

LANDING GEAR AND BRAKES

LANDING GEAR

Hydraulic flow is supplied to the landing gear control manifold and routed to either the extend ports or the retract ports by a solenoid operated directional control valve. When the directional control valve is commanded to the extend position, hydraulic fluid flows through the gear extend lines to the uplock actuators. As the uplock actuators retract, they pull the gear uplock hooks clear of their respective rollers. Once the actuators retract, extend flow proceeds to the gear actuators to extend the landing gear. Regenerative shuttle valves in the circuit allow fluid from the retract side of the main gear actuators to port back to the extend side, thus improving gear free-fall capability and reducing pump demand during extension. The landing gear directional control valve returns to the center position, and extend pressure is removed, when the downlock switches are triggered.

When the directional control valve within the landing gear control manifold is commanded to the retract position, hydraulic fluid is routed into the retract lines and directly to the main gear actuators. Retract pressure not only retracts the landing gear, but also centers the nosewheels prior to retracting, actuates the brake metering valve to provide anti-spin brake pressure, and pressurizes the extend side of the uplock actuators to make sure the uplock hooks are in the proper position to receive the uplock rollers. The steering unit prevents hydraulic flow from proceeding to the nose gear actuator until the nosewheel has been centered.

The nose and main gear actuators each incorporate an internal lock to hold the gear in the extended position. Once the gear is locked in the down position, no hydraulic pressure is required to maintain the lock. Hydraulic pressure is required to unlock the down locks. The gear is held retracted by mechanical uplocks that are normally released hydraulically, but in case of hydraulic or other malfunction, can be unlocked mechanically through pull cables or pneumatic pressure used for emergency gear extension. The gear is locked up mechanically, after which the pressure is removed by the landing gear control manifold. Landing gear extension or retraction cycles take approximately 6 seconds to complete. The gear can be operated at airspeeds up to 210 KIAS (VLO/VLE).

CONTROL

The landing gear control panel contains the landing gear handle, three green gear safe indicators and a red unlocked indicator. The landing gear handle has two positions: full down and full up; it 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 nose gear squat switch and either main gear squat switch physically prevents inadvertent movement of the gear handle while on the ground.

NOTE

The nose gear torque link must be disconnected during towing operations or the system may be damaged. The torque link disconnect pin is removed by: a) removing a safety pin from the shaft, and then b) pushing a release button and pulling out the pin. The torque link is spring loaded to extend horizontally from the nose gear strut when the pin is removed.

EXTENSION AND RETRACTION

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

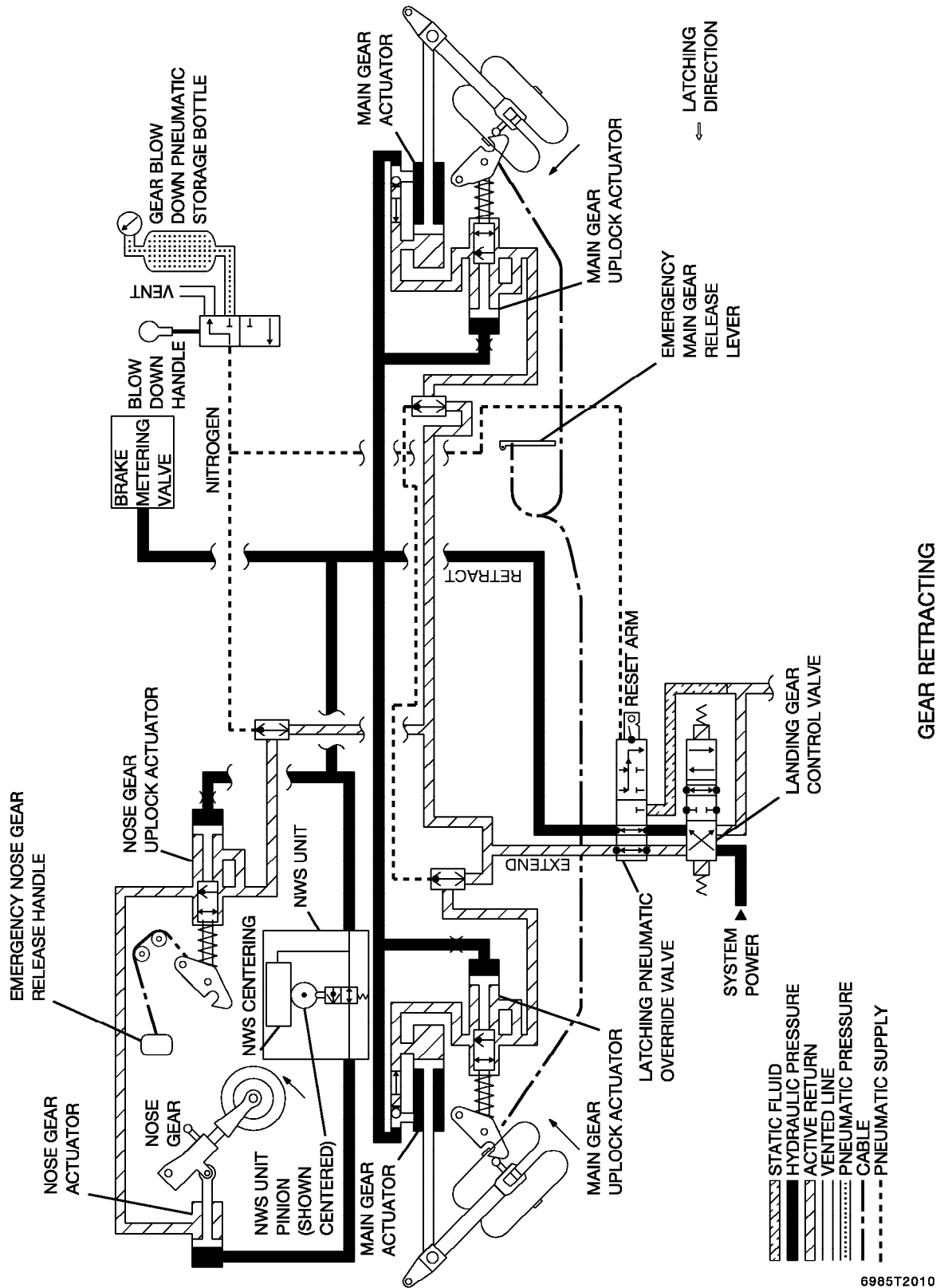
1. With the weight off the landing gear, the main gear and nose gear squat switches close. Power is applied to the lockout solenoid allowing the landing gear handle to be placed in the UP position.
2. Actuation of the UP micro switch by the gear handle simultaneously:
 - a. Lights the gear UNLOCK warning light.
 - b. Positions the landing gear control valve to route hydraulic fluid to the retract side of the nose gear and main landing gear actuators. Landing gear retract pressure is route through the power steering unit and is prevented from reaching the nose landing gear actuator until the nosewheel is in the centered position.
3. Deactivation of the Gear Down micro switches:
 - a. Extinguishes the green LH, RH, and NO gear lights.
 - b. Allows momentarily application of the main wheel brakes.
4. Upon retraction the landing gear are latched and mechanically held in place by the uplock hooks.
5. Actuation of the three gear up micro switches:
 - a. Removes power from the landing gear control valve, which removes hydraulic pressure from actuators and gear uplock hooks.
 - b. Extinguishes gear UNLOCK indicator light.

