

PILOTS: Ensure Your Fuel Selector Works

Worn components can lead to fuel starvation and sudden loss of engine power

The problem

- Worn fuel selectors have led to fuel starvation and loss of engine power, resulting in serious and fatal injuries.
- As fuel selectors wear, the fuel selector handles may be difficult or even impossible to turn. If a pilot applies too much force, the internal components can fracture and obstruct the fuel flow, resulting in a total loss of engine power.
- In addition, worn detents could make it difficult for a pilot to properly position the fuel selector to the desired tank. Positioning the fuel selector incorrectly to an empty tank or in between tanks could ultimately starve the engine of fuel.

Related accidents

Since 2008, the National Transportation Safety Board (NTSB) has cited the fuel selector in 104 accidents; 63 of those accidents involved incorrect use/operation of the fuel selector, and 28 cited degraded function of the fuel selector. Typically, these types of accidents result in fuel starvation and loss of engine power.



Figure 1. Photograph of accident airplane.

- During the initial climb after a touch-and-go landing in a Piper PA-38-112, the flight instructor reported an emergency and indicated that he would return to the airport. The airplane then spun to the left and impacted a marsh. The airplane was destroyed (figure 1); the flight instructor sustained serious injuries, and the student pilot died. Although the fuel selector handle was positioned to the right main fuel tank, an insert in the fuel selector had fractured into multiple pieces that showed overstress and wear (figure 2, next page). The fuel selector handle likely had been difficult to move for some time, and excessive force would have been required to move the handle from one position to another, thus causing the wear. **The failure of the fuel selector valve in a position that**

restricted fuel flow to the engine led to the total loss of engine power due to fuel starvation. The operator failed to detect and resolve the wear of the fuel selector valve. (ERA17FA112)

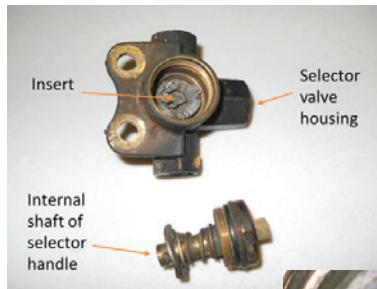


Figure 2. Fuel selector valve housing and section of selector handle (above) and fuel selector insert with fractured pieces (right).

The pilot of a Mooney M20 airplane reported that, during the initial climb from the airport, he noted the engine power slowing, turned on the boost pump, checked the magnetos and fuel mixture, and then attempted to switch the fuel selector to the other fuel tank, which had usable fuel. The engine experienced a total loss of power, and the airplane impacted the ground. A passenger sustained minor injuries, and the pilot and another passenger were uninjured. **The fuel selector handle screw was loose and prevented the fuel selector from moving to the fuel tank position for the tank with usable fuel, resulting in fuel starvation and the subsequent total loss of engine power** (see figure 3). (GAA17CA260)



Figure 3. Photograph of fuel selector.
(Source: FAA)

A witness observed the pilot of a Piper PA-28-140 airplane perform an engine run up, and two witnesses reported that the takeoff sounded normal. However, after they did not hear the airplane continue around the airport traffic pattern, one of the witnesses located the wreckage at the end of the runway and saw that fuel was flowing out of the wing area. The airplane was substantially damaged when it collided with trees and terrain (figure 4), and the private pilot died. Although the fuel selector valve handle was in the right tank position at the time of the accident, testing of the valve with air indicated that the valve was closed. The selector valve was stiff to rotate, and positive engagement of the detents could not be consistently obtained. Disassembly of the valve revealed rotational scoring in the valve and on the plug cock, which had heavily worn detents (figure 5). Debris was also found in the valve and was the result of excessive wear. Both the owner, who was also the operator, and maintenance personnel stated that they checked the fuel selector valve during an annual inspection that was completed about 11 hours before the accident. **The total loss of engine power after takeoff occurred due to fuel starvation as a result of excessive wear of the fuel selector valve.** Also causal was the owner/operator and maintenance personnel's inadequate maintenance and inadequate postmaintenance inspection. (ERA15FA128)



Figure 4.
Photograph of accident airplane.



Figure 5. Plug cock showing discoloration, scoring, wear, debris, and a worn detent.

What can pilots do?

- Check the fuel selectors for proper operation during your preflight assessment, ensuring that the fuel selector moves freely and stays in the correct detent when selected and that fuel selector placards are accurate and legible.
- Do not force a handle that is difficult to turn; it could lead to fractured components inside the fuel selector that may prevent proper operation.
- Do not fly if your fuel selector exhibits any of the following:
 - Sticking and binding,
 - Requires greater-than-average pressure to turn or move, or
 - Worn detents that do not stop the selector in the desired position.
- If you encounter any problems with the proper operation of the fuel selector, do not attempt the flight. Report the anomaly to maintenance personnel for inspection or repair.
- Be informed and review and comply with any applicable airworthiness directives and service bulletins regarding the fuel selector and components.

Interested in more information?

The Federal Aviation Administration's (FAA) [Airplane Flying Handbook](#), FAA-H-8083-3B, Chapter 2, "Ground Operations," page 2-3, contains tips for pilots performing preflight assessments, including checking the fuel selectors for proper operation in all positions, including the OFF position. The handbook notes that "[s]tiff fuel selectors or where the tank position is not legible or lacking detents are unacceptable." In addition, your airplane flight manual/pilot operating handbook will also likely include instructions in the preflight checklist regarding checking the fuel selector valve.

FAA Special Airworthiness Information Bulletin (SAIB) CE-14-22, "Fuel Selector/Shut-Off Valve," alerts owners and operators of certain Piper model airplanes that the fuel selector valve may bind when switching fuel tanks and can cause a loss of power in flight. To reduce the possibility of binding in flight, the SAIB recommends inspection and maintenance of fuel selector valves.

The Experimental Aircraft Association article "[Avoiding Fuel Related Problems](#)" indicates that fuel problems can occur due to malfunction or failure of a fuel system component or poor preventative maintenance and cites situations with fuel selector handles that were difficult to turn.

A [companion video](#) to this safety alert can be accessed from the [Safety Alerts](#) web page.

The reports for the accidents referenced in this safety alert are accessible by NTSB accident number from the [Aviation Accident Database](#) link, and each accident's public docket is accessible from the [Accident Dockets](#) link for the Docket Management System.

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