

DIRECTED STUDY PROGRAM

Page: 1

DHC - 4

Ref.: 1080-3

POWER PLANT

GENERAL

The engines are Pratt and Whitney model R-2000-7M2, 14-cylinder, two row radial, aircooled type. The supercharger is a single-stage, single-speed type. The direction of rotation is clockwise, viewed from the rear. The engine is mounted to a tubular engine mount ring with eight vibration isolators, the engine mount assembly being bolted to the main firewall at four points.

The eight vibration isolators used to attach each engine to its engine mount ring, consists of a rubber core containing a threaded stem, and secured to the engine mounting bracket by a nut and cotter pin. Blast cooling is provided by four duct assemblies which collect air from in front of the cylinder baffles and discharge it onto the forward faces of isolators. An auxiliary firewall. In two sections, upper and lower, is secured to the engine mount ring.

ENGINE ACCESSORIES

The following accessories are mounted on each engine:

| | |
|----------------|--|
| Starter | Air Pump (if de-icing system is installed) |
| Generator | Tachometer Generator |
| Fuel Pump | Propeller Governor |
| Hydraulic Pump | Magnetos |

NOTE: For specific details of engine performance and limitation see section 1080-2. For details of the engine accessories see appropriate sections of this manual; i.e., starter - see 1080-4m.

| | |
|---|---|
| 1. The DHC-4 uses a _____ engine. | |
| 2. The engine has a _____ stage blower section and is bolted to the main firewall at four points. | P & W R-2000-7M2 |
| 3. The eight isolation mounts are cooled by _____. | single |
| 4. Engine driven accessories are _____, _____, _____, _____, _____, _____. | air |
| | generators; fuel pump; hydraulic pump; air pump; tachometer generator; propeller governor; magnetos |

DIRECTED STUDY PROGRAM

Page: 2

DHC - 4

Ref.: 1080-3

ENGINE ACCESSORY COMPARTMENT VENTILATION SYSTEM

Additional ventilation of the engine accessory compartment, during ground operation, is provided by two doors, located in the bottom left cowling panel and on top of the nacelle, just forward of the main firewall. The lower door is opened inward by an electro-mechanical actuator mounted on the main firewall. The upper door, which is spring-loaded to open outward, is connected weight switch on the nose gear which automatically causes the doors to open when the aircraft is on the ground and close when it becomes airborne. A switch on the engine switch panel may be used to override the weight switch to close the doors while the aircraft is on the ground.

For normal operation the VENT DOORS switch on the engine switch panel is selected to AUTO OPEN. With the switch in this position and the aircraft on the ground a circuit is completed through the nosewheel weight switch to the B terminal of each actuator, causing the actuator arm to retract and open the vent doors. When the aircraft becomes airborne the nosewheel weight switch de-energizes the vent doors relay causing it to extend the actuator arm and close the doors. When the VENT DOORS switch is selected to CLOSE MAN. The circuit from the nosewheel weight switch to the vent doors relay is interrupted, causing current to be switched to the actuator A terminals to close the doors.

EXHAUST SYSTEM

Exhaust gases from each engine are directed aft through two groups of four exhaust pipes into two augmentor tubes mounted on the top of each nacelle and over the upper surface of the root flaps.

Although a certain amount of thrust is developed by expulsion of hot gases through the augmentor tubes, their primary purpose is to aid engine cooling during high power, low airspeed climb. By creating a venturi effect in the upper nacelle area additional cooling air is drawn through the cylinder baffling and forced around the cylinders. Thus, the amount of thrust developed by the augmentor tubes is merely sufficient to overcome the drag factor of their being installed, and they contribute nothing to the performance of the aircraft.

1. Ground cooling of the engine accessory section is accomplished by _____ vent doors controlled automatically through a _____ weight switch.

2. The override control switch is normally used in the _____ position.

two;
nose gear

3. The purpose of the augmentor tubes is to aid engine cooling during _____, _____ flight.

AUTO-OPEN

DIRECTED STUDY PROGRAM

DHC - 4

Page: 3

Ref.: 1080-3

4. The augmentors create a _____ effect through the cylinder baffles.

HIGH POWER;
LOW AIRSPEED

5. They contribute _____ to performance.

venturi

nothing

DIRECTED STUDY PROGRAM

DHC - 4

Page: 4

Ref.: 1080-3



- | | | |
|---|--------------------------------------|---|
| 1. FUEL LINE TRANSFER | 11. FUEL PRESSURE TRANSMITTER LINE | 21. MANIFOLD PRESSURE LINE |
| 2. MIXTURE CONTROL ROD | 12. OIL TEMPERATURE RESISTANCE BULB | 22. OIL PUMP OUTLET BLANKING PLATE |
| 3. THROTTLE CONTROL ROD | 13. SCAVENGE OIL FILTER | 23. OIL PRESSURE RELIEF VALVE |
| 4. CARBURETOR | 14. MAIN OIL FILTER | 24. OIL PUMP |
| 5. CARBURETOR VENT PIPE CONNECTION | 15. CRANKCASE BREATHING PIPE | 25. OIL PUMP INLET BLANKING PLATE |
| 6. EXHAUST PIPES | 16. OIL PRESSURE TRANSMITTER LINE | 26. FUEL PUMP INLET CONNECTION |
| 7. OIL DILUTION LINE CONNECTION | 17. HYDRAULIC PUMP OUTLET CONNECTION | 27. FUEL PUMP PRESSURE RELIEF VALVE |
| 8. OIL DILUTION SOLENOID | 18. HYDRAULIC PUMP BYPASS CONNECTION | 28. FUEL PUMP |
| 9. TACHOMETER GENERATOR | 19. HYDRAULIC PUMP INLET CONNECTION | 29. FUEL LINE PUMP TO CARBURETOR |
| 10. OIL TANK VENT LINE CONNECTION (R.H. ENGINE) | 20. HYDRAULIC PUMP | 30. OIL TANK VENT LINE CONNECTION (L.H. ENGINE) |

Power Plant Installation

DIRECTED STUDY PROGRAM

Page: 6

DHC - 4

Ref.: 1080-3

PROPELLERS GENERAL

All Company operated DHC-4's have been modified to use the Hamilton Standard three blade, constant speed, feathering, and reversing type props with the integral self contained control system. The control unit consists of an oil tank of 3.2 gallons capacity, mounted on the engine front nose case, with a float mechanism to indicate low fluid level. A warning light in the cockpit will illuminate when fluid level reaches 10 quarts remaining. On Company aircraft there are no provisions for in-flight replenishment of fluid from the engine oil system.

Also within the control unit are two oil pressure pumps to provide operating pressure out to the prop dome and piston assembly. A main engine driven pump supplies pressure for governor constant speed operation, and an auxiliary pump is electrically activated as required to provide boosted oil pressure during feathering, unfeathering, reversing, and unreversing operations. A solenoid pack mounted externally on the tank controls increase - decrease pitch solenoid valves within the governor unit to direct the oil into the proper channels and block the low pressure relief valve for these special operations. Control of the auxiliary pump is obtained through the feathering button, throttle switches, holding relays, and an electrical timing unit.

CAUTION: A braided bonding strap between the control unit and the engine nose case serves as ground for the auxiliary pump. If this becomes loose or disconnected in flight it will be impossible to feather or reverse.

NOTE: Landing gear weight switches have been bypassed on Company aircraft to permit in-flight reversing.

1. All Company operated DHC-4's use a Hamilton Standard _____ control type propeller.

2. All operations of _____, _____, _____, _____, and _____ are performed by a single control unit.

integral

3. The fluid capacity of the control unit is _____ gallons.

constant speed;
feathering;
unfeathering;
reversing;
unreversing

4. A fluid low level warning light will illuminate when _____ quarts remain in the tank.

3.2

DIRECTED STUDY PROGRAM

Page: 7

DHC - 4

Ref.: 1080-3

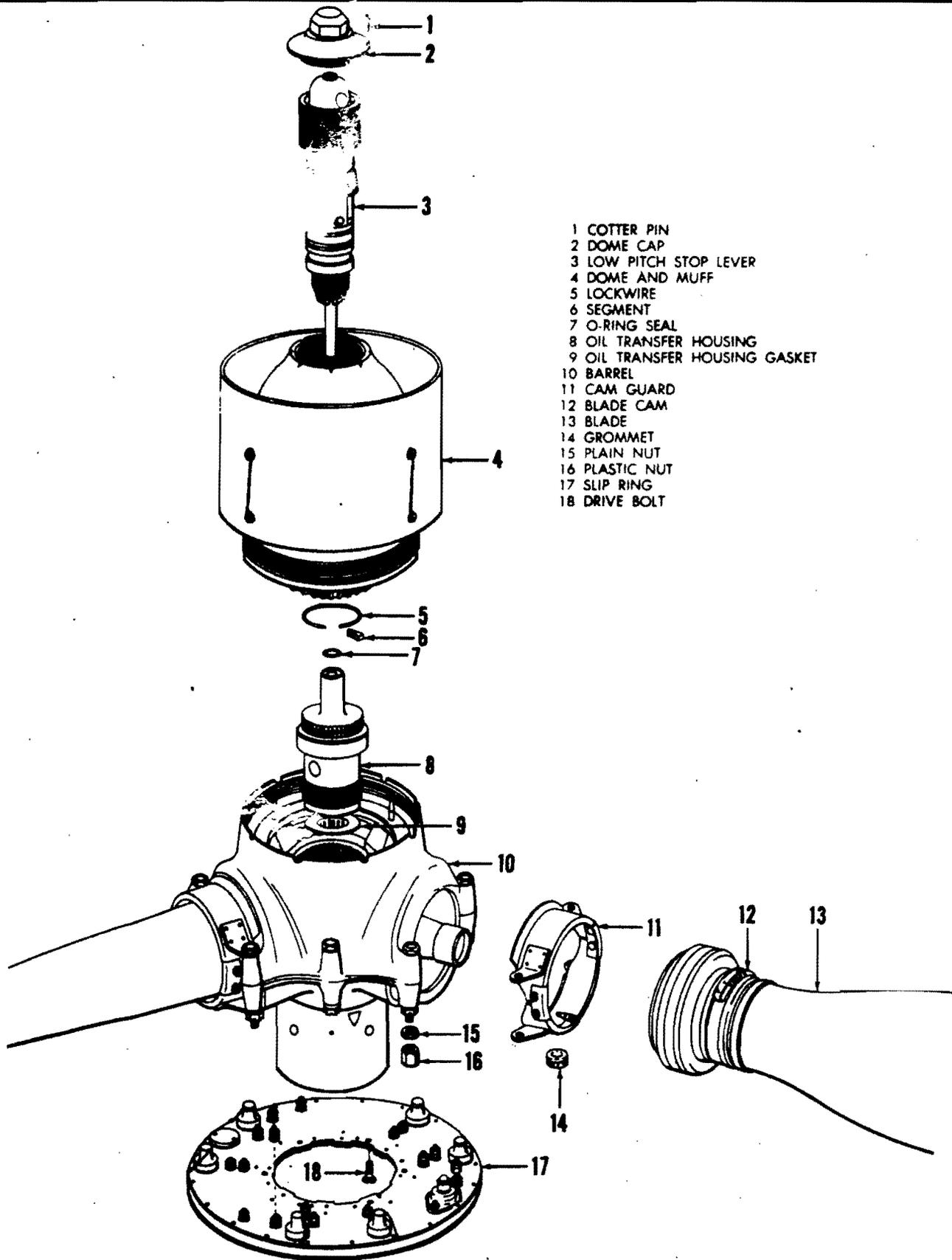
| | |
|---|----------------------------|
| 5. An auxiliary pump supplies _____ pressure for all operations except _____. | 10 |
| 6. On preflight inspection a major item is the _____. | boosted; constant speed |
| | grounding strap |

DIRECTED STUDY PROGRAM

DHC - 4

Page: 8

Ref.: 1080-3



- 1 COTTER PIN
- 2 DOME CAP
- 3 LOW PITCH STOP LEVER
- 4 DOME AND MUFF
- 5 LOCKWIRE
- 6 SEGMENT
- 7 O-RING SEAL
- 8 OIL TRANSFER HOUSING
- 9 OIL TRANSFER HOUSING GASKET
- 10 BARREL
- 11 CAM GUARD
- 12 BLADE CAM
- 13 BLADE
- 14 GROMMET
- 15 PLAIN NUT
- 16 PLASTIC NUT
- 17 SLIP RING
- 18 DRIVE BOLT

Propeller Assembly

DIRECTED STUDY PROGRAM

Page: 9

DHC - 4

Ref.: 1080-3

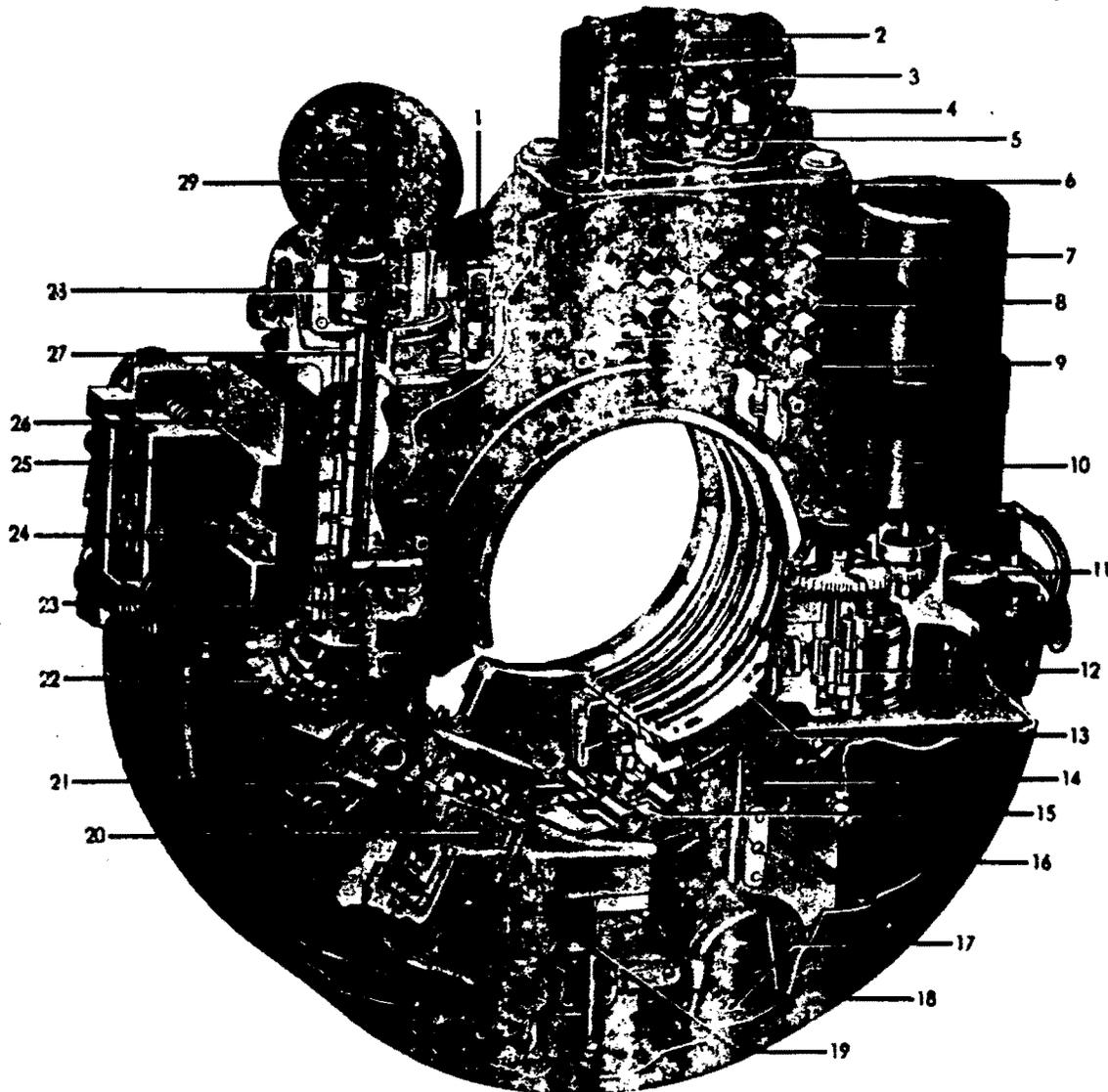
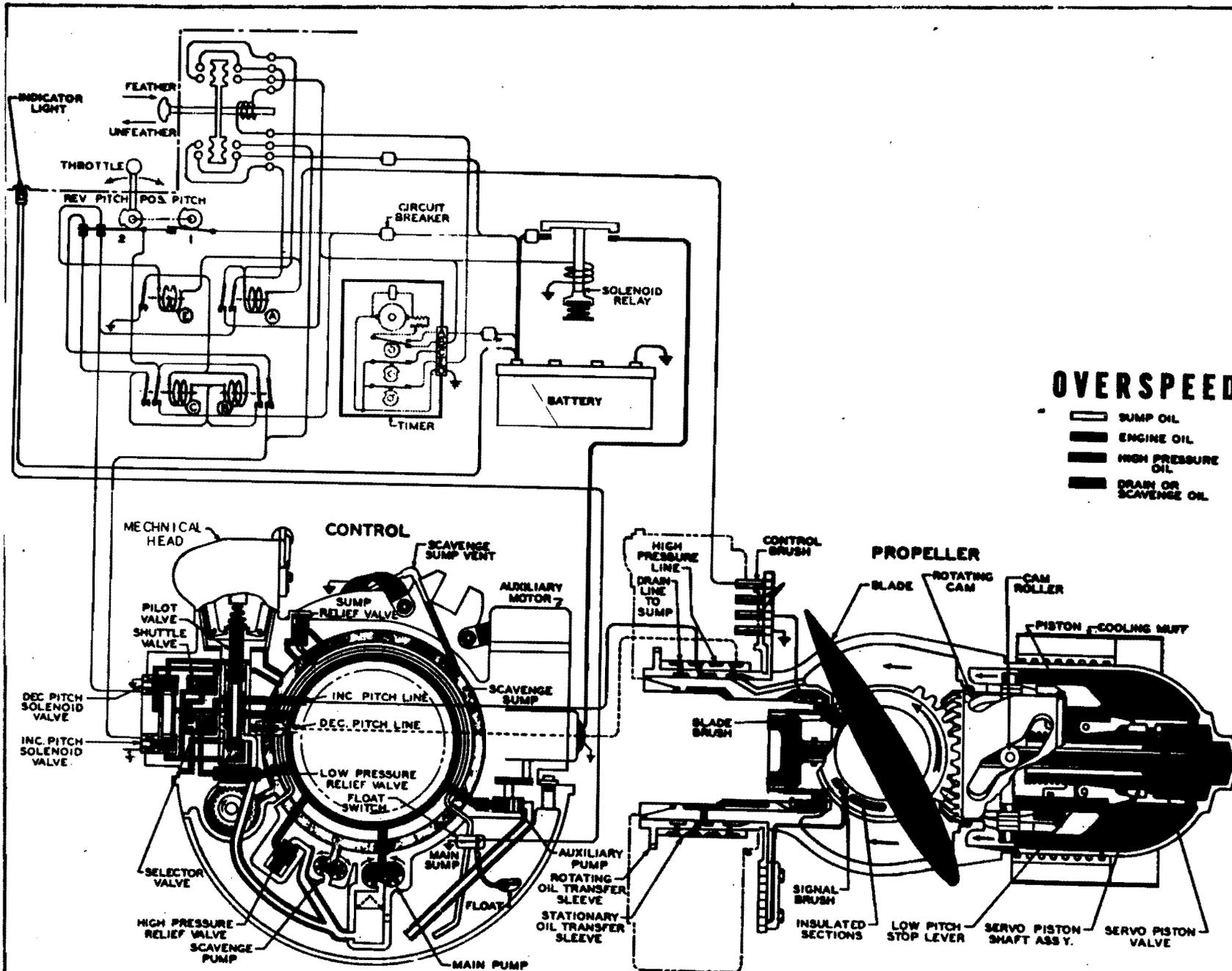


