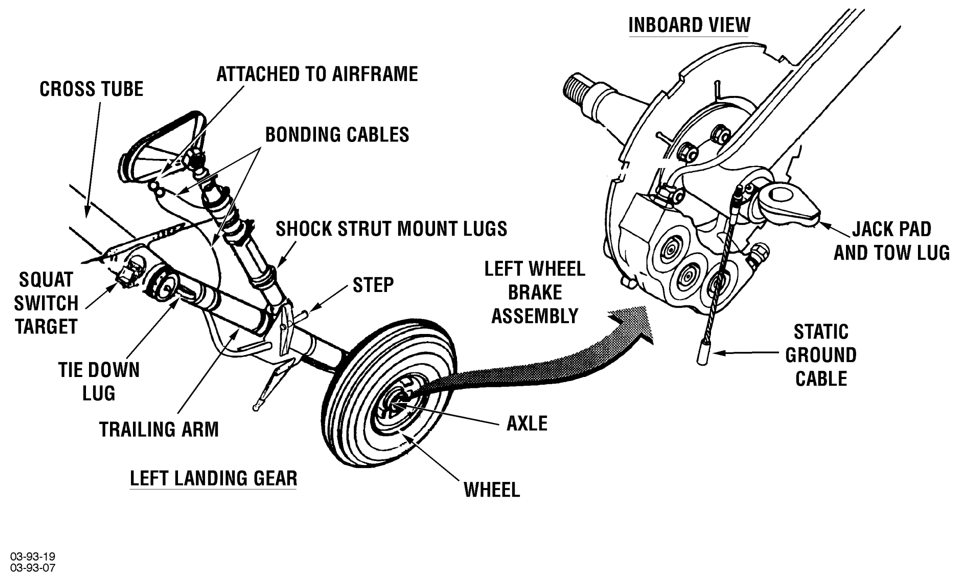
j. A pivot attachment assembly (left and right) is fastened to the fuselage (bolts and hi lock rivets) at FS 120.00 and WL 108.50. It is a major support structure and provides mounting for the support bearing. The attachment is a machined aluminum alloy forging.

k. A self-lubricating ball bearing is pressed into the pivot attachment assembly (left and right). The large support bearings allow the cross tube to rotate within the fuselage.

l. The trailing arms have free vertical movement on the frame cross tube. The pivot attachment assembly contains provisions for installing the jack pad/tow lug adapters.

m. Inspection should be accomplished in accordance with TM 55-1520-238-23-2.

MLG TRAILING ARM DESCRIPTION



NOTES

9. MLG trailing arm

a. The MLG trailing arms are the main support for the landing gear system.

b. The trailing arms transmit vertical loads to the shock struts; and absorb longitudinal and lateral loads during landings.

c. The MLG trailing arms are attached to the cross tube assembly. The trailing arms have free vertical movement on the cross tube.

d. MLG trailing arm provides mounting for:

(1) One squat switch target located on left MLG arm

(2) Integral tie-down lugs

(3) Cutter assembly

(4) Axle and wheels

(5) Steps, secured by the hardware that attaches the shock struts

(6) Lower ends of the shock struts

(7) Airframe bonding cable (A/C S/N 88-0200 and subsequent)

(8) Static ground cable on left MLG arm

(9) Jack/tow pad adapters installed on lower ends

(10) Brake assembly

e. The trailing arm cross section is secured to the end of the cross tube.

f. The trailing arm is made from machined steel tube.

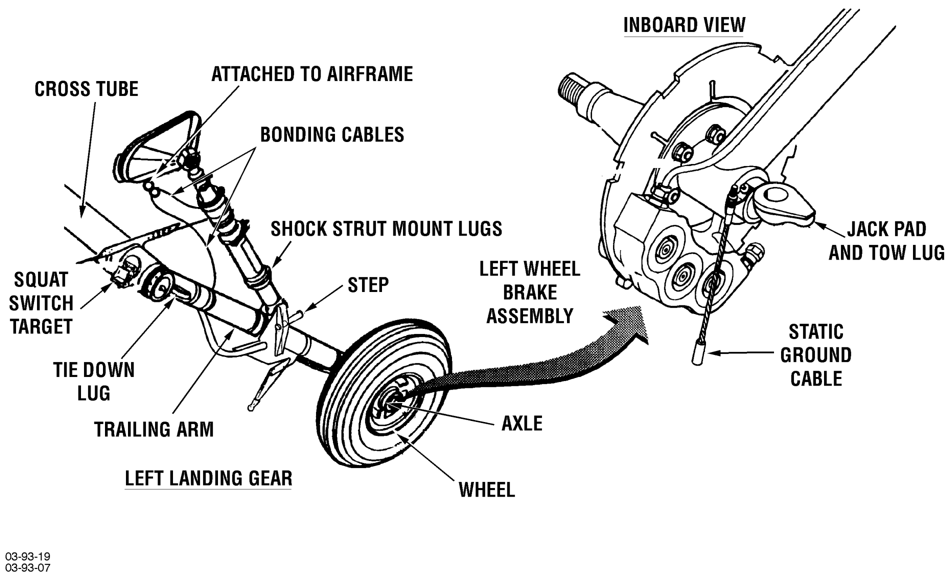
g. The attachment fitting contains teflon/fiberglass bushings. The bushings provide a bearing surface to interface with the cross tube.

h. The left trailing arm attachment has a threaded cap for the installation of the target squat switch assembly.

i. An integral tie-down lug is located just below the attachment fitting, outboard.

j. Two integral (shock strut) mounting lugs are located approximately mid-position of the arm.

MLG TRAILING ARM DESCRIPTION



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k. A step assembly is installed at the mounting lugs. It provides access to the crew stations and upper fuselage areas.

l. A machined axle and flange is provided at the lower end of the trailing arm for mounting of the wheel and brake assemblies.

m. A removable jack pad/tow lug combination assembly is installed inboard of the wheel and brake assembly:

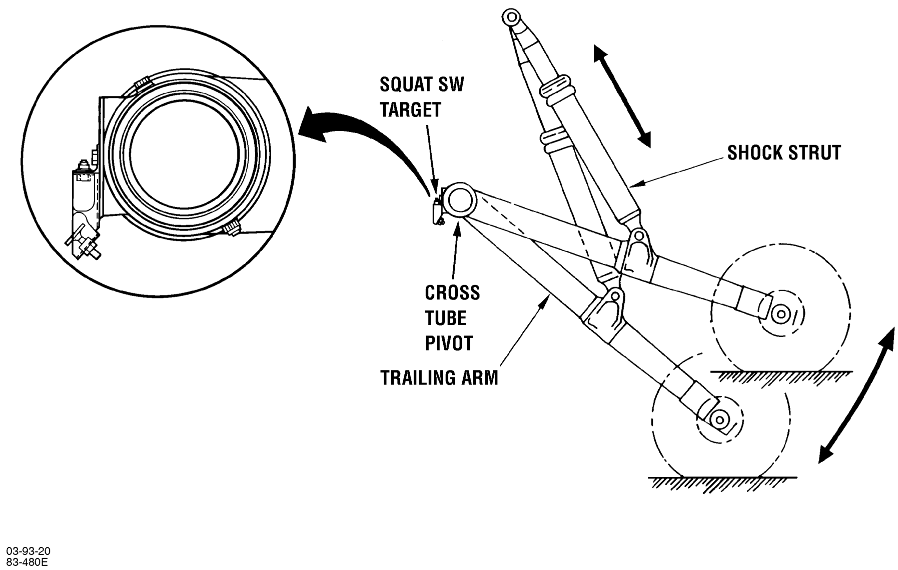
(1) The jack pad provides the capability of jacking the MLG assembly independently, without jacking the complete fuselage.

(2) The tow lug is used primarily for winching the helicopter into a transport aircraft, but can also be utilized to help moor the helicopter.

n. The airframe bonding cables provide a low-resistance path for static discharge between the air vehicle structure and the landing gear.

o. Perform the 10-hour/14-day inspection in accordance with TM 55-1520-238-23-2.

MLG TRAILING ARM OPERATION



NOTES

p. When the wheels contact the ground during landing, the trailing arms pivot (rotate) around the cross tube, transferring the vertical load inputs to the shock struts.

q. When the weight of the fuselage is supported by the MLG, the squat switch target is out of proximity with the squat switch (proximity switch). The switch will de-energize a set of relays, which in turn will:

(1) Enable wing-mounted intercommunication system (ICS) receptacles.

(2) Activate the generator under-frequency protection circuit.

(3) Command the pylon ejector racks to the ground stow position.

(4) Enable ground test fault detection and location system (FD/LS).

(5) Disable the laser, gun, rockets, and missiles.

(6) Disable the yaw function in the automatic stabilization subsystem.

(7) Disconnect electrical power from the target acquisition and designation sight/pilot's night vision sensor (TADS/PNVS) anti-ice circuit.

(8) Enables the capability to do a MODE HOLD in the transponder computer KIT-1A.

r. When the helicopter becomes airborne (either to a hover or transition to flight), the shock struts will extend, causing the trailing arm to rotate downward, moving the squat switch target into proximity of the squat switch. This will cause the two relays to become energized and:

(1) Disable the wing-mounted ICS receptacles.

(2) Deactivate the generator under-frequency protection circuit.

(3) Actuate the pylons to the flight stow position.

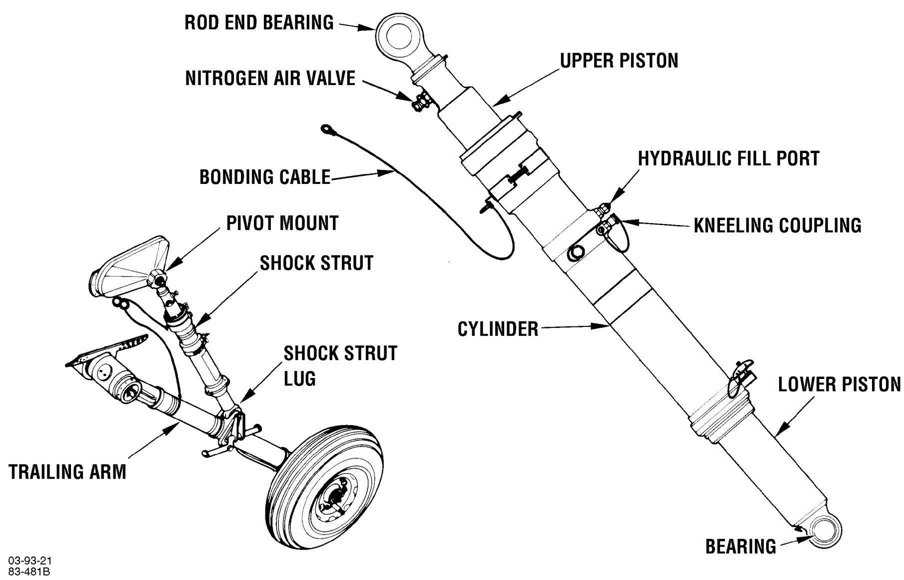
(4) Disable FD/LS ground test.

(5) Enable the laser, gun, rockets, and missiles.

(6) Enable the yaw function in the automatic stabilization subsystem.

(7) Re-establishes power to the TADS/PNVS anti-ice circuit.

MLG SHOCK STRUT LOCATION



NOTES

10. MLG shock strut

a. MLG shock strut absorbs and dampens the vertical forces that occur during takeoff and landing.

b. Provides the capability to lower (kneel) and to raise (erect) the helicopter for transporting.

c. Provides energy absorption during a high-impact landing.

d. The lower shock strut fitting is attached to the center mount lug of the trailing arm.

e. The upper shock strut fitting (rod end bearing) is attached to the fuselage pivot mount at FS 120.0 and WL 135.20.

f. The MLG shock strut is an air-oil shock absorber consisting of a cylinder with an upper and lower piston assembly. This type of shock absorber is more commonly known as an oleo strut. (Oleo is derived from the latin word *oleum*, meaning *oil*).

g. Each shock strut is serviced with approximately 3.8 quarts (3.59 liters) of MIL-H-5606 hydraulic fluid.

h. The upper piston assembly provides the dampening action during takeoff and landing.

i. The lower piston assembly has two (2) functions:

(1) Allows for kneeling the helicopter for transportability.

(2) Acts as a shock absorber in the event of a high-impact landing.

j. The shock strut weighs approximately 42.9 pounds (19.47 kilograms).

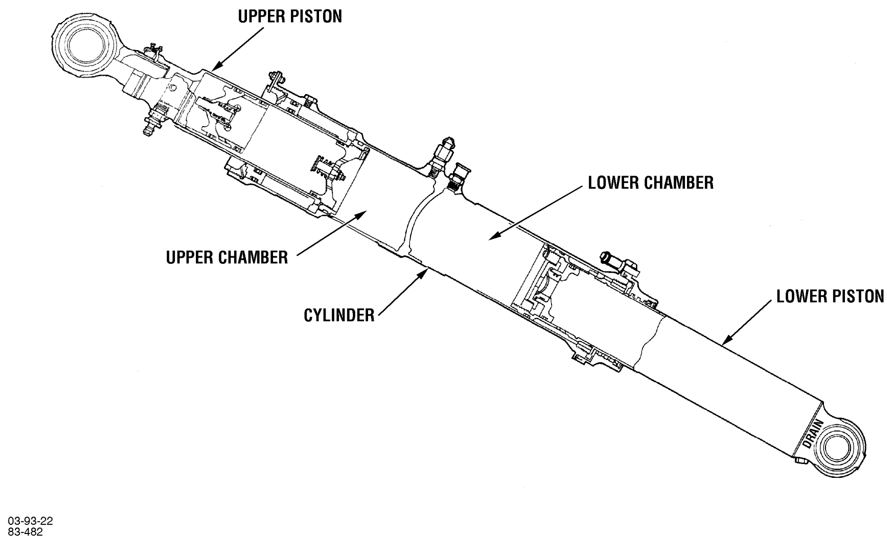
k. Shock strut major components:

(1) Cylinder

(2) Upper piston assembly

(3) Lower piston assembly

MLG SHOCK STRUT CYLINDER



NOTES

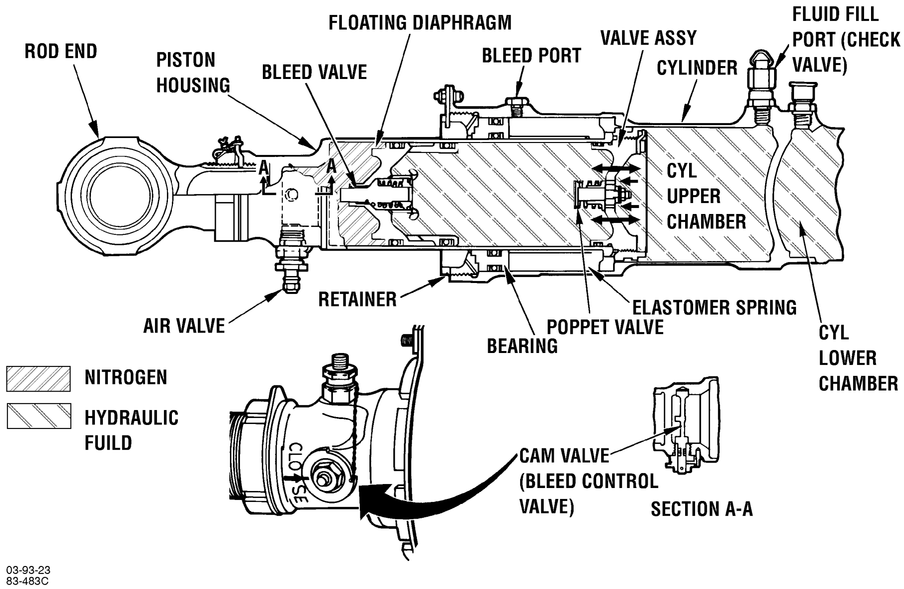
11. Shock strut cylinder

    a. The cylinder has two (2) separate chambers for upper and lower piston operation.

    b. Both ends of the cylinder are threaded for the installation of upper and lower piston retainers.

    c. The cylinder has threaded ports for fluid-filling, kneeling coupling, and bleeding and venting.

