TECHNICAL MANUAL

AVIATION UNIT AND AVIATION INTERMEDIATE MAINTENANCE MANUAL

CH-47D HELICOPTER

This manual together with TM 55-1520-240-23-1, TM 55-1520-240-23-2, TM 55-1520-240-23-3, TM 55-1520-240-23-5, TM 55-1520-240-23-6, TM 55-1520-240-23-7, TM 55-1520-240-23-8, TM 55-1520-240-23-9, TM 55-1520-240-23-10, TM 55-1520-240-23-11, supersedes TM 55-1520-240-23-1, TM 55-1520-240-23-2, TM 55-1520-240-23-3, TM 55-1520-240-23-4, TM 55-1520-240-23-5, TM 55-1520-240-23-7, TM 55-1520-240-23-8, TM 55-1520-240-23-9, TM 55-1520-240-23-10, 10 May 1983, and TM 55-1520-240-23-6, 6 May 1983, including all changes.

HEADQUARTERS, DEPARTMENT OF THE ARMY
19 SEPTEMBER 2002

TECHNICAL MANUAL
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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 19 SEPTEMBER 2002

AVIATION UNIT AND AVIATION INTERMEDIATE MAINTENANCE MANUAL

CH-47D HELICOPTER

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) located in the back of this manual, directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via e-mail, fax, or the World Wide Web. Our fax number is: DSN 788-6546 or Commercial 256-842-6546. Our e-mail address is: 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual immediately preceding the hard copy 2028. For the World Wide Web use: https://amcom2028.redstone.army.mil.

