



**BELL 212 Pilot Training Manual**

**CHAPTER 12**  
**HYDRAULIC POWER SYSTEMS**  
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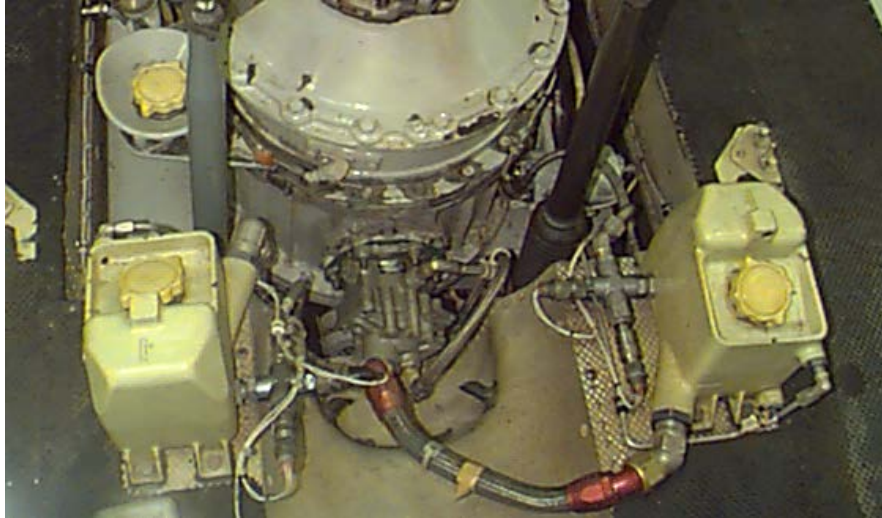
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## **HYDRAULIC SYSTEM**

### **INTRODUCTION**

The Bell 212 has two primary hydraulic systems to power the flight controls. The rotor brake (when installed) is also hydraulic powered but from fluid contained within the rotor brake system. The wheeled landing gear kit, if installed but not a part of Campbell's aircraft at this time, includes a hydraulic system for the wheel brakes.

### **GENERAL**

The main rotor cyclic and collective control dual servoactuators are powered by two separate and completely independent gravity feed hydraulic systems. The systems are referred to as System 1 and System 2. In addition to powering the cyclic and collective control dual servoactuators, System 1 also powers the single anti-torque servoactuator.

### **FLIGHT CONTROL HYDRAULIC SYSTEMS**

#### **GENERAL**

In-flight dynamic forces, acting on both the main and tail rotor systems, cause strong feedback forces in the cockpit flight controls. The No. 1 and No. 2 hydraulic

systems provide assistance in moving the flight controls and overcoming dynamic feedback forces.

Hydraulic servoactuators, mounted between the cockpit flight controls and the flight control linkages to the rotor system, provide the pilot with the necessary mechanical advantage to easily move the flight controls, while, at the same time, dampen out dynamic feedback forces.

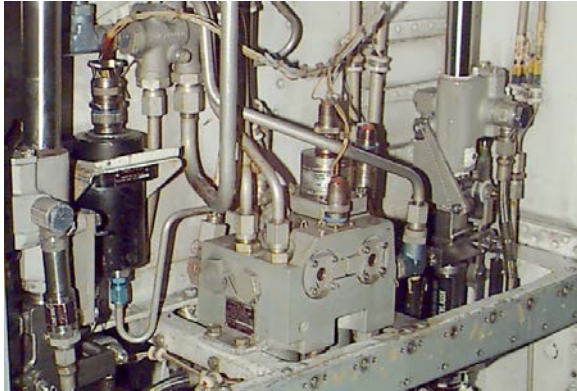
Main rotor flight controls incorporate three dual servoactuators powered by both the No. 1 and the No. 2 hydraulic systems. Two of the servoactuators are used for cyclic control, and one servoactuator is for collective control. The tail rotor flight controls incorporate a fourth single actuator powered only by the No. 1 hydraulic system.

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Each hydraulic system is totally separate and independent from the other system, and each dual servoactuator has a separate actuation section for the hydraulic fluid from each system (Figure12-1).



**Figure 12-1 Hydraulic System Components in Pylon Area**

## **COMPONENTS**

### **GENERAL**

Each hydraulic system consists of a reservoir, a pump, an integrated valve and filter assembly, plumbing, and portions of the servoactuators. The HYDR SYS

switches, using 28 VDC routed through the HYDR SYS circuit breakers, turn each system off. Each system has its own temperature and pressure gauge. A single HYDRAULIC caution light provides cockpit indication of either system's malfunctioning.

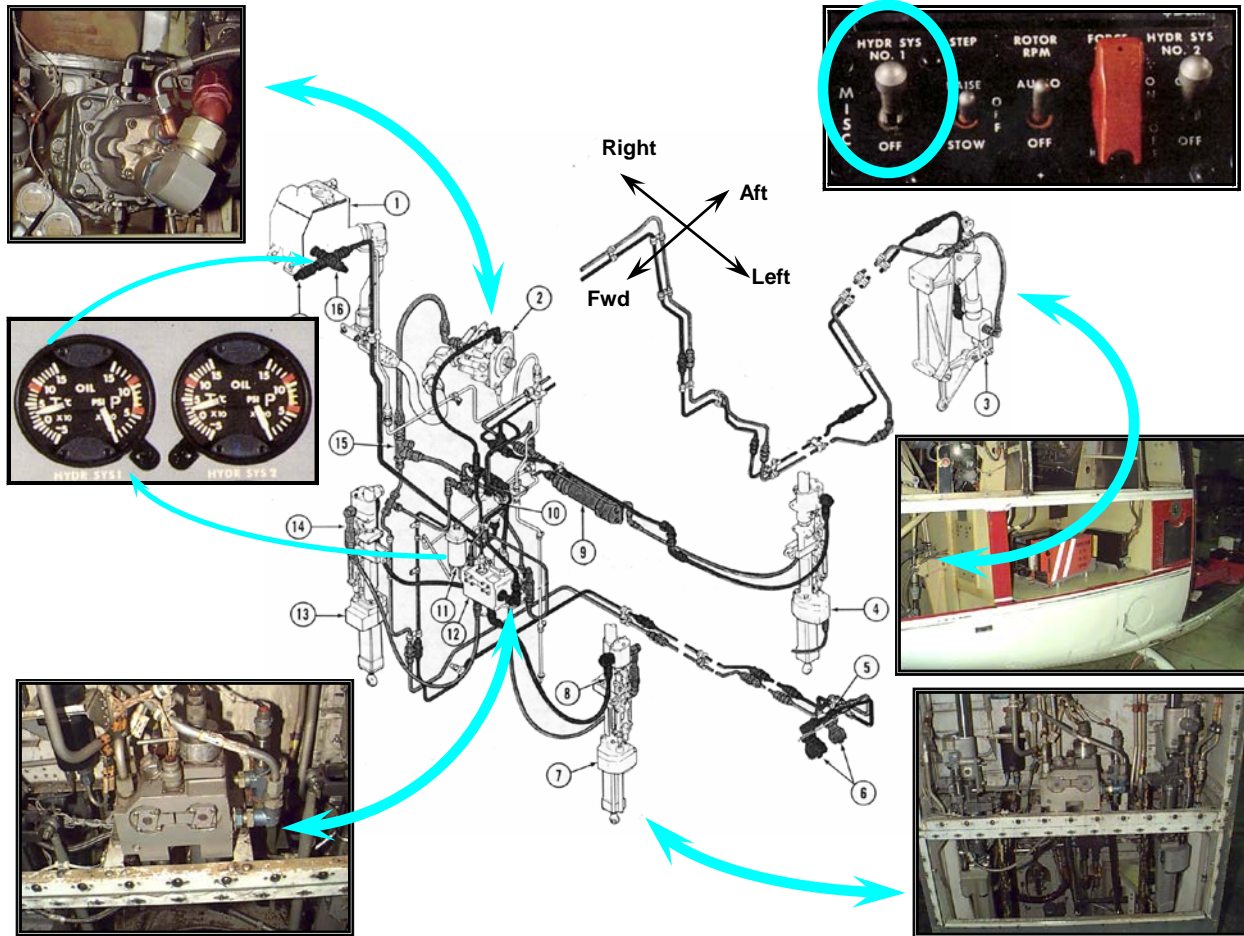
The majority of flight control hydraulic system components, including the three dual servoactuators, are located in the transmission pylon area. The single tail rotor servoactuator is located in the heater compartment (Figure12-2).



