GP-4 BUILDERS & FLYERS NEWSLETTER

**December 2003**
**GP4BFN 41**

# CHANGING YOUR AIRMAN CERTIFICATE NUMBER

When I passed my check-ride and the examiner issued my certificate, everyone used their Social Security number as their Airman Certificate number. But, effective June 1st, 2002, all newly issued Airman Certificates began being issued with a unique certificate number. Because of security concerns over having Social Security numbers where the public could access them, the Airman Certification Branch is no long0er assigning Social Security numbers as the Certificate number.

Airman certificates that still use the Social Security number as a certificate number will continue to be valid with that number unless the airman requests a unique number.

If you hold an Airman Certificate that uses your Social Security number as your certificate number and you would like to change to a unique number, or your would like to remove your Social Security number completely from the Airman Certification Branch's official records, you can download the required form from:

http://registry.faa.gov/docs/SSN_Change.pdf

Complete the form and mail to:

FAA Airmen Certification-AFS-760, P.O. Box 2508 Oklahoma City, OK 73125-0082

You can get one of the new plastic "credit-card" style licenses by following the same procedure as a lost or stolen licensee would. You'll still have to pay the $2.00 fee, but when you receive your replacement license, it will be the new style.

For more info, visit www.faa.gov.

***Inside this issue:***



# ABOUT THE NEWSLETTER

In laying out the newsletter, I tried to combine the good points of the old one and add my own style and touch. Please let me know what you think, or what you think we can do to improve upon it. I've intentionally used 8 1/2 X 11 paper to make it easier to file the newsletters in a binder and keep them.

This should be the builder's letter, and has to serve the builders, or there will be no value to my doing it. I'm hoping that keeping the lines of communication open between everyone will make the building process a little easier.

My contact information is on the last page. I anxiously await your feedback. This month we have one builder's report, I hope we will have more reports in the future, or I can reprint some tips / hints from previous newsletters. Elton

# SOME FACTS ABOUT EPOXY GLUE

Epoxy glue has been used in aviation with excellent results for many years now. If you pick up any of the builder's supply catalogs and flip through the pages, you can find a number of formulations available. So how do you know which one to choose?

Two types of wood glue were used on the GP-4 prototype and are recommended by Osprey Aircraft. All spar laminations used Hughes FPL-16A. It was also used in gluing the wing and tail skins to the structure. T-88 is the other glue recommended. Today let's look at Hughes FPL-16A.

Some years back, the Forest Products Laboratory tested a group of epoxy mixes. The one that tested closest to resorcinol glues was what we now commonly call FPL-16A.

You can probably obtain good results with some other formulations, but Osprey Aircraft recommends the one we have had the most experience with, the one which was used on the GP-4.

The glue against which all modern epoxies are compared is Resorcinol Glue, which is waterproof and has proven itself over time.

Resorcinol is made from resorcinol-formaldehyde, and it too is a two part


glue. One of the chief drawbacks of this glue is that it requires careful assembly of the parts, and critical clamping pressures. An optimum glue joint is one that is about five thousandths of an inch thick, plus or minus one thousandth.

With FPL-16A, clamping pressure is not critical, and the gap filling properties are excellent. Resorcinol is also very quick to set up, whereas FPL-16A is a little slower, which gives the builder more time to align and clamp the pieces being glued, which means better glue joints. At normal temperatures, an FPL-16A glue joint reaches its full strength in about 7 days, though it can be handled in just 1.

Hughes FPL-16A is a 10 to 1 mixing ratio. It is also very important to shake the can prior to mixing. Workshop temperatures between 70 degrees and 80 degrees are ideal. At 75 degrees F, working time is about 45 minutes.

1) Stir thoroughly & then stir some more. Cut the edges of your stirring stick square to make sure that your stirring stick can reach into all the corners of your glue cup.

2) Watch the use-by dates close! Is it really worth taking a chance?

3) If necessary, use a heat lamp to keep the joint warm. Temperatures below 70 degrees can cause a weak joint.

*From the GP-4 Builder's Manual*

# HYDRAULIC GEAR PLANS NOW AVAILABLE

As you look through your plans, you will note that the GP-4 has a manual landing gear retraction system. The manual system has worked very well, but I received feed back from builders asking if I would develop an electric hydraulic gear for the GP-4.

I spent about a year of research to design and build a working mock up that I feel has all the amenities to do the job. It has since been flight tested and it works well.

Both systems have advantages and disadvantages. The manual system requires no redundant back up to get the gear down. It is all mechanical, the F.A.A. feels it is fail safe. Its less expensive if you build your own parts. The main disadvantage is muscling the Johnson bar between the seats about 90° to get the gear up right after take off. There are also more parts to build, all the push rods, bellcranks, and the air drive uplock system.