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CHAPTER 5
ROTOR SYSTEM

SECTION I
ROTARY-WING HEAD AND CONTROLS DESCRIPTION AND OPERATION

5-1 ROTARY-WING HEAD AND CONTROLS 5-1

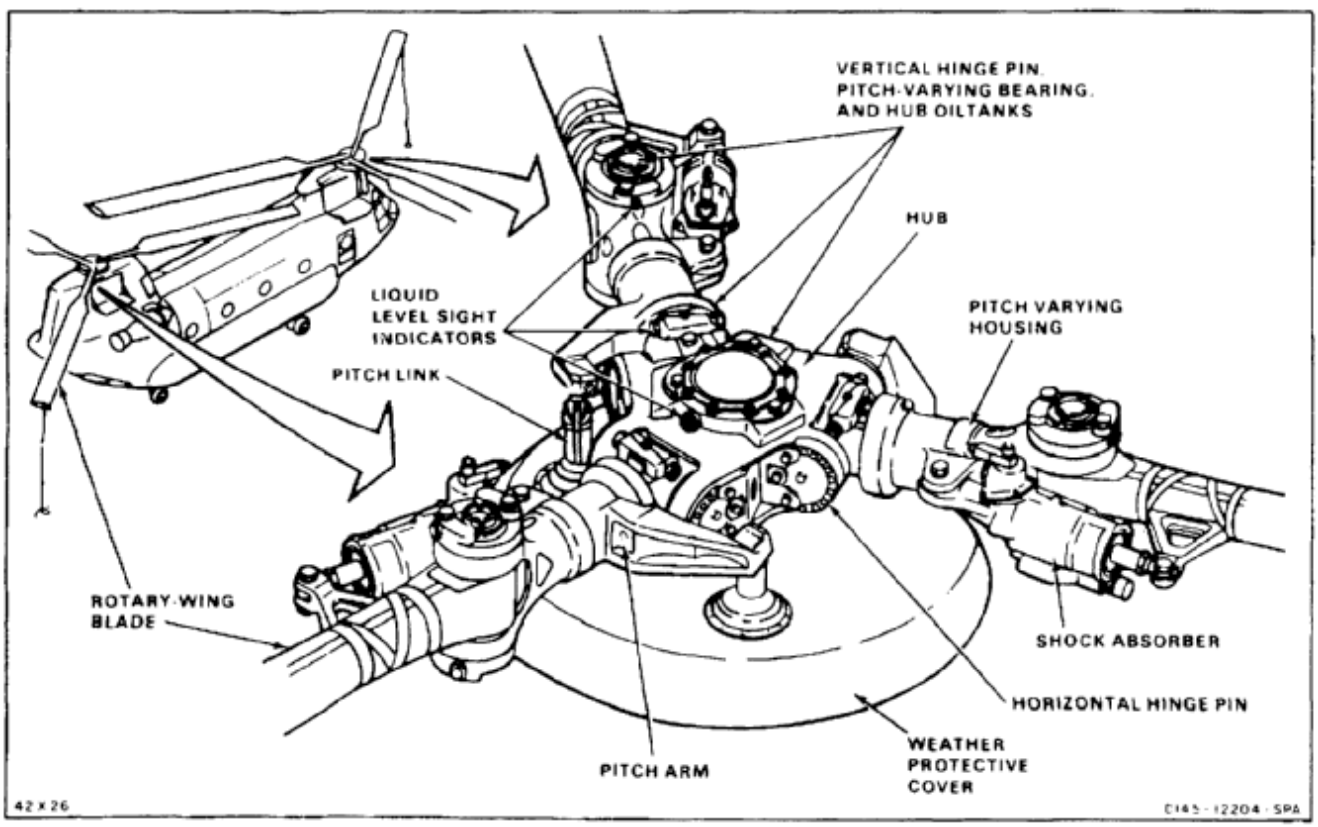
Lift is produced by a rotor system consisting of two fully articulated rotors. Each rotor has three fiberglass blades. The forward rotor is driven by the forward transmission thru a rotor drive shaft. The aft rotor is driven by the aft transmission thru a vertical drive shaft. The rotor head consists of a hub connected to three pitch-varying shafts by three horizontal hinge pins. These pins permit blade flapping. Stops on the top and the bottom of the hub limit the blade flapping motion. The aft rotor head is equipped with centrifugal droop stops, which provide increased blade flapping angle for ground and flight operation. Covers are installed on the centrifugal droop stops, which provide increased blade flapping angle for ground and flight operation. The covers prevent ice accumulation on the mechanism and ensure proper droop stop operation following flight in icing conditions. Mounted coaxially over the pitch-varying shafts are pitch-varying housings to which the blade leading and lagging. Each pitch-varying shaft is connected to the pitch-varying housing by a laminated tie-bar assembly. The high tensile strength and low torsional stiffness of the tie-bar retains the blade against centrifugal force and allows blade pitch changes about the pitch axis. Blade pitch changes are accomplished by three pitch-varying links connected from the rotating ring of the swashplate to the pitch-varying housing on each rotor blade. Cyclic pitch changes are accomplished by tilting the swashplate. Collective pitch changes are realized by vertical movement of the swashplate. Collective and cyclic pitch changes result from combined control inputs by the pilot. A direct action shock absorber is attached to the blade and to pitch-varying housing. When the inboard end of the shock absorber is disconnected, the blade can be folded in either direction about the vertical hinge pin.

ROTOR HUB

The rotor hub contains splines that mate with splines on the transmission rotor shaft. Pitch shafts are connected to the hub through the three horizontal pins. These pins ride in bearings supported by the hub lugs. Caps retaining the pins and bearings are secured by locking beams. The beams connect the leading cap of one pin with the trailing cap of the next pin.

PITCH-VARYING HOUSINGS

The pitch-varying housings are connected internally to pitch-varying shafts by flexible, laminated steel tie-bars. The laminated tie-bar allows the pitch housing to rotate on the pitch shaft to change blade pitch. The tie-bar is connected to the inboard end of the pitch shaft. The pitch arm on each housing is connected by a pitch link to a lug on the swashplate. The pitch link raises or lowers the pitch arm to rotate the housing on two roller bearings on the shaft. Outboard lugs on the housing contain bearings for the vertical hinge pin.