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

1. Solenoid lock on landing gear handle is not in use.
2. Fluid is routed by the control valve through the uplocks to release them, and then to the extend side of the actuating cylinders.
3. Activation of the three Gear Down micro switches:
 - a. Removes power from the landing gear control valve, which removes hydraulic pressure from the actuators and gear uplock hooks.
 - b. Extinguishes the gear UNLOCK light and illuminates the green LH, RH, and NO gear lights.

LANDING GEAR EXTENSION AND RETRACTION FLOW

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Figure 2-11 (Sheet 1 of 6)

LANDING GEAR EXTENSION AND RETRACTION FLOW

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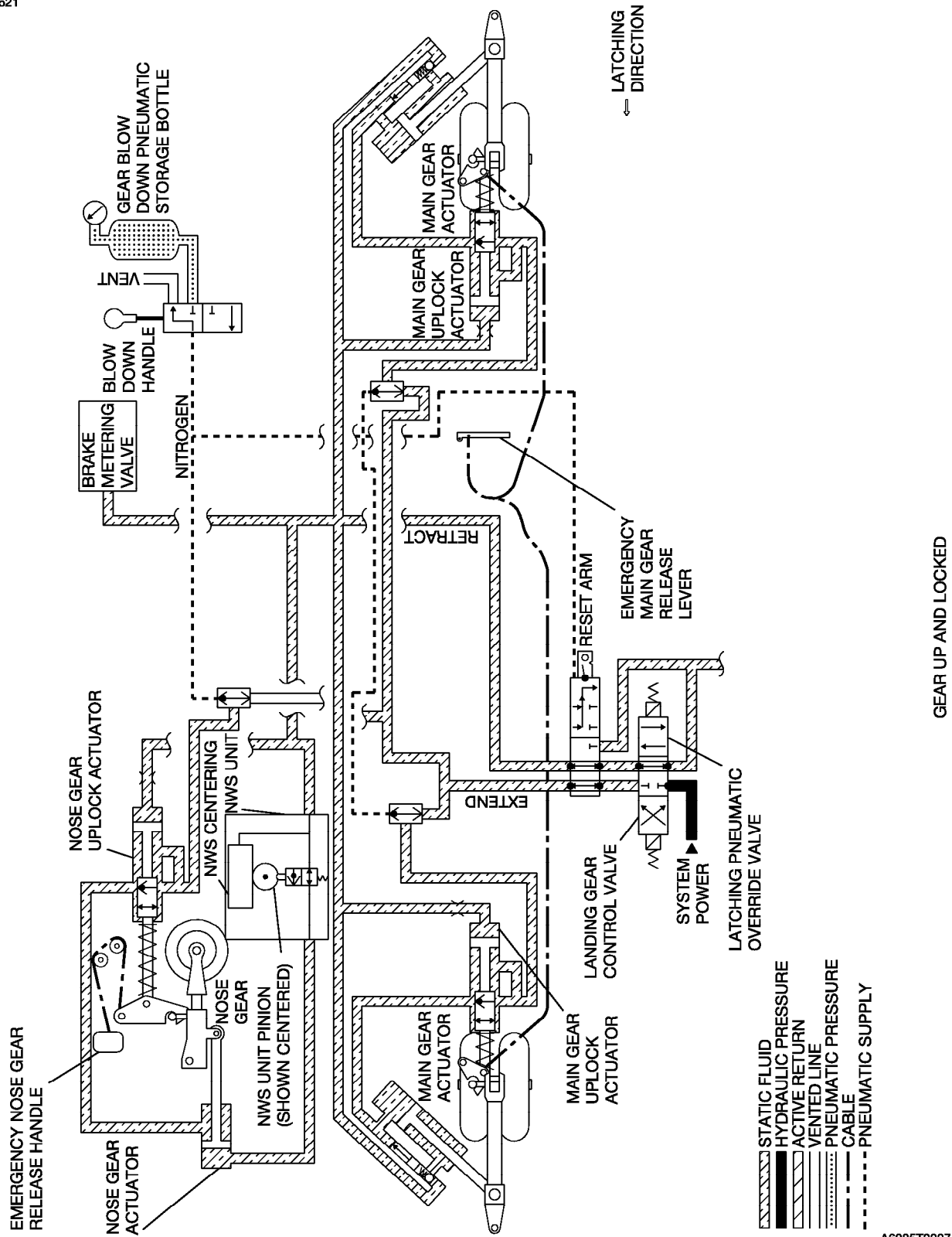
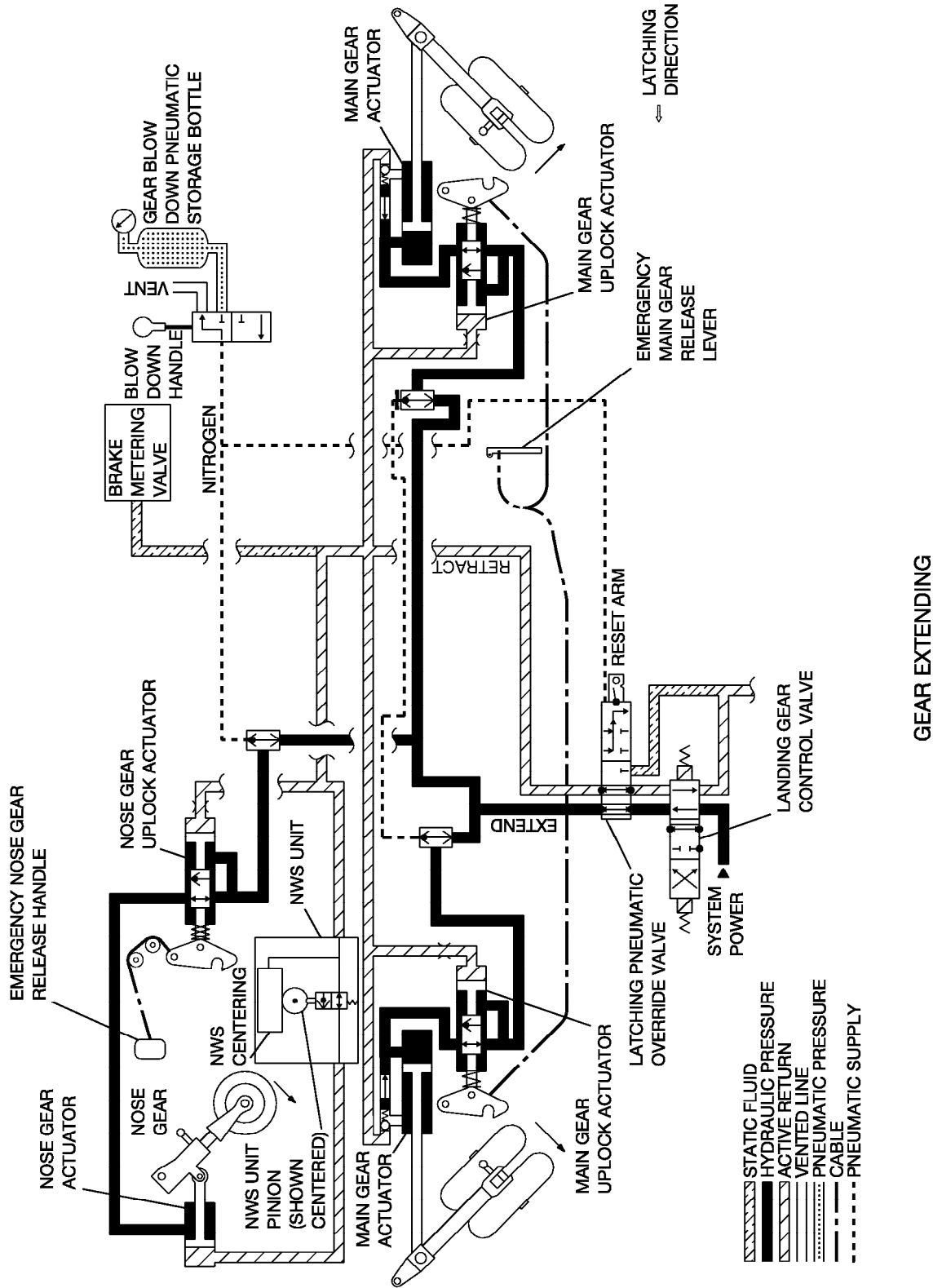


