POWER BRAKE AND ANTI-SKID SYSTEM

GENERAL

The power brake and anti-skid installation is a closed center, phosphate-ester fluid based system with its own separate independent powerpack assembly, accumulator and reservoir. These components provide pressurized hydraulic fluid to the brake metering valve and anti-skid valve, regulated to a maximum of 1050 PSI pressure to the brakes. This pressure is based upon pilot/co-pilot input through the brake pedals, and electronic inputs from the digital anti-skid control unit.

RPM transducers at each wheel sense the beginning of a skid and transmit this information to the digital anti-skid control unit. A hand operated pneumatic emergency brake valve is provided in the event of a power brake failure. Pneumatic pressure is transmitted to brakes through a shuttle valve integral to each brake assembly. Additionally, a parking brake is included in the basic hydraulic brake system. Specific components are described below.

POWER PACK, ACCUMULATOR, RESERVOIR

The powerpack, accumulator, and reservoir are located on the left side of the fuselage, forward of the battery compartment. The powerpack assembly contains the pump, electric motor, filter and associated plumbing. The motor is of fixed displacement, delivering approximately 0.3 gallons per minute at 7000 RPM. The motor runs only when the gear lever in the down position and a pressure switch mounted at the accumulator outlet is closed. The switch contacts are normally closed, and open on increasing pressure at 1500 PSI. The contacts close after pressure decreases a minimum of 170 PSI and above 1230 PSI

If the gear is extended and pressure drops below 900 PSI, a pressure switch installed on the pump manifold will activate the LO BRK PRESS light and the ANTISKID INOP light on the annunciator. Pressure relief is provided by a pump housing mounted valve at 1700 PSI.

ACCUMULATOR AND RESERVOIR

The accumulator is pre-charged with compressed nitrogen gas per servicing placard located on the inside panel of the brake compartment access door. The reservoir contains a sight gage to indicate fill level. If the accumulator is pressurized, rotate the handle to relieve the pressure and then read the pre-charge pressure.

TEMP °F	-65	10	50	70	95	130
PRESS PSI	500	600	650	675	700	750

WHEEL BRAKES

The power brake and anti-skid system are designed independent of the main hydraulic system. Toe-actuated multiple disc carbon 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 backup pneumatic system. Normal braking can be applied from either cockpit seat. The emergency brake control is installed under the left instrument panel only.

PARKING BRAKE VALVE

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.

DIGITAL ANTISKID SYSTEM

The brake control 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 transducers, brake metering valve/antiskid valve, digital antiskid control unit, pressure and control switches and two indicator lights.

System operation is conventional with power braking available at all speeds while antiskid protection is available at speeds between 10 and 175 knots. The antiskid protection feature is designed to operate with maximum pilot brake applied pressure.

The wheel speed transducer 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 transducer generates a signal for each wheel revolution that is sent to the antiskid control unit as a variable frequency. The control unit accepts the output of the left and right wheel speed transducers independently and converts these signals to a direct current (DC) voltage directly proportional to wheel speed. Any significant variation between either wheel speed voltage produces an error signal that activates the antiskid valve which controls the amount of brake pressure being applied to each wheel. The system incorporates a feature called touchdown protection. Touchdown protection inhibits brake pressure to the brakes prior to touchdown.

Touchdown protection is inactive with wheel speed above 59 knots or until three seconds after touchdown. When excessive deceleration of a wheel occurs, transducer voltage suddenly drops. An error signal is generated which energizes the antiskid valve. The antiskid valve will modulate the brake pressure as required to prevent the skid condition. When the airplane speed drops below approximately 10 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.

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 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 backup 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. Certain faults in the system are displayed on a “B.I.T.E.” indicator (fault display unit), which is located in the nose compartment.

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 a red knob located to the left of the AUX GEAR CONTROL 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 6 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 may reposition the shuttle valves in the brake lines, which could allow high pressure air from the brake housing to enter the brake hydraulic reservoir. 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.

BRAKE SYSTEM ELECTRICAL POWER

The brake system receives electrical power through two circuit breakers on the left circuit breaker panel. The 5 ampere SKID CONTROL circuit breaker provides power to the anti-skid system and the 15 ampere PWR BRKS circuit breaker provides power to the power brake motor/pump.

CAUTION

DO NOT PULL THE PWR BRKS 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.