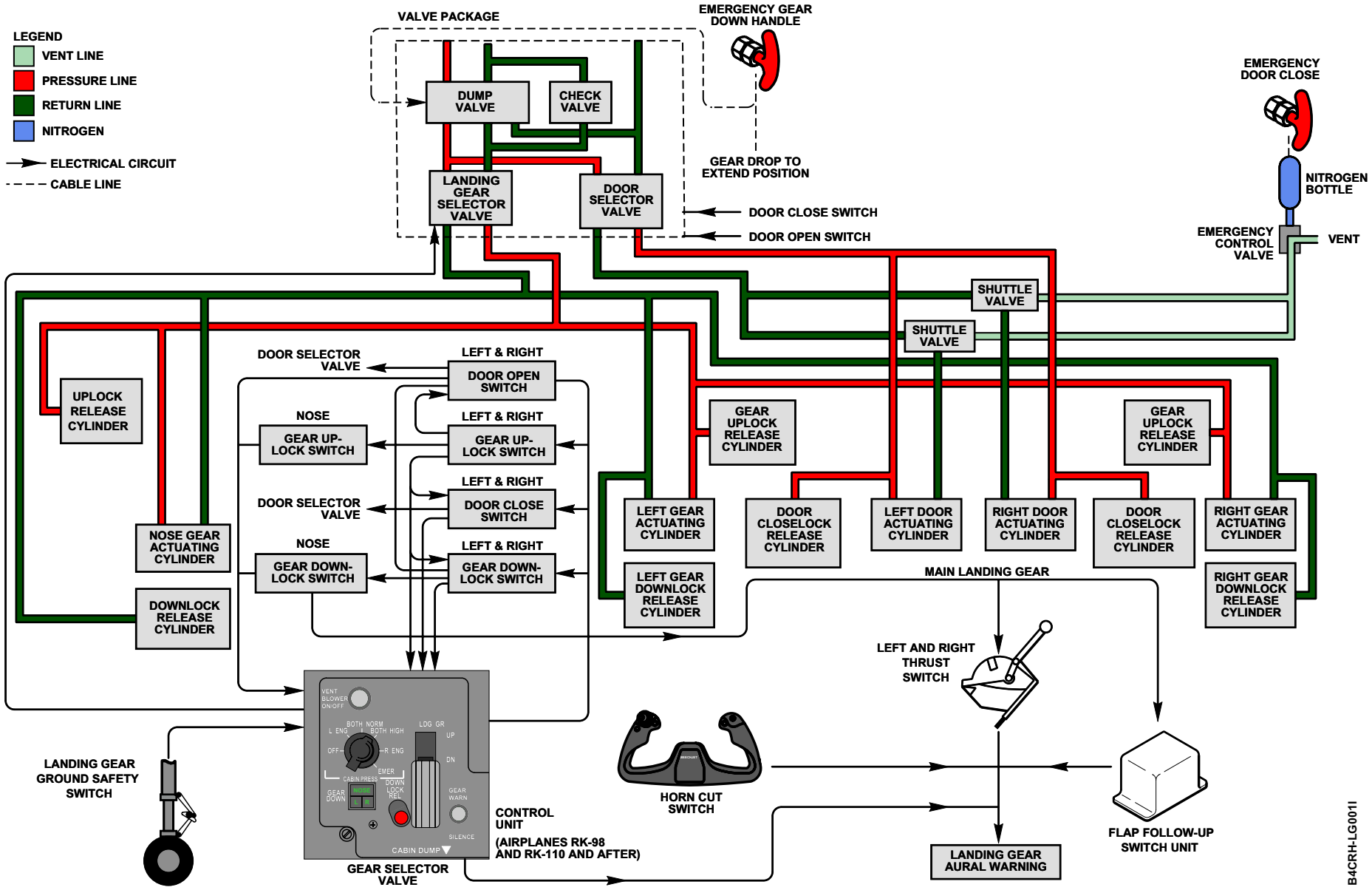
