LANDING GEAR AND BRAKES

GENERAL

The landing gear is electrically controlled and hydraulically actuated. Each landing gear assembly uses a single wheel assembly and an oil over air strut. The two main gear are articulated, with a trailing link arrangement which improves the smoothness of landings. The nose gear has a chined tire for water and slush deflection. The main landing gear doors are mechanically connected to the main gear struts and extend and retract with the individual gear assemblies. The nose gear utilizes three doors. The rear door is mechanically connected to the nose gear strut and extends aft, or retracts forward with the nose gear assembly. The two forward double-action doors are mechanically linked to the nose gear. These doors close with the nose gear fully extended or retracted.

The gear actuators incorporate an internal lock to hold the gear in the extended position. They are held retracted by mechanical uplocks that are normally released hydraulically. The landing gear completes a retraction or extension cycle in less than 6 seconds. The gear can be extended at airspeeds up to 250 KIAS (V_{LO} extend). It can be retracted at speeds up to 200 KIAS (V_{LO} retract). With the landing gear extended, the maximum speed is 262 KIAS (V_{LE}).

CONTROL

The landing gear control panel contains the landing gear handle, an audible warning system and horn silence switch, three gear safe indicators and a red unlocked indicator. The landing gear handle has two positions: full down and full up. The gear handle must be pulled out to clear a detent before it can be repositioned. Operation of the gear and doors will not begin until the handle has been positioned in one of the two detents. A gear handle locking solenoid, activated by the left main gear squat switch, physically prevents inadvertent movement of the gear handle while on the ground.

EXTENSION AND RETRACTION

In a landing gear retraction cycle, the following takes place:

1. With weight off the left landing gear squat switch, power is applied to the solenoid lock, allowing the landing gear handle to be placed in the UP position.
2. Actuation of the gear handle to the UP position:
   a. Lights the GEAR UNLOCKED warning light when a gear unlocks.
   b. Closes the bypass valve in the hydraulic return line, pressurizing the system as required.
   c. Positions the landing gear control valve to route hydraulic fluid to the retract side of the hydraulic cylinders.
3. The landing gear are mechanically snatched and held in place by the uplatches.
4. Actuation of the three gear up microswitches:
   a. Opens the bypass valve in the hydraulic system returning it to open center operation and low pressure.
   b. Removes power from the landing gear control valve.
   c. Extinguishes GEAR UNLOCKED indicator light.

(Continued Next Page)

EXTENSION AND RETRACTION (Continued)

The sequence during a gear extension is identical with the following exceptions:

1. Solenoid lock on landing gear handle is not in use.
2. Gear handle to the DOWN position causes fluid to be routed by the control valve through the uplocks to release them, and then to the extend side of the actuating cylinders. The green LH, RH and nose gear indicating lights illuminate as each gear locks down. After all gear are down-and-locked, the gear down microswitches return the hydraulic system to open center operation.
3. The anti-skid system completes a self-test if the antiskid control switch is in the ON position.

POSITION AND WARNING SYSTEM

The landing gear position and warning system provides visual and audible indication of landing gear position. Three green safe lights and a red GEAR UNLOCK light are located in a group adjacent to the gear control handle. Each green light corresponds to one gear, NOSE, LH or RH and indicates that it is in the down and locked position. The red light indicates an unsafe gear position (in transit or not locked). The landing gear warning system sounds an audible warning when the airspeed is below approximately 150 knots if either throttle is retarded below approximately 70 percent N_2 and the gear is not down and locked. The warning horn can be silenced for this condition by depressing the horn silence switch. The horn will reset if the throttle is advanced. If the flaps are extended beyond the T.O. & APPR. (15 degrees) position and the gear is not down and locked, there will be an audible warning that cannot be silenced by the horn silence switch.

LANDING GEAR POSITION WARNING

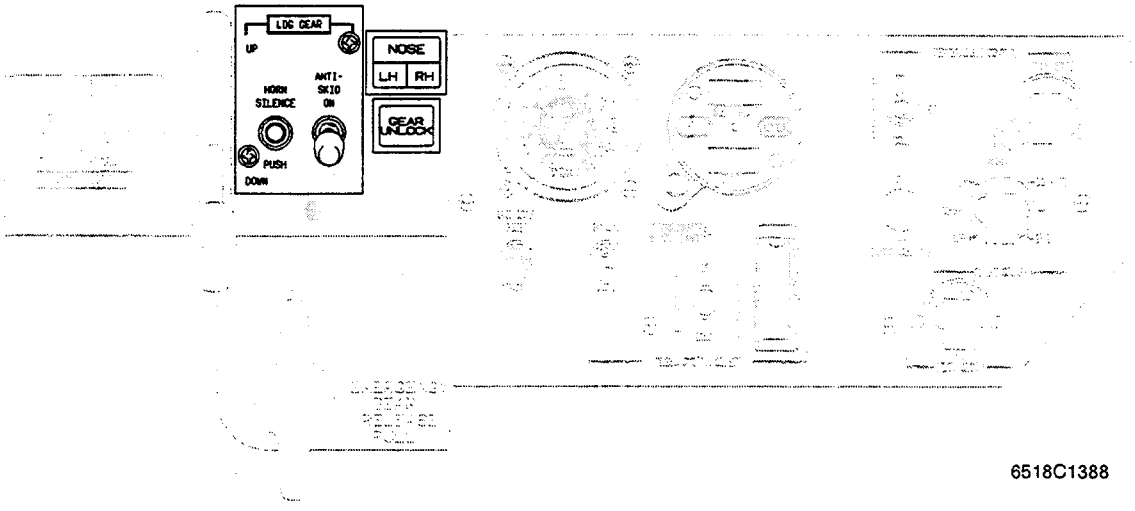

Figure 2-13

EMERGENCY EXTENSION

In the event of normal system malfunction, a manually operated system is provided to release the landing gear for free-fall extension.

