CHAPTER 14
LANDING GEAR AND BRAKES

CONTENTS

ILLUSTRATIONS

CHAPTER 14
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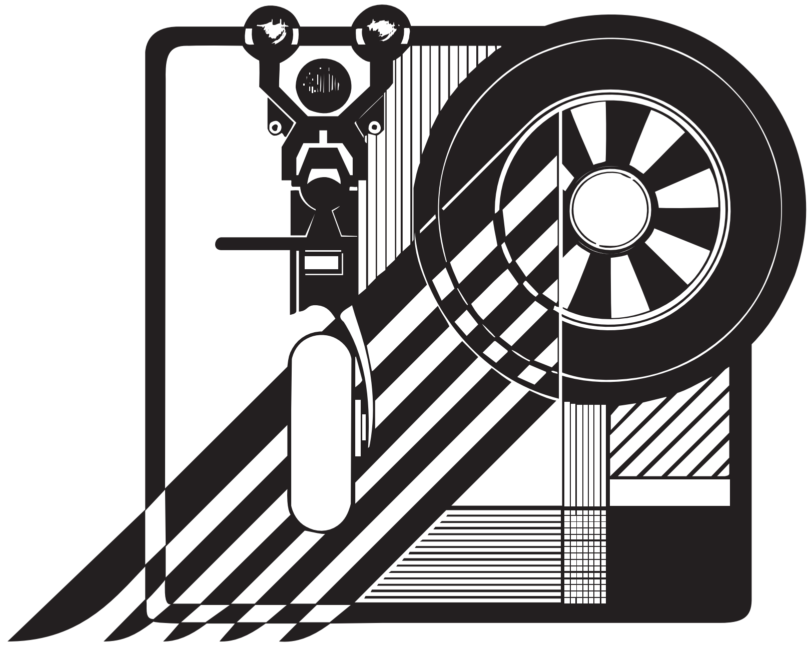

INTRODUCTION

This chapter discusses the landing gear, steering, and brake systems of the P-180 Avanti II. The hydraulic system powers all three systems. The aircraft has retractable tricycle landing gear with nosewheel steering. The two-rotor carbon composite brake assemblies have shuttle valves that operate the brakes in both normal or emergency conditions.

LANDING GEAR

The aircraft has hydraulically actuated, fully retractable tricycle landing gear. The double wheel nose gear retracts forward into the nose section and the single wheel main gear retracts rearward into the fuselage.

Doors completely cover the retracted gear. The rear door of the nose gear and the forward doors of the main gear are mechanically connected to, and operate with, the gear itself. These doors remain open when the gear is extended. All other doors close with the gear extended. All three landing gear have air-oil shock absorbers.

A hand pump emergency extension system is available to extend the gear if the main hydraulic system fails.

MAIN GEAR

The main landing gear (MLG) is a single axle attached to the fuselage (Figure 14-1). Its actuator contains the internal hydraulic up and down locks. Housings at each end of the actuator contain the up and down limit switches.

Figure 14-1. Main Landing Gear

A shuttle valve on the actuator connects the actuator to the hydraulic system normal and emergency lines.

One wheel and one brake are mounted on each main landing gear leg.

The rated inflation pressure for each tire on the main wheel is 115 psi on jacks, 118 psi for aircraft certified for 12,100 maximum takeoff weight (MTOW).

NOTE

For aircraft resting on the wheels, the pressures are 119 psi and 121 psi (12,100 MTOW).

NOSE GEAR

The nose landing gear (NLG) is a twin axle that enables steering (Figure 14-2).

Figure 14-2. Nose Landing Gear

With steering system in taxi mode, the nose gear is steerable through 50° either side of center. With steering system in takeoff mode, the nose gear is steerable through 20° either side of center.

For unpaved runway operations, a suitable gravel protection kit is available for the nose gear.

The nose gear actuator contains the internal hydraulic up and down locks. Housings at each end contain the up and down limit switches. A shuttle valve on the actuator connects the actuator to the hydraulic system normal and emergency lines.

Two wheels are mounted on the nose landing gear strut.

The nose tire has a rated inflation pressure of 64 psi on jacks.

NOTE

For aircraft resting on the wheels, the inflation pressure is 66 psi.

SQUAT SWITCHES

Two squat microswitches guard against inadvertent retraction of the landing gear when the aircraft is on the ground or when the nose wheel is not centered. One squat switch is on the nose landing gear shock absorber and the other is on the right main landing gear shock absorber (Figure 14-3).

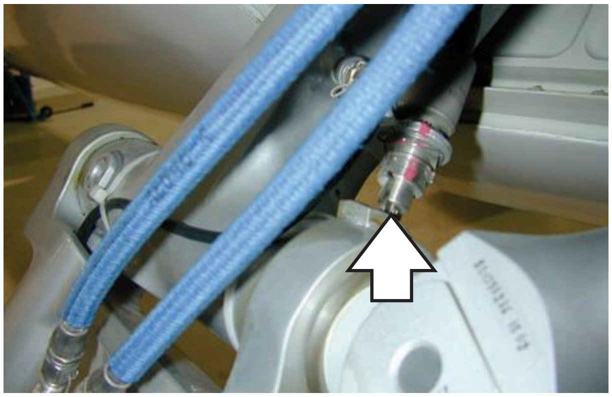

Figure 14-3. Main Gear Squat Switch

The switches inhibit the hydraulic power package from supplying pressure fluid to the up side of the gear actuators, and also control many other system functions. A third squat switch on the left main landing gear shock absorber controls pressurization and anti-ice functions.

LIMIT SWITCHES

Electrical up and down limit switches are incorporated into the normal hydraulic system extension and retraction circuits (Figure 14-4). The switches signal the electrical depressurizing valve (EDV) or the hydraulic pump, as applicable, at the end of each cycle.

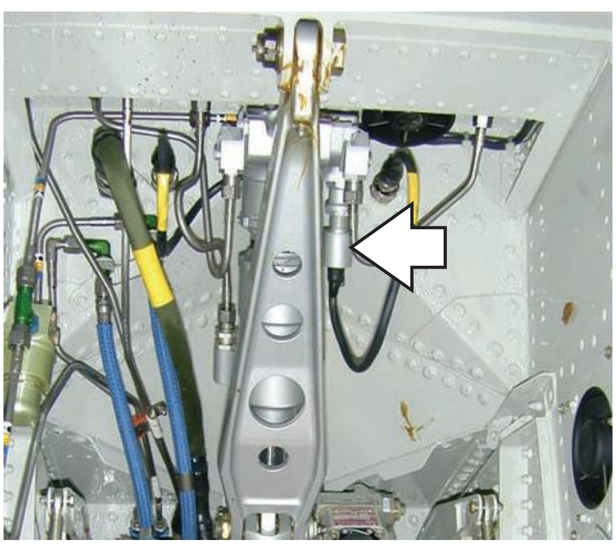

Figure 14-4. Up and Down Limit Switches

At the end of the retraction cycle, the up limit switches de-energize the hydraulic pump because hydraulic pressure is no longer required. System pressure goes to 0 psi.

At the end of the extension cycle, the down limit switches energize the EDV to the low duty position. System pressure is maintained at 1,000 psi in preparation for braking and steering during landing.

LANDING GEAR WEIGHT-ON-WHEELS—SYSTEMS FUNCTION

Nose Gear Weight-On-Wheels Switch (S-93)

- Autopilot System
- Autofeather Warning Systems
- Nose Wheel Steering System
- Digital Clock
- Air Data System

Left Main Gear Weight-On-Wheels Switch (S-85)

- Pressurization System
- Emergency Power Unit
- Wing Anti-ice System

NOTE

Connected to Left and Right WOW switches.

Right Main Gear Weight-On-Wheels Switches (S-8)

- Hydraulic Power Systems
- Stall Warning System
- DC Generation System
- Wing Anti-ice System

NOTE

Connected to Left and Right WOW switches.

LANDING GEAR CONTROLS

The LANDING GEAR panel is on the pilot lower instrument panel next to the center pedestal. The panel is marked with an arrow and UP and DN positions (Figure 14-5).

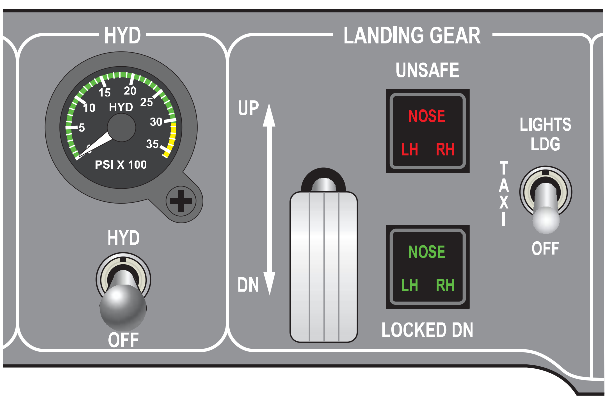

Figure 14-5. Landing Gear Panel

The red UNSAFE lights marked NOSE, LH, and RH illuminate to indicate gear is in transit or not down and locked. The green LOCKED DN lights illuminate when the landing gear is extended and in the down and locked position.

