

KOEHLER KORNER

Have been doing a lot of maintenance on the Mooney this past month, including replacing the vacuum driven Attitude Indicator with a modern electronic version, redoing the main instrument panel mount system, and replacing all the fuel tank drain valves, which will be the topic of discussion for this month.

All aircraft fuel tanks are required to have a system in place to remove any water or solid contamination that gets in them. Water can come from a leaking fuel cap or condensation as the temperature rises and falls through the day. Water in your fuel can ruin your whole day, so it must be removed. Fortunately, water is heavier than avgas and jet fuel and does not mix at all with avgas, assuming there is no alcohol in the avgas. Water takes a long time to come out of jet fuel which causes other issues that we are not going to cover here. So from here on, we will only discuss avgas systems.

Each fuel tank in an aircraft must have a low point, usually called the sump, in which water can settle. The fuel pickup for the engine will be slightly higher in the tank, so as to avoid sucking in this water. The lost volume of the tank is accounted for in the "unusable fuel" which is actually included in the empty weight of the aircraft.

Each one of these sumps must have a drain valve system in it. These drains come in a variety of shapes and sizes and used to be made by several different companies. Several years ago, there was consolidation in the field, and now two companies have emerged having bought out most of the others that provided valves for GA. The two are Curtis and Saf-Air which actually make some valves that are directly copies of each other, such as the old F391 series of valves.

Curtis is noted mostly for their brass barbed valves that operate with a quarter turn of the two pins or ears on each side. These are very common on gascolators and older Piper products, such as Cherokees. Saf-Air, on the other hand tends to specialize in low profile (some call flush) valves that require a pin pushed up in the center to actuate them, such as this picture of the underside of my Mooney's wing shows.



The spot to the right of the valve with the four rivets is the old really flush valve that was permanently riveted in the tank from the inside, making it impossible to replace without opening up the tank. As a product improvement from Mooney many years ago, the removable valve was installed that you see here.

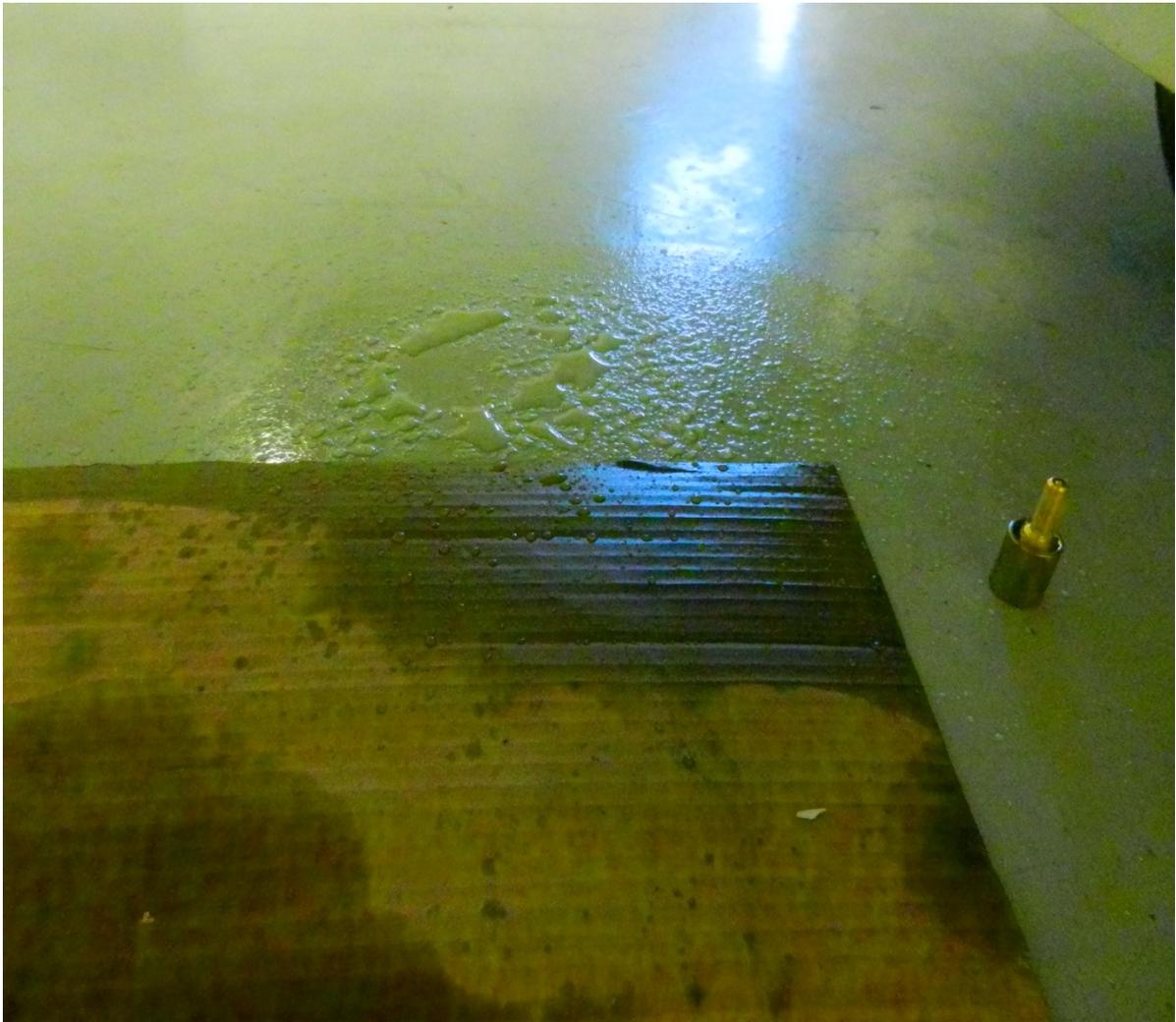
The easiest way to remove a valve is with a ratchet wrench and appropriate sized socket. This picture shows tools and a can of “EZ-Turn” grease, also known as fuel-resistant grease. It is a good practice to butter the threads and sealing o-ring on the valves prior to installing them with the EZ-Turn. The standard sample cup is also in this pic.