Figure 2-11 (Sheet 2)

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LANDING GEAR EXTENSION AND RETRACTION FLOW

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Figure 2-11 (Sheet 3)

LANDING GEAR EXTENSION AND RETRACTION FLOW

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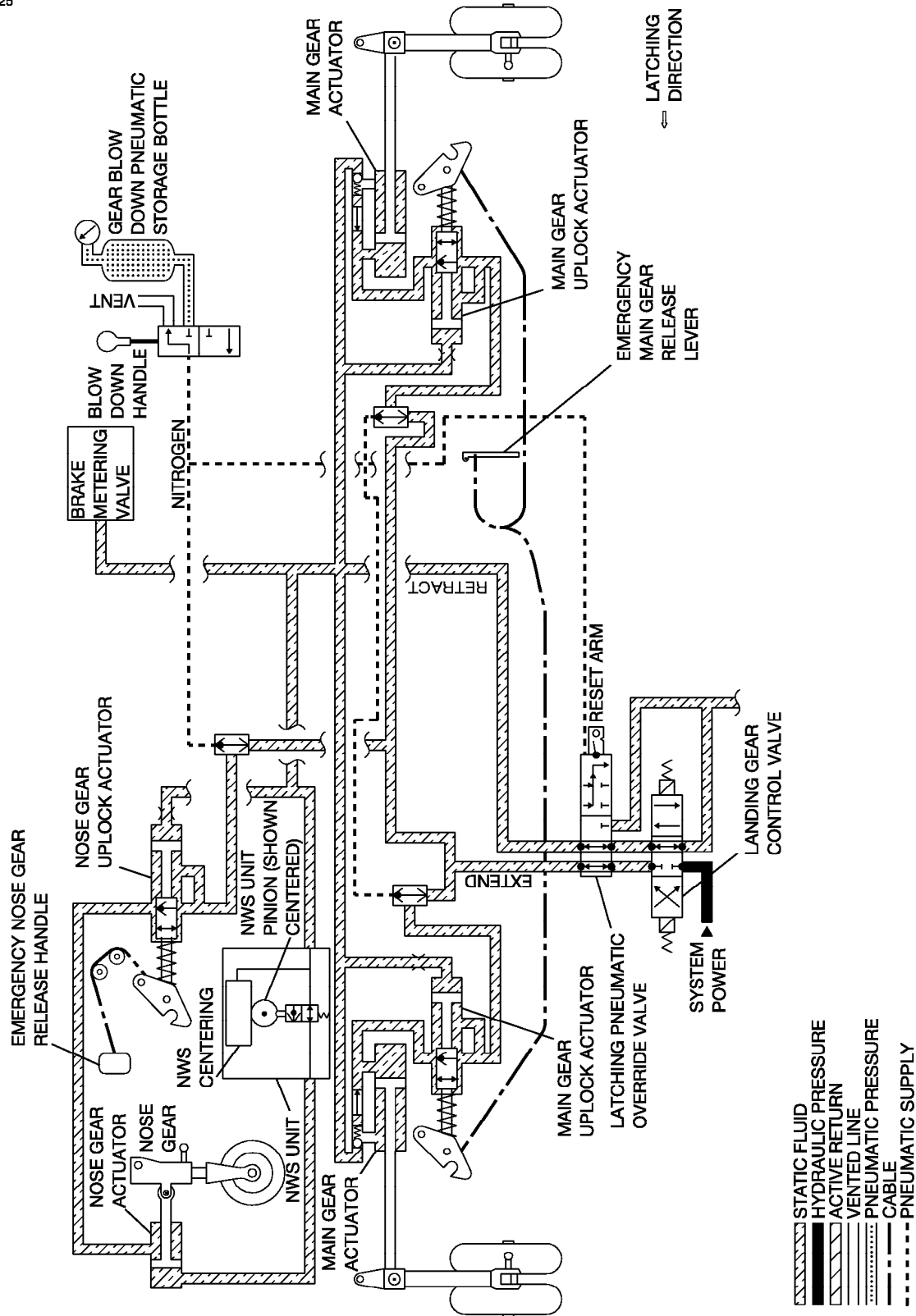