MLG SHOCK STRUT UPPER PISTON ASSEMBLY



NOTES

12. Upper piston assembly

a. The upper piston assembly is installed in the upper end of the cylinder. The components that make up the upper piston assembly are:

(1) Rod end assembly

(2) Nitrogen air valve

(3) Retainer (gland nut)

(4) Bearing

(5) Poppet valve

(6) Elastomer spring

(7) Upper chamber

(8) Fluid fill port (check valve)

(9) Valve assembly

(10) Bleed port

(11) Floating diaphragm

(12) Bleed valve

(13) Cam valve (bleed control valve)

(14) Piston housing

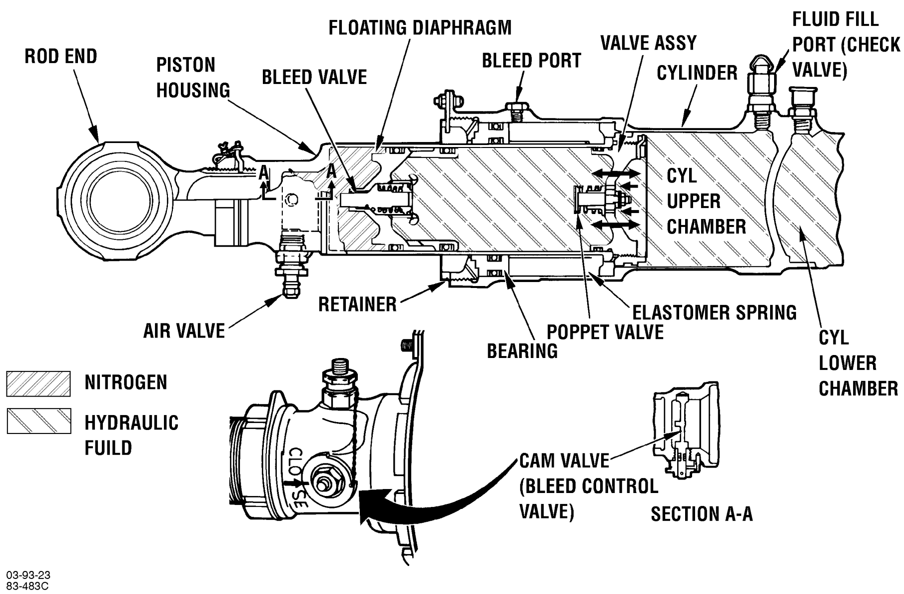
b. The external operating surface of the piston is chrome-plated to provide a protective smooth, hard finish that the piston moves on. The internal surface is cadmium-plated for corrosion protection.

c. A self-lubricating rod end bearing is threaded into the upper piston housing.

d. The upper chamber of the cylinder and upper piston are filled with hydraulic fluid (approximately 3.8 quarts [3.59 liters] of MIL-H-5606) at the fluid fill port and pressurized by nitrogen in the upper piston above the floating diaphragm.

e. The floating diaphragm floats, or rides on top of this hydraulic fluid and compresses the nitrogen during operation for dampening effect. A bleed valve is installed in the floating diaphragm. When servicing the shock strut with hydraulic fluid:

MLG SHOCK STRUT
UPPER PISTON ASSEMBLY



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(1) Nitrogen pressure is removed from the shock strut allowing the floating diaphragm to move to the top of the piston housing.

(2) When the bleed valve contacts the upper portion of the piston housing it opens. This allows all the trapped air to be bled out through the air valve.

f. During landing, the weight of the helicopter causes the shock struts to compress. The upper piston is forced toward the bottom of the cylinder and the floating diaphragm is moved upward compressing the nitrogen.

g. The compression of the nitrogen acts as a spring to cushion the landing.

h. When the helicopter is in flight (or on jacks), nitrogen pressure forces the floating diaphragm toward the lower end of the piston, driving the piston to the extended position.

i. During takeoff, the controlled rate of fluid flow from the upper piston as it extends prevents the MLG from dropping too fast.

j. An elastomer spring (spacer) assembly is installed in the upper cylinder. It provides dampening during extension.

k. The rate of extension and compression is controlled by the poppet valve and orifices on the valve assembly located at the lower end of the piston.

(1) The poppet valve opens during piston compression allowing fluid to flow through the poppet valve and orifices into the piston chamber. This controls the rate of compression.

(2) During piston extension, nitrogen pressure on the floating diaphragm forces fluid from the piston chamber to the cylinder chamber. The poppet valve remains closed allowing fluid flow only at the valve assembly orifices. This slows the rate of extension.

(3) The poppet valve and orifices in the valve assembly control the rate of fluid flow between the piston and cylinder as the upper piston moves in and out.

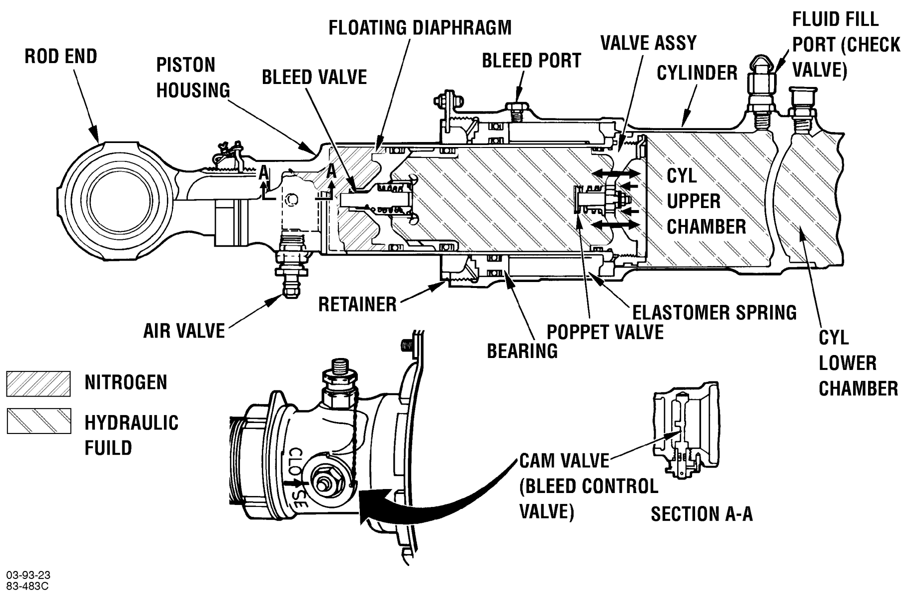
13. Indications of an improperly serviced strut is an abnormal helicopter ground attitude.

14. Correcting an improperly serviced strut:

a. Service the shock struts with nitrogen in accordance with the SHOCK STRUT INFLATION INSTRUCTIONS chart in TM 55-1520-238-23-1.

NOTE: The different pressures/distances on the SHOCK STRUT INFLATION INSTRUCTIONS chart are a function of aircraft gross weight. For instance, at maximum gross weight it will require 2700 psig for distance x = 1.2".

MLG SHOCK STRUT UPPER PISTON ASSEMBLY



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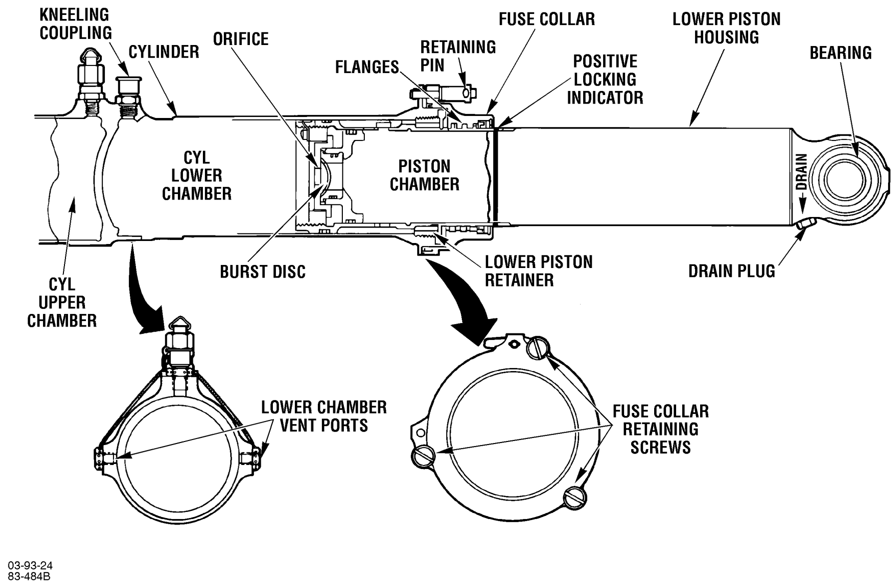
b. To service the shock struts with wheels off ground, use the OPTIONAL METHOD chart in TM 55-1520-238-23-1.

c. To service the shock struts with hydraulic fluid, refer to TM 55-1520-238-23-1.

MLG SHOCK STRUT
LOWER PISTON ASSEMBLY



NOTES

15. Lower piston assembly

a. The lower piston assembly is installed in the lower end of the cylinder.

b. The components that make up the lower piston assembly are:

(1) Lower chamber vent ports

(2) Burst disk

(3) Lower piston retainer

(4) Fuse collar retaining screws

(5) Cylinder lower chamber

(6) Drain plug (inspection plug)

(7) Bearing

(8) Lower piston housing

(9) Locking indicator

(10) Fuse collar

(11) Retaining pin (quick release)

(12) Flanges

(13) Orifice

(14) Kneeling coupling

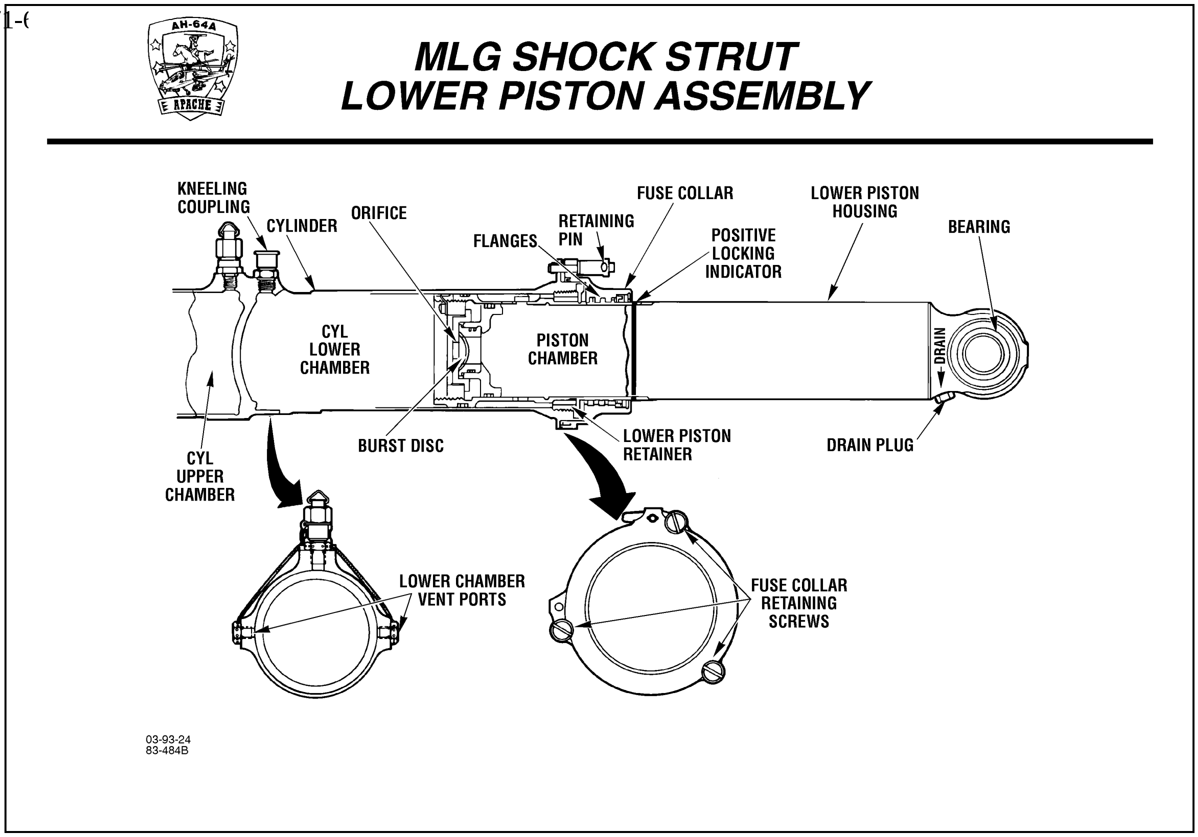
c. The external operating surface of the piston is chrome-plated. The internal surface is cadmium-plated for corrosion protection.

d. The fuse collar mates with the machined flanges on the exterior surface of the piston. It can be engaged or disengaged from these flanges by turning 90°.

e. A quick-release pin is used to secure the fuse collar in the locked position.

f. Three (3) retaining screws prevent the fuse collar from pulling away from the cylinder when the collar is disengaged from the flanges (screws are not torqued.)

g. The bearing installed in the lower piston is a self-lubricating spherical type.


MLG SHOCK STRUT
LOWER PISTON ASSEMBLY
KNEELING COUPLING
CYLINDER
ORIFICE
FLANGES
RETAINING PIN
FUSE COLLAR
POSITIVE LOCKING INDICATOR
LOWER PISTON HOUSING
BEARING
CYL LOWER CHAMBER
PISTON CHAMBER
DRAIN
CYL UPPER CHAMBER
BURST DISC
LOWER PISTON RETAINER
DRAIN PLUG
LOWER CHAMBER VENT PORTS
FUSE COLLAR RETAINING SCREWS
03-93-24
83-484B

NOTES

h. A drain plug is located at the end of the lower piston housing. Used to detect for leakage of hydraulic fluid into the lower chamber. This plug will be checked when the strut is serviced.

i. A kneeling coupling located in the cylinder lower chamber provides a means for connecting the hydraulic hose kit for reducing the height of the AH-64A for transportability.

j. A red band at the upper portion of the lower piston housing provides a visual indication of proper extension for fuse collar to flange engagement.

k. Two (2) vent ports located at the lower chamber, 90º either side of the kneeling coupling, are used during servicing.

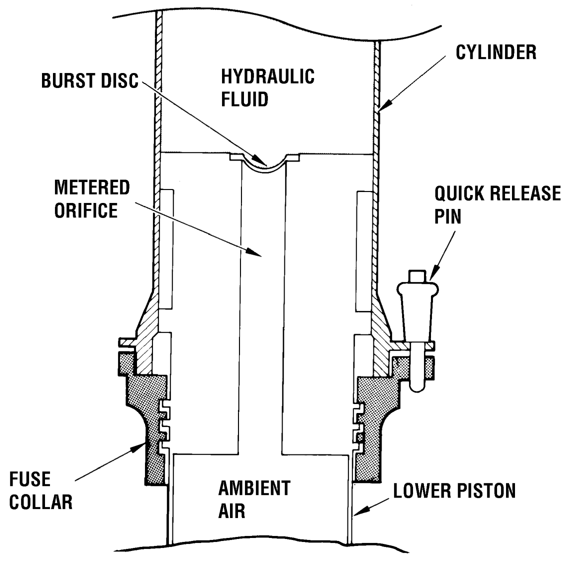
l. Several markings are stenciled on the strut to indicate location of valves, plugs, ports, and locking positions. In addition, a data plate gives shock strut inflation instructions, servicing procedures, and kneeling/erecting instructions.

16. Normal/high impact

a. During normal operation, the fuse collar holds the lower piston in the extended position.

b. The lower cylinder chamber is filled with hydraulic fluid, providing a solid column of fluid against the lower piston chamber, which is normally dry.

HIGH IMPACT LOAD PROTECTION



NOTES

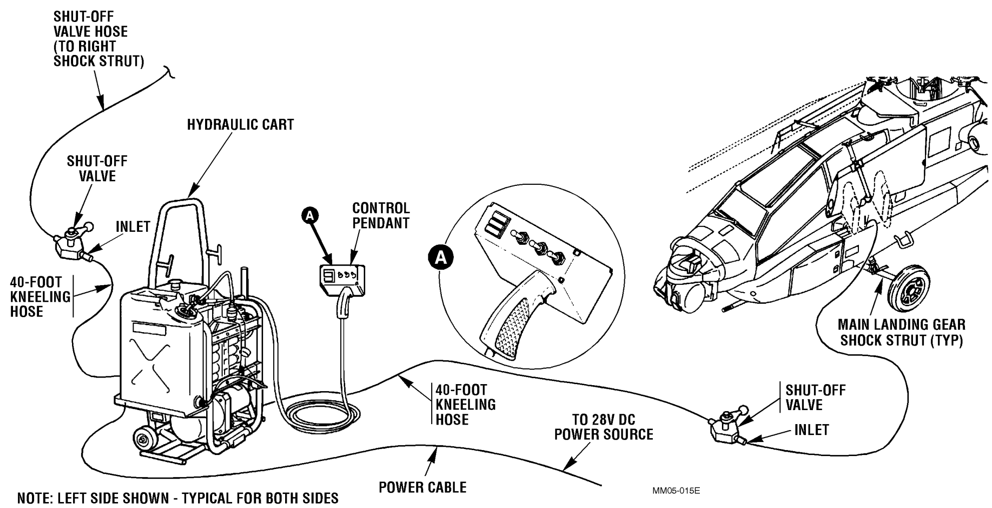
c. In the event of a high-impact landing, the force will shear the retaining flanges on the piston and rupture a burst-disk.

d. The lower piston will move into the cylinder and hydraulic fluid will flow into the lower piston chamber at a restricted rate through an orifice. This action aids the upper piston in absorbing excessive shock loads by providing a controlled rate of collapse.