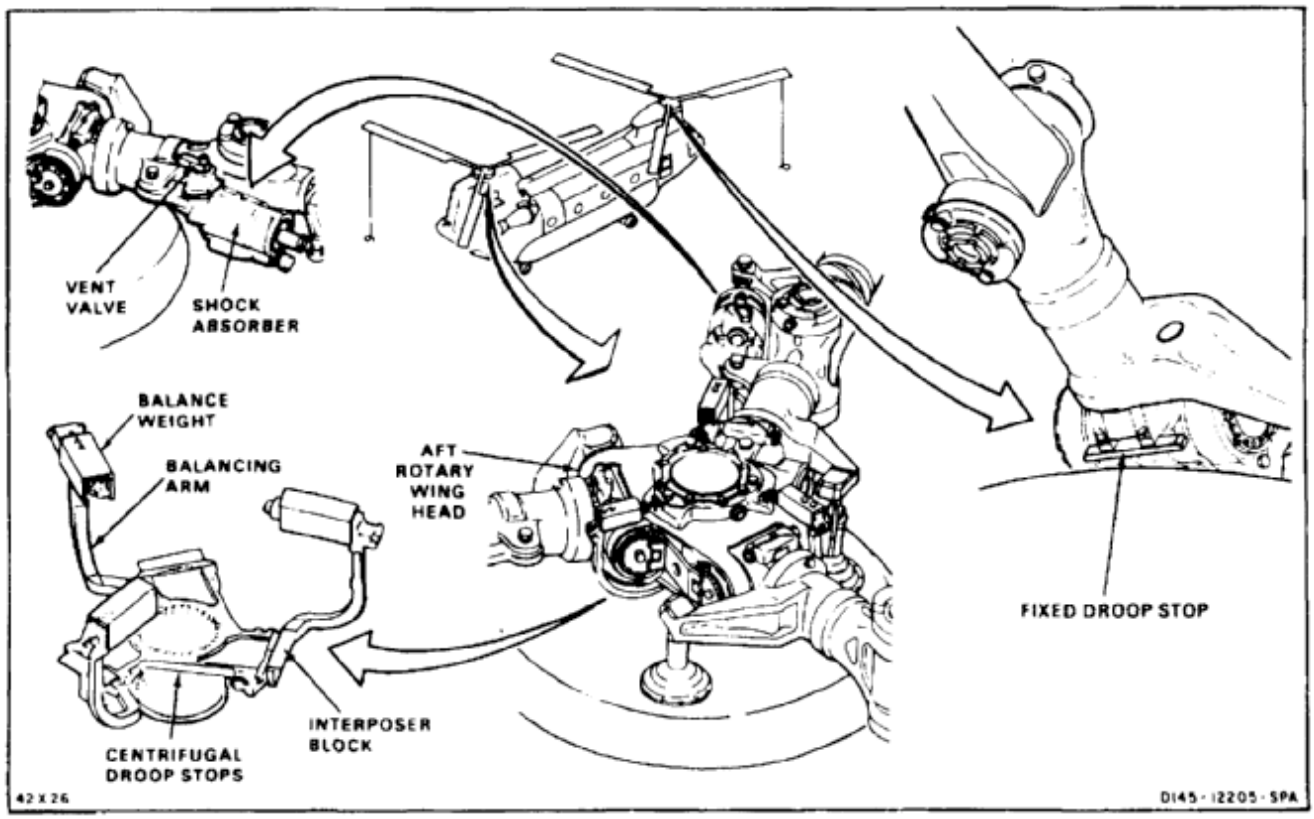


DROOP STOPS

The droop stops limit blade droop. Each pitch-varying housing is supported by a droop stop. Forward and aft heads have fixed droop stops. These are installed on the bottom of the pitch shaft to limit droop at zero rotor speed. These fixed droop stops rest directly against the hub. The centrifugal droop stop assembly is mounted on a splined plate under the aft rotor head. The droop stop contains three balancing arms. These are connected by springs to lugs on the hub oil tank. Interposer blocks on the balancing arms are positioned between fixed blocks and the hub. As rotor speed increases, the centrifugal droop stops swing out. This moves interposer blocks clear of the pitch shafts and allows more freedom for blade droop. As rotor speed decreases, the springs pull the arms in toward the hub. This positions the blocks between the hub and pitch shafts to reduce droop angle.

SHOCK ABSORBERS

Each head has three shock absorbers. They are connected between lugs on the pitch-varying housing and brackets on the blades. The shock absorbers limit lead and lag motion of the blades. Each shock absorber has a vent valve. The valve is opened for extreme cold weather operation. Changing the vent valve position allows the shock absorber to be used on forward or aft head.

