Tips from Comanche *Flyer* magazines Feb 1973 – Sep 2012

CHAPTER THREE

FUEL SYSTEM
(FUEL TANKS, FUEL LINES, TIP TANKS, GAUGES

Table of Contents

Fuel Cell Cover Door Fasteners

A small problem with my Comanche that has irritated me for a while was quickly solved the other day, so I thought I would pass it on to the other members.

That little wing top dzus fastener on the fuel covers will occasionally get stepped on by an un-observant passenger and get bent or broken. A Piper Parts Distributor suggested I replace them with Cherokee Six Cowling Fasteners which are round and flat, a little larger than a quarter.

Now, when they are stepped on they just pop back up unharmed. The washer holds them securely so that fuelers cannot remove them.

Win Servo Valve Torn Diaphragm

We have a 1969 Turbo Twin Comanche which has a factory new engine with 250 hours and new turbos with about 200 hours. On a recent flight we couldn't shut down the right hand engine, the only way in the end was to select the fuel selector to off. After one FBO supposedly cured the problem the right engine quit during an instrument approach. The problem turned out to be a torn diaphragm on the servo valve.

Fuel Cell Cap Repairs

The sight of fuel running off the wing while in flight is distressing at any time, but particularly so with the new high prices of fuel. I found my fuel cell caps run out of adjustment so I took them apart for repair.

What happens is that the dog ears on the cap lock wear down and the slack can not be taken up by tightening up the cap lock any further. So I inserted a brass washer under the cap lock, which made it possible to loosen the lock a little and still have the cap tight.

This does raise the position of the cap lock on the cap and you may have to file the cap down a little when locked to clear the fuel cell cover.

The adjustment on old caps may be corroded and difficult to unscrew, but the cap can be taken apart with tools if necessary. If this proves impossible, cut the rivet holding the cap lock and reassemble with a small bolt.

Fuel Odor

A suggestion on gas fumes problem: "Check underside of wing for evidence of fuel cell leakage. Also, could be sign of leaking diaphragm in injector servo. There are important bulletins on Bendix injector units in our Comanches. Check Bendix service letters and bulletins."

Fuel Flow Surge

In your October 1974 issue, you published a letter from me complaining of a problem I was having with my '260C Comanche, in that in normal cruise the fuel flow indicator would slowly pulsate from 12 1/2 to 14 gallons per hour and as the fuel flow indicator rose the EGT would show a corresponding drop of 50 or so, and as the fuel flow indicator dropped to 12 1/2 gallons per hour, the EGT would rise to its normal reading. So by this cross-check I knew something was not exactly normal.

I never did hear from any members as to the cause or cure of this condition. However, last month I noticed that my fuel sump had a tiny leak in it and after draining my fuel tanks it would really not completely shut off, so I had it changed. Since that time my fuel flow and EGT have behaved normally. I mentioned this problem to the mechanic who changed the sump and he felt that there could be an interrelation between a slightly leaking fuel sump drain, bubbles in the fuel lines causing a variation in the fuel flow. I am not a mechanic so can't say for sure, but I am a lot happier now that things look normal.

Fuel Flow Surge

I have a 1967 Comanche 260B with less than 200 hours on the factory re-manufactured engine, a new electric fuel pump, and all gas lines have been checked for air leaks. Shortly after installation of the new engine, I obtained erratic fuel flow indications in both the lean and rich directions which caused substantial engine missing which could be overcome by the electric fuel pump. The fuel system was checked for air leaks and thereafter the fuel flow fluctuation to the lean side stopped and I have had no more engine mist.

At the present time at altitude I occasionally will receive erratic fuel flow indications to the rich side with as much as one to two gallons of flow per hour with corresponding changes in the EGT. Sometimes the fuel flow remains constant for two or three hours, then will become erratic for a short period of time, sometimes for as long as an hour or two when the needle is in constant motion from a lean setting, rich, and back to the lean setting. There is no indication of missing in the engine performance.

One thing that can cause erratic fuel flow indication is a little dirt in an injector nozzle. This will decrease the actual amount of fuel flowing into the engine, but the fuel flow meter will show an increased flow. This is because the meter senses pressure, and the pressure in the system will be increased by the dirt in the nozzle.

Another source of such difficulty is vapor locking in the fuel pump. I remember a 1970 Comanche C on which we had to install 3 different pumps before the trouble cleared up. Neither the engine driven pump nor the electric pump will pump vapor. If there is a bubble, the pump usually just beats it around. Sometimes with both pumps on, the vapor can be pushed on through. This is why using the electric pump will sometimes help the problem.

I have also seen injection lines that were lined with some sort of scaly corrosion. A small piece of this breaking loose can cause trouble if it lodges in the flow divider, the nozzles or the gas lines. In that case, the trouble was cured by replacing the lines with new ones.

Fuel Odor

Q. For several years, I have detected a gasoline smell in N7611P. I spent over $500 on a fruitless search for the source and was assured that nothing was leaking and it was probably normal. I usually keep the fuel tanks (90 gallons) full to the absolute top. After having used fuel out of all tanks down to about halfway, I noticed the next morning that the ever present fuel odor was missing. However, after takeoff and steep climb, it comes back again. Is it possible that fuel is leaking from around the top of the filler neck?

A. Yes, this is possible. Or, it may be that the tanks have gotten porous along the top. When a Comanche sits in the sun, even with full tanks, there is no fuel touching the upper surface of the bladder, and in time it will develop small pinholes over that upper surface.

You might change the gaskets to the access holes to the tanks, and if that doesn't eliminate the problem you can be pretty sure that you have a porous tank.

From Director of Products and Services: General Aviation Inspection Aids lists for a PA24-250 having Fuel Cell, PIN's 20355-00 and -01 the following;
The causes for a complaint about fuel stains and fumes in both wings was traced to leaking fuel cells. Both tanks were found to have porous areas. Total time in service - 1,800 hours.

Twin Fuel Caps

Just a warning with winter coming on, you need to check these caps. The proper cap for the auxiliary tank is Piper Part Number 27221 -00. Caution on this as the cap has been changed but not the Part Number. The approximate length of the old-style cap with the rubber part un-compressed is 1 3/8", and the new one is 1 7/8". When getting a new cap, be sure it is the longer one. Ask for the "Long-Reach Cap."

The threaded area and hinge parts should be lubricated with a small amount of fuel lube so that adjustments can be made easily as the cap must have a snug fit in the tank filler neck to compensate for the vent line built into the inside radius. If your aircraft has the old style caps, I would strongly recommend removing the top of the tank and sponging out the water from the bottom of the tank. This cannot be drained out through the sump. With regard to the other caps, keep them properly lubricated with fuel lube and properly adjusted. Be sure that the gasket under the hinged cap which closes over the fuel cap is in good condition and fits tightly to the wing skin. This will prevent water from leaking into the filler neck-cap area.

Piper Periodic Inspection Report (page 30) states: Remove, drain and clean fuel filter bowl and screen at least every 90 days.

REMEMBER! All Comanche gas caps are non-vented. An Aztec cap, which is vented, looks like a Comanche cap and will fit a Comanche. The vented cap permits moisture and water to get into the auxiliary tanks on a PA30-39; especially if the gasket under the hinged cap, which covers the fuel cap, is missing or in poor condition.

A phone call to the man who purchased 7184Y has determined that both auxiliary tanks had Aztec caps installed.

ED: We had constant water in the auxiliary tanks of 8239Y until we installed the long- reach caps (done in 1969). At that time, we drained and sponged out all liquids. To date (8 years later), we have not recovered any water from our annual "Spongout" of the auxiliary tanks.

History of Comanche Fuel Caps

During the evolution of the Comanche series, three different types of fuel caps were used. The following is a brief explanation of them in the sequence in which they were used.

1. Fuel Tank Cap, Part Number 25983. This was known as the automotive type cap and was used on the very early PA-24 and PA-250 Comanche aircraft, serial number 24-1 to 24-580 inclusive. It should be noted that Service Letter 516, dated March 7, 1969, advises that when you elect to install the fuel cell vent system modification, you will no longer use the automotive cap - but rather switch to the thermos type. See the end of this article for information on the service letter.
2. Fuel Cell Cap Assembly, Part Number 21821. This cap followed the automotive type cap assembly and was in use on Comanche models, serial number 24-581 and up, and Twin Comanche aircraft. Note that the fuel caps on Comanche models and the Twin Comanche models are identical.
3. Fuel Cap Assembly, Part Number 27221. This is the current cap assembly and has for a number of years replaced fuel cap assembly 21821. Therefore, anyone ordering the 21821 -00 cap will automatically receive the 27221 cap. The cap looks like this:
   This cap is longer than its predecessor and it has a slightly greater ridge of rubber just underneath the cap; both modifications are designed to provide better sealing. This cap is used on all Comanche models, serial number 24-581 and up, including the 400 and Twin Comanche models in both the main and auxiliary tank positions. The Britain Tip tank uses a different cap than any of the above.

A most important point to recognize is that all three caps detailed above are NON-VENTED. A Comanche uses nonvented caps.

PIPER Service Letter 516 discusses a Fuel Cell Vent System modification. It applies to all PA-24 and PA24-250 Comanches; serial numbers 24-1 to 24-3529 inclusive. Its purpose is to provide the necessary instructions to perform the installation of an improved fuel cell venting system incorporating recessed NACA type anti-icing fuel cell vents which will minimize the possibility of fuel cell vent restriction which could cause fuel cell collapse. This recessed vent is on the underside of the wing.

It also includes installation of 1/2 inch forward facing fuel main tubes to minimize difficulties that could occur as a result of loose fuel tank caps; and sealing material is provided to preclude the entrance of water into the fuel quantity gauge sender recess.

Installation of the applicable kit will preclude further compliance with FAA AD 68-13-3, and PIPER Service Bulletins No. 216 and 231A. However, PIPER Service Letter No. 367 shall remain in effect.

Affected aircraft, with only main tanks installed will require only Kit No. 760-277; with auxiliary tanks installed, both Kit No. 760-277 (Main Tank Modification) and Kit No. 760-281 (auxiliary tank modification) will be required.

Note: Serial Numbers 24-1 to 24-580 inclusive must order, in addition to modification Kit Number 760-227, "thermos type" fuel tank caps, PIPER Part Number 27221 because it isn't included in the kit.

Compliance with this Service letter will preclude any future action with regards PIPER Service Bulletin Number 180 and 193.

Check your Comanche during the next preflight and make certain that it is "up to date."

Gremlin in the Fuel Tank

The engine of a newly purchased, 1960 210 blew up in my face. The decapitated propeller cut off part of the right wing while the cowl hung up on the right wing / strut juncture, causing an almost uncontrollable descent. The oil covered windshield blocked my view forward but the forgiving ocean cradled my crash landing. I swam to shore and watched my life savings in airplanes slip below the surface.

It took nine months to find another affordable airplane that turned out to be a tired old 1959 '250 Comanche parked on the field which was pumping oil after only about 500 hours on a new overhaul. One expensive top overhaul later showed that the oil rings had lost their temper from excessive heat which the A&P thought, could only be caused by someone flying the plane with air intake plugs installed (also known as bird bungs) or from excessive ground running probably during break-in.

Now I was ready to break in a new engine in a strange airplane and, after what I had been through, I was nervous to say the least. The instructions for flying on new chrome jugs suggested takeoff light and cool so I had only the main tanks filled to the bottom of the filler flanges (50 gallons) and took off early one morning with my eyes glued on the head temp. gauge. After an hour of flying wide open for three minutes every seven minutes at full rich I landed to check things out. With only one quart of oil burned off, I took off again for another hour. I figured that even at 20 gallons per hour, I had at least two and 1/2 hours of flying. I never trust a fuel gauge, but I was puzzled as to why the right tank appeared to be going dry while the left remained half full.

After about 40 minutes of the second hour, I had just nosed down to start a descent over the airport from 10,000 feet, trying not to cool the engine too rapidly when it quit dead. Oh no - my new cylinders, I thought, now what did I do wrong? The fuel pressure was zero and pumping the throttle and turning on the electric fuel pumps made no difference. There was no use in switching tanks since I was already on both mains and the auxiliaries were empty.

The Britain type tip tank auxiliaries had dual selectors which allowed both mains to be on at once feeding to a central sump or any combinations of the four tanks and off.

After my last harrowing experience, this emergency was a piece of cake. I almost routinely told the tower of my situation with a slight note of disgust for, after all, this was getting old. It took the lightweight Comanche so long to descend from 10,000 feet that they called me several times to ask how I was doing. Finally, at 5,000 feet, I put the gear down to speed things up and hold up other airport traffic. Now the engine was running again, but when the throttle was opened, it would still stop dead. After landing, naturally, it ran fine and I taxied to my tie-down area feeling like a fool. I should have at least made the landing look a little hairy for the benefit of the firemen.

Once the plane was on the ground, the fuel pressure was normal and the engine ran fine at all power settings. The fuel flowed well from the gasolator drain. The right gauge still showed empty and left half full. A visual check of the tanks showed that, indeed, the right dry but the left appeared to be only about 1/4 full, but it was difficult to tell in the bright sun. Next I disconnected the line from the carburetor and checked the fuel flow with the electrics on. Just like a garden hose.

Following the advice from my A&P mechanic, I inserted an inspection mirror down inside the filler opening after dark, being careful not to get the flashlight inside the tank and checked the finger strainers. They both appeared clear and clean, but I did notice a wrinkle in the bottom of the rubber bladder of both tanks. By this time, the fuel had equalized across the tanks and each were about 1/8 full. However, the wrinkle in the left tank was holding up the fuel sender float so that the gauge read half full. Blowing through the fuel tank vents showed no restrictions there.

The clues to the problem were all there but no one I talked to was able to put them together. Can you? The answer was so simple.

After having all the tanks filled half full (still breaking in the engine), I took off again with the selectors still on both mains and then switched to the left main only. After about 5 minutes, the pressure gauge started fluctuating wildly and went almost to zero pressure but the engine kept running. When I switched to another tank, the pressure immediately came up to normal. A little more experimentation showed the fluctuating pressure came with only the left main selector on. Skidding and slipping the plane made no difference, but at least the engine kept running. By this time, I was fit to be tied. I landed and did not fly again for two weeks while picking the brains of everyone in sight but the only advice I got was to have a new fuel pump installed which I did. It just seemed like some sort of left fuel flow blockage to me but it flowed fine on the ground.

The answer came suddenly. I had just taken off again with all tanks full when I happened to look out at the left wing and saw fuel pouring out from under the left filler cap and streaming back off of the flap. After landing, an inspection of the fuel tank cap showed the thermos type cap's expanding cam pin had sheared on one side and bound in a way that the cap felt tight while, in fact, it was loose enough to allow fuel to be siphoned around it as well as up through the center of the cap itself.

The low pressure over the wing had first tried to collapse the flexible fuel bladder and then, after about 5 minutes, would cause the fuel pressure gauge reading to drop but enough fuel still got through to keep the engine running. With another tank switched into the sump was another story. The fuel would flow to the engine from that tank but when it went dry, air was drawn across to the left tank blocking the flow of gas from the left tank to the sump. As the plane slowed down (and the pressure on the wing lessened) it appeared enough fuel got through to idle the engine. Of course, when the plane landed and the pressure disappeared off the wing, then the fuel flowed normally. The low pressure had also caused wrinkles to appear in the bottom of the bladder and buoyed up the fuel sender float giving a false fuel quantity reading. The wrinkles disappeared when the tank was filled and, since the cap was fixed, have never reappeared.

The Comanche has given me no other troubles and I think it is a great plane. I just recently flew a trip, side by side, with a new Lance. We were both slightly loaded, but I had to throttle back to stay with him.

Fuel Selector Valve

Q. Problem: Fuel selector valve - Our PA24-250 (1960 edition - TT 2,015) has, over the past 6 years required both disassembly and lubrication of the valve (or replacement needed or not, 3 times) about every 6 months. Otherwise, it becomes so tight to move in the 'dog dish' as to resist changing valves except with a pipe wrench. All work has been done at approved shops, including Lock Haven Airmotive (her birthplace). Is there a fix? I have been told all Comanches have this problem, so live with it. It's not all that humorous over hostile terrain. Would appreciate any help from ICS that is available.

A. We assume that your 250 dues not have auxiliary tanks and therefore has the three position fuel selector valve. All Comanches do not and should not have this problem. You don't have to live with it. Your valve is cone shaped and spring loaded. PIPER says take it out every 400 hrs. or if it binds, and lubricate it. John Dean does it at every annual. It is a simple job. Remove the fuel select or handle. The cover or 'dog dish' is held in place with a few screws. Take it off and remove the nut from the valve stem. Remove the cone shaped valve. Wipe it clean of any old lubricant. Clean the seat, removing any old lubricant that may be in the openings. Now - coat the cone lightly with a solvent resistant grease having MIL - G-6032 lubricant specification. This is sometimes called fuel lube. It is very important to use a lubricant which is "Not soluble" in fuel for you defeat the purpose of the lubrication, it just washes away. Insert the lubricated cone in the seat and rotate it to transfer the lubricant to the seat. Remove the cone and wipe away any excess from the top and bottom and in the openings. Since it is insoluble in gas this excess can be carried down the fuel lines into the fuel pump or carburetor

screens. Reassemble the valve and you should be OK. A five position selector is used with Comanches having aux. tanks. It is a totally different selector and does not require lubrication.

ED: S.B. 345B, dtd 5/19/82, solves this problem.

Twin Fuel Caps

Just a line to commend the nameless writer for his common sense solution (engineering evaluations indeed), to the fuel feed problem in Twin Comanche 84Y.

I purchased my 1965 PA-30, two and one-half years ago in California. It had the old, short fuel caps on the auxiliary tanks. This area of Oregon has an annual rainfall of 40". The airplane was tied down outside and after our first heavy rainstorm I got a considerable amount of water when I drained the fuel strainers. It was obvious that it was raining into the tanks. I immediately ordered new caps for the auxiliary tanks. Meanwhile, before the new caps were picked up, while enroute IFR to Seattle, both engines quit when I switched to the Auxiliary tanks. (Both tanks were switched nearly simultaneously, a practice since corrected.) I immediately switched back to the main tanks and both engines regained full power and we continued on to Seattle without further incident. Upon draining the strainers, on the ramp at Seattle, considerable water was found in both strainers. The strainers had been thoroughly drained on the ground before the flight, in fact, several gallons were drained into a clean pan. It is obviously not possible to remove all water in a parked attitude. After replacing the caps, there has been no further water problem.

However, in view of the above experience, I agree that it would be a good practice to sponge out the tanks. I have a healthy respect for the Comanche fuel strainer system. To be fed enough water to stop the fuel flow and then continue to feed fuel when switched back, it has to be a good strainer. Has anyone tried a product similar to those used in automobiles, to pass that last little bit of water on through the system and prevent freezing?

Inaccurate Fuel Gauges

Q. My fuel gauges (particularly the aux tanks) are not accurate from 1/4 to empty. How do you use all your fuel and not run her dry? Sometimes I can run an aux to an indicated empty and other times the engine stops with an indicated 1/8 full. Should I fly by the clock?

A. Check your tanks to determine if the liner is badly wrinkled under the liquidometer (transmitter). If they are wrinkled, this could hold the float up giving a higher reading than actually existed in the tank. Another possible cause can be a partially clogged vent line. Your tank has a neoprene bladder. If the vent line clogs, the bladder will be sucked away from the bottom and sides as you use fuel. This can cause a fuel gauge to actually start to read more fuel, even though you're burning it off. If this happened with a metal tank, you would finally pull such a vacuum that the engine would stop. Guess that explains one of the reasons for a neoprene (flexible) fuel cell.

Fuel Flow Surge

Q. On my '65 PA-30, the right engine fuel flow gauge shows a surge of about 1/2 gph. I can hear the prop change pitch when this occurs. The CHT and oil temperature are hotter on this engine. Injectors have been cleaned and everything else checks OK. Any ideas what the problem can be?

A. With the fuel surge and prop changing pitch, this could indicate a fuel flow change. In most cases as long as the prop doesn't change pitch, the problem is something affecting the gauge and is not a true fuel flow problem. Since the prop changes pitch, you probably do have a fuel flow problem.

Check the following items:

1. Does turning on the electric pump correct the problem? If so, this can mean the engine driven pump needs to be replaced.
2. After cleaning the injectors, did you measure the flow? This can be done by inserting the fuel line to each injector into a small medicine bottle, and tying it in that position with wire or string. Turn on the electric fuel pump and let it run for

several seconds. (Not enough to make the bottles overflow.) Now you can easily determine if all your cylinders are getting the same amount of fuel, for the level in all bottles should be the same.
3. Check the diaphragms in the fuel control for leaks.
4. The fuel control itself may be faulty. Since this is a very expensive item, try to determine if it really is the problem before replacing it. Since you have a twin, swap it with the unit on the other engine. If the problem moves to the other engine, then it is the fuel control.

With regard to the CHT and the oil temperature running hotter, this leaning of the mixture due to improper fuel distribution could be the cause. However, it is more apt to be poor engine baffles or in the case of the PA-30, the fact that the baffles are not properly positioned on the cowl.

To really solve this one, it might be necessary to have the aircraft and trace it out. If this is a turbocharged twin, make certain that the air lines from the induction system to the injectors are air tight.

Plugged Fuel Injectors

In furtherance of the question asked by a member relative to plugged injectors, I also had a similar problem with a C model Aztec and spent in excess of $2,000 finding that the flexible lines from the flow divider were flaking off inside and causing the plugging.