Figure 2-11 (Sheet 4)

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LANDING GEAR EXTENSION AND RETRACTION FLOW

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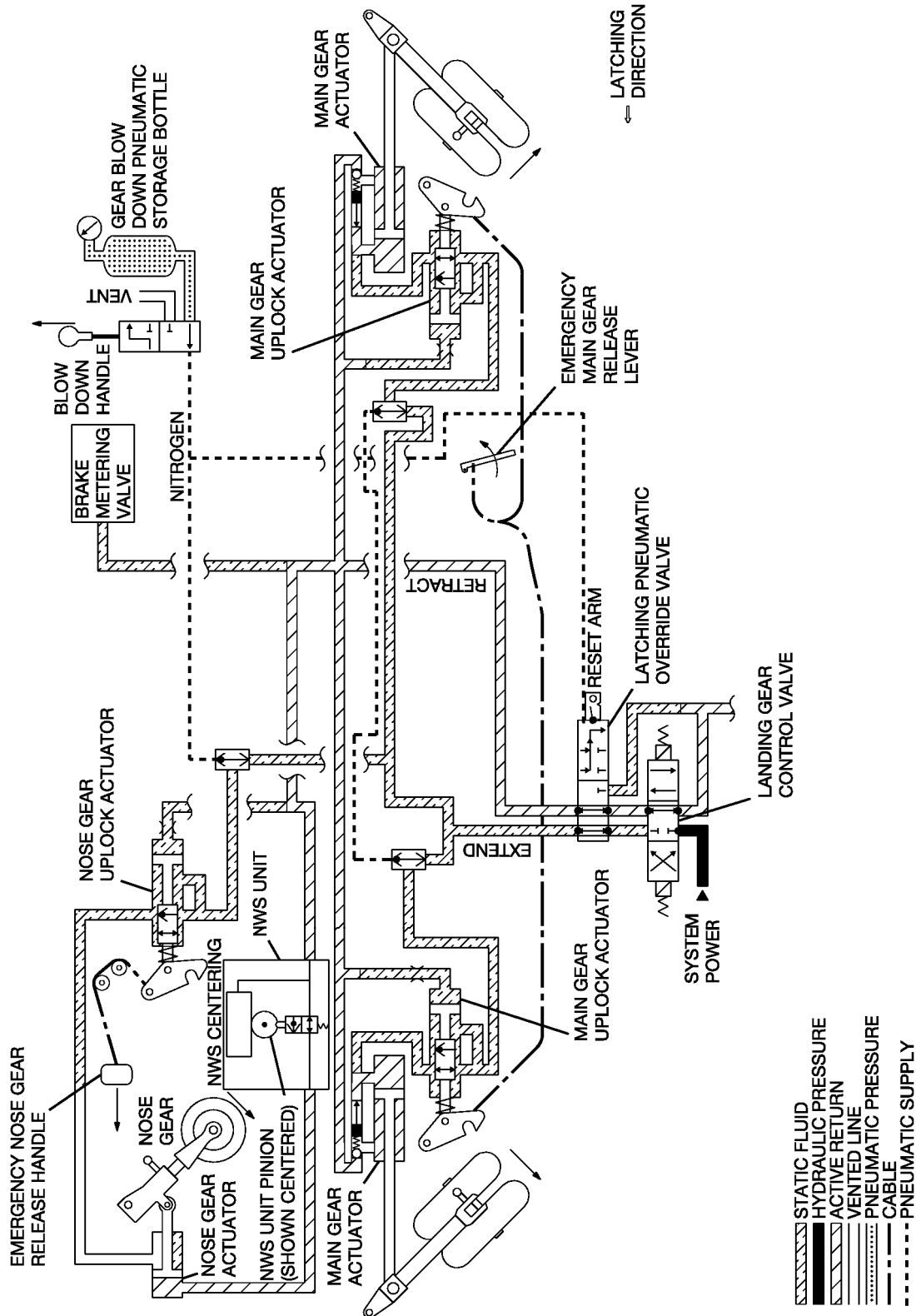
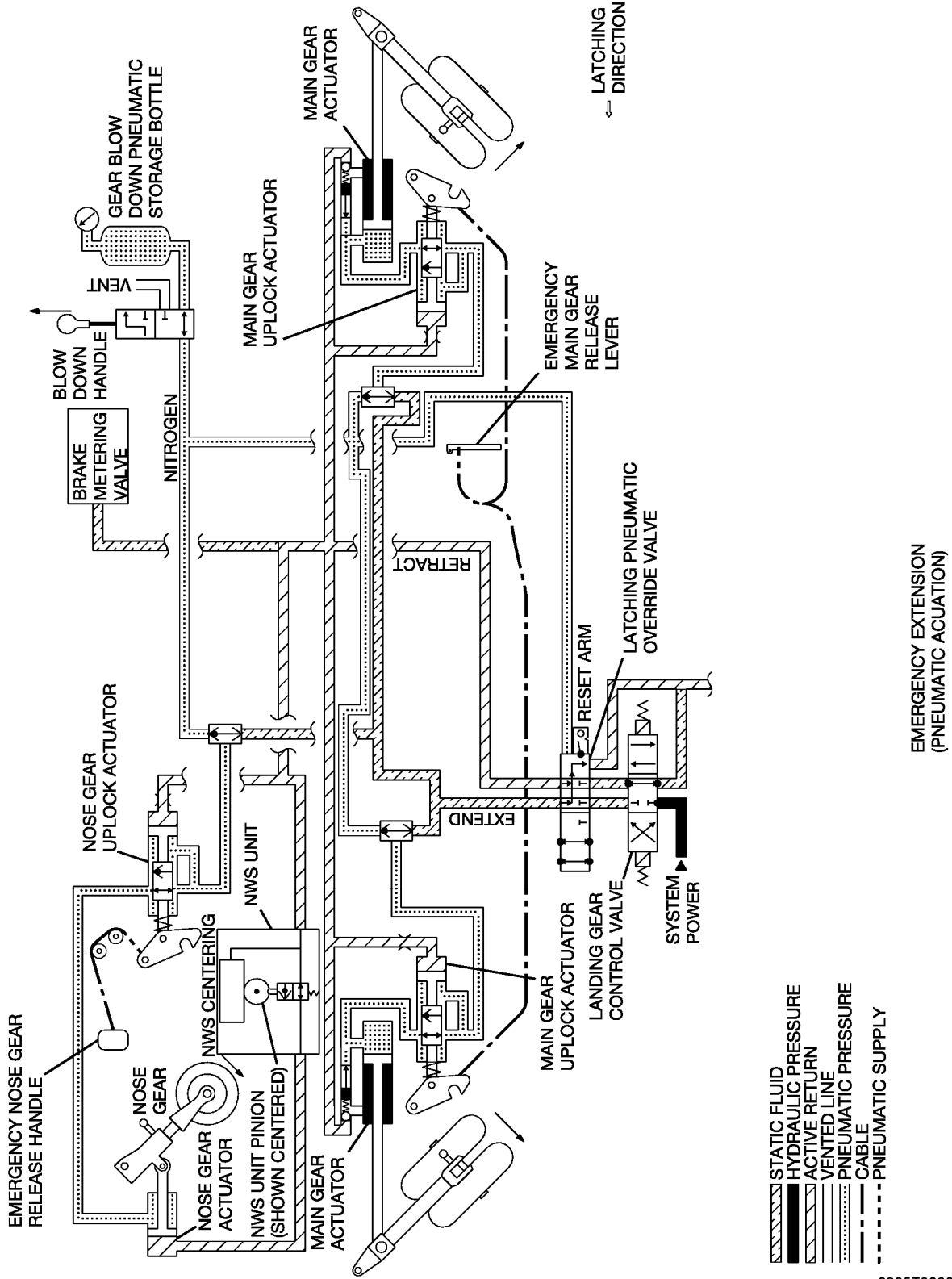


