



# National Transportation Safety Board

Washington, D.C. 20594  
Safety Recommendation

Log 2477

Date: May 5, 1994

In reply refer to: A-94-102 through  
-104

Honorable David R. Hinson  
Administrator  
Federal Aviation Administration  
Washington, D.C. 20591

On August 30, 1993, a Cessna Model 414A, N36990, was involved in an incident at Dickinson, North Dakota, when an explosion within or below the nose baggage compartment blew the left and right nose baggage doors off the airplane. The airplane was taxiing and preparing to depart the Dickinson Municipal Airport when the pilot turned on the Janitrol cabin heater. The explosion occurred approximately 5 minutes later. None of the five persons aboard was injured. The National Transportation Safety Board's investigation disclosed that the explosion occurred when the Janitrol Model B-4050 heater, located under the nose baggage compartment floor, malfunctioned and allowed fuel vapor to accumulate in the nose section of the airplane.

Examination and testing of the heater assembly revealed that the combustion air blower was electrically inoperative because the blower motor's commutator brushes were worn excessively. Therefore, little or no combustion airflow would have been available to the heater while the airplane was on the ground. More importantly, the combustion air pressure switch, which is used to sense combustion air differential pressure, or airflow, was also malfunctioning. The switch contacts, which are normally open, were in the closed position, and the adjusting screw had been turned to a setting corresponding to an extremely low combustion air pressure differential.

In normal operation, a minimum, predetermined amount of combustion airflow must be sensed by the switch before its contacts close and actuate the heater's spark ignition coil and fuel solenoid valve. Fuel is then injected into the combustion chamber, mixed with a swirling combustion airflow from the combustion air blower to form the proper fuel-air mixture, and ignited by the heater spark plug. If the combustion airflow drops below a predetermined setting, the switch contacts open to prevent heater

operation. The switch from N36990, however, would have allowed fuel to flow in the absence of sufficient combustion air as soon as the heater was turned on. Ignition of the raw fuel within the heater's combustion tube was either delayed or did not occur. Nonetheless, an accumulation or pooling of fuel apparently resulted in the dispersal of sufficient fuel vapor, within or below the nose baggage compartment, to form a combustible mixture. The switch may have been malfunctioning for some time. As long as the combustion air blower was operative, or sufficient ram air was available in flight, the heater would have otherwise operated normally and the passive failure or malfunction of the switch would have remained undetected.

On January 2, 1992, a malfunctioning Janitrol cabin heater in a Piper Model PA-31P, N500BH, caused a fire in the nose baggage compartment as the airplane approached the Central Wisconsin Airport at Mosinee, Wisconsin. The pilot, who was conducting the approach in instrument meteorological conditions, attempted to perform an emergency landing but crashed and was killed. The airplane was destroyed. However, the interior of the nose baggage compartment door, which had separated from the airplane at impact, was charred and the exterior was scorched.

Janitrol business and utility aircraft heaters, Models B-1500, B-2030, B-3040, and B-4050, are manufactured by the JanAero Devices Division of Electrosystems, Incorporated, Fort Deposit, Alabama. All of the heaters are similar in design, differing only in size and output capacity.

A review of the service difficulty reports (SDRs) regarding Janitrol heaters installed in a variety of airplanes disclosed a history of failures of the combustion air pressure switches that date to the early 1980s. Excerpts from some of the more recent SDRs illustrate the propensity for failure or malfunction of the switch due to contacts sticking or remaining in the closed position:

**Beech 76 Duchess (January 1993)**

Combustion air pressure switch failed to detect zero combustion air pressure (blower motor failed) allowing fuel to flow to heater where it was ignited and ran out the exhaust burning on the ramp. The pressure switch was found to be sticking. Blower motor replaced. Heater operation normal. No damage to heater or airframe.

**Beech 95B55 (March 1992)**

Heater was tested per AD 82-07-03. Combustion tube was found cracked half way around end of tube. Also, pressure differential switch, P/N A42D36, was found to have failed in the "on" position permitting heater to run despite the crack. It was also found that the heater combustion blower brushes were about worn out. Submitter states differential pressure switch failure was due to salt air moisture getting inside, even though Beech P/N 55-5014-18 heater air switch relocation kit (Beech SI 0721-412 R1) had been installed.

**Piper PA-34-200T (December 1989)**

When complying with Janitrol AD 82-07-03, combustion blower air switch was found defective (always on). It is only supposed to be on when there is combustion air available to combustion chamber. When submitter checked the switch to find the reason to be on all the time, found the microswitch return spring missing. The spring must have been removed on purpose by unqualified person not realizing the danger or qualified person on purpose to make heater work even without combustion air or partial combustion air.

**Piper PA-31-350 (January 1985)**

Combustion air pressure switch failed in closed position. Failed closed switch would not shut off fuel at low air pressure

The manufacturer disclosed that if a heater fails to operate because of reduced airflow from the combustion air blower, some maintenance personnel will arbitrarily turn the combustion air pressure switch adjusting screw to facilitate heater operation. This misguided action defeats the purpose of the switch and can be hazardous. According to the manufacturer, extreme adjustments of this kind in the low pressure direction can result in the switch contacts remaining closed at all times.

While the Janitrol heater design provides a fuel drain line from the heater combustion tube to the exterior of the airplane to prevent the excessive accumulation or pooling of fuel, it is essential that the drain lines be installed (or reinstalled) properly to assure that they are properly sized, remain unobstructed, and have the proper slope. Moreover, the fuel drain line in the Cessna 414A airplane extends only about 1/4 inch below the belly of the airplane and, reportedly, is relatively easy to dislodge and push back into the interior of the airplane.

To prevent an aircraft fire or explosion similar to that involving N36990 or N500BH, the Safety Board believes that a periodic functional check of Janitrol combustion air pressure switches and related heater system operation is essential. Moreover, the combustion air pressure switches should be modified or redesigned to be fail-safe. In the interim, the manufacturer of Janitrol heaters should issue a safety (service) bulletin concerning operation of the combustion air pressure switches and proper installation of heater fuel drain lines.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Issue an airworthiness directive applicable to Janitrol aircraft heaters, Models B-1500, B-2030, B-3040, and B-4050, requiring an operational

check, and adjustment, repair, or replacement as necessary, at the next annual or 100-hour inspection, whichever occurs first, and at appropriate inspection intervals thereafter. The check should establish that the combustion air pressure switch contacts are opening and closing properly, that normal combustion occurs, and that fuel drain lines are installed properly. (Class II, Priority Action)(A-94-102)

Require that combustion air pressure switches on Janitrol aircraft heaters, Models B-1500, B-2030, B-3040, and B-4050, be modified or redesigned to be fail-safe by preventing the flow of fuel in the absence of sufficient combustion airflow and/or heater ignition or if the switch malfunctions or fails. (Class II, Priority Action)(A-94-103)

Require the JanAero Devices Division of Electrosystems, Incorporated, to issue a safety (service) bulletin regarding operation of the Janitrol aircraft heater's combustion air pressure switches and proper installation of heater fuel drain lines. The bulletin should explain the switch function, outline the requirements for testing and adjustment, emphasize the potential fire/explosion hazards due to improper service or adjustment, and specifically warn against arbitrarily moving the switch adjusting screw to facilitate heater operation. Instructions should also be included to assure the functional integrity of fuel drain lines. (Class II, Priority Action)(A-94-104)

Chairman VOGT, Vice Chairman HALL, and Members LAUBER and HAMMERSCHMIDT concurred in these recommendations.



By: Carl W. Vogt  
Chairman