Lycoming finally advised me that "they thought they had recalled all of those lines," and compensated me for the work previously done as well as providing me with new parts. It was a tremendously frustrating ordeal that went on for over two years and included two trips to the factory before the cause of the problem became known.

Plugged Fuel Injector

Readers of the Flyer may remember my letter of last year concerning plugged injectors in my PA-30.

The problem has been solved by the installation of a fuel filter on each engine, placed downstream of the fuel controller, attached to the engine mount. This filter was formerly supplied by Bendix as their Part Number 450-OK and is now made by Facet Enterprises, Filter Products Div., P.O. Box 135, Madison Heights, MI 48071. It is readily available from the makers of the LAKE Amphibian in Tomball, TX, as it is a required item on the LAKE. It can also be ordered (as can replacement elements) from Bernard Industrial Components Inc, P.O. Box 2698, Ivyland, PA 18974. Since installing these filters, and after spending a king’s ransom on my fuel system to no avail, I have not had an injector problem.

Electric Fuel Pump Pressure and Flow Check

Like most pilots, I never worried about the fuel pump on my engine, I had an electric boost pump as back up that worked. It sounded good and supplied fuel flow for engine start up. Good pump, right?

When I decided to install a fuel computer in my 400 Comanche, I was told my electric pump must supply 60 gallons per hour at 18 lbs. pressure before the Feds would allow the installation on the 400 HP engine. I borrowed a pressure gauge to check it out.

It only took a few minutes to set up the gauges to check the pressure. What a surprise! The electric pump only put out 16 lbs. pressure at zero flow and 40 gallons per hour at zero pressure. Bendix, the injector people, told me the pump would not supply enough fuel to keep the engine running. So much for the back-up pump.

I talked to three FBO shop superintendents and they all said they never check the electric pump unless the owner asks. I would suggest all Comanche owners have their electric pump checked now, and insist they be checked at each annual.

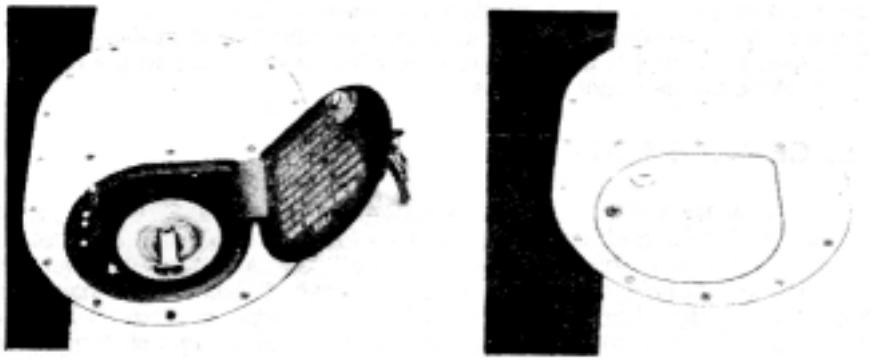
Fuel Drain Valve open

A tip on PA-30 winter flying in case some member does not know. When draining sumps always push down hard on the valve plunger to be sure it is off. These tend to stick in real cold weather (due to metal contraction) and the return spring is not strong enough to close the drain valve to the full off position.

ED: Always double check the valve after draining.

Fuel Cell Door Locks

Somebody a while back inquired about locks on fuel tanks and the enclosed pictures may be helpful. I paid $4.50 each for two locks at a Locksmith and the shop time for installation was about 3 hours. The installation was done by Alair Aviation at Aurora, OR.



Twin Electric Fuel Pump Failure

I had a failure of the right boost pump due to a leaking pump seal washing the grease out of the front electric motor bearing. At the time that I purchased a new pump, the left pump was $175 and the right pump was $335. The right pump was made by a different manufacturer and had a smaller motor than the original and included a different mounting bracket. The pump part was identical. I purchased the lower priced left pump and rotated the pump 180 degrees on the motor which makes it identical to the original equipment right pump.

Brittain Tip Tanks Overflow

Last year I had Brittain tip tanks installed on my 250 to increase the total fuel to 90 gallons. After a couple of months, I noticed that fuel was draining from the right tip to the already full right main; from there it was going through the overflow to the ground. This occurring with the selector in any position, including off.

Naturally, I ordered another valve to replace it. In conversation I discovered that other installations had the same problem. So, before installing the new valve, I decided to check the valve in the plane. With the tanks on the right side run dry, I disassembled the valve in the plane. After some close examination, I discovered that the pin securing the valve stem to the rotating tapered valve was too long on one side. As the tapered components wore and seated it permitted the pin to ride on the shoulder of the fixed body of the valve. By filing the pin so it does not extend out beyond the diameter of the rotating valve, it permitted the valve to properly seat. Enough pin still protrudes to permit click-stop valve positioning. The pin serves the purpose of valve positioning by working against a spring-loaded steel disc with slots in it. In reassembling it is important to note which way it faces to the main tank position. Hope this helps some others.

Fuel Cell Capacity

I have owned a 180, a 250 and a Twin Comanche "B". I have repaired the main tanks on all of these and calibrated the tanks to make dip sticks (I do not trust gauges). Without exception, the inboard tanks held 30 gallons when they were filled above the top vent hole. Any tank that does not take 30 gallons must have some snaps loose. My dip sticks have proved out to be accurate to within 1/4 gallon on mine and several of my friend's Comanches. Before gassing up I stick my mains, subtract it from 30 gallon and see how close the truck comes to that number. This also would show you a collapsed or partially collapsed tank.

All Comanche drivers should have a dipstick to check their fuel. They are easy to make. Drain a tank, then go to the pump when they are not busy and put one gallon in, measure from the top of the neck to the fluid surface, record this dimension, add another gallon, measure and so on until the tank is filled to the top of the neck. Make these marks on a piece of aluminum about 1 1/2" wide, stamp the numbers, spray with flat black lacquer and you have a dipstick.

By the way, my 250 Comanche (1962) held exactly 15 gallons to the top of the neck in the auxiliary tank and the twin holds 16 1/2 gallons.

Unsnapped Fuel Cells

I thought some of the members might like to know about a rare problem with extra fuel burn that I had with my Comanche lately. I noticed that I was burning about 22 gal. per hr out of the right main tank and normal burn out of all the other tanks. (I have 90 gal. in-wing fuel, two mains and two aux's.) I asked around at several FBO's and got every explanation from loose tank caps to fuel by-passing the selector I attacked these problems one by one, first replacing the tank caps then checking for leaks, then etc. etc. Still could not find out why the excess burn out the right main tank. I noticed that the tank would stay full if you didn't use it at all and it was full for takeoff. This really puzzled me. I determined that the tank couldn't possibly be leaking if it stayed full on the ground and if it were not selected during flight.

Finally, after moving my airplane to St. Louis, where I now live, I ran across an explanation from John at American Jet at Spirit of St. Louis Airport. He told me that the right main tank had come UNSNAPPED on the inside and whenever I selected the tank and it started to burn down, the collapsed tank would force fuel out the tank vents. The fix is simple. You just take the tank access cover off (be sure you have a new seal available), drain the tank and snap the tank back in place. I now have normal fuel burn and it really makes a difference when you pay the fuel bills.

Fuel Drain Valve open

A member noticed in the May 1982 "Pilot News" an article concerning a PA-30 that crashed in August 14, 1980. There was no post crash fire. The first person to reach the scene reported that there was no gasoline on the ground nor was there any odor of gasoline.

During functional tests of the fuel selector valves, contamination caused the left fuel selector drain valve to remain in an open or drain position when the drain handle was released - a condition that results in continuous fuel leakage from the drain located beneath the fuselage. Since the spring force acting on the drain plunger valve is relatively light, the drain valve would not return to the spring-loaded, normally closed position until physical pressure was applied to the drain handle. A stiffer spring probably would have resulted in positive closure under the same conditions.

The drain spring retaining washer in the right drain valve assembly was corroded extensively. Although the right fuel drain system was functional, loss of this retaining washer was imminent.

Under the circumstances, there would have been no spring force available to hold the drain valve in the closed position and excessive fuel leakage would have occurred.

ED: The ICS Technical Advisor acquired copies of Service Bulletin No. 314A "Selector Valve, Fuel Modification"; Service Letter No. 589 "Stainless Steel Fuel Selector Valve Housing" and Service Letter No. 851 "Fuel System Draining Procedure, Water Contamination, Parts A and B" and sent them to ICS headquarters. If you don't have these we can

make a copy and send to you. He advises that due to the inside drain one should always get back out to make sure that the drain valve has shut off.

Fuel Odor

Responding to the question concerning the "fuel fume smell on final".

This problem plagued my pocketbook for sometime. Finally, after determining there were no leaks in the fuel system, my mechanic suggested we take the covers off the fuel cells to see if there could be a problem topside. Nothing visible, but all the bolts were loser than specified. After torquing these bolts, no more fumes. The problem seemed to be the new fuel cells which were installed a couple years ago. The gaskets compress and need torquing once or twice to retain a good seal.

Engine Fuel Pump Low Pressure

A couple of things - A friend of mine has a 250 and once when flying back from Mexico from Caba San Lucas where he had topped his tanks he ran out of fuel after 3 1/2 hours. He landed safely on the highway, contacted Mexicali airport by radio prior to touch down and parked off the road. Soon a pick-up from Mexicali arrived with 10 gallons and with help from them by their tending to the traffic, he took off for Mexicali. Examination showed his tank's hangers had come loose and allowed part of the tank to collapse which prevented a full load of fuel when refueling. He had this attended to and now periodically checks the hangers.

The second item of interest occurred on my Comanche at about 5,000 ft. altitude enroute to San Diego from Torrance, CA. I had leveled at 5,000 feet, shut off my boost pumps and reduced power to cruise when the engine quit, as if from fuel starvation. I was near Santa Ana so I started a slow turn toward the airport, switched tanks, turned on the boost pumps and continued the glide for probably 15 seconds. Meanwhile the prop was still rotating, but the cabin was quiet as a tomb. Fuel pressure was up and then the engine picked up, but ran rough as if a plug or two were fouled.

I took it back to Torrance, pulled the plugs and found two (platinum) plugs to have the ground wires bent so that they made contact with the center electrode. After setting them properly, the engine ran fine as it had before flight.

However, the problem was caused in flight by a vapor lock in the fuel line from the engine driven fuel pump to the boost pump T". The engine pump's output was less pressure than the two boost pumps and during the climb heat had allowed a bubble to form. As soon as the boost pumps overcame the bubble, fuel was again delivered to the carburetor and the engine came to life. Apparently, the plug electrodes bent due to rapid cool down of the chambers. Of this I am not sure, but I suppose it could happen. After replacing the engine driven fuel pump, I have not had any more problems with engine failure. Luckily, I was high and had plenty of time. Also the airport (S.D.) was about 3 miles away.

Fuel Cell Repairs

A helpful tip for Comanche owners: Uniroyal makes a repair kit for their fuel cells that are used in PA-24's. The kit contains everything that is needed to repair leaking rubber fuel cells and instructions.

My cells were dried out and leaking around the top, due to the airplane being left outside in the sun. A coat of the Uniroyal 3230 cement supplied in the kit made them look like new and stopped all leaks.

The kit of cement can be ordered through a local Uniroyal Industrial Rubber Supplier.

Fuel Cell Wrinkled Bottoms hold Water

A member explained that the engine of his 1959 Comanche failed on takeoff resulting in serious injuries and total loss of the airplane. Wrinkles were found in the bottom of the fuel tank bladders, damming up the condensation water which apparently filled the carburetor on takeoff.

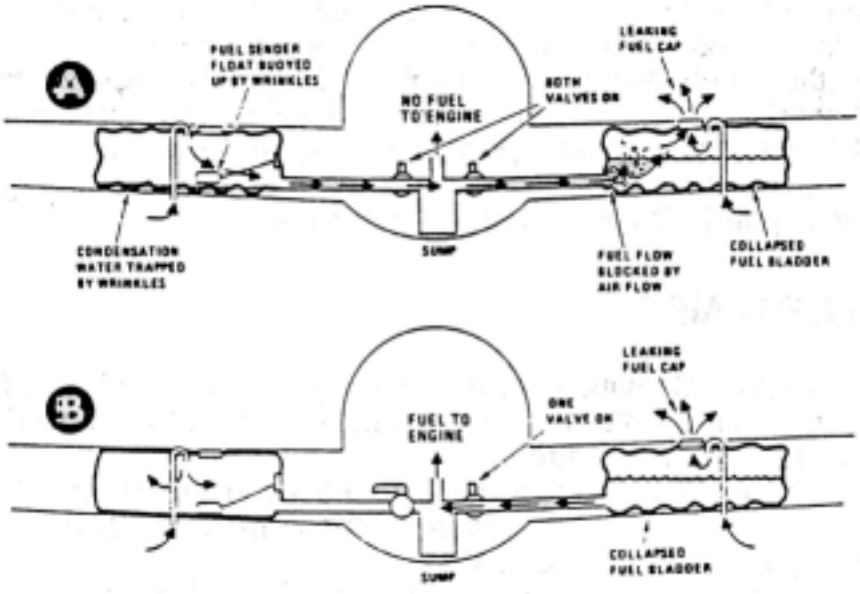
I became familiar with wrinkles in the bottom of my fuel cells in my 1959 Comanche after experiencing an engine failure while breaking in a newly overhauled engine over my airport. The wrinkles were caused by the failure of one of the fuel caps thermos type cam which allowed the low pressure on the top of the wing to collapse the fuel bladder. It also drew the fuel across from the other tank until it went dry. Then, the air moving up the line into the collapsed tank blocked the flow of fuel so the sump and the engine quit until after I landed and the pressure was eliminated. I was also receiving a false reading of fuel in the tanks when the fuel sender float was lifted by the wrinkles.

This situation is illustrated below.

I suspect leaking fuel caps is the only way the wrinkles could have formed in the fuel cells. After fixing the leaking caps, the wrinkles completely disappeared. It should be noted that improperly installed caps by an inexperienced line boy could also create this problem. I now make it a policy to fly on only one tank at a time - ESPECIALLY DURING TAKEOFFS AND LANDING. Even if you were using a tank with a leaking cap and collapsed cell, the fuel would still flow into the sump - just as long as it were not blocked by air coming from another tank.

My airplane is equipped with tip tanks. I have heard that there is a placard against takeoffs and landings on the tip tanks only, although I have never seen one on my airplane. One could hypothesize that if there were a large difference in pressurization between the tip and the main, a similar situation could develop. If the high pressure tank were empty, then air could flow through its intake port and across, through the sump, to the other tank and out intake port thereby blocking the flow of fuel.

I have never had this happen in all my combinations and I suspect the tanks are pretty much equally pressurized. This is possibly what the AD on the main tanks on Comanches (to install larger intake ports) was all about but more than likely it was brought on by the leaking cap problem.



Fuel Cell Filler Necks on backwards

This is a story that is hard to believe. Eighteen months ago I purchased a Twin Comanche. During most of this time, I have been plagued with water in the fuel system. There was rust, corrosion, crud in all fuel valves, corroded stainless steel fuel line between the flow dividers and corrosion in the fuel dividers. Every time it rained the auxiliary fuel tank filler

necks were full of water. This resulted in plugged fuel nozzles and sticking fuel flow dividers and other thrilling things. I tried three different gaskets of different materials for the tank covers. Nothing worked. Still water in the fuel. Finally, after inspecting several other twins that landed here, I discovered that mine was different. The fuel filler necks were installed backwards. (The left neck was in the right wing and the right neck was in the left wing.) This resulted in the water drains being on the outboard side or uphill. After conferring with Piper, their answer was "couldn't have happened here". There is no record of any maintenance being done to this area so it must have been assembled at the factory this way.

I am interested to hear if any other owners have had this experience and if so I suggest you inspect filler necks to ascertain drain direction. I am in the process of having the necks switched and will let you know if this solved the problem.

Tip Tanks Tips

To drain the sumps on the tip tanks, turn on the master switch and put the switches on the fuel selector to "tip", then drain the fuel as you would the aux's and the mains. If the aircraft has been standing for sometime, it is best to catch the fuel in a bottle and examine, it. If you are alone, this requires quite a few trips from the cockpit to the ground; but believe me, it is worth it!

Secondly, if either one or both of the tips are drained dry in flight unless the procedure that is outlined in the installation manual of the tip tanks (it is not in the flight manual) the next time the tip tanks are used with the switch on the fuel selector valve pointed to the tips, you will not be using the fuel from the tips, but from the aux. tanks, and this can spoil your whole day as it did the pilot in Furfari's article.

Fuel Cell Preservation

Is there a compound available to treat fuel cells to prevent or at least delay deterioration? Could such a compound be applied while the cell is installed after removing the access cover?

ED: I know of no compound presently available to treat fuel cells. The two things will help the most are to keep the tank full of fuel and out of the hot sun as much as possible. They all seem to fail on top where it is not kept wet with the fuel and the most heat is at this point

AD 68-13-3, Fuel Cell Collapse

Fuel cell systems in PA-24 and PA24-250 with Serial No. 24-1 to 24-3529 inclusive.

It is apparent that this is not being properly taken care of as we keep getting reports of collapsed fuel cells. Paperwork for this subject is Piper S/B No. 180, 193, 216, and 231 A as well as S/L No. 367 and 516. AD No. 68-13-3 also pertains to this.

If you want to eliminate the repetitive cleaning of the vent lines as is covered in the above paperwork, there are 3 kits available. Kit No. 760-277 for the main tanks, Kit No. 760-281 for the aux, tanks, and S/B No. 216 requires Kit No. 756-756. Labor would be in addition to kit prices.

For your information, if you are flying when there is a plugged vent, the tank might be reading half full and a bit later, it will show more, not less. This indicates that the tank is collapsing, and pulling the float up. If nothing is done about this, the next time you fuel, that tank will not hold the number of gallons that it should and you will have less fuel on board than you think you do.

Fuel Drain Valve Container

Since the Comanche fuel drain is on the bottom of the plane, and in order to drain fuel, you have to pull the drain valve inside the plane, we made a catch bottle to save the drained fuel sample for inspection. We took the black bottom off of a clear plastic two-liter pop container and (after washing it out thoroughly) we punched a hole in the aluminum cap with a

center punch. We then forced a three-eighths inch inside diameter plastic hose approximately four inches into the bottle and left approximately four inches sticking out. By slipping this plastic tube over the outlet tube of the fuel drain, the bottom of the bottle stands on the ground and a fuel sample can be drained from the tanks for visual inspection. We very seldom have any water in our tanks, but it is good to know that a proper inspection can be made this way. We take a large fuel sample and if any water is present, we carefully decant most of the fuel back into the tank and then pour the rest of the sample out, including the water and any other impurities that are found.

Fuel Gauges for each Tank

We put in four fuel gauges and bypassed the single gauge system previously installed in the aircraft. I discovered that the selector on the floor had worn to the point where the flat in the circular hole which locked the rotary switch to the fuel selector shaft had worn completely out and the hole was circular and one never knew which fuel sender was connected to the single fuel gauge.

Because of my concern for safety and having read several places that fuel exhaustion played a part in several Comanche accidents, we decided to by-pass the rinky dink system that this aircraft was originally equipped with and install new Stewart Warner Gauges (Part Number 82303) and new Stewart Warner Senders (Part Number D385B).

The original gauges were Stewart Warner. Of the four original senders which came on the aircraft as purchased, one had rusted into and was lying in the bottom of the fuel cell, one was in such a condition that the float would pivot but it was otherwise non-operational. The third float was locked in position and would indicate approximately threeeighths full, regardless of how full or empty the tank was. The fourth sender worked intermittently. I'm happy to say that we are very satisfied with the new system, however, I would pass on the following advice: if one chooses to use the old gauge and the original rotary switch, one should be very careful to inspect the rotary switch often.

We found that Beechcraft fuel senders available from Wag-Aero (Beech Part Number 96-380043-5, Wag-Aero, Catalog Number A-1 56000) worked perfectly with the original equipment fuel gauge.

The new Stewart Warner fuel gauges, however, require their own sender. We discovered on searching for senders to interchange, that there must be some industry-wide convention in regard to the bolt pattern on these senders because we found all of them to be similar. This is a lucky break for us and we pass on this information with the hope that safety will be enhanced. You can easily imagine what might happen if you were in IFR and ran a tank dry when the fuel gauge reads half full. Now we have a gauge for each tank and having calibrated them personally, we know what the sender means when it says there's a fourth of a tank full, etc.

Fuel Sumps Drain after Flight

My service is being done by Hill Aviation at Lancaster, PA, and I strongly recommend that Northeast Tribe members get to know Dudley Hill. He is careful and sensible about maintenance and annual inspections, and goes all out to make the annual as convenient as possible with minimum out of service time. They have tooled up to fix the Airborne Instrument Fuel Valves, which can be a headache.

Operating tip suggested at Hill: Drain your aux. and main lines through the filters after each flight, so that accumulated water does not remain in the valves to rust and/or freeze.

Fuel Odor

Read the letter on fuel smell in the cabin. In my experience, keeping the tanks filled to the very top is the best insurance against cell rotting. I find that almost 3 gallons can be squeezed into the tank, after filling to the bottom of the filler neck. Our bird is kept inside, where temperatures are moderated by the shade. Leaving the Comanche out in the hot sun is ruinous. Found that out, parked at Yolo County for three weeks. The top of one cell was totally destroyed by that caper!

But something else comes to mind on the fuel smell, and that is the quick drain in the belly. Despite what some may say, crawling under there is the only sure way to preflight the tanks. I have occasionally found tiny bits of debris can keep the

spring loaded drain from closing completely. Pulling down on the drain stem with the fingers will ensure complete closing, preventing a slow drip from developing. I have confirmed this, in flight, to be the source of fuel smell in our bird. Once we started making checks on the drain valve, no more smell in the air.