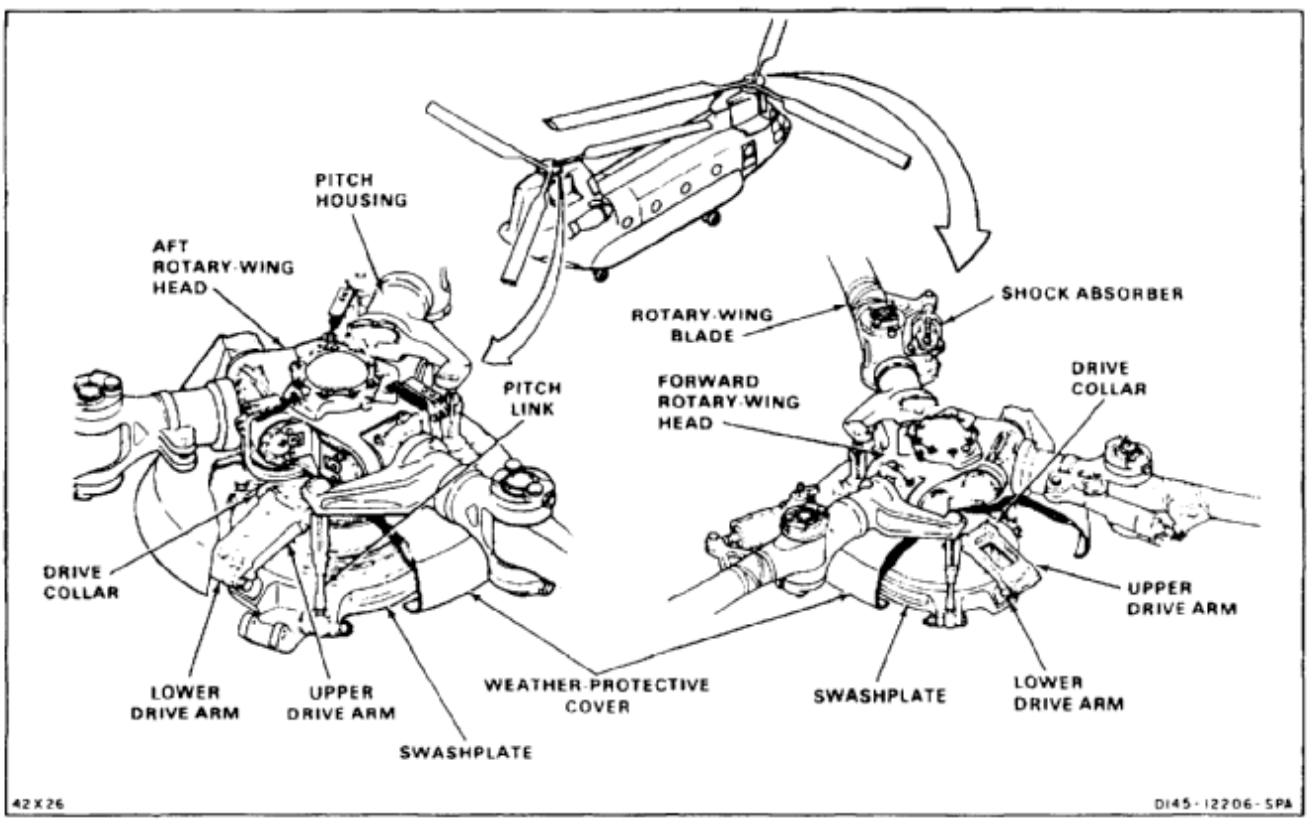


SWASHPLATES

The forward and aft swashplates transmit manual or automatic cockpit control movements to the rotary-wing blades. The swashplates can be tilted and moved vertically. This movement is transferred to the blades through the pitch links and pitch-varying housings. Forward and aft swashplates have aluminum rotating rings. The stationary ring on the aft swashplate is steel. On the forward swashplate this ring is aluminum. The stationary ring of each swashplate is mounted on a spherical bearing. This allows the swashplate to tilt in any direction. A ball bearing connects rotating and stationary rings. The swashplate is free to slide up or down on a slider shaft to change blade pitch angle. Lugs are provided on the rotating ring for connecting three pitch links and an upper drive arm. Drive arm lugs are located in two positions so the rotating ring can be used on forward or aft swashplate. Lugs on the stationary ring provide for connection of two servocylinders, fixed link, and longitudinal cyclic trim actuator. Two single interrupters and a double interruptor on the rotating ring, and a magnetic pickup on the stationary ring, are used for rotor balancing.

PITCH LINKS

The six pitch links are connected between the swashplates and pitch-varying housings. Tilting a swashplate up or down moves the pitch link and pitch arm in the same direction. This increases or decreases the blade pitch angle. Raising or lowering the swashplate on the slider shaft changes pitch on all three blades.