**Figure 12-2 Tail Rotor Servoactuator in Heater Compartment**



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**Figure 12-3 No. 1 Flight Control Hydraulic System**

**RESERVOIRS**

Identical magnesium Reservoirs are used in both systems (Figure 12-3a). System 1 reservoir is mounted on the right aft edge of cabin roof, with filler scupper aft. System 2 reservoir is mounted on the left aft edge of cabin roof, with filler scupper forward. Access to both reservoirs is obtained by opening the transmission fairing.

Each reservoir has an overflow capacity of 2.64 quarts. The fluid level sight gauge (Figure 12-3b) on the outboard side

indicates refill level and fluid volume of 2.5 pints. Sight gauges are visible through holes in the transmission fairing when fairing is closed.

The reservoir filler neck is fitted with a 160 x 160 mesh monel screen strainer and a filler cap. Service to overflow with the system static. A vent, made of 30 x 30 monel screen is located in the top of each reservoir.

Bosses are provided for connecting three lines: pump suction line, system return, and



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filler scupper drain. A fourth boss contains a drain plug. A T-fitting located in the system return boss is fitted with a temperature bulb, temperature switch, and a 100 x 100 mesh monel screen baffle approximately 2 inches long and 1/2 inch in diameter. De-aeration is accelerated by the return fluid passing through this baffle into the fluid below fluid level.

The reservoir serves as storage for hydraulic fluid when the system is not in use, and supplies fluid, by gravity, to the pump. Adequate space is provided for fluid expansion.



**Figure 12-4a Hydraulic Reservoirs**



**Figure 12-4b Hydraulic Reservoir View port in Transmission Cowling**

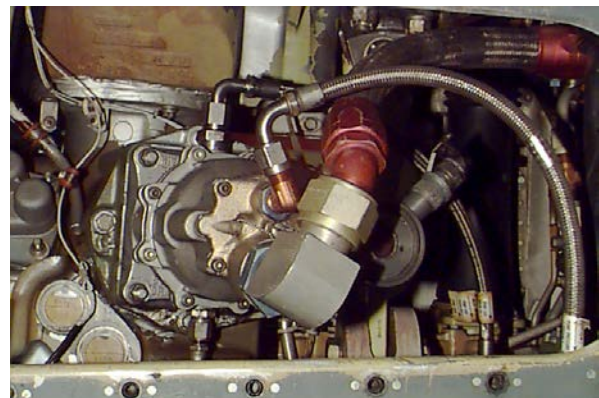
## HYDRAULIC PUMPS

The System 1 Hydraulic Pump is mounted on the right side of the transmission accessory and sump case and is driven by a quill at .65 engine drive shaft speed (4302 RPM @ 100% N2).

The System 2 Hydraulic Pump is mounted on forward side of transmission main case and is driven by a quill at engine drive shaft speed (6600 RPM @ 100% N2). Pumps are a variable delivery type and develop 1000 ± 25 PSI at no flow and 900 PSI at full flow. Hydraulic Pumps are not Interchangeable.

Capacities of the pump are as follows:

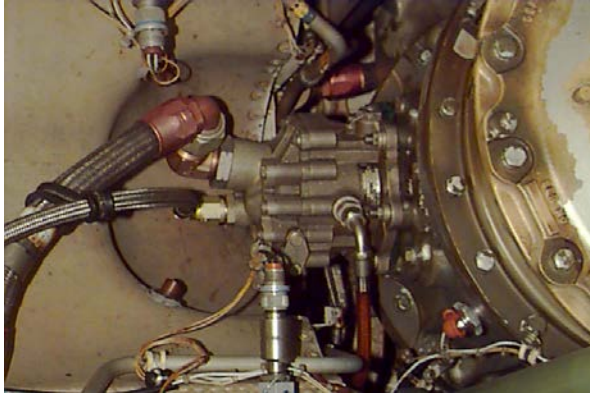
	<u>System 1</u>	<u>System 2</u>
Engine RPM	6600	6600
Rotor RPM	324	324
Pump RPM	4302	6600
Delivery	6.1 GPM	5.6 GPM



**Figure 12-5b Hydraulic Pump #1**



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**Figure 12-5a Hydraulic Pump #2**

## INTEGRATED VALVE AND FILTER ASSEMBLY

Integrated Valve and Filter Assemblies provide functions such as *filtering, pressure relief and sensing, fluid by-pass, and system control* (Figure 12-6).

System 1 assembly is located behind the access panel at the front of the pylon island, with the pressure filter to the left side of the helicopter. System 2 assembly is located in the left side of compartment below the transmission. Access to the System 2 assembly is gained by removing the panel in front of the pylon island or, alternatively, through the cargo-sling opening underneath the fuselage. System 2 assembly is rotated 180°, as compared with the System 1 assembly, and has a pressure filter to the right side of the helicopter.