(Continued Next Page)

LANDING GEAR EXTENSION AND RETRACTION FLOW

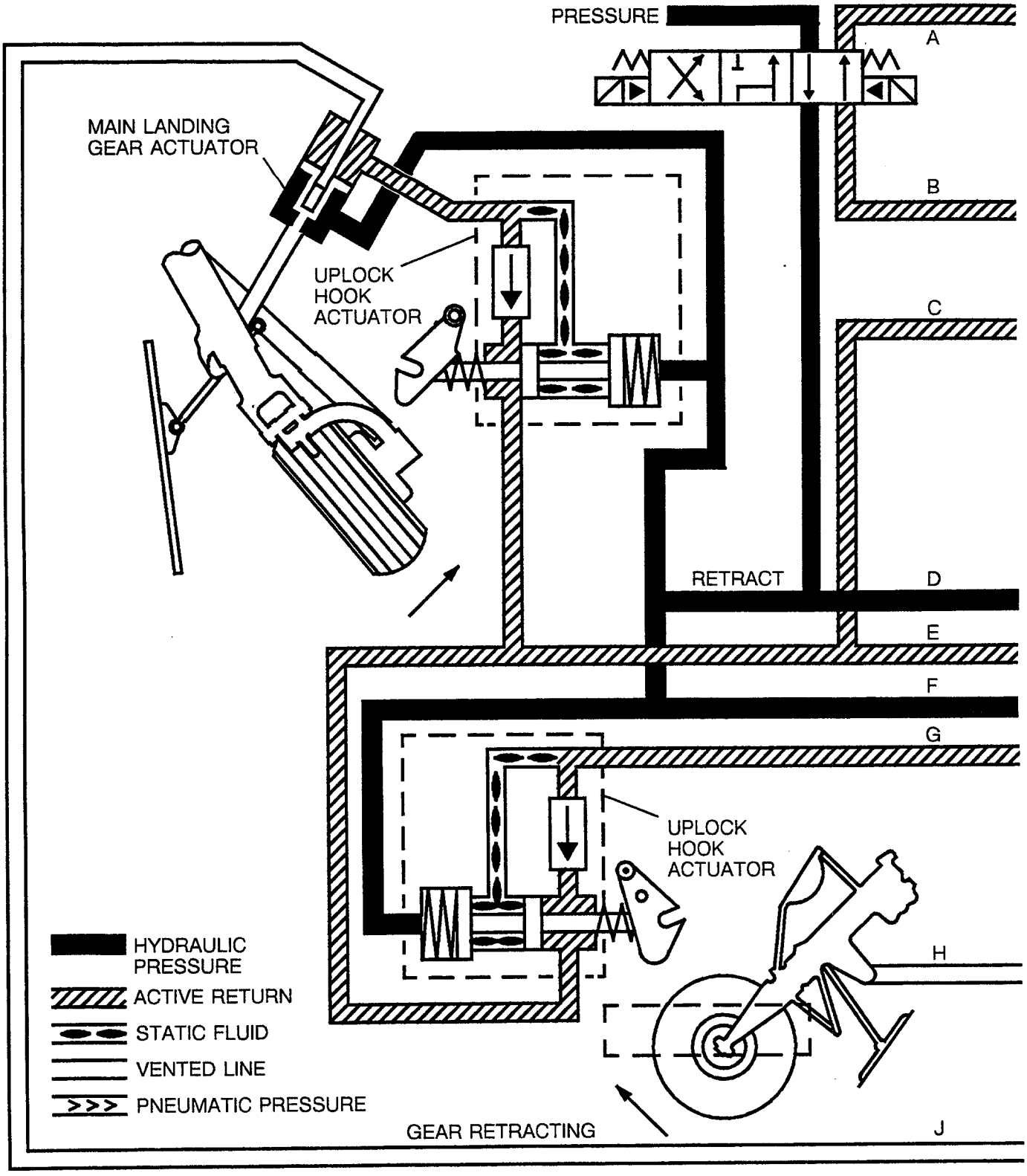

Figure 2-14 (Sheet 1 of 6)

6594C7003 (L)