WARNING

Personnel must remain clear of helicopter during kneeling and erecting operations to prevent injury to personnel in event of main landing gear strut collapse and helicopter roll over.

MAIN LANDING GEAR KNEELING CART



03-94-03

NOTES

17. Kneeling/erecting operation

a. Is performed for transportability or servicing requirements, accomplished with a hydraulic hose kit.

b. The kit provides an interface between the hydraulic cart and the helicopter's main landing gear shock struts for reducing the height of the AH-64A.

c. The kit enables positioning, connecting, and disconnecting of the hydraulic cart with the helicopter at any main landing gear height.

d. The kit includes:

(1) A web strap assembly for securing the hydraulic hose and shutoff valve.

(2) Two (2) 40-foot wire braided hydraulic hoses with quick-disconnects at each end.

(3) Two (2) 10-foot hydraulic hoses with shutoff valves and quick-disconnects at each end.

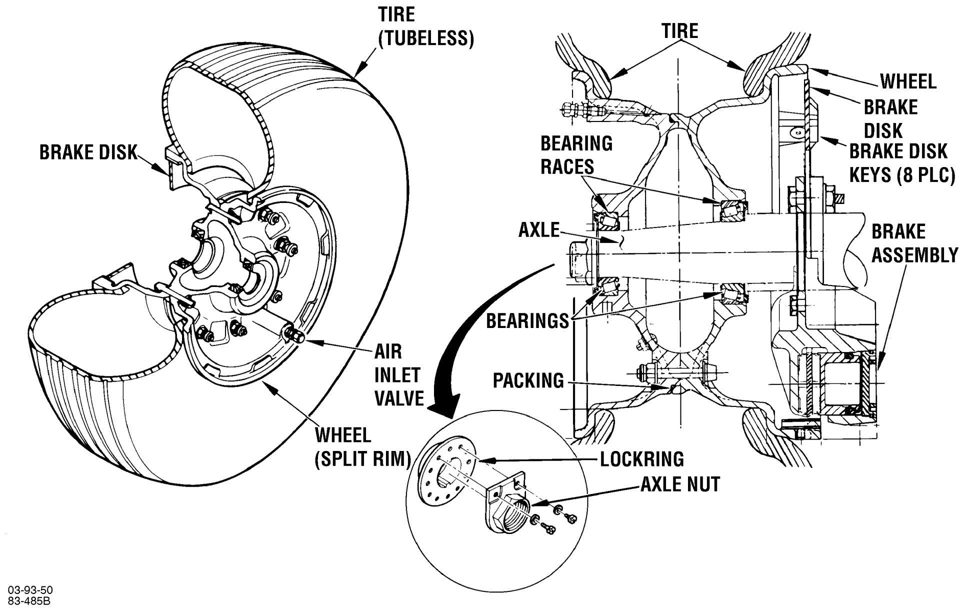
e. A hydraulic cart is not included in this kit, but it is needed for kneeling and erecting operations.

f. The hydraulic cart provides the necessary power to kneel and erect the main landing gear struts.

g. The cart is an electrically-driven device that requires external power. A 7.5 Kw generator with a 28 VDC adapter will provide adequate electrical power.

NOTE: Due to the redesign of the kneeling/erecting cart, kneeling/erecting procedures are not in the current technical manuals.

MLG WHEEL AND TIRE ASSY



NOTES

CAUTION

Main landing gear wheel assembly parts (bolts, nuts, bearings, and air valves), that are manufactured by one company cannot be intermixed with wheel assembly parts which are manufactured by a different company. The two sources for main landing gear are PARKER-HANNIFIN and GOODYEAR and the differences will be discussed later.

18. Wheel and tire assembly (MLG)

a. Provides the capability of helicopter ground movements such as taxiing, run-on landings, towing, and aids in cushioning landing shocks.

b. The wheel assemblies mount on each MLG trailing arm axle. The rims are made of aluminum alloy. They are split rim-type, bolted together. A packing or O-ring provides an air seal between the two halves.

c. The inboard half rim contains an outer bearing race for the inboard wheel bearings and brake disk keys.

d. The outboard half rim contains an outer bearing race for the outboard wheel bearings and an air valve for tire inflation.

WARNING

Wheel and tire must be in safety cage when tire is being inflated. The tire could blow off wheel, or the wheel halves could separate. Flying parts could injure personnel. If injury occurs, seek medical aid.

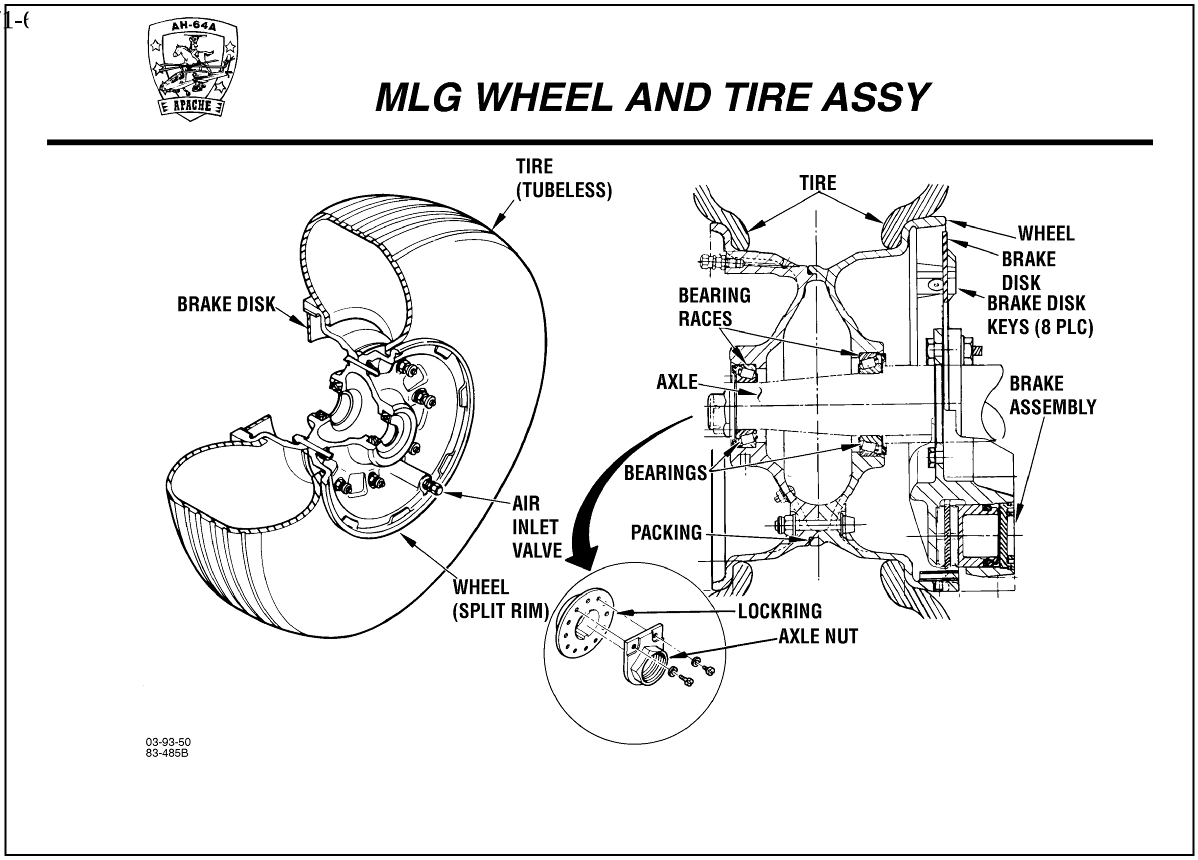
e. The main landing gear tire measures 8.50 x 10-inch (21.6 x 25.4-centimeter). 10-ply is tubeless with rib tread design, inflated to 105 $\pm$5 psi (7.03 to 7.7 kgcm^2) with nitrogen. Burst pressure is 420 psi (29.5 kgcm^2).

f. Wheel bearings: The inboard and outboard wheel bearings are tapered roller anti-friction-type bearings that mate with outside bearing races contained within the wheel rims.

19. Operation:

a. The MLG wheel and tire assemblies rotate around the trailing arm axles on bearings.

b. Each wheel and tire assembly is retained on the axle by an axle nut that secures a lock ring against the outside wheel bearings. The tightened axle nut prevents bearing damage and eliminates wheel free play.

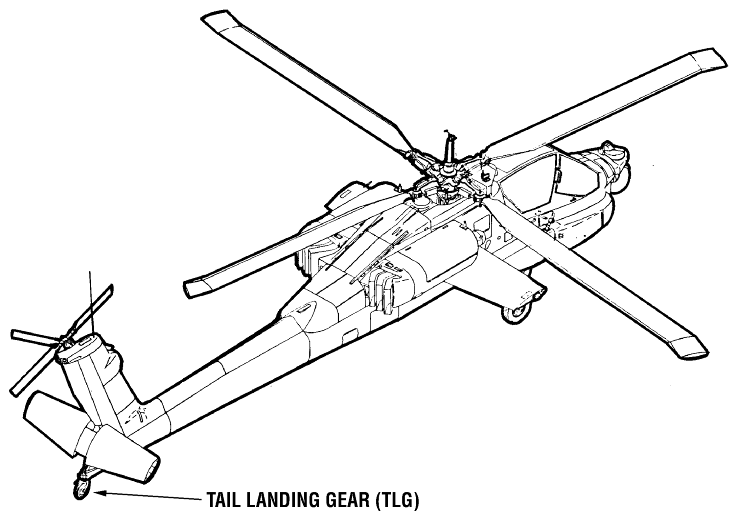

AH-64A
APACHE
MLG WHEEL AND TIRE ASSY
TIRE (TUBELESS)
BRAKE DISK
AIR INLET VALVE
WHEEL (SPLIT RIM)
TIRE
WHEEL
BRAKE DISK
BRAKE DISK KEYS (8 PLC)
BEARING RACES
AXLE
BRAKE ASSEMBLY
BEARINGS
PACKING
LOCKRING
AXLE NUT
03-93-50
83-485B

NOTES

c. The inboard rim brake disk keys mate with the brake disk slots and rotate the brake as the wheel disk rotates.

d. When brake pressure is applied, it is slowing and stopping disk rotation and, in turn, slowing and stopping wheel rotation.

TAIL LANDING GEAR (TLG) LOCATION



03-93-26
83-486

NOTES

A. Tail Landing Gear

1. Functions

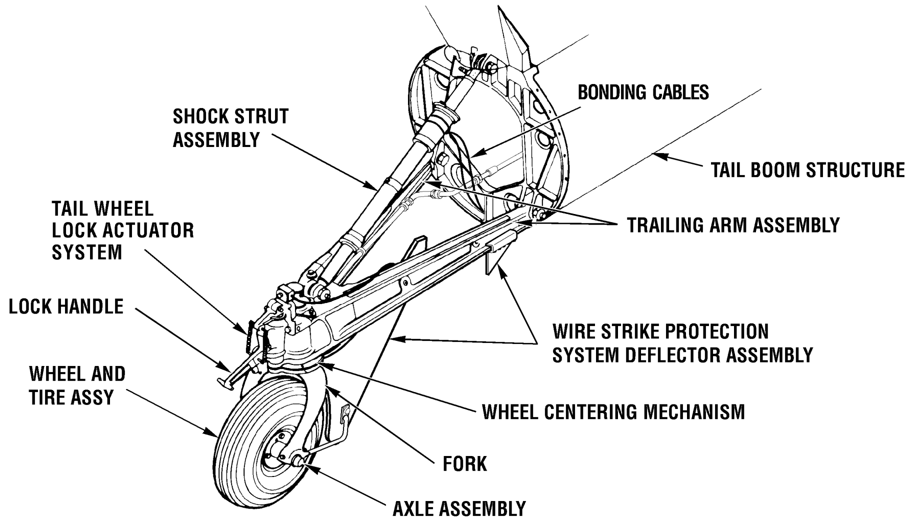
a. Supports the aft helicopter fuselage during all modes of ground operations.

b. Provides the capability of maneuvering helicopter during taxiing and towing.

c. Reduces pitching velocities and the possibility of blade-to-boom contact during tail-low landing impacts.

d. Attached to the end of the aft fuselage section (tailboom).

TAIL LANDING GEAR MAJOR COMPONENTS



03-93-27
85-464A

NOTES

2. TLG Components:

   a. Trailing arms

   b. Cutter assembly (not shown)

   c. Jack pad (not shown)

   d. Fork assembly

   e. Axle

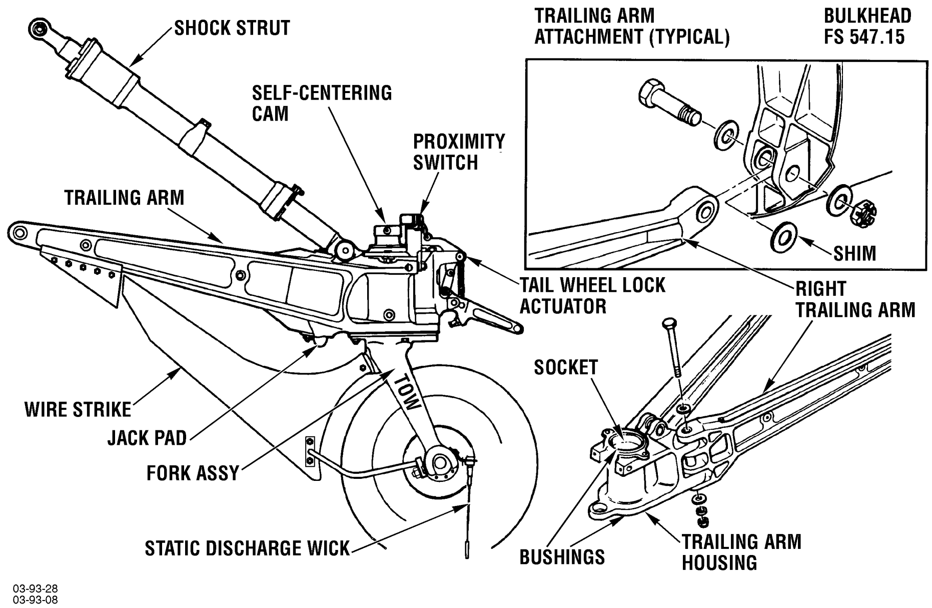
   f. Wheel and tire assembly

   g. Wheel centering mechanism

   h. Tail wheel lock actuator assembly

   i. Shock strut

TLG TRAILING ARM DESCRIPTION



NOTES

3. TLG trailing arm

   a. Provides the main support for the tail landing gear.

   b. Absorbs forward and side loads during landing and taxiing and transfers the loads to the shock strut and tailboom structure.

   c. Provides mounting for the TLG components.

   d. Attaches to an integral clevis assembly (2) at the aft tailboom structural bulkhead at FS 547.15.

   e. Machined from an aluminum alloy forging.

   f. Two-piece, "V" shaped design, using "I" beam construction.

   g. The aft end of the left trailing arm forms an integral housing and socket which provides mounting for:

      (1) Fork assembly

      (2) Tail wheel self-centering cam mechanism

      (3) Lower end of TLG shock strut

      (4) Tail wheel lock actuator and a proximity switch

   h. The right trailing arm has four machined lugs to provide mounting at the left trailing arm housing.