Each integrated valve and filter assembly incorporates two filters, two differential pressure indicators and switches, a system relief valve, solenoid valve, check valve, and a pressure operated shut-off valve.

## FILTERS

Two Filters are installed in the bottom of each integrated valve, pressure filter and return filter. Both filter elements are 15

micron absolute, metal type and are interchangeable.

Pressure filter does not incorporate a by-pass and would restrict fluid flow to system if the element should become clogged.

Return filters have a by-pass valve, which allows return fluid to by-pass element should element become clogged. Valve cracks at  $100 \pm 10$  PSID and re-seats at 65 PSID minimum.

Pressure filter receives hydraulic fluid under pressure from the pump, filters the fluid through the 15 micron filter, and passes the fluid to the system relief valve and solenoid valve.

The return filter receives return fluid from the system, filters the fluid through the 15 micron filter, and then passes the fluid to the reservoir.

## DIFFERENTIAL PRESSURE INDICATORS

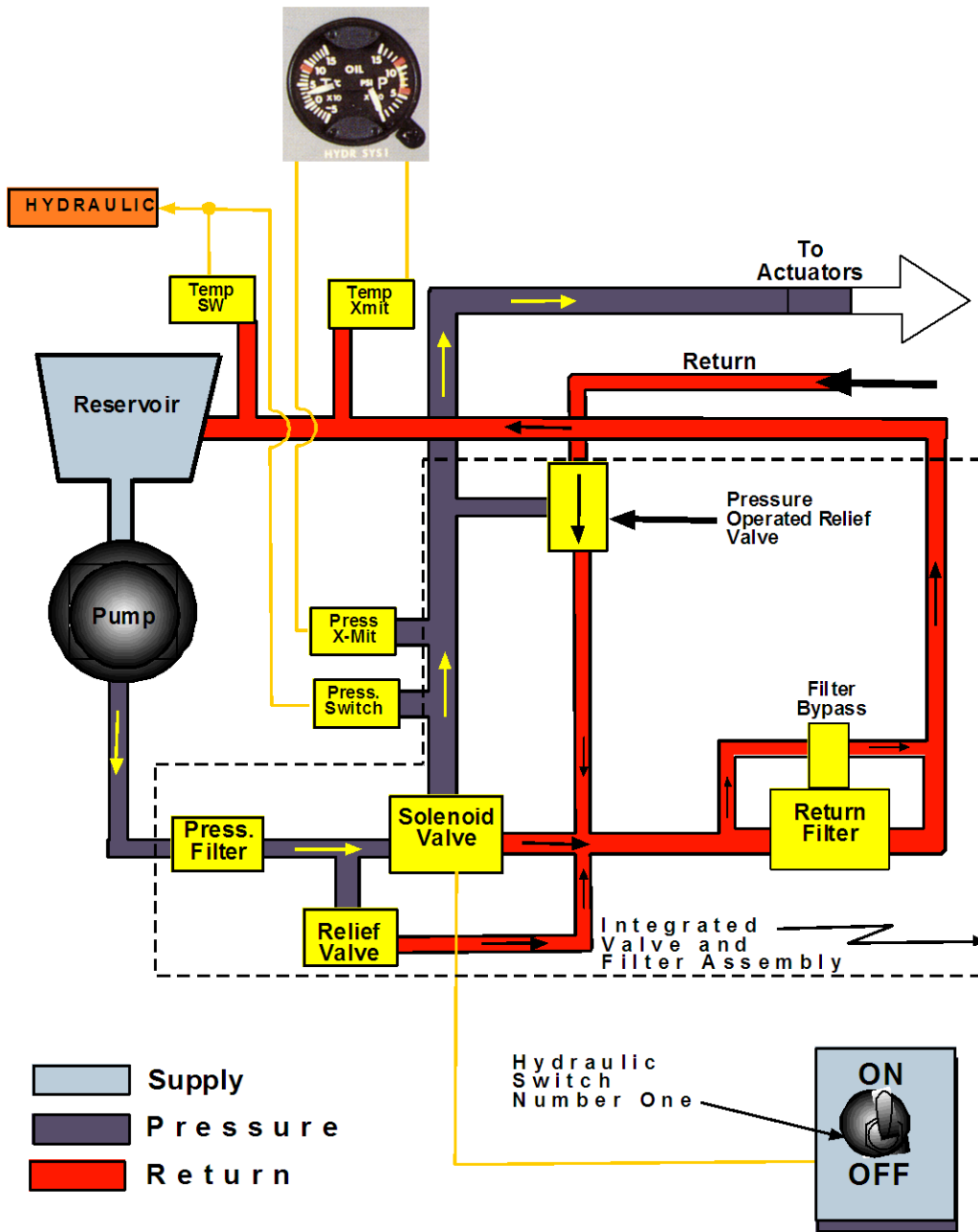
A Differential Pressure Indicator is provided for each filter element. Indicators are on forward side of the integrated valve for System 1 and on aft side for System 2.

A red indicator button (Figure 12-6) will extend should a filter restriction cause a pressure drop of  $70 \pm 10$  PSI across a filter element.

Simultaneously, an electrical switch closes, causing an electrically actuated indicator located in the lower right hand nose bubble, to display a red dot if either filter in System 1 or System 2 should clog. If the electrically actuated indicator is red, a determination of which filter is clogged can be made by a visual inspection of the individual filter indicators. All indicators can be reset manually when the pressure differential no longer exists.