When the gear is up and locked, no lights are illuminated.

Each gear actuator contains an internal uplock and downlock. The locks are actual detents that hold the gear in place. Only hydraulic pressure can release the locks. The three green LOCKED DN gear indicator lights are attached to, and operated by, the downlocks. The three red UNSAFE gear indicator lights are operated by both the uplocks and downlocks.

A green light is an indication that the associated gear has reached its downlock. The associated red light extinguishes to confirm the down-and-locked position has been reached and the gear is no longer in transit.

As a gear leaves the up-and-locked or down-and-locked position, the associated red light illuminates to indicate the gear is in transit. When the gear reaches the selected position and locks, the red light extinguishes.

CAUTION

A red LH or RH light illuminated after gear retraction may indicate that the corresponding side main gear rear door is not positively closed and locked. If this occurs, the positive lock of the landing gear leg can be checked through the hydraulic pressure indication. The door/light logic is in the retraction circuit only.

The main gear rear doors close after both extension and retraction. They are held closed by J-hooks in each wheel well. If a J-hook is misaligned or there is play in the door, the associated red main gear door light may illuminate after retraction.

If hydraulic pressure is zero after gear retraction and 1000 psi after gear extension, the gear is safely up or down, respectively. A red light—after retraction only—indicates a door problem. A red or extinguished green light after extension—with 1000 psi indicating—is probably a position light indicating problem.

If hydraulic pressure is 3,000 psi after gear extension or retraction, a red light indicates an unsafe gear.

The panel also contains two lights for the nose-wheel steering system: STEER T-O and STEER TAXI discussed later in this chapter.

The Essential bus powers landing gear control and indication through the 3-amp LDG GEAR CONT circuit breaker on the pilot CB panel.

Testing Indicating System

The SYS TEST rotary knob tests the landing gear indicating system. When the button is pressed and held, the red UNSAFE and green LOCKED DN lights illuminate. The gear warning horn sounds with the speaker selected and the AVIONICS switch in COM 1 ONLY or ON (see Chapter 4 Master Warning Systems).

AURAL WARNING

The landing gear system has an aural warning system. The aural warning system is tied to the flaps, landing gear, and power levers. Various combinations of these can trigger the aural warning (horn). In the following instance, the horn can be silenced:

Power on one or both engines reduced below a setting sufficient to maintain flight while landing gear is not down and locked. The tone may be silenced with the GEAR MUTE switch on the right power lever (Figure 14-6).

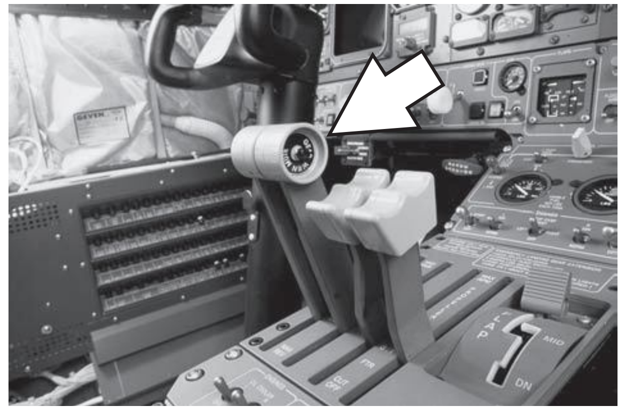

Figure 14-6. Gear Mute Switch

In the following instances, the horn cannot be silenced and continues until either the landing gear is extended or flaps are retracted to the clean (UP) position:

- If flaps lowered to the DN position and landing gear not down and locked (Figure 14-7)
- If flaps in MID position, landing gear not down and locked, and left power lever is retarded below approximately the half travel position

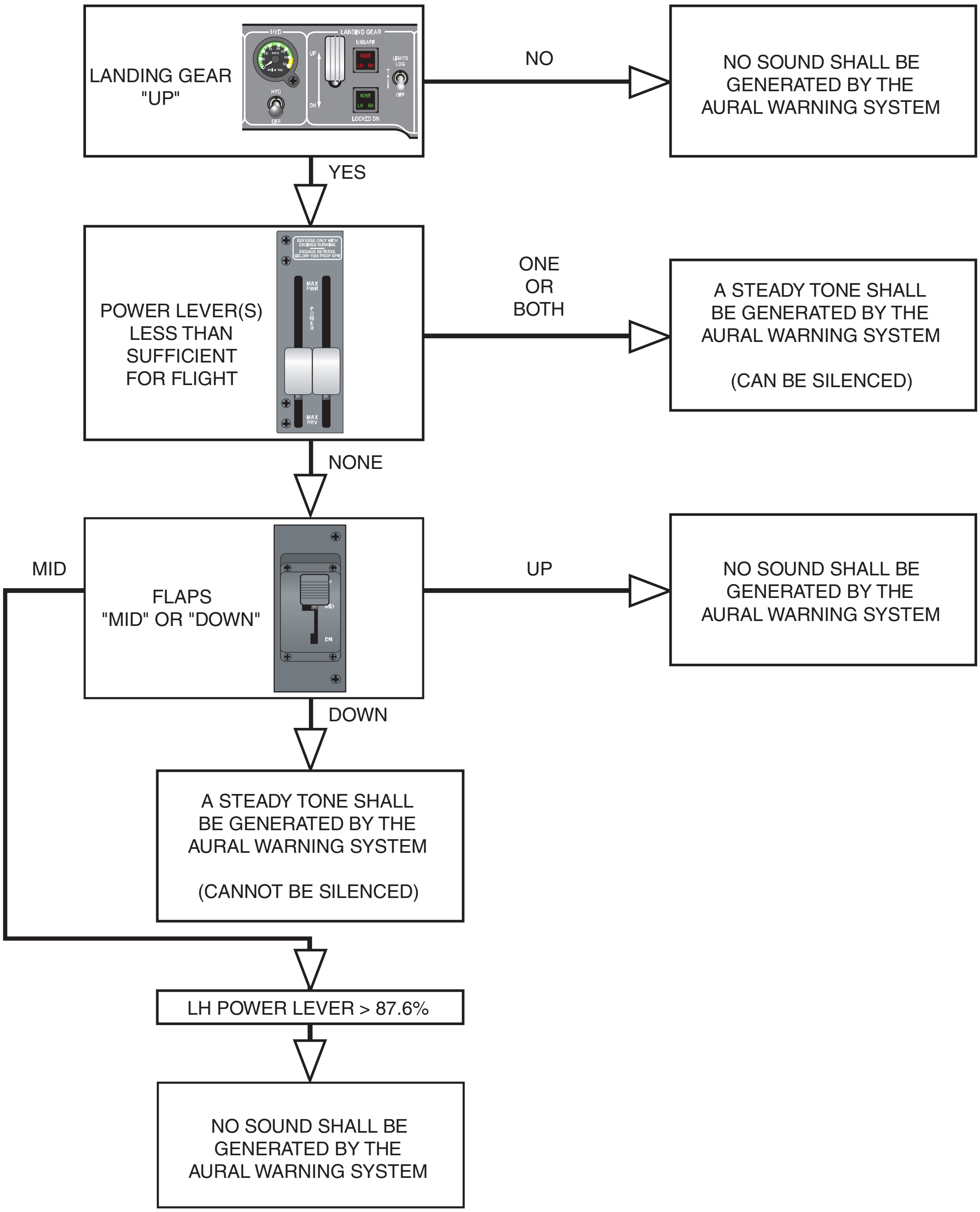

Figure 14-7. Audio Warning

EMERGENCY LANDING GEAR SYSTEM

The emergency landing gear system consists of an emergency selector valve (red T-handle) and a hand pump. The emergency selector valve is on the left side of the center pedestal and marked EMERG LDG. The hand pump has a telescopic-type handle and is on the right side of the pedestal (Figure 14-8).

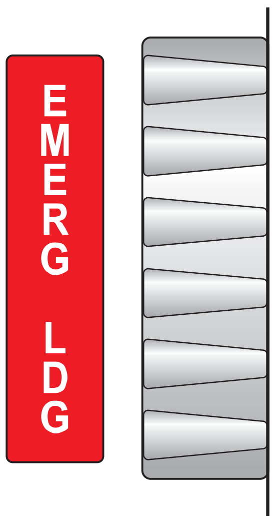

Figure 14-8. EMERG LDG T-Handle

The extend side of each gear actuator contains a shuttle valve. One side of the shuttle valve is connected to the normal hydraulic system (power package) and the other side is connected to the emergency hydraulic system (hand pump).