Figure 5-144. Propeller Oil Control Unit

- | | |
|---------------------------|---|
| 1. Sump relief vent | 16. Float |
| 2. De-icing terminals | 17. Auxiliary pump screen |
| 3. Ground terminal | 18. Reservoir |
| 4. Blade switch connector | 19. Main pump screen |
| 5. Blade switch terminal | 20. Scavenge pump |
| 6. Brush block assembly | 21. High pressure relief valve |
| 7. Blade switch brush | 22. Governor drive gear |
| 8. De-icing power brushes | 23. Low pressure relief valve |
| 9. Ground brush | 24. Selector valve |
| 10. Auxiliary pump motor | 25. Solenoid pack (Consisting of decrease and increase pitch solenoids) |
| 11. Filler cap | 26. Shuttle valve |
| 12. Auxiliary pump | 27. Pilot valve |
| 13. Rotating sleeve | 28. Speeder ring assembly |
| 14. Float switch | 29. Mechanical head |
| 15. Main pump | |

DIRECTED STUDY PROGRAM

DHC - 4



Ref.: 1080-3

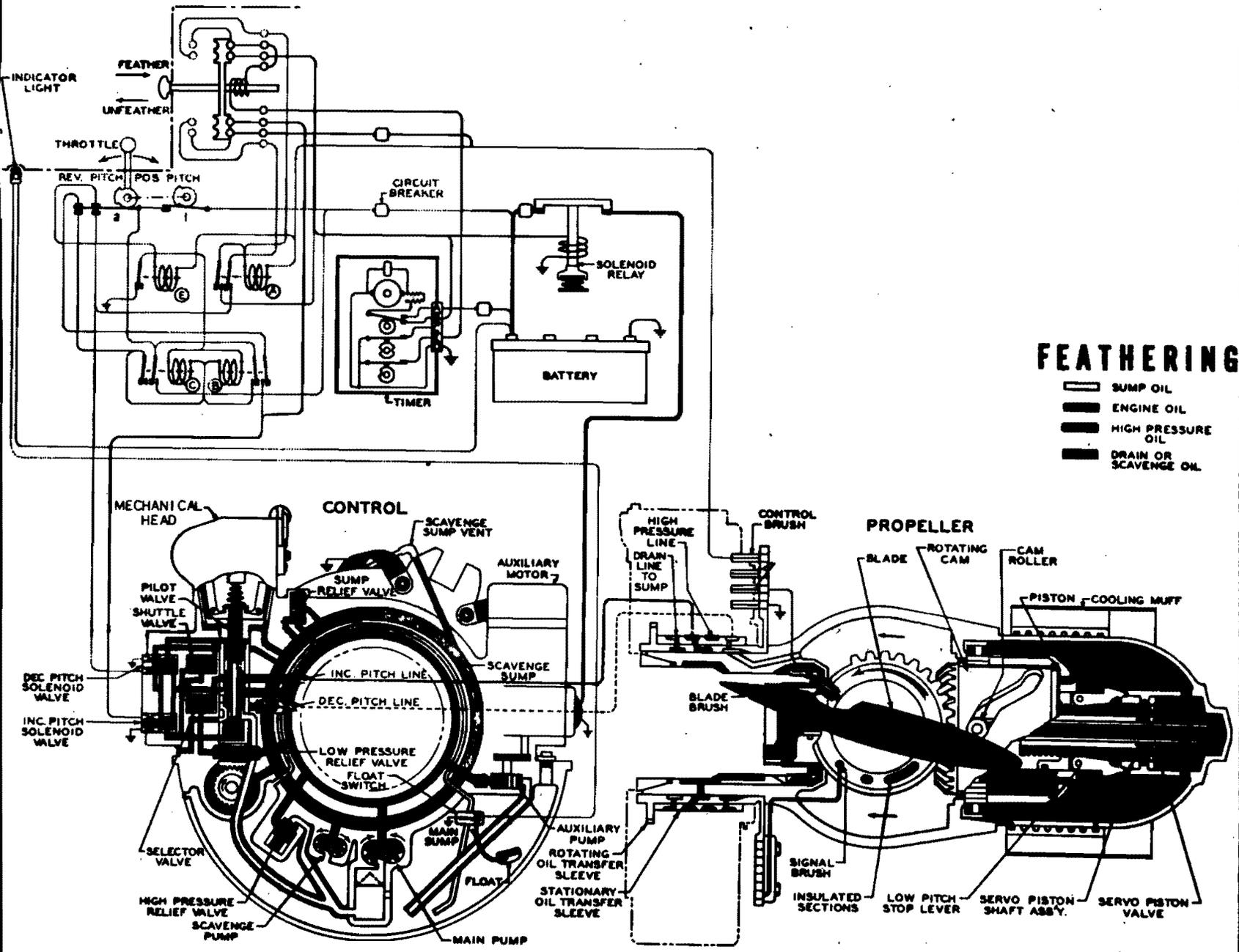
Page: 10

DIRECTED STUDY PROGRAM

DHC-4

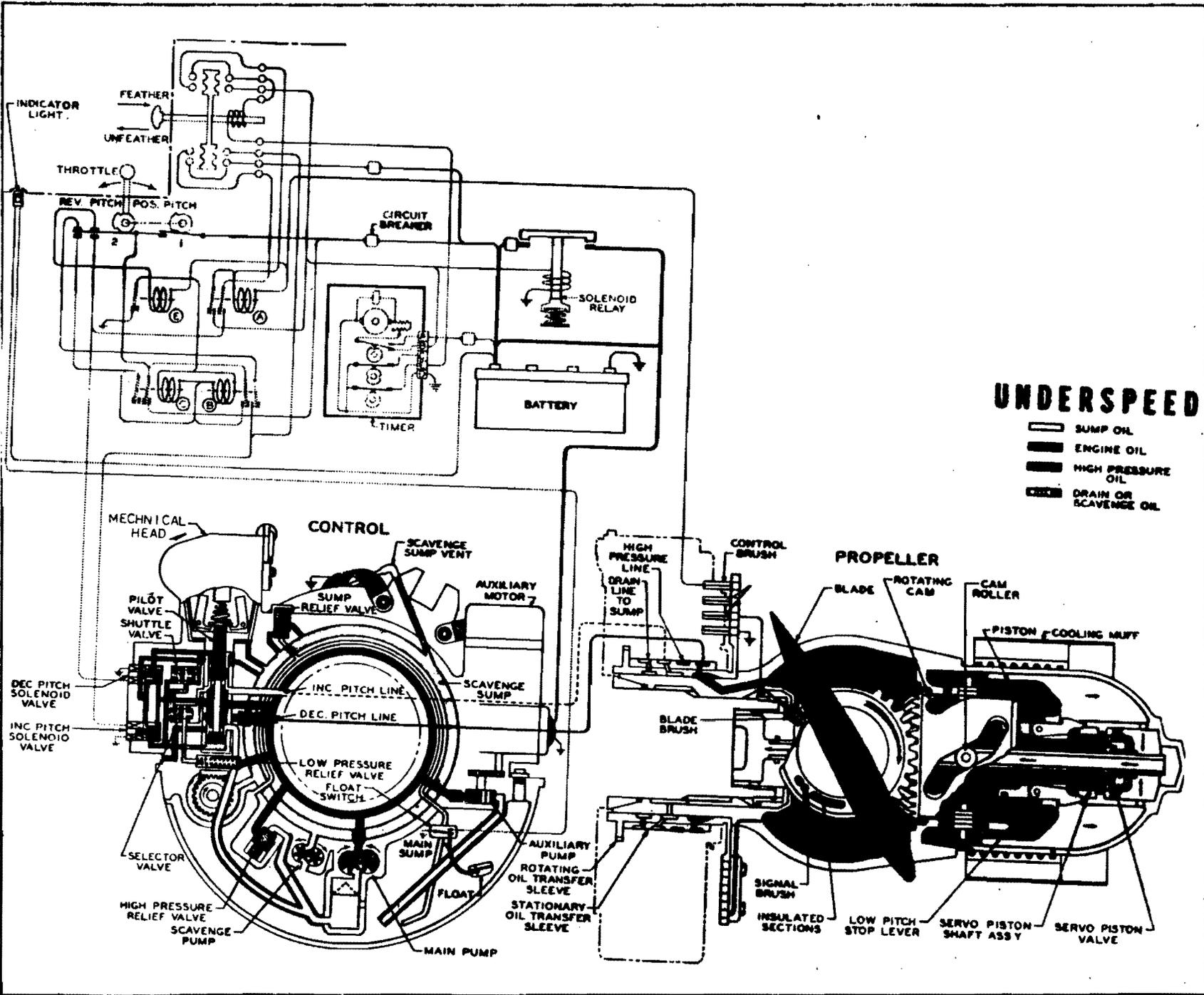
Page: 11

Ref.: 1080-3



DIRECTED STUDY PROGRAM

DHC - 4

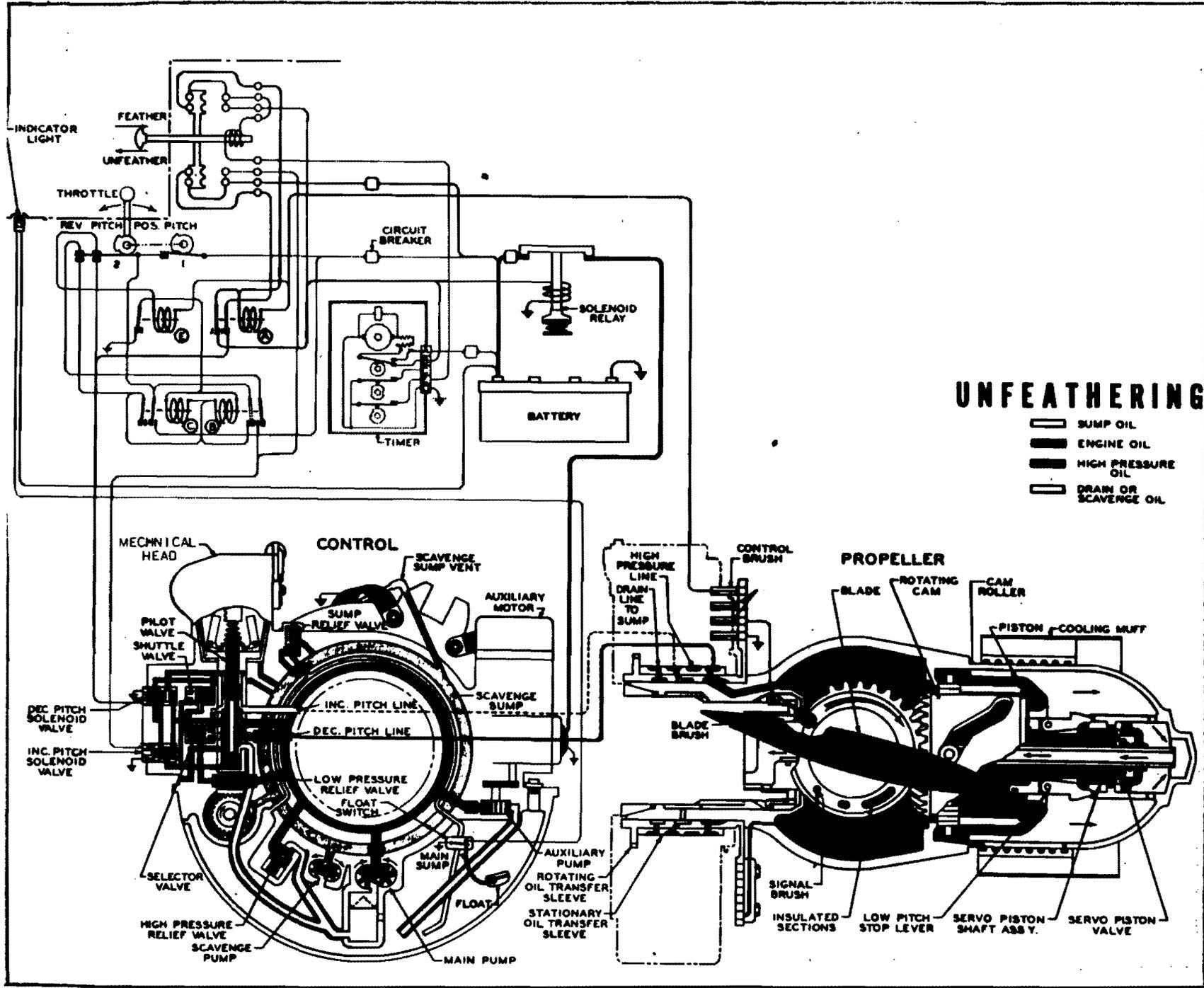


Ref.: 1080-3

Page: 12

DIRECTED STUDY PROGRAM

DHC - 4



Ref.: 1080-3

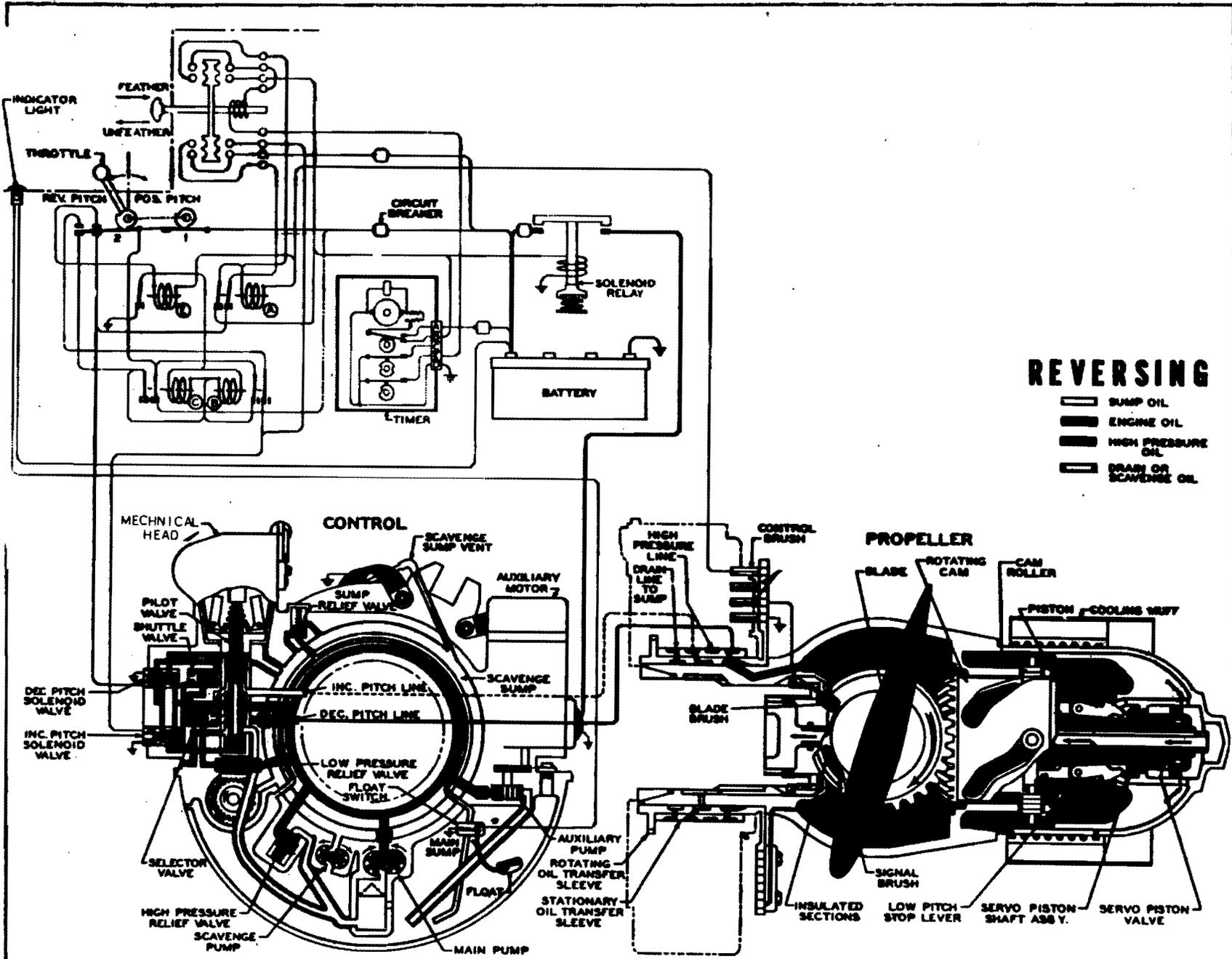
Pages 13

DIRECTED STUDY PROGRAM

DHC - 4

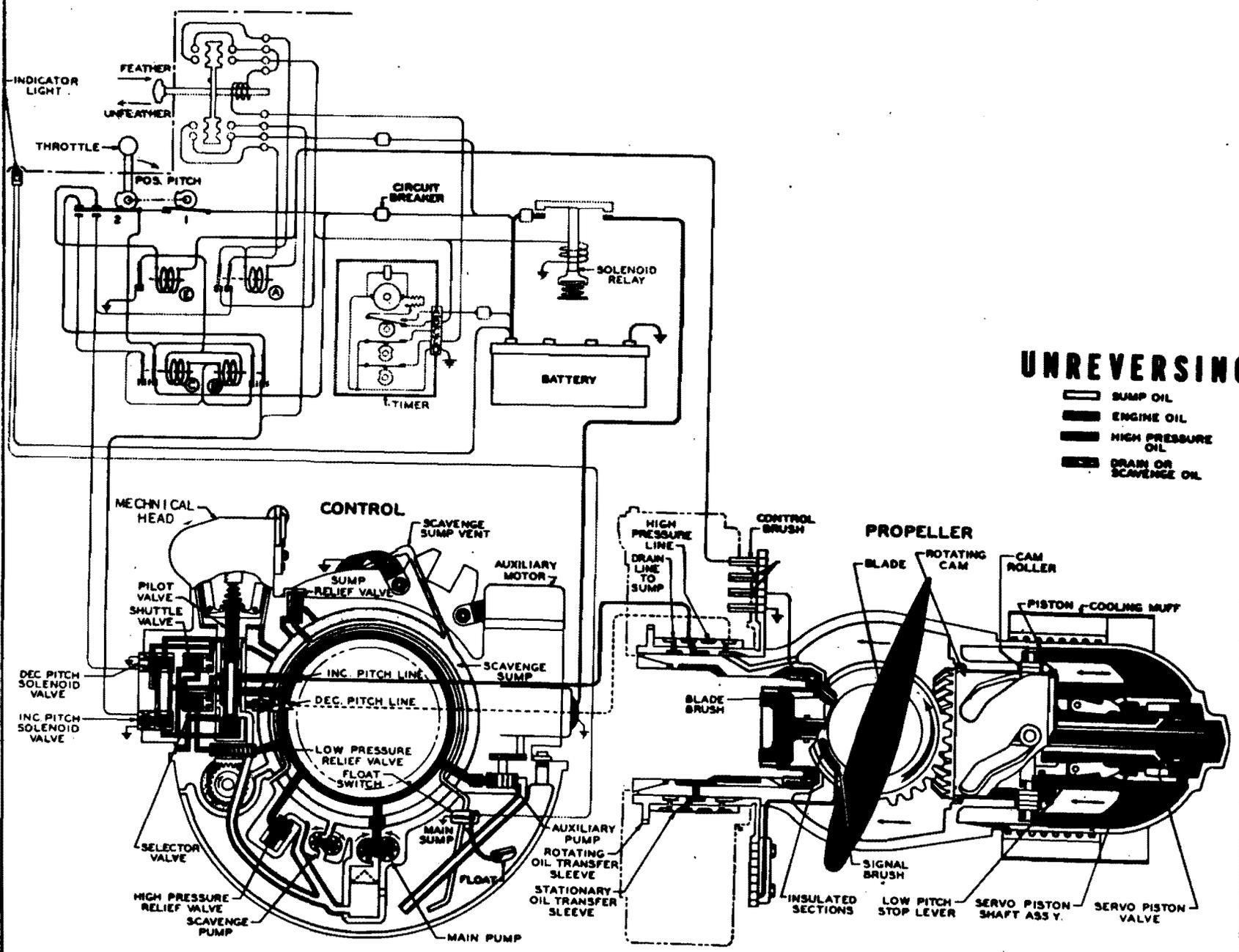
Ref.: 1080-3

Page: 14



DIRECTED STUDY PROGRAM

DHC - 4



DIRECTED STUDY PROGRAM

Page: 16

DHC - 4

Ref.: 1080-3

PROPELLER OPERATION

Onspeed Condition: Normal governor action to compensate for internal leakage.

Underspeed Condition: To decrease blade angle, oil from the main pump (or auxiliary pump during unfeathering) is delivered to the governor through the pressure annulus in the stationary sleeve. It then goes to the decrease pitch annulus in the stationary and rotating sleeves and then is directed through holes in roots of the inboard side of the piston, moving it outboard and producing a lower blade angle.

Oil draining from the outboard side of the piston flows back through the oil transfer tube to the oil transfer housing. After passing outside ports in the transfer housing, the oil enters the clearance space between the oil transfer housing and the spider. The oil then goes through the spaces between the halves of the front cone, along the splines of the propeller shaft to the inboard passages in the rear barrel or spider extension. From these passages the oil enters the increase pitch annuli on the rotating and stationary sleeves and then flows back to the governor to be returned to the main sump.

Overspeed Condition: To increase blade angle, oil from the main pump (auxiliary pump during feathering) is delivered to the governor through the pressure annulus in the stationary sleeve. The governor pilot valve then directs it to the increase pitch (blade angle) annulus in the rotating sleeve from which it enters the passages in the inboard end of the barrel extension. From here it passes along the splines of the propeller shaft, through the space between the halves of the front cone, is prevented from going to the inboard side of the piston by seals on the retaining nut and passes into side holes of the transfer tube to the outboard side of the propeller piston moving it inboard and producing a higher angle.

Oil draining from the inboard side of the piston passes through holes (in the spider) at the roots of the arms to the decrease pitch annulus (nearest propeller barrel) on the rotating sleeve. From here the oil passes through slots in the sleeves to the decrease pitch annulus (nearest propeller barrel) on the stationary sleeve and then back to the governor to be returned to the sump.

1. To decrease blade angle, main pump pressure is first routed through _____ annuli in the stationary and rotating sleeves.

2. Pressure oil is directed to the _____ end of the piston to decrease blade angle.

decrease pitch

DIRECTED STUDY PROGRAM

Page: 17

DHC - 4

Ref.: 1080-3

| | |
|--|-----------------------|
| 3. Return oil flows through an _____ tube and returns to _____ sump. | inboard |
| 4. During the feathering operation an _____ condition is simulated by the control unit. | oil transfer; main |
| 5. To correct an overspeed condition, pressure oil is directed to the _____ end of the piston. | overspeed |
| | outboard |

GOVERNOR OPERATION

Onspeed During onspeed operation, the centrifugal force of the flyweights is balanced by the force of the speeder spring. The pilot valve in this condition permits a sufficient flow of oil to the outboard side of the piston to compensate for internal leakage.

The main pump draws oil from the main sump and maintains pressure at the two solenoid valves between the two metering lands on the pilot valve and at the two relief valves and check valve. When the differential pressure between propeller oil and main pump oil reaches 110 ± 10 psi, the low pressure relief valve opens allowing main pump oil to return to the main sump through the relief valve discharge tube. Leakage and drain oil which has accumulated in the scavenge sump is returned to the main sump by the scavenge pump.

Underspeed During the underspeed condition the force of the speeder spring exceeds the centrifugal force of the flyweights and moves the pilot valve downward. This action opens ports in the pilot valve sleeve which connect the main pump output to the decrease pitch side of the propeller piston and also the increase pitch passage to the main sump by way of the hollow pilot valve and the circular holes drilled through the valve above the upper and beneath the lower metering lands. As the blades change to a lower angle, the RPM increases and the governor returns to the onspeed condition. At the same time propeller oil draining through the increase pitch passage enters the selector valve and flows to the spring side of the low pressure relief valve which opens when the pressure differential between propeller return oil and main pump output exceeds 100 ± 10 psi. Propeller oil also flows from the control to and through the auxiliary oil supply housing and back to the main sump.