Fuel Cell Wrinkled Bottoms hold Water

The fuel bladders in our Comanches can get wrinkles in them which trap water. This trapped water may not drain out during the pre-flight fuel draining process.

Good refuelling practice, i.e using clean good quality fuel and not leaving tanks partially full over night along with well maintained fuel caps and seals in the the fuel cap doors will go a long way to stopping water getting into your tanks.

If you find more water than normal during the pre-flight, it is worth draining again after giving the plane a good rocking (by moving it it from the wingtips) in an attempt to dislodge any water that may be trapped in the wrinkles.

It is also a good practice to do a fuel drain at the completion of a flight. Any small amounts of water that may have been present (and trapped by the wrinkles) at the start of the flight will most likely be now in the bowl of the fuel drain. If left there between flights could start corrosion in the fuel bowl. Let's face it there can be several days or weeks between flights for our birds.

Water in Fuel Cells

For many years we operated a PA-24. We based the aircraft outside, in St. Louis, MO, in the United States. During the many years in which we operated this Comanche we never experienced any significant amounts of water in the fuel. In retrospect there are a number of factors to consider. One was that the aircraft was used at least 6 hours or more each week, and the other was that the tanks were always completely filled immediately upon landing. If, on occasion, we had a little rough engine operation, then along with carburetor heat we would normally open the door in the floor and pull the filter drains while in flight. We did, however, consistently have the auxiliary tank fuel cells collapse which gave an incorrect quantity reading.

When we purchased our PA-30, however, we found to our surprise that there was a much more pronounced water problem associated with the fuel. After a number of questionable experiences we felt that we managed to understand these problems and solve them. For one thing, our mode of operation was different. We flew the PA-30 much less frequently, and, due to the difference between "duty free" and "duty paid" fuel prices we no longer tanked up fully upon landing. This meant that the aircraft usually was parked outside for extended periods of time with partially filled tanks. With the typical temperature changes here in Switzerland between day and night our tanks work as a "condensing machine", breathing in water vapor laden air during the day, and condensing it out on the tank walls at night, so that a slow but sure accumulation of water in the fuel takes place. In addition to this, we noted that the auxiliary tanks in the PA-30 appear to be accumulating more water. If you look carefully at the fuel port, with the rubber "Thermos bottle" cap removed, then you will notice that the opening is not perfectly round, but in fact has a discontinuity where a vent line is welded into the opening. I am no longer certain if the PA-24 opening looks the same, but my memory is that it does not have this. The correct rubber "Thermos bottle" caps are (a) quite long, so that they deform and bulge out at the bottom, (b) do not have a vent hole (only the Aztec, I believe uses caps which look the same but which have a vent hole), and (c) should be soft enough to seal properly. How soft is soft enough? I don't know, but we replace the rubber caps now at least every two years and have just about eliminated the water problem. Another potential leak is the seal around the tank bladder installation plate itself.

During pre-flight the tanks should be drained and the drained fluid should be caught in a container for inspection. With a little cleverness you can do this even if you are alone. At annual inspection, or 100 hours, replace the clear plastic tubes that go from the sump out the bottom of the fuselage, so that you can see what is flowing if you pull the drains while sitting inside. The water will be clear and will look like bubbles in the fuel.

The tank bladders in the Comanche should not collapse or deform, but if they are empty it is possible for wrinkles to exist in the bottom of the tank. It is also possible for pools of water to form in locations that will not drain into the sump. When you do your pre-flight drain on the ground, be sure to drain all tanks every time. Once you have been flying for a few hours

at subzero temperatures aloft, even a small drop of water which freezes can form a piece of ice which has the potential of stopping your fuel flow.

After having done a thorough drain on the ground, we do another drain in the air after we have bumped around a bit or made a few slightly uncoordinated turns. This gets the water which was trapped by a wrinkle in the tank into the sump. Once you are in cruise configuration, and not too busy, just go around to all tanks and do another drain procedure in the air. Take care to push the drain knobs solidly down afterwards. It is possible for the knobs to stick open and allow your fuel to drain out.

Twin Changing Fuel Tanks

A visual check during the preflight of the fuel on board by using a dipstick is recommended.

You should always preserve the fuel in the main tanks for the stages of flight where you are manoeuvring the aircraft, i.e take off, climb, descent, approach and landing, missed approach or go around. If you are planning on using the fuel in the Aux and Tip tanks this fuel should be selected as soon as you are in the cruise. If fitted the Tip tanks should be used first then the Aux tanks. This to prevent a failure of the electrical system or the solenoid system that selects the Tip tanks.

In the PA 30 don't be in a hurry to change both tank selectors unless of course you are draining the tanks to empty prior to changing. Before changing the second selector allow time for the newly selected tank to prove that it is flowing properly.

Electric Fuel Pump Line Deterioration

A member has a PA24-250 and when he used full power, the engine had a bad surge. After having the governor checked, as well as a number of other items, he, somewhat by chance in inspecting the engine compartment, noticed a drop of fuel coming from the flexible line on the fuel tank side of the two electric pumps. This flexible line was removed and tested under water as you would test an inner-tube. This revealed the presence of minute pinholes shown up by the air bubbles. With this condition with maximum fuel required for full power, air was pulled through these holes and starved the engine for fuel. A new line corrected the problem.

We have to remember that many of these aircraft are thirty or more years old and flexible lines need to be changed during this span of time. With the fuel injection models, the small flexible line between the fuel injector and flow divider is very important. Small particles come off the inside and there is no fuel screen between there and the nozzles.

ED: Flexible fuel and oil lines should be changed not later than 5 year intervals.

Ice in Fuel Cells

I would like to mention another problem I found when taxing the tops out of the fuel cells to install the collars.

The plane had been sitting outside in weather that for a few weeks had been raining in the daytime and freezing at night. Apparently the gasket between the wing skin and the tank top was leaking, because, on removal I found a block of ice 2" thick and almost as large as the tank pushing the top of the cell down. I hate to think how many minutes early one of these tanks would run out with 2" less fuel in it. It has been said before but I will say it again "Be sure your tanks are full and that it is all gas".

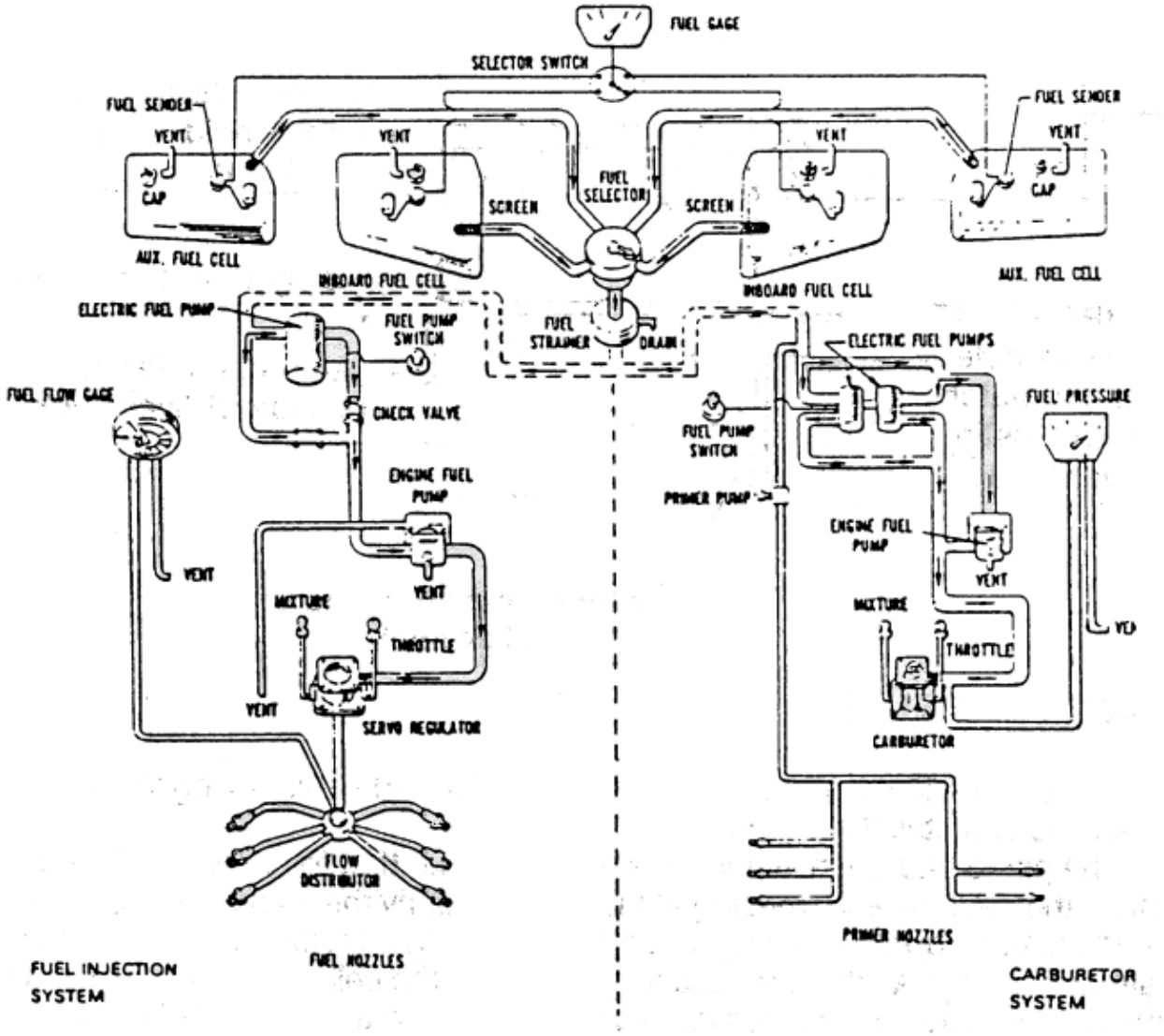
Electric Fuel Pump

Note from the drawing that the fuel from the electric pump bypasses the engine driven pump. This is not true of the fuel injection models. Be sure that your aircraft - other than a 180 - has the cooling baffle with blast tube for cooling the fuel pump. A 180 does not have this cooling baffle.

I suggest the following procedure, especially when the ambient temperature is high. Before starting the engine, turn on the electric pump and check the pressure. This will prove that the pump is working, and then turn it off. Start engine, taxi to runway and do your run up. Just prior to takeoff as you go through your check list, turn the electric pump on. As soon as you are at a safe altitude above the field, turn the electric pump off. This method will keep cool fuel going through the engine driven pump, keeping it cool and avoiding vapor lock. The fuel pressure range is 5 to 5 PSI and the engine runs just as good at one as it does the other. It takes fuel from the carburetor bowl and .5 pressure will keep that full.

In my opinion, this method will prevent the very large drop or the temporary loss of fuel pressure when the electric pump is turned off after being on a long time on the ground plus a long time to altitude. However, there will be some drop in full pressure when the electric pump is turned off but no interruption of fuel flow should occur.

A typical Comanche fuel line schematic. Carb. models could suffer excessive fuel heat and vapor build-up in engine-driven pump and its lines when electric pumps are operated for long periods.



Electric Fuel Pump

In the past, we discussed the rotary electric pumps on the fuel injected singles. Now for the electric (or auxiliary) pumps on the 180's and 250's. The Piper part number for these pumps is 481- 666 and the Facet number is 478-360. The 180 uses one pump and the 250, two.

Before starting engine with master switch on and electric pump on, the 180 with one pump or the 250 with two, your fuel pressure gauge should read a minimum of 4 PSI. You should make this check before every flight. Then shut fuel pump off before starting engine. This will let you check the operation of the engine-driven pump.

For proper procedure with the electric pump on the carburetor models, check the January 87 Flyer.

AD 77-25-05, Fuel Injector Ice

An interesting point raised in the Flyer was the notice of Piper Service Bulletin 861. For the benefit of those who fly Comanches, or any other aircraft equipped with a Bendix RSA fuel injector, you should read Airworthiness Directive AD 77-25- 05, under Enstrom helicopters. You should excerpt it and put it into your Pilot Operating Manual and your pre-flight checklist. There are two ways in which these fuel injectors leak internally. The one mainly addressed by AD 77-25-05 concerns idle mixture valve leaking and causing a rich idle mixture. This problem can be fixed in the field by lapping the valve and plate. Alas, the other form of internal leakage occurs on rare occasions and quite randomly. Small quantities of fuel leak past the center body seal and out of the impact tubes, or venturi bullet and can result in icing, just like with a carburetor (see also Lycoming Service Instruction 1166A). Such leakage might show up as a rough running engine at idle on taxi, but in the air, it is hardly noticeable. But, when descending at low power in humid conditions, not the icing conditions that the Flyer reported for bulletin 861, the throttle can ice up. The pilot will probably be unaware of any problem until he opens his throttle and finds his engine dead.

The insidious thing about this is that a fuel injected engine is not supposed to suffer from "carburetor" ice. This, it seems to me, is why the alternate air has to be heated, just like it is with a carburetor. This form of internal leaking cannot be fixed in the field, and the fuel injector servo must be sent away for overhaul.

The pre-flight check list should simply include the following check: With the engine warmed up and idling, switch the boost pump on and off. Any change in rpm indicates internal leakage. Do not fly until corrected, or as AD 77-25-05 puts it, replace with an air-worthy unit.

ED: Piper considers SB 861 compliance absolutely necessary for Comanche 260 models. To encourage owner action, Piper and Av-Pac have reduced the cost of the kits to the manufacturer's cost.

Fuel Cell Repairs

Fuel Cells, Main: The A/C service manual calls for a sealant/glue by 3M that is still made, but rarely available. My calls to 3M to locate some source revealed that most dealers instead stock 3M's EC-776 Sealant / Adhesive and this is used by A/C mfg's and the military for AvGas tanks. If you have a "minor" seepage point to repair, this will save you the down time involved in shipping your tank off for overhaul. (Not to mention the cost for an over-haul when needing only a small repair.) My tank had a spot about 1/4" diam. on the upper outboard side, where it was apparently working against the cavity liner. Examination revealed the fore-aft upper corner apparently buckles with less than full fuel, pushing the spot against the aluminum. I sealed the entire tank, inside and out, tho it otherwise looked like new. Just as a precaution I then soaked a patch in the sealant, let it dry, putting additional coat of sealant on the bared tank fabric. My "patch" I made large enough to go around the corner, reinforcing it, to try and prevent future buckling. Put it together, as per the tech-reps instructions and the info sheet. Clamped and let cure 24 hrs. A note of caution: The interior of the tank doesn't dry / cure well due to lack of ventilation for the solvent. I used a muffin fan in the opening to blow air in and the fumes out. Then when the tank has stopped being tacky for several hours, coat the inside and outside adhesive areas as per the ASM, with light oil to prevent it sticking together when handling.

On my tank, one deteriorated place that almost convinced me overhaul, with its long wait was going to be necessary, was the fuel outlet nipple. The exterior surface of the nipple was cracked, or spilt, and in generally bad shape from long term

exposure to the air. Finding a replacement seemed impossible, not to mention how tricky removing the old nipple and gluing in a replacement would be. Close examination with a 10x glass, while crushing and rolling the hose part of the nipple, failed to show any interior cracks. But I was sure it was, or soon would, leak. The finger- screen on the fuel line made putting any sealant on the nipple interior look inadvisable. A talk with a 3M tech-rep brought the suggestion that it might be worth a try to coat the cracks with the sealant by opening them, then wrap the exterior with a thin fabric patch to reinforce it. The nipple goes through the inboard bulkhead, so a thick exterior patch would not work, I used the suggestion and when that cured, pressure tested the whole tank.

The wing access opening must be taped before removal, and left taped until the cell is back in, for sure. Before re-installing, get the wing compartment spotless. Vacuum and I used tape lint remover to pat up every particle of grit. Check the flannel over rivets, seams, etc. Re-glue and/or replace with more flannel, making sure every possible rough point in the cavity is covered. Lube the nipple interior to slide the finger screen through easily. Use fuel soluble lube, such as heavy oil, or light grease, so you don't plug the screen. Last, but not least, if you can afford the time, or live west of the Mississippi, I would seriously consider sending the cell to Continental Fuel Cell for overhaul. I made "necessary repairs," which I hope will give me a few years of trouble-free ops. An overhaul ought to give a full "cell life" period of freedom from trouble, so it's worth the money.

Engine Fuel Pump Fire

About a year ago, while making a practice instrument approach and taxi back, I lost the left engine. I continued to taxi and attempted a re-start. During this procedure, I saw fire and smoke coming from rear of engine. Thinking it a backfire, I continued cranking, thinking it would be sucked back into intake. Not successful. Luckily, I was just passing a line vehicle, the boys converged on me with a fire extinguisher and quickly put it out without major damage. As you may be aware, this type fuel pump has an overflow or vent line from pump to drain manifold on bottom cowl. This line had come loose and was lying on the hot exhaust. The engine or boost pump will continue to feed this line (if pump leaks), even though the fuel mixture is in the OFF position. I found out later that neither of my fuel control valves would shut completely off. Had I been in the air when this happened, I would never have survived. These were overhauled immediately by Bob Weber, Newton, KS, for $45 each. New ones from AV-PAC were $1200, and as far as I know Bob is the only one who performs this service on these valves.

Safety check to make frequently to catch this problem:
1. Remove side cowl LEFT from both engines.
2. Mixture IDLE CUT-OFF.
3. Master switch ON.
4. Boost pump ON. Observe pump and drain while boost is operating. If there is an internal leak, it will show.

Firewall Fuel Line Leak

I had flown my 180 Comanche, to pick up some aircraft parts about 12 miles away, prior to giving the plane its 100 hr. inspection. Upon entering the cockpit for the return trip, I caught a slight whiff of fuel odor, but didn't get alarmed or suspect a serious problem. The following day, I opened the cowl and immediately spotted a blue stain down the left firewall, running directly down to the exhaust tail pipe. Needless to say, I was gratified that somehow I was spared an in-flight fire. The fuel pressure 3/16" line had chaffed through at the firewall and fuel was flowing down both sides of the firewall. Had a fire started, I would have lost her, and possibly my letter of caution would have been presented in a different manner by an accident report.

I repaired the chaffed line by cutting a 1 1/4" section from the forward side, installed a "B" nut and sleeve and flared the tube. I repeated the same on the cockpit side. I drilled a hole through the firewall the diameter of the firewall fitting and installed from the cabin side with the nut on firewall side. Securing the "B" nuts completed the repair.

My aircraft had flown 3,500 hrs. prior to the incident, but the contact with the prop gov. cable and cabin heat cable had been concealed by the compound sealing the grommet and had not been discovered.

Firewall Fuel Line Leak

I recently had a fuel leak problem. We started noticing an intermittent minor fuel odor in the airplane, but could not isolate the source. It seemed to become more noticeable during the landing pattern phase of the flight. Fuel tank caps appeared to be seeping and were replaced with the improved Weber type.

Then one day just after takeoff, a large fuel odor dictated an immediate return to the airport. Investigation revealed fuel leaking from the 3/16" fuel pressure line right at the firewall grommet with fuel running down the firewall and back on the belly of the airplane.

Removal of the bulkhead sealer revealed corrosion and pitting around the fuel line under the sealer. A slight pull on the line during removal caused separation of the line at the corroded area.

At that point, the complete line to the fuel gauge fitting was replaced and the old line also had chaff points from being rubbed by the control cables. It was noted that the sealer around the line appeared to have cork chips as part of the sealant material and it looked as though it absorbed moisture, causing the line corrosion problem. This sealer has been replaced with silicone firewall sealant material.

Unsnapped Fuel Cells

All Comanches have bladder-type fuel cells; big, floppy, rubber like bags in the wings to hold gasoline - and occasionally a bit of water. While these bladders are probably less prone to the annoying little fuel leaks found in wet-wing airplanes, in which fuel is stored in a metal box formed by the wing skin and structure, they can cause some serious problems An accident involving a PA24-250, which was recently reported in NTSB Reporter magazine, illustrates the point.

The airplane was on a planned IFR, daytime flight from Pittsburgh, PA, to Oshkosh, WI. Before takeoff, the fuel quantity gauges and a visual check indicated that both fuel tanks were full. Conservatively estimating a consumption rate of a bit over 13 gallons an hour, the airplane should have had a cruising range of almost 4.4 hours. However, nearing Oshkosh after only 3.41 hours of flight, the engine failed due to fuel exhaustion; both tanks were completely empty. The pilot made a forced landing during which he and his passenger were both injured and the airplane was "substantially" damaged. After the accident, investigators determined that several of the fuel bladder retaining clips were loose. These clips normally hold the fuel bladders in position and give them their shape. With the clips loose, the fuel bladders had partially collapsed, significantly reducing the capacity of the tanks. While they would have looked and indicated full before the flight, the tanks were not actually holding anywhere near as much fuel as they should have been.

The problem is not new. It was recognized over 20 years ago when Airworthiness Directive (AD) 68-13-03 was issued on 29 May, 1968. This AD applied to all PA-24 and PA24-250s from serial number one through 3529. It required a visual inspection of the fuel bladders, initially within 25 hours. The inspection is to be repeated every 100 hours thereafter (the AD is still valid) unless a fuel cell vent and drain tube modification kit has been installed. These kits, No. 760-277 for the main tanks and 760-281 for auxiliary tanks, provide for the installation of recessed, NACA type air inlets on the bottom of the wings to vent the fuel cells. The idea is that these air inlets are less likely to be restricted than the original vent tubes. That should minimize the possibility of the fuel cell collapsing as fuel is pumped out of it by ensuring adequate vent air to the tank.