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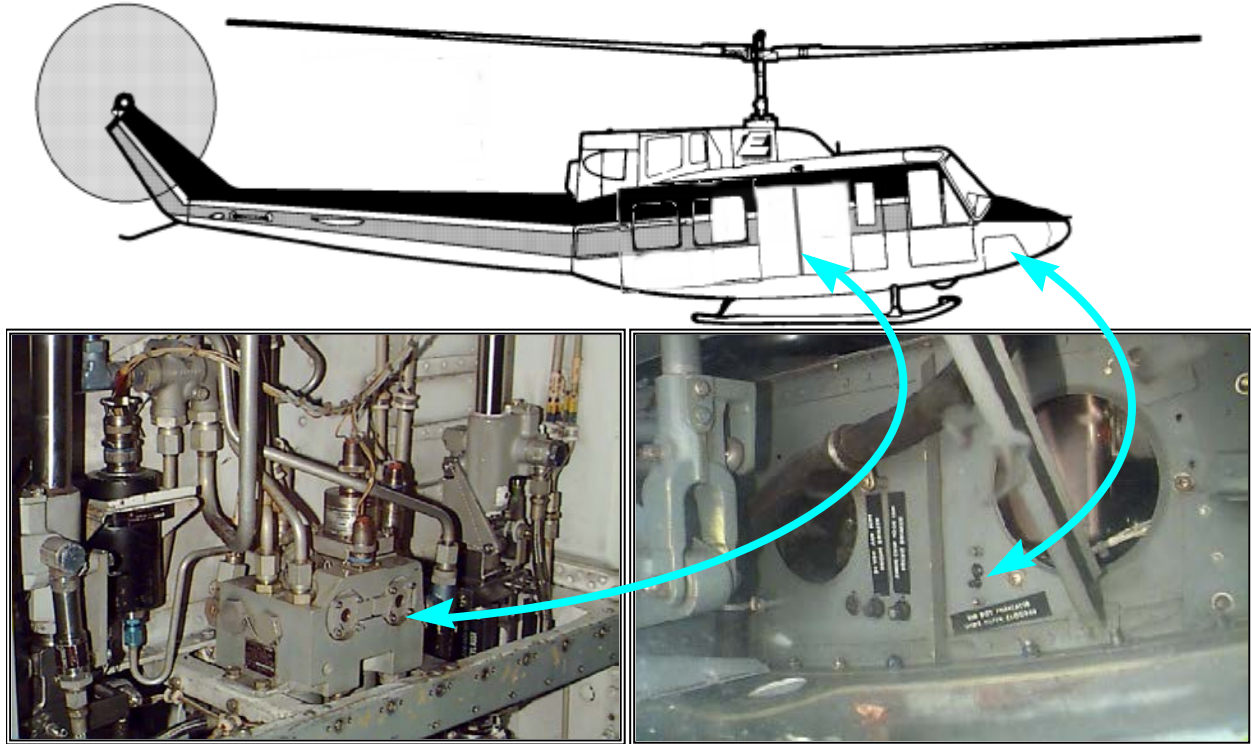


**Figure 12-6 Hydraulic System Schematic**





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**Figure 12-7 Remote Filter Clogged Indicator**

### **PRESSURE RELIEF VALVE**

The Pressure Relief Valve is installed into the passage *between pressure and return side of the integrated valve*. These valves protect the Hydraulic system against excessive pressure, should the pump malfunction, by relieving excessive pressure to the return side of integrated valve. Valve cracks (opens) at 1100 PSI, becomes fully open at 1400 PSI (6 GPM flow), and re-seats at 1065 PSI minimum.

### **SOLENOID VALVE**

The Solenoid Valve controls hydraulic system operation. When open, the valve allows pressurized fluid to be directed to pressure sensing, the return fluid shutoff valve, and the servoactuators. When

closed, the valve diverts pressurized fluid back to the reservoir through the return filter. Each solenoid valve is spring loaded to open (on) and is separately controlled by the associated **HYDR SYS** switch on the center pedestal.

Each solenoid valve is powered independently by 28 VDC power routed through a HYDR SYS circuit breaker. When a hydraulic system is on, no electrical power is applied to the solenoid valve, and the spring holds the valve open.

When a system is switched off, electrical power is applied to the associated solenoid valve and overcomes the spring to close the valve. When the system is switched on, electrical power is removed from the solenoid valve, and the spring moves the valve to open.



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### PRESSURE SENSING

Pressure Sensing within the integrated valve and filter assemblies consists of *pressure switches, pressure transmitters, and return fluid shutoff valves.*

A pressure switch is located on the left side of System 1 integrated valve and on the right side of System 2 integrated valve.

Either pressure switch will supply a ground to illuminate the HYDRAULICS caution segment when hydraulic pressure is low. Switches make contact at 650 PSI decreasing pressure and break contact at 750 PSI increasing pressure. Power is supplied by essential Bus. No 1 through the caution panel.

The System 1 pressure transmitter is located to the right of System 1 integrated valve and is connected into a system pressure boss on the left side of the integrated valve.

System 2 pressure transmitter is located just aft of the lift beam on the right side of the compartment below the transmission.

Both pressure transmitters are vented to a common overboard drain line. Transmitters convert hydraulic pressure into electrical signals to provide a reading in PSI on the pressure indicator located on the instrument panel (Figure 12-7).

Electrical power is supplied to System 1 transmitter from the *26V AC Bus No. 1* and System 2 transmitter from *26V AC Bus No. 2.*

### RETURN FLUID SHUTOFF VALVE

Since pressurized hydraulic fluid also provides lubrication for the servoactuators,

a Return Fluid Shutoff Valve is installed in each system to trap hydraulic fluid within the servoactuators in case there is a loss of pressure from the pumps.

Hydraulic pressure in excess of 750 PSI will open the spring loaded return fluid shutoff valve so that fluid from the servoactuators may return to the reservoir for recirculation. If system pressure drops below 750 PSI, the spring closes the shutoff valve and traps hydraulic fluid within the servoactuator plumbing lines to provide lubrication and prevent servoactuator binding.

### SERVOACTUATOR HYDRAULIC FLUID

Pressurized hydraulic fluid is directed out of the integrated valve and filter assembly for use by the flight control servoactuators. Used fluid is directed back to the integrated valve and filter assembly, where it is re-filtered before being sent back to the reservoir.

### RETURN FILTER

Used fluid re-enters the integrated valve and filter assembly through one way check valves and, provided the return fluid shutoff valve is open, is then directed through the Return Filter for additional filtering. A by-pass is incorporated in the return filter to allow returning fluid to by-pass the filter should it become clogged. The return filter also has a red pop up button that activates if the filter is by-passed, causing the remote **FILTER CLOGGED** indicator, in the pilots' "chin bubble" window, to change from green to red.



Figure12-8 Hydraulic System Cockpit Indicating Systems

Used hydraulic fluid, exiting the filter, leaves the integrated valve and filter assembly through external lines and is directed back to a fitting at the entrance of the reservoir. The fitting includes a temperature bulb and temperature switch.

## TEMPERATURE BULB

Located in a T-fitting at system return boss of each reservoir is the Temperature Bulb. Each temperature bulb is connected to an electrical resistance gauge on the instrument panel which indicates an increase in temperature as the resistance in the bulb circuit rises as the result of increasing temperature of the bulb core. Power is supplied by the *28V DC essential Bus No. 1 for System 1* and by *essential Bus No. 2 for System 2*

There are no hydraulic fluid coolers. Fluid cooling occurs due to the flow of the hydraulic fluid through the systems metal

plumbing lines. Because the No. 2 system pump turns faster than the No. 1 system pump, and does not supply the tail rotor servoactuator, No. 2 system fluid receives less cooling and *indicates approximately 15° hotter than the No. 1 system fluid*

## TEMPERATURE SWITCH

A Temperature Switch, using 28 VDC power from the caution panel, closes and illuminates the **HYDRAULIC** caution panel lights if hydraulic fluid temperature exceeds 88° C.