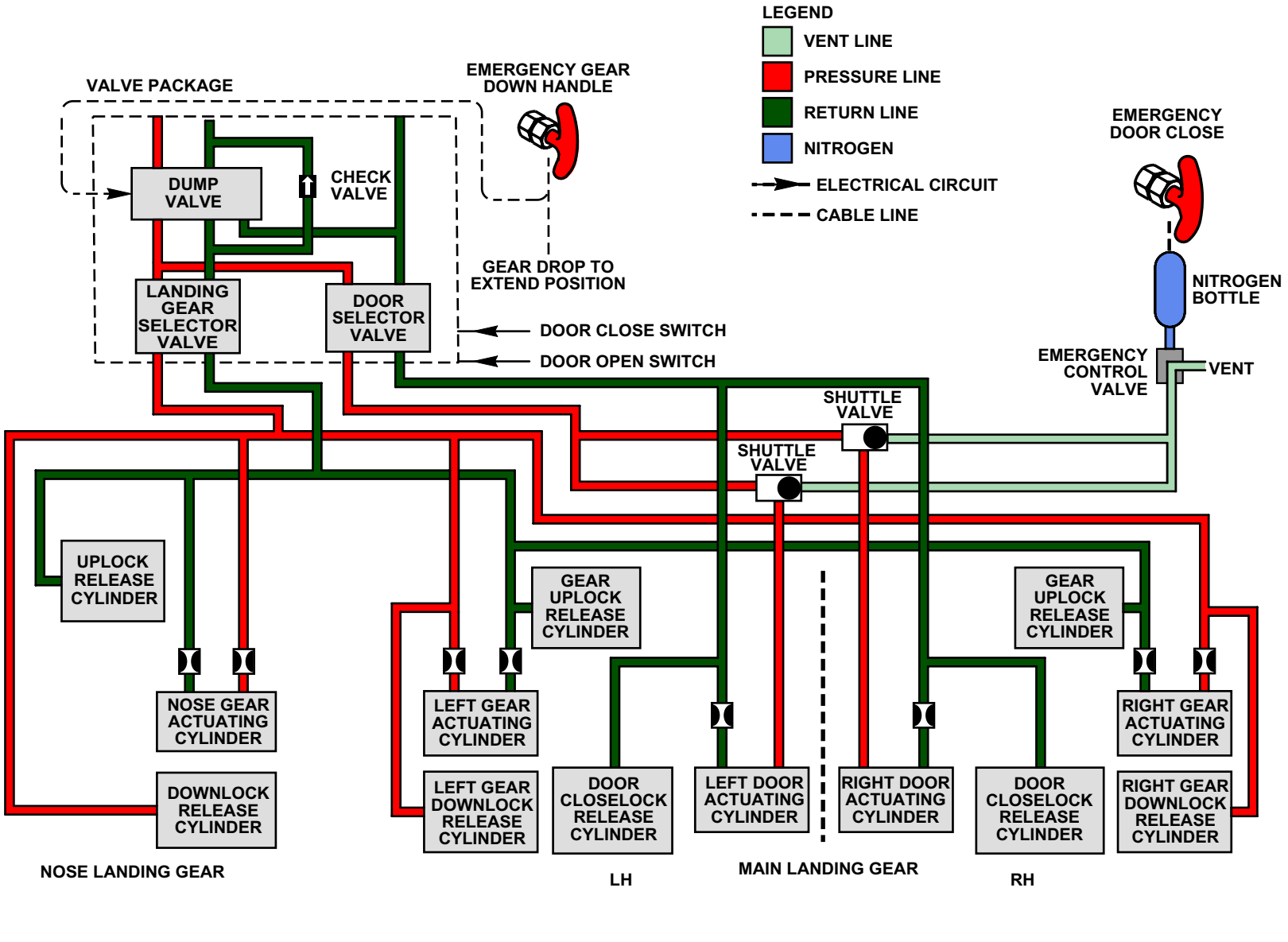