Figure 2-11 (Sheet 5)

LANDING GEAR EXTENSION AND RETRACTION FLOW

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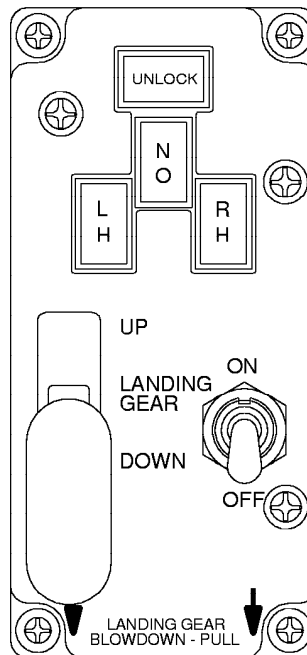
Figure 2-11 (Sheet 6)

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, NO (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 if the gear is not down and locked and the throttles are retarded past a certain point. The warning horn can only be silenced by advancing power, which will reset the horn, or by clearing the condition that caused the warning.

LANDING GEAR CONTROL PANEL

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Figure 2-12

EMERGENCY EXTENSION

Using the LANDING GEAR BLOWDOWN knob located on the bottom left hand side of the copilot's instrument panel activates the emergency gear blowdown. The knob is connected to a valve on the blowdown bottle by a push/pull cable. Upon activation, the emergency gear blowdown valve allows compressed nitrogen to pressurize the pneumatic gear extension lines. The valve input lever is locked in the discharge position once activated. This allows the LANDING GEAR BLOWDOWN knob to be returned to the stowed position without the loss of pneumatic pressure to the gear extension lines. The landing gear control manifold is equipped with a pneumatic line to engage a pneumatic override valve to allow the use of the emergency blowdown system. The pneumatic override valve becomes latched in the blowdown position in order to prevent hydraulic fluid from entering the gear extend and retract lines.

NOTE

If the gear handle is locked up, the blowdown will bypass the hydraulic system. After the gear blowdown has actuated, the gear cannot be retracted.

Whenever the emergency blowdown system is used, trapped nitrogen between the bottle valve and gear actuators must be vented. Venting of the system is accomplished by resetting the control arm on the blowdown bottle valve. This allows the trapped nitrogen along with a small amount of hydraulic fluid to be vented overboard. Venting the gear blowdown system may cause a significant amount of hydrocarbon fog to be released. The pneumatic override valve must also be manually reset back to the normal position. Once the override valve has been reset, slow retraction of the landing gear will purge the remaining excess nitrogen from the landing gear actuators. Applying hydraulic pressure to the landing gear extension lines securely reseats the shuttle valves. Cycling the gear several times is necessary any time the emergency blowdown system is used.

WHEEL BRAKES

The Citation Sovereign uses hydraulically powered main landing gear brakes. This system operates off the main airplane hydraulic system. Crew inputs to the brake metering valves are transmitted mechanically via a series of cables from the toe brakes on the rudder pedals. Springs installed in the rudder pedal assemblies, along with brake pressure feedback, provide braking "feel" to the flight crew. The metering valves regulate main system hydraulic pressure based on pilot or copilot inputs from the toe brake pedals. An electronic antiskid system monitors the main gear wheel speed and reduces braking forces as necessary to optimize stopping distances and prevent wheel lock-up. A parking brake valve is used to trap pressurized fluid in the brake lines and is activated by a T-handle in the cockpit. Brake fuses are used to prevent the loss of fluid due to a brake line failure on the landing gear.

A backup pneumatic braking system is provided in the event of a power brake failure. Pressurized nitrogen is supplied from a nitrogen bottle, located in the nose, directly to shuttle valves on the brakes and is controlled by a lever located on the left side of the main pedestal.

BRAKE METERING VALVE AND CABLE SYSTEM

The brakes are operated by deflection of the upper portion of the pilot and copilot's rudder pedals. Pedal deflection is transmitted to the brakes by a series wire rope cables leading into a mixer assembly located beneath the copilot's seat. The pilot and copilot toe brakes can be operated independent of one another through this mixer assembly. Aft of the mixer assembly are a pair of sheathed ball bearing ribbon cables that transmit pilot or copilot brake inputs to the brake metering valve in the RH forward wing fairing. This valve regulates main hydraulic system pressure to the brake system up to a maximum of 3000 (± 50) PSI in proportion to the amount of deflection by the pilot or copilot braking inputs. The metering valve also provides anti-spin braking during gear retraction in response from the gear retract hydraulic circuit.

ANTISKID SYSTEM

The antiskid system provides optimal wheel braking by controlling each wheel of the main landing gear independently, locked wheel crossover protection, touchdown protection, and incorporates a comprehensive built-in-test (BIT) system. It will also inhibit touchdown protection during gear retraction to allow the use of the anti-spin braking provided by the brake-metering valve. Brake system fault indications and operational status are provided by the EICAS as an ANTISKID FAIL indication and the failed LRU is reported to the integrated Cessna Diagnostic and Maintenance System (CDMS) for display indication.