LANDING GEAR EXTENSION AND RETRACTION FLOW

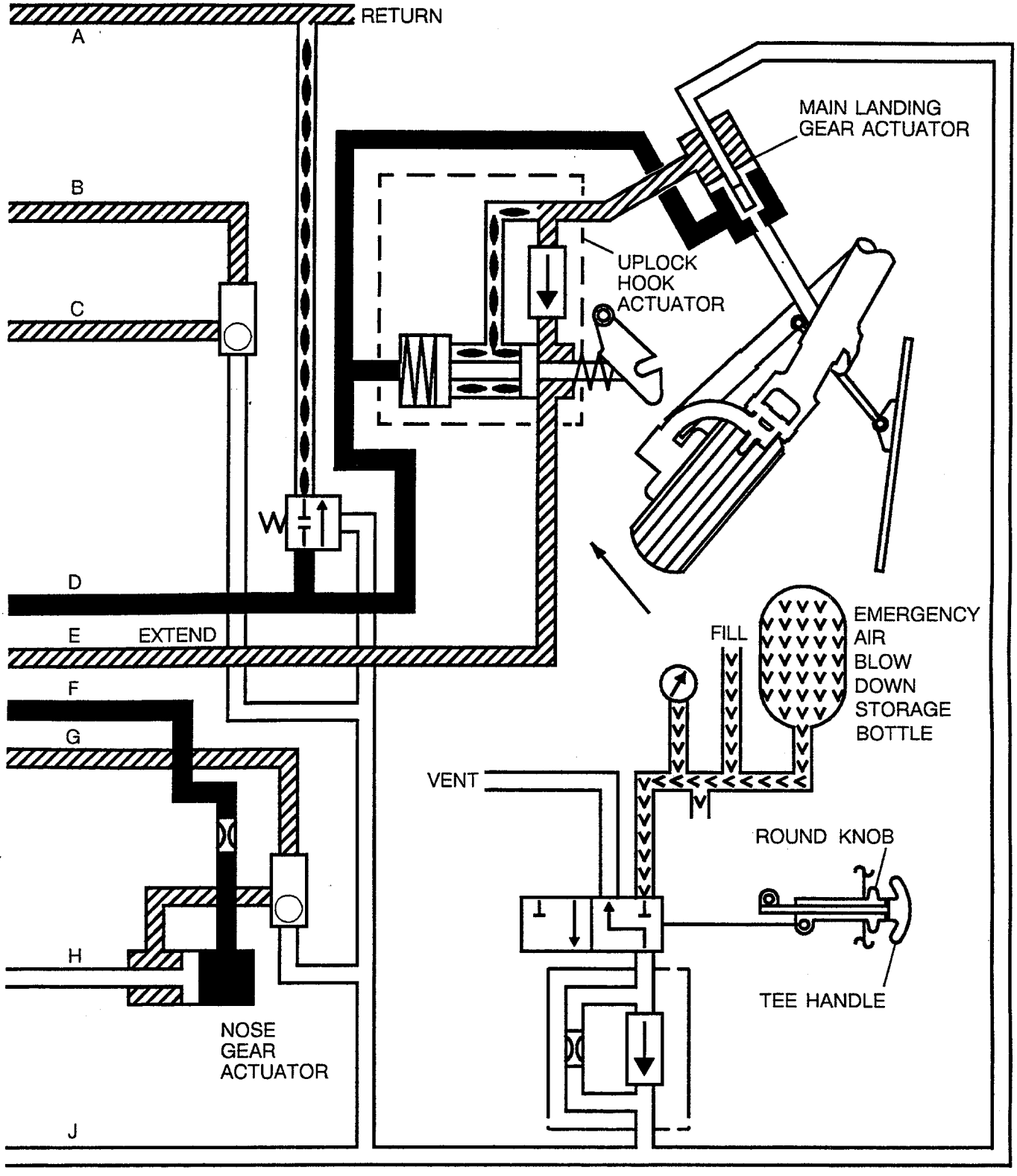

Figure 2-14 (Sheet 2 of 6)

6594C7003 (R)

LANDING GEAR EXTENSION AND RETRACTION FLOW

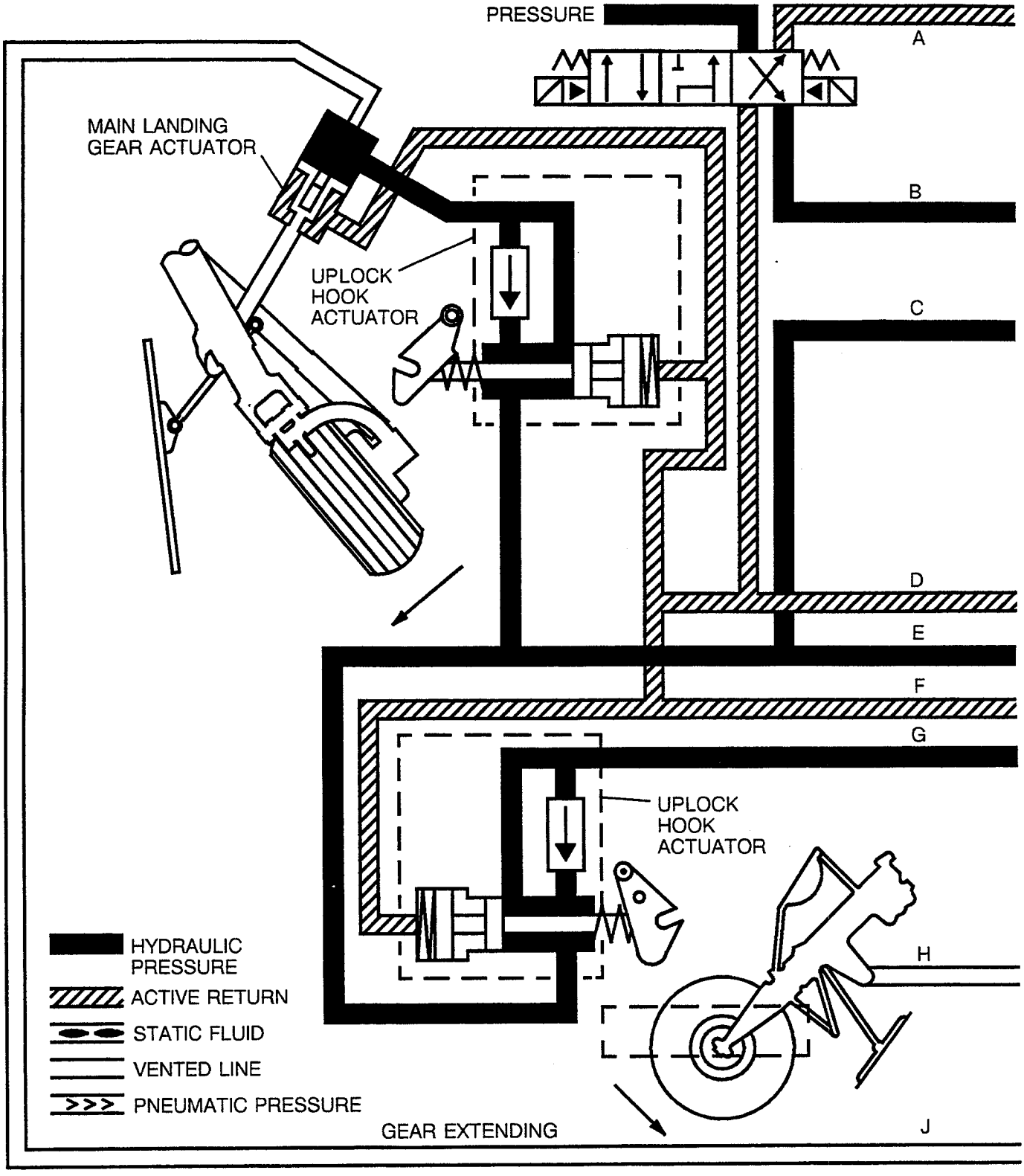

Figure 2-14 (Sheet 3 of 6)