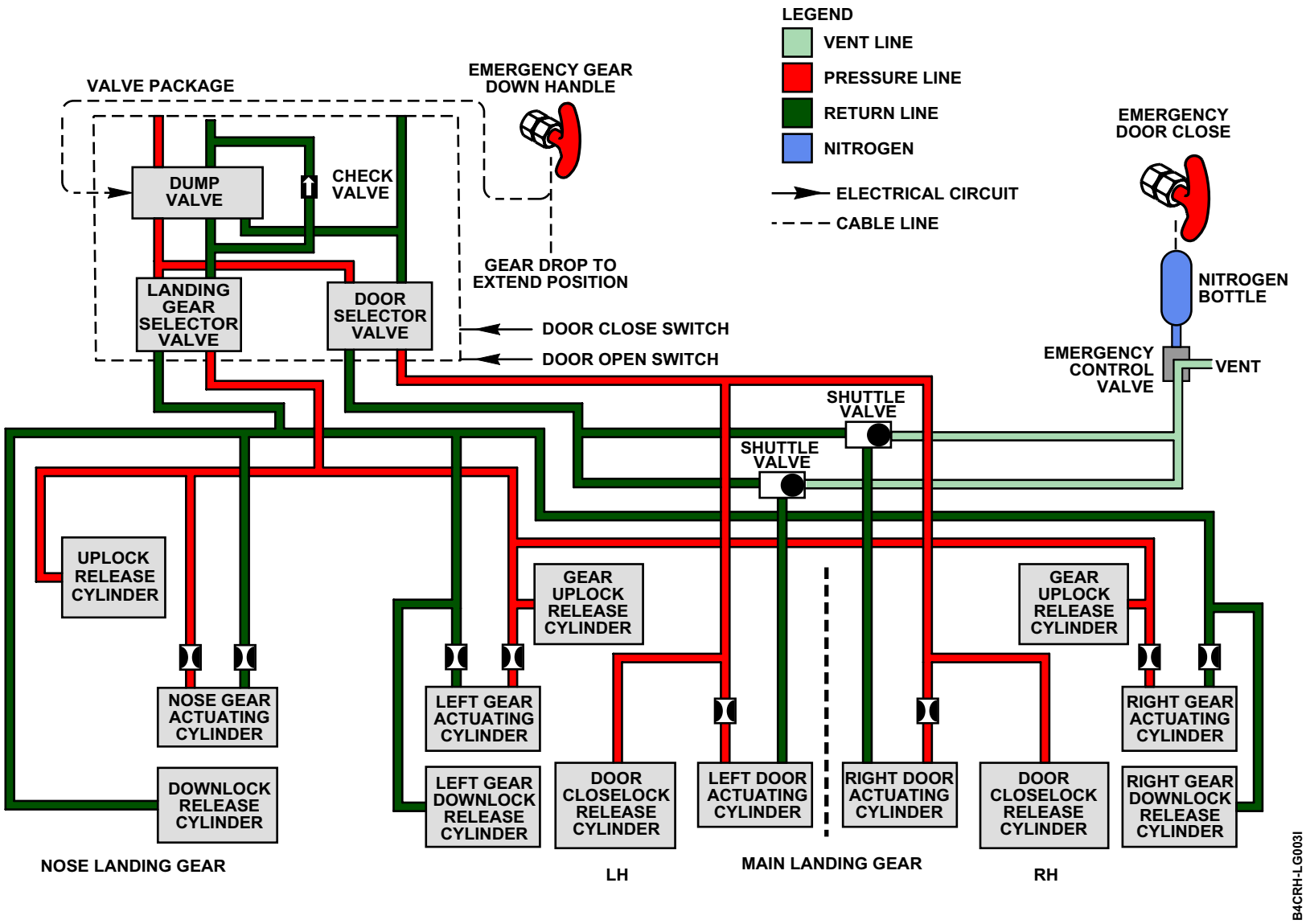
Landing Gear System