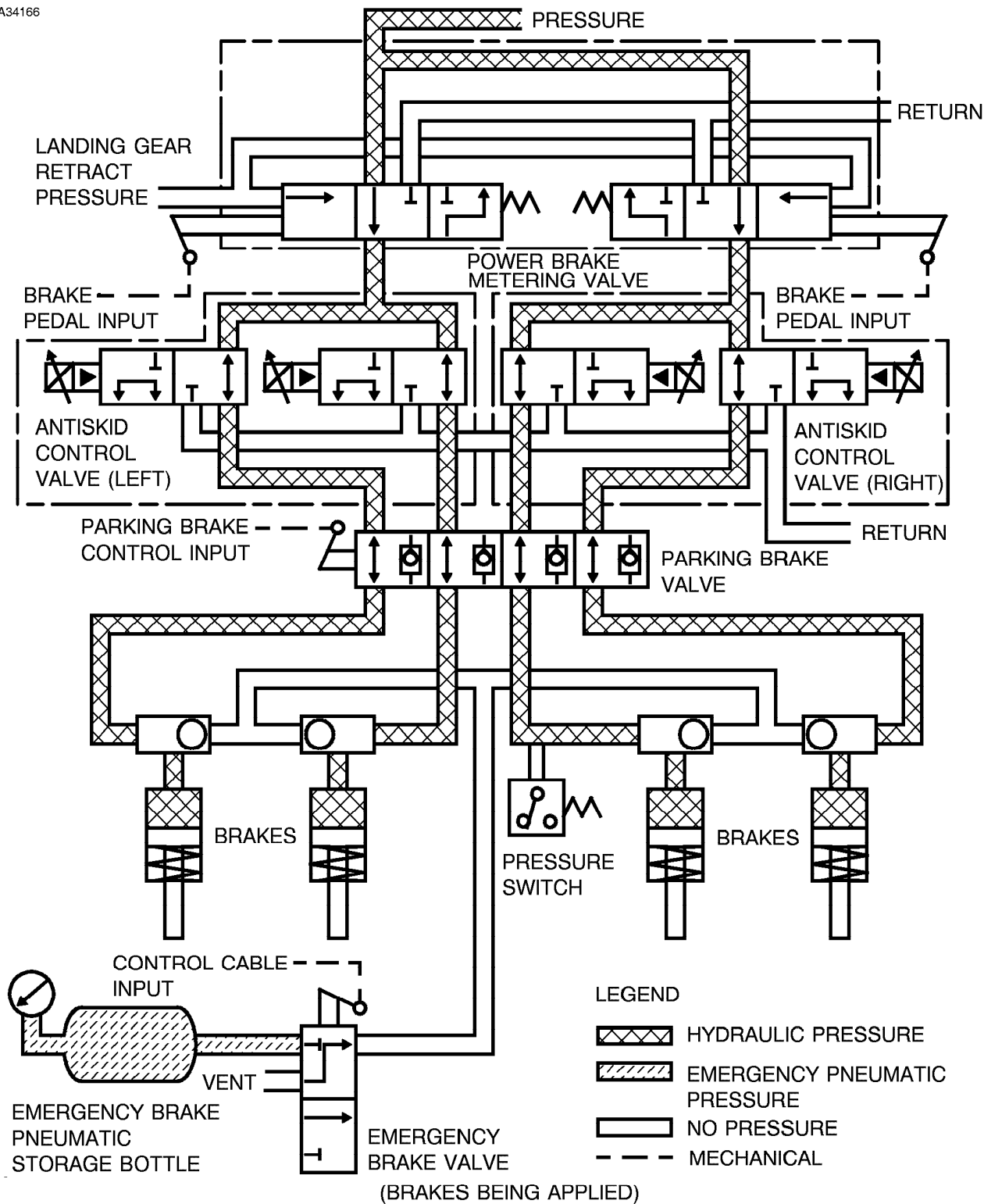
The antiskid system works in conjunction with the hydraulic brake system to provide optimal braking on any runway surface. Four transducers monitor the main gear wheel speed, one for each wheel. These transducers transmit wheel speed information to the antiskid controller located in the tailcone aft of the baggage compartment. The antiskid controller continuously monitors and updates wheel speed information to detect a wheel skid condition. In the event of a wheel skid, the antiskid controller senses the skid and sends an appropriate level current signal to the corresponding wheel antiskid control valve that decreases commanded brake pressure and alleviates the wheel skid.

Brake antiskid control remains active until the main gear squat switches signal that a landing has occurred. Wheel braking could remain unavailable for up to five seconds after the squat switches realize weight on wheel. In the case of landing on wet or ice covered runways, the touchdown protection will be overridden when the wheel rotations meets a specified speed requirement (59 knots).

The antiskid system can be manually activated and deactivated by the ANTISKID switch located on the landing gear control panel on the lower left hand side of the copilot's instrument panel. In the ON position the antiskid system will perform all normal automatic functions.