When pressure comes in one side of the shuttle valve to extend the gear, the ball in the valve is forced to the other side, thereby blocking incoming pressure from the opposite side. Only one hydraulic source, therefore, is available at one time to extend the gear.

There is no shuttle valve on the return line; it is a comon line plumbed back to the hydraulic reservoir.

When the EMERG LDG handle is pulled up, the following connections are made:

- Hand pump line to emergency gear down line
- Normal gear return line to emergency return line

The hand pump, emergency selector valve, and associated plumbing only extend the gear. The system does not allow emergency retraction by the pilot.

The hydraulic reservoir in the power package retains some fluid if a severe leakage or loss occurs.

As the pilot actuates the hand pump, pressure builds and is supplied to the three gear actuators (shuttle valves). The emergency gear down line is plumbed opposite the normal gear down line in the shuttle valve.

As the hand pump pressure increases, the ball in the shuttle valve repositions to allow emergency hydraulic pressure into the actuator to extend the gear. The normal return line is connected to the emergency return line to allow fluid flow back to the reservoir. This completes the circuit.

One liter of the 2.5 liter capacity remains for the hand pump. This guarantees enough fluid for landing gear emergency extension with the hand pump.

During hand pump operation, the pressure gauge on the HYD panel in the cockpit does not indicate pressure. The pressure transducer is between the hydraulic pump and a check valve on the supply line in the power package. If the hydraulic pump is switched off, the pressure gauge may go to zero in a few seconds even though pressure on the hydraulic system may be trapped for a long time.

An additional handle controls the manual selector valve for maintenance purposes on the ground only. It allows the gear to be retracted with the hand pump. The handle is on the right side of the pedestal and is inaccesible in flight.

OPERATION

Normal Retraction

Figure 14-9 shows an overview of the normal landing gear system. When the landing gear handle is placed in the UP position, the directional control valve is energized and routes pressure to the up side of the landing gear actuators. The electrical depressurizing valve is also deenergized to deliver hydraulic pressure at 3,000 psi to unlock the internal locks of all actuators. The gear retracts.

While the landing gear is in transit, the red UNSAFE light for each gear is illuminated. When the uplocks are engaged, the lights extinguish. When the gear is up, the up limit switches deenergize the hydraulic pump relay. This depowers the pump; hydraulic pressure goes to 0 psi.

Normal Extension

When the landing gear handle is placed to DN, the directional control valve in the hydraulic package is deenergized. The valve moves under spring pressure to open the gear down line. Because the EDV is already deenergized, the hydraulic pump commences operating at 3000 psi.

The pressure unlocks the internal up locks: the gear extends. The landing gear red UNSAFE lights illuminate until the gear is down and locked. When the downlocks operate, the UNSAFE lights extinguish. The green LOCKED DN lights then illuminate.

The down limit switches then energize the EDV to the low-duty position. Hydraulic pump pressure reduces to 1,000 psi. The pressure remains at 1,000 psi until the HYD switch is set to OFF or another gear selection is made.

Emergency Extension

Figure 14-10 shows the landing gear system in emergency operation. If a hydraulic system failure occurs because of a line break or a power package malfunction, the hand pump and emergency selector valve provide for emergency extension.

When the EMERG LDG handle is pulled up, the auxiliary hydraulic (hand pump) line is connected to the emergency (gear down) lines on the valve of each actuator. Operation of the hand pump operates shuttle valves in the gear actuators to provide hydraulic pressure to unlock and extend the gear.

The emergency extension procedure requires the HYD switch to be set to OFF, gear handle be in the DN position, and the EMERG LDG handle pulled up. About 60 hand pump strokes and 90 seconds are required for a positive lock of the gear (three LOCKED DN green lights illuminated).

LIMITATIONS

The maximum tire speed is 154 kts.

EMERGENCY PROCEDURES

Landing with Gear Up or Unlocked

If one or more red UNSAFE lights remain illuminated with three green lights after landing gear extension, it is possible that the downlock switch controlling the gear position light has failed. If the hydraulic pressure reading is about 3,000 psi, a possible jamming has occurred. Applying positive load factors or sideslipping the aircraft may lock the gear in place.

If the hydraulic pressure reading is stabilized around 1,000 psi, the gear can be assumed to be down and locked.