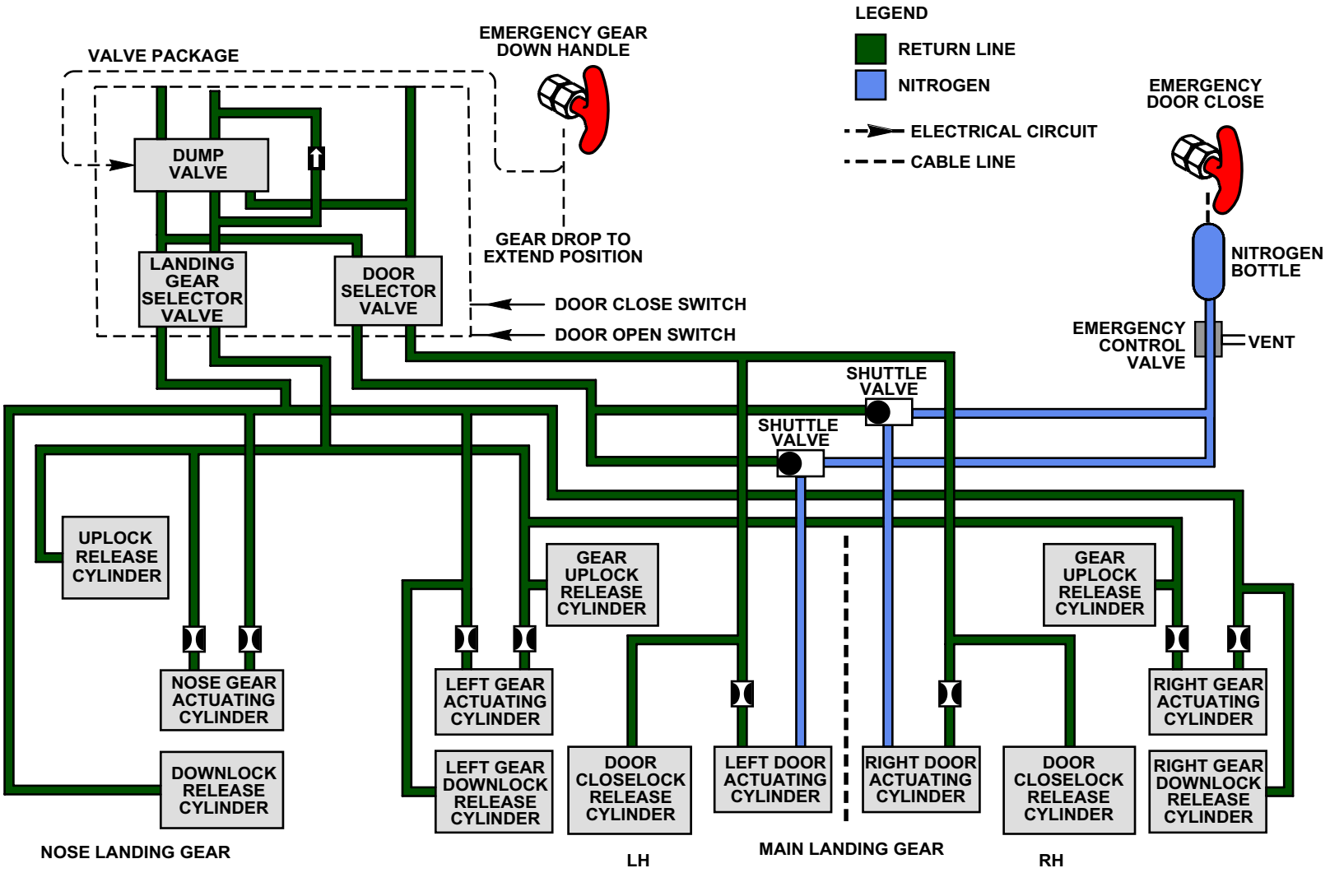
Normal Retraction



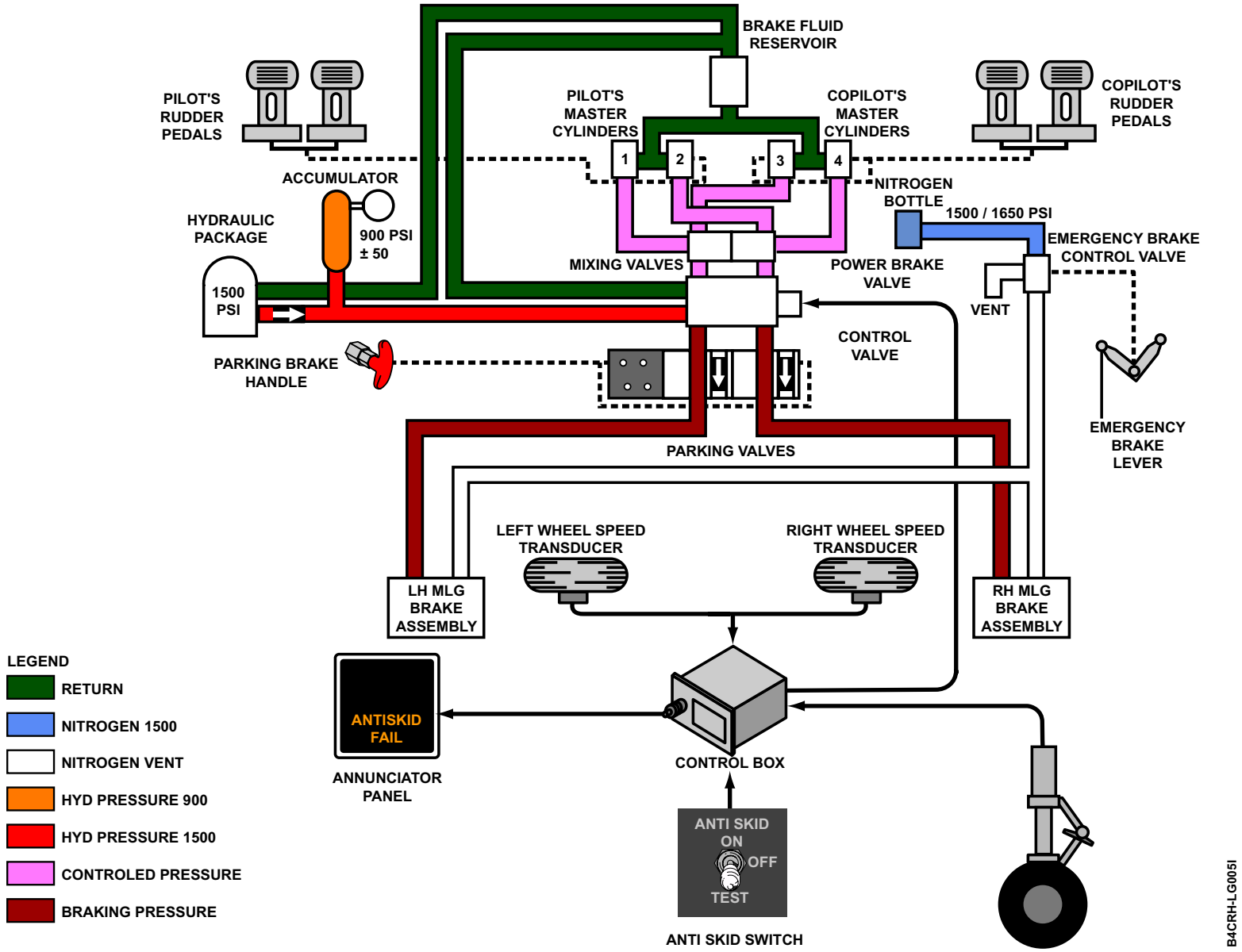
Normal Extension



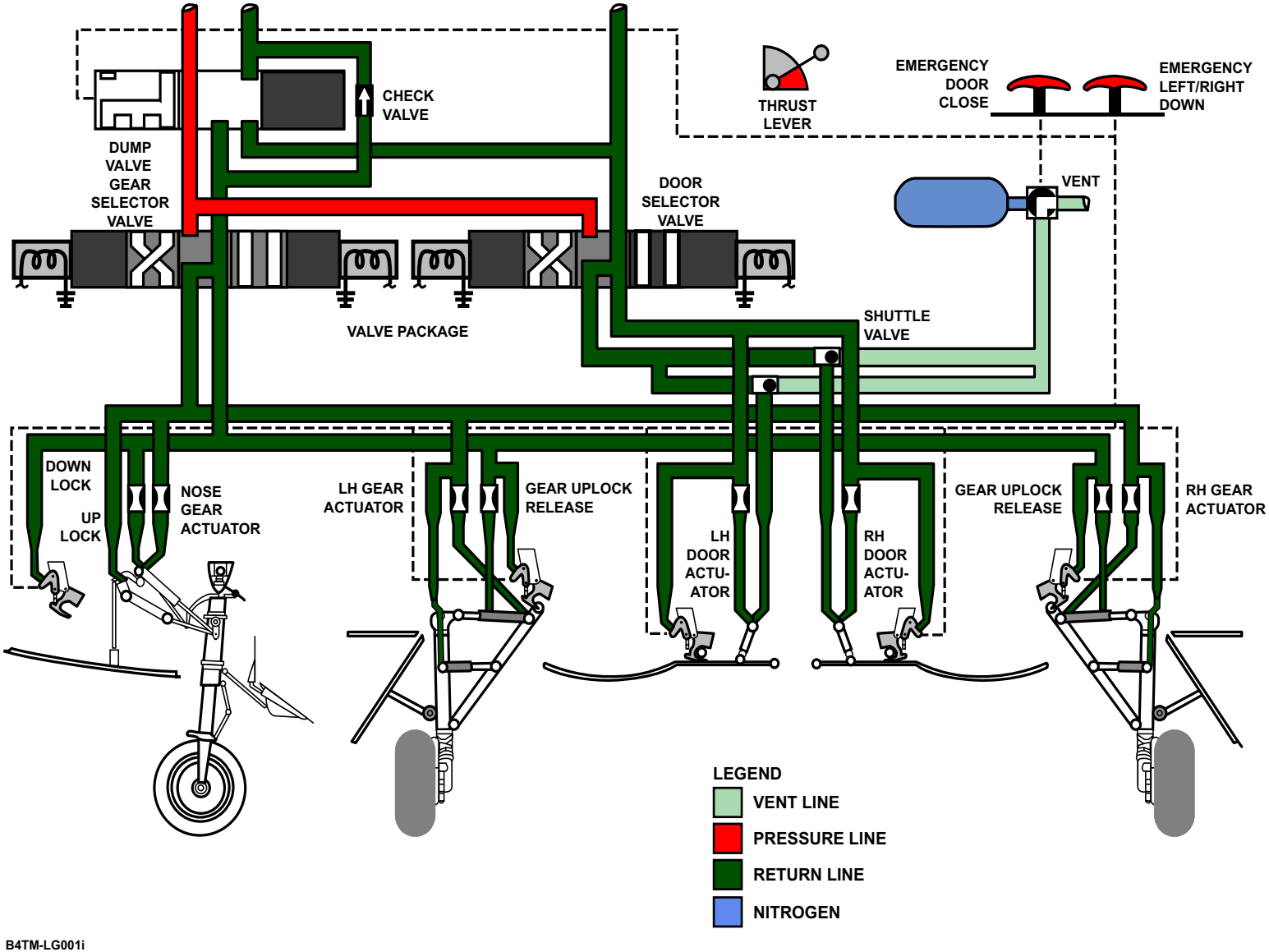
Emergency Extension



Brake System



Landing Gear Control System Flow Diagram



Landing Gear and Brake System

The landing gear is electrically controlled, hydraulically actuated and is enclosed by mechanically and hydraulically actuated doors. Gear position and warning are provided by indicator lights and a warning horn.

Nosewheel steering is mechanically actuated by the rudder pedals to provide directional control on the ground. A separate, self-contained shimmy damper prevents nosewheel shimmy.

The power brakes are master cylinder controlled, featuring electrical antiskid protection.

Each inboard-retracting main gear utilizes five hydraulic actuators: one to extend and retract the gear, one for inboard door actuation and one each for gear uplock/downlock/inboard door release. The forward-retracting nose gear requires three hydraulic actuators: one to extend and retract the gear and one for each gear uplock/downlock release.

Gear position indication is provided by colored lights on the landing gear control panel. In addition, a warning horn sounds if any gear is not down and locked when flap settings are in the landing configuration.

The nosewheel steering system, capable of steering 25 degrees either side of center, is mechanically actuated by rudder pedal deflection and can be castered to 45 degrees by use of asymmetric brake application and thrust. The system is disengaged when the gear is retracted. Vibration feedback is prevented by a steering damper and nosewheel shimmy is prevented by a separate shimmy damper.