I assume that airplanes after serial number 3529 were built with the improved vent system since the AD does not apply to them. However, I have not gone out and looked at one to be sure I do know there are a number of early airplanes that have not been modified. Mine is one of them. I think the accident airplane was probably another, since the report said the AD had been complied with, probably by inspection, 41 flight hours before the mishap.

This accident almost sounded like Catch 22. There was a problem with fuel cells collapsing, an AD to prevent the problem, the AD was complied with, and still the pilot was left holding the short straw. Is there anything you can do to avoid the same trap? I think so. But it will take a little planning and forethought.

Here's how:

The accident airplane took off with about 13 gallons less fuel aboard than the pilot thought it had, even though the tanks looked and indicated full. The only way to detect a shortage in this situation would have been to cross-check the amount of fuel added during the last refueling with the flying time, since the refueling before that. For example, assume your 250 normally burns 13 gallons an hour. You fill it up, fly it 2 hours and find it only takes 14 gallons to fill it back up again. Don't start congratulating yourself on your exceptional leaning techniques. Suspect a fuel cell problem.

Actually, I'd recommend cross-checking fuel and flying time this way on any airplane, all the time. Not only could it alert you to a collapsed fuel cell, it should also give you pretty accurate fuel burn figures to use for flight planning and let you know if fuel consumption is changing. That could be the result of other fuel system problems, including even a leak that you haven't suspected.

Finally, even if you have an airplane after serial number 3529 or your early model has been modified, I'd still watch out for the possibility of fuel cell collapse. The improved vent system should "minimize the possibility" of the problem, but I don't think anything will absolutely guarantee that it can't happen.

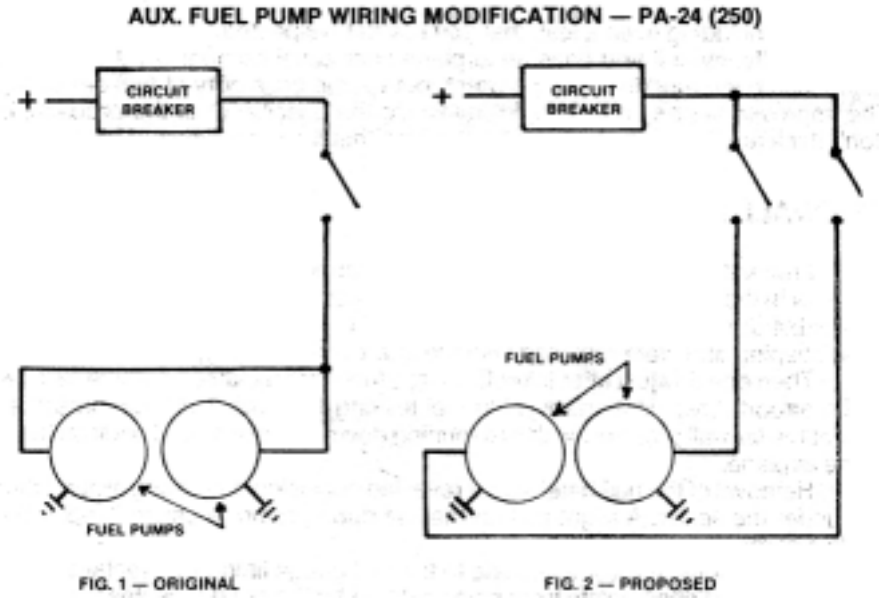
Electrical Fuel Pump Modification

I am the owner of a 1959 Comanche PA24-250. I have always been unhappy with the way in which the electrical circuit to the dual electric auxiliary fuel pumps was originally designed because:

1. When checking the aux. pumps for proper operation prior to engine start-up, it is impossible to determine whether both pumps (as opposed to only one of them) are operating.
2. In case of switch failure or wire breakage, or in case of short circuit in one aux. pump or anywhere else between and including the switch and pumps, the use of both auxiliary pumps is lost, thus losing a very desirable degree of redundancy.

I therefore modified the auxiliary fuel pump circuit as shown on the accompanying drawing. A split type Cessna master switch fits nicely into the space previously occupied by the single aux. pump toggle switch. Since the circuit breaker is upstream of the switches, I could see only limited benefit in doubling up that part of the circuit, so left it as is.

I have a one-time approval from Transport Canada's Airworthiness Branch for this modification.



Fuel Cap Repairs

I'd like to pass on a "fix" I observed a seasoned mechanic perform. The rubber portion of my fuel cap had shrunk and become hardened. He rummaged around in his back room and came out with a can of MEK (Methyl - Ethyl - Ketone). He loosened the clamp / thread so the MEK could surround all the rubber parts. He immersed the cap for a couple of hours, checking it about every 30 minutes. I was amazed to see the rubber swell to its normal size, and become soft enough to seal the tank opening again. It worked! I've since used MEK myself on other caps that didn't seal, with good results.

I bought a one-gallon can of MEK at a local 'Standard Brands' paint store for approximately $12. That gallon has lasted 5 years and still has some MEK remaining. Some cautions need to be observed. MEK is a powerful stripper. Vapor can be harmful, use plenty of ventilation. When using, check it every 30 minutes or the rubber may swell too much. Make sure all the MEK is emptied out of the gas cap before you try it in your gas tank. You don't want this stuff in your gas tank. Try it on a "spare" or a cap that you discarded because it wouldn't seal. It works!

Electric Fuel Pumps

It has been brought to my attention by a member to again remind the members of the importance of checking the performance of the electric fuel pumps. If you have been at one of my seminars, you are aware that we cover this in some detail, but let's go over it again.

First, the fuel injected models - singles & twins: Remember that if the engine driven pump should fail, you cannot keep the engine running without a properly functioning electric boost pump. From a pilot's or operator's point of view, if you can start the engine with the electric pump, this does not guarantee that it is working properly. With the small amount of fuel needed for starting and the help of the engine driven pump, even at cranking speed will furnish enough fuel with the help of a very weak electric pump to start the engine.

If your 250 or 260 has a Dukes pump, it should flow 50 GPH at 14 PSI and have a no flow pressure of 25 PSI max. If you have a 400 with the Airborne #2B5-26, I do not have exact data on this pump, but feel that the pressures and flow would be very close to the Bendix pump for the 400.

For the PA-30/39, the shut off pressure from each electric pump should be 26 PSI max. I have no flow information. Since all of the above rotary pumps are positive displacement pumps, just a shut off pressure test will tell you a great deal.

Now, the models with carburators - 180 / 250 / 260: These aircraft use a Bendix plunger type pump. The 180 has only one and there are two on the 250 and 260. Each pump should have 4 to 4.75 PSI shut off pressure and flow 32 GPH at 0 pressure - 3.2 gallons in 6 minutes. It is very important that if you have the two pumps, you test them separately to make sure both of them are operating. On all of these pumps, there should be no fuel stains or leaks of any kind.

Be sure to use the necessary caution when working with the fuel.

Fuel Selector Valve

My Comanche sat unused for a long period of time before I purchased her. Since I purchased it, the fuel selector has been difficult to turn. At first it took two hands to operate, but finally loosened enough to only require one strong hand. During the first annual, I squawked it and the selector handle was removed and lubricated with a fuel valve lubricant that I ordered from the ICS. It was easier to operate afterwards, but was always tight. I assumed that was the best that could be done.

A few months ago, I had some other work done and the shop noticed that the valve was tight. Evidently, someone that they knew was killed when the fuel valve broke off in his hand and he couldn't switch tanks, so they insisted that they perform the AD on the valve again. This time they disassembled the valve completely and cleaned and lubed it per the AD. Turning the valve now is a two finger operation. If yours is tight, have your A&P perform a complete disassembly and lubrication.

ED: Per SB 354B.

Electric Fuel Pump Gaskets

The gaskets for the Bendix electric fuel pumps are indeed available through auto supply stores. They are AC (Delco) Part Number FG-1. However, they may be difficult to locate because many auto parts are now supplied as "after market" components, that may not be equivalent. Do Not accept substitutes, especially cork! These same gaskets also fit the gascolator bowl. They are inexpensive, should be inspected every 100 hours, and changed periodically.

The little snap-on dust caps over the zerks fittings on the landing gear system and prop can also be obtained through auto supply stores. One brand is know as "Lubricap" with Part Number 715-1091. Large supply houses should carry them.

System Maintenance

Further to previous discussions on the fuel system, there are other elements of the fuel system to be aware of, namely fuel boost pumps, filters, injectors, etc. These must be maintained in perfect operating condition.

On the 180 there is only one boost pump and it is simple to check for condition. Simply turn on, listen for the regular clicking and note fuel pressure on gauge. This pump should pump min. 4 PSI. On all Comanches it is essential to have correct fuel boost pump pressures. If they are low and you have a main fuel pump failure, your boost pump may not deliver enough fuel to keep your engine going.

The 250 Comanche has two Bendix boost pumps and are checked in the same way as the 180 except that they are wired to the same switch and operate together. One must be disconnected to check that each one operates. Note the injected 250 is essentially the same as the 260 system where the boost pump is a vane type capable of supplying higher pressures, which vary according to the type of pump used. There are also external check valves plumbed into the system and should be checked also, as a leaking valve can effect pressure readings.

The Twin Comanche uses two Weldon fuel pumps mounted in the underfloor area and have external adjustment provision in the rear of each pump. The pressure relief valves on these pumps are set at 26 PSI.

Fuel filters that show signs of leaking when stationary are a source of concern as during flight, air is sucked into the system depending upon the degree of defect and will show up in a fluctuating fuel flow indication as the system struggles to rid itself of the air bubbles. If your fuel sump valve does not close off properly after a water check, air can be induced through this valve. The Bendix injection system does not have an air bleed return, consequently any air in the system must pass through the system into the engine.

A blocked injector will show up as rough running and lean misfire, accompanied with a rise in fuel flow. Because the fuel flow-pressure line is tapped in at the flow divider on top of the engine, any blockage downstream of here causes less fuel to get away from the divider and thus increases the fuel flow reading, even though less fuel is passing through the divider.

Your injector nozzles should be removed and cleaned at regular intervals (Piper says each 100 hrs.). Indications of injectors blocking up can be seen by excess fuel stains around the injector area. This stain occurs because the injector nozzle blocks and fuel is still coming down the line, no air is coming in the gauze screen, so fuel is forced out here. Regular cleaning of the gauze filter is necessary to promote good atomization of the fuel, as these injectors draw unfiltered air from the engine bay. Do not poke or probe a blocked injector, as the hole is a precise size and finely metered. Sonic clean or use high pressure air. Do not mix injectors, as each cylinder sometimes uses a different code as determined by the engine manufacturer.

Another service point often overlooked is the finger filter inside the injector body. Access to this filter is gained by removing the fuel inlet hose and unscrewing the fitting from the injector body. On removing the screen it may at first appear to be clean, but this filter works in reverse to a normal screen, in as much as the fuel flows from the inside to the outside, therefore any contamination will be contained on the inside. Take care that the "0" ring is still in place where the filter fits into the fuel line fitting. The absence of this "0" ring allows fuel to bypass the filter screen. (Do not remove the filter from the plug situated in the opposite end to the fuel inlet fitting, as this can allow any contaminate contained in the filter to fall into the injector body.) Remember to use clean fuel and keep it clean.

Gauge Senders

I recently inspected the main and auxiliary fuel tanks quantity sending units on C-FAKY, a 1969 PA 24-260C, Serial No. 24- 4832, for the possibility of a fuel leak in that area. What I found was not a pleasant sight. The 2 main tanks sending units were rusted away to the point that you could look through the body of the units into the fuel cells. The right auxiliary tank sender was severely rusted, but the left auxiliary tank showed no sign of rust. All units were still functioning accurately.

Calling a Piper Dealer in Canada, I was told that the sending unit replacements were no longer available and that the replacement units now used required the fuel receiver gauge to also be replaced, at a cost of $250 for the gauge and $190 each for the sending units.

A search for used parts was made at a local salvage company that was parting out a PA24-250 that had landed several hundred feet short of the runway due to fuel exhaustion. The 2 fuel quantity sending units were removed, but were badly rusted and inoperative.

A further search at the salvage company turned up 2 fuel senders that were tagged for a 108 Stinson. These were identical units made by A.C. with a resistance of 0 to 32 OHMS. They were installed and work fine.

I purchased the aircraft in August 1990 at Burlington, Ontario, Canada, and brought it out to South Vancouver Island, B.C., where as we all know, there is no ice or snow (very often). The problem may have been caused by snow on the wings melting and freezing, plugging the drain lines from the fuel filler section, thus allowing water to leak over the top of the bulkhead between the filler section and the sending unit section. This would fill the sending unit section with water that would remain trapped. Rust deposits in this section indicated that they had been full of water for a long time, probably until the senders rusted through, allowing the water to drain into the fuel cells.

There was also corrosion of the aluminum well in which the senders are mounted. Anyone with an aircraft parked outside in similar weather conditions might be advised to take a look at this area.

Fuel Pump Replacement

For PA24-180 owners - when, or it, it is necessary to change your engine driven AC fuel pump #40295 to a new AC pump, you will find the replacement pump #41271 is larger. This fact requires modifying the engine mount to avoid the pump striking it. You can now have your old pump #40295, rebuilt by Aero Accessories Inc. of Gibsonville, NC. Their telephone number is (800) 822-3200 or (919) 449-5054 and talk with Charles Wood. In addition to not having to modify your engine mount, this will cost less.

Fuel Contamination

In earlier Flyers I discussed the importance of correctly sealing filler caps to prevent water entry to the fuel cell in regard to rain water entry. A correctly designed cap is essential to prevent water entry from other sources also. If you are still using the old style cap and you park your aircraft outside or even if it does not rain, given the right conditions, moisture will condense in the fuel filler compartment and collect in the top of the fuel cap and enter the tank in this way.

Fitting the new style cap will not entirely eliminate water contamination, as we still have to contend with normal condensation problems. If you do not refill your tanks after use, moisture will collect on the exposed inner wall and fall to the bottom when either the droplets become heavy enough, or when you fill at a later stage and it is washed down during the refilling process. This process occurs because the Comanche tanks are pressure vented to the atmosphere through the lower portion of the wing. The vent line is open to the atmosphere at all times.

Correctly sealing fuel caps play several other important roles in the safe operation of the fuel system. In the first instance, if your fuel cap does not seal tightly and the seal around your fuel cover flap is not fitting correctly, fuel can be drawn from a full tank in flight. This occurs because air from the high pressure lower side of the wing flows up through the fuel drain

pipe into the filler bay and out through the cover flap to the top low pressure side, causing the fuel to escape to the atmosphere.

In instance No. 2, a correctly sealing fuel cap is essential in maintaining the proper venting pressure in the fuel tank, in particular, the fuel injected engines. Low pressure venting can cause erratic fuel flow indication, and in twin engine operation, different fuel flow indications between left and right engines.

Vent systems should be checked at regular intervals to ensure against blockages, as they are susceptible to closure by the hornet or mud daubing insect. If further venting problems continue to occur, check the flexible rubber hose which connects the fuel bay filler housing to the vent pipe for security and condition. I have found those to be kinked and blocked off and the clamps insecure.

As you can see, the fuel system is a fairly complex unit, and the lowly fuel cap is not there merely to allow you to fill the tank.

Leaks

1. All propeller governor oil lines with the blue anodized aluminum nuts should have been replaced by now. This applies to all Twins and 180's
2. Any sign of leakage from the small drain tube near the center of the Twin cowling or the drain line in the nose wheel well of the 250 / 260 / 400 fuel injected singles should be investigated. More than likely, your engine driven fuel pump has a ruptured diaphragm.
   To check it, do the following:
   Operate your electric fuel pump's while the mixture and throttle are at idle cutoff and idle position and check for fuel leakage from the drain tube. There should be no fuel leakage from the drain. Of course, the drain also carries excess fuel overboard if you over prime the engine for starting.
3. Recently I noticed a blue stain on the bottom of my right cowling near one of the drilled drain holes. Further investigation utilizing the above procedure found a pin hole leak in the fuel line between the firewall fitting and the fuel servo unit. Needless to say, the line was replaced immediately. Don't overlook any slight evidence during your preflight.

Booster Pump Mix-Up

I began to have problems with left boost pump (sporadic operation) on the left engine of my Twin Comanche a month ago. I located a used boost pump (Weldon), and had my local mechanic, Steve Johnson, put it in. This was an all-day job, as Piper really buried those boost pumps.

After the pump was installed, I had scheduled an instrument flight lesson in the plane with my instructor Rob Hunter. We usually do instrument flight lessons at night, as that is the only time I consistently have available. After takeoff, I turned off each boost pump in turn. It's a good thing I waited the recommended interval - after about 10 seconds the left engine fuel flow started dropping. I turned the left boost pump on and it came back up. I turned it off again and waited until the engine started stumbling (not the gauge), before starting the boost pump again. We returned to the airport and landed.

I called my mechanic again and told him the problem. The left engine is 100 hours out of major, but the motor driven mechanical fuel pump did not appear to have been replaced. He ordered a new mechanical pump and put it on the aircraft the next afternoon when it arrived. I started the airplane and thoroughly checked both engines via runup (without the boost pumps on). Nothing abnormal appeared. I taxied to the runway, did another set of runups (also normal) and set up for takeoff by turning on the boost pumps. I heard the normal whine (hard to tell if both are running).

As the airplane picked up speed, I watched the fuel flow meter closely. Everything was normal. I adjusted the mixtures to lower fuel flow, as it was 90 degrees at 5,270 ft. field elevation. I rotated at 90 and pulled the gear up (Coronado apt is a small field). At about 50 feet the left engine fuel flow started dropping (boost pumps still on). I tried changing left fuel tank from main to aux. (both full), but it didn't help. I cycled the left boost pump switch several times but it didn't help either. The engine was stumbling badly, barely running, and causing a lot of drag I couldn't afford (Coronado airport has trees at the

end of 17). I feathered / shut down the left engine and went around the pattern for a single engine landing. The good news is a Twin Comanche will climb under these conditions (slowly) with only one person and lots of fuel on board.

This time around I took the time off work and Steve and I tore the entire left engine fuel system, selector valves, boost pump, etc., apart. We made electrical checks of all wiring, the switches, circuit breaker and all other components remotely associated with the fuel system.

The first thing we found is that the left boost pump that was installed three days earlier would run, but at a very slow speed. There was hardly any noticeable pressure increase at the left engine cowling where the fuel line enters the mechanical pump. The motor would get hot, and after a couple of minutes, it would stop altogether.

We reassembled the selector valves/piping and removed the boost pump panel containing both boost pumps. I noticed that the tag numbers were different on the Weldon pumps (different between left and right side). The right side was a Weldon Model "J" 8100 - AA, but the left side, the used pump that I got was a Weldon Model "J" A8001-A. It doesn't take a person with dyslexia to glance at the two pump tags and see the same number. You have to look closely at very small stamped print to see the differences.

These differences are however critical. The 8000 series pump is not from a Comanche; it is out of an Aztec. The electric motor connected to this pump is out of a Comanche (same bolt pattern, 3/8" shorter electric motor to fit in that ridiculous Comanche bulkhead space). The point being this is an Aztec pump mated to a Comanche motor.

This is a potentially deadly combination. The 8100 series pumps required for Twin Comanches contain an internal bypass to allow unrestricted fuel flow if the boost pump is either not running or disabled. The mechanically driven pump takes its suction from the tanks / selector valves through the body of the boost pump on a Twin Comanche.

On an Aztec there is external piping to provide this by pass function. The 8000 series pump has no internal bypass and it is difficult to even blow air through the pump with your mouth. The mechanical fuel pump on an Aztec takes its suction through a separate line to assure unrestricted fuel flow when the boost pump is off.

Steve Johnson got all this great information from the Weldon Tech Rep. at (216) 721-5454. He also got another great piece of information - this is NOT the first time this has happened. Evidently someone out there is mixing / matching boost pump parts out of different Piper aircraft and the particular combination described above is dangerous. It appears identical to the other boost pump. You cannot tell the difference with a brief glance, casual physical inspection, port locations, etc. You have to do a number by number tag comparison.

In retrospect, it would have been prudent to stop and go back to the boost pump problem rather than put a new mechanical pump in the aircraft, but the failure I experienced with my flight instructor sure looked like a mechanical pump failure. This, coupled with the fact the mechanical pump was not replaced during the major overhaul, made the failure seem plausible.

There are several insidious aspects of this problem. First, Twin Comanche engines are small; they will run for awhile with diminishing fuel pressure (long enough to get airborne and gear up). This is also why the manual recommends waiting 20 seconds prior to accepting the fact that boost pumps aren't needed after turning them off. The Aztec pump assembly will allow minimal flow past the impeller region, causing fuel pressure to bleed down slowly. This is NOT great news it you are taking off.

The second aspect of this problem that bothers me is the fact that the two pumps are visually identical. If they were even a different color, it would help, but they aren't. I'm sure its the same casting, port location, bolt pattern, etc. This visual similarity, coupled with the similarity in model number (displaced A's and 1's) makes inadvertent installation of this pump / motor combination highly likely.

The final and worst aspect is the apparent existence of more of these combinations of Aztec pump bodies bolted to Comanche electric drive motors. I recognize that multiple failures are needed to repeat the problem I had shortly after takeoff. However, given the fact that these are used pumps, a boost pump failure is more than a remote possibility. Once this boost pump fails, as mine did during takeoff, you will shortly be single-engine whether you like it or not.