Overspeed During overspeed operation the centrifugal force of the flyweights overcomes the force of the speeder spring and lifts the pilot valve. In this upward position, the pilot valve opens ports in the pilot valve sleeve which connect the main pump output to the increase pitch side of the propeller piston and also the decrease pitch passage to the main sump. As the blade assume a high angle, the RPM decreases and the governor returns to the onspeed condition.

DIRECTED STUDY PROGRAM

Page: 18

DHC - 4

Ref.: 1080-3

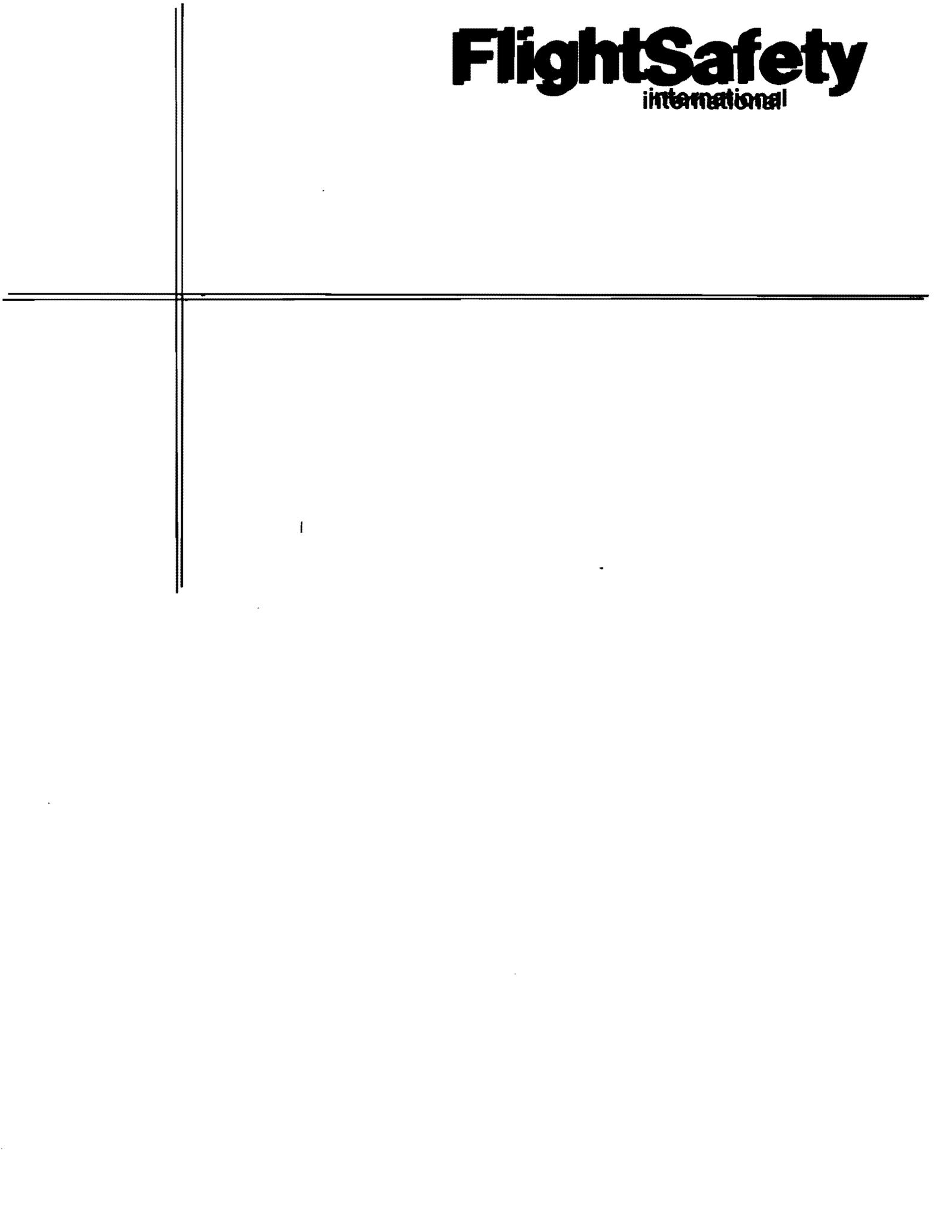
The increase pitch passage is connected through the selector valve, to the spring side of the low pressure relief valve, thereby deeping this valve partially closed. Propeller oil draining through the decrease pitch passage returns to the main sump. Maximum oil pressure during overspeed may, if necessary, build up to the setting of the high pressure relief valve, (800 ± 50 psi) but these pressures are never reached during normal constant speed operation.

- | | |
|---|--|
| 1. During onspeed conditions the governor allows oil to the _____ of the piston to compensate for _____. | |
| 2. Centrifugal force of the flyweights will be effected by any change in engine _____ or _____. | outboard end; leakage |
| 3. Speeder spring compression is controlled by _____. | RPM; blade angle |
| 4. Unbalanced forces between the speeder spring and flyweights cause movement of a _____ to correct the _____ or _____ condition. | cable |
| 5. Main pump pressure is maintained at the two _____ valves. | pilot valve; overspeed; underspeed |
| 6. The low pressure relief valve opens at _____ psi to allow return oil to flow back to _____. | solenoid; relief |
| | 110; main sump |

FEATHERING OPERATION

Manual Feathering The feathering operation is initiated when the feathering switch is pushed in. This action simultaneously energizes the electrical circuit to the auxiliary oil pump, the increase pitch solenoid valve on the oil control unit and the auxiliary pump timer. The energized auxiliary pump timer magnetically holds the feathering switch in. The energized increase pitch solenoid valve opens. High pressure oil from the main pump (until its output drop to 0) together with the auxiliary pump output passes through the increase pitch (feather or unreverse) solenoid, the spring loaded shuttle valve, and the selector valve to the spring side of the low pressure relief valve, holding it closed. Oil pressure may also reach the spring side of the low pressure relief valve by

FlightSafety international



DIRECTED STUDY PROGRAM

Page: 19

DHC - 4

Ref.: 1080-3

acting directly through the selector valve from the increase pitch passage. The flow through the increase pitch solenoid valve continues to the lower positioning chamber moving the pilot valve upward to an artificial overspeed condition. This directs feathering pressure to the increase pitch side of the propeller piston. Propeller oil draining through the decrease pitch passage returns to the main sump. At the end of the specified feathering time of 10 to 17 seconds a cam-operated switch in the auxiliary pump timer breaks the ground connection to the holding coil in the feathering switch which pops out. This action shuts off auxiliary motor and de-energizes the increase pitch solenoid. A maximum of 5 seconds is required for a propeller to reach the full feather position and 12 seconds for the feathering switch to pop out to the neutral position. The feathering cycle can be stopped by pulling the feathering switch to the neutral position.

| | |
|--|---------------------------------------|
| 1. Manually pushing the feathering button simultaneously energizes the _____, _____ pitch solenoid, and the auxiliary pump _____. | |
| 2. The high pressure oil flow to the increase pitch solenoid acts to block the _____ relief valve, and raise the governor _____ valve. | auxiliary pump; increase; timer |
| 3. Movement of the governor pilot valve upward simulates an _____ condition. | low pressure; pilot |
| 4. Oil pressure through the open governor port is directed to the _____ end of the piston via a transfer tube. | overspeed |
| 5. As the piston moves aft, drain oil is returned to the _____. | outboard |
| 6. Time required for the blade to reach full feather is _____ seconds. | main sump |
| 7. A cam operated switch in the timer breaks the circuit in a maximum time of _____ seconds. | 5 |
| 8. Breaking the electrical circuit returns the feather button to _____, and stops the _____. | 15 |
| 9. The feathering cycle can be _____ interrupted. | neutral; auxiliary pump |
| | manually |

DIRECTED STUDY PROGRAM

Page: 20

DHC - 4

Ref.: 1080-3

Autofeathering When the autofeathering switch is selected to ON an electrical circuit through the autofeathering capability light (green), thrust differential pressure switch, and blocking relay is armed for operation of the propeller feathering switch. The thrust differential pressure switch is interconnected with the slip stream pitots of the thrust indicating system. When a difference in thrust between engines in excess of four inches of water is sensed on the diaphragm of the switch an internal contact completes a circuit through the blocking relay to the solenoid of the feathering button which is grounded via the auxiliary pump timer, to pull in the button, energize the red light in the feathering switch, put out the autofeathering capability light, and start the feathering cycle.

The activated blocking relay blocks any signal from the opposite side of the thrust differential pressure switch to the other propeller feathering button, so that both propellers cannot be feathered simultaneously.

NOTE: On Company aircraft the autofeather system is ~~not used~~.
IS USED AS DESIRED OR REQUIRED

Feathering operation is the same as manual feathering previously described.