The power brakes are controlled by pressure from toe-operated master cylinders. Antiskid, when selected, provides maximum braking capability without skid under all runway conditions.

Landing Gear System

The airplane is equipped with hydraulically-actuated, retractable, tricycle landing gear. Each gear is actuated by its own piston-type actuator. Each fuselage MLG door is operated by its own piston-type actuator. The MLG and NLG doors are mechanically linked to the main landing gear and the nose landing gear. The ground safety switch on the torque link of each main landing gear prevents accidental retraction of the landing gear when the airplane is on the ground. The landing gear control handle on the landing gear control unit controls gear retraction and extension.

Control Unit

The landing gear control unit has a manually operated handle that electrically controls the position of the landing gear. The manually operated handle operates four limit switches which, according to the selected position of the handle, apply 28V DC power to the UP or DOWN solenoid of the hydraulic valve package through the gear position-limit switch circuit. The manually operated handle has a locking mechanism in the DOWN position to prevent accidental movement of the handle. When the airplane is on the ground and electrical power is ON, a solenoid is de-energized to lock the handle in the DOWN position. In flight, when the solenoid is energized through the landing gear safety (squat) switch, the landing gear control handle downlock is released. The LH landing gear safety (squat) switch keeps the landing gear control unit handle from moving out of the DOWN position when the airplane is on the ground. If the switch fails to close, the