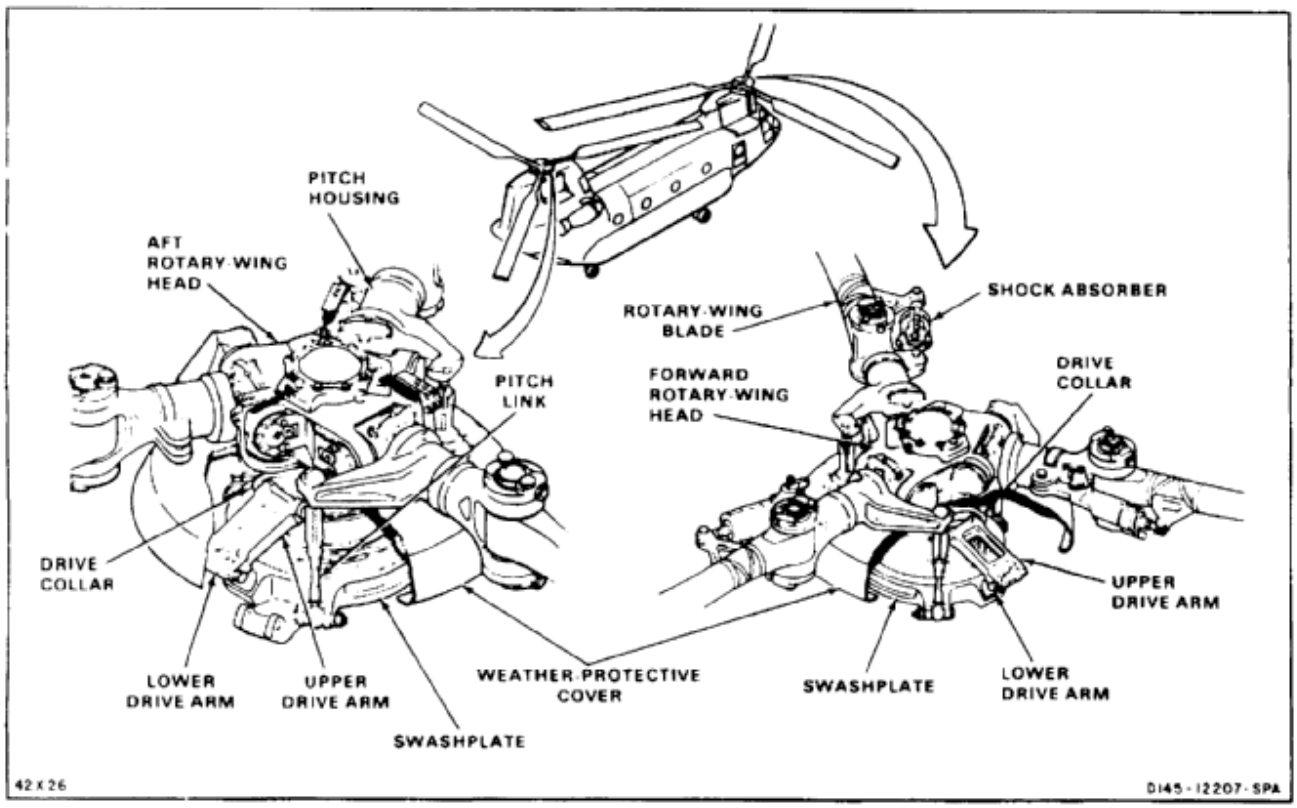
Three pitch links are installed on each rotary-wing head. Forward and aft pitch links are similar except for the angle between rod ends. Each pitch link is adjustable to change the pitch of an individual blade. Moving the turnbuckle toward the + mark makes the pitch link longer and increases blade pitch. A turn in the – direction shortens the pitch link and decreases blade pitch.

DRIVE COLLAR AND DRIVE ARMS

The drive collar transmits torque to the swashplate through the upper and lower drive arms. The drive arms are hinged to allow the swashplate to slide up and down on the slider shaft. The splined drive collars mate with splines on the transmission rotor shafts. A flange is located on the drive collar for installation of the weather-protective cover. Drive collar lugs are provided for connecting the upper drive arm. The upper drive arm is connected at the other end to the lower drive arm. Both connections are hinged. A ball spherical bearing on the lower drive arm is connected to the swashplate. This arrangement allows swashplate to tilt.