Operation of Thrust Differential Pressure Switch The diaphragm of the thrust differential pressure switch is sensitive to pitot air pressure differences of the thrust indicator system. While the thrust indicator pressure of each engine remains equal throughout the range, the diaphragm is balanced and the switch contacts remain in the normal open position. Should an engine thrust indicator decrease approximately 4.0 inches of water below the other, the diaphragm pressures are unbalanced, causing one set of switch contacts to close. Providing the autofeathering ON-OFF switch on the emergency panel is selected to ON, the closed contacts of the thrust differential pressure switch completes a power circuit to the applicable propeller feathering button solenoid and the applicable propeller is feathered in a similar manner to the manual feathering operation.

| | |
|--|------------------------------|
| 1. When the autofeathering system is armed a _____ light is illuminated. | |
| 2. A _____ will sense a change of thrust. | green |
| 3. A blocking relay will prevent _____ of both engines. | pressure differential switch |
| 4. On Company aircraft the autofeather system is _____ used. | feathering |
| | NOT |

DIRECTED STUDY PROGRAM

Page: 21

DHC - 4

Ref.: 1080-3

Unfeathering Operation of the governor during the unfeathering condition is initiated when the pilot pulls out and holds the feathering switch. This action closes the electrical circuit which energizes the red light in the feather button, the decrease pitch solenoid and auxiliary pump relay which operates the auxiliary pump. High pressure oil from the auxiliary pump passes through the decrease pitch solenoid valve to the upper positioning chamber where it forces the pilot valve sleeve which connects auxiliary oil to the decrease pitch side of the propeller piston and connects the increase pitch passage to the main sump by way of the hollow pilot valve. From the upper positioning chamber auxiliary oil also flows to the spring loaded shuttle valve where it is directed to the selector valve which moves to the right (in the schematic drawing). This allows auxiliary oil to back up the spring side of the low pressure relief valve which remains closed.

As soon as the propeller begins to windmill, the main pump starts to operate and its output combines with auxiliary pump output to aid the unfeathering operation. When the cockpit control button is released or the blade switch breaks the electrical circuit, unfeathering stops and normal constant speed operation is resumed.

Because of an internal connection in the control button, required by other installations, the holding coil becomes energized whenever the button is pulled out to unfeather. This action, while not required for operation of the button during unfeathering, does not in any way interfere with its proper functioning.

The feathering switch must be held until the propeller blade is returned to the governing range. Releasing the button, shuts down the unfeather sequence. If the button is not released, the blade is returned to the mechanical low pitch stop position. This actuates the No. 1 blade switch which disconnects the decrease pitch solenoid circuit and shuts off the unfeather sequence. Should the mechanical low pitch stop system fail, and the propeller continues toward reverse, blade switch NO. 2 is tripped at the secondary low pitch stop.

| | |
|--|-------------------------------------|
| 1. Holding the feathering switch out energizes a _____ light, the _____ pitch solenoid, and the _____. | |
| 2. Pressure oil in the positioning chamber forces the _____ down to simulate an _____ condition. | red; decrease; auxiliary pump |
| 3. Oil is then ported to the _____ end of the piston to move the blades toward _____ position. | pilot valve; underspeed |
| 4. The low pressure relief valve remains _____. | inboard; low pitch |

DIRECTED STUDY PROGRAM

Page: 22

DHC - 4

Ref.: 1080-3

5. Unfeathering stops when the feathering button is _____, or the _____ is interrupted by the No. 1 blade switch.

closed

6. If the feathering button is not released the blades will return to the _____ stop.

released;
electrical circuit

7. The No. 1 blade switch de-energizes the _____ pitch solenoid to stop unfeathering action.

low pitch

8. If the blade continues towards reverse, a No. 2 blade switch will temporarily energize the _____ pitch solenoid.

decrease

increase

REVERSING The reversing operation is similar to unfeathering when the throttle lever is moved vertically from the idle position to engage in reverse, it actuates a set of three reverse pitch throttle microswitches. These switches remain actuated throughout the reverse throttle power range. Before the start of the reverse sequence the propeller blade switches No. 1 and No. 2 are both actuated by the blade angle position. The electrical circuit through the throttle switches and the propeller reversing relay energizes the decrease pitch solenoid, the red light in the feather switch, and the auxiliary pump relay providing power to the auxiliary pump. This circuit is completed if the weight switches on the main gear upper torque arms are closed.

NOTE: ~~Complete a check of the weight switches before the propeller is reversed.~~

The main pump and the ~~auxiliary pump~~ supply high oil pressure to hold the propeller in the reverse position. As the blades move towards reverse, blade switch No. 2 is tripped for circuit lock-on control in the reversing relay. On completion of the reverse sequence, blade switch No. 1 is tripped to energize the PROP REVERSE light, and re-energize the auxiliary pump relay circuit and the feather switch light. The main pump continues to supply high pressure oil to hold the propeller in reverse and the decrease pitch solenoid remains energized to keep the low pressure relief valve closed and the pilot valve down in the underspeed condition. If operating conditions are such that the pump output rises to 800 ± 50 psi or 1000 ± 50 psi, the high pressure relief valve opens, allowing the excess oil to drain back to the sump. (In installations incorporating a reverse dump valve or surge valve, inboard oil pressure holding the propeller in reverse will be at some value less than the high pressure relief valve setting.) The decrease pitch solenoid remains energized until the throttle is moved out of the reverse range.

DIRECTED STUDY PROGRAM

Page: 23

DHC - 4

Ref.: 1080-3

| | |
|---|--|
| <p>1. The reversing operation is similar to the unfeathering except the control is exercised by _____.</p> | |
| <p>2. The _____ pitch solenoid simulates an underspeed condition by positioning the pilot valve.</p> | <p>throttle switches</p> |
| <p>3. Activation of the throttle switches energizes a _____ pitch solenoid, _____ and the _____.</p> | <p>decrease</p> |
| <p>4. _____ and _____ _____ both supply high pressure oil to hold the prop in _____.</p> | <p>decrease; feathering light; _____ pump</p> |
| <p>5. The decrease pitch solenoid remains energized to block the _____, and to position the _____.</p> | <p>Main pump; auxiliary pump; reverse</p> |
| <p>6. A high pressure relief valve functions at _____ psi.</p> | <p>low pressure relief valve; pilot valve</p> |
| <p>7. The No. 1 blade switch illuminates a blue _____ light as the blade reaches reverse range (-7°).</p> | <p>800</p> |
| <p>8. On Company aircraft the _____ has been bypassed.</p> | <p>prop reverse</p> |
| | <p>main gear weight switch</p> |

UNREVERSING Unreversing is similar to feathering. When the throttle levers are returned from reverse into the idle position, each set of reverse throttle switches is tripped to de-energize the decrease pitch solenoid. Inasmuch as the relay box electrical lock on circuit is complete and both the No. 1 and No. 2 blade switches are tripped, the propeller increase pitch solenoid, the integral red light in the feathering switch and the auxiliary pump relay and pump are energized. As propeller pitch begins to increase the No. 1 blade switch de-energizes the PROP REVERSE light, the No. 2 blade switch de-energizes the relay box lock on circuit. As the propeller blades move forward past the low pitch stop blade switch No. 1 is tripped and the feather switch light goes out. The auxiliary pump is de-energized along with the increase pitch solenoid. Normal constant speed operation begins.

DIRECTED STUDY PROGRAM

Page: 24

DHC - 4

Ref.: 1080-3

1. Unreversing is similar to _____.

2. Moving the throttle back into forward range, the _____ pitch solenoid is de-energized.

feathering

3. The _____ pitch solenoid becomes energized, the _____, and _____ continue to be energized.

decrease

4. No. 1 blade switch turns off the _____ as the blade angle increases.

increase;
feather light;
auxiliary pump

5. As blade angle continues beyond the _____ the circuit is broken by the No. 1 blade switch.

prop reverse light

6. The _____ pitch solenoid, _____, and _____ become de-energized and _____ operation resumes.

low pitch stop

increase;
feather light;
auxiliary pump;
governor

DIRECTED STUDY PROGRAM

Page: 1

DHC - 4

Ref.: 1080-4a

FUEL SYSTEM

GENERAL

Each fuel tank compresses ten flexible rubber fuel cells, secured between compartments within the wing. Fuel from each cell passes into a common manifold which extends along the underside of the cells from No. 10 to No. 1 cell. The sump of each No. 1 cell contains a fuel booster pump. In the line between the fuel booster pump and engine-driven fuel pump are 3 tank selector valves, fuel filter, and fuel emergency shut-off valve. Connecting the two fuel tanks is a crossfeed line, containing a crossfeed valve which permits fuel from either tank to be supplied to both engines. An electric tank selector switch in cockpit provides selection of the fuel system flow. The tanks are vented from the end cells to atmosphere. During flight the airflow enters the outlets of the vent system and supplies a positive pressure in the fuel tanks. The quantity of fuel available in each tank is shown on the fuel quantity indicators on the fuel panel. The tank filler neck is located on the wing upper surface and is installed in cell No. 7.

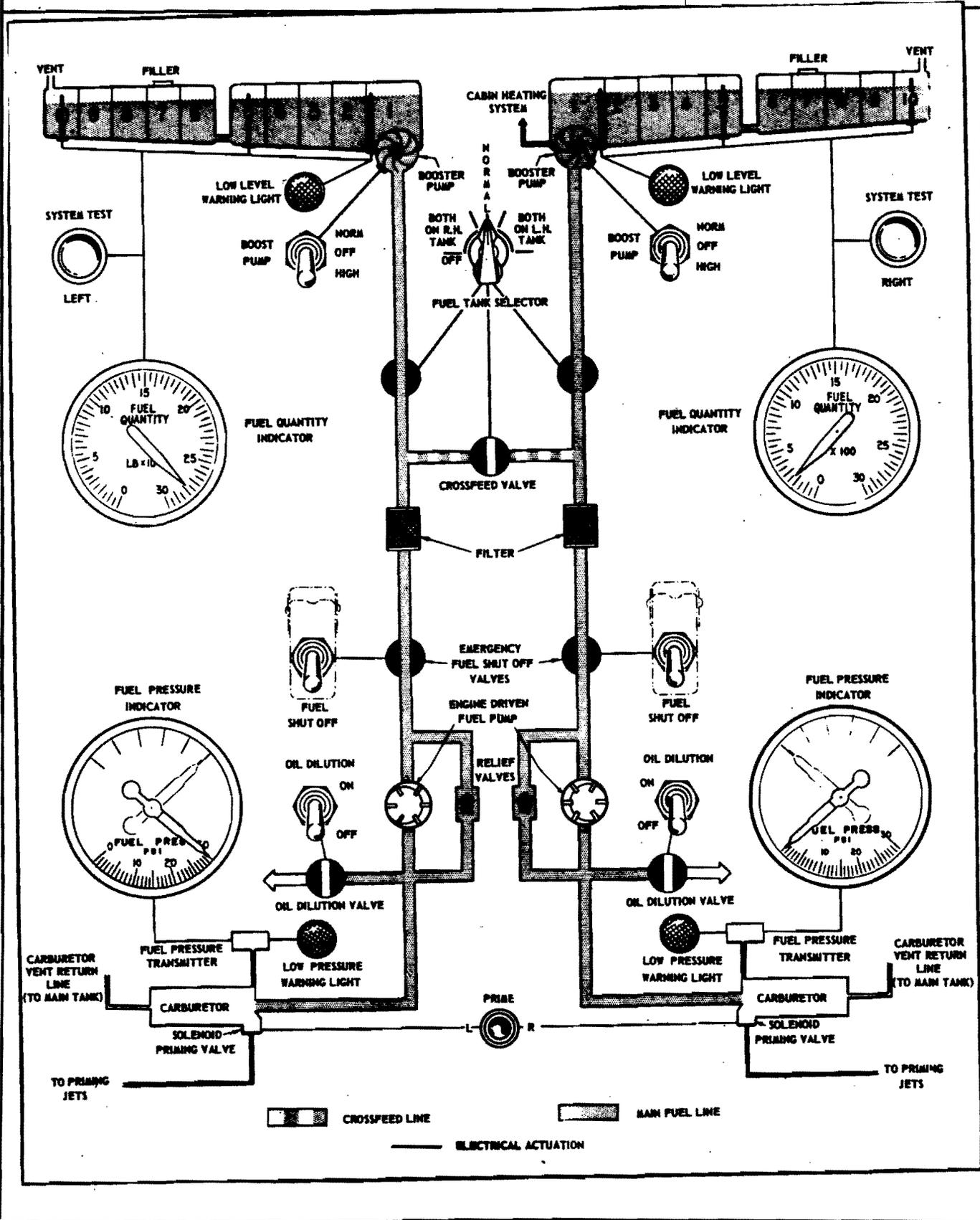
| | |
|---|--|
| 1. The DHC-4A has _____ main fuel tanks, each divided into _____ inter-connected cells. | |
| 2. All inter-connected cells gravity feed into the _____ cell, which contains a single _____. | two; 10 |
| 3. Fuel is trapped in the No. 1, cell and prevented from flowing outboard by a _____. | No. 1 root; fuel boost pump |
| 4. The main tank filler neck is located at the _____ cell. | flapper valve |
| 5. There are _____ electric _____ valves operated from a _____ panel. | No. 7 |
| 6. The fuel control panel consists of a single rotary switch with placarded positions _____, _____, _____, _____. | 3; solenoid; fuel control |
| | off; both L.H.; normal; both R.H. |

DIRECTED STUDY PROGRAM

Page: 2

DHC - 4

Ref.: 1080-4a



DIRECTED STUDY PROGRAM

Page: 3

DHC - 4

Ref.: 1080-4a

BOOST PUMPS

The submerged fuel booster pump is of the centrifugal type, driven by a 28 volt dc motor. The pump and motor form an integral unit bolted to the sump of No. 1 fuel under pressure for: priming crossfeeding; and as an emergency fuel pump in the event of engine-driven pump failure. A three-position toggle switch on the fuel panel, marked NORM, OFF, HIGH, controls each pump. The switch is positioned at NORM for engine starting, take-off, climb, and landing, and is OFF during flight. Should the engine-driven fuel pump and fuel booster pump on one side fail, the remaining fuel booster pump will develop sufficient pressure with the switch at HIGH to supply both engines.

ENGINE-DRIVEN PUMP

Mounted on the left side of the rear case of each engine, the pump is of the rotating vane type and incorporates an adjustable relief valve set to provide a fuel pressure to the carburetor of 17 ± 1 psi.

| | |
|--|------------------------------------|
| 1. The boost pumps are of the _____ type. | |
| 2. They supply fuel pressure for _____, _____, and _____. | centrifugal |
| 3. The boost pump switch has three positions, _____, _____, _____. | priming; starting; crossfeeding |
| 4. The engine-driven pumps are rotating _____ type with an adjustable _____ valve. | NORM; OFF; HIGH |
| 5. On _____ position a single pump is capable of supplying sufficient pressure for both engines. | vane; relief |
| 6. There are _____ engine-driven fuel pumps to deliver pressure at _____ psi. | HIGH |
| | two; 17 ± 1 |

DIRECTED STUDY PROGRAM

Page: 4

DHC - 4

Ref.: 1080-4a

EMERGENCY SHUTOFF VALVE

There are two fuel emergency shutoff valves, one for each engine, and they are bolted to the outboard side of each main firewall. Each is an electrically-actuated, motor-driven gate valve operated by the fuel or oil emergency shutoff switches, and is enclosed in a metal, fireproof box on the aft face of the main firewall.

CARBURETOR

The carburetor is of the pressure type mounted below the upper nacelle intake on the intermediate rear case. Between the carburetor and rear case is an adaptor which contains the external priming line and nozzles, which inject the fuel into the impeller throat. Vapor return lines from the top chamber of the carburetor lead to the No. 1 fuel cell of each tank. Additional lines are provided for a fuel pressure transmitter and an oil dilution system. A carburetor air intake adaptor and screen is attached to the carburetor throat. The mixture and throttle control linkages are located on the left side and a fuel strainer is mounted on the right side of the carburetor.

| | |
|--|-----------------------|
| 1. There are _____ electrically actuated emergency shutoff valves. | |
| 2. They are controlled by either the emergency _____ shutoff switch or the _____ shutoff switch. | two |
| 3. The valves are _____ gate valves mounted on the _____ firewall. | fuel, oil |
| 4. The carburetor priming system injects fuel into the _____. | motor-driven; main |
| 5. Return fuel is vented to the _____ of each _____ tank. | impeller throat |
| 6. A fuel strainer is located on the _____ side of the carburetor. | No. 1 cell, main |
| | right |

DIRECTED STUDY PROGRAM

Page: 5

DHC - 4

Ref.: 1080-4a

FUEL QUANTITY INDICATING SYSTEM

This consists of two fuel quantity indicators mounted on the fuel panel, ten tank units (five for each tank), and two system test button switches mounted on the fuel panel. The tank units are located in the fuel cells numbers 1, 2, 5, 6 and 9 in each tank. The basic circuit of the system is a continuously rebalanced, capacitance bridge in which the tank units act as a variable capacitor. By means of the bridge, the fuel quantity indicator averages the fuel level sensed by the five tank units, thus providing accurate fuel quantity indications for all normal flight attitudes. Mounted to the tank units in number 1 and number 2 fuel cells in each tank are sensing elements used in the fuel low level warning system. The tank units consist of two conductive tubes separated by an air gap. The units in each are interconnected by coaxial cables with the capacitance, caused by changing fuel level unbalance the bridge circuit causing signals to flow to the amplifier. The signals are amplified and applied to a two-phase induction motor which drives the fuel quantity indicator pointer in a direction depending on whether the fuel level is rising or falling. The shaft which drives the pointer also drives the wiper arm of a potentiometer. As the motor operates, the wiper arm is positioned to rebalance the bridge circuit. The bridge circuit incorporates resistors for empty and full adjustment for calibration purposes.