landing gear control unit handle cannot be moved toward the UP position in flight. On airplanes RK-1 thru RK-109, except RK-98, an override switch located above the landing gear control handle is provided to release the downlocked handle. On airplanes RK-98 and RK-110 and after, the override switch is located beside the landing gear control handle on the copilot's instrument panel.

Landing Gear Retraction

When the main landing gear is down and locked, the fuselage MLG doors are closed and locked. In the gear extended configuration, three green lights on the control unit are illuminated to indicate a down and locked condition, the red warning light is extinguished and the aural warning is silent. When the weight of the airplane is off the landing gear, the gear struts are fully extended and the landing gear control handle can be moved to the UP position. Moving the handle up electrically positions the gear door selector valve so as to direct hydraulic pressure to the fuselage MLG door lock release cylinders and the door actuating cylinders. The door locks release and the doors open, actuating the door open switches. When both door open switches are actuated, the gear selector valve is electrically positioned to direct hydraulic pressure to the gear downlock release cylinders and to the retract side port of the main and nose actuating cylinders. As the landing gear retracts into the wheel wells, each gear strut uplock roller rotates the uplock hook past center; all the uplock assemblies will be mechanically moved to the locked position. When all uplock switches are actuated, the gear door selector will be positioned to the closed position and pressure will be directed to close the fuselage MLG doors.