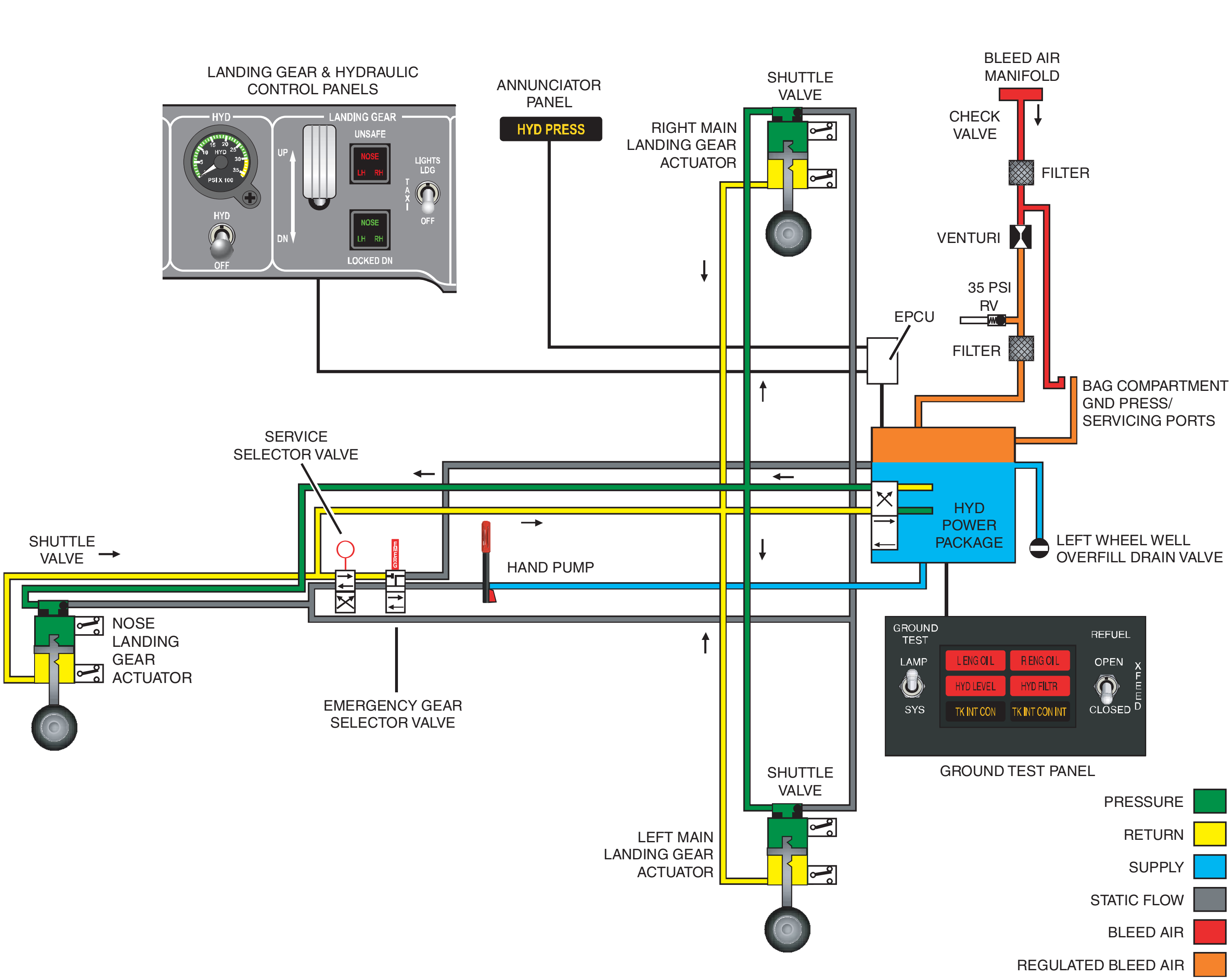

Figure 14-9. Landing Gear System—Normal Operation

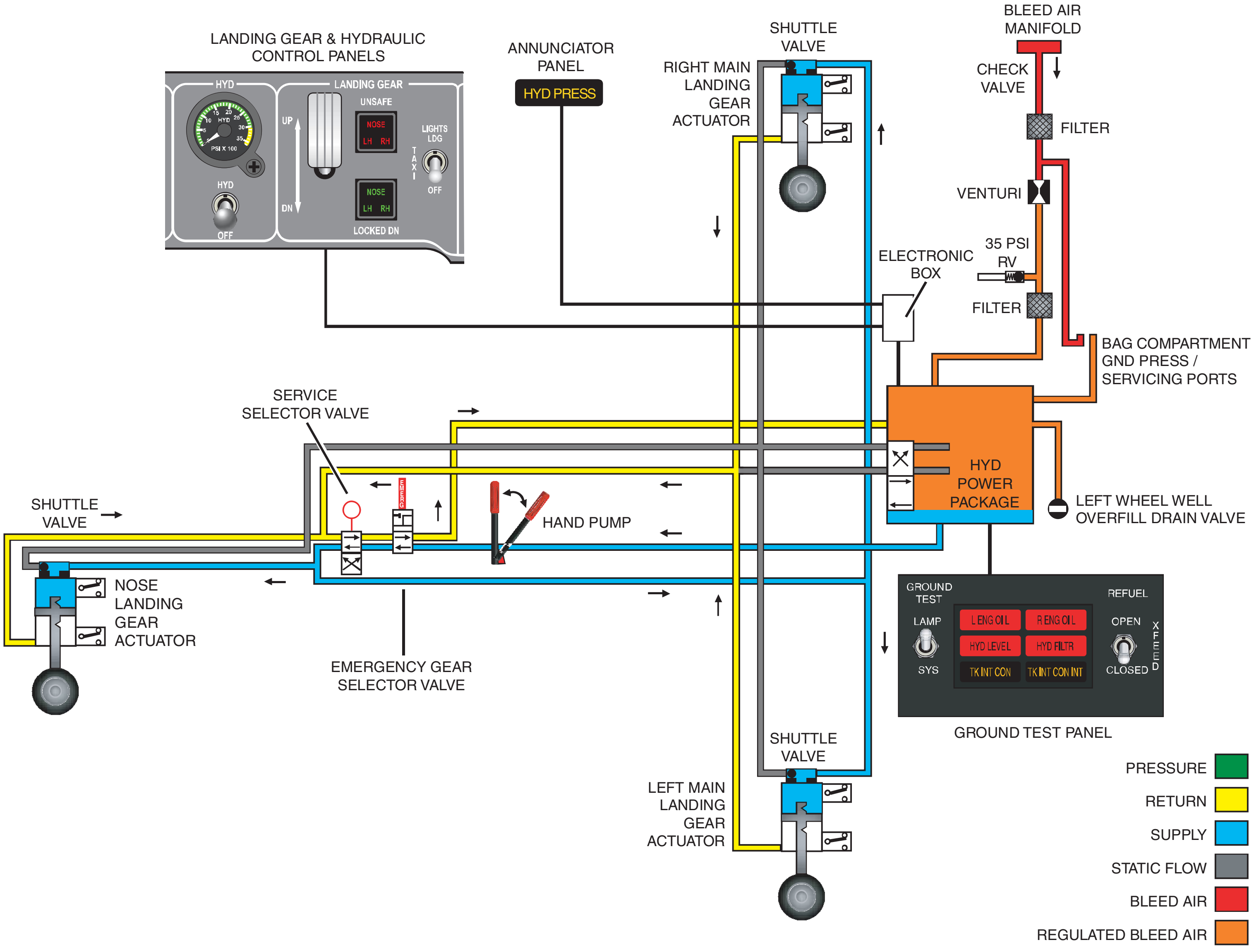

Figure 14-10. Landing Gear System—Emergency Operation

If the associated green light is not illuminated (red UNSAFE still illuminated), lower the gear with the EMERG LDG handle and the hand pump.

If this procedure is also unsuccessful, a tower fly-by could help determine the status of the landing gear.

Nose Gear Up or Unlocked Landing

If the nose gear is up or unlocked, fly a normal approach and landing. Upon landing, maintain a nose up attitude to the lowest practical speed. After the nose touches the ground, apply maximum braking and reverse.

NOTE

When operating in icing conditions, perform the same procedure except that flaps must be in the MID position and approach speed must be the flaps MID approach speed plus 6 KIAS.

Main Gear Unlocked Landing

If a main gear is assumed extended, but unlocked, fly a normal approach and landing. Touch down on the locked gear in a nose up attitude. After touchdown, keep the wing up on the side with the unlocked gear and apply reverse cautiously. When speed has decreased considerably, apply brakes.

Main Gear Up

If one or both main gear remain retracted after using normal and emergency extension procedures, push the EMERG LDG red handle back in and turn on the hydraulic pump. Perform the Gear Up Landing procedure.

NOTE

When operating in icing conditions, perform the same procedure except that flaps must be in the MID position and approach speed must be the flaps MID approach speed plus 6 KIAS.

Gear Up Landing

Select a suitable landing area, inform ground personnel, brief passengers on use of emergency exit, and ensure that all occupants have seat belts and shoulder harnesses secured properly.

If conditions permit, burn off excess fuel. When ready to land, complete the landing checklist as for a normal landing except that the gear selector lever should be in UP.

In order to silence the gear warning horn, pull the AURAL WARN circuit breaker on the pilot CB panel prior to extending the flaps.

NOTE

In this case, no AURAL STALL WARNING signal is provided.

The flaps should be DN for final approach and landing. Make a normal approach and, when landing is assured, depressurize the aircraft, switch off both generators, place the condition levers to CUT OFF, select fuel pumps OFF and fuel firewall shutoff valves CLOSED. Finally, switch off the battery.

NOTE

Turning both generators off will disable the DUMP switch, therefore, ensure the aircraft is completely depressurized before switching the generators off, or depressurize using the MAN pressurization mode and holding the UP/DN control knob in the UP position.

Land smoothly, touching down in a level attitude. All occupants should evacuate as soon as the aircraft has stopped.

NOTE

When operating in icing conditions, perform the same procedure except that flaps must be in the MID position and approach speed must be the flaps MID approach speed plus 6 KIAS.

STEERING SYSTEM

The nosewheel steering system is electrically controlled and hydraulically actuated. The steering system can be actuated only when the aircraft is on the ground with weight on the nose gear squat switch.

COMPONENTS

The system consists of the following:

- Steering selector valve
- Servo valve
- Command potentiometer
- Steering actuator and feedback potentiometer
- STEERING CONTROL button
- STEER T-O/STEER TAXI annunciator on PFD
- STEER FAIL annunciator

In addition to these components, two restrictors provide shimmy damping when the steering is off; two relief valves protect the unit against pressure surges on the steering mechanism, and two non-return valves prevent cavitation in the steering lines.

The nose gear down limit switch provides an additional safety feature by preventing the steering sytem from being powered if the nose gear is not down-and-locked.

Steering Selector Valve

The steering selector valve is a solenoid-operated valve that essentially acts as a shutoff valve. It supplies pressure to the servo valve. It also isolates the hydraulic supply and connects the actuator ports together (Figure 14-11).

When not energized, the valve disconnects the steering system from the hydraulic system. This converts the steering actuator to a shimmy damper.

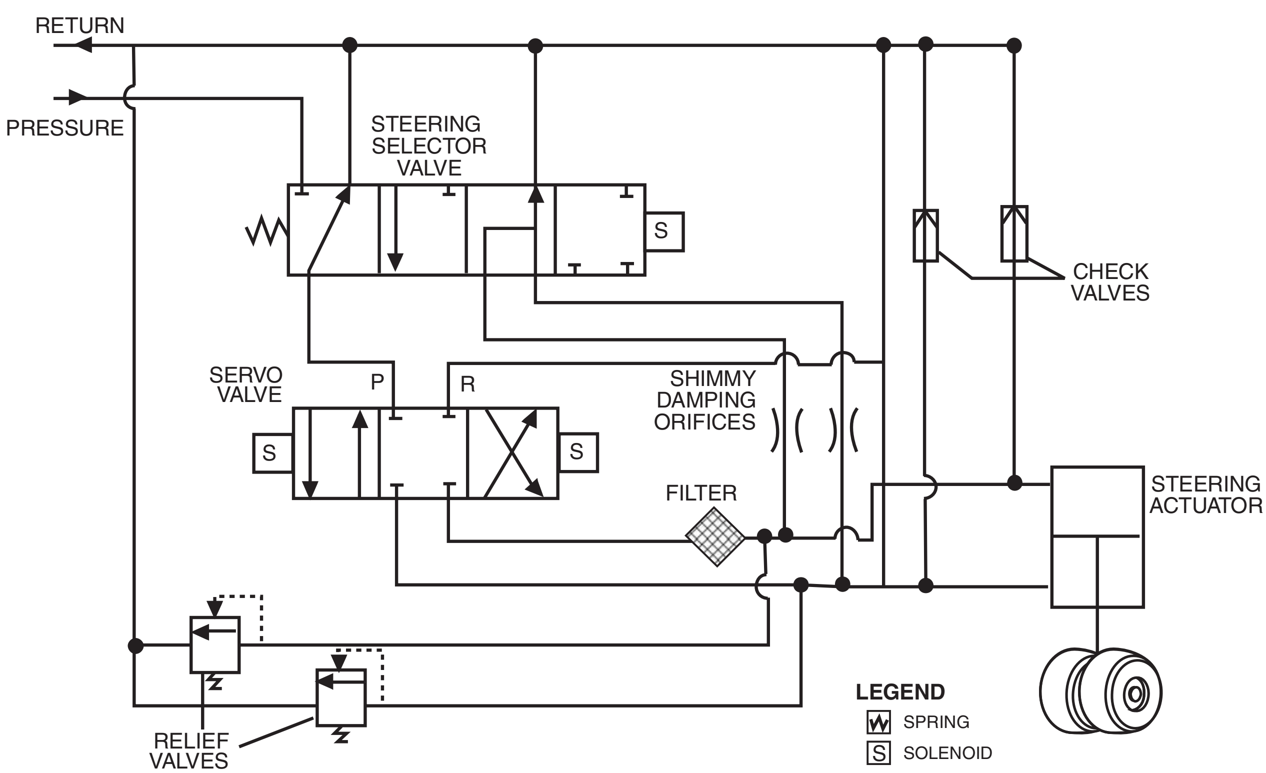

Figure 14-11. Steering Manifold

When energized, the valve connects the hydraulic system to the servo valve to drive the steering actuator.

