

# PRESSURIZATION

## GENERAL

The pressurization system in the Citation Sovereign is designed to provide cabin pressure altitude to make sure flight crew and passenger comfort is maintained.

To account for fuselage leakage, a constant source of airflow and a controlling method for that airflow is used to maintain the desired differential pressure. Constant air inflow is available through a wide range of power settings controlled by a single Environmental Control Unit (ECU). Two outflow valves control outflow air. Either the Cabin Pressure Controller or the Manual Rate toggle valve controls the positioning of the outflow valves.

**GROUND OPERATION**

In order for the pressurization system, bleed air must be directed to the cabin via the Bleed Air Control Panel.

The following bleed air control panel switch positions provide normal operation of the pressurization system:

- L ENG BLD AIR Knob - NORM
- R ENG BLD AIR Knob - NORM
- PRESS SOURCE Knob - NORM
- L and R BATT Switch-Annunciator - ON (or EXT PWR - ON)
- BUS TIE - CLOSED

The Cabin Pressure, R BLEED AIR CONT, L BLEED AIR CONT, and R BLEED AIR MONITOR Circuit Breakers must also be engaged.

**GROUND MODE (UNPRESSURIZED)**

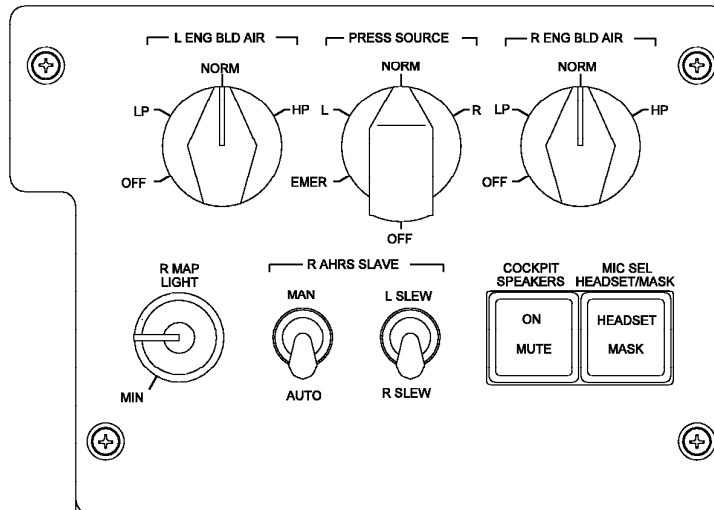
When the LH throttle setting is sensed at less than 82.5% N<sub>2</sub> nominal (24.5° TLA), the Pressurization Controller goes into unpressurized operation commanding the Outflow Valves to the full open position.

**NOTE**

With both Outflow Valves at full open and cabin airflow is "On", the system should hold a minimum pressure differential of 0.073 PSID with 40 lbs./min of airflow.

**BLEED AIR CONTROL PANEL**

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Figure 2-26

## GROUND MODE (PREPRESSURIZATION)

The primary purpose of the prepressurization is to prevent cabin climb bumps during takeoff. Once the left throttle is advanced to beyond 82.5% N<sub>2</sub> nominal (24.5° TLA), the TLA decoder logic module signals the pressurization controller to start pressurizing the cabin.

To start pressurizing the cabin, the CONTROLLER begins to close the OUTFLOW VALVES to descend the cabin at a rate determined by the position of the rate knob, (located on the cabin pressure selector), to an altitude of 180 feet (54.9 meters) below field elevation. This pressure will be held until takeoff or until the system senses an aborted takeoff by the LH throttle being pulled back past 82.5% N<sub>2</sub> nominal (24.5° TLA), on the ground. An aborted takeoff will prompt the system to hold for another 30 seconds before returning the outflow valves to their full open/minimum pressure differential position.

### NOTE

Once the OUTFLOW VALVES are given a full closed signal, the valves require 10-20 seconds to close from fully open. This is due to the rate at which cabin pressure bleeds through the filtered orifice on the PRIMARY OUTFLOW VALVE.