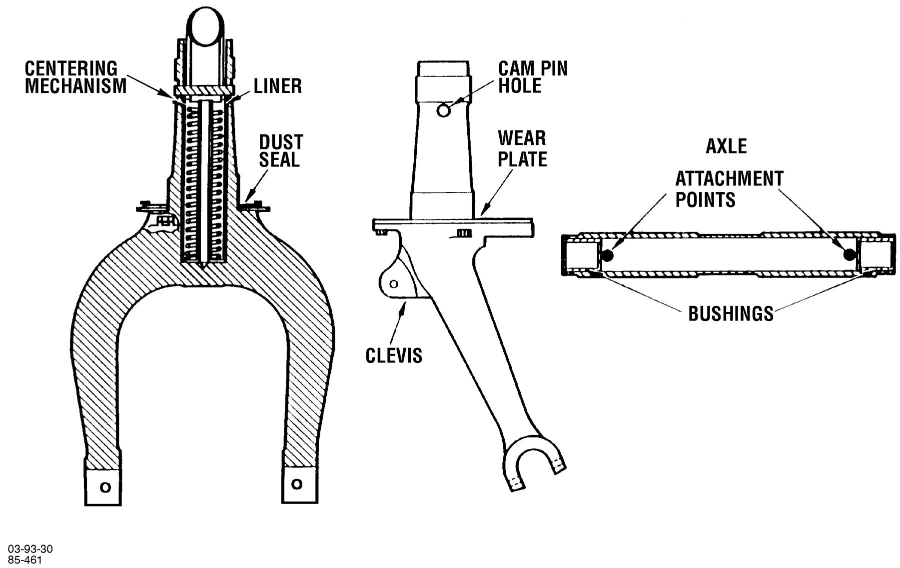
   i. The right and left-side trailing arm attachment points at the tailboom are shimmed 0.001 to 0.004 inch (0.003 to 0.010 centimeters) to eliminate excessive lateral movement.

   j. The fork assembly is allowed to swivel by means of bushings installed in the upper and lower socket of the trailing arm housing.

   k. A jack pad is provided at the bottom of the left trailing arm, forward of the tail wheel fork.

   l. The TLG trailing arm is inspected during all phase maintenance for cracks, bending, distortion, and security.

TLG FORK AND AXLE



NOTES

4. TLG fork and axle:

   a. The fork provides wheel and axle interface with the trailing arms and a 360° swiveling capability of the tail wheel.

   b. The axle provides support for the tail wheel and a means of towing the helicopter.

   c. The fork is installed in the socket at the aft end of the trailing arm.

   d. The axle is attached to the open ends of the fork assembly.

   e. Fork assembly

      (1) The fork is machined aluminum alloy forging (anodized and shot peened). The center pivot shaft of the fork is hollow and provides mounting for the centering mechanism. The hollow shaft contains an aluminum alloy liner.

      (2) Mounted on the fork assembly is an aluminum alloy, chrome-plated wear plate with a single locking hole. The actuator lock pin connects with the locking hole on the wear plate when fork centering is accomplished.

      (3) A dust seal between the trailing arm housing and fork prevents foreign object damage (FOD).

      (4) The lower ends of the fork are opened and drilled to mount the axle.

      (5) An integral clevis is located on the lower forward portion. The clevis is used to secure the tail landing gear wire strike protection system components.

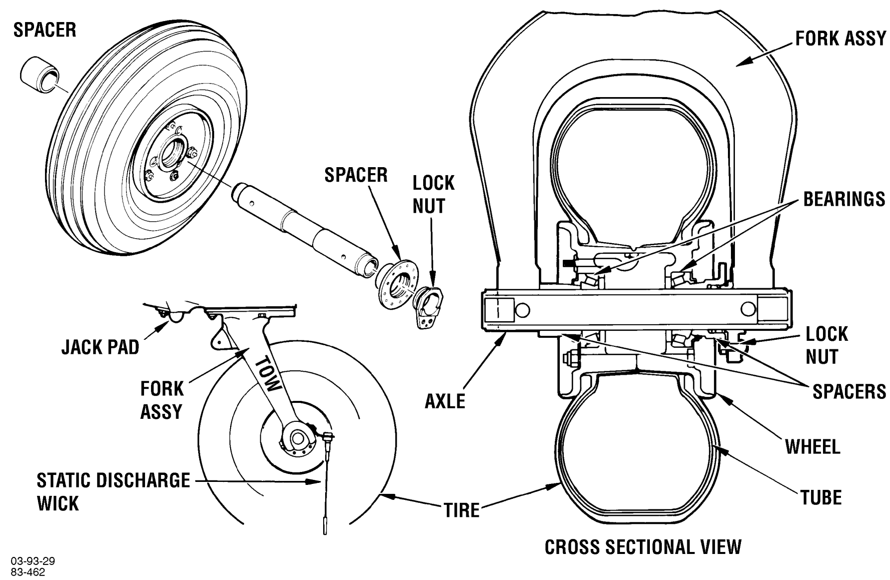
   f. Axle assembly

      (1) Hollow steel construction approximately 9.5 inches (24.13 centimeters) long with bushings installed in both ends.

      (2) Holes drilled through the axle, one at each end provide, a means for securing the axle to the fork assembly.

      (3) The hollow ends are provided for attaching a steering bar during ground handling (towing) of the helicopter or attaching a tow bar for towing from the rear.

TLG WHEEL AND TIRE ASSEMBLY



NOTES

5. Wheel and tire assembly

a. The wheel is 4.75 inches (12 centimeters) wide and 5.50 inches (14 centimeters) in diameter. Split-rim aluminum alloy-type rim that is bolted together. Tapered roller anti-friction type bearings are used.

b. The tire is a 14-ply, tubeless rib tread design. An inner tube is used in the tire for added impact and side load protection. TLG tire inflation is 95 "5 psi (655 kPa "34.5 kPa), using dry nitrogen. Burst pressure is 340 psi (2344 kPa).

c. The wheel and tire assembly mounts on the fork axle.

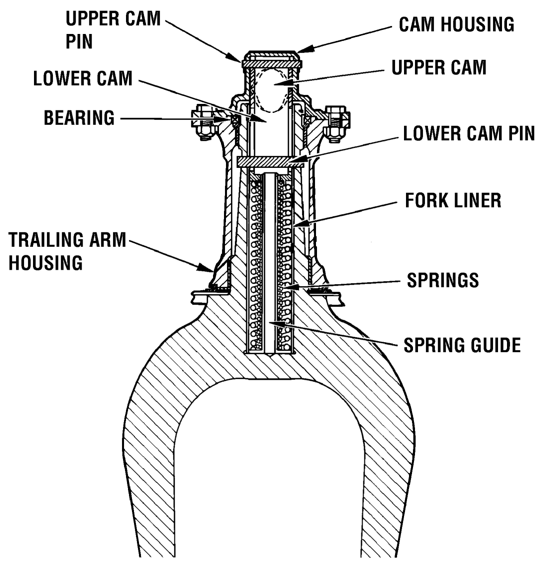
(1) Two (2) spacers are used; one is nonadjustable, the other is adjustable.

(2) The spacers center the wheel on the axle and a locknut provides the capability of adjusting bearing and wheel free-play.

d. A static ground cable, attached to the bottom of the left side fork, provides helicopter grounding upon landing and during ground operations.

e. Perform 10-hour/14-day inspection on TLG wheel and tires in accordance with TM 55-1520-238-23-2.

WHEEL CENTERING MECHANISM



NOTES

6. Wheel centering mechanism

   a. Provides a self-centering capability for the tail landing gear.

   b. Mounted into the trailing arm socket and fork assembly.

   c. The center pivot shaft of the fork contains two (2) springs, a spring guide, and a lower cam (cam is aluminum bronze alloy).

   d. The lower cam is retained in the fork assembly by a headless pin (through a slot in the cam) which allows the cam to move up and down on the fork liner during cam activation.

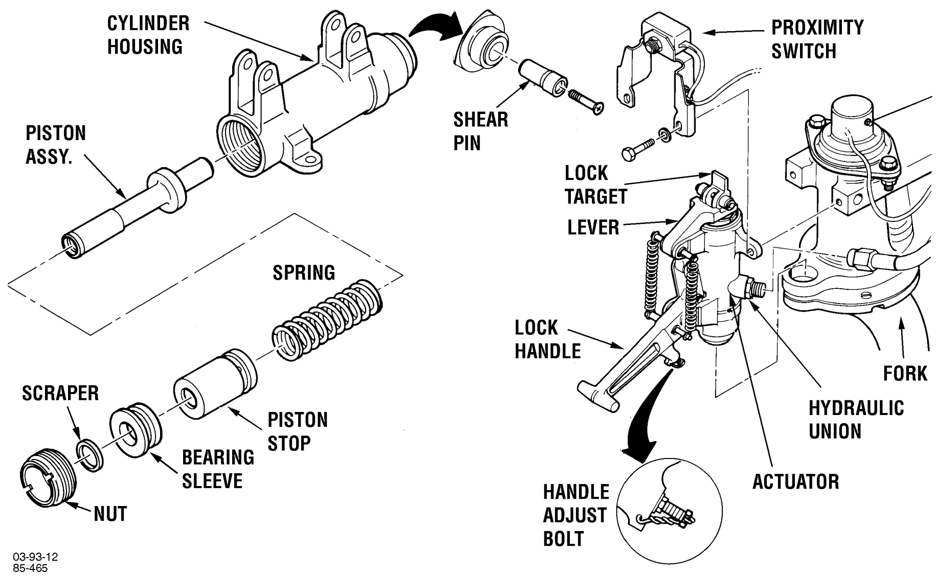
   e. The upper cam is retained in the upper cam housing assembly by a headless pin. The stationary cam mates with the lower cam. When the fork rotates, it forces the lower cam down.

   f. Spring tension at the lower cam causes the fork assembly to center when weight is off the gear.

   g. A bearing supports the rotational movement of the cam as the fork swivels. The fork assembly is held in the trailing arm socket by a retaining ring.

   h. Inspect centering mechanism in accordance with TM 55-1520-238-23-2.

TAIL WHEEL LOCK ACTUATOR ASSEMBLY



NOTES

7. Tail wheel lock actuator assembly

   a. Provides a means for locking the tail wheel in the center position, either mechanically or hydraulically.

   b. Mounted to the trailing arm housing.

   c. Major components:

      (1) Actuator

      (2) Lock handle

      (3) Proximity switch

   d. Actuator components:

      (1) Cylinder housing

      (2) Piston assembly

      (3) Spring

      (4) Piston stop

      (5) Bearing sleeve

      (6) Scraper

      (7) Nut

      (8) Fuse pin (shear)

   e. A packing and seal are installed into the sleeve bearing, and two retainers and a packing are installed on the bearing. A seal and packing are installed at the shear pin end of the cylinder housing.

   f. Spring-loaded in the locked position.

   g. The fuse pin is the actual locking device and is installed into the piston assembly via a self-locking screw.

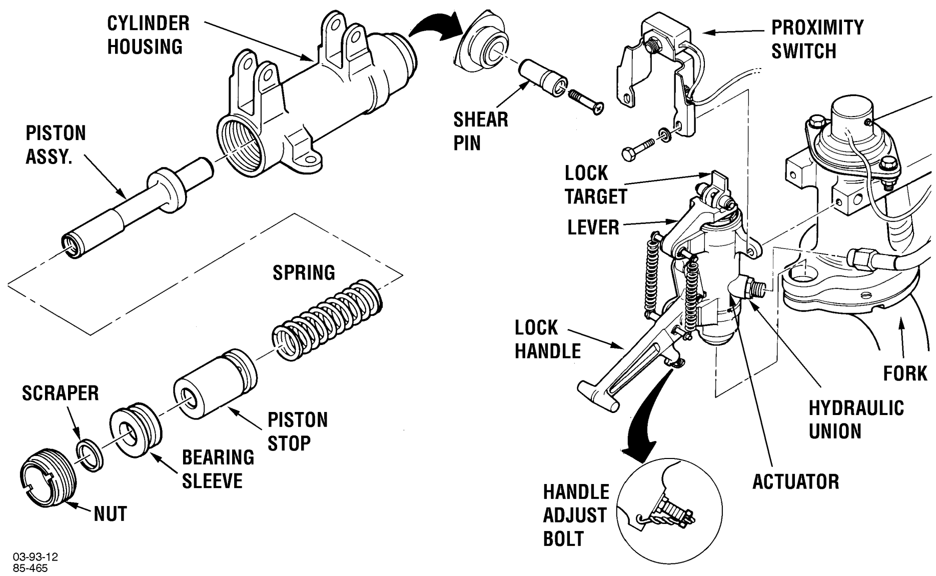
   h. Lock handle

      (1) Provides for manual operation of the lock actuator.

      (2) Mounted to a set of lugs on the lower portion of the actuator.

      (3) Connected to the lock target via a swing lever attached to the upper set of lugs.

TAIL WHEEL LOCK ACTUATOR ASSEMBLY



NOTES

(4) The lock handle is held in the locked and unlocked positions by two springs.

(5) The underside of the lock handle contains an adjustable bolt assembly to set the handle mechanism so that it will not automatically return to the full-up position.

i. Proximity switch (sensor)

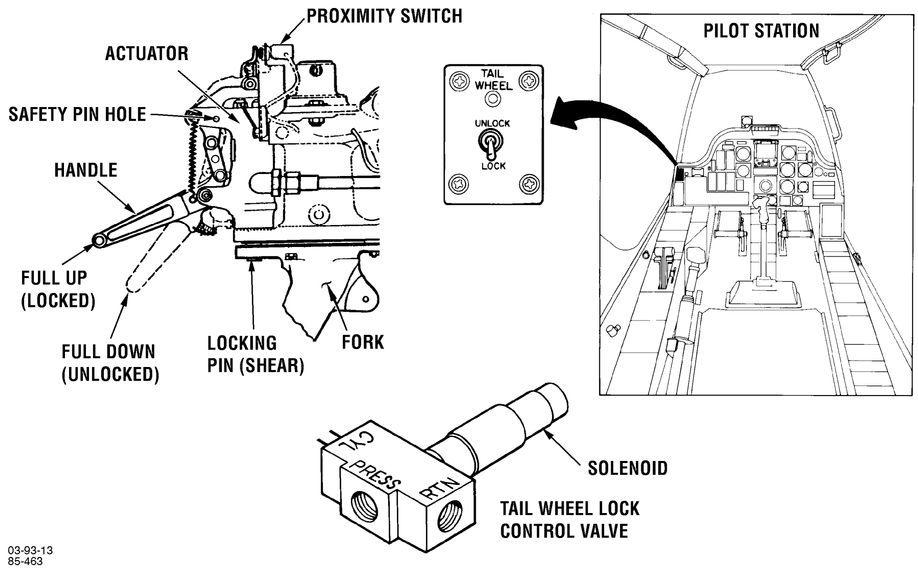
(1) An electrically controlled, magnetically operated proximity switch is installed on a bracket that mounts to the upper portion of the lock actuator.

(2) Works in conjunction with the lock target installed in the upper end of the actuator.

(3) When replacing the switch, a vertical alinement and gap adjustment are required between the proximity switch face and target.

(4) Perform the 10-hour/14-day and all phase inspections in accordance with TM 55-1520-238-23-2.

TAIL WHEEL LOCK ACTUATOR OPERATION



NOTES

j. Tail wheel lock actuator operation

(1) The actuator is used to lock and unlock the tail wheel. It is controlled by the tail wheel LOCK/UNLOCK switch through the tail wheel lock control valve, or manually at the TLG.

(2) When the actuator is in the locked position, it prevents tail wheel swiveling due to rotor torque or crosswind effects, and during normal landings or landings on sloped terrain.

(3) Inhibits tail wheel shimmy during takeoff and landing.

(4) The locking pin shears under high side load conditions to prevent damage to the fork, trailing arms, or tail boom. The force required to shear the pin is approximately 6800 pounds (3,087 kilograms).

(5) Manual control

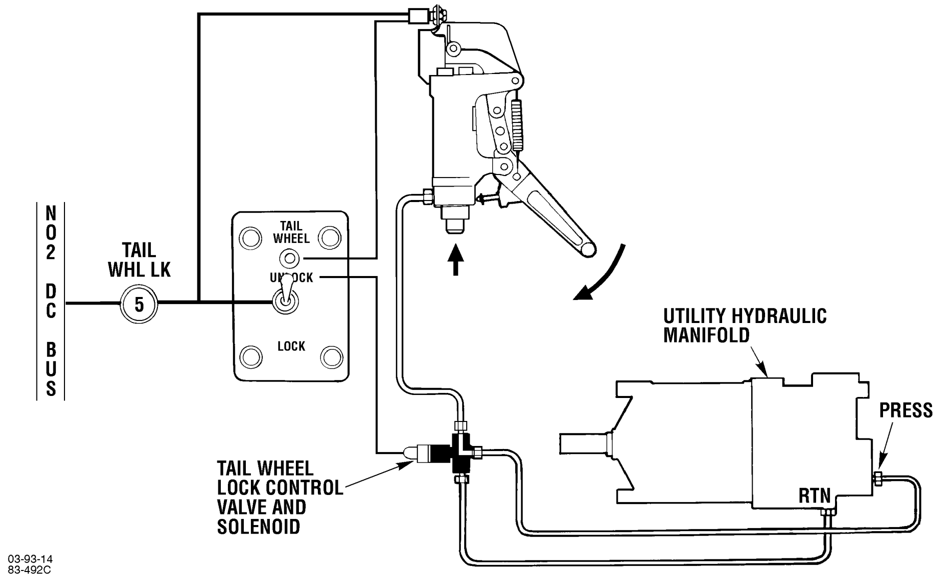
(a) The handle attached to the actuator is used to manually unlock and lock the tail wheel.