At the same time, the landing gear retract solenoid is de-energized and hydraulic pressure is removed from the gear actuator. When the fuselage MLG doors are closed and locked, hydraulic pressure is removed from the door actuators. As each gear unlocks from the downlocked position, its respective green indicator light extinguishes. When all gear and doors are up and locked, the red warning light will extinguish. The retraction cycle will be completed in approximately 7 seconds.

Landing Gear Extension

Moving the landing gear control handle down electrically positions the gear door selector valve to direct pressure to the fuselage MLG door lock release cylinder and to the door actuating cylinders. As each door reaches the full open position, it actuates the door open switch. When both door open switches are actuated, the landing gear selector valve is electrically positioned to direct hydraulic pressure to the gear uplock release cylinders and to the extend port of the MLG and NLG actuators. The gear uplocks open and the gear extends. Movement of the gear into the downlocked position actuates downlock switches that electrically position the gear door selector valve to direct pressure to the door actuators. These switches de-energize the landing gear selector valve solenoid to shut off pressure to the gear actuators. When the gear doors are closed and locked, hydraulic pressure to the door-actuating cylinder is shut off. Upon initial opening of the fuselage MLG doors, the red warning light will illuminate. As each gear downlock switch is actuated, its respective green indicator light will illuminate and when the fuselage MLG doors close, the red warning light will extinguish. The landing gear extension cycle will be completed in approximately 7 seconds. The NLG door is moved by mechanical linkage connected to the nose landing gear strut.

Nose gear movement controls the doors during its operating cycle. The nose gear doors cover the wheel well when the gear is retracted and only the forward part of the wheel well when the gear is extended. The door covering the aft part of the wheel well is linked directly to the gear strut and opens and closes as the gear moves. It remains open when the gear is extended. The two doors, which cover the forward part of the wheel well, are linked to a torque tube and then to the nose gear trunnion. During nose gear extension and retraction, the first half of trunnion travel opens the doors and the last half closes the doors.

Emergency Extension

The EMER L/G DOWN handle and the EMER DOOR CLOSE handle are installed under the pilot's instrument panel. Pulling the EMER L/G DOWN handle all the way out (approximately 10 inches), releases the fuselage MLG door uplocks, MLG uplocks, and NLG uplock. The gear doors open and the landing gear free falls to the down-and-locked position, assisted by extension springs on each landing gear downlock. At the initial opening motion of the doors, the red warning light will illuminate. As the landing gear extends to the down-and-locked position, their respective green indicator lights will illuminate. After the three green indicator lights illuminate, the EMER L/G DOWN handle is pushed to the stowed position and the EMER DOOR CLOSE handle is operated to close the fuselage MLG doors by nitrogen pressure. After the doors are closed, the red warning light will extinguish. The nitrogen pressure is supplied from a nitrogen bottle mounted in the left nose electronic compartment.

NOTE: This bottle also provides nitrogen pressure for emergency braking.

Position and Warning System

The landing gear position and warning system provides visual and aural indications of landing gear position. Three green indicator lights are located adjacent to the landing gear handle. A red gear unsafe warning light is located either above the green indication lights (airplanes RK-1 thru RJK-109, except RK-98) or in the knob of the landing gear handle for airplanes RK-98 and RK-110 and after. Each green light corresponds to one gear (NOSE, L and R) and indicates that it is in the down-and-locked position. The red warning light indicates an unsafe gear position (in transit or not locked) or an open gear door. The landing gear aural warning is provided to generate a warning when any landing gear is not down-and-locked and one or both thrust levers are retarded to a low power setting. The HORN

CUT switch located on each control wheel or the GEAR WARNING SILENCE button on the copilot's left sub-panel silences the warning. The warning system is reset when the thrust lever is advanced.

Land Sel Switch

When the LAND SEL switch on the center pedestal is selected to FLAPS 10° and the flaps are extended to 10 degrees with any gear not down-and-locked, the aural warning will sound and cannot be cancelled.

When the LAND SEL switch is placed to FLAPS 30° and the flaps are extended beyond 20 degrees with any gear not down-and-locked, the aural warning will sound regardless of the thrust lever position. In this condition, the aural warning cannot be cancelled.

Steering

The nosewheel steering system is controlled through the rudder pedal. When the nose gear is extended, a slotted cam is moved into position and rotates the nose gear strut. The maximum available steering angle is 45 degrees left or right. Rudder pedal mechanical linkage steering angle is 25 degrees left or right with an additional 20 degrees obtained through the use of differential braking and asymmetrical thrust. A steering disconnect pin in the torque link permits free rotation of the nosewheel for towing purposes. When the nose gear is retracted, the steering mechanism is separated mechanically at the slotted cam and the gear is held in the neutral position.