## FLIGHT OPERATION

As the airplane reaches a takeoff attitude, the landing gear squat switches indicate to the Pressurization Controller that the airplane is airborne. The control logic will automatically switch to Flight Mode.

## AUTOMATIC CONTROL

Two Types of automatic in-flight pressurization control are available to the flight crew. They are described as follows:

**SCHEDULED MODE** - With the CABIN PRESS MODE switch-annunciators in NORM (auto scheduled mode) and AUTO, the pressurization controller compares scheduled altitude value with the selected cabin altitude. The higher value between these two values is used as the control value. The pressurization controller then modulates the Outflow Valves as required to ascend or descend the cabin altitude toward the control value (at a rate not exceeding the selected rate limit).

Because schedule altitude is a function of airplane altitude, the cabin rate of change required to follow the schedule altitude is a function of airplane rate of change. For most normal flight conditions, the cabin rate of change required to follow the schedule altitude will be some value less than the selected limit rate.

**ALTITUDE SELECT MODE** - Altitude Select (ALT SEL) mode provides a lower cabin altitude for a given airplane altitude. In the cabin ALT SEL mode, the system ignores the automatic schedule cabin altitude and defeats the down rate clamp. The pressurization controller climbs the cabin at the selected rate to a selected cabin altitude.

## MANUAL/BACKUP CONTROL

In addition to the two automatic modes of operation, a manual method of cabin pressure control is provided that is not dependent on electrical power.

Manual control can be intentionally initiated by selecting MANUAL on the AUTO/MAN CABIN PRESS MODE switch-annunciator. The cabin pressurization system will automatically revert to manual mode in the event of an electrical failure.

Once the manual mode is initiated, the following actions occur:

1. Power to the Torque Motor Metering valve on the Primary Outflow Valve is removed. This causes the valve to close and no longer regulate the Outflow Valves.
2. The Secondary Outflow Valve immediately takes over, locking the current cabin pressure (Isobaric Hold) closing the solenoid Isolation Valve from the removal of electrical power. This traps the current control pressure in the control-metering valve causing the Secondary Outflow Valve to become the primary source of cabin pressure control.

### NOTE

The cabin pressure will momentarily decrease in altitude until the Secondary Outflow Valve sufficiently opens in order to maintain a controlling position.

In order to adjust cabin altitude when in manual mode, select the Red Manual Control Toggle Valve (Cherry Picker) to the up or down position. The Manual Control Toggle Valve is spring loaded to the center position enabling the cabin pressure to be maintained at release.

### NOTE

If rapid rate of change in cabin altitude is desired, the MANUAL RATE knob should be selected to the MAX position.

The manual control may be used to dump cabin pressurization by positioning the MANUAL RATE knob to MAX and holding the Manual Control Toggle in the UP position. If the airplane is above 14,250 feet, the cabin altitude will increase to 14,250 ( $\pm 250$ ) feet controlled by the altitude limit control on the Outflow Valves.

**CABIN DUMP** - The switch guard covering the CABIN DUMP switch-annunciator must be raised to select DUMP. A full open signal is sent to the Torque Metering Valve on the Primary Outflow Valve commanding it to full open. Cabin altitude will increase rapidly and hold at 14,250 ( $\pm 250$ ) feet.

Placing the switch-annunciator back to the NORM (auto-scheduled) position returns the pressurization control to normal.

Cabin altitude will not go above 14,250 ( $\pm 250$ ) feet due to the Altitude Limit Valves. For complete cabin depressurization, Bleed Air must be shut off via the Bleed Air Control Panel.

## CABIN ALTITUDE WARNINGS

Cabin altitude greater than 8500 feet is indicated visually by EICAS if cabin altitude exceeds 8500 feet, a single chime will be heard in the cockpit, followed by an amber cabin altitude message on EICAS. When the cabin altitude descends below 8100 feet, the EICAS messages will extinguish. This message is generated from an absolute pressure transducer mounted in the left or right logic module. The pressure transducers are an integral part of the logic module.