The advantages of the hydraulic system are obvious. Flip a switch, and fly the airplane. Less parts to build, and you get the Johnson bar out of the cockpit. Disadvantages? Possible electric hydraulic failure, approximately 5 to 6 more pounds weight, and maybe some more expense. And, the F.A.A. requires a back-up system, even in a homebuilt.

The system has an excellent emergency back-up, consisting of a mechanical cable uplock release and nose gear extension. It is both simple and foolproof.

No machine work is required for any of the components. Plans are available for $150.00 from Osprey Aircraft. You can find the address and an order form at www.ospreyaircraft.com.

# GEORGE'S CORNER

BY GEORGE PEREIRA

Fellow GP-4 builders:

Elton Cultice has taken on the difficult job of editing a new GP-4 Newsletter. The success and quality of any newsletter needs the participation of all of us that have a common interest, the GP-4.

Your building photos, building problems, successes and failures are all valid information to us. Please try to help Elton in his b-monthly editions. I will try to submit articles that relate to building problems as well as flight information.

Some Brief History:

The GP-4 was meant to be my own personal, high performance, hot rod. No finished plans, just my rough drawings, and dreams of a 200 mph, two place airplane with long legs. Remember the late 70's and early 80's? There were few two place airplanes with that kind of performance around.

One of the hardest parts of a new design is computing the gross weight before the design takes shape. You can't engineer stress loads without a gross figure. Its like the chicken or the egg syndrome of which came first. A number of full scale mock-ups for cabin seating, spar attachments, landing gear, geometry, etc... were built. After a year of engineering and mockups I finally was able to start flight hardware. The woodworking went fast, but the wiring and engine cowl seemed to go on forever.

In the spring of 1983 I trailered the fuselage with the wing on a pickup truck plumber's rack to Yolo County Airport. Yolo County has wide, paved runways, 7,000 feet long, with flat fields on both ends. There is no tower, and very little traffic in the morning.

My incomplete but flyable GP-4 prototype was in primer, no upholstery and pretty light, about 1240 pounds. The second day I was able to fast taxi, and make some short lift offs. So far, everything felt good and I really felt I had my airplane. We pulled the cowl, and all of the inspection plates. We readied for the first flight, and were blessed with decent weather on day 3. After a couple more lift offs I decided to take it around the pattern. I left the gear down, but used about 20 degrees of flaps on final. The touch down went well.

The next flight I left the pattern, slowed to about 100, and retracted the gear. Everything started to get real smooth. I accelerated to about 180 mph as I set up 20" of manifold pressure and 2400 rpm. I ran a number of test flights during the next couple of months.

All was not a bed of roses though. As performance rose, so did the problems. Hot oil, one hot cylinder, a bad magneto, and a gear up-lock failure. The testing continued as I worked out each problem.

I was able to get it painted and upholstered in time to take off for Oshkosh 1983, and I guess you could say, "the rest is history".

Regards to all,
George

# 'TWAS THE NIGHT BEFORE CHRISTMAS

'Twas the night before Christmas, and out on the ramp,
Not an airplane was stirring, not even a Champ.
The aircraft were all fastened to tiedowns with care,
In hopes that come morning, they all would be there.

The fuel trucks were nestled, all snug in their spots,
With gusts from two-forty at thirty-nine knots.
I slumped at the fuel desk, now finally caught up,
And settle down comfortably, resting my butt.

When the radio lit up with noise and with chatter,
I turned up the scanner to see what was the matter.
A voice clearly heard over static and snow,
Called for clearance to land at the airport below.

He barked his transmission so lively and quick,
I'd have sworn that the call sign he used was "St. Nick".
I ran to the panel to turn up the lights,
The better to welcome this magical flight.

He called his position, no room for denial,
"St Nicholas One, turnin' left onto final'
And what to my wondering eyes should appear,
But a Rutan-built sleigh, with eight Rotax Reindeer!

With vectors to final, down the glidescope he came,
As he passed all the fixes, he called them by name.
"Now Ringo, Now Tolga, Now Trini and Bacun
On Comet, On Cupid!" What pill was he takin?

While controllers were sittin' and scratchin their heads,
They phoned to my office, I heard it with dread.
The message they left was both urgent and dour,
"When Santa pulls in, have him please call the tower."

He landed like silk, with sled runners sparking,
Then I heard "Left at Charlie,", and "Taxi to parking."
He slowed to a taxi, turned off of three-o,
And stopped on the ramp with a "Ho,ho-ho-ho-ho-"

He stepped out of the sleigh, but before he could talk,
I ran out to meet him, with my best set of chocks.
His red helmet and goggles were covered with frost,
And his beard was all blackened from the Reindeer exhaust.