The Temperature switch of either Hydraulic System will supply a ground to illuminate the **HYDRAULIC** caution segment should the hydraulic fluid overheat. Switches make contact at 88°C (190°F) increasing temperature and break contact at 77°C (170°F) decreasing temperature. Power is supplied by essential Bus No. 1 through the caution panel.



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### ACCUMULATORS

System 1 and 2 Accumulators are mounted to the aft side of the lift beam, (System 1 is mounted above System 2). Each accumulator is of the spring/piston type and charged by system pressure.

The accumulator provides a fluid flow range of 1.5 cubic inches from 575 PSI to 135 PSI to partially pressurize the servoactuators, in the event of a loss of system pressure. Accumulators are designed to replace hydraulic fluid (lost to seepage) in the servoactuators after a Hydraulic system is shut Off. The fluid in the accumulators is NOT sufficient in volume to power the servoactuators.

### TEST COUPLINGS

Two Test Couplings, *pressure* and *return*, are provided for each system. Couplings are located on left side of fuselage below the cargo door, System 1 is located aft and System 2 forward.

For normal system operation, all couplings are capped. Couplings provide a means of applying external hydraulic pressure for the testing of systems and components.

### Pressure Operated Valves

The System 1 Pressure Operated Valve is located forward of the lift beam and above the integrated valve at the front of the pylon island.

The System 2 Pressure Operated Valve is located below and to the right of the pressure supply line check valve.

**CAUTION:** When using external hydraulic power DO NOT operate with pressure less than 550 PSIG and DO NOT turn system OFF. Overfilling reservoir will result.

These 3-way, 2-position pressure-operated valves connect the system return test coupling when test pressure is applied. The valves are pressure energized (actuated) when test pressure reaches  $225 \pm 135$  PSI.

When valves are de-energized, system return is connected to the reservoir. Valve is de-energized when decreasing test pressure reaches 50 PSI minimum.

### RESTRICTOR FITTINGS

Restrictor Fittings are located in each system in the bridle line between system return and test pressure. The restrictor prevents the pressure operated valve from being actuated by a build-up of thermal pressure in test pressure line when pump is operating. The orifice allows a maximum flow of .26 GPM @ 1000 PSI.

### Check Valves

Located at different points in each system, Check Valves allow fluid in one direction and prevent flow in opposite direction. Cracking pressure is generally 2 to 8 PSID.

A check valve installed in pump by-pass (case drain) port prevents system return pressure from pressurizing the pump case.

A check valve installed in each servoactuator return line, at the integrated valve, prevents system return pressure from pressuring the servoactuator return line.

A by-pass type check valve is installed into the pressure port of each dual servoactuator providing irreversible feature by retaining fluid in the actuator upon loss of system pressure. Valves allow fluid to flow from actuators, removing check valve irreversible feature, when the system is operating. This arrangement prevents high pressure build-up in the servoactuators and resultant high loads to the structure.

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### Flight Control Servoactuators

Four servoactuators are installed to assist the pilot in moving the flight controls, and to prevent rotor forces from being transmitted to the flight controls.

Three dual servoactuators, one for the collective and two for the cyclic controls, are located adjacent to the transmission in the compartment below the transmission.

The collective and cyclic dual servoactuator assemblies are alike, each having a separate upper and lower, servoactuator system.

One smaller tail rotor servoactuator is located in a compartment at the right aft side of the fuselage. This servoactuator is mounted vertically in a support attached to the bulkhead.

### Dual Servoactuators

Three similar Dual Servoactuators (Figure12-8) serve to minimize the force required to actuate the main rotor control systems, one for the collective and two for the cyclic control systems. Each dual servoactuator is powered by both or either hydraulic system, upper portion by System 1 and lower portion by System 2.

### Servo & By-pass Valves

Both lower and upper portions of each dual servo actuator are equipped with a Servo Valve and By-pass Valve. The valves of each dual actuator are actuated by linkage from a common input.

### Upper Servo

Valves direct fluid to top or bottom of piston, causing piston to move in desired direction. Piston moves, cylinder is stationary.

