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## Fuel Vents and Systems

Fuel vents. Concept is good; air needs to displace the fuel that is drawn from the storage place, be it a cell, tank, reservoir, or whatever it is called in your aircraft. Often overlooked, the fuel venting system is vital to the proper and safe operation of your engine(s). The nutshell arrangement for a fuel vent is a positive pressure applied to the inside of the fuel cell. In detail there are several components associated with this system. Most fuel vent systems start with a forward pointing, or positioning, tube in the air stream. Generally, this is under the wing, but on some aircraft it is on top of the wing. Some manufacturers place it unobstructed, others place it behind something else; for example, Cessna places them behind the lift struts on their strut-equipped high wing aircraft, as an aid in preventing ice accumulation.

It is important to note that all aircraft manufacturers have explicit instructions on the maintenance of these external appendages, in the form of length, angles, and positioning to other objects, like the wing strut on the Cessna.

Another type of 'inlet' for the venting system may be a flush vent; this is basically a hole in the bottom wing skin that is plumbed into the tank. Very effective, as it takes advantage of the normal high-pressure area under the wing. And, of course, there are the vented fuel caps that do not require additional plumbing.

Many aircraft use a combination of these sources for venting. As mentioned, vented caps are probably the easiest to design and put into service, but I believe also the least effective, as they are generally in a low pressure area. The remainder of the vent inlets require plumbing to get the air to the tanks. Generally, this is with 1/4" or 3/8" diameter tubing, terminating in the highest point of the fuel tank. Some manufacturers use check valves in these lines, allowing air to go in, but preventing fuel from coming out.

With the fuel vent system found on a Beech Bonanza, we start with the under-wing flush vents, air path through a check valve and into the fuel cell. There is a "Y" in the line between the cell and the valve; this allows for air displacement from the secondary vent, the forward facing appendage mounted near the rear spar/fuselage intersection. On later Bonanzas, there is also a third vent, very near to and additionally Y'ed into the system. This is at the rear of a recessed inlet.

On aircraft that are certified for flight into known icing, at least one of these fuel vents are heated to prevent ice accumulation.

As mentioned, many aircraft use a combination of venting methods, as a fail-safe should one method not perform adequately. What are the enemies of a fuel vent system, and what will occur should it fail?

The enemies fall into two categories: Mother Nature, and improper handling. Mother Nature includes the subjects of ice, as well as insects / insect debris. We are generally taught to look at the pitot tube during pre-flight for obstruction, yet we typically have a cover for it to help keep insects out. Rare is the individual who covers his / her fuel vents, but rarer is someone who routinely inspects the fuel vents on pre-flight.

As a pilot, during preflight look for the obvious things like fuel level being different on an aircraft used with fuel selected "both". Listen for a rush of air when opening a cap. (This is mostly noticed at refueling immediately after a flight.) In flight, if fuel is selected "both", watch for un-even feed from the tanks. If your aircraft has bladder type cells, watch for the gauge staying full - that would be an indication of the bottom of the tank being sucked up, as they are rarely attached to the wing. (As a side note, these cells are well snapped to the top to keep them in place, however enough negative pressure will also unsnap them.) Abnormal EGT may also be a clue.

One time, when flying my Cessna many years ago, I was climbing over the Cascades, leaning along the way. At about 8,000 feet, when I went to lean again, I noted a drop in EGT, so I pushed the mixture back in, but to no avail; the engine shut down. OK, what happened - best glide - check mags - confirm fuel on - 'nearest' button on the GPS and take a heading - try the primer (hey; why not?) The engine momentarily surged back to life. OK, now I know I can extend my glide if needed, so I assumed a heading to a better airport than the GPS had picked. At about 5,000 ft, it started to run again, so I did make it home. My first thoughts were water to ice in the fuel line or carburetor, but found no evidence. I did find the under-wing fuel vent was plugged solid with bug nest debris. Then I reasoned the temperature I was flying at, with the low pressure on top of the wing, the cap vents must have frozen over. I was VFR, but there was certainly enough humidity and the right temperature for it. I adopted checking my fuel vents as part of my pre-flight.

Do I do this in the Bonanza now? Perhaps not every flight, but certainly more often than at annual inspection.

If you even suspect a problem with your fuel vents, contact your maintenance provider for guidance on checking them. It will give you that extra feeling of knowing your bird is happy.

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## Customer Furnished Parts: Problem or Not?

Why do some shops allow the customer to bring in their own parts, and others do not? On the surface, it looks to be a reasonable question. And, you can save some money by doing it, right?

Say your airplane needs a set of spark plugs. What ones are they? A quick look at the part number on the side tell you what is in there now, but was the last installation performed with the correct parts? Always a good question to ask. With a little bit of research through the TCDS (Type certificate data sheet), you will find the approved part numbers, or a reference of where to find them. Note the plural; there can be several choices after that: brand, heat range, harness connector, etc. If the ones coming out are on the list, you are in fine shape to use the same part number. In this example, a little bit of research amounted to about five minutes. So, you hand your plugs to your technician, and he sets about the process of installation, which includes confirming applicability (unless he did this prior to your purchase), checking the gap, testing them, putting on the thread lubricant, installing and torquing them, then attaching and securing the harness. If all goes according to the plan, all is well; but let's look at a couple of things that may go wrong.

You supplied the wrong plugs: Whether you went on the assumption what was in there was correct or copied down a number or letter incorrectly, your technician can't install them. Then, who gets to deal with the seller (presumably a discount parts mail-order store) to return and get the correct ones?