It is this final point that concerns me the most. I hope this information proves useful to you and ICS.
If you require further information you can reach Steve Johnson (my mechanic) at (505) 865-7389 or me at (505) 299-9275.

Fuel Pumps

If you are in need of an engine driven fuel pump, you can get in touch with Aero Accessories, Inc. They are an approved overhaul agency for most or all of the fuel pumps used on our aircraft. Their address is:

Aero Accessories, Inc.
1240 Springwood Church Road
Gibsonville, North Carolina 27249
Telephone: (919) 449-5054
(800) 822-3200

This is especially important for the 180 owner, as the new AC pump is larger than your old one. The AC pump will bolt on the engine, but unless the engine mount has been modified as indicated in the Tech Tips video, it will strike the engine mount when the engine is started. Getting your pump overhauled will save the big job of modifying the engine mount.

Fuel System Maintenance

Whenever problems arise the first move is to check the fuel inlet screen for blockage. This 74 micron screen should be removed from the same side of the injector to which the fuel line is attached. This stops any dirt from falling into the injector body. On early type injector bodies the screen is attached to the fuel inlet fitting and can only be removed from that side.

Later types have spring loaded screens to provide a fuel bypass in case of blockage. (Refer Bendix Bulletin RS-48 Revision 2). To clear the screen, tap the filter open side down on a clean piece of paper and inspect the contaminants for signs of fuel system deterioration. Wash the screen in MEK, and blow out with compressed air.

The next step is to check for the correct linkage geometry and adjustment. When shutting down the engine observe that you can get a 25 to 50 rev. rise as the engine tops. A lean mixture will cause the engine to falter or "flat spot" as the throttle is moved open from idle. To adjust the idle mixture place the aircraft crosswind to eliminate propeller loads. Have the engine at operating temperature. Turn the scalloped wheel either towards R or L as indicated until the desired rise in RPM is reached. Each time the mixture is changed run the engine up to 2,000 RPM to clear it before making the rev rise check.

If your engine refuses to quit when the mixture control is fully retarded suspect a fault with the mixture control jet on rotating plate or a faulty jet "O" ring. To check for these faults remove the fuel outlet line at the injector body, place the throttle and mixture controls in the fully retarded position and turn the boost pump on. Observe the open fitting. There should not be any fuel coming from this outlet at this time.

If no problem exists here and the engine continues to run on, then the delivery nozzles are blocked. Remove the nozzles and clean in MEK or sonic cleaner and blow out with compressed air. Check the top threads on early type nozzles for damage from over torquing the fittings. Later type nozzles have a removable center distribution tube. Check that the top flange is missing the center tube falls into the center of the nozzle and causes the nozzle to inject a solid flow of fuel. The engine will not fire and that particular cylinder until 1,800 - 2,000 rpm is reached. At these revs the port air velocity is sufficient to atomize the fuel. This nozzle when viewed from the top will look like an early type, so check them carefully.

Fuel stains around the filter screen of the nozzles indicate a plugged nozzle. Standard R.S.A. nozzles will flow 32 pounds per hour at 12 PSI.

On the turbo charged engines the nozzles are shrouded and vented to the compressor discharge. "Deck Pressure". Check for leaks and dirt obstructions in these lines and fittings.

When installing RSA nozzles make sure that the letter "A" stamped on the hexagonal base is pointing down + or - 30 degrees. This places the air bleed hole up. If this is not done the fuel which flows down the line after engine shut down, flows out the hole and through the screen and gives a visual indication of a fouled nozzle. When replacing a nozzle, torque valves change the flow characteristics.

The next check is for an internal leak in the center body. If there is an internal leak all the delivered fuel will not flow through the injector lines, some will enter the engine via the throttle body. This fuel will not show up on the cockpit fuel flow gauge and cause the engine to run overly rich. If this conditions exists you may find that you have to retard the mixture control on landing or that the idle mixture will require constant adjustment.

To check for an internal leak, remove the induction hose at the RSA body, then plug off the fuel delivery line to the flow divider. Place the throttle and mixture controls full forward, and operate the boost pump. No fuel should flow from the air impact tubes. If it does, the center body seal is leaking and requires that it must be removed for overhaul.

Heater Fuel Valve

Ivan Warrington, ICS #08405

The Heater Fuel Valve needs to be checked immediately for the safety wire, (item 1 in attached Diagram). The manual states that the assembly must be replaced if the nut is not bored for the safety wire and the safety wire is missing. We have just experienced a large fuel spillage due to the nut (6) backing off the shaft (2) allowing leakage past the shaft.

Check with the bonnet off and observing for fuel when the electric fuel pump on the right engine is operating and the valve is open 3/4 to 1 turn open.

If any fuel is observed valve must be repaired or replaced.

Item "C" of the service manual states to inspect the stem, seat body and threads for possible damage. On our valve we found that the shaft was dirty from years of service and when opened allowed the shaft to enlarge the seal (4). The stem was cleaned with MEK and Scotchbrite, lubed and returned to service. The valve is now operating correctly and not leaking.

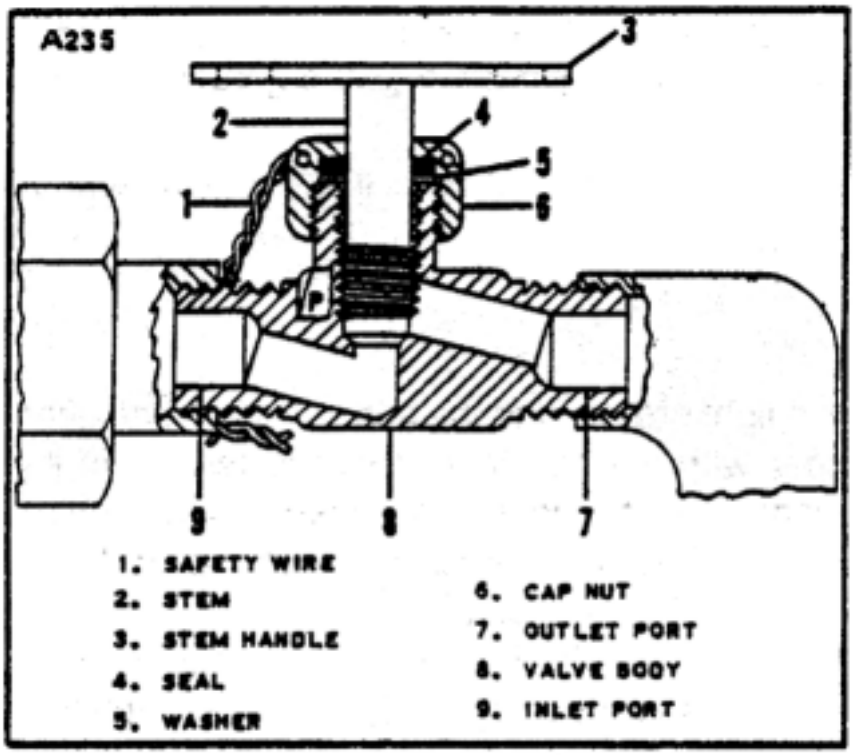


Diagram A235[above], is taken from Twin Comanche Service Manual, Heating and Ventilation Section

Leaking Fuel Sender Units

John A Pabst, ICS #02722

After years of frustration I finally located a persistent fuel leak in my Comanche '250. The symptoms were a leak from the left main, right main, and right auxiliary fuel tank; the leak only appeared to occur when the tanks had been "topped off"; and only a small amount of fuel would leak from the tanks, but enough to leave a stain on the wings during flight. No stains appeared anywhere else on the plane.

During every annual inspection, we removed the inspection plate over the fuel tanks. We could see no fuel stains either over the fuel gauge sending unit or around the actual cap primarily due to the zinc chromate paint.

The tanks would leak for the first three or four minutes of flight.

Prior to the annual, the AI advised me to fly a substantial amount of fuel out of the tanks. This would minimize the amount of fuel to be unloaded to comply with the fuel tank AD.

I replaced the fuel caps, in frustration I removed the inspection plate over the fuel cap after refueling the aircraft completely. The seals surrounding the fuel gauge sending units had deteriorated, causing fuel to seep out of the tanks and form in the indentation over and above the fuel gauge sending unit. At the annual the tanks were always approximately 3/4 empty. The fuel never reached the level of the fuel gauge sending units. The pool of fuel was not noticed because of the barrier between the fuel sending unit and the fuel cap. After a resealing of all fuel sender units, this matter has corrected itself.

This ended an extremely frustrating detective game. I was thoroughly convinced that the fuel caps were leaking, when in fact, it was the seals around the fuel gauge sender units.

Again our thanks go to Maurice Taylor for pointing us in the right direction.

Fuel Selector

Al Bieck, ICS #02171

One of Murphy's laws says: "if it is possible to install a part backwards, someone will do so!"

Recently, when I removed the sediment bowl from the strainer assembly, (part No. 22312-00), in our "250", I discovered internal leakage through the fuel selector valve (hoof) which I later rectified by installing a new "O - rings". What concerned me was that the fuel dribbled out of the outlet port above the screen. To make sure it wasn't fuel draining from the line to the boost pumps, I selected a full tank and, sure enough, fuel streamed out of the wrong port! I then removed the strainer assembly from the aircraft. Confirming what I already knew, the arrows on the casting showed that the outlet port was connected to the fuel selector and the inlet port 180 degrees opposite had the 45 degree fitting which connects the line to the fuel pumps and the engine. Turning the unit 180 degrees and changing the fittings over to where they belong (the right angle fitting receives the line from the fuel selector) corrected the situation.

For 18 1/2 years we flew our Comanche with fuel flowing through the strainer the wrong way and I feel embarrassed to admit this. But then, we never had leakage through the selector valve resulting in a dribble in the "OFF" position. Neither did I have a reason to take the strainer assembly out. You can't see the arrows on the casting while the unit is installed, except by using a mirror but I never had reason to be suspicious. We never had a problem but think we were very lucky. If we had ever gotten a load of dirty fuel, all the crud would have been trapped on top of the screen, possibly blocking it! No wonder we never found anything bad in the samples we have been taking all these years! I never found anything that caught my attention on top of the screen either during annual inspections or I would have caught on.

Before we brought our "250" in 1975, it was operated and maintained by a Piper dealer. We never had occasion to remove the strainer from the aircraft and the dealer probably didn't either. Did the aircraft come like that from the factory, or did the mistake occur during a subsequent repair or modification? We will never know. Most of the early records were lost in a hangar fire long before we bought the aircraft and the surviving records do not give any clues.

Fuel Pumps

Maurice Taylor

At annual time are your fuel pumps getting checked for flow and pressure? It's required by item #34 on inspection sheets both single and twins. You check the electric pump (pumps) when it is turned on before you start the engine. The thing that you can't check on the 250 or 260 with a carburetor (they have two pumps) controlled by one switch, are they both working? Many of these aircraft have one pump that's inoperative. Be sure that your IA checks them for both flow and pressure.

Engine driven Fuel Pump Problems

Stanley Gitlow, ICS #03324

Just read V. 24 #7 of the Comanche Flyer, where on pages 2021, Bruce Williams asks about the trouble with his left engine driven pump on his 1964 PA-30. I am certain that many people gave him help on that one, but just in case the issue remains open, I would advise that he change the pump. In 1963, 1 owned 7056Y and went to the Piper Service Hangar for minor assistance one day. I returned that evening, and took off (to the SW as I recall). Shortly after turning off my electrical pumps, I lost one engine (the left, I believe). Starting the boost pump brought the engine back to full function immediately. I landed and one of the service personnel took a look at the plane the next day.

During my visit, they had done no work on the engine at all. We ran the engine to full throttle WITHOUT ANY DIFFICULTY on the ground. Flight, however, produced the same problem. They changed the engine fuel pump, and everything corrected itself at once. They could NOT see what they believed was a minute pin hole in the diaphragm but said that they had experienced such events before. They felt that the climb and the temp change had something to do with why they could NOT trust a full throttle ground run up.

A year later, flying a loaner 1964 PA30, while climbing out of Salt Lake City (after having had no trouble whatsoever flying from NYC to SLC in the same A/ C a few days before), the same thing happened to me. I landed and asked the local mechanic to change the mechanical fuel pump, over his protestations since the full throttle run up on the ground revealed NOTHING wrong! He changed it, everything was perfect on my next climb out, and the trip to NYC was without incident.

On my next PA-30, I installed turbines; that kit gave me "real" mechanical fuel pumps rather that the ones dating back to the early automobile days using a rubber diaphragm and a lever action (in which, needless to say, I have less than adequate trust). In somewhat over 11,000 hours in PA-30's since those days, I have never lost an engine driven fuel pump again.

Fuel Sytem Management - Carbureted Models

Maurice Taylor

I had an ICS member visit me not long ago, and we got to talking about fuel pump operation. I'm aware that it's not summer with its hot weather, but this reminded me that we could review the proper operation of fuel pumps on the carbureted models.

The last few Flyers have had a series of articles pertaining to this problem. This only occurs when the temperature is above normal, and last summer was one of the worst that I can remember. However, if you operate the system correctly, even these extreme temperatures should not cause you any trouble.

The problem is that the temperature of the engine driven fuel pump gets so hot that the fuel vaporizes. There is nothing wrong with these pumps. GM built millions of them for their cars, and they have a very long life. If on a very hot day the engine pump fails because you left the electric pumps) on while on the ground or forgot to turn pumps) off after takeoff, you have not damaged either pump in any way. You now have to get rid of the vapor in the engine pump which is quite easy when you understand how.

A checklist of how I operate to eliminate or minimize this vapor lock problem follows:

1. Before starting engine turn on electric pumps) and check to be sure you have a minimum of 4 PSI. Turn off pump(s).
2. Start engine. Check fuel pressure again for a minimum of 4 PSI on the engine pump.
3. Leave the electric pumps) off for all taxi operations.
4. Turn electric pumps) on just before takeoff.
5. At approximately 1,000' AGL or a safe altitude for the terrain, turn off the electric pump(s). Monitor fuel pressure just after turning off the electric pump(s).

The engine driven fuel pump operates off a cam on the back of the camshaft. The only time that it operates with a full stroke is when the pressure is at or near zero as the pressure builds up to its normal operating pressure of 4 to 6 PSI.

The stroke is reduced to near nothing, so when the electric pumps) are on, they maintain the pressure of 4 to 6 PSI. This compresses the spring in the engine pump, holding the lever away from the cam lobe which causes it to have no stroke or pumping action at all.

This is why there is no fuel flow through the engine pump when the electric pumps) are on. As soon as the electric pumps) are turned off, and if the pressure drops below 4 PSI, the spring in the engine pump will move the diaphragm to a point where the stroke begins to produce the pump action, and it will start to move fuel through it.

Although this system has worked for over 30 years, and I see no reason why it shouldn't continue to work for that again, we just have to live with its limitations, knowing what they are. It is helpful, but not mandatory, to know how the system works, but it is absolutely mandatory that you know how to operate it. Do not operate on the ground with the electric pumps) on other than the takeoff run. If you have forgotten to turn off the electric pump(s), then you need to know how to get rid of the vapor lock.

This can be done by turning off the electric pumps) and monitoring the fuel pressure. If it drops down to or nearly to zero, turn the electric pumps) back on only long enough to bring the pressure back up to the normal 4 to 6 PSI, then immediately turn the electric pumps) off. In an extreme case, this may need to be done two or three times, requiring only a few seconds each cycle. If you turn the electric pumps) back on just as the pressure reaches zero, the engine will not falter. Remember that you have to give the engine pump time to push the vapor out of the pump through the line to the carburetor and into the carburetor bowl and out the bowl vent.

The real fix for this problem would be to have all the fuel go through the engine pump as it does in the fuel injected models. The valves in these pumps are of adequate size to permit this. However, this would require changing the fuel lines and getting approval from the FAA -the latter being the more difficult part of it.

You must be sure that your pumps) are working properly. The engine pump pressure must read between 4 and 6 PSI. If it is below 4 PSI, have it repaired. Pressure for the electric pumps) must be between 4 and 6 PSI on each pump and the flow 32 GPH (3.2 gallons in six minutes).

These electric pumps are not being checked properly. Request from you IA that they be checked and have a note in the log book of the results on each pump. This should be done at each annual.

Note on these engine driven fuel pumps that GM no longer makes them but Lycoming does. If you have a 180, and you get an overhauled engine from Lycoming, you will get a new fuel pump, AC #41271. That is the new style, but it is larger, and although it will bolt on the engine, it will strike the engine mount when you start the engine. Piper made a drawing on how to modify the engine mount to give it room. MY advice on this is to call Aero Accessories in NC at (800) 822-3200 and get an overhauled AC #40295 at less cost. This fits the 180, and either one will work on the 250 or 260.

Fuel Selectors (Feb 2003)

Mike Rohrer ICS #13392

This month, I would like to address an old AD that has been around since 1970. AD 70-22-02 covers the "Airborne" fuel selector in our PA 30/39's. I don't know why, but I have found two PA30's and one PA39 that this AD was not complied with. In short, this AD addresses the selector valve. What you are looking for is a roll pin retaining sleeve and safety spring clip to insure a more positive means of securing the fuel selector valve control arm roll pin. Look for the valve model number. This can be found on the manufacturer's plate. Open the door between the front seats where the fuel quick drain is located. Under the model number is another set of numbers and letters. If the number is 4-R, 5-R, etc., and subsequent letter codes, the valve is not affected by this AD. The purpose of this AD is to prevent the possibility of engine fuel starvation resulting from the inability to operate the fuel selector valve due to loss of the control arm roll pin. If your valve is covered by this AD and has not been completed, a red dot should be located on the fuel selector arm immediately adjacent to the retaining sleeve. Piper Service Bulletin 314A also covers this AD. Contact your IA if you have any question, or feel free to contact me. I'll fax you a copy of both.

I have received many calls about what to look for during an Annual inspection that is not on the inspection sheet. The things that I find that are missed are actually in the list, but are either ignored or just missed. I know that I have covered several items this past year, but I'll give them all again here; that way they are all together. These are things I have found that are very costly, and if found early, can save a lot of money and grief.

1. Pull fuel plates off (these are the ones that the fuel cap is under). On the twins, remove the cover plates located under the engine nacelle. This requires removing the fairing around the nacelle. Also, remove the wrap-around panel aft of the cowling. With these items removed, you can remove the fuel panels. Under the panels, you will find the fuel sending units. This is where the problem lies. If the gasket is torn or missing (usually the latter), water will get into this area, and the

corrosion process will begin. I keep Air Parts of Lockhaven busy repairing the fuel sending units. If your fuel adapter isn't corroded too much (this is the plate the fuel sender is attached to), it might be cleaned up and reused. The problem is that the fuel adapter usually is corroded to the point that pins holes are present. These babies are getting very hard to find.

2. On the twins, again, remove the small plate behind the top engine cowling. Under this is the vacuum filter and cables. I have found many filters so old that when touched they fell apart and into pieces. Also, while you have this plate off, please lube the cables. Now is the time when cables get very stiff and, if forced, will break. What a nightmare this is. Call, and I will sell you the best can of lube that I have found to break free stubborn, stiff cables. I have not found one yet that had to be changed due to this problem.

3. Check tension on all control cables. Did you know that if you have an autopilot and are having problems with the Altitude hold doing a little roller coaster maneuver, most times it is the cable tension?

4. Turn on the autopilot. What you want to do is put opposite pressure on the controls; for example, if the control wheel is turning to the left, hold it and turn to the right. Just slight pressure, and do the same with the pitch. What this does is clean the discs in the clutch pack. You would be surprised if you knew that most autopilots would not disengage if a need rises. Autopilots are made to disengage with a certain amount of force in an emergency.

5. Remove the flap jackscrew and motor assembly. This is very seldom done. I remove it every 500 hours, clean, remove the end cap, and clean out the old grease and install fresh.

6. Remove and clean the fuel injector. This is another item that is missed. I soak them in gun cleaning solution while in an ultrasonic cleaner. If you don't have one, just soak them.

7. With the exhaust removed, spray the welds with some sort of penitrant spray. Let it soak for a while, drink a coke, or if you smoke, have one. The oil will seep through if there is a crack. I have found cracks that were not visible to the eye. Once cleaned up by sandblasting, it showed up.

8. With the exhaust removed, look into the exhaust ports and between the fins located next to the exhaust ports. You will see a fine line that is white, or black. Looks like a carbon crack, for those who have seen those before. Also, I suggest spraying dye penitrant into the exhaust port, and then wait. If it's cracked it will show up between the fins. I have found that cylinders that were overhauled and have about 600 - 800 hours usually have cracks.

9. Remove the gear jackscrew and motor assembly. This is cleaned and lubed just like the flap assembly.

10. Remove the mags, both Slick and Bendix type. Check the condition of the points and adjust per manufacturer specifications.

11. On the PA24's remove the fuel selector valve, clean and lube. This takes a special type of lube. If your IA doesn't have it, call and I will send you some. I can't see buying a can; you will never use it all in your lifetime, or your kids' for that matter. Use it sparingly; if not, it will show up later in your fuel filter. Trust me on this.

12. On the 250's, make sure that the fuel pumps (electrical) are disconnected from each other and checked individually. You will be surprised how many I have found where only one is working. One switch and one C/B for both, and they are both wired together. Good idea, huh?

13. On the 260's, the fuel pump is under the co-pilot's floor, just behind the rudder pedals. For some reason, this panel is not removed. When removed, there usually is a small fuel leak found.

