

*or with supervision and endorsement by a certificated mechanic if required

By George Brown

Fuel Cap O-Rings

Do It Yourself lets members pass along Owner-Performed Maintenance tasks and minor items that can be done under the supervision of a certificated mechanic. The idea is to learn more about your Beechcraft and maybe save a little money in the process. Send your **Do It Yourself** articles and pictures to us at asf@bonanza.org.

Water in the fuel tanks has brought down an unfortunate number of piston-engine aircraft, including the ABS types. Although fuel handling errors or failures in fuel storage and delivery can contribute to water accumulating in aircraft fuel tanks, the primary cause is a leaking fuel cap. Deteriorated O-rings in the flush fuel caps used in the ABS types can allow entry of water into the tanks. This water can result from rain, dew, melting snow, and even washing of the aircraft. Deteriorated O-rings can also lead to the syphoning of fuel out of the tanks during flight (see the video "The ABS Hangar: Takeoff Surprise," on the ABS YouTube channel at www.tinyurl.com/ABSHangar). Additionally, an improperly adjusted fuel cap can let water in and fuel out. Any of these conditions can lead to the loss of the aircraft and property and, far worse, injury or death to the aircraft's occupants as well as possibly people on the ground. A less catastrophic result of water passage around deteriorated O-rings is corrosion that can render an expensive fuel cap useless.



Photo 1

Fuel Cap O-Rings

Three types of flush fuel caps are used on the ABS types: Shaw 431/531, Shaw 416, and Gabb 37810. Each of these caps has a large external O-ring that seals the top

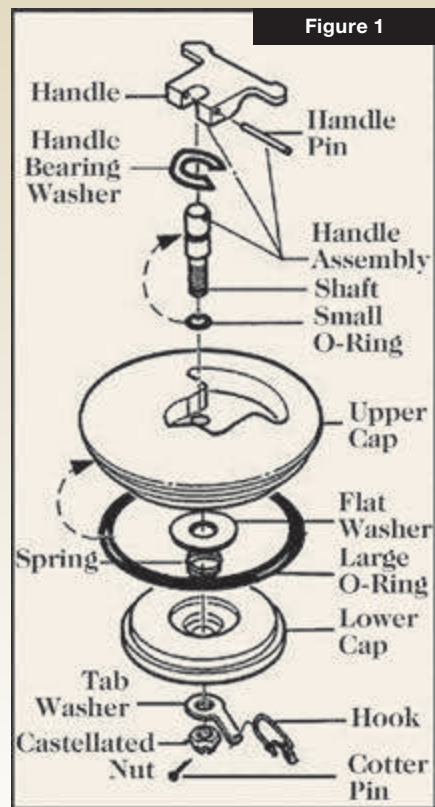


Figure 1

of the cap to the cap adapter in the wing plus a small internal O-ring that seals the rotating shaft within the cap. **Photo 1** represents a Shaw 531 cap and shows the location of these O-rings plus the cotter pin that secures the castellated nut at the bottom of the cap. The O-rings in the other caps are in identical or similar locations.

Table 1 lists the Buna-N (nitrile) O-rings specified in the Beech parts manuals plus the cotter pin used in each of the flush fuel caps. Also listed are flourosilicone O-rings that are reported to have a longer service life but a higher cost than the nitrile O-rings. Some A&P/IA mechanics may choose to install flourosilicone O-rings in place of the nitrile ones.

Visual inspection of the large exterior O-ring is easy whenever the cap is

O-Ring and Cotter Pin Part Numbers					Table 1
Fuel Cap	Large O-Ring Nitrile	Small O-Ring Nitrile	Cotter Pin	Large O-Ring Flourosilicone	Small O-Ring Flourosilicone
Shaw 431/531	MS29513-338	MS29513-10	MS24665-298	M25988/1-338	M25988/1-010
Shaw 416	MS29513-232	MS29513-10	MS24665-132	M25988/1-232	M25988/3-010
Gabb 37810	MS29513-339	MS29513-110	MS24665-298	M25988/1-339	M25988/1-110

removed from the wing for checking fuel level or refueling. Typically within several months after installation, small, vertically biased cracks develop along the exposed peripheral portion of the O-ring, but they can be difficult to see. If deterioration becomes readily noticeable, replace the O-ring immediately.