The system test switches are used to open the 400 cycle supply and unbalance the bridge circuit for test purposes. The fuel gage is not a moving coil instrument, and the amplifier is not a part of the measuring circuit. AC power (115 volts, 400 cps) is provided from the aircraft inverter. The right side system is supplied from phase A and the left system from phase C. The 400-cycle supply to the tank units is completed through the system test switch.

| | |
|--|---|
| 1. Five fuel sensors of the _____ type balance a _____. | |
| 2. To check the fuel gage operation a _____ unbalances the _____ to indicate a drop in quantity. | variable capacitance; bridge circuit |
| 3. Fuel quantity is measured in _____. | test switch; bridge circuit |
| 4. Two tubes form the _____ of the capacitor with _____ or _____ acting as the dielectric. | pounds |
| 5. A _____ attached to the indicator keeps the circuit in _____. | plates; air; fuel |
| 6. The gage is calibrated for _____ and _____ indications by adjustable _____. | wiper arm; balance |

DIRECTED STUDY PROGRAM

Page: 6

DHC - 4

Ref.: 1080-4a

empty; full;
resistors

FUEL PRESSURE INDICATING SYSTEM

The system for each engine comprises a fuel pressure transmitter, a fuel pressure indicator, fuel pressure switch, and fuel low pressure warning light. Fuel pressure from the carburetor is directed by flexible line to the transmitter, where the physical pressure is converted to electrical current and conveyed to the indicator on the engine instrument panel. A tee fitting at the rear of the transmitter provides a branch line to the fuel low pressure switch, which is mounted immediately above the transmitter mounting frame.

1. A pressure _____ converts fuel pressure to _____.

2. A tee fitting at the transmitter provides pressure to a _____ warning switch.

transmitter;
electrical current

3. A drop in fuel pressure will activate a _____ on the fuel _____.

low pressure

4. Both the fuel _____ and fuel _____ gages operate on _____ current.

warning light;
control panel

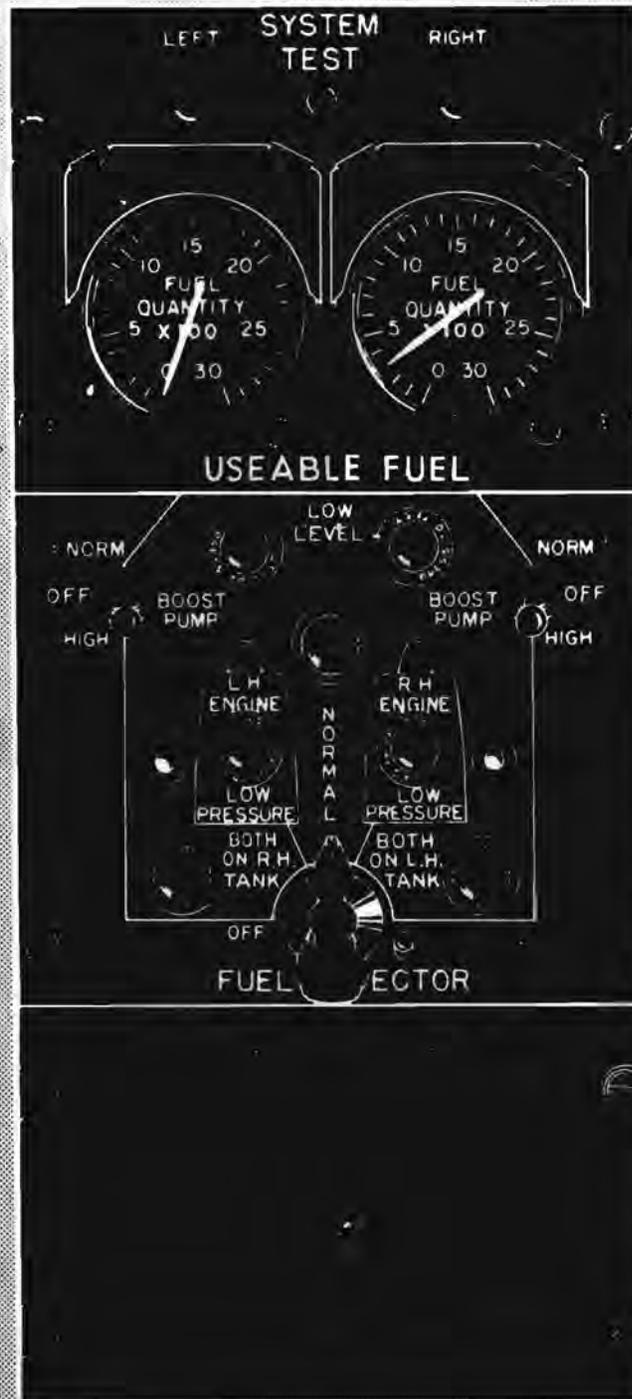
quantity;
pressure;
AC

DIRECTED STUDY PROGRAM

Page: 7

DHC - 4

Ref.: 1080-4a

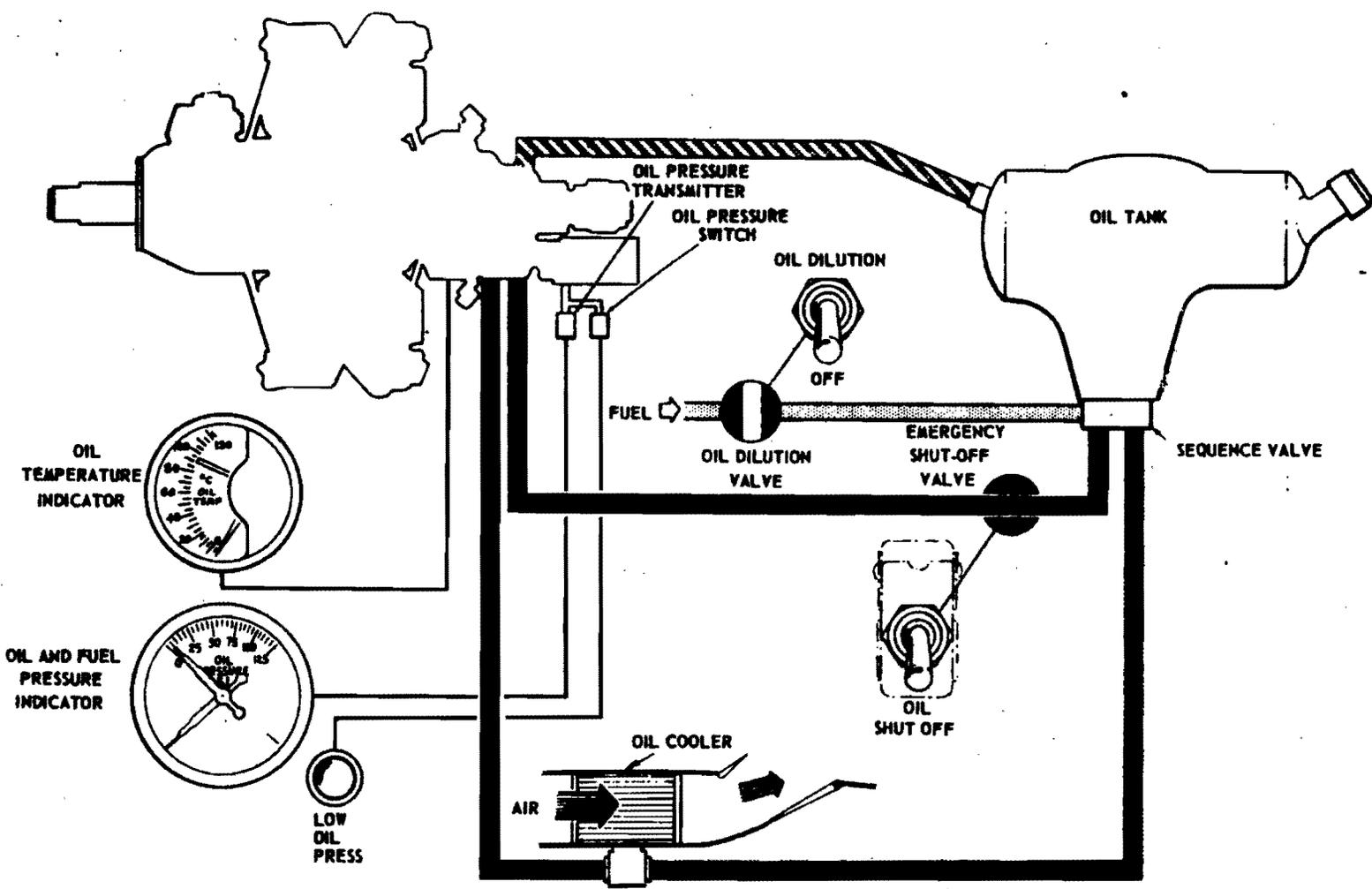


DIRECTED STUDY PROGRAM

DHC - 4

Ref.: 1080-4b

Page: 1



Oil System Schematic

DIRECTED STUDY PROGRAM

Page: 2

DHC - 4

Ref.: 1080-4b

OIL SYSTEM

GENERAL

A separate and similar oil system for each engine comprises an oil tank and sequence valve, oil cooler and temperature regulator valve. The system incorporates an oil dilution (gasoline shutoff) valve, an oil emergency shutoff valve. A short oil pressure line from the engine directs oil to an oil pressure transmitter on the aft face of the main firewall. The oil pressure gage is mounted on the engine instrument panel, and is a compound type which also registers fuel pressure. Oil is drawn from the tank by an engine-driven pump and is filtered by the engine main oil screen. Scavenge oil is returned through a temperature regulator valve and oil cooler back to the oil tank where it is de-aerated before re-circulating to the engine. To provide a minimum warm-up period, the sequence valve and temperature regulator valve are each thermostatically controlled. This arrangement restricts the amount of cold oil circulating through the system and bypasses the oil cooler. Complete oil flow is resumed progressively as the oil warms up and reaches 60°C. Oil dilution is provided for extreme cold weather operations and is operated by switches mounted on the engine switch panel in the flight compartment.

OIL TANK

Located at the rear face of the main firewall of each nacelle, and the total capacity of each tank is ~~22~~ 18 gallons. The body of the tank is of aluminum alloy, and contains a quick-warm-up hopper, a cascade, and swirl plates. A stack pipe assists the function of the quick-warm-up hopper. Fitted externally is a vent connection, dipstick, an oil filler neck, and an overflow tray. At the bottom of the tank is a sequence valve, and to one side of it an oil drain valve. The filler neck and dipstick are each accessible through individual hinged doors fitted in the wing leading edge. The dipstick is marked to indicate the number of gallons to ADD, gals. REMAINING, or both. Use extreme caution! 18 gals. are available to engine pumps.

TANK HOPPER

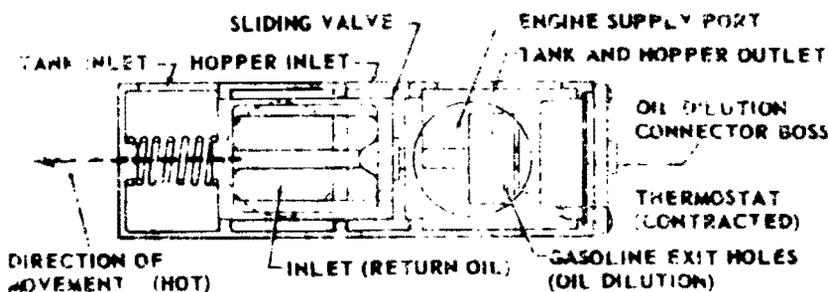
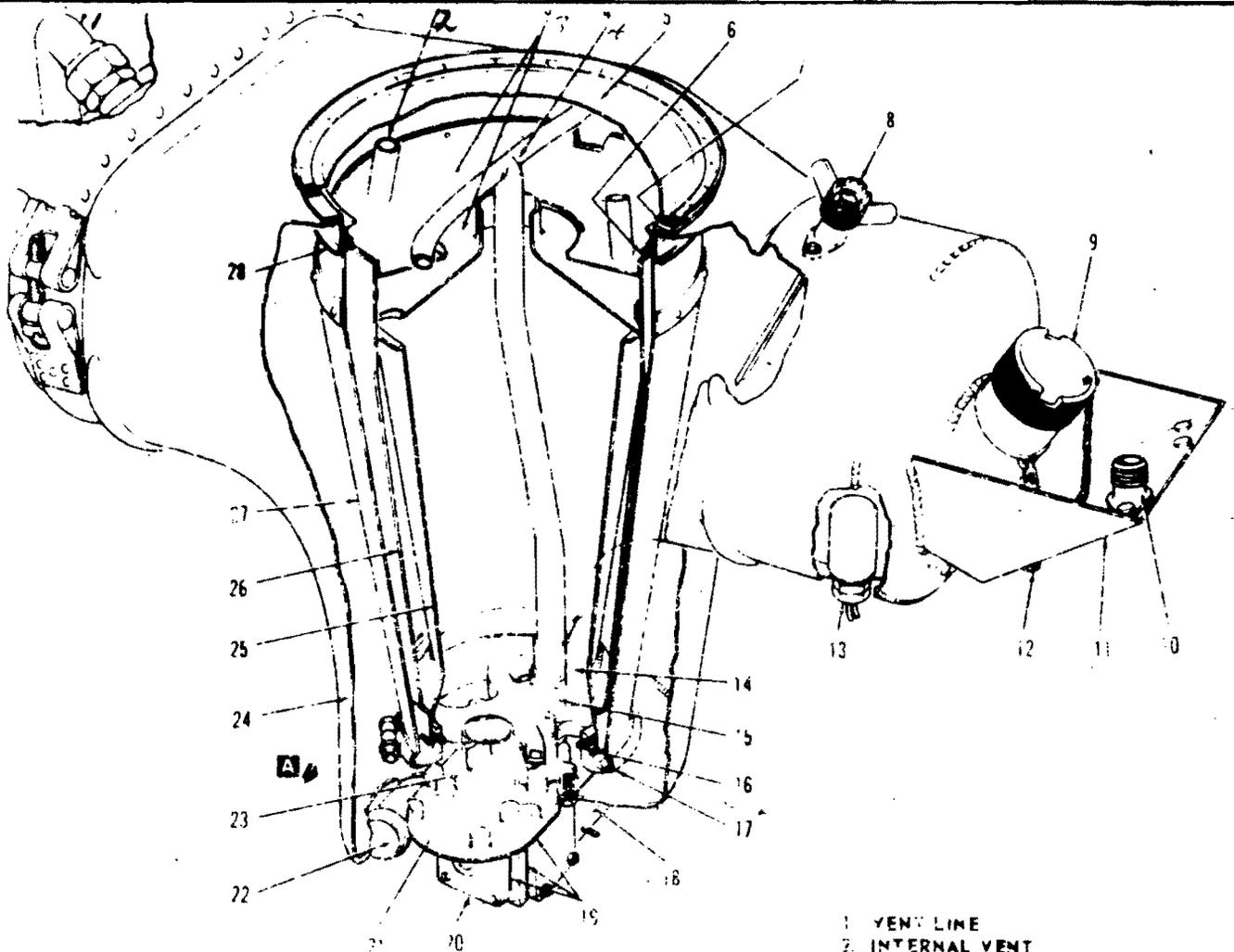
The oil tank hopper is a series of oil reservoirs constructed within the center of the tank and extending from the top of the tank well. It comprises outer and inner walls and a minor container attached at their lower ends to swirl plates. Mounted vertically within the inner container is a stack pipe which rises from the adapter block assembly to the cascade plates fitted at the top of the hopper. The space between the inner and outer walls of the hopper is used to funnel hot oil from the engine to the cascade.

DIRECTED STUDY PROGRAM

Page: 3

DHC - 4

Ref.: 1080-4h



SEQUENCE VALVE SHOWN IN THE
BELOW 140°F (60°C) POSITION

VIEW ON ARROW 

- 1 VENT LINE
- 2 INTERNAL VENT
- 3 CASCADE PLATES
- 4 STACK AND SWIRL PIPES
- 5 ACCESS PLATE
- 6 O-RING UPPER SEAL
- 7 GASKET
- 8 DIPSTICK
- 9 OIL FILLER CAP
- 10 FERRY OIL LINE STORAGE BOSS
- 11 OVERFLOW TRAY
- 12 OVERFLOW DRAIN CONNECTION
- 13 OIL LOW LEVEL FLOAT SWITCH
- 14 FEATHERING OIL PIPE
- 15 SWIRL PLATES
- 16 O-RING LOWER SEAL
- 17 HOPPER BASE CLAMP (3 SECTIONS)
- 18 INLET (RETURN OIL)
- 19 GASKETS
- 20 SEQUENCE VALVE
- 21 BASE ADAPTER BLOCK
- 22 ENGINE SUPPLY PORT ELBOW
- 23 OIL OUTLET PIPE
- 24 TANK OUTER SHELL
- 25 HOPPER INNER WALL
- 26 FEATHERING OIL RESERVOIR
- 27 HOPPER OUTER WALL
- 28 COVER SEAL RING

DIRECTED STUDY PROGRAM

DHC - 4

Page: 4

Ref.: 1080-4b

| | |
|--|-------------------------|
| 1. The capacity of the oil tank is _____ gals. | |
| 2. Complete oil circulation occurs at _____ °C. | 26.4 |
| 3. An internal _____ and _____ valve provides limited circulation for quick oil warm-up. | 60 |
| 4. Oil circulates between the _____ during engine warm-up. | hopper; sequence |
| 5. Oil available to the engine pumps is _____ gals. | hopper walls |
| 6. The dipsticks are calibrated to read gals. _____, gals. to _____, or _____. | 18 |
| | REMAINING; ADD; both |

OIL TANK SEQUENCE VALVE

The sequence valve housing has four ports which are arranged to allow oil to flow under pressure from an inlet port (return oil) to the hopper port or the tank inlet port, and from the tank and hopper to the engine supply port. Contained and operating within the valve housing are three slide type valves positioned by a thermostatic element which locates the sliding valves at one end of the housing, while at the other end is a spring which loads the sliding valves against the thermostatic element. The related position of the valves to each other is a fixed ratio and, depending on the oil temperature sensed by the thermostat, the valves cover and uncover internal chambers machined with the valve housing. The oil tank hopper and sequence valve function as one unit to restrict the amount of oil being circulated through the oil system to enable the warm-up period to be kept to a minimum. At an oil temperature below 43°C the thermostatic element of the sequence valve positions the sliding valves to direct engine return oil through the tank base to the swirl plates. The oil then flows under pressure up between the inner and outer walls of the hopper over the cascade at the top of the tank. The cascade directs oil into the hopper. The sequence valve position prevents oil flowing from the main portion of the tank but allows the engine to be supplied from the warmed up oil in the hopper. A progressive warm-up of the circulating engine oil is sensed by the valve thermostatic element, which progressively repositions the sequence valve and diverts the return oil to the stack pipe, and also allows the oil in the main portion of the tank to commence circulating.