The squat switch on the nose gear permits the selector valve to be energized when the aircraft is on the ground. A fault monitoring circuit also prevents energizing the selector valve if the steering system has failed.

Servo Valve

The servo valve receives hydraulic fluid from the steering selector valve and passes it on to the actuator (Figure 14-11). The servo valve controls the direction of fluid flow in proportion to an electrical control input signal. The signal that controls the servo valve is a function of the difference between the signals generated by two potentiometers: a command potentiometer driven by the rudder pedals and a feedback potentiometer driven by the nose gear strut while being steered.

Command Potentiometer

The command potentiometer is on a bracket below the floor. It is a rotary potentiometer connected to the front rudder sector (Figure 14-12).

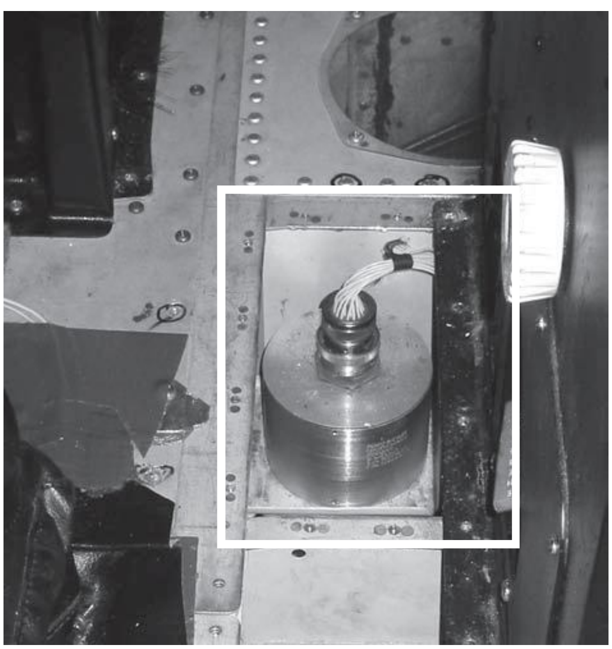

Figure 14-12. Command Potentiometer

As the pilot pushes on a rudder pedal, the potentiometer rotates with it. This rotation creates an electrical signal that is sent to the servo valve.

The signal is proportional to the direction and angle of the rudder pedal movement. The command potentiometer contains all the control and fault circuits for the steering system.

Steering Actuator and Feedback Potentiometer

The steering actuator, which is on the nose gear strut, is a cylinder assembly containing the feedback potentiometer (Figure 14-13).

As the nose strut turns, the feedback potentiometer rotates with it. This rotation creates an electrical signal that is sent to the servo valve.

The servo valve compares the signal from the command and feedback potentiometers to ensure the nose gear strut is deflected the proper amount.

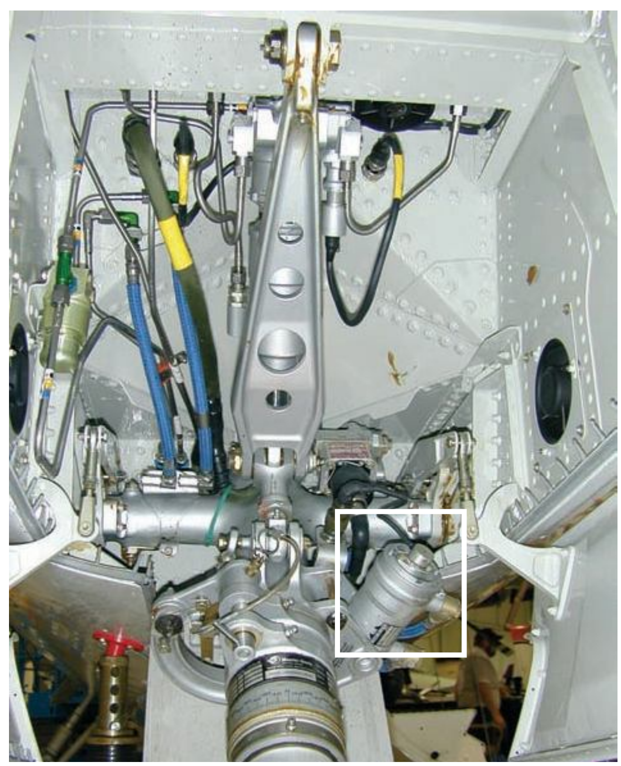

Figure 14-13. Feedback Potentiometer

STEERING CONTROL Button

A button labeled NOSE STEER on the left horn of the pilot control wheel selects the different operating modes of the steering system (Figure 14-14).

The black two-position momentary switch selects either the high gain or low gain mode. High gain mode is for taxi operations; low gain mode is for takeoff operations.

The button has two steps, or positions, to activate the steering system. The first step, taxi mode, is activated when the button is pressed halfway down. The second step, takeoff mode, is activated by pushing the button all the way down.

Takeoff must be selected prior to TAXI, that is, TAXI may only be activated if TAKEOFF is first selected.

STEER T-O/STEER TAXI Advisory

In takeoff mode, the STEER T-O haloed white advisory appears on both PFDs.

In taxi mode, the haloed white flashing advisory STEER TAXI appears on both PFDs (Figure 14-15).

STEER FAIL Annunciator

The red STEER FAIL annunciator on the annunciator panel illuminates if the fault monitoring circuit detects a steering system failure.

Figure 14-14. Steering Control Button

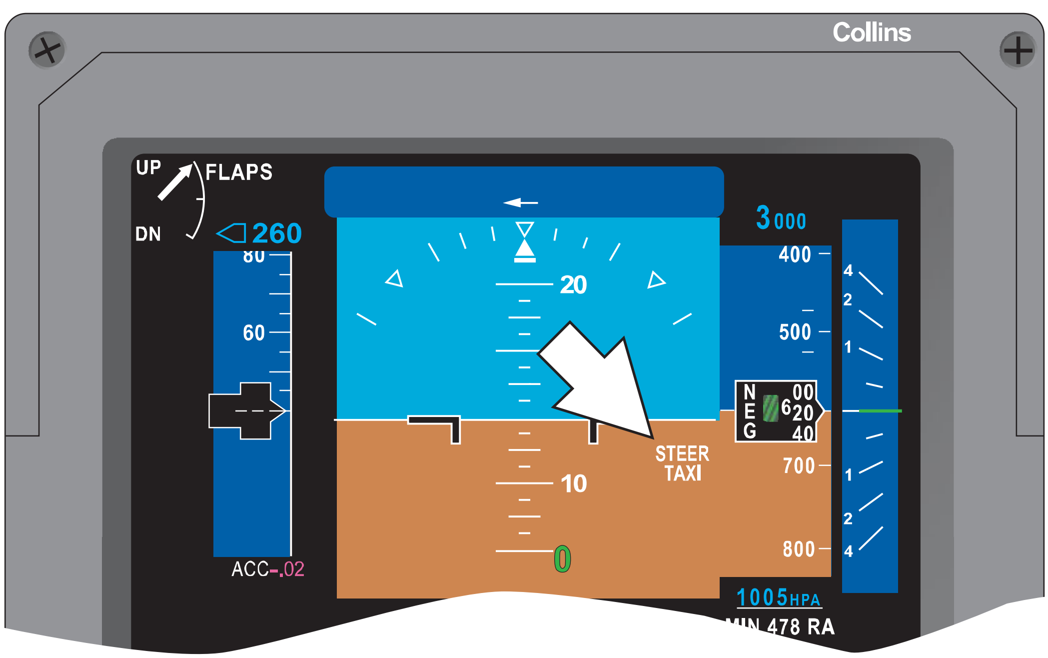

Figure 14-15. Steer T-O/Steer Taxi Light

OPERATION

Figure 14-16 shows an overview of the nosewheel steering system. When the system is not engaged, pushing the NOSE STEER button to the first step (halfway down) does not engage the steering system. The switch must first be pressed to the second step (all the way down) to engage the system. This enables the takeoff mode. The nose gear can then be steered up to 20º in both directions. Pressing the button halfway down again engages taxi mode. The nose gear can be steered up to 50º in both directions.