### NOTE

If the airplane is above 14,250 feet, the cabin altitude will increase to 14,250 ( $\pm 250$ ) feet and be controlled by the altitude limit control on the Outflow Valves.

## LANDING OPERATION

### NORMAL LANDING MODE

Upon airplane touchdown, the landing gear logic module (via the Squat Switch input) indicates to the Pressurization Controller the airplane is on the ground. The cabin is depressurized at a rate determined by the position of the RATE knob. Depressurization of the cabin will then begin for 60 seconds or until the cabin becomes unpressurized. After 60 seconds the Pressurization Controller enters the Ground Mode and dumps any remaining cabin pressure.

If the left throttle is advanced past 82.5%  $N_2$  nominal (24.5° TLA) the prepressurization mode will begin.

### HIGH ALTITUDE MODE

The cabin pressure control system incorporates a discrete electrical signal from the pressurization controller any time an aircraft altitude above 8000 feet is selected while in the either automatic mode. This signal becomes active when airplane altitude is less than 24,500 feet and the cabin altitude is above 8000 feet shifting the red EICAS cabin altitude warning message from 8500 feet to 14,500 feet cabin altitude.

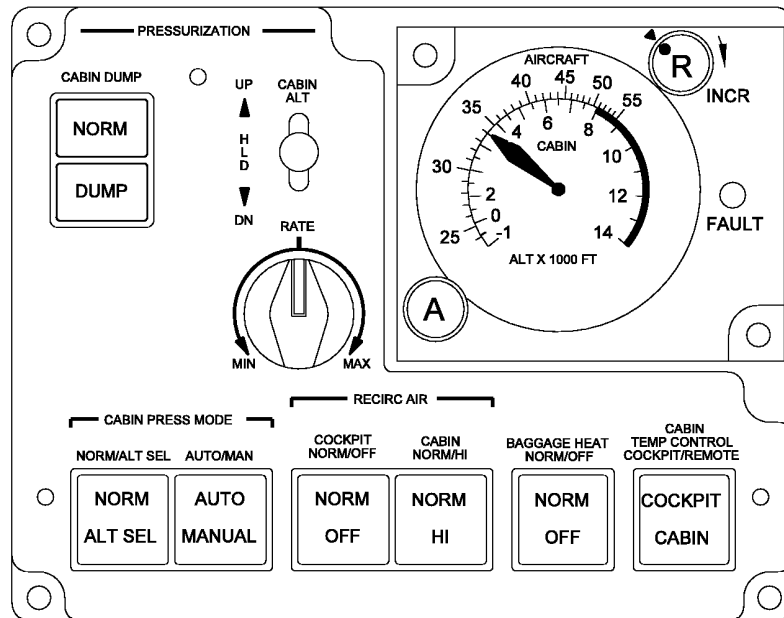
To make sure the cabin altitude will not exceed 8000 feet any time airplane altitude is greater than 25,000 feet, the cabin pressure controller incorporates rate of change multipliers that affect the selected rate once the discrete signal is active.

As the airplane descends to an airport above 8,000 feet, the cabin pressure controller will not allow the cabin altitude to rise above 8000 feet until the airplane descends below 24,500 feet.

Takeoffs from airports higher than 8000 feet with a selected altitude for landing less than 8000 feet activates the discrete signal and rate multipliers. They remain active until the airplane exceeds 24,500 feet or the cabin altitude drops below 8000 feet, whichever occurs first.