(b) A quick-release safety pin with an attached warning flag is used to hold the actuator in the unlocked position during ground handling. This prevents accidental locking of tail wheel.

(c) When the handle is placed in the full-up position, it seats the lock pin, which secures the fork in the center position.

(d) Placing the handle in the full-down position unseats the lock pin, allowing fork freedom of movement.

TAIL WHEEL LOCK ACTUATOR - UNLOCKED POSITION



NOTES

(6) Pilot's station control - unlocked position

(a) When the TAIL WHEEL switch is placed in the UNLOCK position, it energizes the tail wheel lock control valve solenoid.

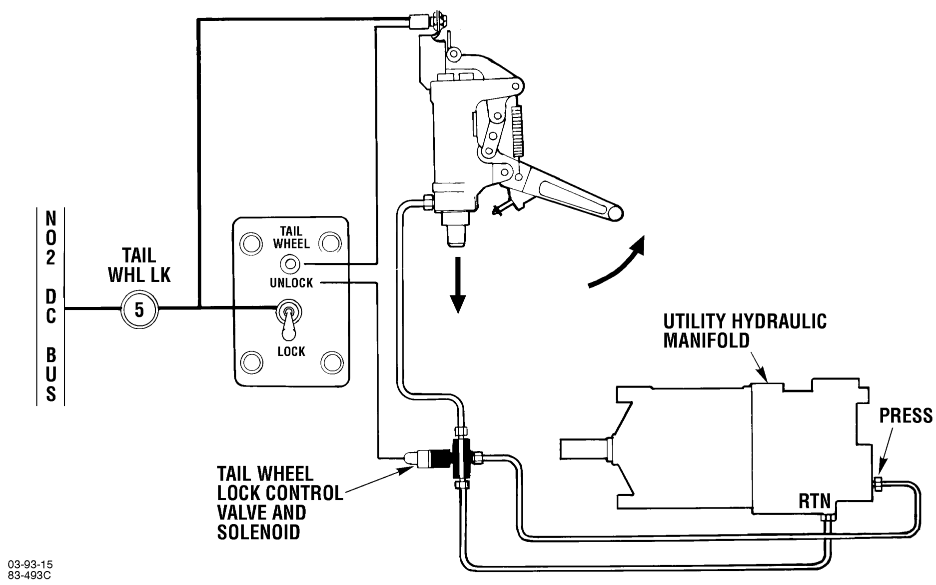
(b) This closes the return line to the utility manifold and opens the pressure line from the manifold, through the control valve, to the actuator.

(c) Hydraulic pressure overcomes the actuator spring tension, lifting the locking pin out of the fork assembly. The tail wheel is then free to swivel.

(d) When the actuator moves to the unlocked position, a target, located at the top of the actuator, is moved upward, interrupting the proximity switch.

(e) The movement closes the switch, turning on the green light at the pilot's TAIL WHEEL switch panel, indicating that the tail wheel is unlocked.

TAIL WHEEL LOCK ACTUATOR - LOCKED POSITION



NOTES

(7) Pilots station control - locked position

(a) Placing the TAIL WHEEL switch in the lock position removes power to the tail wheel lock control valve.

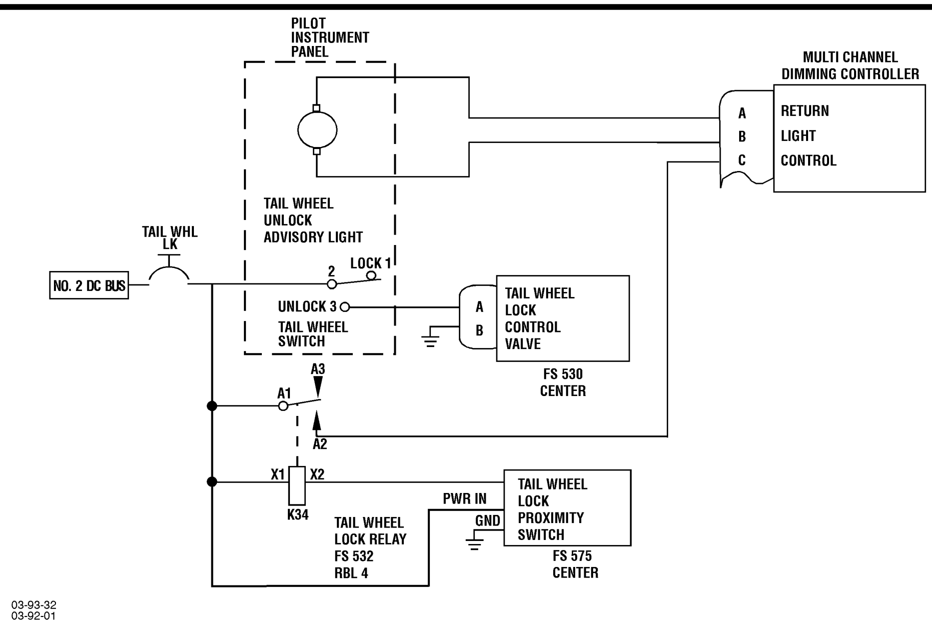
(b) The control valve solenoid is de-energized, shutting off hydraulic pressure from, and opening the return line to, the utility manifold.

(c) Hydraulic pressure, venting from the actuator through the control valve return, allows spring tension to force the locking pin down into the fork assembly, locking the tail wheel.

(d) The movement of the lock target opens the switch, turning off the green light at the pilot's TAIL WHEEL switch panel, indicating the tail wheel is locked.

(e) The tail wheel lock is fail safed to the lock position.

TAIL WHEEL LOCK/UNLOCK SCHEMATIC DIAGRAM



NOTES

k. Tail wheel lock electrical operation

(1) 28 VDC from the No. 2 DC bus is applied to the tail wheel lock/unlock switch, the open contacts of the tail wheel lock relay (K34), the coil of relay K34, and the tail wheel lock proximity switch.

(a) The tail wheel lock relay electrical ground is controlled by the tail wheel lock proximity switch.

(b) The 28 VDC applied to the proximity switch is operating voltage. When the tail wheel is unlocked, the proximity switch supplies an electrical ground to the tail wheel lock relay.

NOTE: The schematic is shown with the tail wheel lock/unlock switch in the LOCK position.

(2) Placing the tail wheel lock/unlock switch in the UNLOCK position will apply 28 VDC to the tail wheel lock control valve solenoid, allowing hydraulic pressure to unlock the tail wheel.

(3) When the actuator is in the unlock position, the tail wheel lock proximity switch is actuated and supplies an electrical ground to the tail wheel lock relay.

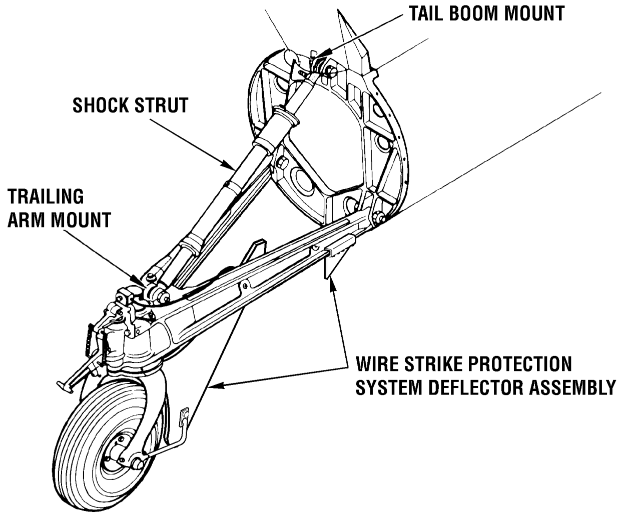
(4) When the tail wheel lock relay is energized, 28 VDC control voltage is applied to the multichannel dimmer. The dimmer supplies voltage to illuminate the tail wheel unlock light.

(5) The voltage output from the multichannel dimming controller to the tail wheel unlock light will depend on the position of the INSTR LT switch-rheostat on the pilot's EXT/INT LIGHTS control panel.

(a) If the switch-rheostat is in the OFF position, output from the controller to the light will be 28 VDC and the light will be illuminated bright.

(b) If the switch-rheostat is anywhere other than the OFF position, output from the controller to the light will be 9.5 VDC and the light will be illuminated dim.

TLG SHOCK STRUT LOCATION



03-93-33
83-494

NOTES

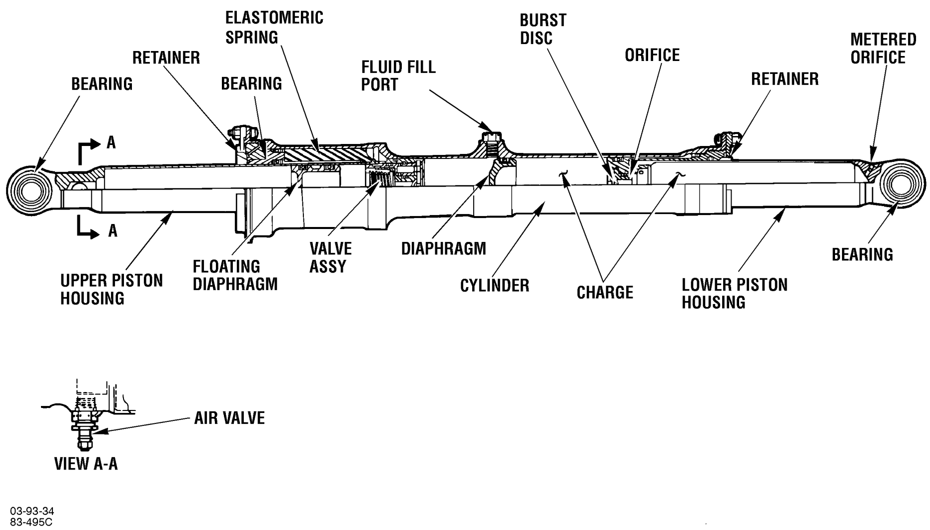
8. TLG shock strut

   a. Absorbs and cushions vertical impact loads resulting from normal and high-impact landings.

   b. The upper end of the shock strut attaches to a fitting on the tail boom bulkhead.

   c. The lower end of the shock strut attaches to the trailing arm.

TLG SHOCK STRUT DESCRIPTION



NOTES

d. The shock strut consists of a steel cylinder that is fitted with an upper and lower piston assembly.

e. The upper piston assembly consists of:

(1) Piston housing with a rod end bearing

(2) Floating diaphragm

(3) Valve assembly consisting of a poppet valve, orifice, and burst disk

(4) Elastomeric spring (rubber) for dampening and resonance

(5) Bearing

(6) Retainer (gland nut)

f. An air valve on the upper piston is provided for nitrogen servicing.

g. The upper piston functions the same as the MLG shock strut upper piston.

h. The cylinder is one (1) piece with threaded ends.

(1) The upper and lower piston assembly retainers screw into each end of cylinder.

(2) A fluid fill port is provided for fluid servicing of shock strut.

(3) The hydraulic fluid in the cylinder maintains separation between the upper and lower pistons.

i. The lower piston assembly consists of:

(1) Piston housing with rod end bearing

(2) Orifice

(3) Burst disk

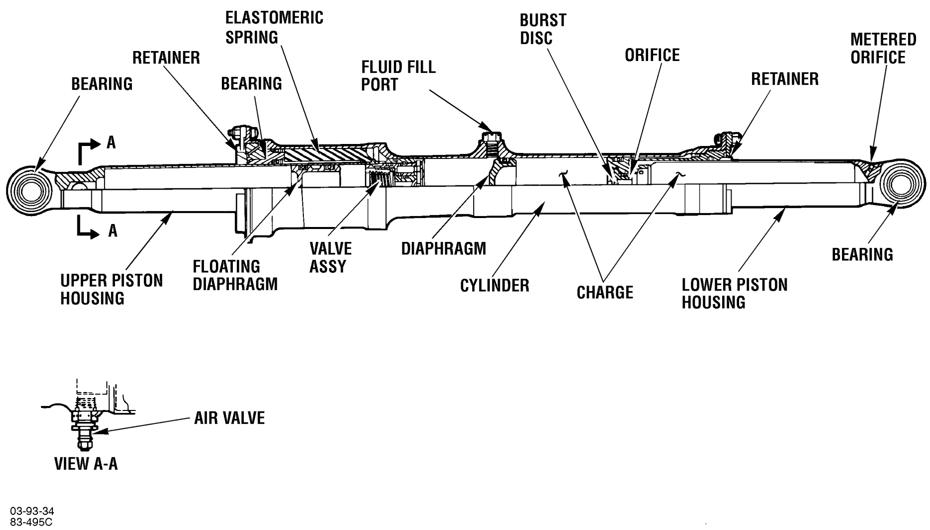
(4) Charge

(5) Retainer

(6) Lower metered orifice

j. The charge in the lower piston is an elastomeric, solid material and functions during high-impact landings.

TLG SHOCK STRUT DESCRIPTION



NOTES

(1) The charge is similar to a dough or putty substance.

(2) Made from a mixture of a silicone elastomer and silicone gel.

k. The lower metered orifice allows the mixture to be ported to the atmosphere during high-impact landings.

l. Nitrogen gas servicing is only performed on-aircraft and in accordance with the shock strut inflation instruction data in TM 55-1520-238-23-1.

m. The TLG is serviced with MIL-H-5606 hydraulic fluid in accordance with TM 55-1520-238-23-2 (tail landing gear shock strut piston removal/installation (AVIM)). To service the TLG shock strut with hydraulic fluid, the strut must be removed from aircraft. It must be removed because the strut must be held in various vertical and horizontal positions, for specified periods of time, in order to bleed all of the remaining air from it.

n. The TLG shock strut functions basically the same as the MLG shock strut.

o. The floating diaphragm separates the hydraulic fluid from the nitrogen gas and moves on top of the fluid as the strut upper piston extends and retracts.

p. The hydraulic fluid flows between the upper piston and cylinder through a poppet valve and orifices that restrict the flow. This, in conjunction with the nitrogen gas compression, dampens the landing shock.

q. During a high-impact landing:

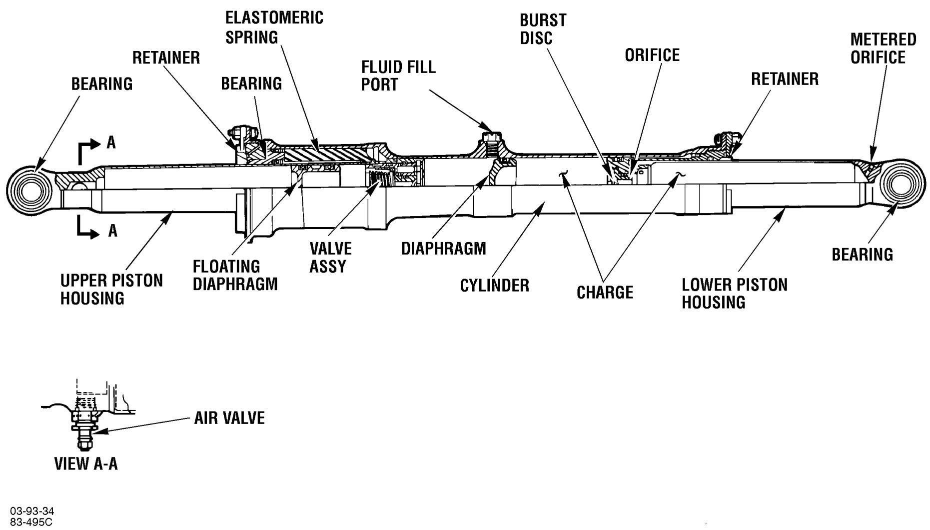
(1) Pressure buildup against the lower piston burst disk will cause the disk to rupture, allowing the lower piston to stroke.