Oil flowing through the stack pipe passes through connecting swirl pipes to the cascade where it overflows into the main portion of the tank. The cascade de-

DIRECTED STUDY PROGRAM

Page: 5

DHC - 4

Ref.: 1080-4b

aerates the incoming oil. When the oil reaches a temperature of 60°C, the thermostatic element positions the sequence valve to close off the hopper oil supply port, opening a port to the main portion of the tank to provide a complete circulation of all oil within the tank.

| | |
|--|--|
| 1. The purpose of the sequence valve is to direct the internal circulation of oil supply in response to _____. | |
| 2. There are _____ slide valves positioned by a _____ element. | temperature |
| 3. Below _____°C only oil from the _____ is allowed to circulate to the engine. | three (3); thermostatic |
| 4. Return oil is forced between the walls of the _____ and returned to the top _____. | 43; hopper |
| 5. As the oil warms it is diverted to the _____ and _____ where it overflows into the _____. | hopper; cascade plates |
| 6. When fully warmed up at _____°C, the hopper supply port is _____ and the main supply port is _____. | stack pipe; swirl pipes; main tank |
| | 60; closed; open |

OIL COOLER

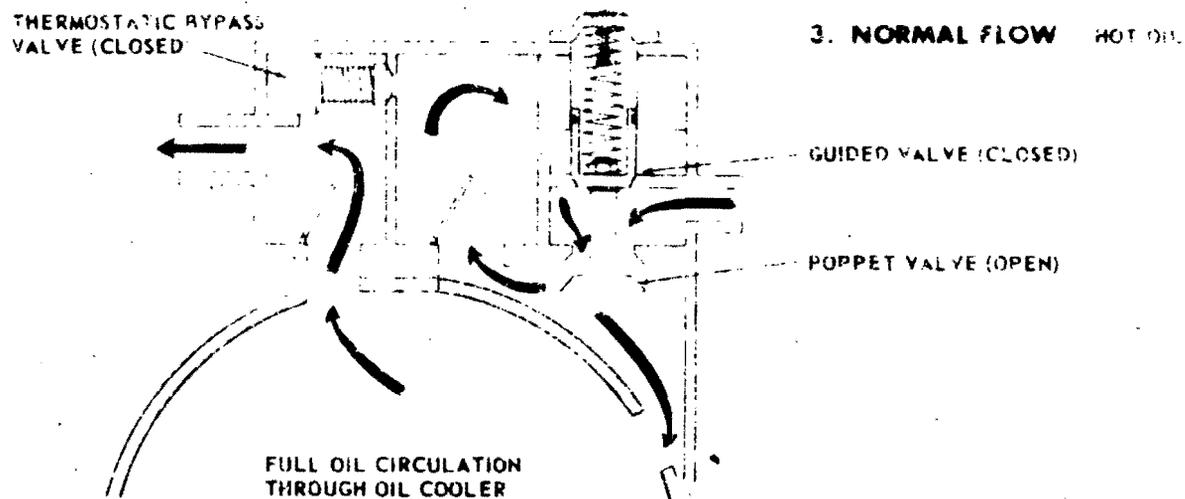
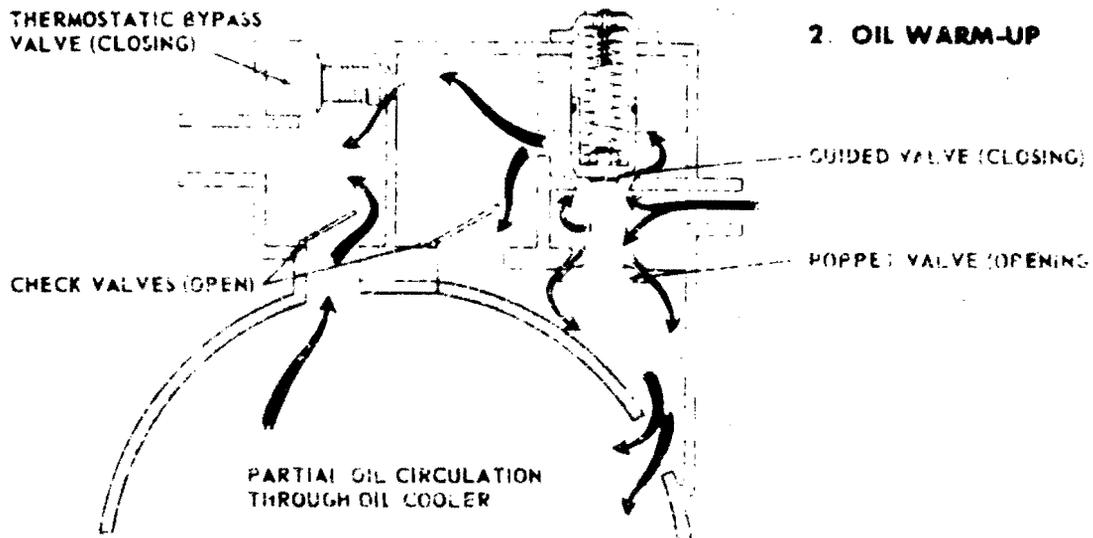
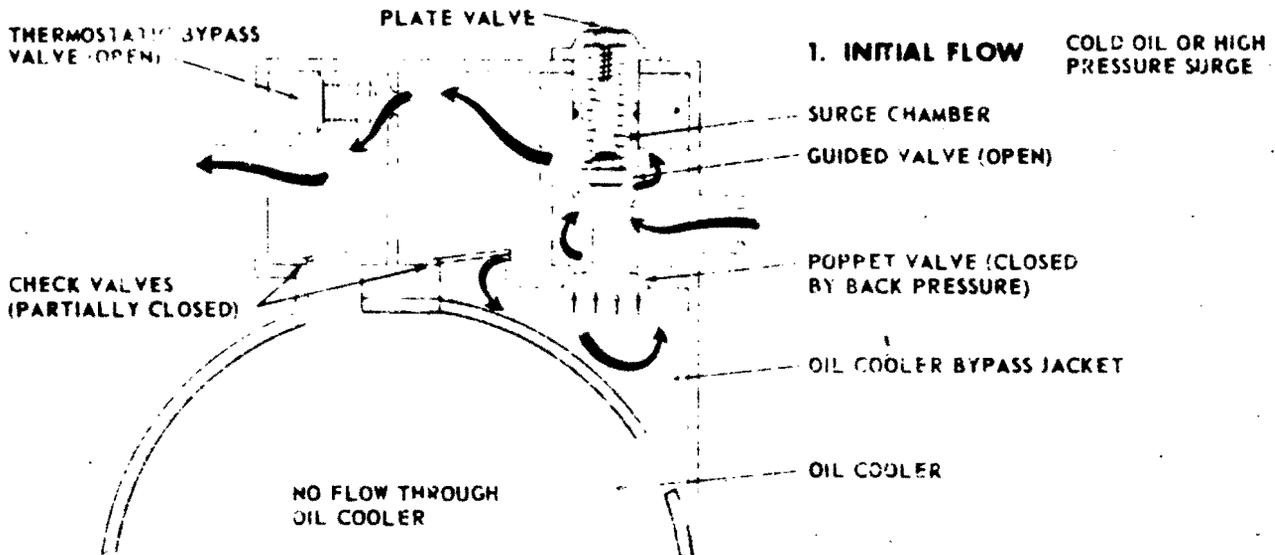
Mounted above the oil tank within each nacelle, the cooler consists of a shell assembly and tubular core. The shell assembly incorporates baffles to direct oil through core passages and the cooler bypass jacket. The cooling air that flows through the tubes is provided by ram air directed through air intake ducts in the top cowling. The air, after passing the tubes, is expelled through an air exit duct in the nacelle structure between the two augmentor tubes. Two vent doors are positioned in the exit duct to restrict the outflow and normally provide adequate air flow for cooling. The position of the lower vent door is fixed, but the upper vent door can be adjusted on the ground to suit various climatic conditions and engine requirements.

DIRECTED STUDY PROGRAM

Page: 6

DHC - 4

Ref.: 1080-4b



DIRECTED STUDY PROGRAM

Page: 7

DHC - 4

Ref.: 1080-4b

| | |
|---|-----------------|
| 1. The oil cooler is a shell and core assembly mounted in the upper _____ duct. | |
| 2. Exit ram air is expelled at the rear nacelle between the _____ tubes. | air intake |
| 3. Two _____ doors restrict the air flow from the exit duct. | augmentor |
| 4. The _____ vent door is fixed, but the _____ vent door is ground adjustable. | vent |
| | lower; upper |

EMERGENCY SHUTOFF VALVE

An oil emergency shutoff valve is fitted in the engine supply line from the oil tank to the engine oil inlet, and adjacent to the oil tank. The valve is a two-position, full flow, gate type valve, having a 28-volt electric motor unit incorporating a planetary reduction gearing a controlled positive-drive clutch, internal cutout switches, and a switch for visual indication of the gate position. A small lever, painted red, is attached externally to the gate valve mechanism and indicator valve position by aligning with housing marks OPEN or CLOSED. A fire-proof metal box completely encloses the valve. An oil emergency shutoff switch on the emergency panel in the flight compartment operates the valve circuit in conjunction with the fuel and hydraulic emergency shutoff valves. The switch is guarded to prevent inadvertent operation of the valves.

DILUTION SYSTEM

An oil dilution system is fitted to each engine oil system but is not normally required in SEA climatic conditions.

TEMPERATURE INDICATING SYSTEM

The indicating system for each engine is electrical and consists of an oil temperature bulb, located in the right-hand side of the rear case, which is wired to an oil temperature indicator. The indicator is mounted on the engine instrument panel and indicates temperatures from 0° to 125°C, normal engine oil temperature is 60°C.

DIRECTED STUDY PROGRAM

DHC - 4

Page: 8

Ref.: 1080-4b

PRESSURE INDICATING SYSTEM

The indicating system for each engine comprises a short flexible pipe, to an electrical oil pressure transmitter and oil pressure switch, an oil pressure gage and an oil low pressure warning light. Each transmitter and switch is mounted on the top rear face of the main firewall, and are the two top components. The gage lights are on the engine instrument panel. The oil pressure indicator is an autosyn type, indicating oil pressure from 0 to 125 psi on the upper portion of the dial face, and fuel pressure on the lower. Oil under pressure is taken from the right-hand side of the engine rear case, above and forward of the engine oil screen. The other end of the tee connector directs oil to the oil pressure switch. The transmitter converts oil pressure into a steady electrical signal which is received by the indicator. Should the oil pressure drop to 45 psi or less, an oil pressure warning light is illuminated by the oil pressure switch. Engine normal oil pressure is 85 to 90 psi at an oil temperature of 60°C with an engine speed equivalent to a manifold pressure equal to the field barometric pressure of the day.

- | | |
|---|---------------------------------------|
| 1. The oil emergency shut valves are _____ position, _____ type valves. | |
| 2. They are operated by _____ motors, controlled by switches located on the flight _____ panel. | two; gate |
| 3. Activation of the oil shutoff switch will also shutoff _____ and _____ lines. | 28 VDC; emergency |
| 4. Oil temperature is measured by a _____ in the engine rear case. | fuel; hydraulic |
| 5. The electrical gage operates on _____ current. | temperature bulb |
| 6. Normal oil temperature is _____°C. | 28 VDC |
| 7. An oil pressure _____ converts _____ pressure from a flexible line to an _____ gage on the instrument panel. | 60 |
| 8. The oil gage is of the _____ type. | transmitter; direct; electrical |
| 9. A tee connector also provides pressure to an oil pressure _____ to operate a low pressure _____. | autosyn |

DIRECTED STUDY PROGRAM

Page: 9

DHC - 4

Ref.: 1080-4b

10. The low pressure warning light will illuminate at _____ psi or below.

switch;
warning light

11. At 60°C temperature, normal oil pressure is _____ psi.

45

85-90

DIRECTED STUDY PROGRAM

Page: 1

DHC - 4

Ref.: 1080-4c

HYDRAULIC SYSTEM

GENERAL

The normal hydraulic system power is supplied by the two engine-driven hydraulic pumps. Each pump is supplied with fluid from the reservoir through a suction line, and delivers the fluid through a system filter and a hydraulic pressure shutoff valve to selector valves for the various circuits. Pressure is regulated to a nominal 3000 psi by a pressure control provision in each pump, and excess fluid is bled through a pump bypass line to the reservoir. Return lines from the brakes, flaps, and steering hydraulic circuits are connected to a common return line which extends from the landing gear selector valve to the reservoir. A relief valve relieves pressure from the main pressure line to return in the event of excessive pressure build-up in the system. A hydraulic system pressure gage is located in a pylon between the pilot's rudder pedals. Two amber hydraulic low pressure warning lights above the pressure gage are electrically connected to two corresponding pressure switches, one in each engine-driven pump pressure and bypass line to isolate an inoperative pump. Additional check valves are located in the pressure and return lines to each of the services. An electrically-operated hydraulic emergency shutoff valve in each engine-driven pump suction line is controlled by the appropriate oil emergency shutoff switch on the emergency panel in the cockpit, to isolate the pump in case of fire.

- | | |
|---|---|
| 1. The hydraulic system on the DHC-4 operates the _____, _____, _____, and _____. | |
| 2. Normal pressure is supplied at _____ psi by _____ engine-driven pumps. | landing gear; flaps; brakes; nosewheel steering |
| 3. An auxiliary _____ is available for emergency use. | 3000; two |
| 4. All operating units use a common return line from the _____ selector valve. | hand pump |
| 5. A system pressure gage is mounted between the _____ rudder pedals. | landing gear |
| 6. The _____ low pressure warning lights are colored _____. | pilot's |
| 7. _____ emergency shutoff valves are controlled electrically from the _____ panel. | two; amber |
| | two; emergency |

DIRECTED STUDY PROGRAM

DHC - 4

Page: 2

Ref.: 1080-4c

HYDRAULIC RESERVOIR

Mounted on the forward face of the flight compartment bulkhead behind the pilot's seat, it has a fluid capacity of 1.52 gallons and is equipped with a filler neck, an inspection window, and a drain valve. A wire mesh prevents entry of foreign matter when filling the reservoir. Four integral standpipes in the reservoir connect to the normal suction, emergency suction, pump bypass, and return lines. The four standpipes end at different fluid levels, the lowest being the emergency suction outlet, so that in the event of a leak occurring in the normal system sufficient fluid will be trapped in the reservoir to supply the handpump for lowering the nose gear and replenishing the brake accumulator. The return line standpipe ends in an open tee above the fluid level and directs the fluid around the reservoir walls to eliminate air bubbles. The reservoir is maintained at atmospheric pressure by a vent which connects to an elbow in the top of the reservoir. A vent tube connects the top of the filler neck to the main body of the reservoir at a point above the fluid level.