## PRESSURIZATION CONTROL PANEL

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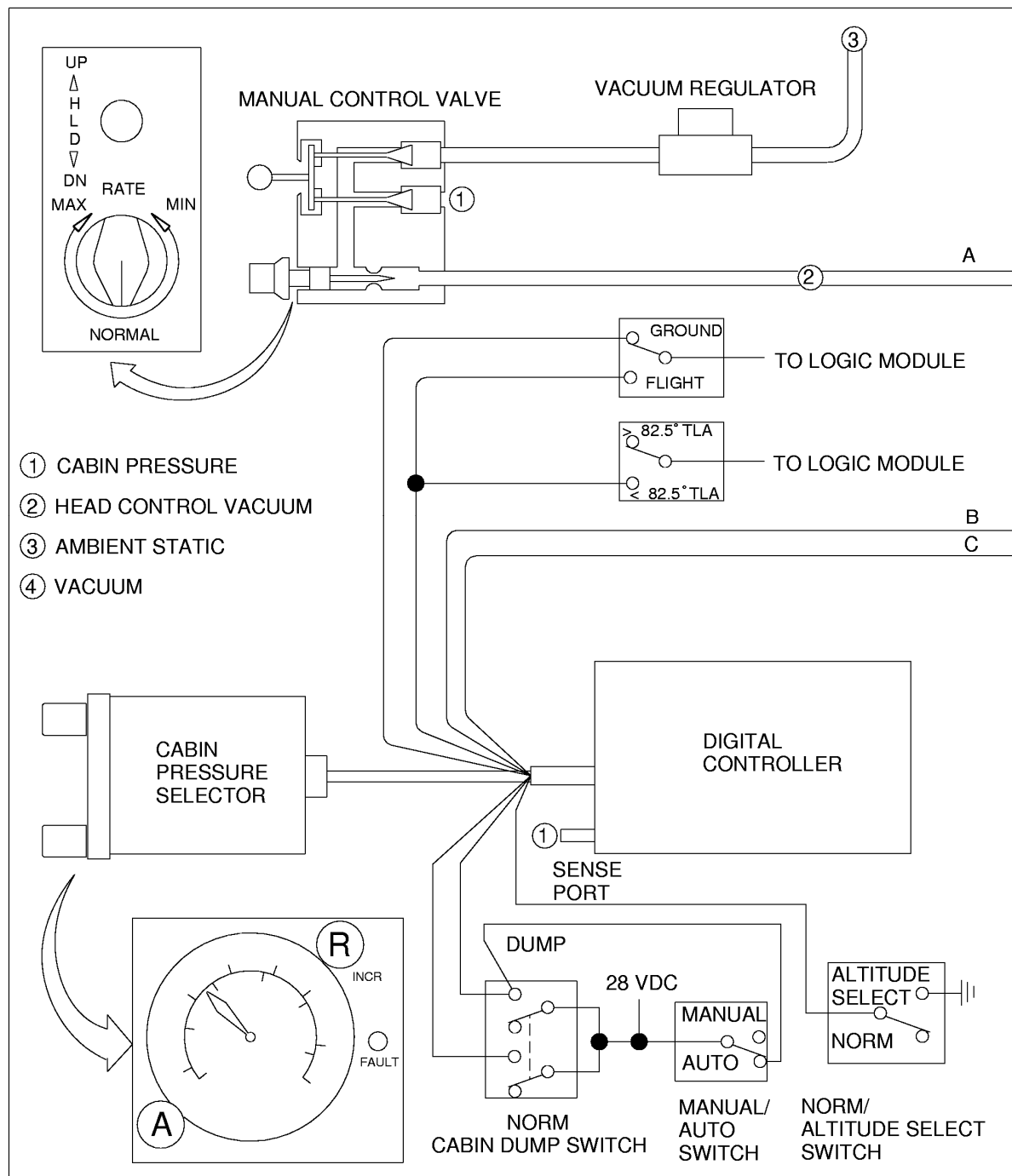


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Figure 2-27

# PRESSURIZATION SCHEMATIC

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Figure 2-28 (Sheet 1 of 2)