(2) The elastomeric charge in the lower piston is then allowed to flow through an orifice at a controlled rate, causing pressure buildup in the cylinder.

(3) The pressure buildup in the cylinder will then cause the upper piston burst disk to rupture, allowing the complete shock strut (upper and lower pistons) to collapse for increased shock absorption.

r. Unlike the MLG shock struts, the TLG shock strut is not capable of kneeling.

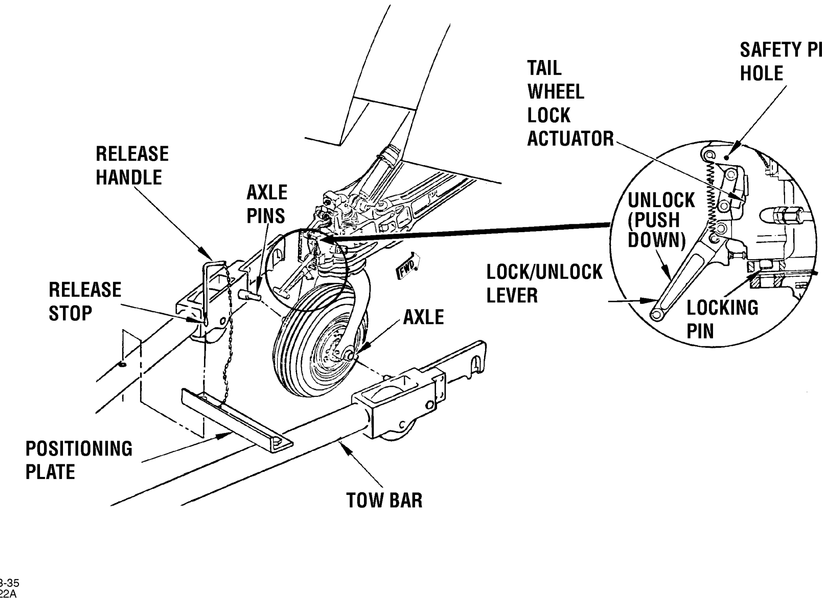
TLG SHOCK STRUT DESCRIPTION



NOTES

s. During an exceptionally hard landing (approximately 12-feet-per-second [3.66-meter-per-second] impact), the lower TLG shock strut piston can be partially collapsed. Such damage may not be detectable by visual inspection. Inspection requirements for TLG shock strut following a reported hard landing can be found in TM 55-1520-238-23-1.

TAIL WHEEL TOWING



NOTES

9. Tail Wheel Towing

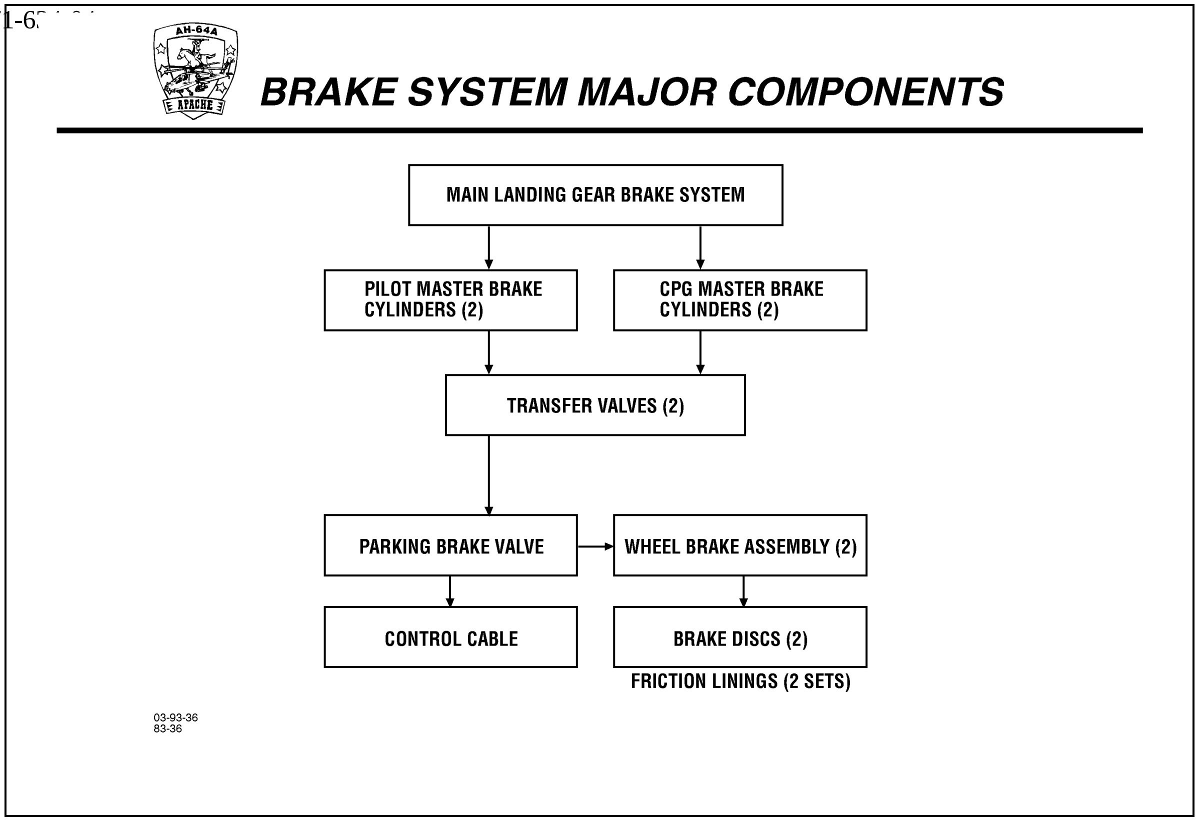
a. Tail wheel towing is performed during manual ground maneuvering operations and is used to assist in keeping main and tail wheels on loading ramps when helicopter is being loaded on transport aircraft.

b. Connecting tow bar to tail wheel:

(1) Lock release stop on bottom of release handle is moved to the unlocked position (straight down).

(2) Release handle is removed from tow bar positioning plate and tow bar.

(3) Tow bar axle pins are inserted into the hollow axle ends.


AH-64A
APACHE
BRAKE SYSTEM MAJOR COMPONENTS
MAIN LANDING GEAR BRAKE SYSTEM
PILOT MASTER BRAKE CYLINDERS (2)
CPG MASTER BRAKE CYLINDERS (2)
TRANSFER VALVES (2)
PARKING BRAKE VALVE
WHEEL BRAKE ASSEMBLY (2)
CONTROL CABLE
BRAKE DISCS (2)
FRICTION LININGS (2 SETS)
03-93-36
83-36

NOTES

A. Brake system

1. Provides braking and directional control capabilities during ground taxiing, ground handling, and parking.

2. Can hold maximum gross weight of 17,650 pounds (8,013 kilograms) on a 12^{o} slope.

3. A separate system for left and right wheels.

4. Can be operated from the pilot's or CPG's crewstation.

5. Parking brake is locked from the pilot's crewstation only, but can be released from either station.

6. Master cylinders are interchangeable.

7. Self-contained system which uses MIL-H-5606 hydraulic fluid.

8. System uses aluminum alloy tubes and flexible nonmetallic (polyester braid, chafe guard) hose to transfer the fluid pressure from the major components to the wheel brake assembly.

9. Brake system major components:

a. Master cylinders (2 pilot and 2 CPG)

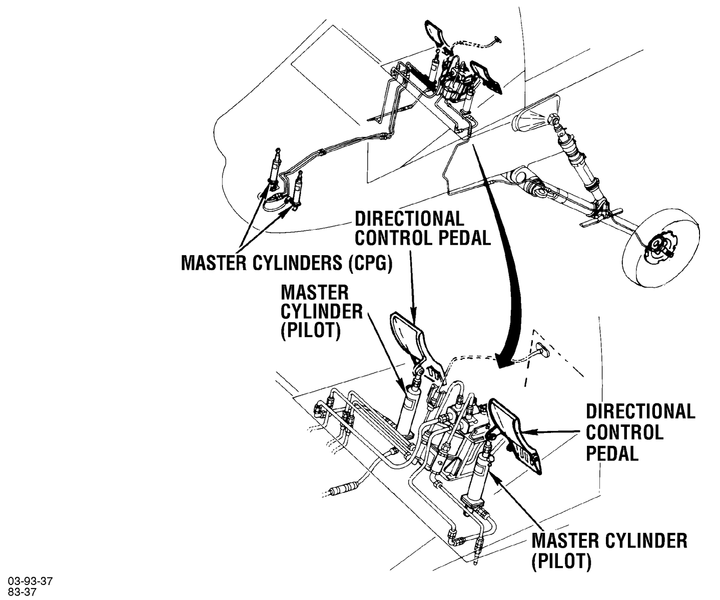
b. Transfer valves (2)

c. Parking brake valve

d. Wheel brake assemblies and disks (2)

e. The master cylinders, transfer valves, and parking brake valve can be overhauled at the AVIM level. See TM 55-1520-238-23-2.

MASTER CYLINDER LOCATION



NOTES

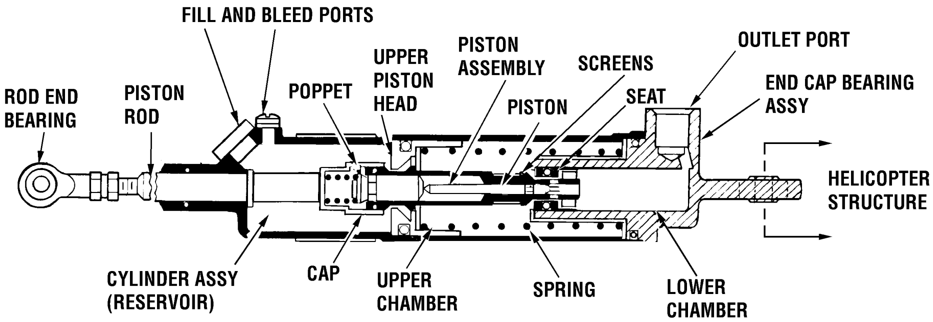
10. Master cylinder (4 each)

a. A means of transforming force, applied by the crewmember's foot, into fluid pressure.

b. Supplies hydraulic fluid to other brake system components, and serves as a reservoir for brake fluid.

c. One attached to each directional control pedal (rod-end bearing portion) and directional control pedal mounting bracket (end cap bearing).

MASTER CYLINDER MAJOR COMPONENTS



- CYLINDER SHOWN IN THE STATIC POSITION

03-93-38
83-2921A

NOTES

d. Fully extended length is approximately 11.25 inches (28.6 centimeters). Weighs approximately 1 pound.

e. Stroke of piston rod is 1.50 inches (3.8 centimeters).

f. Aluminum alloy body.

g. Consists of the following components

(1) Rod end bearing

(2) Piston rod

(3) Fill and bleed ports

(4) Poppet valve

(5) Upper piston head

(6) Piston

(7) Screens

(8) Seat

(9) Outlet port

(10) End cap bearing assembly

(11) Lower chamber

(12) Spring

(13) Upper chamber

(14) Cap

(15) Cylinder assembly (reservoir)

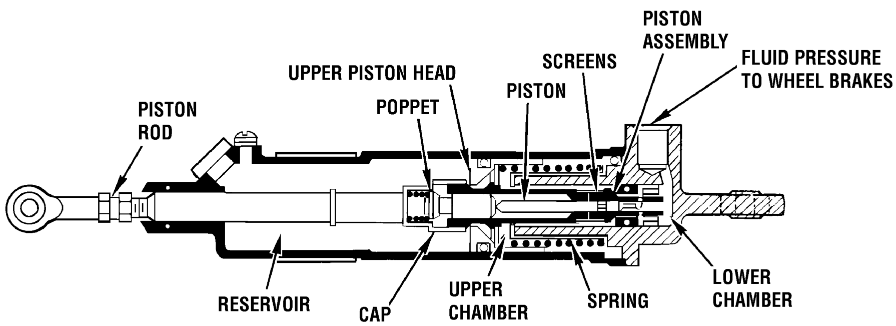
11. When the cylinder is static, the spring maintains the extension of the piston rod and no pressure is present.

a. Pushing on a directional control pedal at the top (or toe pressure) causes the piston rod to move downward.

b. As the piston rod moves toward the lower end of the cylinder, hydraulic fluid is pressurized by the upper piston head.

c. As the upper piston head moves downward, the cap seats against the upper piston head, stopping fluid flow to the reservoir.

CYLINDER - ACTUATED



03-93-39
83-2920A

NOTES

12. Cylinder - actuated

a. When the reservoir closes, pressure builds in the upper chamber. This pressure buildup will cause hydraulic fluid to flow through screens in the piston assembly, and partially unseat the poppet.

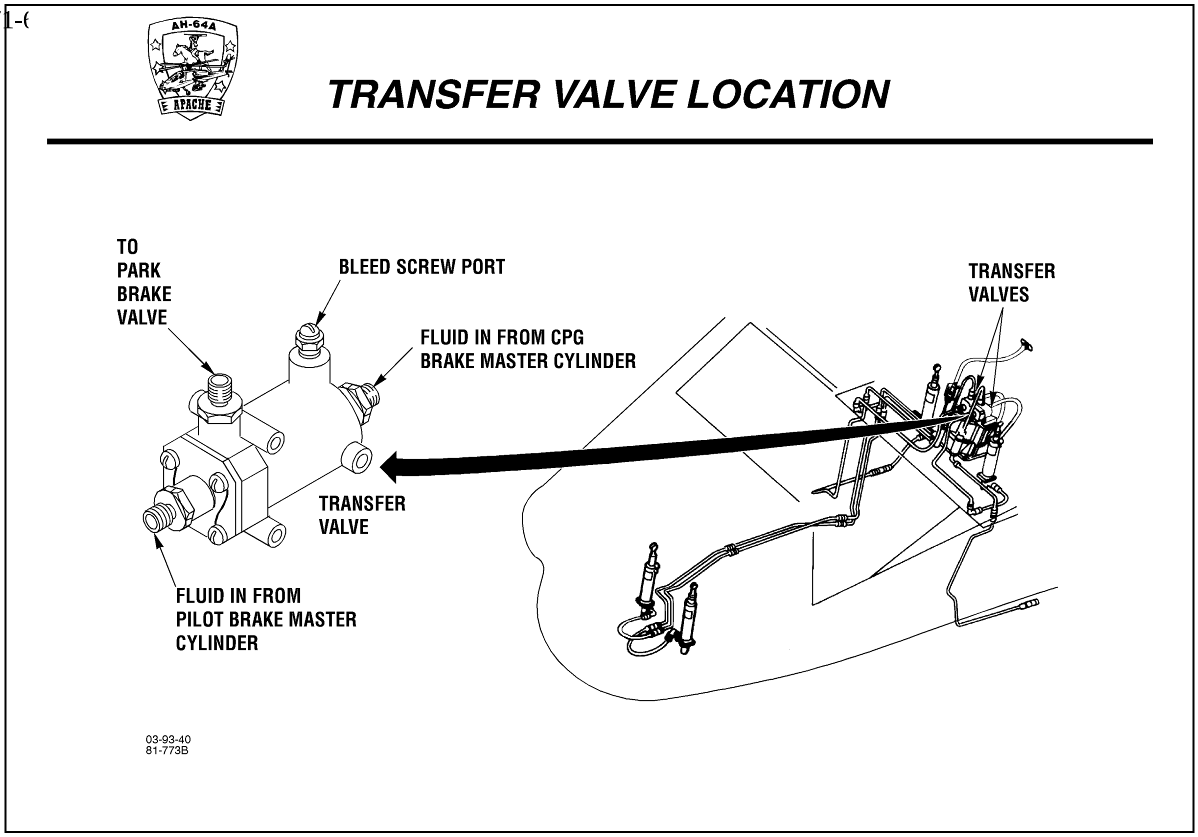
b. As pressure continues to build in the upper chamber, the piston assembly seats, trapping fluid in the lower chamber.

c. Increased pressure causes the piston to fully open the poppet, allowing unused fluid to flow from the upper chamber back to the reservoir.

d. Hydraulic braking pressure is supplied to the wheel brakes from the lower chamber through the outlet port.

e. When the directional control pedal is released, a spring inside the upper chamber extends the cylinder to its original length, relieving fluid pressure.

f. Perform all phase inspections in accordance with TM 55-1520-238-23-2.