WEATHER-PROTECTIVE COVER

The weather-protective cover is bolted to the drive collar flange and turns with the collar and shaft. The cover provides weather-protection for the upper controls. Flexible boots protect the upper portion of the pitch links where they pass through the cover.

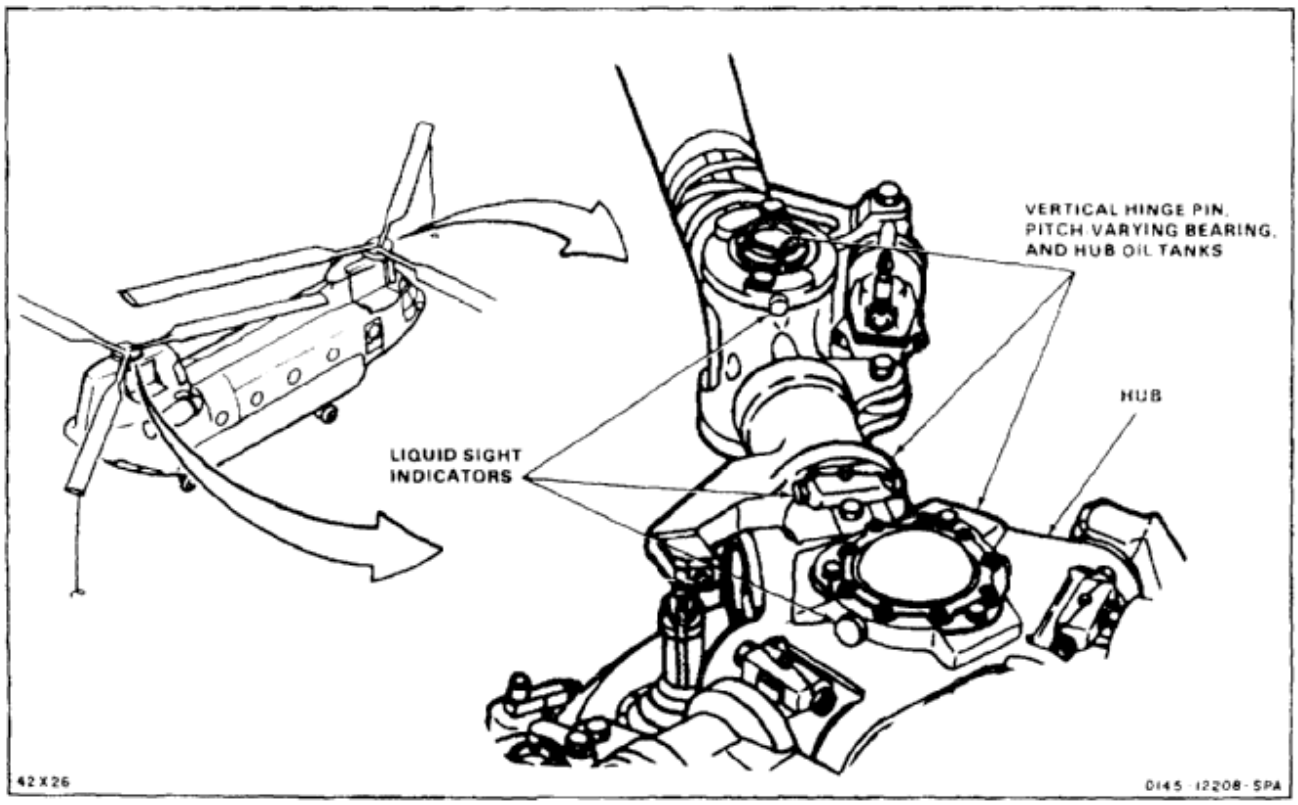


LUBRICATION SYSTEM

A single hub oil tank lubricates the horizontal pin bearings. Each pitch-varying housing has a pitch bearing oil tank and two vertical pin bearing oil tanks. The vertical pin tanks are connected to each other by an oil manifold tube. Sight indicators are provided for each tank, to check oil level. The swashplate is lubricated with grease.

SELF-RETAINING BOLTS

Bolts connecting upper controls and shock absorbers are the positive-retention or impedance types. These bolts have a pawl or lock ring to keep the bolt in place, even with the nut removed. Bolts are installed with bolt heads facing the direction of rotation (Task 1-14).



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