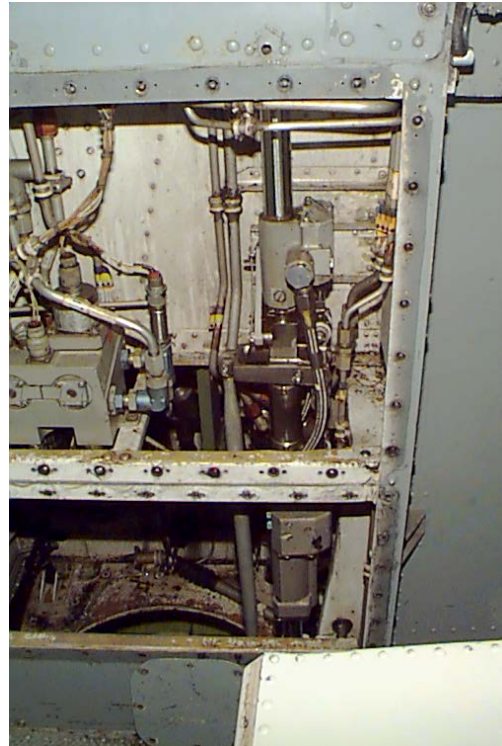


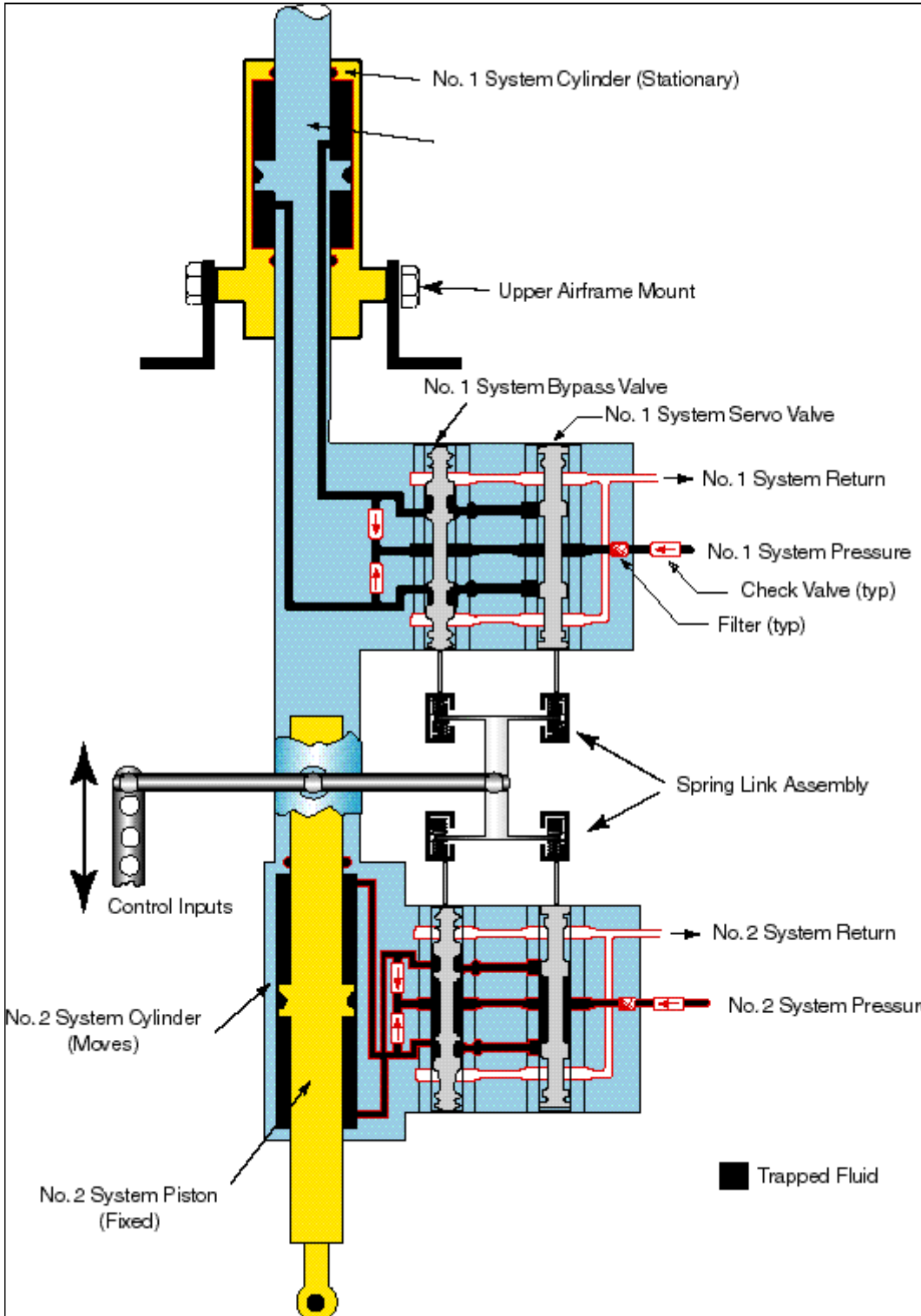
Figure12-9a Dual Servoactuator

### Lower Servo

Valves direct fluid to top or bottom of piston, causing cylinder to move in desired direction. Cylinder moves, piston is stationary.



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**Figure12-9b Dual Servoactuator Operation**



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### **Spring Linkage**

The linkage for each servo and by-pass valve incorporates a spring to allow movement of the other three valves, should a single valve become jammed.

### **Normal Operation**

Hydraulic pressure at 1000 PSI acts on the top or bottom of the pistons to move the controls. With the valve in neutral, pressure is directed to both sides of the pistons.

Repositioning the servo control valves via the control linkage (from the flight controls) will cause the upper piston and lower cylinder to move. This follow-up movement of the upper piston and lower cylinder will return the valves to neutral, directing pressure to both sides of the piston.

### **Manual Operation**

With System 1 not functioning, the upper piston is moved by the lower actuator.

With System 2 not functioning, the lower cylinder is moved by the upper actuator.

With both systems not functioning, the upper piston and lower cylinder are moved manually.

Both the upper and lower servoactuators are similar during manual operation. Check valves in the actuator prevent a liquid lock. Cavitation of the actuator is prevented by a check valve at the pressure inlet port and the pressure operated shut-off valve in the integrated valve. Minor loss of fluid from the actuator, due to seal leakage, is replenished by the system accumulator. With this arrangement, the actuator is irreversible as long as fluid is retained in the system between the actuator and the integrated valve.

### **Tail Rotor Servoactuator**

Powers the tail rotor control system when hydraulic System 1 is functioning.

### **Servo & By-pass Valves**

Fluid is directed to the top or bottom of the piston, to move the piston in the desired direction, by a Servo Valve and a By-pass Valve which are actuated by movement of the tail rotor pedals.

### **Normal Operation**

As in the main rotor servos, hydraulic pressure at 1000 PSI acts on the top or bottom of the piston to move the controls. With servo and by-pass valves in neutral, pressure is directed to both sides of the piston.

Repositioning the servo and by-pass valves from neutral will cause the piston to move. This follow-up movement of the piston will return the valves to neutral, directing pressure once again to both sides of the piston thereby canceling any movement.

### **Manual Operation**

The tail rotor actuator is very similar in function to the main rotor control actuators. The primary difference is that the tail rotor actuator is somewhat smaller and is powered by the Number 1 hydraulic system only. The Tail rotor servo cannot supply control boost authority in the event of a number one system failure. However, the piston can be moved manually as check valves will prevent a "liquid-lock".

### **Series Actuators (Bell AFCS)**

Three electro-hydraulic actuators, installed in series with the mechanical linkage of the cyclic and anti-torque control systems,

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provide stability and control augmentation in the pitch, roll and yaw axes.

With no hydraulic power applied, the actuator assemblies are a fixed length tube in their respective system. With adequate hydraulic pressure applied, the actuator assemblies can extend or retract .337 inch (.675 inch total movement) from nominal fixed length. Extension or retraction of an actuator assembly, actuates its respective control stick or pedals. Hydraulic pressure to extend or retract the actuator is directed electrically by a servo valve. Piston movement is sensed by a *Linear Variable Differential Transformer (LVDT)* which provides an electrical signal to return the actuator to neutral.

The actuator will center and lock in the event of electrical or hydraulic power loss or when its respective channel is disengaged. The actuator requires approximately 125 PSI to release locks and 300 PSI to permit full piston stroke. The actuator will be mechanically locked in the neutral position when hydraulic pressure is below 50 PSI.

### **Solenoid Valves**

Hydraulic pressure to the series actuators is controlled by their respective Solenoid Valve.

Each valve is a 3-way, 2-position, electrically operated type, and is controlled by an individual **ARM** switch on the AFCS control panel. The valves are electrically energized when their respective switch is in the **SCAS** or **ATTS** position and de-energized when the switch is in the **OFF** position.

When valve is electrically energized, hydraulic pressure is directed to its series actuator and the return port is blocked.