6594C7004 (L)

LANDING GEAR EXTENSION AND RETRACTION FLOW

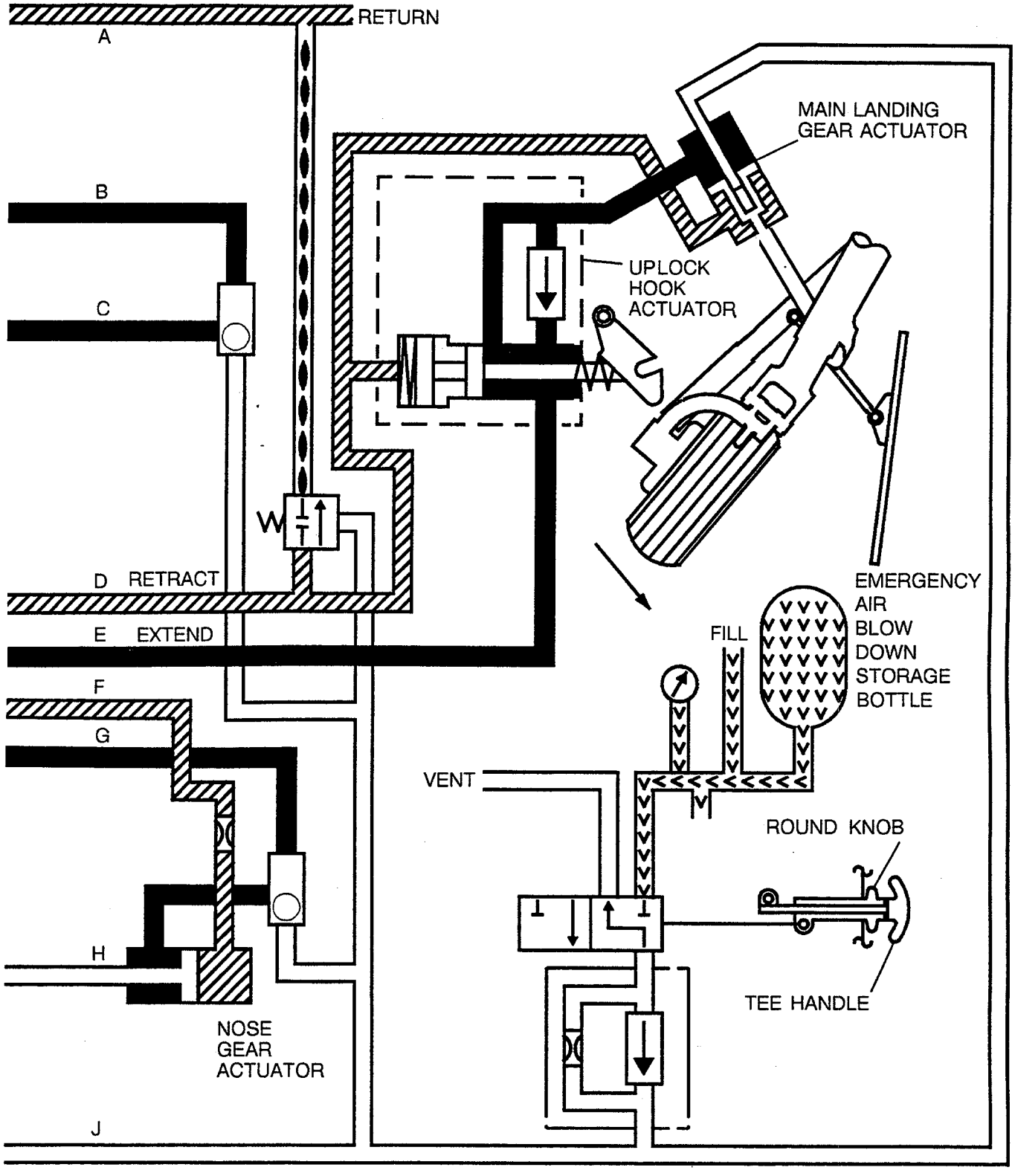

Figure 2-14 (Sheet 4 of 6)

6594C7004 (R)