ANTISKID BRAKE DIAGRAM

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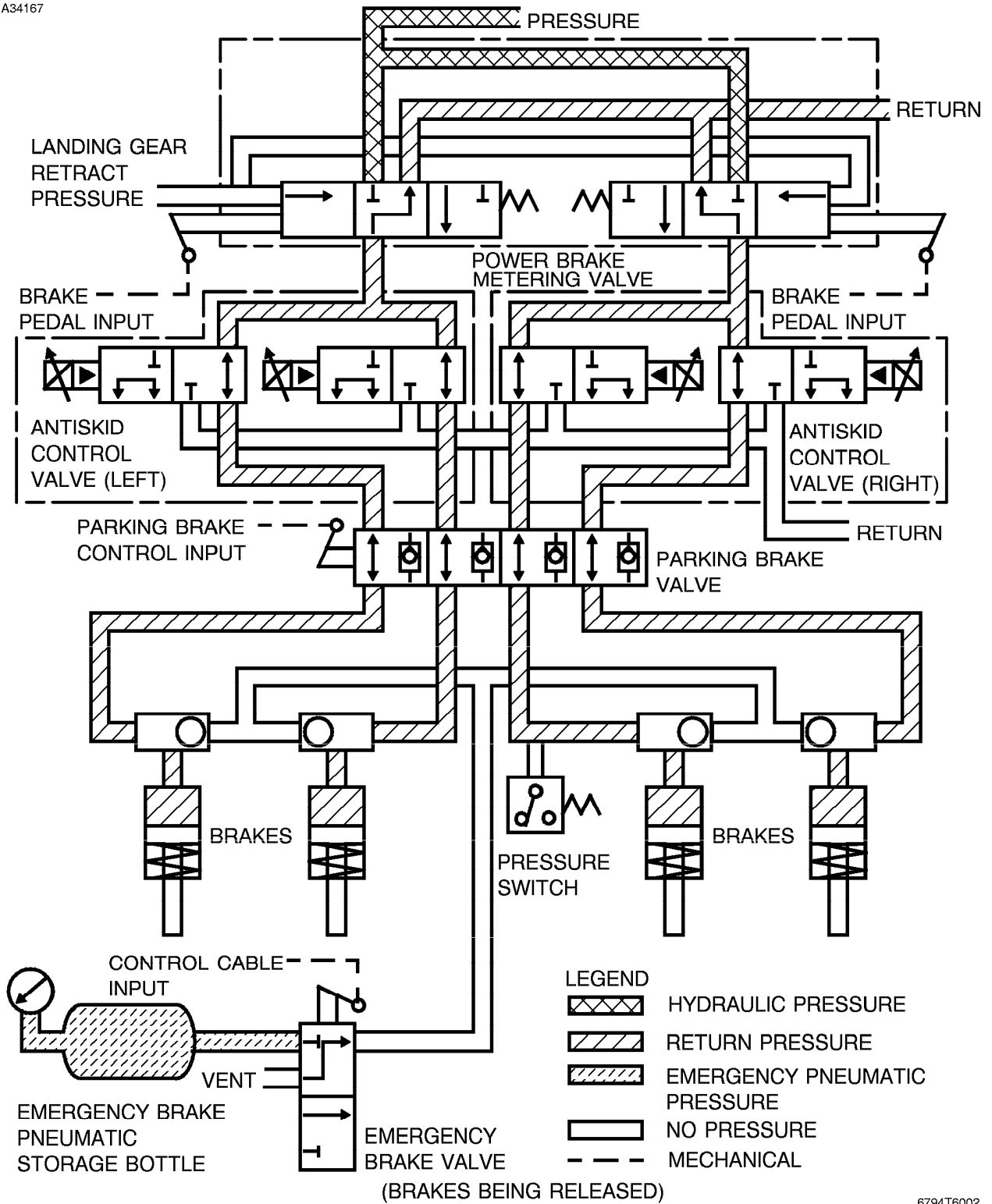


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Figure 2-13 (Sheet 1 of 4)

ANTISKID BRAKE DIAGRAM

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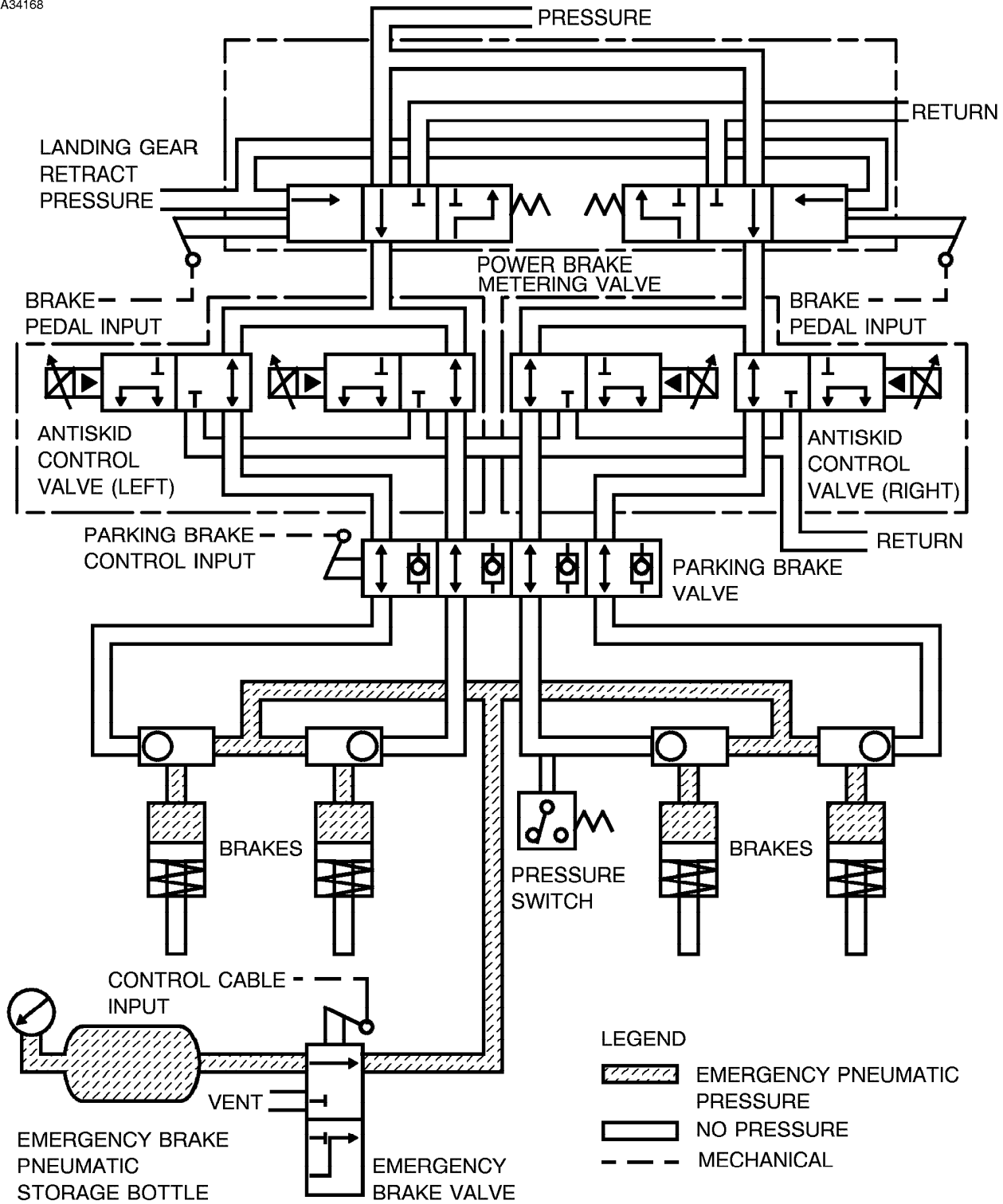


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Figure 2-13 (Sheet 2)