1. The reservoir has a capacity of _____ gallons.

2. It contains _____ standpipes at different levels.

1.52

3. The lowest level standpipe serves the _____
_____.

four

4. The _____ standpipe directs the fluid to
eliminate air.

hand pump

5. The reservoir is kept at _____ pressure by a vent.

return line

atmospheric

ENGINE-DRIVEN HYDRAULIC PUMPS

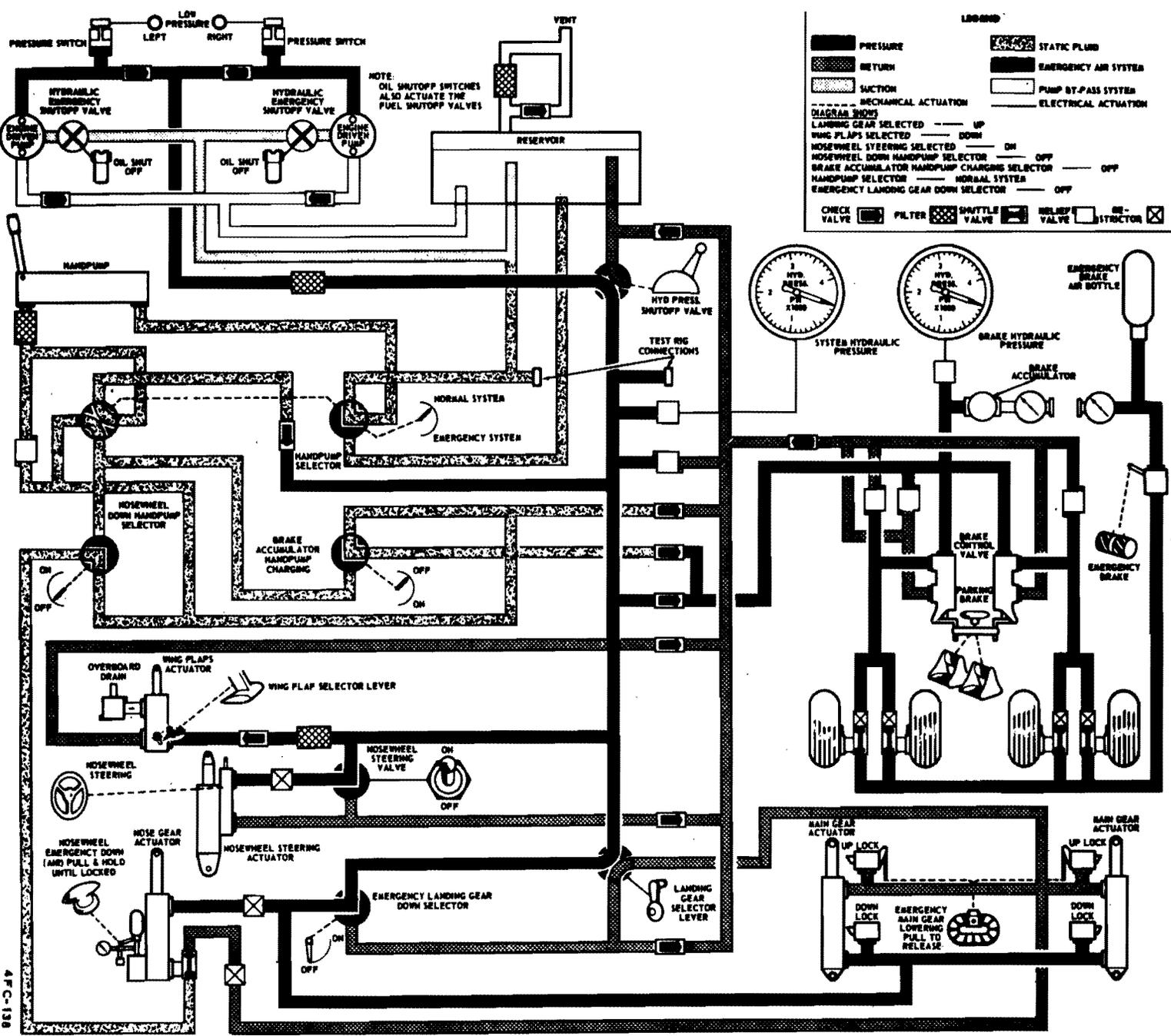
Mounted on the rear case of each engine below the dc generator, the pumps are of the variable flow type with a pressure control mechanism controlling fluid outlet pressure. Delivery of fluid is progressively decreased during reduced flow requirements by the pressure control mechanism. A bypass line between the pumps and the reservoir provides cooling and lubrication during non-operation of hydraulically controlled units.

DIRECTED STUDY PROGRAM

DHC - 4

Page: 3

Ref.: 1080-4c



Hydraulic System Schematic

AFC-138

DIRECTED STUDY PROGRAM

Page: 4

DHC - 4

Ref.: 1080-4c

HYDRAULIC LOW PRESSURE WARNING LIGHTS

Two amber, press-to-test, hydraulic low pressure warning lights, located on the pylon between the pilot's rudder pedals, above the hydraulic system pressure gage, provide warning of malfunction of the engine-driven hydraulic pumps. The lights are controlled by pressure switches, one in the left engine-driven pump pressure line, and one in the right engine-driven pump pressure line.

- | | |
|---|-------------------------|
| 1. The engine-driven pumps are of the _____ type. | |
| 2. Reduced flow requirements are controlled by a _____ mechanism within the pump. | variable flow |
| 3. _____ and _____ of the pumps is provided for by a bypass line to reservoir. | pressure control |
| 4. The low pressure warning lights are controlled by _____. | cooling; lubrication |
| | pressure switches |

HYDRAULIC PRESSURE SHUTOFF VALVE

Mounted on the forward face of the flight compartment bulkhead alongside the hydraulic reservoir, it is provided to permit isolation of the pressure line from the engine-driven hydraulic pumps by directing flow from the pumps back into the reservoir. The valve provides an emergency shutoff in flight in the event of major leaks in lines downstream of the valve. It can also be used to isolate the pumps during ground servicing operations.

EMERGENCY SHUTOFF VALVES

Installed in the suction line to each engine-driven pump, they are located in the wing center section. Each valve is a 28-volt motor-operated gate valve operating from the emergency dc bus, controlled by the appropriate oil emergency shutoff switch on the cockpit emergency panel. A red-colored lever on the valve gives indication of the valve OPEN and CLOSED positions. Two thermal relief valves, one for the valve body and the other for the line, are built integrally with the shutoff valve.

DIRECTED STUDY PROGRAM

Page: 5

DHC - 4

Ref.: 1080-4c

1. A pressure shutoff valve is provided for _____

2. When closed, the pressure shutoff valve will _____
the pumps and direct the pump output to _____.

inflight emergencies

3. The emergency shutoff valves are operated by a _____

isolate;
reservoir

4. Power to operate the emergency shutoff valves is
supplied from the _____ bus.

28 VDC motor

emergency

LANDING GEAR HYDRAULIC CIRCUIT

The gear is extended and retracted by fluid from the hydraulic system. The fluid is directed to the main gear retraction actuators, up locks, down locks (shortening mechanisms), and nose gear drag strut (actuator) by a two-position landing gear selection only, through a two-position emergency landing gear down selector valve. Return fluid is fed back to the reservoir common return line via the emergency landing gear down selector valve (during the landing gear down selection only) and the landing gear selector valve. Two restrictors in the nose gear circuit control the speed of extension and retraction.

MAIN GEAR

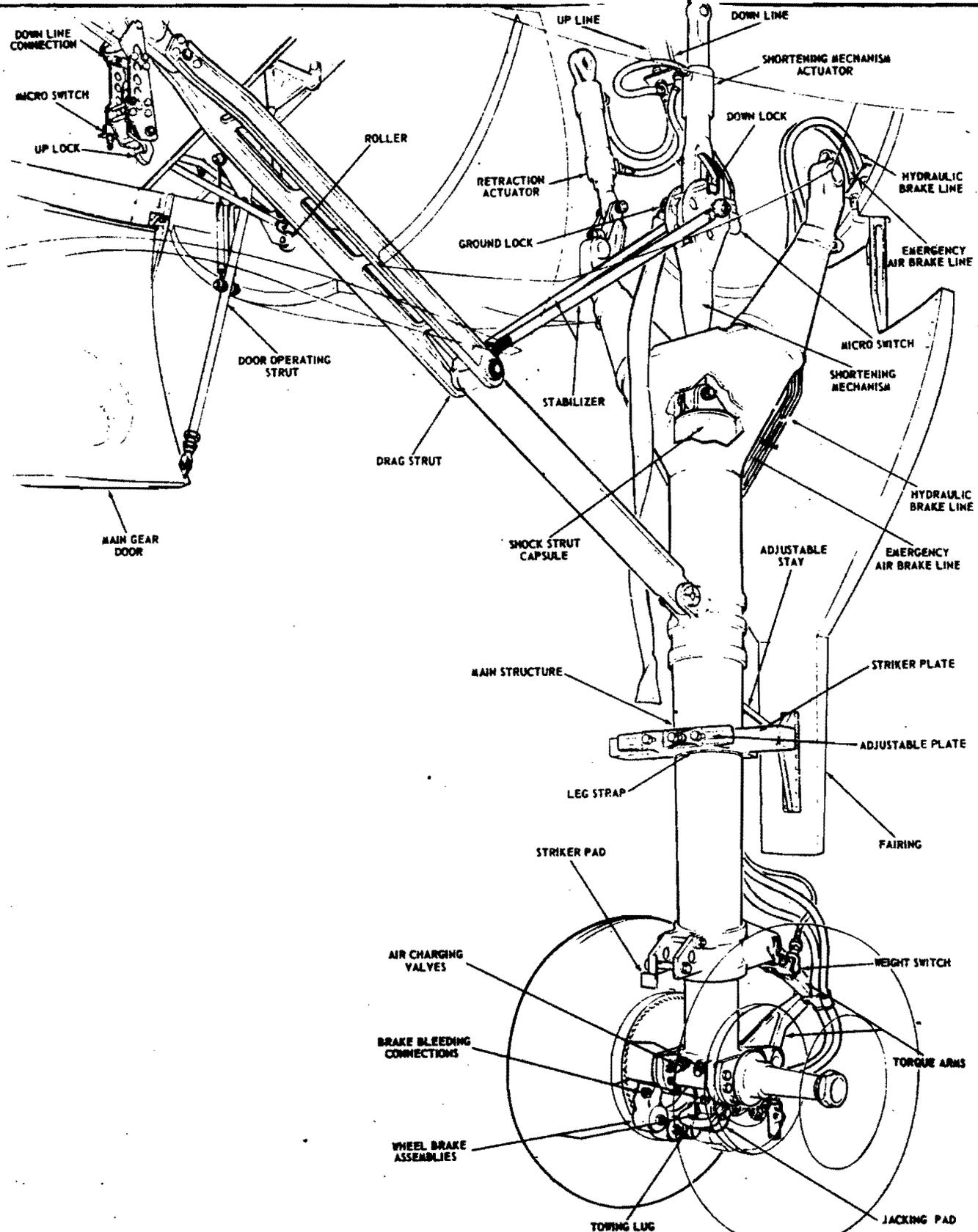
Each main gear unit consists of a pneudraulic shock strut cylinder, a shortening mechanism (including the down lock), a retraction actuator, a drag strut, a stabilizer, and an up lock. The units are housed within the engine nacelles and are attached to the wing front and rear spars. When the landing gear lever is selected to the up position, the hydraulic pressure is fed to the retraction actuator. The shortening mechanism, which later retracts, releases the down locks, and pulls the stabilizer to initially fold the drag strut. The retraction actuator extends and starts retracting the main structure, which in turn continues folding the drag strut. This causes the shortening mechanism (through the stabilizer) to pivot about its attachment, crawl the shock strut cylinder upwards, and thus shorten the overall length of the leg. When fully retracted, a spring-loaded, hook type up lock automatically locks the gear on contact with the hook, and mechanically-operated doors completely enclose the unit.

DIRECTED STUDY PROGRAM

Page: 6

DHC - 4

Ref.: 1080-4c



Main Landing Gear Installation

DIRECTED STUDY PROGRAM

Page: 7

DHC - 4

Ref.: 1080-4c

1. When the gear is selected UP, hydraulic pressure is applied to the _____ and the _____ mechanism.

2. The shortening mechanism breaks the _____ and _____.

retraction actuator;
shortening

3. The retraction actuator extends and folds the _____ and _____.

downlock;
drag strut

4. Pivoting of the shortening mechanism then draws the _____ upward to shorten the overall length of the main gear.

main gear;
drag strut

5. A _____ holds the gear in the retracted position.

shock strut

6. _____ closes the doors.

spring-loaded hook

Mechanical linkage

MAIN GEAR RETRACTION ACTUATOR

Pivot mounted to the wing rear spar and to one leg of the Y-shaped upper portion of the shock strut, the actuators are simple in design and consist of a piston, a piston rod, and an outer casing (cylinder). Two ports labeled UP and DOWN transmit hydraulic fluid from the landing gear selector valve to the selected side of the actuator piston. Each port has a filter screen and two restrictors. The outboard restrictor of each pair is single-acting, and is held against its seating by a coil spring to regulate the flow of return fluid. Inlet fluid pressure compresses the spring, forces the restrictor off its seating, and bypasses it in favor of the inboard fixed restrictor.

MAIN GEAR SHORTENING MECHANISM

Bolted to the main gear shock strut cylinder, and anchored to the wing rear spar, its purpose is to provide a down lock for the main gear, to release the down lock and initiate the folding sequence of the gear for retraction by moving the drag strut through its overcenter position, and to shorten the overall length of the gear during retraction.

DIRECTED STUDY PROGRAM

Page: 8

DHC - 4

Ref.: 1080-4c

MAIN GEAR LOCK

Consists of a cylinder and piston with a spring return, a locking hook, and a manually-operated emergency release lever. When the landing gear selector lever is selected down, hydraulic pressure is fed to the top of the up lock piston via an elbow, filter, and a restrictor. The piston is forced down against the spring and pivots the locking hook to release the main gear. When the landing gear selector lever is selected up, the pressure on the up lock piston is relieved, and the spring forces the piston up and pivots the locking hook to the locked position, where it is ready to snap around the up lock roller on the shock strut. A cable-actuated emergency release lever is pivot mounted on the up lock structure, and is used to depress the piston and unlock the hook in the event of a hydraulic failure. The up lock structure also provides a mounting for the up lock microswitch.

- | | |
|---|--------------------------------------|
| 1. The main gear actuator is attached to the _____ spar and one of the Y-shaped legs of the _____. | |
| 2. It has _____ ports labeled _____ and _____. | rear; main gear shock strut |
| 3. Return fluid flow is regulated by a spring and ball _____. | two; UP; DOWN |
| 4. The purpose of the gear shortening actuator is to provide a _____, to release the _____, and _____ the folding sequence. | restrictor |
| 5. The drag strut is moved through its _____ position, and overall length of the gear is _____ by the gear shortening actuator. | down lock; down lock; initiate |
| 6. The main gear uplock is a cylinder and piston with a _____ return, a _____, and a manually-operated _____ lever. | overcenter; shortened |
| 7. Selecting gear DOWN, moves the _____ against the _____, and pivots the _____. | spring; hook; emergency release |
| 8. Selecting gear UP, relieves hydraulic _____ and the _____ pivots the hook to receive the _____. | piston; spring; locking hook |

DIRECTED STUDY PROGRAM

Page: 9

DHC - 4

Ref.: 1080-4c

pressure;
spring;
unlock roller

MAIN GEAR SHOCK STRUT CYLINDER

A two-stage, pneudraulic shock absorber consisting of a fixed outer cylinder and a sliding inner cylinder. The outer cylinder is attached to the aircraft through the shortening mechanism and has a head and a metering pin, while the inner cylinder carries the wheels and has a head with fixed orifices and a flapper valve, two floating pistons, a fixed tube, and floating tube. The inner cylinder is separated into upper and lower cylinders by a floating piston; the upper cylinder (cylinder No. 1) is charged with air at 150 psi while lower cylinder (cylinder No. 2) is charged with air at 1030 psi. The space within the outer cylinder (above the head of the inner cylinder) is charged with hydraulic fluid to 100 psi.

OPERATION

When subjected to a landing load, fluid is forced through the fixed orifices of the cylinder, past the flapper valve, into the space above the upper floating piston and into the annular space between the inner and outer cylinders. The upper floating piston is pushed downwards until sufficient load has been applied to raise the pressure in cylinder No. 1 to 770 psi; at this point, the upper floating piston bottoms on the lower floating piston and the cylinder is partially contracted. Further increases in loading raise the pressure without contracting the cylinder until the fluid pressure above the floating pistons equals the air pressure in cylinder No. 2. Loading beyond this point moves the floating pistons down until they reach the stop on the floating upper stack tube. The two floating pistons and the floating upper stack tube will now move together as unit.

| | |
|---|------------|
| 1. The main shock strut is a _____ stage, pneudraulic shock absorber. | |
| 2. The fixed outer (upper) cylinder is attached to the _____ mechanism. | two |
| 3. The inner (lower) cylinder carries the _____. | shortening |
| 4. The _____ cylinder uses two floating pistons as the first stage of compression. | wheels |
| 5. The upper cylinder is air precharged to _____ psi and the lower cylinder is air precharged to _____ psi. | lower |

DIRECTED STUDY PROGRAM

DHC - 4

Page: 10

Ref.: 1080-4c

6. Movement of the upper cylinder forces _____ through a flapper valve and pushes the _____ floating piston until it bottoms against the _____ floating piston.

150;
1030

7. At this stage the air in the upper cylinder has been compressed to _____ psi.

fluid;
upper; lower

8. Second stage compression continues until both upper cylinder and lower cylinder pressures reach _____ psi.

770

9. Further increases in loading will then move _____ down until they reach a stop.

1030

both floating pistons

Up to this point, the oil pressure on the upper floating piston has been balanced by the air pressure on the lower floating piston, minus the area of the floating upper stack tube (since the piston has been sliding on the tube). Now, however, the area of the floating upper stack tube is added to that of the lower floating piston, so that more oil pressure can be applied without further closure of the cylinder until the balance is again reached. Further increases of load beyond this point result in the cylinder being fully contracted, and the head of the inner cylinder butts against the head of the outer cylinder. On rebound, the fluid is forced back into the outer cylinder by the floating pistons. The fixed orifices are closed by the flapper valve and the fluid returns via a variable orifice formed by the metering pin in the head of the inner cylinder.

1. Oil pressure on the _____ floating piston balances _____ pressure on the lower floating piston.

2. Severe impact load will cause the _____ of the inner cylinder to butt against the head of the _____ cylinder.

upper;
air

3. On rebound, _____ is forced back into the upper cylinder by the _____ pistons.

head;
outer

4. Since the _____ valve is closed fluid is returned via a _____ orifice in the head of the inner cylinder.

fluid;
floating

flapper; variable

DIRECTED STUDY PROGRAM

Page: 11

DHC - 4

Ref.: 1080-4c

MAIN GEAR WEIGHT SWITCH

A microswitch is mounted on the upper torque arm of each main gear. The switches are wired in series to one another (and also to the weight switch on the nose gear) and are connected into the landing gear control relay to prevent the gears being retracted when the aircraft's weight is resting on the wheels. When the wheels are clear of the ground, the torque arms are open to their full extent and the main gear weight switches are tripped by brackets on the main gear housing.

MAIN GEAR EMERGENCY EXTENSION SYSTEM

A means of extending the main gears in the event of hydraulic failure is provided by a yellow and black striped D-ring on the front of the flight compartment bulkhead behind the pilot's seat. A cable connected to the handle runs aft to a fork end and two cables connected to the fork end extend to the left and right engine nacelles. The cables are each attached to a lever on the up lock structure. Pulling the emergency extension handle causes the levers to pivot against the up lock piston and unlock the hook to allow the gears to free fall.