LANDING GEAR EXTENSION AND RETRACTION FLOW

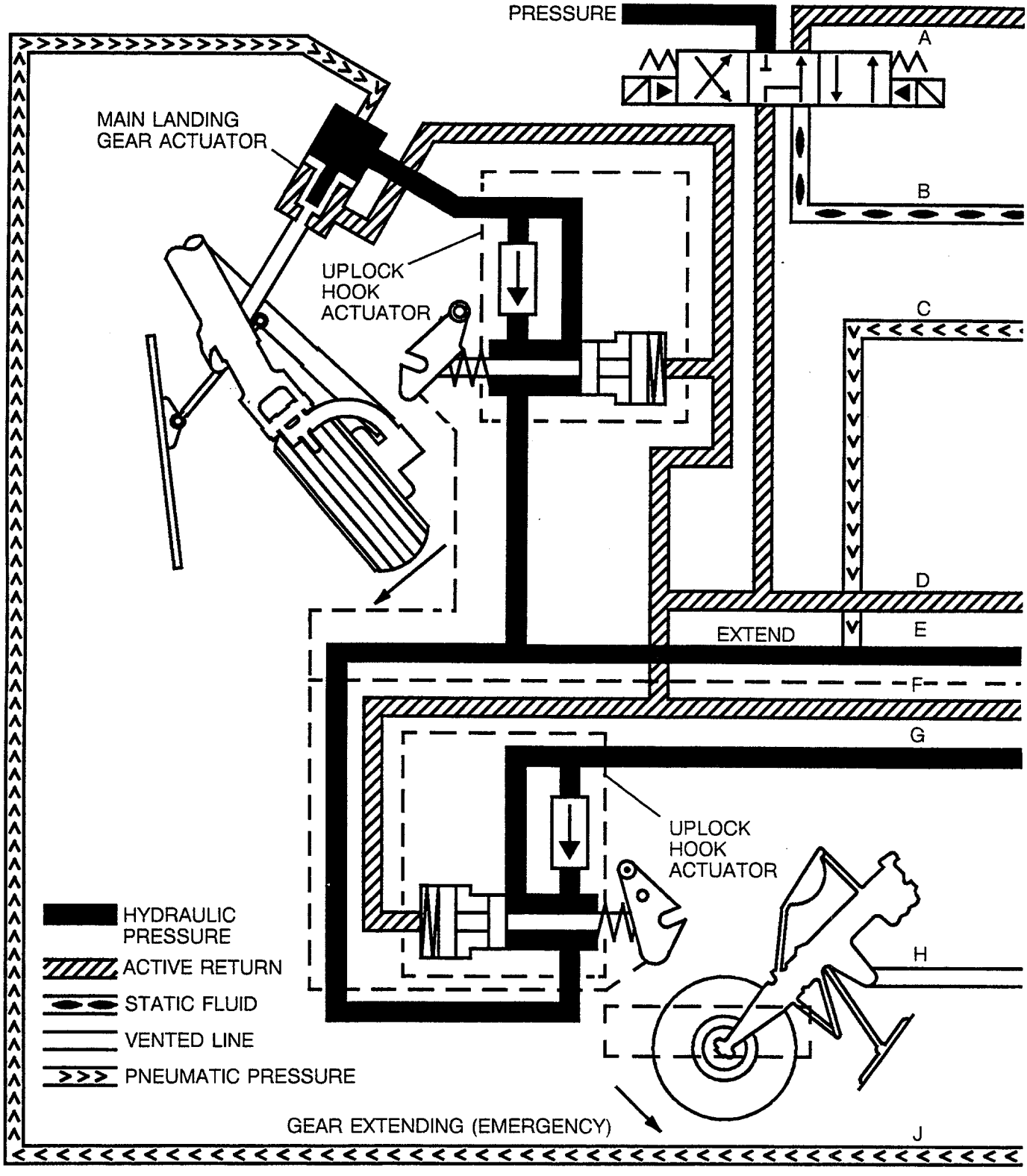

Figure 2-14 (Sheet 5 of 6)

6594C7005 (L)