The steering can be disengaged by depressing the MSW on the outboard horn of either the pilot or copilot control wheels.

NOTE

In addition to the steering system disengagement, the momentary MSW pushbutton, when depressed, disengages the autopilot and yaw damper and inhibits the primary pitch trim or rudder trim in the event of an actuator runaway.

A steering dead band in the system enables the pilot to operate the rudder on crosswind takeoffs or landings. The dead band corresponds to +/-6 of rudder pedal travel either side of center. This feature keeps the nose wheel centered while the pilot makes small rudder inputs to compensate for crosswinds.

Steering system control and monitoring is powered by the Essential bus through the 3-amp NOSE STRG circuit breaker on the pilot CB panel.

Testing System

The warning and feedback circuitry can be checked for proper operation by rotating the SYS TEST knob on the instrument panel to the STEER position and then depressing the SYS TEST knob (see Chapter 4 Master Warning).

LIMITATIONS

Steering in TAXI position is only for taxiing operations. It is not to be used for takeoff.

Steering engagement during landing is prohibited.

Maximum speed in takeoff mode is 60 kts.

EMERGENCY PROCEDURES

Steering System Failure

If the red STEER FAIL annunicator illuminates, the steering system automatically disengages. Press the red MSW to ensure system disengagement. Check that both steering lights are extinguished.

Maintain directional control with differential braking and asymmetric power.

Nosewheel Steer Runaway

As soon as an uncontrolled heading change occurs, press the red MSW on the outboard horn of either control wheel.

Maintain directional control with differential braking and asymmetric power.

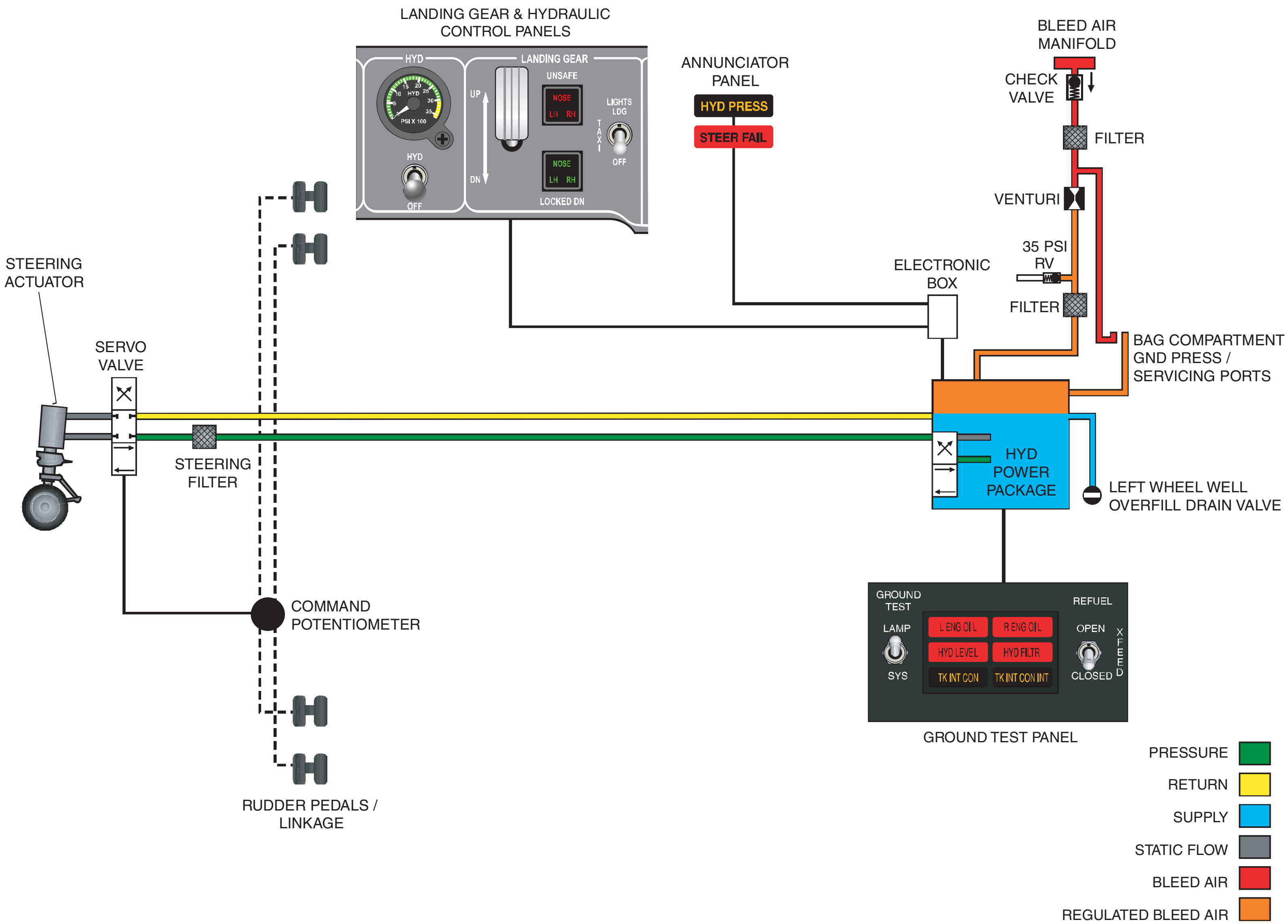

Figure 14-16. Nosewheel Steering System

BRAKE SYSTEM

The left rudder pedals are mechanically interconnected to one another and to a common brake valve. The right rudder pedals are similarly interconnected and linked to a separate brake valve.

The brakes are actuated by depressing the top of the rudder pedals. The toe-operated brake valves operate the hydraulic normal and emergency braking system. The brake valves operate as hydraulic metering valves during normal operation and as master brake cylinders when hydraulic pressure is not available.

The rudder pedal interconnection design means that the pilot who pushes hardest controls aircraft braking.

A pressure relief valve in each normal brake main line protects the brake line against overpressure.

COMPONENTS

Major components of the system include the following:

- Brake assemblies
- Brake valves
- Relief valves
- Parking valves
- Three-way selector valve
- Brake wear indicators
- Parking brake

Brake Assemblies

The brake is a multiple-disk brake. Hydraulic pressure actuates the brakes. A shuttle valve has connections for both normal and emergency pressure lines.

The BF Goodrich carbon brake uses a two-rotor carbon composite brake assembly. The assembly consists of one stator disk sandwiched between two rotor disk assemblies. Steel clips fastened to the rotors protect the carbon from damage (Figure 14-17).

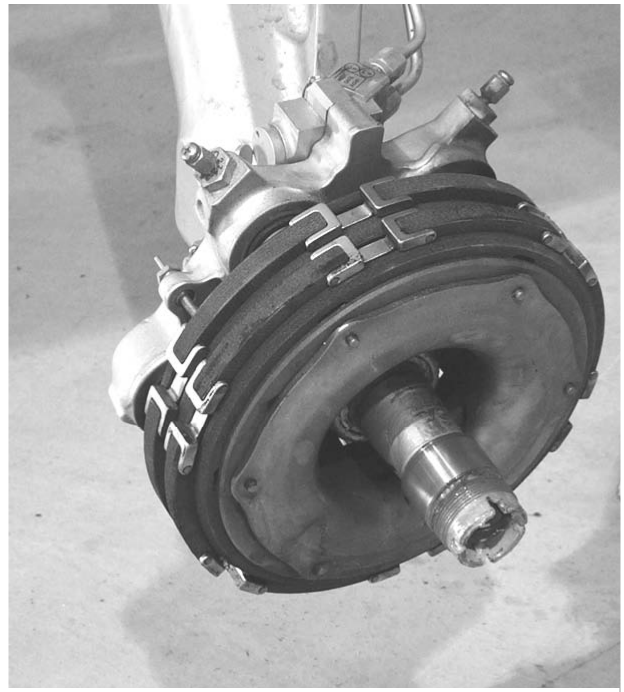

Figure 14-17. Brake Assembly

Brake Valves

The left and right wheel brakes can be operated with differentiated and regulated pressure through two brake valves connected to the rudder pedals. The output pressure from the brake valves to the brakes is regulated proportionally to the load the pilot applies to the rudder pedals.

The brake valve contains a selector valve operated by hydraulic pressure. The valve is connected to the brake piston via a shuttle valve through two different lines: normal and emergency.

During normal operation, the valve acts as a metering valve when hydraulic pressure is more than 500 psi. The hydraulic pump supplies hydraulic pressure for braking.

During emergency operation, the internal selector valve uses the brake valve as a master cylinder. In this case, the pilot supplies the pressure for braking.