As taught in the ABS Maintenance Academy and recommended in the Service Clinics, both O-rings in each fuel cap should be replaced each year during the aircraft's annual airworthiness inspection. Replacement of the fuel cap O-rings is *not* approved as owner-performed preventive maintenance as defined in 14 CFR 43.3 (g), Appendix A (c). However, the project can be done by the owner under supervision of the A&P/IA during an owner-assisted annual inspection or other maintenance activity, and endorsed in the airframe logbook by the certificated mechanic.

O-Ring Replacement

After we acquired our Baron I was surprised to find that the small O-rings inside both of the Shaw 531 caps had deteriorated. According to the airframe logs, every annual inspection hosted replacement of the large external O-rings, but there was no mention of the small internal ones. Out of simple curiosity, after moving the first cap to my workbench I poured a small amount of light oil into the recess in the top of the cap. The oil immediately ran down into the cap and began flowing out the bottom at the axle. Had the small O-ring been good, the oil would have remained in the recess and not leaked into and through the cap. Luckily, no water had accumulated in the fuel tanks because of the deteriorated O-rings in both caps.

The tools I use for the O-ring replacement project are:

- Long nose pliers
- Small wire cutters

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Photo 2

- $\frac{7}{16}$ " wrench
- Thin flat-blade screwdriver
- O-ring lubricant such as Parker-O-Lube or EZ Turn Lubricant
- Digital force gauge

I found that replacing the O-rings in each Shaw fuel cap takes about 30 minutes, which includes adjusting the force required to lift the handle as specified in the *Baron 55/58 Maintenance Manual*. Actually, adjusting this lifting force to specifications establishes adequate compression of the large O-ring, thereby creating a reliable seal between the cap and the cap adapter in the wing and also holding the handle securely closed.

To replace the fuel cap O-rings:

Unlatch the cap from the wing and disconnect it from the safety pin-style hook (**Photo 1**).

To prevent any contaminants from entering the tank, cover the open fuel port. A retired computer mouse pad works great.

Before disassembling the cap, count the number of exposed threads on the end of the shaft. This number of exposed threads provides a starting point for later adjustment of the force required to unlatch the handle.

Remove the cotter pin, castellated nut, and tab washer from the shaft (**Photo 2**).

Disassemble the cap and remove both O-rings. I used a small thin screwdriver to get under the O-ring and lift it out. With the large O-ring removed and folded, its perimeter surface cracks are apparent (**Photo 3**).

Clean and air-dry all the parts. Pay special attention to the O-ring groove in both the steel shaft and the aluminum upper cap. Clean and treat any evidence of corrosion.

To begin assembly, lightly coat the large O-ring with an O-ring lubricant and install it on the upper cap (**Photo 4**). If you are installing fluoro-silicone O-rings, Dow-Corning DC-4 Compound works well as an installation lubricant.



Photo 4



Photo 5





Photo 6

Coat the small O-ring with an O-ring lubricant and then apply a thin coat of oil such as LPS 2 on the base of the handle, the handle bearing washer, and the shaft.

Install the handle bearing washer on the shaft and then the O-ring. Insert the assembly into the upper cap (**Photo 5**).

Place the spring into the recess in the lower cap and slide the flat washer onto the shaft.

Flat sections on opposite sides of the shaft and in the hole of the lower cap provide the keying for proper assembly and operation (**Photo 6**). Align the flats,

insert the axle into the hole in the lower cap, and hold the assembly together.

Install the tab washer and castellated nut on the axle. Adjust the nut to leave the number of exposed axle threads noted during disassembly. *Do not* install the cotter pin yet.

Before placing the cap in the cap adapter, this is a good time to clean the adapter, especially the surface that contacts the large O-ring in the cap.

Place the cap in the cap adapter on the wing and slowly close the handle. *Do not force the handle closed*. If necessary, loosen the nut as needed to allow the handle to close and latch.

Using an appropriate force gauge, loosen or tighten the castellated nut to attain the *lifting* or unlatching force specified in the maintenance manual for the aircraft (**Photo 7**). On our Baron, the specified force is 12–18 pounds applied perpendicular to the handle. To quote the Baron 55/58 manual, this force is "... applied 0.20 ± 0.03 inches from the edge of the handle at its center." In summary, adjust the nut so pressing the handle fully closed compresses the large O-ring sufficiently to seal the cap and also to latch the handle closed.

Install and secure the cotter pin.

Connect the hook and chain to the cap and install the cap.

Have your mechanic inspect your work and sign it off in the logbook. Project completed for one cap!



Photo 7

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