LANDING GEAR EXTENSION AND RETRACTION FLOW

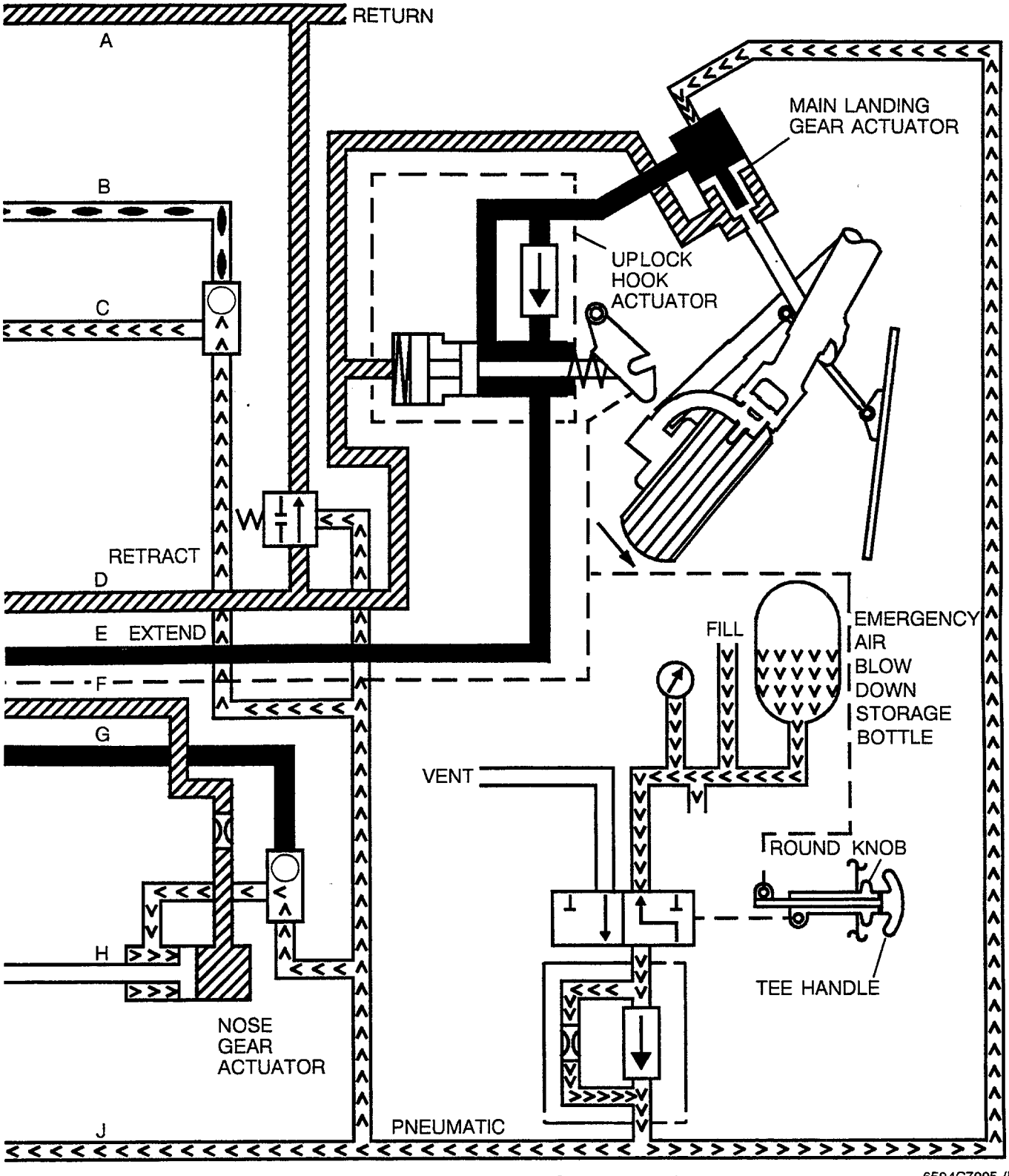

Figure 2-14 (Sheet 6 of 6)

6594C7005 (R)

EMERGENCY EXTENSION (Continued)

The manual system is actuated by the red EMERGENCY GEAR RELEASE PULL T-handle located under the pilot's instrument panel. The handle is pulled and rotated clockwise to lock. This action mechanically disengages the landing gear uplocks, allowing the landing gear to free-fall to the down and locked position and also unlocks the red, collar-type, blow down knob. Lowering the landing gear by the free fall method is not advisable at speeds above 200 KIAS, as the gear may not fully extend above that speed. Approximately 150 KIAS with flaps up is the optimum speed/configuration for free fall extension. Yawing the airplane may be required to achieve green light indications and the pneumatic system should always be used to assure positive locking of all three gear actuators.

Pulling the red, collar-type knob on the T-handle shaft mechanically ports the emergency air bottle into the extend side of all three landing gear actuators. The gear is driven to the down and locked position and normal indications will appear in the cockpit providing the gear handle is down. After actuation of the pneumatic system, the knob should be left in the extended position. After each use, the system must be reserviced.

WHEEL BRAKES

Toe-actuated multiple disc brakes are installed on the main gear wheels. Braking can be accomplished by either of two independent systems: the power brake hydraulic system or the back-up pneumatic system. Normal braking can be applied from either cockpit seat. The emergency brake control is installed under the left instrument panel only.

ANTISKID/POWER BRAKE

The antiskid system provides power assisted braking with skid protection. It is designed to provide maximum braking efficiency on all runway surfaces. The system consists of two wheel speed generators, power brake relay/antiskid valve, control box, reservoir, accumulator, an electrically driven hydraulic pump, filter, pressure and control switches and two indicator lights.

CAUTION

DO NOT PULL THE SKID CONTROL CIRCUIT BREAKER TO PREVENT THE POWER BRAKE PUMP FROM CYCLING. WITH THE CIRCUIT BREAKER DISENGAGED, THE POWER BRAKE SYSTEM IS INOPERATIVE AND THE RUDDER PEDAL TOE BRAKES ARE DISABLED. BRAKING IS THEN AVAILABLE ONLY BY USE OF THE PNEUMATIC BRAKE SYSTEM.

System operation is conventional with power braking available at all speeds while antiskid protection is available at speeds above approximately 12 knots. The antiskid protection feature is designed to operate with maximum pilot brake applied pressure.

The wheel speed generator is bolted in the main gear axle with the drive shaft connected through a drive cap to the main wheel. As the wheel turns, the generator generates a 36 Hz signal for each wheel revolution that is sent to the control module as a variable frequency. The control module accepts the output of the left and right wheel speed generators and converts these signals to a direct current (DC) voltage that is directly proportional to wheel speed. The voltage from the left and right wheels is averaged to provide a composite or reference voltage.

(Continued Next Page)

ANTISKID/POWER BRAKE (Continued)

Any significant variation between either wheel speed voltage and the reference voltage produces an error signal that activates the power brake and antiskid valve which controls the amount of braking being applied against each wheel. At touchdown, the generator voltage reaches maximum as soon as the wheel spins up. As long as no skid occurs, the generator voltage follows wheel speed and the reference voltage follows the voltage of the generator. When excessive deceleration of a wheel occurs, generator voltage suddenly drops. An error signal is generated which energizes the servo valve segment of the power brake and antiskid valve. The servo valve controls the movement of spools within the main body of the power brake and antiskid valve which modulate the braking effort being applied by the pilot as required to maintain generator voltage and reference voltage within the skid limits, preventing the skid condition. When the airplane speed drops below approximately 12 knots, the antiskid function disengages.

To ensure proper braking on water, snow and ice-covered, hard-surface runways and all unimproved surfaces, it is necessary for the pilot to apply maximum effort to the brake pedals throughout the braking run. When the system anticipates a skid and releases the applied brake pressure, any attempt by the pilot to modulate braking can result in an interruption of the applied brake signal and may increase stopping distance significantly.

Hydraulic power for the antiskid system is provided by an electrically driven hydraulic pump located in the left nose of the airplane. An accumulator is installed in the system to maintain system pressure when the pump is not running. The pump is controlled by a pressure switch that opens when the pressure approaches 1300 PSI and closes when the system pressure approaches 900 PSI.