When valve is de-energized, the actuator port is connected to return and the system pressure port is blocked.

Hydraulic System No. 1 supplies hydraulic pressure to the Yaw series actuator and System No. 2 supplies the Pitch and Roll.

Hydraulic fluid for the SCAS actuators is supplied from the pressure transmitter/switch line and fluid returns to the pump case drain line of the appropriate system.

### **Pitch (Fore & Aft) Actuator**

The Pitch series actuator is installed in the fore and aft cyclic system between the jackshaft arm and the scissors assembly.

The actuator authority is limited to  $\pm 9.3\%$  (18.6% total) of control travel.

### **Roll (Lateral Actuator)**

The Roll series actuator is installed in the lateral cyclic system between forward bellcrank and mixing bellcrank assembly.

The actuator authority is limited to  $\pm 11.1\%$  (22.2% total) of control travel.

### **Yaw (Anti-torque) Actuator**

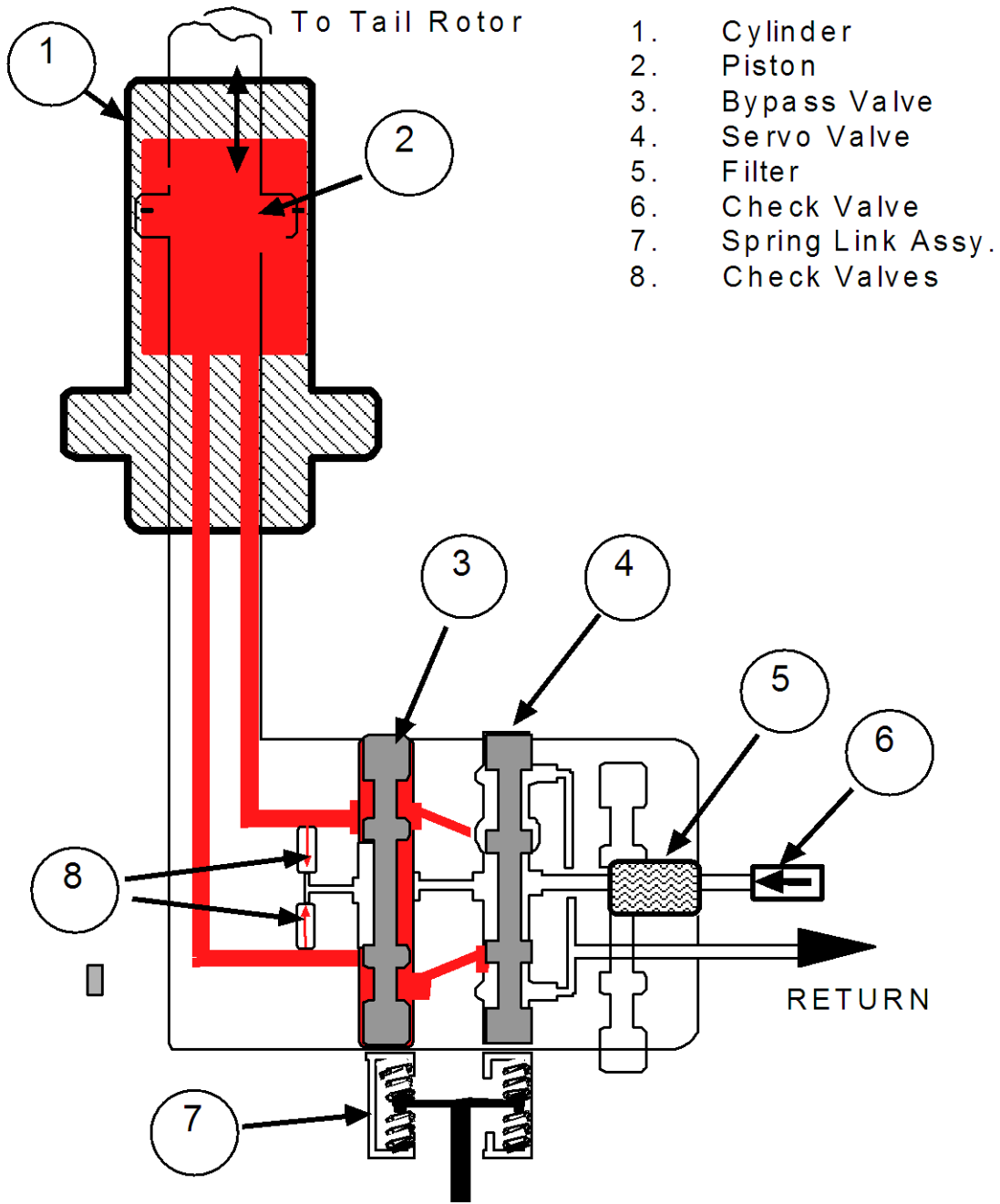
The Yaw series actuator is installed in the anti-torque system just prior to the yaw hydraulic servoactuator.

The actuator authority is limited to  $\pm 11.1\%$  (22.2% total) of control travel.





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**Figure12-10 Single Servoactuator Operation**



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# MALFUNCTIONS

## GENERAL

In the Bell 212, the loss of a hydraulic system is a serious situation and can result from a loss of a pump, a loss of fluid, or an intentional shutdown as the result of low pressure or high temperature.

Dual flight control hydraulic systems provide the required safety to allow the helicopter to be flown to an area where a safe landing can be made if one hydraulic system fails. Although it is possible to control the helicopter without hydraulic boost, the dynamic forces are excessively high and *flight should never be attempted with both systems off line.*

### Hydraulic Pump Failure or Low Pressure

Hydraulic pump failure or loss of system fluid causes a system pressure loss which causes the associated pressure switch to close and illuminate the caution light. *Loss of system pressure should be verified on the respective system's pressure gauge.*

Cyclic and collective flight control response is not affected by the failure of one hydraulic system. However, failure of the No. 1 hydraulic system causes detectable dynamic feedback forces when the anti-torque pedals are moved. The pilot should land as soon as practical, following the Hydraulic Malfunction procedures in Section 4 of the *RFM*. If the No.1 system fails or is switched off, landing to the ground (with minimum ground run) is recommended to minimize tail rotor pedal movement.

Failure of one hydraulic system does not affect the remaining hydraulic system or operation of the dual servoactuators. Loss of hydraulic pressure on one system allows that system's pressure operated shutoff

valve to close, trapping hydraulic fluid with its servoactuator loops. Since flight control inputs move the servo valves and by-pass valves of both systems, when a servo valve is moved, the operating hydraulic system moves the control rod while the failed system, due to its moved by-pass valve, allows trapped hydraulic fluid to pass from one side of its piston to the other (Figure12-10).