ANTISKID BRAKE DIAGRAM

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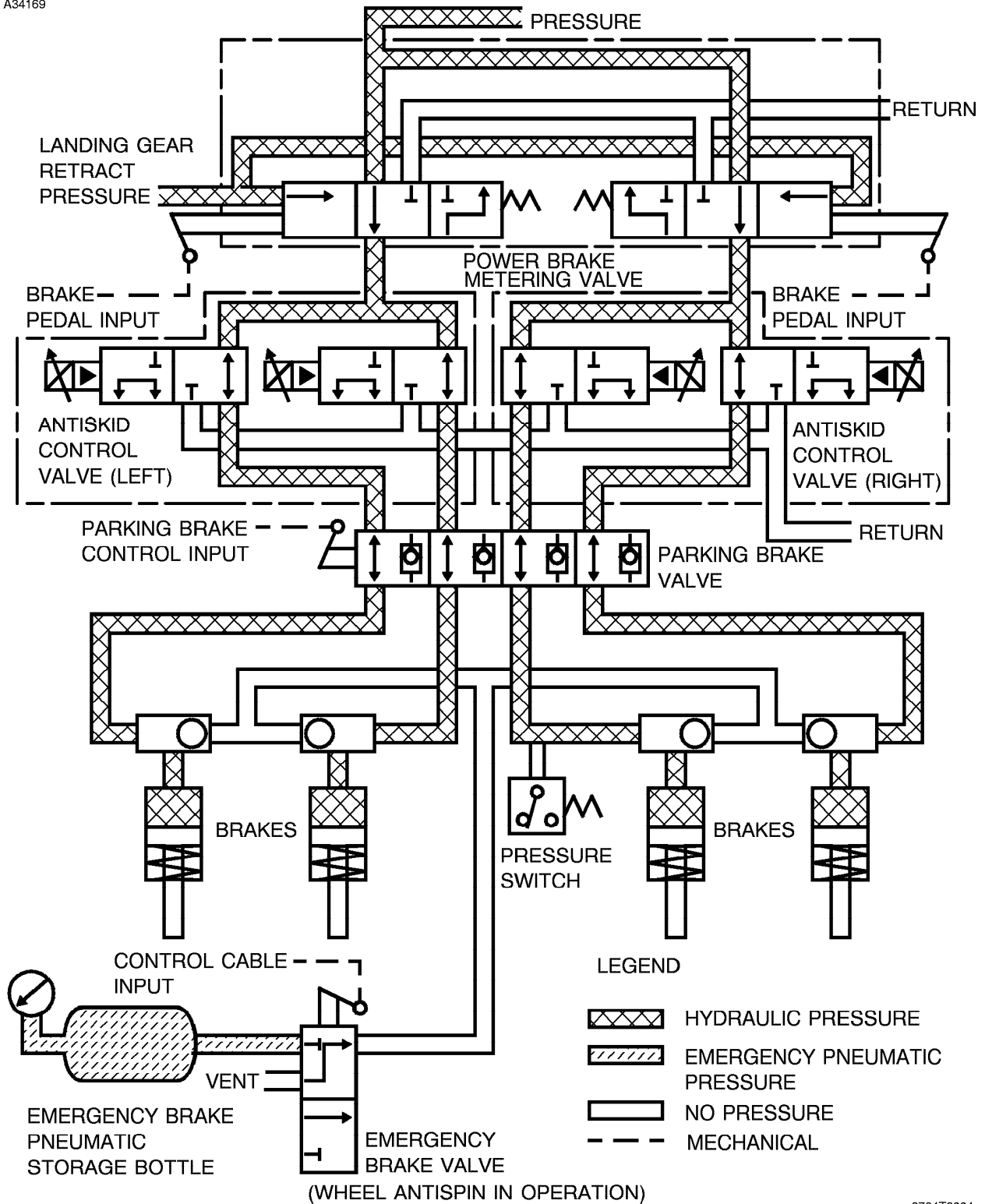
(EMERGENCY BRAKES BEING APPLIED)

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Figure 2-13 (Sheet 3)

ANTISKID BRAKE DIAGRAM

A34169



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Figure 2-13 (Sheet 4)

PARKING BRAKE

The parking brake valve is engaged by pulling the parking brake T-Handle located on the aft side of the center pedestal. Pulling of the T-Handle activates check valves within the parking brake valve that trap existing or subsequent pressure from application of the toe brake pedals. The parking brake valve also incorporates thermal relief valves to accommodate a pressure rise caused by fluid heating and expansion following engagement of the parking brake. The electrically powered auxiliary hydraulic pump may be used to set the parking brake if the engines are not operating.

If a heavy braking condition was observed during landing, or in the event of an aborted takeoff, the brakes should be allowed sufficient cool-down time before applying the parking brake. Due to the decreased cooling airflow in a stopped condition the thermal relief plugs in the wheel can melt causing the main gear tire to lose pressure.

BRAKE FUSE OPERATION

In the event a brake line failure occurs on the landing gear, brake fuses will close after a certain volume of fluid passes to prevent loss of all hydraulic fluid. These fuses will self reset after inlet pressure drops to zero and incorporate a manual bypass to bleed the brake lines for servicing.

EMERGENCY BRAKING

In the event of a main hydraulic brake system failure, braking is accomplished by the use of a backup pneumatic system. The backup system uses a charged nitrogen bottle to provide pressure through dedicated pneumatic lines and an emergency brake valve located on the forward pressure bulkhead. The emergency brake valve sends this line pressure to the brake shuttle valves located on the wheel brake piston housings. Emergency braking is activated by the use of a lever, located to the right of the main pedestal and underneath the pilot's side of the cockpit instrument panel. Pulling this lever enables the nitrogen charge to be distributed equally between all four brake assemblies proportional to the amount of deflection induced by the pilot. The emergency brake lever is spring loaded, which enables it to close the emergency brake valve and reduce the amount of pressure and vent the residual nitrogen overboard.

NOTE

Pneumatic brake pressure is proportional to the lever position. Use caution in initial application of the emergency brake lever until a "feel" for the deceleration rate is obtained. Too sudden of an application can result in blown main tires

A fully serviced emergency brake bottle will initially provide approximately 95 cubic inches of nitrogen in each bottle at a maximum of 1800 to 2050 PSIG. The amount of brake application by the emergency brake handle is mechanically restricted in order to limit the amount of pressure metered to the brakes. Under normal braking conditions, full handle travel will result in braking that is just short of that which would cause tire skidding, however caution should still be used so as not to over brake. The antiskid system will not function with emergency braking. When surface conditions are other than dry and normal, braking application should be adjusted accordingly.