# PRESSURIZATION SCHEMATIC

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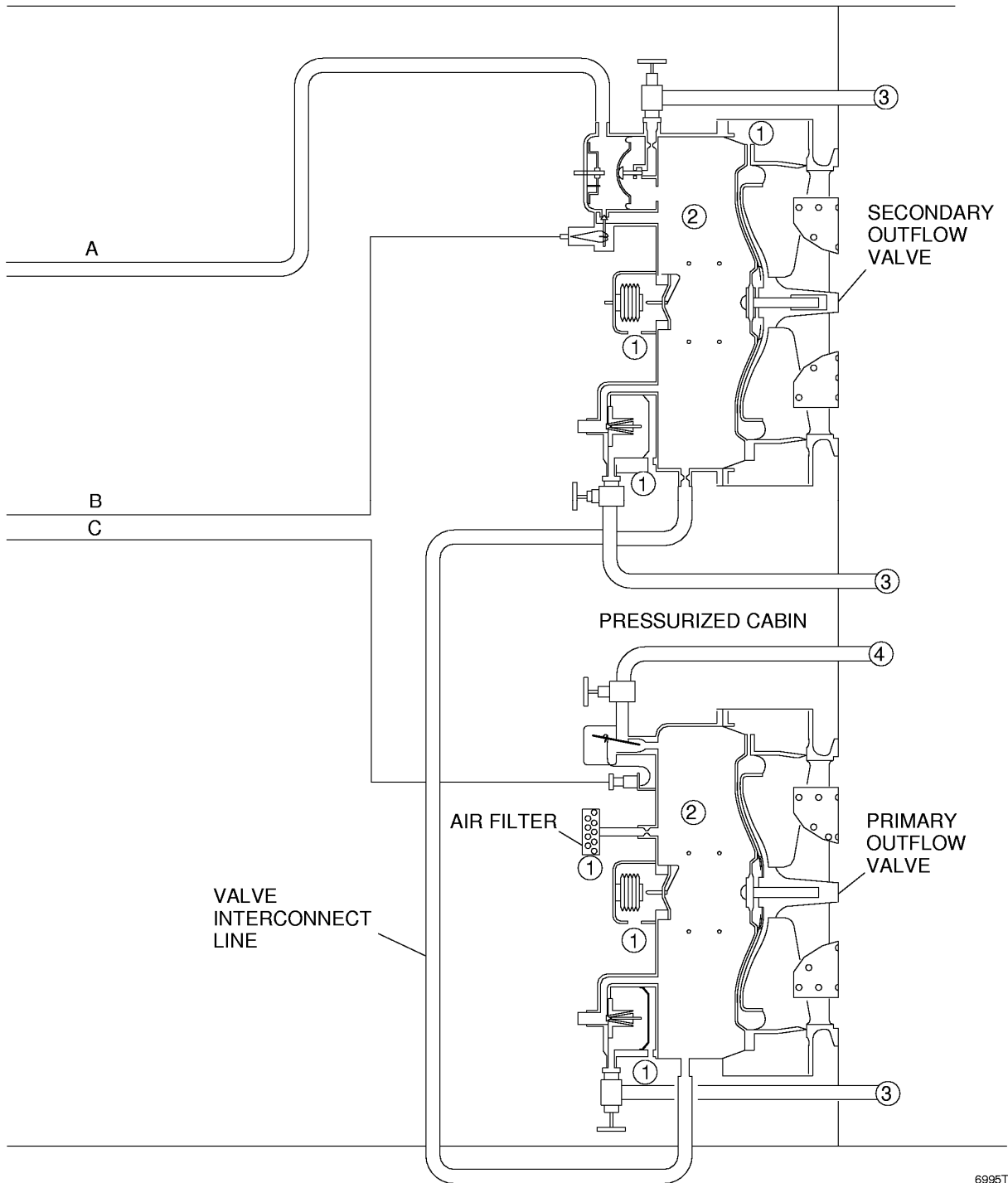


Figure 2-28 (Sheet 2)