### Excessively High Hydraulic Fluid Temperatures

Excessive hydraulic system fluid temperature (above 88° C) closes the associated temperature switch and illuminates the HYDRAULIC caution panel light. Excessive hydraulic fluid temperature should be verified on the affected system's temperature gauge.

High system temperature does not normally affect cockpit flight control response. However, the affected system should be switched off and *FLIGHT MANUAL* procedures for a failed hydraulic system followed.

## MAIN ROTOR BRAKE HYDRAULIC SYSTEM

### GENERAL

A single disc rotor brake is installed on the left side of the main transmission to provide rapid deceleration of the rotor systems after engine shutdown. The rotor brake system consists of a brake disc (driven by the transmission), a dual brake assembly, a cockpit actuating lever, associated plumbing, and a warning light system. The rotor brake should only be activated at or below 40% NR. The two warning lights advise the pilot if the rotor brake pads are extended and the brake applied (Figure12-11).



## **BELL 212 Pilot Training Manual**

### **OPERATION**

The rotor brake actuating assembly consists of a master cylinder, a reservoir, and an actuating handle. The assembly is mounted in the crew compartment roof just right of the overhead console.

Pulling down and pushing forward on the actuating handle pressurizes hydraulic fluid in the master cylinder and directs the pressure through external lines to the dual brake assembly. A detent holds the handle in the fully off position and prevents inadvertent lowering of the handle and brake actuation. At full throw of the handle an over center cam maintains the brake in the fully on position. In the dual brake assembly, pressurized fluid is directed to two brake cylinders. The pressurized fluid forces the brake pads against the sides of the rotor brake disc, causing it to decelerate the transmission quill gear and the rotor systems.

As the brake pads move out of their fully retracted position, a microswitch attached to each pad closes and illuminates a ROTOR BRAKE warning light on the caution panel. The ROTOR BRAKE warning lights remain illuminated until the brake pads are in the fully retracted position.

After use, the actuating handle is pulled aft and pushed up into the detent. This deactivates the master cylinder and depressurizes the hydraulic fluid. Springs within the brake pad cylinders withdraw the pads and return them to the fully retracted positions. When the brake pads reach the

retracted positions, the microswitches open and the warning lights extinguish.

### **ROTOR BRAKE USE**

The rotor brake shall be used only when main rotor rpm is at or below 40% and the engines are shut down. The rotor brake should never be used in flight or during engine starting.

When used, the rotor brake should be fully applied and left on until the rotor has almost stopped and then fully released. The brake should never be pumped because such operation may cause damage to the transmission quill gear due to over pressurization of the Rotor Brake system. The operation of the rotor brake and the ROTOR BRAKE warning lights is checked prior to engine starting.

### **ROTOR BRAKE**

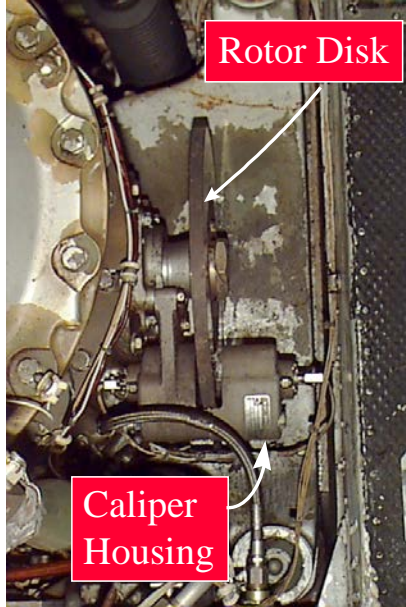
#### **MALFUNCTIONS**

Failure of the rotor brake to operate after engine shutdown is not a problem since the rotor can be safely allowed to coast to a stop.

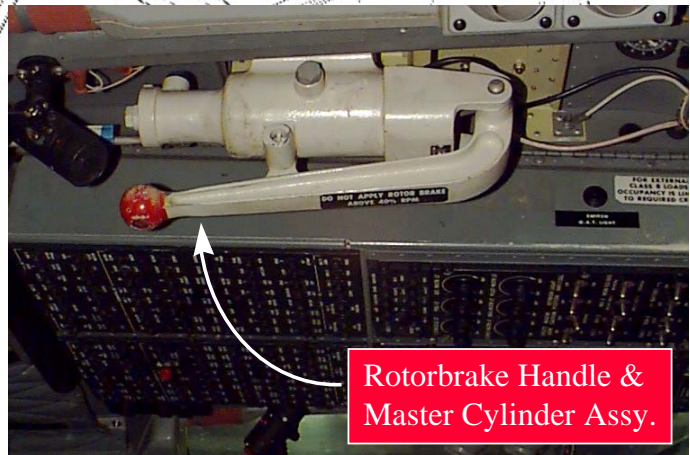
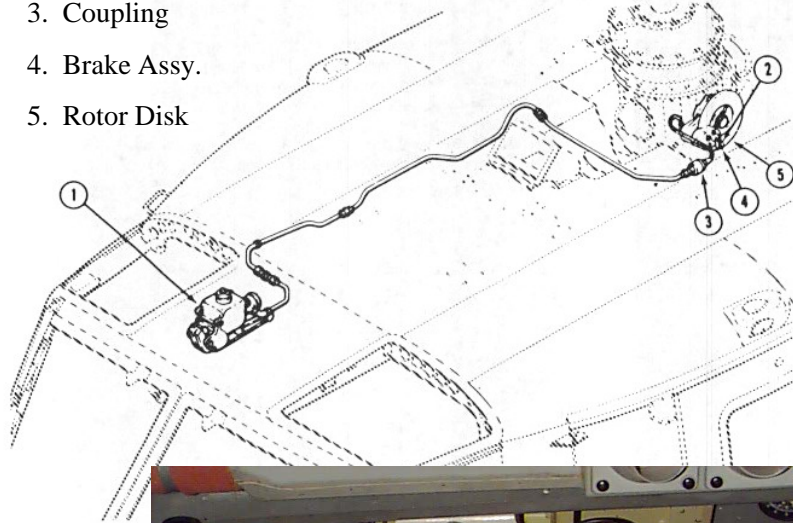
Inadvertent illumination of the ROTOR BRAKE warning lights in flight is very serious since it may indicate that the brake pads are extended. The pilot should check that the rotor brake handle is fully retracted and in the detent. If the lights remain illuminated, the helicopter should be landed as soon as possible.



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1. Master Cylinder
2. Micro Switch
3. Coupling
4. Brake Assy.
5. Rotor Disk



**Figure12-11 Rotor Brake System**