14. Check for fuel stains under the wing close to the wing root area.

15. When changing oil filters, replace the CH48110 with a CH48111, which is longer and holds more. Last month, I covered this item and when I received my issue, I found an error. It should have stated that the CH48110 would bypass around 25 hours not 50 hours. Costs the same, but the CH48111 will last for 50 hours. In addition, remember it is important to change your oil every 3 - 4 months not just every 50 hours, or sooner, if operated in dusty conditions.

16. Remove the Stabilator and check for corrosion. I find this on most of the birds that we inspect. Continue to call me about this. I average about four calls per week on this matter. About one out of five is "clean and corrosion free".

17. Please check this item. It's AD 77-13-21, the notorious gear AD. For some reason, IA's are doing par. (b) every 3 years or 500 hours and not par. (a). They are signing off the AD as complete by doing par (b). Please check your logs and look for the completion of par (a) by inspection. This is not considered complete by merely replacing the BUNGEES.

18. On the twins, remove the fuel filter bowls and clean. If rust or sand is found, you are not draining enough. This will in time cost you a lot of money to overhaul the fuel selector valve, and if you are lucky, it will not kill you or destroy your airplane when the engine shuts down because of fuel starvation. I have found a great place to have the selector valve overhauled. George, down at AirParts of Lockhaven in PA, does a wonderful job and provides a quick turnaround.

19. The fuel bowls on the PA24's are equally important.

20. Check the nose strut where the turning stops are located. The stop should have a shoulder on it and not worn off, and check real close for cracks. The damage is caused from turning the nose gear beyond the stops. Call, and I'll send you the turn limit decal.

Fuel Siphoning Problems (Mar 2003)

Mike Rohrer ICS #13392

Recently, while investigating a complaint on a PA30 fuel-siphoning problem, I found that the fuel selector was by-passing through. The left aux. tank was leaking into the right main tank. When I removed the fuel bowls for the inspection, I found what I had expected. There was a lot of sand and water in the bowls, and when the fuel selector was removed, I found the check balls were leaking through because of corrosion. The selector could not be overhauled and a "serviceable unit" had to be purchased. Moral of the story - drain, drain, and drain some more.

Fuel Selector Problems (Mar 2003)

Al Bieck ICS #02171

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Recently, when I removed the sediment bowl from the strainer assembly (part No. 22312-00) in our "250", I discovered internal leakage through the fuel selector valve (hoof), which I later rectified by installing a new "0 - ring". What concerned me was that the fuel dribbled out of the outlet port above the screen. To make sure it wasn't fuel draining from the line to the boost pumps, I selected a full tank, and, sure enough, fuel streamed out of the wrong port! I then removed the strainer assembly from the aircraft. Confirming what I already knew, the arrows on the casting showed that the outlet port was connected to the fuel selector, and the inlet port (180 degrees opposite) had the 45 degree fitting which connects the line to the fuel pumps and the engine. Turning the unit 180 degrees, and changing the fittings over to where they belong (the right angle fitting receives the line from the fuel selector), corrected the situation.

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or did the mistake occur during a subsequent repair or modification? We will never know. Most of the early records were lost in a hangar fire long before we bought the aircraft, and the surviving records do not give any clues.

Water Contamination in Fuel Filters Is Easily Avoidable (Jan 2004)

Mike Rohrer - ICS #13393

I was just reading an article in the December issue of *Flying* magazine on a topic that I have written about several times. I guess it still isn't getting across. We need to take care of these machines so that they will take care of us. In addition, this is one of the reasons that our insurance rates are going up. Did you know that some companies are not insuring Twin Comanches that are older than 1965? And some are not even covering the Comanche 180's.

The *Flying* article states that a Twin Comanche lost power in both engines and crashed due to ice build-up in the fuel filters. Come on people, there is an AD that covers this and it's due every 50 hours. It states, "To eliminate water contamination of the aircraft fuel supply" and mandates compliance every 50 hours of operation. This aircraft had not been complied with in 16 calendar months and 234 hours of operation.

Basically the AD wants you to remove the filter bowls and check for water every 50 hours. The Owner's Handbook states auxiliary fuel and tip tank fuel should be used in level flight only. Examination of the wreckage revealed evidence of fuel at the scene with the left fuel selector in the "auxiliary" position and the right selector in the "main" position. The airplane was in cruise flight at 6,000 feet in below zero temperatures.

I know that not everyone checks his or her fuel filters, but at least drain the things 20 to 30 seconds for each tank. I go as far as draining them after flight. This way, if any water is trapped when first drained it most likely will be repositioned after flying.

I continue to see water in the filter bowls in twins, some so bad that the selector had to be overhauled because of severe corrosion.

A sign of corrosion is when you go out to the airplane after it has sat, and when you remove a fuel cap the fuel gushes out and one of your other tanks is low. This is the result of a rusted check valve in the selectors, which does not seat anymore. Therefore, fuel passes through into another tank.

So please, for safety sake, drain your tanks. Airplanes get very quiet when the fuel flow stops. It is so easy to drain, so why take the chance?
It doesn't make any sense to me.

Electric Fuel Pumps Problems (Feb 2004)

Q Occasionally the engine on my 250 sputters and wants to quit after takeoff when I switch off the electric fuel pumps. The pressure indicates it is low when this occurs, but goes back up when I switch the electric pumps back on. Is my engine-driven pump going bad?

A The plumbing of the aux. pump on 180s and 250s is configured so that while the aux. pump is on, fuel is not flowing through the engine-driven pump and the fuel in the engine-driven pump rapidly heats. This can result in a vapour lock in the pump and an engine stoppage when the electric pumps fails or is turned off.

It is recommended that the aux. pump is checked as part of pre-flight and then not turned on until immediately prior to takeoff. It should be off during the engine run-ups to prove the efficiency of the engine-driven pump. Vapour lock is usually a concern only during the hot summer months. Also, here is some additional information concerning your engine-driven pump.

Most normally aspirated Comanches use a diaphragm type, engine-driven fuel pump. Old age and non-use can cause these pumps to fail. If your electric aux. pumps are not working correctly (i.e. able to supply the correct volume and pressure) you may be faced with an engine failure. (See the TIPs Manual for advice on testing and ensuring correct pressure during maintenance.)

Comanche Fuel Tanks Venting (Feb 2004)

Q How do the Comanche fuel tanks vent? I have heard there can be problems with the venting system. What are the problems if any?

A The fuel caps on Comanches are not vented. A blocked tank vent will therefore result in the fuel cell either not feeding, or else the fuel cell being sucked flat. Tip tanks can be deformed and collapse and rubber bladders will either be lifted upward or the cell will detach from the retainers and collapse from the top. In either case, the fuel quantity indicators will read incorrectly. Comanche vent tubes (mains, aux's and tips) have proven to be preferred homes for mud wasps. It is a good idea to keep a length of flexible plastic tube in the aircraft and (with the fuel cap off) ensure that you can blow air into the tank. It is a good idea to check the overflow at the same time. I keep a short length of old tachometer cable in my toolbox to run thru through the vents to clear blockage. This is important especially prior to an Atlantic flight.

Fuel Tank Dipsticks (Mar 2004)

Q The fuel gauges in my Comanche 250 are not very accurate and when I look in the tanks it is very hard to judge how much fuel there is. Lots of times I have a short trip that doesn't require a lot of fuel, but with four people aboard, I don't want to fill the tanks to the top. Yet by just looking in the tank, sometimes I'm not certain if there is enough fuel. Is there a way to measure the fuel?

A Years ago I made a dipstick for my 250 just to address the very concerns you expressed. I used a piece of white oak (any dense wood will work), and with a tank that I had run empty, I added 5 gallons at a time and measured the result. (See accompanying photos.) One side of the stick is for the mains, the other for the auxiliary tanks. I made the marks with a saw and painted the stick flat black.

For 5 and 10 gallons in the aux. tank, the marks are at:
• 2 9/16 inches and 4 5/16 inches
The main tank markings in 5 gallon increments are:
• 2 inches, 3 1/2 inches, 4 5/8 inches, 5 3/4 inches, and 7 1/8 inches.

I now use the same stick for my Twin Comanche. Of course the aircraft needs to be level for the readings to be valid.

Fuel Venting Overboard (Mar 2004)

Q I have a twin Comanche. Occasionally I will find fuel going overboard via the vent line from my right auxiliary tank. It is as though the tank is being overfilled even though it is not. I have been careful to not fill the tank to maximum, and still, sometimes there will be fuel dripping from the overflow after the aircraft has been sitting for some time. Is my airplane haunted? It seems to be manufacturing fuel! What is happening?

A Although you didn't say so, I assume your twin has tip tanks. The fuel system is designed so that the lines from the tip tank and the aux. tank both feed into a solenoid valve. The switch near the tank selector switches the solenoid valve so the fuel feeds from the tip or the aux. tank. If the o-ring is bad in the solenoid valve, or if there is a bit of debris lodged

against the valve seat, fuel will drain from the tip tank to the aux. tank through the solenoid valve since the tip tank is higher.

Your aircraft is not “manufacturing” fuel. The fuel is simply transferring from the tip tank to the aux. tank. When the aux. tank cannot hold more than its capacity, the excess vents overboard. You need to remove the solenoid valve for inspection. Both solenoids are located in the cabin against the front of the main spar.

Fuel Gauge Sender Unit Gasket Leaks (June 2004)

Q When I fill the right auxiliary tank on my twin after landing, I find a blue fuel stain that seems to be coming from a panel behind the tank fill door. What is under there that could be leaking and how do I fix it?

A The panel you refer to is where the bladder is installed. It is also the location of the fuel quantity sending unit. The cork gasket on the sending unit tends to dry out after time and, if the tank is full, there can be leakage during climb out.

Usually, you can resolve the leak if you remove the sending unit and apply Fuel Lube to both sides of the cork gasket. Fuel Lube is a Vaseline-like substance available from Aircraft Spruce (p/n 09-25300). Also, be sure to apply a sealant to the edges of the cover to keep water out of the cavity. If water gets into the cavity, corrosion can occur on the bolts that retain the bladder and cause leakage around the bladder retaining plate.

There is more than one choice for a sealant. One is aviation grade RTV, which is an approved aircraft sealant compound, but you must be very careful when using it, especially on fuel systems. Unlike Fuel Lube, some RTV can harden and become brittle. Small pieces could cause a blockage if they get in your fuel system. An alternative to aviation grade RTV is a non-hardening sealant used by some of our members: Sealube by Ohio Industrial Lubricants. A one-pound can from Aircraft Spruce will last forever.

Fuel Odor in the Cabin (Jul 2004)

Q I have a 1967 PA-30. There is an occasional fuel smell in the cabin. We have checked all the fuel lines in the cabin along with the fuel selector and the boost pumps. We can’t find the leak. Any ideas?

A If there is even a tiny leak in one of the fuel bladders, the fuel smell can migrate to the cabin thru the wing root, and is often especially apparent after landing. The most common place for small holes to develop is in the top of the bladders (main or aux tanks). In this case, the fuel smell is present when the tanks are full, but not when they are down a bit. Another site for fuel leaks is in the fuel sender fittings in the tanks. These may become corroded if the overlying inspection panel has not been correctly sealed, allowing water ingress.

Another source of a fuel leak could be the combustion heater. John Regier at Webco reports that they have lately found a couple of cases where the fuel leaks slightly around the valve stem, but only when the valve is being operated. That situation would make the leak difficult to locate. Check that the lines are not reversed to the valve. The valve stem seal should not be pressurized when the valve is “off”, but this will occur if the lines are reversed (as they can be).

While you say that you have checked all the fuel lines, the fittings on these lines can actually leak without any visible evidence of a fuel stain. Someone familiar with them should check them. Do not just tighten them further. This can crack them. Some of these fittings require small o-rings which should be present and in good condition.

Engine Running Rough due to Clogged Fuel Injectors or Spider (Aug 2004)

Q I have a 1966 260-B Model Comanche. Lately the engine is running a little rough and I have noticed the fuel flow is higher than normal. What do you suppose is causing this? Leaning doesn't help; it gets worse.

A Unlike the earlier carbureted single-engine Comanches, the 1966 and later models have fuel-injected engines and the symptoms you describe are not uncommon. Our panel of technical experts suggests you have at least one blocked injector, or foreign material in the fuel distributor ("spider"), possibly both. As a result, one or more of your cylinders is not receiving proper fuel flow and is running too lean. That is why leaning makes it worse – you are already too lean on one or more cylinders. The fuel flow, which you think is rising, is not doing so. The fuel flow gauge is actually a pressure gauge calibrated in fuel flow units. With an obstruction increasing the back pressure in the fuel system, you have an indicated rise in fuel flow, not an actual rise. While the problem could possibly be isolated with an engine analyzer, it is probably best to clean the entire system. The injectors, the fuel "spider," and the related lines should be cleaned and the small strainer from the fuel servo should be checked for contamination and corrosion. Another good bit of advice is to have a look at the top of the piston and underside of the valves in the affected cylinder to make sure there is no damage caused by running lean at high power for a prolonged period.

One member with a 1966 260B removes and ultrasonic cleans his injectors every 200 hours as a matter of routine maintenance since all the injectors become dirty with use. This can be caused by fuel dye and other additives in the fuel. He says he is amazed at the difference in performance with clean injectors.

Electric Fuel Pump Not Pumping (Dec 2004)

Q I have replaced two left electric fuel pumps this year; and the third one just failed. Always the left one. One was old, one was new from Weldon, and the last one was overhauled by Aircraft Accessories. The aircraft is hangared in south Florida, and the fuel is sumped every flight. We usually get a teaspoon of water from 6 tanks. We have installed reminder lights for the pumps and do not leave them on except as required. Any suggestion would be greatly appreciated.

A We're sorry to say you may have stumped the experts, but let's give it a whirl. The fuel pump situation sounds onerous, and the fact it is always the left one that fails does not suggest a quality problem with the pumps, although it doesn't rule it out. Definitely, the pump manufacturer should be contacted and an inquiry as to the possible causes for pump failures. The answers should give a clue as to where to start looking for the problem.

Repetitive pump failure sounds as if the pump may be working too hard. The fact that each failure has involved a different condition pump (i.e. used [old], a new Weldon and now an overhauled one from AA), is puzzling. There may be something else going on. You might check the fuel lines and make sure they are unobstructed.

The pump itself has hardened steel vanes, and if it turns by hand, it is probably okay, but the motor is a different matter. There was a discussion on the Delphi site about the uniqueness of the new motor Weldon uses for the PA-30 pumps. The pump has a tab on the shaft, while the motor has a slot. The end play tolerance between the tab and slot is critical. If, upon assembly, the tab bottoms out on the slot, the motor does not have enough torque to overcome the end play tightness. One fix is to use the standard length motor, make cutouts and bead them in the transverse shear web where the pumps are located. Also, the pressure needs to be set at 25 psi after the pump is installed.

There is one report of a series of pump failures, more than six in all, and these were all new Weldon units as supplied by Webco. On disassembly of some of the older units, it was found that the motors seem to run fine but the pumps have apparently seized. When turned by hand, the pumps turn okay and when reassembled they appear to work. However, there is still a problem and the pumps cannot be refitted without overhaul by an approved shop. As this column is written, there has been difficulty getting a response from Weldon on the warranty position. Apparently, with all the pump failures, none have yet been returned to Webco or Aircraft Accessories and they can do nothing for warranty until the pumps come back. It sounds like Catch-22, and until someone sends one of the failed pumps back to be disassembled, a determination cannot be made concerning the failures.

Water in the fuel of a hangared plane that is flown somewhat regularly seems strange. It may have nothing to do with the pump failures but nevertheless the fuel caps and lid seals should be checked. Also it should be noted if the water-in-fuel is coming from the left tanks only or distributed among all tanks, left and right. The water in the fuel could also be from your

supplier. If you buy your fuel regularly from the same place, you might want to mention your water-in-fuel problem to the supplier and ask if there are any reports from others since it is an unusual condition.

Replacing & Relocating the Electric Fuel Pumps – An STC (Apr 2003)

Hugh J. Gallagher, Gallant Airmotive Inc.

To: FAA
I am submitting form 81110-12 for a one-time Supplemental Type Certificate. This alteration replaces and relocates the electric fuel pumps.

The electric fuel pumps will be relocated from the right lower aft side of the engine compartment to the right stringer of the gascolator compartment in the belly of the fuselage. In the PA-24-260 design, the electric fuel pump is located in the belly of the fuselage. The fuel System will not be changed in design. Only the location and type of fuel pumps will change. The pumps will be mounted on the right stringer, and the stringer will be reinforced at the mounting location. The pumps (2) will be new solid State type, Facet #40106, 12v, solid State, negative ground, 4-6 p.s.i. max., 30 g.p.h., with the same p.s.i. and g.p.h. as the original Bendix (now Facet) #478360, interrupter type. Relocation of pumps will prevent pumps from heat soaking and possible vaporization of warm fuel causing low fuel pressures during hot weather operations. These pumps are recommended by Rutan Aircraft Factory, Stoddard Hamilton and other aircraft designers. A new fuel line, running parallel to the original fuel supply line, will be extended from the electric fuel pumps in the gascolator compartment, through a new Standard bulkhead fitting at the firewall, and continue to the outlet side of the engine-driven fuel pump. The original fuel supply line will be extended from the firewall directly to the engine- driven fuel pump with a new section of fuel line.

All work performed will be in accordance with acceptable methods and practices as per AC43.13-1A Chapter 1 Section 3 Para. 99, Chapter 14 Section 2 Para. 709, Chapter 11 Section 7 Para. 514, 515, 516, and 519. Weight and balance and equipment list changes will be made, and flight manual Supplements will be entered.

PA-24-250, S/N 24-2999, was manufactured in 1962. Piper manufactured PA-24-250 Comanches from 1958 until the model was discontinued at the end of 1964. The PA-24-260 model started production in 1965 and continued until 1972. A significant improvement in the PA-24-280 model was the relocation of the electric fuel pumps from the engine compartment into the fuselage, away from any heat source. Therefore, the alteration I am applying for is an improvement that Piper made on the later PA-24-260 model aircraft and will improve the safety and Performance of the PA-24-250 model aircraft.

I am submitting schematics of the PA-24-250 and the PA-24-260 fuel Systems, a drawing of the new fuel System (showing location of pumps, lines and fittings), copies of weight and balance changes, equipment list changes, and flight manual Supplements. Thank you for your time and attention in this matter.

Dear Mr. Gallagher:
Approval of Fuel Pump Installation Modification in a Piper PA24-250 / Model Aircraft (Serial Number 24-2999) Project No. ST4209LB-A.

We have reviewed the data submitted by the above referenced letters from Mr. Michael Ross, the aircraft owner, and find them acceptable. Also, Mr. VanDyke of this office inspected the aircraft Installation at the Palomar Airport (reference 3) and found it to be satisfactory. Therefore, we are issuing Supplemental "type Certificate (STC) SA00198LAtoyou. Also enclosed is a stamped approved copy of your engineering Master Data Report 92024 dated May 13, 1996. This STC is applicable to Piper Aircraft Serial Number 24-2999 only. If at some future date you wish to obtain a multiple (i.e. applicable to more than this one aircraft) STC, you will need to reapply at that time.

In accordance with Federal Aviation Regulations §21.3, and as a recipient o this certificate, you are required t| report any failure, malfunction, or defect, except as provided in §21.3(d)J in any product or part manufactured b you or your contracted suppliers, and which you have determined h resulted or could result in an; occurrences listed in §21.3(c). The report should be communicated initially by telephone to the Manager Propulsion Branch, Los Angel Aircraft Certification Office, Phone No.: (310) 627-5241, within 24 hours after it has been determined a fail has occurred and followed up with

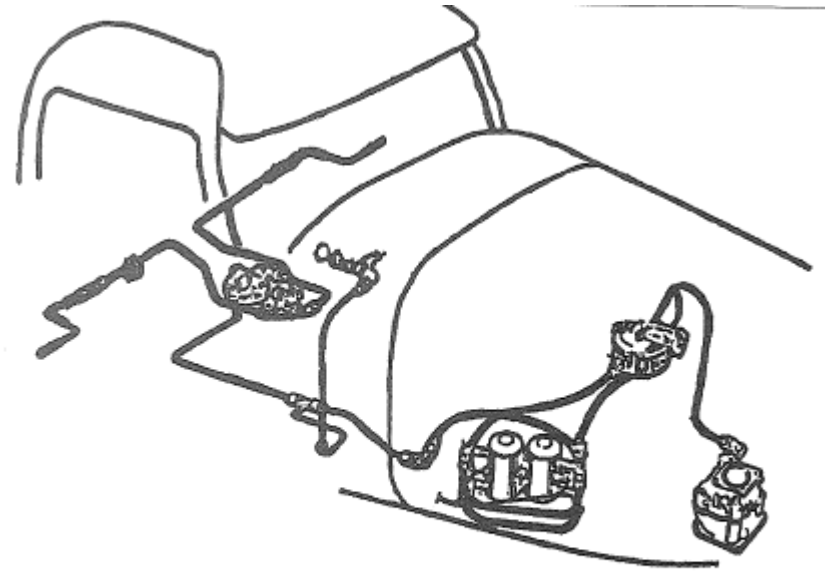
written notice to the address show: above. FAA Form 8010-4 (malfunction or defect report) or other appropriate format is acceptable in transmitting the required detail.

You, as the STC holder, responsible for any design changes necessary to correct unsafe conditions as well as for submitting those design changes to this office for approval. This requirement is contained in §21.99. In addition, you are required to advise this office of any change in address.