AH-64A
APACHE
TRANSFER VALVE LOCATION
TO
PARK
BRAKE
VALVE
BLEED SCREW PORT
FLUID IN FROM CPG
BRAKE MASTER CYLINDER
TRANSFER
VALVE
FLUID IN FROM
PILOT BRAKE MASTER
CYLINDER
TRANSFER
VALVES
03-93-40
81-773B

NOTES

13. Transfer valves (2 each)

    a. Allow either pilot's or CPG's master cylinder pressure to operate the brakes without mixing the fluids.

    b. Both valves are mounted on a bracket between the pilot's directional control pedals (pilot's lower center console structure; forward portion).

    c. Aluminum alloy casting, weighing approximately 3/4 pound (0.34 kilogram).

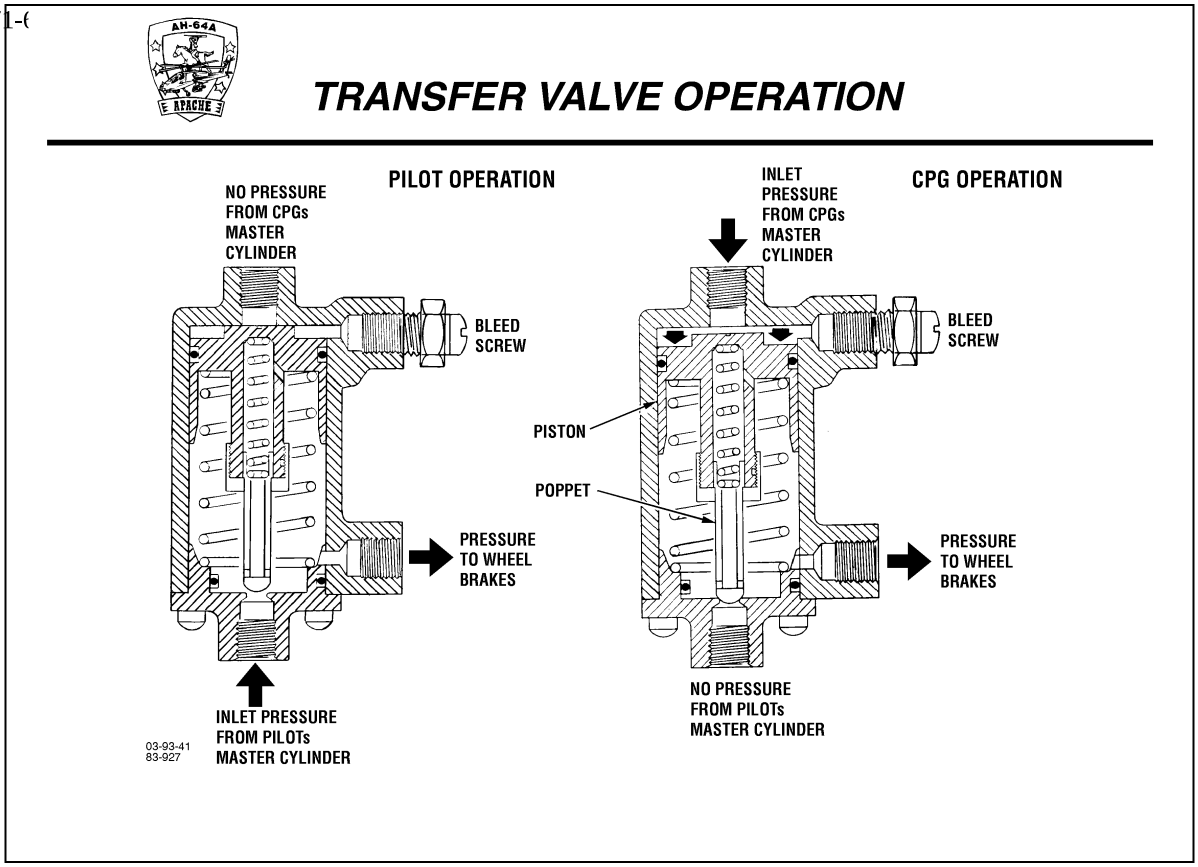
    d. A bleed screw port.

    e. Three ports for connecting lines to provide:

        (1) Fluid pressure to the park brake valve.

        (2) Fluid pressure in from the pilot's brake master cylinder.

        (3) Fluid pressure in from the CPG's brake master cylinder.


AH-64A
APACHE
TRANSFER VALVE OPERATION
PILOT OPERATION
NO PRESSURE FROM CPGs MASTER CYLINDER
BLEED SCREW
PRESSURE TO WHEEL BRAKES
INLET PRESSURE FROM PILOTs MASTER CYLINDER
03-93-41
83-927
CPG OPERATION
INLET PRESSURE FROM CPGs MASTER CYLINDER
BLEED SCREW
PISTON
POPPET
PRESSURE TO WHEEL BRAKES
NO PRESSURE FROM PILOTs MASTER CYLINDER

NOTES

14. Internal major components:

    a. Piston

    b. Poppet valve

    c. Spring (2 each)

15. In the static position, the springs seat their respective valves and no pressure is present.

16. Operation

    a. The two (2) transfer valves provide the pressure interconnection between the pilot's and CPG's master brake cylinders.

    b. When the brakes are operated from the pilot's crewstation, the transfer valves perform no mechanical function.

    c. Fluid pressure passes from the pilot's master brake cylinder through the transfer valves to the wheel brakes.

    d. The valves function only when the CPG's brakes are operated. Fluid pressure from the CPG's master brake cylinder causes:

        (1) The piston to move, opening the CPG's inlet port.

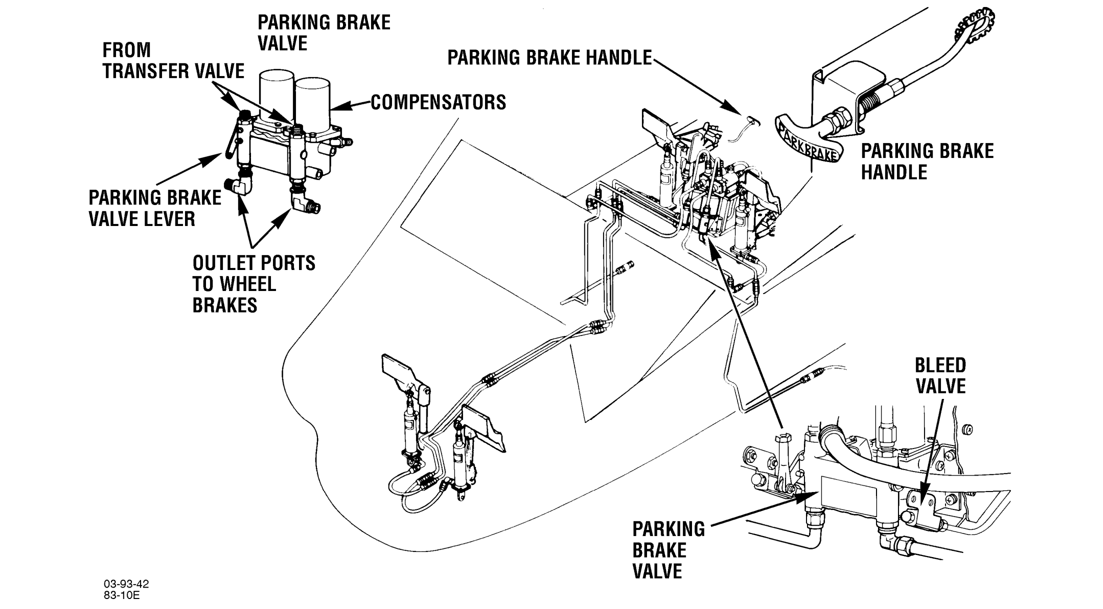
        (2) The poppet, attached to the piston, to seat, closing the pilot's inlet port, preventing fluid from flowing back into pilot's reservoir.

        (3) The CPG's piston to transmit pressure to the pilot's fluid, then to the wheel brakes.

        (4) Additional pressure to operate wheel brakes will be applied if the pilot's master cylinder overrides the poppet valve.

    e. The transfer valve bleed screws are used to bleed the CPG's master cylinders of air.

PARKING BRAKE VALVE ASSEMBLY



NOTES

17. Parking brake valve assembly

    a. Traps fluid pressure in the wheel brake assemblies to keep the brakes applied for parking.

    b. Secured to a bracket assembly forward and below the transfer valves.

    c. Components:

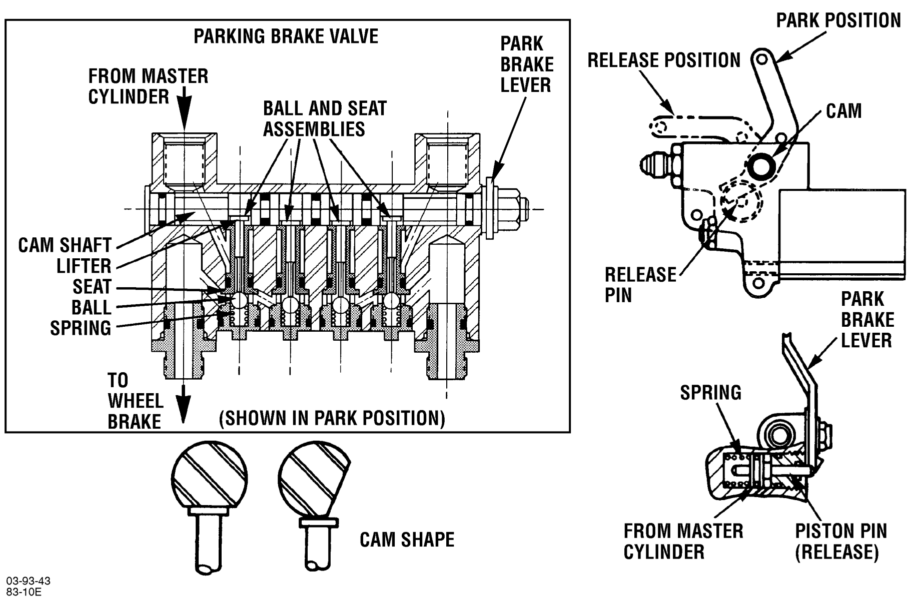
        (1) Parking brake valve

        (2) Compensators (2)

        (3) Parking brake valve lever and handle

        (4) Bleed valves (2)

PARKING BRAKE VALVE ASSEMBLY DESCRIPTION



NOTES

d. Two (2) inlet ports receive fluid pressure from the transfer valves via the master cylinders.

e. Two (2) outlet ports provide fluid pressure to the wheel brake assemblies.

f. Four (4) valves (ball and seat) route the fluid pressure to the wheel brake assemblies during normal operation and to the compensators when parking.

g. Valve components:

(1) Lifter

(2) Seat

(3) Ball

(4) Spring

(5) Cam shaft assembly

18. Parking latch assembly locks the brake lever in the park position and releases it upon application of the brakes (pressure from the master cylinder). The assembly consists of a spring, piston, and cap.

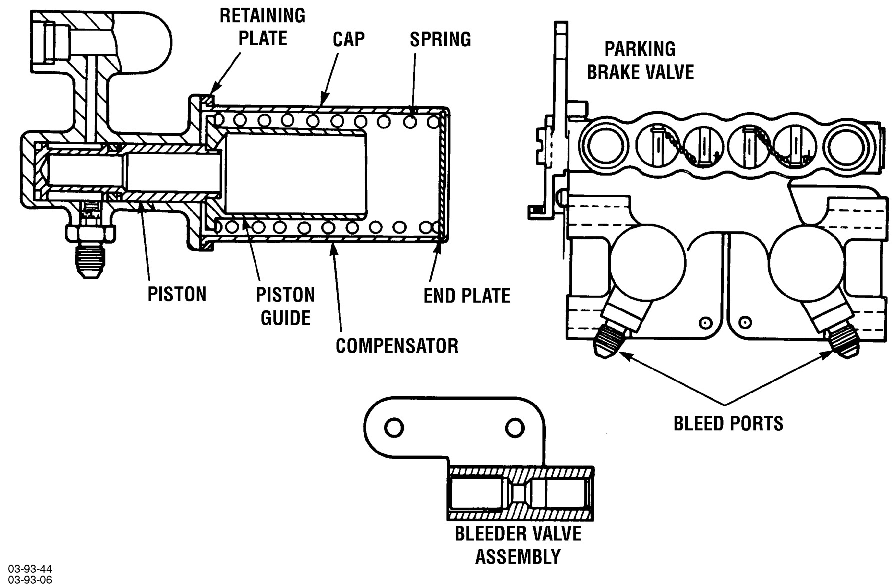
19. Parking brake lever and handle

a. A corrosion-resistant steel lever is installed on one end of the cam shaft to rotate the cam shaft to set the park brake.

b. A handle assembly in the pilot's station is connected via a flexible steel wire cable and clevis to the lever. The clevis is adjustable.

c. A lever return spring is attached to one end of the lever and the transfer valve mounting bracket.

PARKING BRAKE VALVE COMPENSATOR DESCRIPTION



NOTES

20. Compensators (2)

    a. Provide an automatic means of compensating for changes in hydraulic oil volume caused by temperature changes or minor leakage.

    b. Compensator components:

        (1) Retaining plate

        (2) Cap

        (3) End (valve) plate

        (4) Spring

        (5) Piston guide

        (6) Piston Assembly

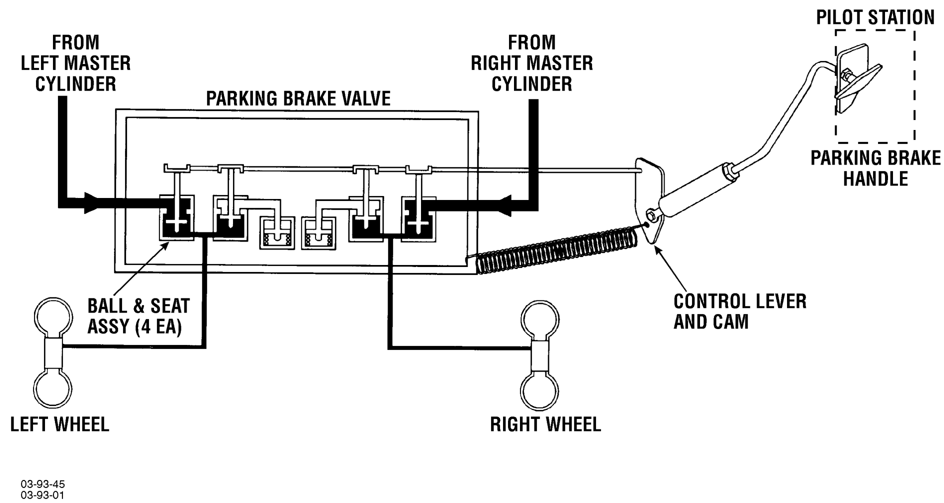
        (7) Two (2) bleed ports

21. Bleed Valves (2)

    a. The bleed valves are installed at the aft cockpit center console panels.

    b. The bleed valves are connected via tubing to the bleed ports at the parking brake valve (right and left, inboard).

PARKING BRAKE VALVE OPERATION - I



NOTES

22. Parking brake valve operation

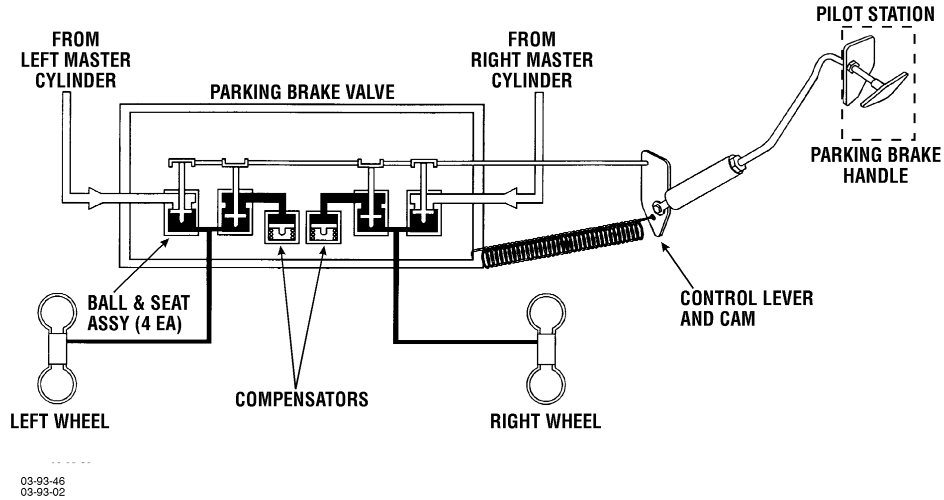
a. During normal braking of the aircraft by pedal actuation, the lever of the parking brake valve is held in the OFF position by the spring assembly.

b. The camshaft to which the lever is attached holds the two (2) outer valves (ball and seat) unseated (opened).

c. This permits fluid pressure, caused by applying force at the toe portion of the directional control pedal (pilot's or CPG's), from the master cylinder through the transfer valve, and into the parking brake valve, to be transmitted to the wheel cylinder through lines and tubing.

d. In this position, the inner valves are seated (closed) and the compensators are inoperative.