Or, one is damaged by the technician. We have a saying: If a spark plug gets dropped, drop it again - in a garbage

can. A fine crack may have been made in the ceramic that may not show itself until hot and under a load, so to be safe, we won't use it. But, your technician didn't sell you the part; is he liable for replacing it out of his own pocket?

In these examples, it is more of the convenience factor than the dollar amount that comes to the front. But, what about more expensive things?

We have a customer that has a 'special needs' aircraft. Without going into detail, it has some systems on it that are not like this aircraft's brethren. One is the fuel system. Granted, the customer did his research on the needs, but so did we, confirming his research, as well as finding the required parts. As work was progressing, he decided to save some time, went around us, and purchased the parts direct from our supplier. He did not see a problem with that, but there is.

First, the supplier was placed in the middle. An honest supplier, like this one, doesn't like to be moved from one end to the middle; they prefer a reputable shop to be in the middle. Second, it cuts the shop out of their discount on the parts. That may not sound like a big deal to you, but when you consider that I spent my time confirming applicability, my people spent their time finding the parts, and I have to take responsibility for correct installation without damage. Two things came directly out of my pocket, with the potential for a third. We do not charge hourly for the research and procurement of the parts other than the mark-up we make (the discount we get on purchase). And that, my friends, is not much, but it does help defray those expenses. By cutting the shop out of a modest parts profit is like telling your technician's supporting crew their time is worthless. (As a side note, this particular customer assisted in finalizing our customer-furnished parts policy, but was rather disturbed when he found it also applied to him.)

Then, what happens when something does go wrong?

Another customer decided to have us install a new engine analyzer that he proudly placed upon my desk, then later added a separate fuel flow totalizer (the analyzer had fuel flow option, but this stand alone unit would replace the original fuel flow gauge) to the installation, also, just bringing it in and handing it to me. The products were manufactured by the same leading company in the aviation electronics field. Frankly, we had issues getting the two systems to play nice in this airplane. The customer service from the manufacturer was outstanding, and they tested and even replaced components that tested OK. (The problem was everything worked OK with the avionics master 'on', but not 'off'. Even though the fuel flow transducer was powered by the primary bus, the stand-alone fuel flow instrument would not work unless the avionics master was alive. As this was going to be a primary instrument - the analog gauge was removed - this was not acceptable.) Eventually the customer had us remove the interface to the analyzer, so the stand-alone unit functioned normally. A few months later, the customer took his aircraft to a shop near the manufacturer of the products, and they were able to make them work together. He was unsure of what they did (their record entry stated 'installed per manual number X', which was what we tried.) None the less, if it works, great! However, the customer not only told me I owed him for my time in troubleshooting it (last fall), but then tried to extort this from me by saying the local type-club was anxious to find out how I was going to handle it.

I invited the aircraft owner to bring his airplane by so I could see the 'new' installation. I suspect one of three different things happened here: First, they didn't care that the primary instrumentation had to be operated by a secondary bus, or there is now another component, be it a diode or other electrical device, installed to direct current flow. I will also be upright enough to admit it could have been an installation error. However; as anxious as he was to get a rebate, I have not seen or heard from him again.

People, this just isn't right. Please work with your maintenance provider; he / she is not your enemy. If you desire to supply your own parts, you need to take your share of the responsibility if something goes amiss. If you have any questions on how matters may be addressed, get them out in the open *before* the work starts. Ask for the information; if you are dealing with a reputable provider, there should be nothing hidden.

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*At AVSTAR Aircraft of Washington, Inc., the customer furnished parts policy, general warranty, and customer policy are not only posted on the wall, but on our website.*

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## Tidbits

**891JH Update:** With the coming of July, so came time for the first annual on the new ol' girl. Didn't fly her as much as I wanted to this past year, but did get up a few times. Many thanks to Larry Becker, from Anacortes, who finished up my check out and biennial flight review earlier this year. The annual found few discrepancies, but there were some. Mainly, a couple of oil leaks and the obligatory wing-bolt re-torque. Also been working on getting her interior done. Will probably keep the old front seat for another year, but the side panels, headliner, and carpet are coming along quite nicely. We made all new metal backing, and Janice's sewing skills are a great help!



**Kudos to TCM:** Teledyne Continental experienced a cracking problem on some of the cylinders they produced over the last couple of years. Early this year, they determined they were off of one of the casts used in the process, so they issued a voluntary recall of these cylinders. One of our customers had two affected aircraft, for a total of ten cylinders. TCM stepped up to the plate, and replaced them, including freight and labor. Now, multiply that by all the affected cylinders that were / are out there. *That's customer service!*

**Your tax dollars at work:** The county and the post office have conspired against all of us out here at Pierce County Airport; on September 1, we all started using our new addresses and zip code. Hey, we must be up-town, we even have street signs! If you had not noted it yet, our new address is on the bottom of this page.



Thank you for reading this issue of our newsletter. I hope you have found it interesting and informative. If you have any questions or comments, you can email them to me at [avstarair@att.net](mailto:avstarair@att.net). If this issue was sent to you by a friend, you may opt in to receive further issues by sending an email to me at [avstarair@att.net](mailto:avstarair@att.net). If you chose to opt-out of receiving further issues, please email me at [avstarair@att.net](mailto:avstarair@att.net) with the word remove in the subject line.

Gear Green,

*Mike*

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