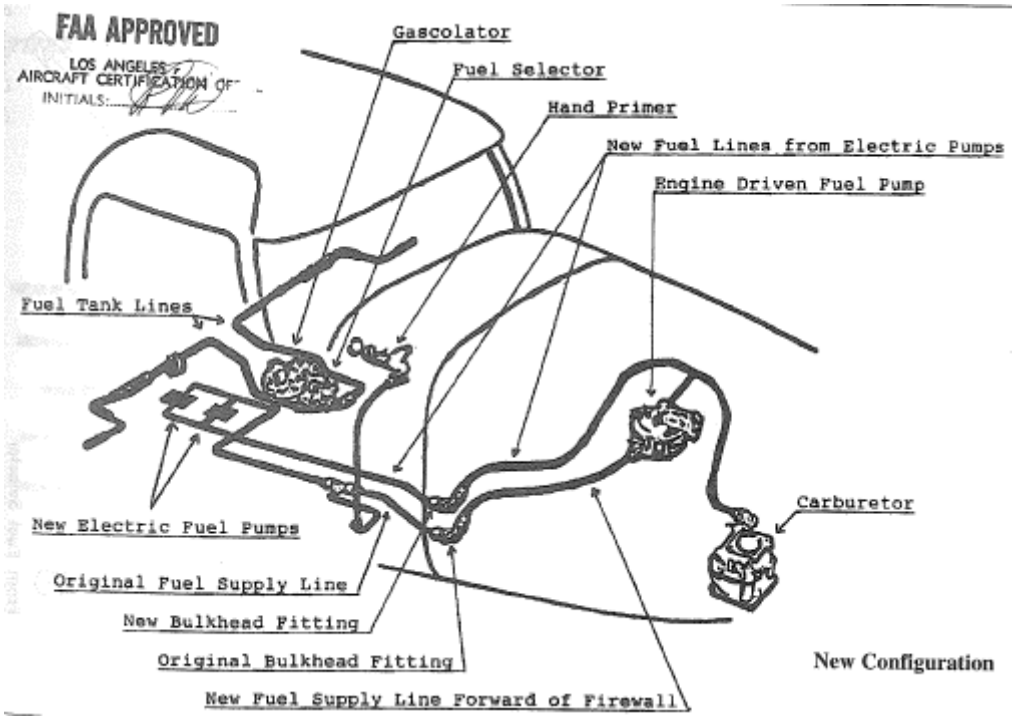
Also, §21.50 requires that maintenance procedures for continued airworthiness, as applicable to this change in type design, be made available to the Operator at the time the aircraft is returned to Service.

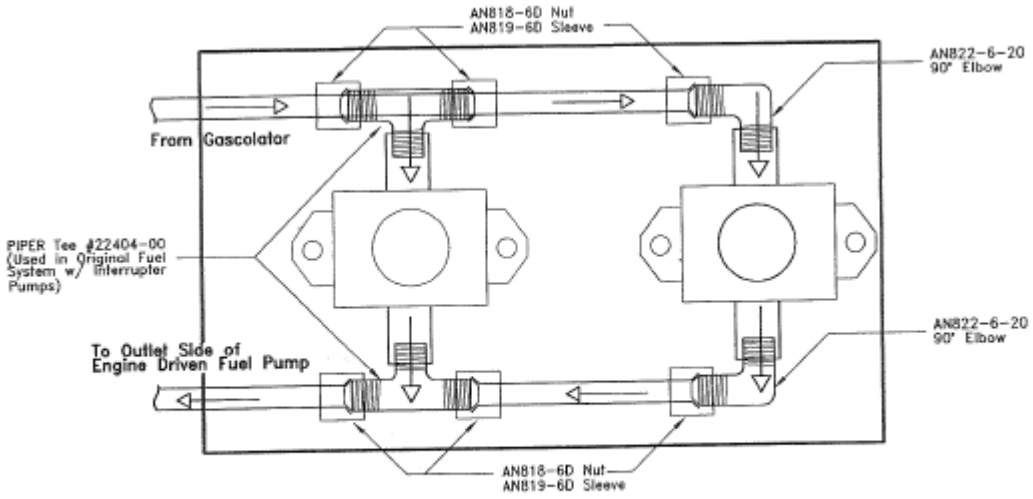
By accepting this certificate, you acknowledge that you have read and understand your responsibilities as STC holder.

Editor's Note: This is only a portion) of the Information - there is too much to print - For more details on this time STC please contact HQ.

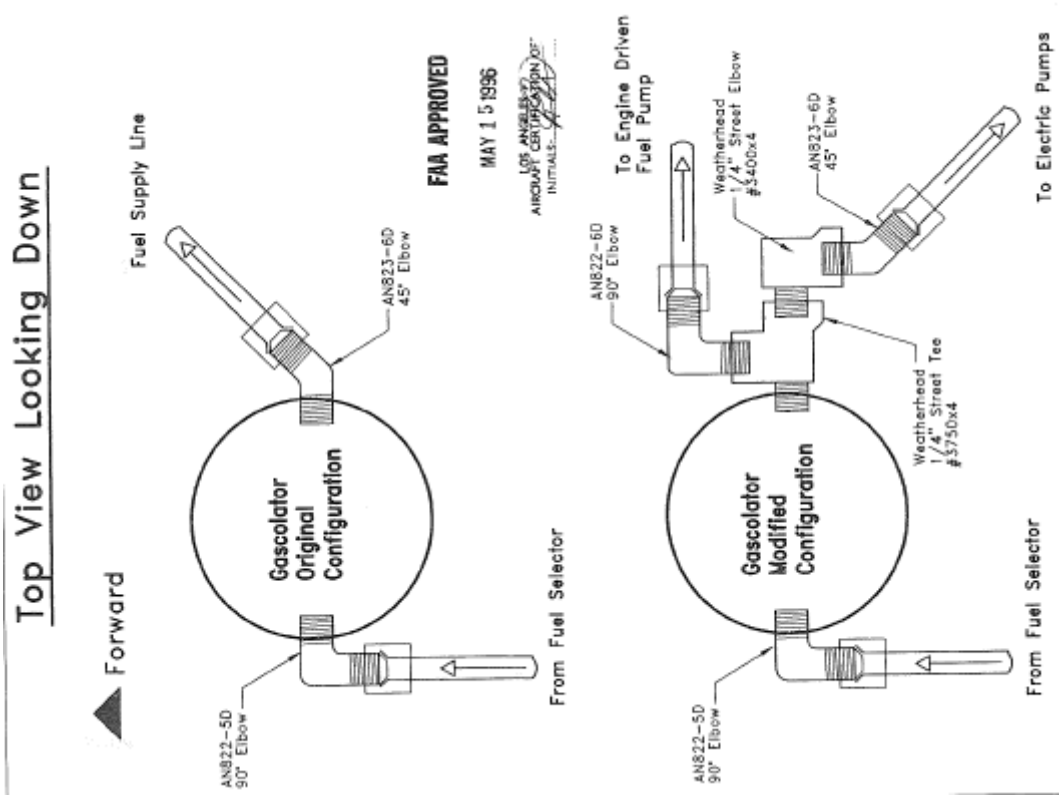


Original Fuel System Configuration with Interrupter type fuel pumps, hoses and connections all located in lower aft section of engine compartment.





Fuel Pumps and Fittings As Mounted On Right Stringer Of Gascolator Compartment



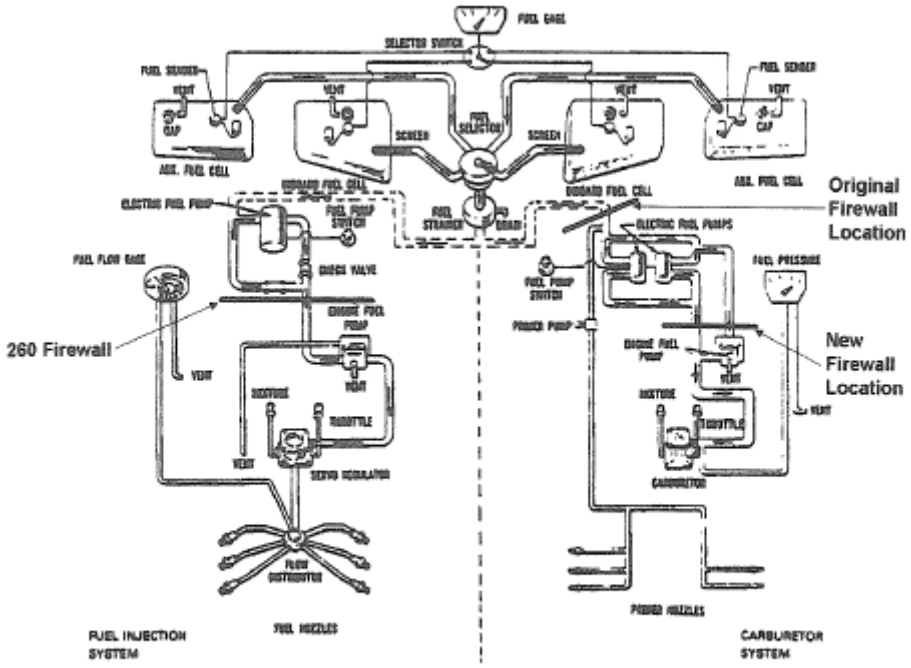


FIGURE 8-4. FUEL SYSTEM SCHEMATIC
PA-24-250, Serial Nos. 24-2299 and up and PA-24-260

FUEL SYSTEM
ISSUED: 8/18/72

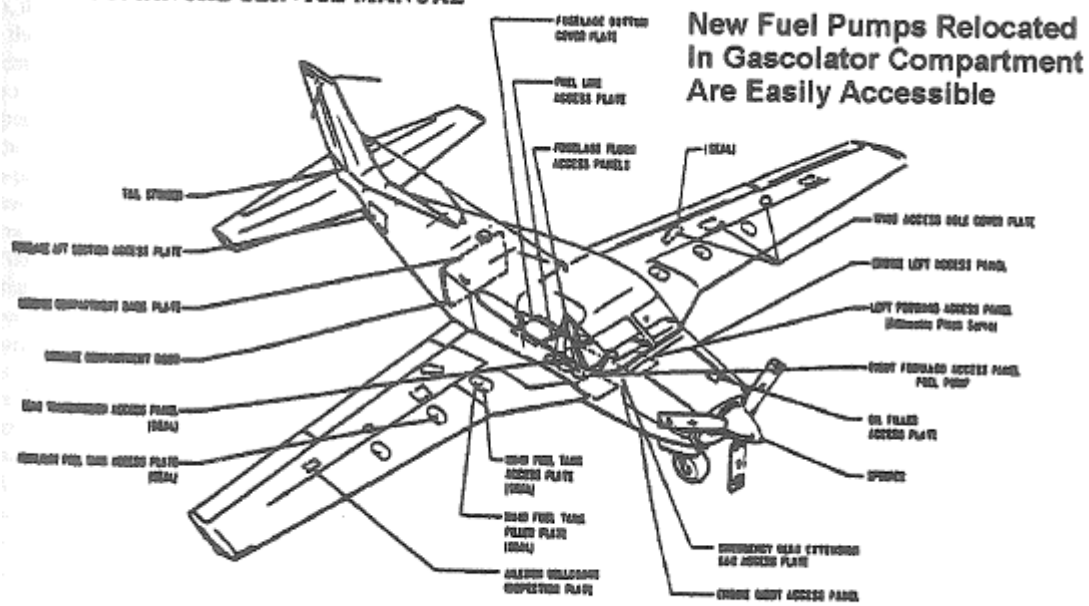


Figure 2-6. Access Panels and Plates
PA-24-180, PA-24-250 and PA-24-260, Serial Nos. 24-4000 to 24-4246, 24-4248 to 24-4299

WEIGHT AND BALANCE REVISION

MODEL Piper PA-24-250 S/N 24-2999 N7782P

DATE	ITEM	WEIGHT	ARM	MOMENT	ADDED	REMOVED
	Removed 2 Interrupter Fuel Pumps	-4.00lbs	40.0	-160		xx
	Added 2 Solid State Fuel Pumps	+2.25lbs	102	+229.5	xx	

	WEIGHT	ARM	MOMENT
PREVIOUS EMPTY AIRCRAFT	1940.175	+80.41	156024.58
CURRENT EMPTY AIRCRAFT	1938.425	+80.53	156094.06

INSPECTOR: Hugh J Gallagher

I D #: AP174387458IA

DATE: 5/13/96

No certificate may be issued unless a completed application form has been received (14 C.F.R. 21)

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

APPLICATION FOR TYPE CERTIFICATE, PRODUCTION CERTIFICATE, OR SUPPLEMENTAL TYPE CERTIFICATE

FORM APPROVED
O.M.B. No. 04-R0078

1. Name and address of applicant
HUGH J. GALLAGHER
2006 PALOMAR AIRPORT ROAD
CARLSBAD, CALIFORNIA 92008

2. Application made for –
☐ Type Certificate
☐ Production Certificate
☒ Supplemental Type Certificate

3. Product involved
☒ Aircraft
☐ Engine
☐ Propeller

4. TYPE CERTIFICATE (Complete item 4a below)

a. Model designation(s) (All models listed are to be completely described in the required technical data, including drawings representing the design, materials, specifications, construction, and performance of the aircraft, aircraft engine, propeller which is the subject of this application.)

5. PRODUCTION CERTIFICATE (Complete items 5a–c below. Submit with this form, in manual form, one copy of quality control data or changes thereto covering new products, as required by applicable FAR.)

a. Factory address (If different from 1 above)

b. Application is for –
☐ New Production Certificate
☐ Additions to Production Certificate (Give P.C. No.)

P.C. No.

c. Applicant is holder of or a licensee under a Type Certificate or a Supplemental Type Certificate (Attach evidence of licensing agreement and give certificate number)

T.C./S.T.C. No.

6. SUPPLEMENTAL TYPE CERTIFICATE (Complete items 6a–d below)

a. Make and model designation of product to be modified
Piper PA24-250, Serial No24-2999, N7782P

b. Description of modification
Replace and relocate the electric fuel pumps from the engine compartment to the gascolator compartment. See attached drawings and information

c. Will data be available for sale or release to other persons?
☐ YES ☒ NO

d. Will parts be manufactured for sale? (Ref. FAR 21.303)
☐ YES ☒ NO

7. CERTIFICATION – I certify that the above statements are true.

Signature of certifying official

Title: INSPECTION AUTHORIZATION

Date: 5/13/96

FAA Form 8110-12 (3-80) SUPERSEDES PREVIOUS EDITION

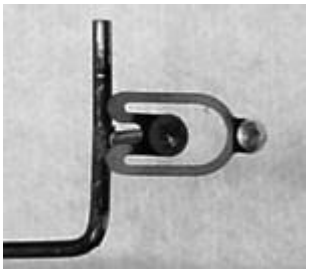
Test and Refurbish Procedure For Comanche Fuel Transmitters (Apr 2006)

Matt Kurke, A&P - ICS #10288

If you are experiencing erroneous fuel quantity indications in your Comanche, this may be of some interest and assistance in the diagnosis and repair of the fuel quantity indicating system. This is not intended to replace the methods found in the service manuals nor to re-hash them; rather it is to offer additional information. And obviously one should refer procedurally to the appropriate manual. You determine if your capabilities include doing this yourself; there isn't much mystery involved once the system is understood.

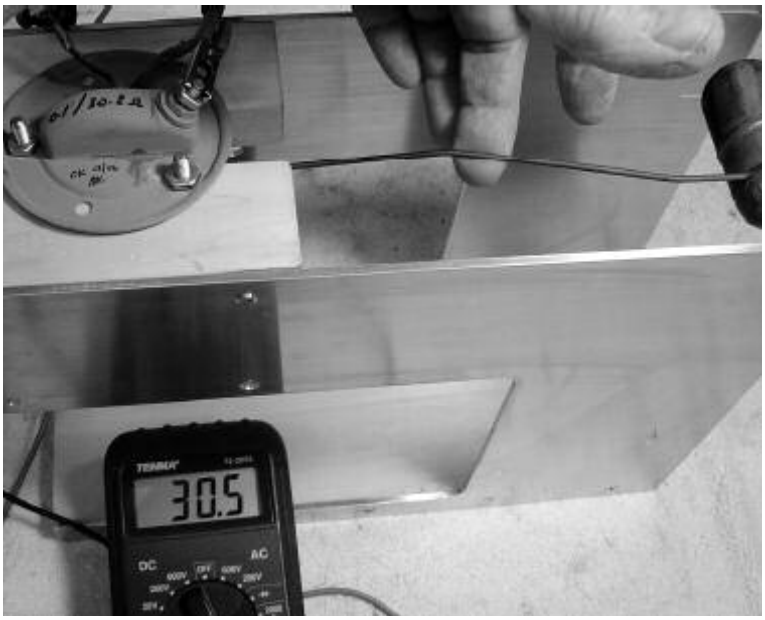
An error in fuel quantity indication can be caused by an incorrect resistance value being transmitted to the display gauge unit. There can be a few sources for this problem. Checking for poor connections should be your first line of diagnosis, secondary would be a component. One cause of incorrect resistance can be from corrosion where water has leaked into the transmitter area from poor sealing of an access cover. Water collects in the depression where the transmitter unit is mounted – take a look there.

This main tank transmitter didn't survive due to the extensive corrosion.



This wiper button is okay, even with the small spot that has worn.

Another cause is internal to the transmitter – a dirty resistance winding (not obvious) inside a fuel transmitter is quite common and easy to check. The internals of the transmitter are simple and diagnosis and repair fairly simple once disassembled. There are cases however where the fuel level transmitter has reached the end of its life, i.e. the wiper button is too worn, broken or missing, or excessive housing corrosion.



A full-range test must be 29.6 to 31.3 ohms for all except the Comanche 400 auxiliary transmitters (they require two transmitters).

Before getting into the actual dissection of the transmitter, take a moment to consider other possible culprits. On the single models with one gauge display unit, you will find four push-button momentary switches and a rotary selector switch co-located with the fuel tank selector. Any of these electrical components may have developed some resistance which will add to the value from the fuel level transmitter – the result will be erroneous fuel quantity indication. If you have this type of system, put it on the diagnostic check list in addition to the gauge, fuel transmitters, and connections.

The work-related portion starts with removing the wing access cover for the suspect transmitter. Obviously, you need to heed all safety precautions when working in this area. If necessary, drain sufficient fuel from the tank to avoid a problem when the transmitter is removed, then remove the transmitter from the plate assembly. To test the transmitter (see single Comanche service manual section 8-10; section 9-15 for twins) connect an ohmmeter between the terminal and the housing and slowly move the float arm from the bottom stop to the top stop. The ohmmeter indicator should steadily move up-scale, without fluctuation, as the float arm is moved upward. No “drop-outs” or “opens” are allowed. If it isn’t perfect, proceed with the disassembly phase which is not covered in the service manual, although the main subject of this writing.

Once you have determined necessity, the disassembly method depends upon the type of transmitter you are investigating; most employ the soldered-rivet method, some a cover with securing tabs (400 aux). After disassembly, you should first examine the wiper button condition. If the wiper button is not serviceable, your choice is a replacement transmitter. If the wiper components pass inspection, then use an ultra-sonic device employing a basic (non-acidic) solution bath to clean the wound-resistor element. The ultra-sonic bath device is a Harbor Freight item; alternatively they can commonly be found in the female’s area of the bathroom. Don’t tell her you used it to clean your fuel injectors! Remember the end result of approximately 0 to 30 ohms is required. The 400 Comanche auxiliary transmitters are 15 ohms each because the aux tanks require two transmitters which are connected in series. Be sure to repeat the test procedure after you have cleaned a transmitter.

To mechanically reattach the pieces of the transmitter, try using a compression riveter on copper rivets (I bought them from McMaster-Carr). The rivets will need to be annealed prior to squeezing. If everything is clean with no corrosion, you should be able to solder the rivets to assure a seal (and no fuel leaks). If you’re not interested in purchasing 100-lot quantities, kits are available. The kit includes five sealing washers, one gasket, five SS screws, two copper rivets, two

PVC sleeving, one brass nut and washer. And if you don't like the condition of the wiring in the wing, a few feet of 18-gauge MS22759/16 Tefzel® wire can be used to splice onto the existing inside the wing. The wire kit comes with butt connectors, heat shrink tubing, a grommet, and ring and knife terminals already crimped.

If you do decide to take on this task yourself, this is what I suggest for a logbook entry:
Removed the fuel level transmitter for (tank position) fuel tank. Cleaned, adjusted, and tested the transmitter. Re-installed this serviceable unit with new gasket, screws, and seals. (Note: You are the judge on this language – Piper doesn't address "repair" of this component.) Some/all work performed and using methods found in accordance with the Piper Comanche Service Manual 773-516, 9th revision dated August 15, 1998. An operational check was performed and found to be satisfactory.

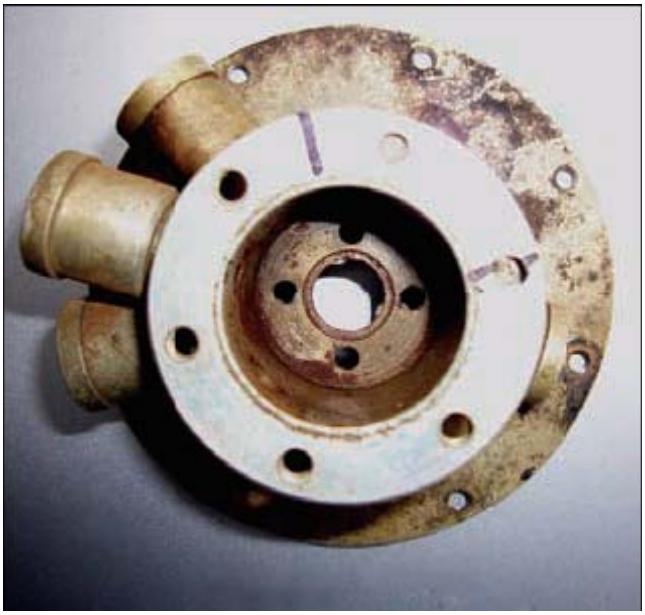
Cancer Within — the Care and Feeding of twin Comanche Fuel Selectors (Feb 2008)

Kristin A. Winter, ICS #15964

Much attention has been paid to the Comanche landing gear system and recently the condition of our tail feathers. Another issue peculiar to the Twin Comanches made itself felt in "Maggie," my own PA-30. The first clue that all was not well in her fuel selectors, was the presence of flecks of material, which I later discovered was rust appearing in the fuel samples. I had seen these before, but was not overly concerned. Even during the 50-hour when I complied with AD 79-12-08 and AD 83-10- 01, I merely cleaned out the strainer bowl and investigated no further.