Relief Valves

Two relief valves, one in each normal brake line, protect the lines against overpressure if the brake metering valve or the electrical depressurizing valve (EDV) fails.

When pressure to the brakes is 1,250 psi or greater, the valves discharge the pressure from the supply line into the return line back to the reservoir. (Figure 14-18).

Parking Valves

Two parking valves are below the flight compartment floor. A cable physically connects the parking valves to the parking brake handle.

The valve for each brake is located in the emergency line between the brake valve and the brake. The parking valves set the parking brake when the hydraulic pump is not running.

The parking valves contain check valves that set the brakes when the hydraulic pump is not running. When the pilot pulls the parking brake handle out and pushes on the brakes, hydraulic fluid flows though the check valves into the emergency braking line and then into the shuttle valve of each brake. This sets the brakes because the check valves prevent large return fluid flows.

The check valves, however, contain small holes that allow a calibrated amount of continuous fluid leakage. This means the brakes eventually release when enough hydraulic fluid leaks back. For this reason, the aircraft must always be chocked.

Three-way Selector Valve

The three-way selector valve sets the parking brake when the hydraulic pump is running. A check valve on the supply line from the reservoir locks brake pressure to the brakes when the parking brake handle is pulled out. The three-way selector valve is physically connected to the parking brake handle (Figure 14-19).

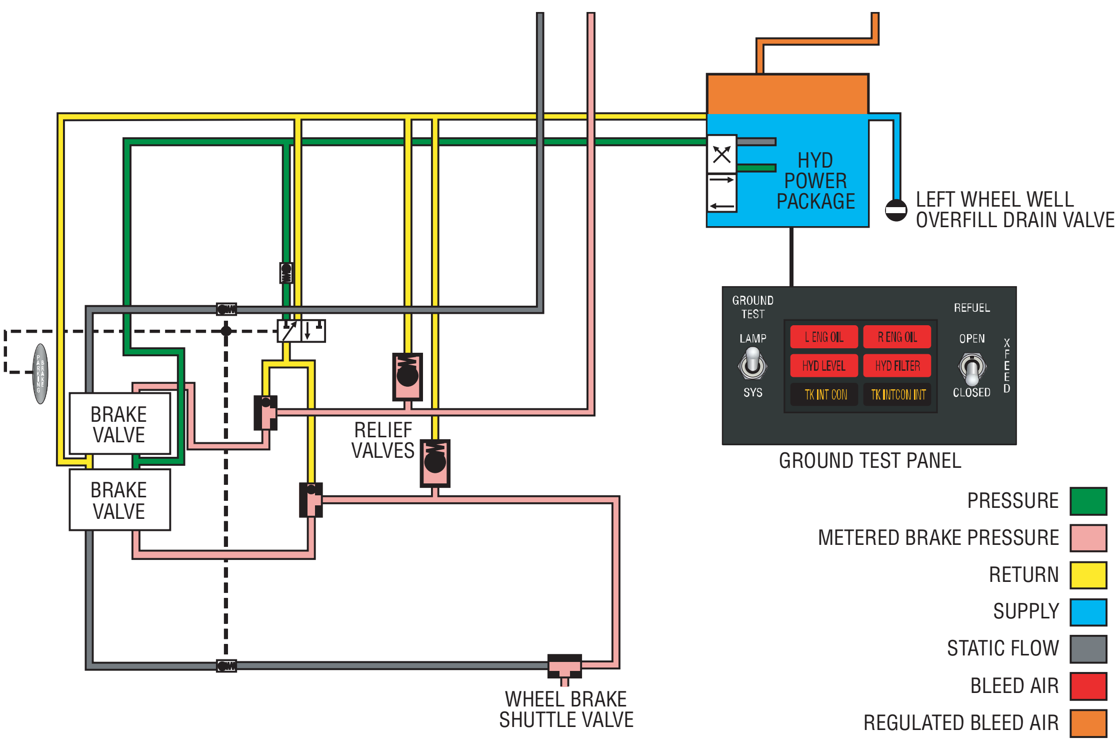

Figure 14-18. Relief Valves

When the handle is pulled, the selector valve repositions. This allows normal system pressure to flow through the selector valve and the normal system shuttle valves. Then the fluid flows into the normal braking lines and finally into the shuttle valves of each brake. This sets the brakes because the check valve prevents any return fluid flow.

Figure 14-19. Three-Way Selector Valve

Brake Wear Indicators

Two brake wear indicators are along the outer diameter of each wheel's piston assembly. The indicator is a pin with a compression spring (Figure 14-20).

Worn brakes are indicated when the indicator pin is flush with the outer surface of the housing with the parking brake set. (Figure 14-21).

Checking the wear indicators is a pilot preflight item.

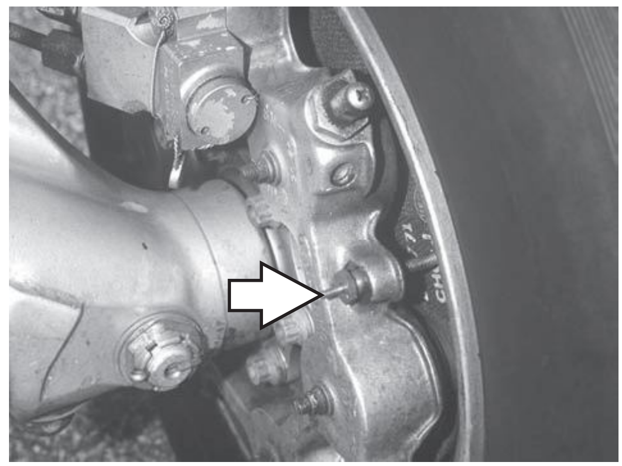

Figure 14-20. Brake Wear

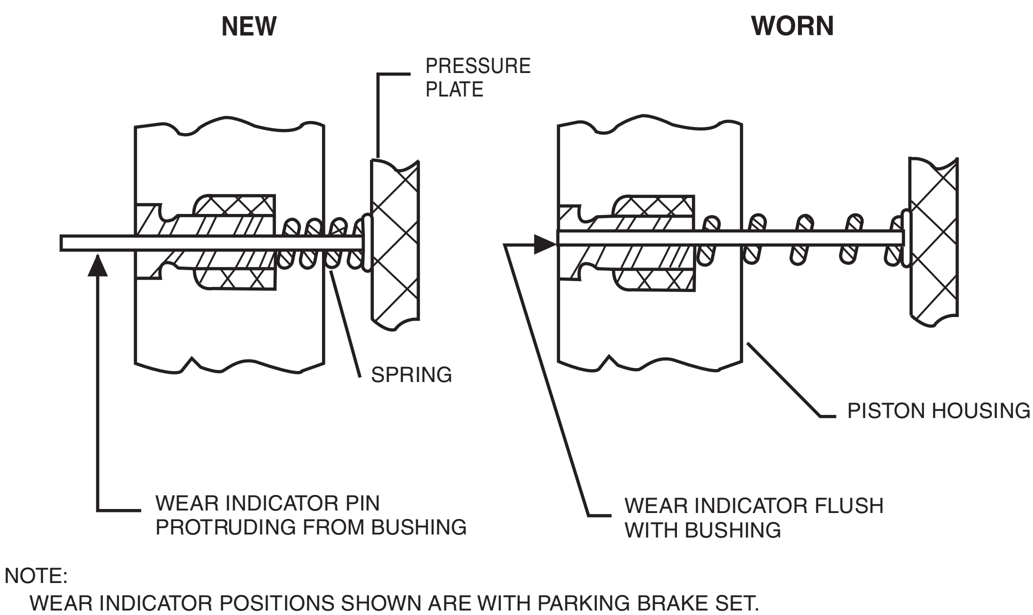

Figure 14-21. Brake Wear Indicators

Parking Brake

The PARKING BRAKE handle just below the instrument panel on the left side of the center pedestal actuates the parking brake. The handle simultaneously operates the three-way selector valve and two parking brake valves (see Figure 14-19).

With hydraulic pump on, the parking brake can be engaged by pulling out the handle and then rotating it clockwise to the vertical position. There is no need to depress the rudder pedals because the hydraulic pump is supplying sufficient pressure.

The three-way selector valve connects the landing gear down pressure line to the brakes' main lines through two shuttle valves. A check valve in the inlet line to the three-way selector valve maintains trapped pressure to the brakes after the parking brake has been engaged (Figure 14-22).

When the hydraulic pump is not operating, the pilot must supply sufficient pressure to set the parking brake by pushing on the tops of the rudder pedals. The parking brake can be engaged by pulling out the handle, rotating it to the vertical position, and pressing on the tops of the rudder pedals. The parking brake valves in the emergency braking lines trap pressure to the brakes. More than one action on the pedals is recommended.

The vertical position of the handle indicates the parking brake system is engaged.

Release the parking brake by rotating the handle to the horizontal position and then pushing it in.