NOTE: See section 1080-7 for emergency gear extension.

MAIN WHEEL TIRES

The main wheels have 8-ply rating, 11.00 x 12 tubeless nylon tires which should be kept at a pressure of 40 psi for hard runway operation or 35 psi for soft ground operations. Tire pressures may be increased up to 50 psi for sub-zero operations.

| | |
|---|--|
| 1. Each gear has a microswitch mounted on the upper _____ to prevent gear retraction on the ground. | |
| 2. All three switches are wired in _____. | torque arm |
| 3. Emergency gear extension is accomplished by a _____ behind the pilot's seat. | series |
| 4. Attached _____ cause a lever to pivot against the _____ and the gear will _____. | D-ring |
| 5. Normal tire pressure is _____ psi for hard surface and _____ psi for soft surface operation. | cables; uplock piston; free fall |
| | 40; 35 |

DIRECTED STUDY PROGRAM

Page: 12

DHC - 4

Ref.: 1080-4c

OPERATION

Movement of the nosewheel steering wheel in the flight compartment is transmitted to a steering control valve which is normally held in a neutral position by a "feel" spring. When the nosewheel steering switch in the cockpit is selected ON, the steering valve in the pressure supply line is opened. Fluid is fed into the selector valve, through a filter incorporating a 50 psi differential relief valve, and through an internal drilling to the steering control valve. Raising the steering control valve directs fluid to the top side of the piston and forces the cylinder upwards to turn the wheels to the left. As the cylinder moves upwards, the pivot point of the actuating lever is also raised and the steering control valve is returned to its neutral position.

When the steering control valve is lowered, the cylinder moves downwards, the wheels turn to the right and the valve is returned to neutral. Thus the pivoted lever acts as a follow-up device and enables the wheels to be turned to any predetermined position. A cylinder reservoir within the selector valve is fed by return fluid from the actuator cylinder and houses a spring-loaded floating piston incorporating a 250 psi relief valve. The floating piston varies the capacity of the reservoir to eliminate surging in the return line, while the relief valve allows pressure in excess of 250 psi to be relieved into the hydraulic system common return line. The fluid maintained within the reservoir compensates for any internal leakage during the period when the nosewheel steering valve in the pressure supply line is closed (e.g. during flight). A shimmy-damping restrictor, introduced between the lines to either side of the piston, is effective only when the nosewheel steering switch is OFF. When the nosewheel steering switch is selected ON, fluid from the pressure supply line lifts a shimmy-damping shut-off valve which blanks off one side of the restrictor and renders it inoperative. A double-acting pressure relief valve is positioned between the pressure lines to the actuator cylinder and the return line, and is set at 3100 psi. During takeoff a nose gear weight switch opens the electrical circuit and the steering valve is shutoff.

| | |
|---|--------------|
| 1. The steering valve is _____ actuated to admit pressure to the selector valve, provided the nose gear is on the ground. | |
| 2. A variable volume fluid reservoir from the return line is provided to eliminate _____. | electrically |
| 3. The shimmy-damping feature is not effective with the control switch in the _____ position. | surging |
| 4. In flight the nose wheel steering valve is _____. | ON |
| 5. A nose gear weight switch shuts off the _____ after takeoff rotation. | CLOSED |

DIRECTED STUDY PROGRAM

Page: 13

DHC - 4

Ref.: 1080-4c

steering valve

NOSEWHEEL STEERING SYSTEM

A hand-operated steering wheel on the left side of the flight compartment is connected by cables to the selector valve of a hydraulically-operated steering actuator. The actuator is attached at the upper end to the outer cylinder of the nose gear shock strut, and at the lower end to the upper torque arm. Extension and retraction of the actuator is transmitted through a universal joint between the upper and lower torque arms to the nose wheel axles to give a nominal left and right steering range of 60 degrees.

NOSEWHEEL STEERING ACTUATOR

Consists of a piston, a cylinder, and a selector valve which is an integral part of the cylinder. The piston is bolted to the nose gear shock strut pivot arm and the cylinder is attached to the upper torque arm via an interconnecting lever, while the selector valve ports hydraulic fluid under pressure to the selected side of the piston. As the piston is fixed, the cylinder will move and thus move the wheels. The selector valve has two main functions: to supply hydraulic pressure to the selected side of the piston; and to dampen wheel shimmying.

NOSEWHEEL STEERING RESTRICTOR AND CHECK VALVE

A restrictor is fitted into the hydraulic supply line between the nosewheel steering valve and the nosewheel steering actuator. A check valve in the return line from the actuator is mounted on the hydraulic panel.

NOSEWHEEL TIRES

Nosewheel tires have 6-ply rating, 7.50 x 10 tubeless nylon tires which should be kept at a pressure of 42 psi for hard runway operation or 38 psi for soft ground operation.

| | |
|--|----------------|
| 1. Nosewheel steering is controlled by a _____ on the _____ side of the cockpit. | |
| 2. Connecting cables lead to a hydraulic _____. | wheel; left |
| 3. The _____ _____ ports fluid pressure to the selected side of the piston. | selector valve |
| 4. The nominal left and right steering range is _____ degrees. | selector valve |

DIRECTED STUDY PROGRAM

DHC - 4

Page: 14

Ref.: 1080-4c

5. Another function of the selector valve is to _____ wheel shimmy.

60

6. Nosewheel tire pressure for hard surface operation is _____ psi.

dampen

42

NOSE GEAR

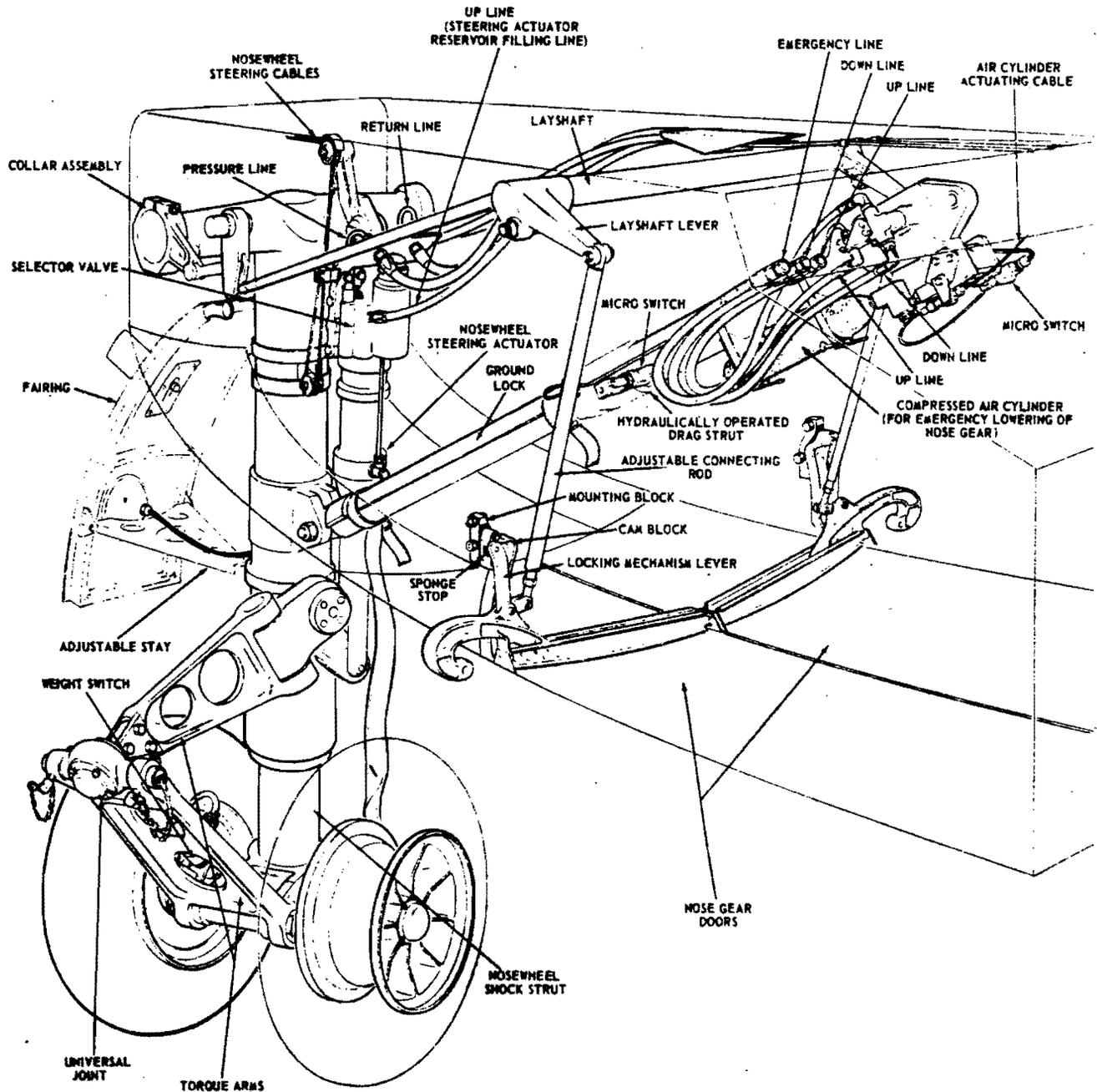
The nose gear consists of a pneudraulic shock strut which is mounted on a pivot shaft, and raised and lowered by a hydraulically-operated drag strut. An internal arrangement of segments backed up by a hydraulically-operated piston provides the up and down locks for the drag strut. Two doors, connected to the shock strut pivot arm by a system of rods, are open during the retraction and extension of the gear but are closed when the gear is either fully up or down. In the retracted position, enclosure of the gear well is completed by fairing attached to the shock strut. A compressed air cylinder, strapped to the drag strut and operated from the flight compartment, is provided as an emergency method of lowering the nose gear in the event of hydraulic failure. A weight switch mounted on the shock strut lower torque arm is wired in series to similar weight switches on the main gears and also to the landing gear control relay to prevent the gears being retracted when the aircraft's weight is resting on the wheels.

DIRECTED STUDY PROGRAM

Page: 15

DHC - 4

Ref.: 1080-4c



Note:
NOSEWHEEL SHOWN IN APPROXIMATELY 60 DEGREE TURN

Nose Gear Installation

DIRECTED STUDY PROGRAM

Page: 16

DHC - 4

Ref.: 1080-4c

NOSE GEAR DRAG STRUT

Pivot mounted to a transverse structural beam in the nose gear well and to the outer cylinder of the nose gear shock strut, the drag strut also serves as a retraction actuator. In the extended position (nose gear down), the down lock segments bottom on the piston sleeve and are expanded into a beveled recess in the cylinder wall.

When the gear is selected up, the down lock is broken by fluid pressure which is fed to the piston sleeve and to the outside edge of the down lock segments. The sleeve compresses the spring and moves back from under the segments are then forced inwards until they clear the recess in the cylinder wall. Fluid is also fed to the annular area between the bores of the cylinder and piston rod, and the piston and rod are retracted and locked up. The method for locking the piston up is similar to that used for the down lock. The up lock segments are expanded into a recess in the cylinder wall by being forced up the beveled edge of a spring-loaded sleeve. When the gear is selected down, the sleeve retracts against the spring, and the spring and the segments unlock. Fluid is also ducted to the hollow extension tube and is fed to the end of the piston rod, where it exerts the pressure required to extend the rod and piston, and lower the gear. Microswitches, connected to the indicator lights in the flight compartment are located on the outside casing of the strut cylinder opposite the recesses occupied by the up and down lock segments. Emergency extension of the strut is provided by an air bottle strapped to the strut outer casing. See section 1080-7 for emergency extension. See section 1080-4s for nose wheel steering.

WHEEL BRAKE UNITS

Bolted to the torque plate of each main wheel axle, each unit consists of a single annular disk which is mounted to and rotates with the wheel, two pairs of flat opposed brake linings, and four pistons. Hydraulic pressure acting on the pistons forces the inner brake linings against the floating annular disk, and moves the disk until it contacts the outer linings to effect braking. Two springs return the linings to their normal position when the hydraulic pressure is released.

WHEEL BRAKES HYDRAULIC CIRCUIT

The brakes are actuated by hydraulic pressure controlled by pedal-operated wheel brakes control valves, the pressure being in proportion to brake pedal depression. The fluid is supplied from the main hydraulic system to the control valves and a brake hydraulic accumulator, the return fluid being fed back to the main system common return line. Check valves are located in the supply line, the return line, and the accumulator charging line, while a thermal relief valve between the supply and return lines, and pressure relief valves connected between the control valves, brake units, and return line, protect the system against excessive pressure. The system is also provided with shuttle valves for a wheel brakes emergency air system.

DIRECTED STUDY PROGRAM

Page: 17

DHC - 4

Ref.: 1080-4c

| | |
|--|---|
| 1. A _____ annular disk bolted to the wheel is mounted between _____ sets of flat, opposed brake lining. | |
| 2. Hydraulic pressure actuates _____ pistons which move the _____ brake lining to clamp the disk against the _____ brake lining. | single; two |
| 3. _____ return the linings to their normal position when pressure is released. | 4; inner; outer |
| 4. Brake pressure is controlled through a _____ valve in proportion to pedal depression. | springs |
| 5. Fluid pressure is supplied from the _____ and a brake _____. | brake control |
| 6. Return fluid flow is back to main system _____ line. | main hydraulic system; hydraulic accumulator |
| 7. The brake system is protected by _____ valves, and _____ valves. | common return |
| | thermal relief; pressure relief |

WHEEL BRAKES HYDRAULIC ACCUMULATOR

Mounted beneath the flight compartment floor, its function is to provide the wheel brakes with supplemental pressure in an emergency or during limited periods of peak demand, and to maintain brake pressure while the aircraft is parked with the engines stopped. The accumulator consists of a steel tube, housing a floating piston which separates fluid and air chambers. It is connected into the hydraulic system to the wheel brakes control valves, and an air charging valve with an integral gage is mounted on a bracket immediately behind the nose left-hand access door. The air precharge is 800-850 psi at 70° F. In event of failure of the main hydraulic system a one way check valve isolates the pressure in the brake system, or accumulator pressure may be hand pumped in an emergency.

WHEEL BRAKES CONTROL VALVES

Located beneath the floor of the flight compartment, they are in effect variable pressure reducers which meter fluid from the main hydraulic system to the brake pressure lines in proportion to brake pedal movement. Each valve has a maximum

DIRECTED STUDY PROGRAM

Page: 18

DHC - 4

Ref.: 1080-4c

delivery pressure of 800 psi; and consists of a cast aluminum alloy body containing a lever-operated floating piston and a spring-loaded poppet valve. The valves are connected into the system through three ports, inlet, outlet, and exhaust, and are protected by a thermal relief valve (in the inlet line) which is set at 3200 psi.

| | |
|--|---|
| 1. The brake accumulator is the _____ type. | |
| 2. It is located behind the nose _____ access door. | floating piston |
| 3. The accumulator air precharge is _____ psi. | left |
| 4. Accumulator pressure may be _____ in an emergency. | $800 \pm \begin{matrix} 50 \\ 0 \end{matrix}$ |
| 5. The brake control valves meter fluid from the _____ system with a maximum delivery pressure of _____ psi. | hand pumped |
| 6. They are floating pistons with a spring-loaded _____, and incorporate _____ ports. | main; 800 |
| 7. The inlet line contains a _____ relief valve. | poppet valve; three |
| | thermal |

WHEEL BRAKES SHUTTLE VALVES

Two interconnecting shuttle valves are mounted to the aft brake unit connections of each main gear, and are connected to the hydraulic fluid line from the respective brake control valve, and to the emergency air line from the wheel brakes emergency system. The main body of each shuttle valve houses a shuttle piston, which is spring-loaded against the emergency air inlet to allow free passage of the hydraulic fluid to the wheel brake units. A filter and a spring-loaded restrictor are incorporated in the fluid inlet connection, the restrictor acting as a safety valve to prevent excessive loss of fluid in the event of complete failure of a wheel brake unit. When the pressure at the wheel brake units is released, the resulting back pressure forces the restrictor from its seat and the fluid is exhausted in an unrestricted flow past the cutaway sides of the restrictor. Emergency air selection moves the shuttle piston against its spring, closes the fluid inlet, and opens the air inlet to the wheel brake units.

NOTE: See section 1080-7 for operation of emergency air brake.

DIRECTED STUDY PROGRAM

Page: 19

DHC - 4

Ref.: 1080-4c

WHEEL BRAKES SYSTEM CHECK AND RELIEF VALVES

The three check valves in the pressure, return, and brake accumulator handpump charging lines, and the 3200 psi thermal relief valve, are mounted on the hydraulic panel below the flight compartment floor.

PARKING BRAKE

Hand-operated from a handle on the pylon immediately in front of the pilot's position, the parking brake is applied by first depressing the brake pedals and then pulling out the parking brake handle to retain the brake control valves lever.

| | |
|---|----------------------------------|
| 1. A restrictor valve in the inlet line to the brake to prevent _____ of fluid in case of brake failure. | |
| 2. Back pressure unseats the valve to provide _____ return flow. | loss |
| 3. A _____ valve separates the fluid line to the brakes and the _____ brake air inlet line. | unrestricted |
| 4. Emergency selection of air moves the _____ against its spring, _____ the fluid inlet, and _____ the air inlet to the brakes. | shuttle; emergency |
| 5. The parking brake handle is located on a pylon in front of the _____. | shuttle piston; closes; opens |
| 6. To set the parking brake, first _____ the pedals and then _____ the handle. | pilot |
| | depress; pull |