VARIABLE ISOBARIC SYSTEMS

Today's light aircraft cabin pressure systems are direct descendants of the earlier fixed isobaric systems. Instead of having a fixed system, pressurization manufacturers relocated the aneroids to a controller in the panel and ran pneumatic lines to the valves. Turning the altitude select knob on a Garrett controller simply rotates the aneroid directly, allowing more air to enter or leave the valve and causing the cabin altitude to change.

Such a direct linkage does have its problems, as it makes setting cabin pressure in flight difficult. Even a small change in dial setting can cause a rapid change because there is no rate of change control. Newer systems incorporate a rate of change function so the dial can be moved in flight, allowing for more flexibility.

Take, for instance, Janitrol's pressurization system for the Cessna P210. The system has four basic modes of operation: unpressurized, isobaric, differential, and negative relief. The unpressurized mode is in effect any time the aircraft is at a lower altitude than the cabin altitude requested by the pilot; this is common during takeoff, climb, descent, and landing. The isobaric mode begins when the aircraft climbs through the selected cabin altitude, which may range from below sea level to 10,000 feet. In the P210, the pilot selects the desired cabin altitude on the manual controller prior to takeoff; no other input is required through takeoff, climb, and level-off. If a change of aircraft cruise altitude is required, the pilot slowly adjusts the controller to preclude abrupt cabin altitude changes, which can be uncomfortable for passengers. Unless, of course, you don't like your passengers and you like that "bug-eyed" look.

The manual controller has two altitude scales, as shown in Figure 12-1. The outer scale indicates cabin altitude; the inner scale indicates the corresponding aircraft altitude at the maximum operating cabin pressure differential, which is the ratio between inside and outside air pressures. These numbers on the controller face must be multiplied by 1000 feet to determine the appropriate altitude. The pilot turns the cabin rate control knob to adjust the rate at which the cabin pressure "climbs" or "descends" to the altitude set on the manual controller. The differential pressure mode goes into operation whenever the maximum cabin-to-ambient pressure differential is reached. Because differential pressure is a measure of internal stress on the fuselage skin, if it were to become too great, structural damage to the fuselage might occur.

The transition from the isobaric mode to the differential control is automatic. The operating differential normally is maintained by the outflow valve with the safety valve acting as a backup, allowing a pressure differential only slightly higher than what is regulated by the outflow valve. The reason for the slightly different pressure differentials between valves is because if it were the same on both the primary and safety valve, the two valves would "talk" or open and close opposite of one another, which can be uncomfortable for passengers.

Maximum Pressure Differential

The maximum pressure differential value varies from aircraft to aircraft, depending on system and structural limitations and the type of operation for which the aircraft is