When one of my boost pumps gave up the ghost, I decided to replace both with the newer version STC'd pumps. With everything apart, it seemed a good time to remove the fuel selectors and make a closer examination. I am glad that I did.

What I discovered was that the design of the valve body traps moisture that is not drained during normal pre-flight, or even when drained using the mandated procedure which calls for 10-25 seconds of draining per tank. This water had, in turn, caused rust to form in the divider area between the upper and lower chambers of the valve. Fortunately for me, my selectors were not as badly corroded as the one shown in the photograph.



Corroded fuel selector body

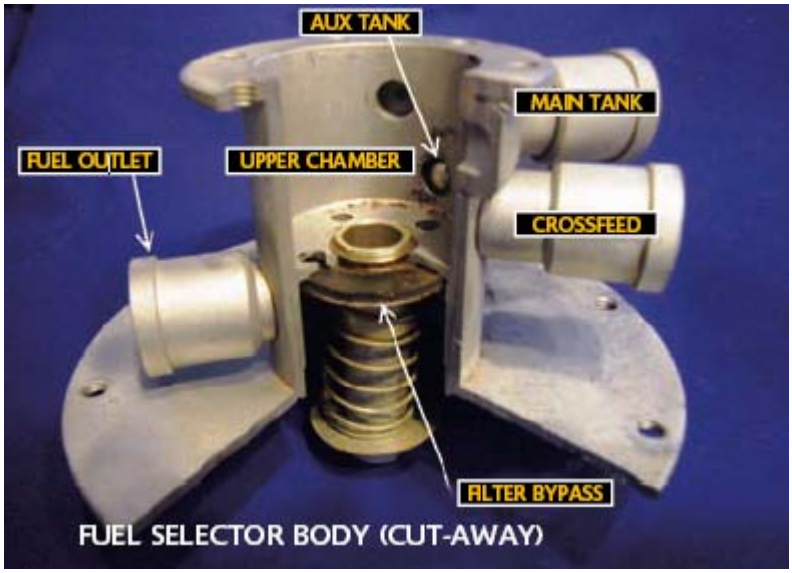
From the comments of others on the Comanche Flyer forum and on the Delphi forum, numerous other Twin Comanche owners have found rust in their fuel selectors. Based on the obvious design issues regarding the fuel selector itself, it appears that this may be a fleet-wide problem.

Operation of the Fuel Selector

In normal mode, the fuel selector operates by porting the fuel into the upper chamber of the body. The position of the selector determines which of the ball check valves is pushed open. From the upper chamber, the fuel flows down the center tube, into the stainless steel fuel bowl. The fuel then travels steel fuel bowl. The fuel then travels up through the filter into the lower chamber and up out of the outlet.

In the bypass mode, the pressure differential created by a clogged filter will pull down the bypass valve, allowing fuel to flow from the upper chamber, through the four holes, into the top of the lower chamber and through the outlet port.

It is easy to tell from the cut-away photo, that the design of the divider between the upper and lower chamber has a tendency to trap droplets of water both above the divider and on the lower side of the divider, between it and the seat of the bypass valve. Sooner or later, the droplets of water will overcome the cadmium plating on the selector body, and rust will form.



In hindsight, it seems that making the body out of cadmium-plated steel was inadequate to withstand the water that was bound to accumulate. The fact that an earlier service bulletin required the replacement of the cadmium-plated bowl, with one made of stainless steel, is evidence that the potential for internal corrosion was not sufficiently taken into account in the design. This occurred after little more than five years in service. The follow-on airworthiness Directives are further testimony to the potentially serious nature of the problem.

Besides potentially degrading the fuel selector to the point of being unserviceable, the accumulation of rust has the potential to clog fuel injector nozzles. Rust particles also have the potential to lodge in the seat of the ball check valves, causing leakage and transferring of fuel from one tank to the other. Given the clear airworthiness implications, and the seeming pervasiveness of the problem of corrosion in the Pa-30 fuel selectors, improved maintenance procedures appear to be necessary.

Some Suggestions

The first step is to recognize the seriousness of the issue in terms of the potential that rust has on degrading the airworthiness of the fuel selector, and hence the aircraft. The other key issue is that these fuel selectors are a dead part as far as being able to replace a fuel selector body, if yours corrodes beyond serviceability, as did the one in the photograph. There may be a few new-old stock units available, but these are limited and likely expensive. Take care of your fuel selectors or lose them.

I suspect that many owners are only performing ADs 79-12-08 and 83-10-01 at the annual inspection. This is likely inadequate. I used to be a bit sloppy about draining the fuel bowls before flight. That has changed. In truth, the fuel selectors should be drained after flight. The longer water sits in the valve, the more damage it will do.

The two ADs should also be performed religiously at 50-hour intervals, as required. It is probably a good idea to perform the ADs at least once every six months, if the aircraft is not flying frequently. When removing the fuel bowl to clean the filter as required by aD 83-10-01, I go one step further. After removing the fuel filter, I remove the little clip holding the bypass valve spring in position (see photo.)

This allows me to remove the retaining washer, spring, and the bypass valve itself. Then I place a pail or other catch basin under the selectors and get into the aircraft. By switching the selector from OFF to MAIN, the AUX, and the Crossfeed, for each tank, I drain fuel through the bypass, as well as the normal pathway. This, I hope, will help flush some of the water droplets which seem to accumulate above the divider between the upper and lower chambers and the water trapped between the bypass valve and underside of the divider. I have not figured out how to test this technique, so I don't know if it offers significant benefit. At least the effort is very modest.

It is likely that as further time passes, more of these selector bodies will become unserviceable. The day may come where no serviceable replacement is available. The solution would be to design and gain approval for a replacement body made of stainless steel. Once the Comanche community has addressed the horn issue, the Twin Comanche fuel selectors may merit our attention.

Regulatory Requirements

ADs 79-12-08 and **83-10-01** address the condition of the fuel selector. These are recurrent ADs. They are required at a minimum of 50-hour intervals, and portions of **AD 79-12-08** are required as part of routine operations.

AD 79-12-08 incorporates Piper Service Letter 851. It addresses two issues. The first, addressed in Part A of SL 851, deals with seal leakage which can cause fuel to shift from tank to tank or lead to a certain amount of air being pulled in to the fuel line if the tank with the leaky port, happens to be empty. Compliance involves positioning the fuel selector valve to off, and checking to see if the valve continues to drip fuel. Compliance with Part A is required every 50 hours.

Part B of SL 851, concerns ensuring that any water is eliminated from the fuel system. The procedure specified in Part B has been incorporated into the updated pilot's manuals. **AD 79-12-08** requires draining the sumps through the required procedure, if the aircraft has been exposed to freezing temperatures. This means that if you are flying at an altitude that is below the freezing level, the pilot is required by the AD to drain the sumps before the first flight of the day and after refueling.

AD 83-10-01 concerns solid contamination in the fuel, by requiring that the fuel filter be cleaned every 50 hours.

Fuel Cell Deterioration: A “Fuelish” Tale (Jul 2008)

Don Ostergard, ICS #3263

Our sturdy bird was recently in for its annual. It is a 1959 PA24-250, which makes it 49 years old. We’ve owned it since 1979 — almost 29 years. It is equipped with the standard (for 1959) two 30 U.S. gallon inboard fuel bladders (some folks call them fuel cells). It also has tip tanks that are of no consequence to the following story.

Back in 1988 (20 years ago), we became aware of fuel stains under the inboard area of the wings, as well as the occasional whiff of gasoline fumes in the cockpit. Clearly, the main fuel cells were beginning to seep. So, as the logbook entry states, out they went for overhaul at a repair shop that is licensed to repair/overhaul fuel cells. We were in on the decision and remember it well.

Now, it is always the top surface of a fuel cell that dries out and starts leaking. When a fuel cell is sent out to the repair facility for overhaul, they will pressure it up, find the leaks, then turn the cell inside out and cement patches onto the offending spots, pressure test again and return the fuel cell to service. In most cases, there will be several patches involved, along with multiple retests, before the last leak is repaired.

The bladders were overhauled, replaced in the wings, and gave nearly 20 years of excellent service. There was never a trace of fuel seepage and never a whiff of gas fumes in the cabin.

Shortly after the Comanche was introduced 50 years ago, there were apparently some instances of the fuel vent tubes (which are located on the underside of the wings and face forward) becoming blocked with ice when the aircraft was being operated in icing conditions. With no opportunity to vent the bladder to compensate for the fuel being consumed in flight, the bladder would, of course, collapse upon itself, popping some or all of the snaps that were holding it in place.

Service Bulletin #190 (June, 1960) and AD 68-13-03 (1968) address this issue. The Service Bulletin is a simple fix that largely removes the risk of the vent plugging when flying in icing conditions. It is likely that almost every Comanche in existence has had this procedure performed on it. To comply with the later AD, one may either install a different fuel venting system (very expensive, high labour component) or simply check the vent tubes for obstructions and inspect the fuel bladder internally every 100 flight hours.

This inspection, to reduce it into the simplest terms, consists primarily of inserting a small mirror through the fuel filler neck and shining a flashlight into the bladder to see if the bladder has collapsed/unsnapped. It takes about five minutes per tank to perform this inspection. The sturdy bird does not have the modified fuel vent, so it undergoes the 100-hour inspection. No big deal. Our AME (we call them Aircraft Maintenance Engineers here in Canada, they’re known as A&Ps in the U.S.) has done it at least 28 times. One could perform the inspection oneself every time the plane is refuelled, if one wished. It might actually not be all that bad an idea.

In the course of this latest inspection, our AME discovered a big patch hanging down from the top of one fuel cell. Then he checked the other fuel cell. Same thing! (We are not making this up.) So he removed the oval access plates, reached his hand inside and ran it inside the top of each fuel cell. Imagine his surprise when patches started falling off in his hand! Why these patches all choose to loosen up, more or less simultaneously, after 19-plus years is somewhat of a mystery, but is beside the point. It takes very little imagination to visualize one of these patches falling off and blocking the fuel outlet — one’s bones go soft just thinking about it.

The photo shows one of the fuel cells and the fifteen patches that it contained. There were patches on the patches! The other fuel cell wasn’t any different.

We must stress that the repairs to these fuel cells were in full compliance with approved, recognized practices. Everything was perfectly legal.

Summary

To recap: The plane was built in 1959; we bought the plane in 1979. The fuel cells may have been overhauled sometime during the period 1959-1979; we haven't bothered to check the old records. We do know that they were overhauled once between 1979 and the present, namely in 1986. We are fanatic about maintenance. There have been no maintenance shortcuts taken with this plane in the past 29 years. There has never been anything but avgas in the tanks. If this happened to us, it can happen to anyone.

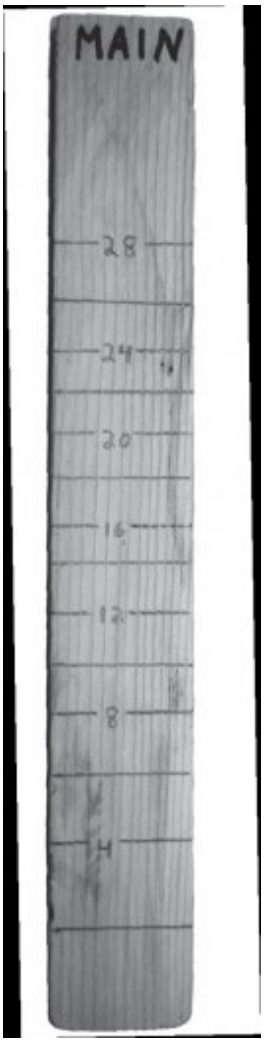
What Can We Learn From This?

1. Be sure to check those fuel cells **regularly**. You can do it yourself in a few minutes using a flashlight and a mirror. If our plane had the new style vents installed, there would have been no requirement to check the inside of the fuel cells; ever. Not having changed the vents may have saved our lives. Imagine the irony of that!
2. Always have half-an-hour of gas in a tank that you can go back to.
3. Don't ever ignore basic maintenance. That $100,000 radio stack won't save your hide if the prop stops turning.

It is our understanding that we could legally have sent these old fuels cells out for overhaul, again. Did we? Absolutely not! We destroyed them and bought new ones.

The Webco Fuel Cap Stuck on my PA24 (Jun 2011)

Charlie Littwin ICS #14089



About eight years ago, I upgraded to Webco fuel caps and I am very pleased with the upgrade. I can always tell when someone else has fueled the airplane because they don't line up the placard on the cap to face the front like I do. At a recent annual at Heritage Aero, they replaced two of the rubbers on the caps. Afterward, I had noticed it took a lot of turning to tighten them. Recently, I made a flight to Freeport Bahamas. While I know a good preflight should always include visual inspection of the fuel quantity by looking in the tanks, when the airplane is parked on a ramp outside the country, I always include this as a preflight item to make sure no fuel was taken out. To my surprise, one of the fuel caps would not come off. When I twisted the handle, there was great resistance and the cap would not loosen. I listened to my wife who said, "If you get it off, it might not go back on." Since we had plenty of fuel to return back to Florida, we headed back.

Upon returning to my home base, I emailed Zack Grant, one of the ICS Technical Directors, on this issue. He confirmed my suspicion that the filler flange from the tank might have to come off and to loosen the nut on the bottom plate of the cap since it was evident it was spinning with the lever. But before I did that, I made a tool to give me more leverage. The cap began to spin in the filler neck and in conjunction with a slight upward prying; it came off – thank goodness! And yes, my wife was right … it did not want to go back on.
When I called Webco to order new rubber for the other two caps and explained the situation to John, he immediately suspected the threading on the shaft handle of the cap was worn. After inspection, he was 100% correct and a new shaft and bottom plate is on order.

Another Neat Trick Regarding Fuel
Since we are on the subject of fuel, I would also like to share a neat trick Bob Williams told me about. I like to play the fuel game and always buy cheap fuel in route using AirNav.
I would estimate about five to 10% of my flying are "fuel runs" just getting the bird out flying and topping off at the best price in my area. This has created a situation where the tanks are rarely full (yes, I know that is not the best for the bladders), so following Bob's instructions, I made fuel dip sticks. First I ran a main and aux tank dry, and then I put in two gallons of fuel at a time and made a mark on my main or aux sticks. It works great!
You can also make note of the fuel gauge indication during this process.

Electrical Fuel Pump (Jul 2011)

Q I just purchased a '59 250. Looking it over in the engine compartment, I noticed that the electric fuel pumps are automotive type – two of them. Is there an aviation fuel pump I should be using or will these be okay?

A Others might weigh on this question – if you noted the boost pumps' name and model numbers, I'd go to the parts book and see if they are in compliance. Piper used a great deal of automotive off the shelf items from that era and when they fail, there are facilities that service them and keep them going.
I'm not surprised that you'd see them as automotive types, yet they should be approved parts and on the parts list for the aircraft. ICS has the parts book for the PA24 online. You might want to either download and get it copied, or buy a printed book so you can see the various parts. I would typically see a model and part number and go to that part's book and compare. Perhaps you can do that and see? *Pat*

Electrical Fuel Pump (Aug 2011)

Q The electric motor on the fuel pump has quit. Tell me your thoughts and where I can get the motor and the pump overhauled.

A I think that you mean the electric boost pump quit − the mechanical fuel pump on the engine is not electric, so I can only conclude that it is the boost pump. The answer is a long story, but the bottom line is that all facilities in the United States send their boost pumps to Rapco Fleet Services for repair, and I have had absolutely awful quality problems with Rapco. They don't honor their warranties and I won't deal with them under any circumstances.

Aviation Innovations is a company in the Pacific Northwest; they have developed a better motor and pump and they stand behind their work and their warranty, and I am delighted that they are there for us. They have an STC on the Twin Comanche pump, and I feel that I can recommend them with confidence.
I believe this is the contact: Aviation Innovations, LLC 35004 NE 185th Avenue Yacolt, WA 98675-4129 Phone: (360) 907-0888 Give it a try; the owner is a flight instructor so you could call at night.
Pat Berry

A You can also call Aircraft Systems, Inc. in Rockford, Ill. at (815) 399-0225.
Ask for Terry Norris, Sr. Terry has been overhauling boost pumps (and many other accessories) for the last 40 years. He does all of ours and we have had very good experience with his work.
Cliff Wilewski

Electrical Fuel Pump (Dec 2011)

Q The electric fuel pump on my PA24 has a leaking gasket and my mechanic is unable to locate a replacement. In fact, he was told the pump is no longer made and nobody rebuilds it anymore. Where do I go from here? Is there a replacement pump, or do I scour the bone yards?

A It sounds like you have a Bendix fuel pump, for which parts are no longer available.
However, a gasket is a relatively simple item and your mechanic should be able to fabricate one as an owner produced part. Or you can replace your fuel pump with one made by Dukes, which can be overhauled and for which parts are still available.
Those are the only two choices that are available to you at present.
Pat Barry

Tank Solenoids (Sep 2011)

Q I think my left tip tank solenoid is sticking. When parked, I had a full left tip tank drain into the already full aux tank (selector was set to "off") and the expensive fuel overflowed onto the ground through the aux overflow tube.
For now, I'm leaving the tip tanks empty. What do I need to do?

A The tip tank solenoid diagnosis is correct. You should call Osborne at (800) 963-8477.
The Osborne family has the STC for these tip tank systems and they will sell you an approved valve replacement. If the valve is stuck in the open position, then you need to replace it.
Pat Barry

Fuel Gauges (Jan 2012)

Q My fuel gauge won't go below one-fourth or above seveneighths.
My plane is a PA24-250, built in 1962. It has the single gauge and 90 gallon capacity. Is there a new replacement gauge that is high quality and fits in the hole, or do I have to get the old one rebuilt?

A The first thing to do is to read the service manual and see how the sending unit in the tank is described. It can be removed for servicing and should be done by someone with experience. In testing the sender, the unit should put out zero ohms at full downward extension where it indicates the tank is empty. And at full tank, when the float is in the up or retracted position, it puts out 28 to 32 ohms.

Almost certainly your sending unit is clogged with varnish and other residue from the fuel additives that get inside of the unit. It needs to be serviced by one of the many firms that do this. I like John Wolf and Co in Willoughby, Ohio (Google them). But Webco also services them, as does Matt Kurke. The typical cost is about $250 for each sending unit.
Pat Barry

A Do the four tanks indicate the same on the gauge when they are all empty or all full, or does one tank have a different reading than the others? If the throw of the needle is the same for all of the tanks, the easy thing would be a simple recalibration of the gauge with a piece of red electrical tape on the glass at the empty point. Legally the gauge only has to be accurate at empty, and have relative movement with more than empty fuel. That is to say, if when the tanks are full, but only indicate half full, that is okay, as long as empty tanks read empty on the gauge. While this is difficult for some folks to accept, it is the rule, and many of our stock fuel gauges are made to do no more than simply comply with that rule.

The fuel gauge in your aircraft works on variable resistance. Splicing the wires in the circuit or acquiring some dirt or corrosion on a contact can alter the resistance to a point where the gauge never sees a "no resistance" circuit, and thereby never reads empty.

If it appears the gauge needs to be repaired or overhauled, I recommend Air Parts of Lock Haven. The answer to your original question is no, there is not a replacement gauge that works any better.
The better solution is to install a digital fuel flow/totalizer, and to keep an eye on the fuel pressure gauge when you get down to the last of the fuel in a tank.
Zach Grant

Tank Selection Switch Wiring (Jun 2012)

Q I have a 1964 PA24-250 with the five position fuel selector valve. The wiring on the tank selection switches and wafer have been damaged (a couple are broken) and I'm looking for a wiring diagram for the gauge selection switches and the wafer.

A M a t t K u r k e a t *www.comanchegear.com* has an excellent wiring set that he sells for a reasonable price, so I suggest that you contact him for a set. The wiring diagram is in the maintenance manual that is on the ICS website in case you don't have one of your own.
However, since you have a damaged "wafer" and some broken wires, I recommend that you start with fresh equipment (rather than patching old wires), which is where Matt Kurke can help.
Pat Barry

The Correct Fuel Pump for a 250 (Sep 2012)

Q I have a PA24-250. During the annual, we found that the electric fuel pump has been leaking. One of the local mechanics suggested using a pump for a 260.

Do you know of an STC for such a conversion, and a part number for the 260 pump?

A The correct procedure is to repair or replace with a like pump. If the 260 pump is a different series, the answer is no. Remember, the fuel system for a 260 is fuel injected and while a boost pump provides fuel pressure, I don't see where you can swap components without FAA field approval.
Look in the PA24 parts manual (if you don't have one, download it off the ICS website) and compare the two part numbers. If they are the same part, then the answer is yes, and if it is different, then the answer is no.
Pat Berry