Wheel Brake System

The main landing gear wheels are equipped with full powered brakes operated by toe action on the rudder pedals. An antiskid system is incorporated in the power brake system. Emergency braking is accomplished through the nitrogen brake system. The emergency brake control lever is installed on the upper right side of the pedestal.

Power Brake System

When the pilot or copilot depresses the brake pedals, the delivery pressure of the master cylinder (directly connected to the brake pedals) is transferred to the power brake valve through the mixing valves. The power brake valve amplifies the master cylinder pressure and transfers the increase of pressure to the MLG brakes.

NOTE: The power brake system can be used with or without the antiskid system.

Antiskid System

The airplane is equipped with an electrically controlled antiskid system. The system detects the start of a skid condition at the wheels and automatically releases the brake pressure for both wheels in proportion to the severity of the skid. Use of the antiskid system offers protection from skids and can provide consistently shorter landing rolls for all runway conditions. Placing the ANTI SKID switch in the ON position activates the system. A stationary wheel speed transducer, mounted inside each main gear axle, electrically senses any change in wheel rotation speed. As a skid is detected, an electrical signal is supplied to the system, which releases hydraulic pressure from the brakes. With brake pressure released, the wheel speed will increase and hydraulic pressure will be restored to the brakes. The antiskid system continues this control cycling as long as

braking pressure is sufficient to cause the skidding condition. Antiskid protection is not available below 10 to 14 knots.

NOTE: In the event air squat switch logic is not removed from the control box after landing, spin-up override will permit antiskid protected braking down to approximately 37-47 knots. At approximately 37-47 knots a total brake release (hard pedal with no braking action) will be experienced. The ANTISKID FAIL annunciator will not be illuminated.

Selecting the OFF position on the ANTI SKID switch, located on the center pedestal, will restore the system to the power brake mode after a two to three second delay.

If immediate braking action is required, follow the Power Brake Failure Procedures in the EMERGENCY PROCEDURES Section of the AFM Approved Airplane Flight Manual.

CAUTION: Do not land with brake pedals depressed.

Antiskid Control Switch

This three-position toggle switch is located on the center pedestal. When the ANTI- SKID switch is ON, power is supplied to the system. Placing the ANTI SKID switch to OFF will turn off the antiskid system. To test the system, apply brakes while the airplane is in motion and note that the brakes release when the ANTI SKID switch is placed to TEST. If the ANTI SKID switch is placed to ON immediately after the test, normal braking is not available for 3 to 4 seconds. Normal braking is available with the ANTI SKID switch OFF.

Antiskid Fail Annunciator

The ANTISKID FAIL annunciator illuminates if a malfunction exists in the system when the gear is extended and the ANTI SKID switch is ON. The annunciator will also illuminate when the ANTI SKID switch is turned OFF.

NOTE: When the ANTISKID FAIL annunciator illuminates, the system is in a fail-safe condition and complete control of braking, through the normal braking system, is available.

Parking Brake

The parking brake is a part of the normal brake system and employs check valves that prevent the return of fluid after the brake pedals have been released. Parking brakes are set by pulling out the PARKING BRAKE HANDLE, located under the lower left side of the instrument panel, and depressing the toe brakes two or three times. Do not set the parking brake with the copilot's pedals if the engines are not running. Without power boost (i.e. engines not running) the copilot's pedals require several pumps to set brakes. This may cause the first or second subsequent application of brakes from the pilot's pedals to be ineffective. The parking brake is released by pushing in the handle.

The parking brake should not be set if the brakes are very hot. This increases brake cool-down time due to decreased airflow. This may result in sufficient heat transfer from the brakes to cause the parking brake hydraulic pressure to rise excessively, or to melt the thermal relief plugs in the wheel.

Emergency Brake

In the event of normal hydraulic brake system failure, the pilot or copilot can continue braking operation by using the spring-loaded emergency brake lever mounted on the upper right side of the pedestal. The nitrogen bottle, mounted in the lower portion of the left electronics bay in the nose, contains sufficient pressure for 7 to 10 full brake applications when fully charged.

NOTE: This bottle also provides pressure to close the MLG doors during emergency extension.

For the most efficient use of the system, use steady and smooth application, gradually increasing force until desired braking action is attained. Maintain that pressure until the airplane is stopped. When the lever is released, residual nitrogen pressure from the brakes is vented overboard. Normal braking should not be applied while using the emergency brakes.