The power brake system is enabled through a switch at the landing gear control. When the landing gear is down, the switch is closed providing a ground for the power brake hydraulic pump motor. The motor will then run in response to signals from the motor pressure switch. When the landing gear squat switch senses the airplane is on the ground it signals the antiskid electronic control box, which enables the antiskid system.

A switch on the instrument panel allows the pilot to select antiskid ON or OFF. When the switch is in the ON position, the antiskid function is operational. With the control switch in the OFF position, the amber ANTISKID INOP light on the annunciator panel will illuminate and the pilot will have power braking available without the antiskid function. If the power system should fail, braking will only be available through the back-up pneumatic system. The antiskid control module incorporates test circuitry which continually monitors the antiskid system. If a fault is detected, the ANTISKID INOP light will illuminate on the annunciator panel. If hydraulic pressure in the power system drops below 750 PSI, the amber LO BRK PRESS light on the annunciator panel will illuminate. Certain faults in the system are displayed on a "BITE" indicator (fault display unit), which is located under the removable panel at the aft of the left nose compartment. A white flag may appear in any of the five circular indicators located in a row on the fault display unit. The faults which may be displayed are: left transducer failure (LEFT XDCR), right transducer failure (RIGHT XDCR), left and right squat switch disagreement (SQUAT DISAGREE), control valve failure (VALVE), and control unit failure (CONTROL).

The brake system receives electrical power through a 20-ampere circuit breaker on the left circuit breaker panel, which is labeled SKID CONTROL. The brake antiskid system and the power brake motor/pump receive power through this circuit breaker which, when disengaged, disables the power brake system. Braking is then available only by means of the pneumatic brake system.

WHEEL BRAKE HYDRAULIC SYSTEM SCHEMATIC

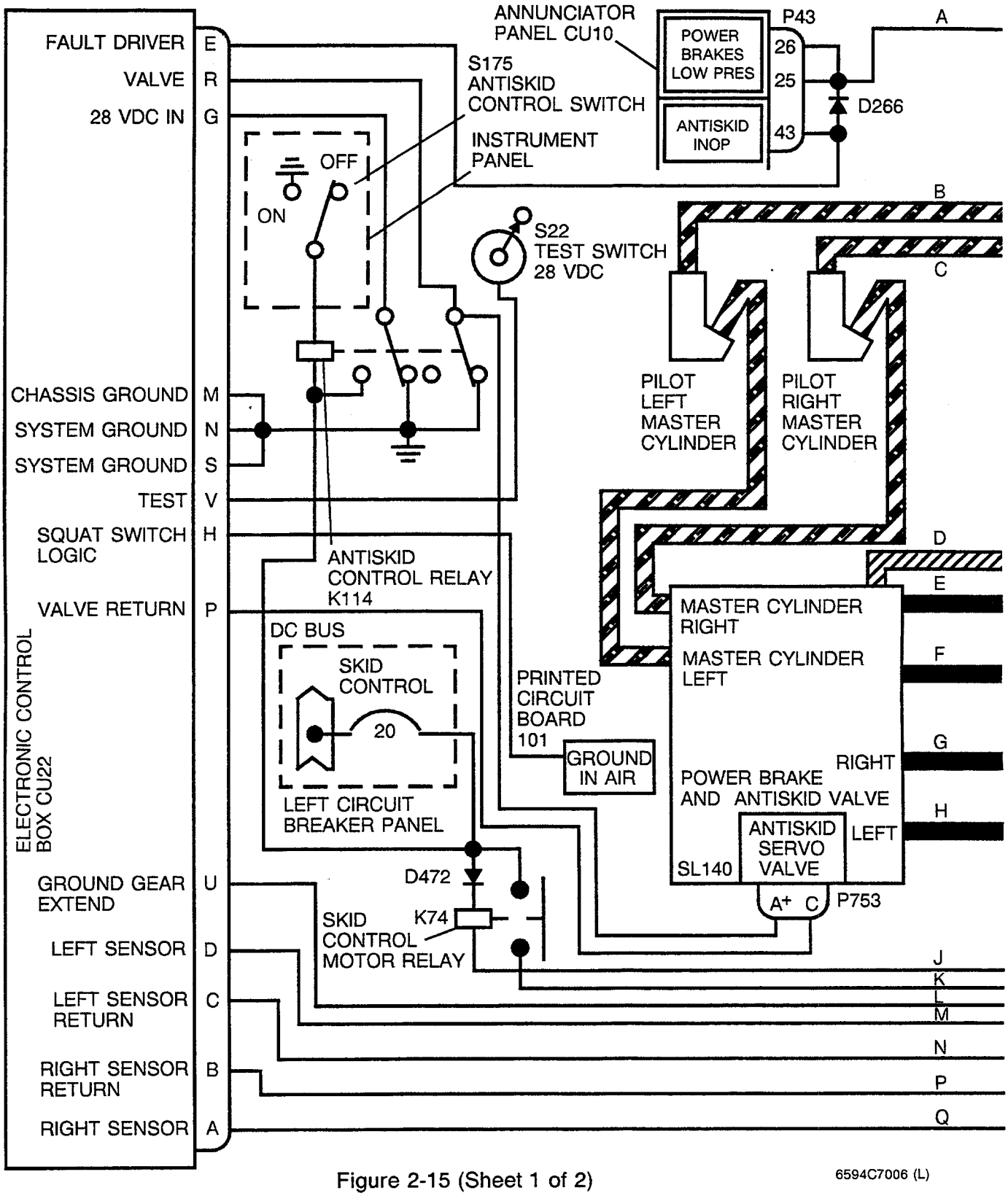

Figure 2-15 (Sheet 1 of 2)

6594C7006 (L)