To actually change a valve, all you have to do is unscrew the old one and replace it with the new (greased) one. If the tank is empty, it is a piece of cake. If the tank has fuel in it, you have two choices, drain the tank, or do what is referred to in the industry now as the “Indiana Jones Maneuver” where you quickly unscrew the old valve, and then quickly insert the new one, letting some fuel escape in the process. If you are reasonable quick, put your finger over the hole when both valves are out, and have everything ready to go, you will spill about a pint or so of fuel, much of which goes down your arm and burns when it hits the more tender areas of the armpit!



This is what my arm looked like after doing two valves. The outboard tanks were dry. The Avgas washed all the oils from my skin and left it clean and very dry. An immediate shower felt good. Turned out spilling some “fuel” out of one of the sumps was a good deal, as it had water in it. Here is the floor under that sump after the valve



You can see the beads of water on top of the spilled fuel. If you have not seen it before, here is a sample cup with about 30% water in it.



Note that the water is dirty, indicating bad things growing in it, and perhaps the result of corrosion in the tank,

Here are the valves, as removed and new, from one wing.



These valves which are part of the old F391 series, originally made for cars, are made from 1144 steel and then cadmium plated, so they will corrode in the presence of water. Originally the inner valve could be removed with a clip, and a new o-ring installed, but as you can see, the new ones are crimped and the inner o-ring cannot be replaced in the field. This is true for most fuel drain valves now. Good news is that both companies make compatible versions for around \$20. My old valves are at least 10 years old.

Note that these valves are straight threaded and have a sealing o-ring at their base. Some valves are pipe threaded and will require a fuel proof thread seal (EZ-Turn will work). Be very careful to not over tighten the valves to get them to seal. I have had to replace a cracked tank fitting on two planes, and both were major repairs involving opening the tanks, riveting, and new, expensive, tank sealant.

Hope this little maintenance tip helps you maintain your plane and keep it safely flying. Keep building, flying, maintaining, learning and having fun.