PARKING BRAKE VALVE OPERATION - II



NOTES

e. To set the brakes for parking, apply force to the toe portion of the directional control pedals. While the pedals are still depressed, pull the park brake control handle.

f. This rotates the camshaft, causing the outer valves to seat (close), stopping back flow (pressure) to the master cylinder. Fluid pressure is locked within the wheel brake assemblies.

g. At the same time, the rotating camshaft unseats (opens) the inner valves, allowing the compensators to open to the wheel brakes.

h. Constant braking pressure is maintained by spring tension in the compensator pistons when the brakes are set for an extended period of time. The spring tension compensates for volume changes produced by changing temperatures and minor leaks.

i. Compensator displacement volume is 0.324 cubic inch, each.

  (1) Compensator output pressure

    (a) At minimum displacement: 450 to 500 psi (3103 to 3447 kPa)

    (b) At maximum displacement: 1000 to 1100 psi (6895 to 6584 kPa)

  (2) After the parking brake has been set, the brake pedals are released. The parking brake lever then becomes locked in the park position by the latch assembly (locking pin), which is extended by a spring assembly.

j. The park brake valve maintains fluid pressure until pressure is applied from either crewstation directional control pedals.

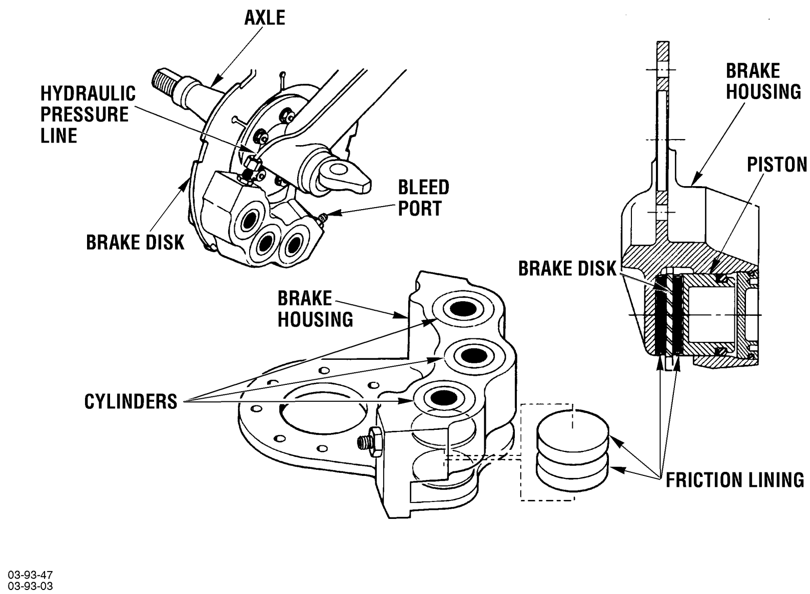
k. Master cylinder pressure of 130 psi (896 kPa) (15 inch-pounds [1.7 newton-meters]) of torque applied on the lever arm) or more causes the release pin to retract, unlocking the park lever and rotating the cam shaft, relieving trapped pressure and releasing the wheel brakes.

l. If the brake system is not properly serviced, the locking pin will not release and the pin will require manual resetting.

m. Brake system cannot be properly serviced with the park brake set.

n. Inspect park brake valve in accordance with TM 55-1520-238-23-2.

WHEEL BRAKE DESCRIPTION I



NOTES

23. Wheel brake assemblies and disks (2 each)

    a. Convert hydraulic pressure into a retarding force that stops wheel rotation.

    b. The wheel brake assembly is bolted to the flange at the inboard portion of the trailing arm axle.

    c. The disks are attached to the wheel assembly.

    d. The wheel assembly part numbers are:

        (1) Goodyear: 5001580-1 (an eight (8) bolt wheel assembly)

        (2) Parker-Hannifin: 040-20800 (a nine (9) bolt wheel assembly)

24. The wheel brake assembly consists of:

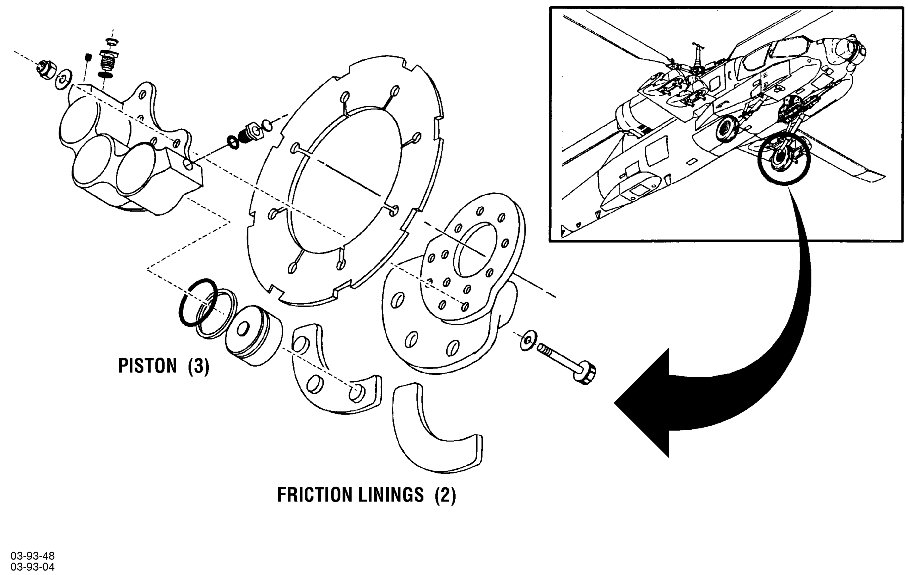
    a. An aluminum-magnesium casting brake housing, which contains three cylinders, a pressure inlet port, and a bleed port.

    b. A cylinder head assembly secures a piston in the housing cylinder.

    c. The pressure inlet port contains a union, a bleed port, and a bleed valve assembly. The union and bleed valve assembly are interchangeable, therefore providing for either left or right brake installation.

    d. The Goodyear brake friction linings are round pads made of organic material. There are six (6) linings in a set, one set per wheel.

WHEEL BRAKE DESCRIPTION II



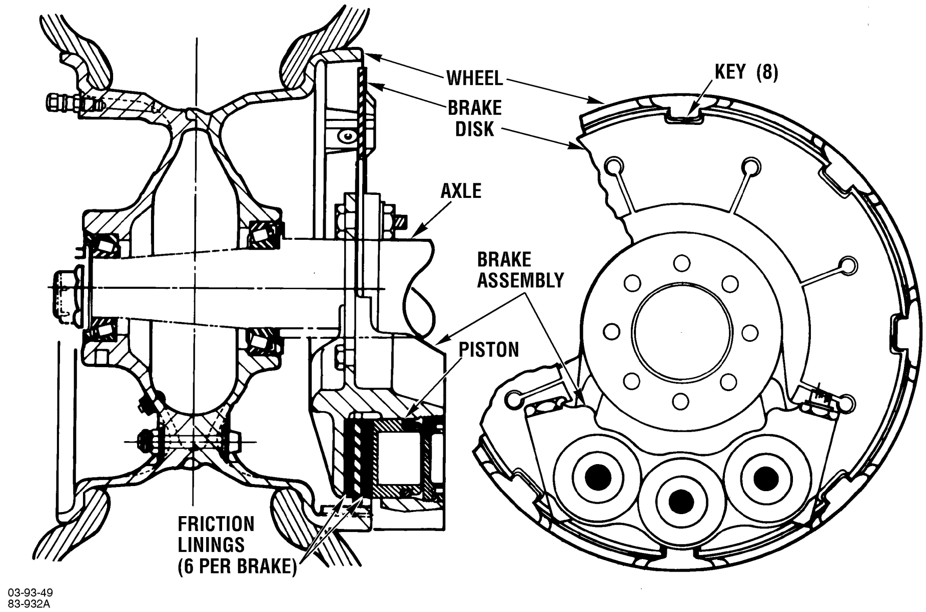
NOTES

e. The alternate source Parker-Hannifin wheel brake assemblies utilize only two (2) brake linings per assembly and a two-piece brake housing. This design is two-way interchangeable with the Goodyear unit and its operation is the same. The components are not interchangeable between Goodyear and Parker-Hannifin brake assemblies.

f. The Parker-Hannifin brake cylinder assemblies are forged assemblies and are stronger than the current cast assemblies. This will prevent possible cracking due to the moderately high pressures developed in the brake system. Additionally, the piston bore lead-in chamfer is changed to reduce the chance of damage to "O" rings during installation, the piston ends are radiused rather than chamfered to prevent hard anodize build-up on sharp edges, and the "O" ring has been changed to a less brittle, more elastic compound.

g. The brake disk is non-plated steel forging and is keyed to the wheel. It is positioned into the brake housing between the friction linings.

WHEEL BRAKE OPERATION



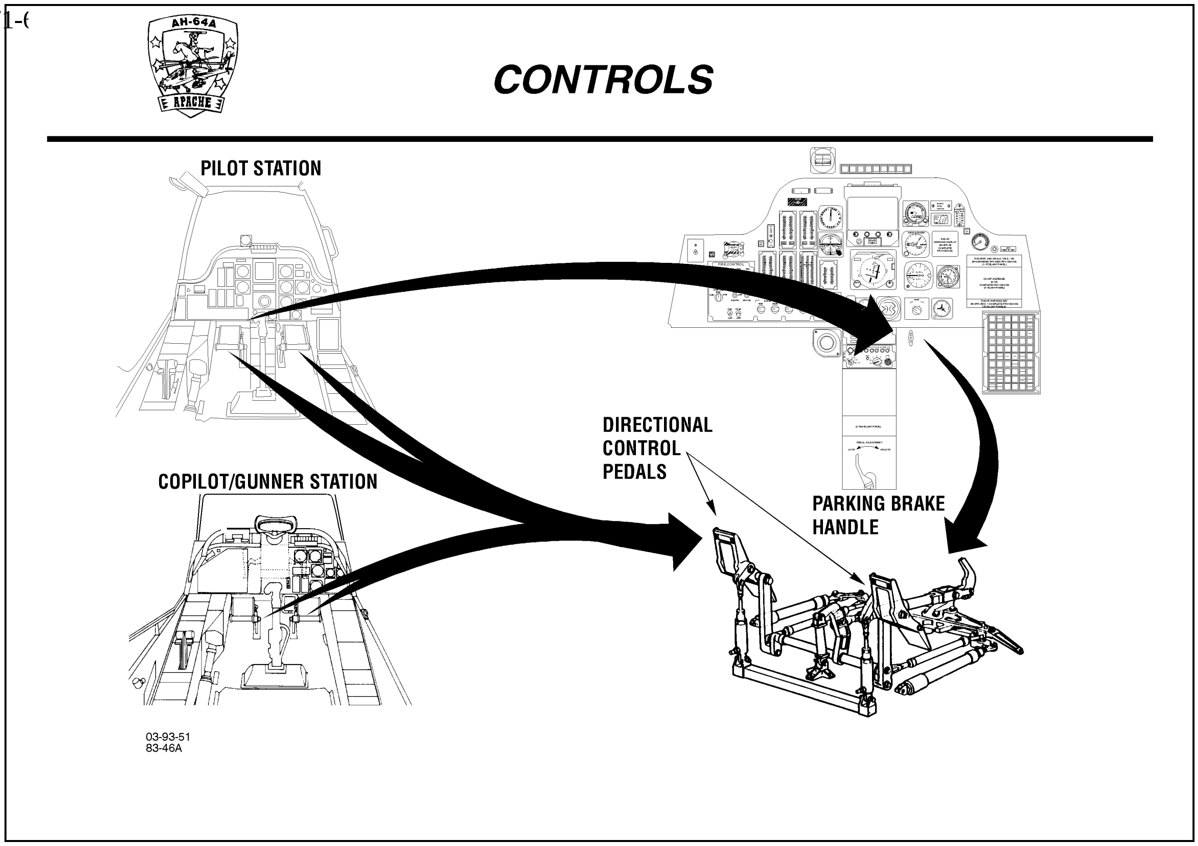
NOTES

25. The brake disks are keyed to the wheels so that the disk and wheel turn together.

26. The disk turns between the friction lining pads.

27. Hydraulic pressure activates three (3) pistons in each brake assembly to press the friction linings against the floating brake disk, slowing/stopping wheel rotation.

28. Perform 10-hour/14-day and phase inspections on wheel brakes in accordance with TM 55-1520-238-23-2.


AH-64A
APACHE
CONTROLS
PILOT STATION
COPILOT/GUNNER STATION
DIRECTIONAL
CONTROL
PEDALS
PARKING BRAKE
HANDLE
03-93-51
83-46A

NOTES

29. Controls

a. Directional control pedals:

(1) Two (2) in each crewstation.

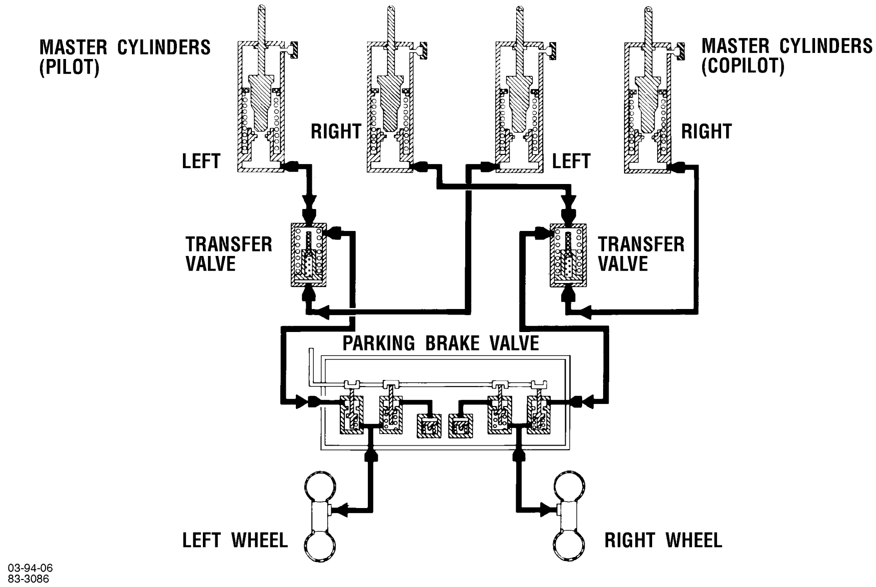
(2) Toe portion used to put a downward force on the master cylinders.

b. Park brake handle

(1) Located to the right of the pilot's center console.

(2) Used to set the parking brake by the pilot. May be released by either crewmember.

BRAKE SYSTEM OPERATION



NOTES

c. System operation

(1) Braking action is initiated from either crewstation by applying foot pressure to the top (toe) portion of the directional control pedals.

(2) This activates the master cylinders, which pressurize the hydraulic fluid in the brake system.

(3) The master cylinders pressurize hydraulic fluid in the system's components.

(a) Pressure is transmitted through tubing to the transfer valves and the parking brake valve to the wheel brake assemblies.

(b) This actuates pistons in each wheel brake assembly, causing friction linings to move against a floating brake disk (keyed to the wheel) to stop wheel rotation.

(c) When the brakes are operated from the pilot's crewstation, the transfer valves perform no mechanical function. Fluid is routed through the parking brake valve to the wheel brakes.

(d) When the brakes are operated from the CPG's crewstation, fluid pressure from the CPG's master cylinder displaces the piston in the transfer valve, causing the poppet to seat and close the inlet port from the pilot's crewstation. The piston pressurizes the closed fluid path to the wheel brakes.

(e) Exerting pressure on the pilot's directional control pedal overrides the poppet to allow pilot's pressure to operate wheel brakes.

(f) When the helicopter is to be parked, either crewmember can apply and maintain pressure on the brakes until the PARK BRAKE handle is pulled out, by the pilot, to lock the parking brakes.

1) When the parking brake is set, the control pedals are released.

2) Hydraulic pressure is maintained in the system by the parking brake valve.

3) Either the pilot or CPG can release the parking brake by exerting pressure on the directional control pedals.