WHEEL BRAKE HYDRAULIC SYSTEM SCHEMATIC

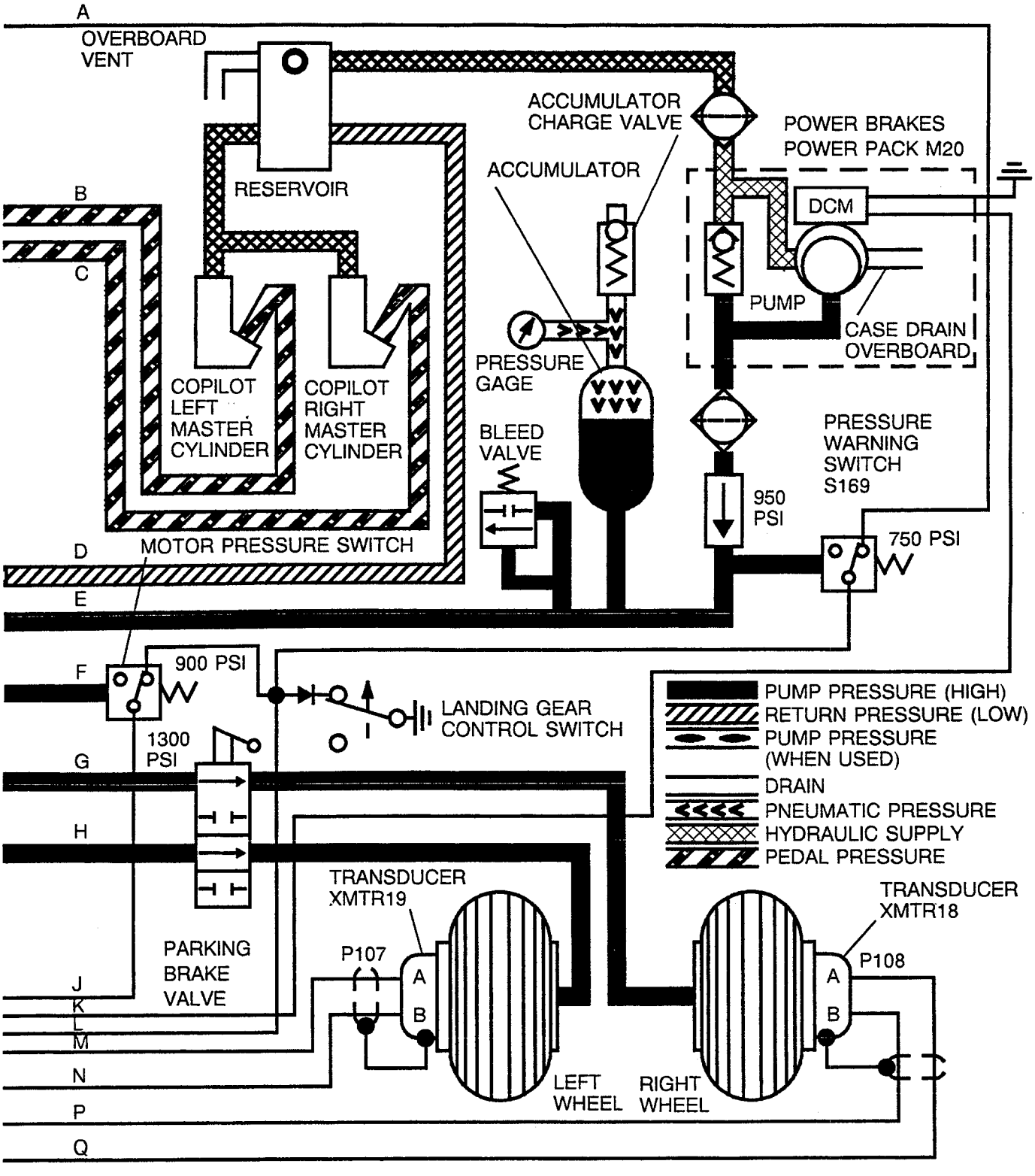

Figure 2-15 (Sheet 2 of 2)

6594C7006 (R)

PARKING BRAKE

The parking brake is a part of the normal brake system and employs controllable check valves that can prevent the return of fluid after the brakes have been set. Parking brakes are set by depressing the toe brakes and pulling out the black parking brake handle located under the lower left side of the instrument panel. The parking brake should not be set if the brakes are very hot. This increases brake cool-down time due to decreased airflow, and may result in sufficient heat transfer from the brakes to cause the parking brake thermal relief valves to open or to melt the thermal relief plugs in the wheel, causing deflation of the tire.

EMERGENCY BRAKING

In the event of normal hydraulic braking system failure, a pneumatic system is available. The pneumatic pressure required is contained in the emergency air bottle and is controlled by a lever with red knob located to the left of the EMERGENCY GEAR RELEASE PULL T-handle. Pulling the lever aft will apply equal pressure to both main landing gear brake assemblies. Releasing the back pressure on the lever and allowing it to move forward will relieve the pressure. The air pressure to the brakes may be modulated to provide any braking rate desired, but differential braking and antiskid will not be available. The emergency air bottle, when fully charged, contains sufficient pressure for ten or more full brake applications. For the most efficient use of the system, apply sufficient air pressure to the brakes to obtain the desired deceleration rate. Maintain that pressure until airplane is stopped. When the handle is released, residual air pressure from the brakes is exhausted overboard. Normal braking should not be applied while using the pneumatic brakes. Depressing the pedals will reposition the shuttle valves in the brake lines to open, allowing high pressure air from the brake housing to enter the brake hydraulic reservoir, which might possibly rupture it. Adequate emergency braking for most conditions will be available from a properly serviced air bottle, even if the landing gear have been extended pneumatically. After stopping and clearing the runway, it is probably best to shut down the engines and have the airplane towed to the ramp, as there is no warning in the cockpit when the air bottle is depleted.