A metered leak rate is built into the parking brake valves. Over time, hydraulic pressure decreases to zero and the brakes release.

OPERATION

Normal Operation

Figure 14-23 shows an overview of the normal wheel and brake system.When the aircraft is on the ground, the hydraulic pump normally supplies flow to operate the brakes at a regulated pressure of 1,000 psi.

When the rudder pedals are depressed, the brake valves allow fluid under pressure to flow through the normal lines to the shuttle valves on the brakes. At the same time, a spring in the master cylinder gives the pilot an artifical feel to simulate the amount of braking force applied.

Emergency Operation

Figure 14-24 shows the brake system in emergency operation. A hydraulic leak, failure of the hydraulic pump, or failure of the electric motor require emergency brake operations. During emergency operation, the brake valve acts as a master cylinder. The master cylinder pumps hydraulic oil directly to the brake.

In the absence of the hydraulic pump, the pilot becomes the pressure supplier. Repeated rudder pedal activation is required to build sufficient pressure for braking. Pedal brake operation becomes harder than normal—about a 50% increase.

CAUTION

Emergency brakes operation requires increased load applied on the pedals.

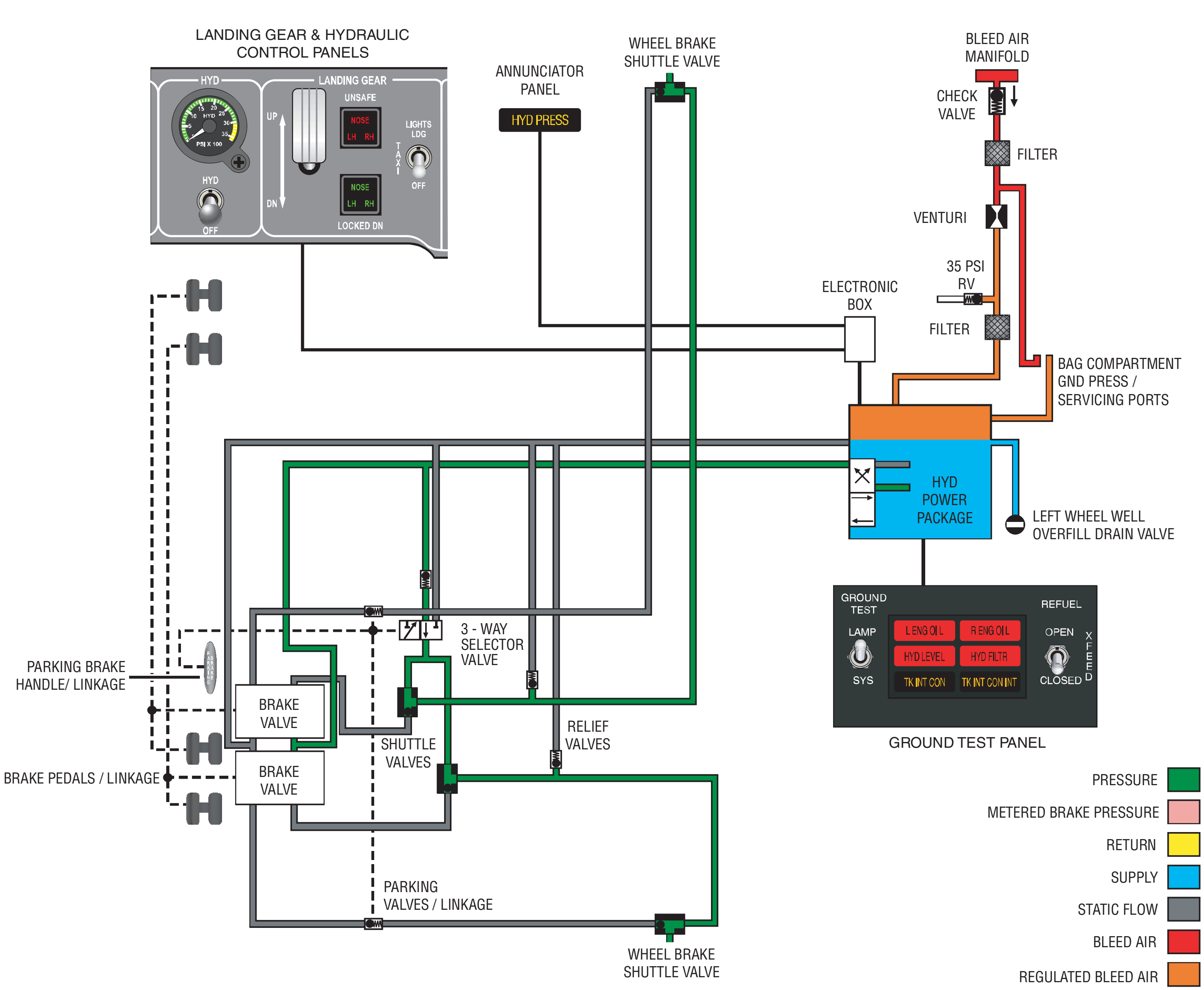

Figure 14-22. Parking Brake System

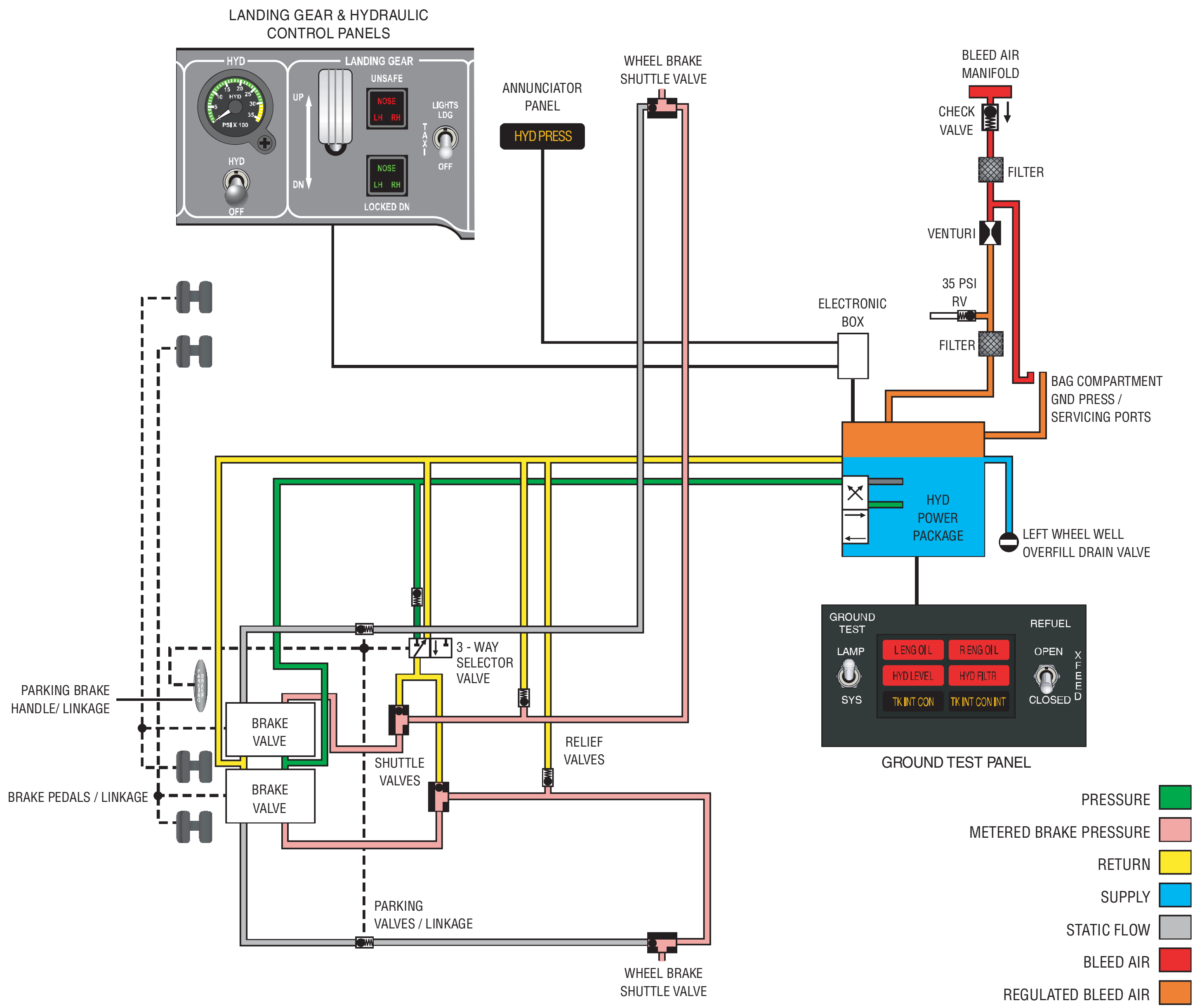

Figure 14-23. Wheel and Brake System—Normal Operation