His breath smelled like peppermint, gone slightly stale,
And he puffed on a pipe, but he didn't inhale.
His cheeks were all rosy, and jiggled like jelly,
His boots were as black as a cropduster's belly.

He was chubby and plump, in his suit of bright red,
And he asked me to "fill it, with hundred low-lead."
He came dashing in from the snow-covered pump,
I knew he was anxious for draining the sump.

I spoke not a word, but went straight to my work,
And I filled up the sleigh, but I spilled like a jerk.
He came out of the restroom, and sighed in relief,
Then he picked up the phone, for a flight-service brief.

And I thought as he silently scribed in his log,
These reindeer could land in an eighth-mile fog.
He completed his pre-flight, from the front to the rear,
Then he put on his headset, and I heard him yell, "Clear!"

And laying a finger on his push-to-talk,
He called up the tower for clearance and squawk.
"Take taxiway Charlie, the Southbound direction,
Turn right three-two-zero at pilot's discretion."

He sped down the runway, the best of the best,
"Your traffic's a Grumman, inbound from the west."
Then I heard him proclaim, as he climbed through the night,
"Merry Christmas to all, I have traffic in sight."

Happy Holidays Everyone !

# BUILDER'S UPDATE BY JIM CHRISTIAN

Here is Jim's update and a few pictures of his project's current status.

I started on my GP-4 in November of 1997. I work full time as a manager at a local manufacturing plant. As you can see, progress is slow. Life seems to get in the way of fun, and I do consider building the GP-4 fun.

Although plagued by delays which include building a new house and convincing my wife of the need for a larger than normal garage, insulated and heated (Minnesota winters are both very long and very cold), big enough to house the plane project and our cars. After a proper amount of begging, the house including the larger garage

was completed. The building table and partially completed GP-4 was moved to the new address, and I was finally able to get back to working on the plane.

Then came that fatal evening. I was up on the table gluing the formed

plywood to the bottom of the fuselage (which I had placed on the table bottom side up), when I lost my balance and performed a backwards swan dive off the table, hitting my arm on a table saw on the way to the floor, dislocating my shoulder in the process. There would be no progress on the plane for several months. I'm happy to report that all is well now, and I do work on the plane a little bit each and every day. To date the fuselage is nearing completion, excluding Plexiglass and Instrument panel. I've elected not to put a fuel tank in the cockpit, so I have made formers for the area that the fuel tank would normally occupy. I'm hoping to connect to another builder who has successfully extended the fuel capacity in the wings, to make up the difference.

I would also like to modify the main landing gear to bring the tail end of the airplane a little higher off the ground. I believe Bernie Griffin was able to achieve this with the manual gear system. I hope to be able to accomplish the same thing with the hydraulic gear system. As you may be able to see in the pictures, the front landing gear and motor mount are completed and installed. As mentioned, I am using the hydraulic gear system, with a slightly modified cylinder and cam arrangement. My cylinder shaft is a little larger than George calls out in the prints. That make the OD of the cylinder slightly larger, which would not allow the fork and wheel assembly to fully retract into the gear tunnel. After modifying the cylinder cam to raise the cylinder up a little in the tunnel, the front gear retract and extension now works very well. The fuselage is covered with deck cloth, using a West system epoxy for sealer, with both inside and outside having been coated. A little sanding and another coat of West epoxy to the fuselage and its ready to take to the hangar for storage.

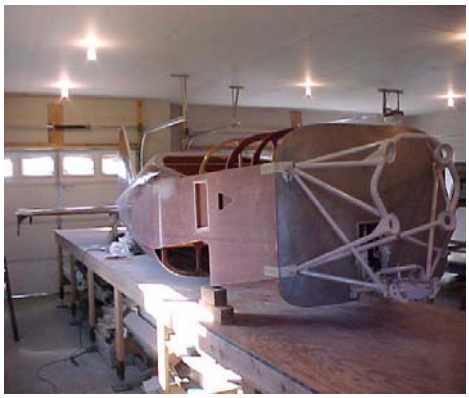
I think I'll start building the wing this winter. I ordered the spar lumber months ago from Wicks Aircraft

Supply thinking that it would take a long time to get, but not so. It arrived two weeks after ordering, and has been sitting in the box waiting for me to free up the building table ever since.

That's all for now, I'll keep you posted on my progress.

Respectfully submitted,

Jim Christian



# THE HOWS AND WHYS OF PREHEATING

For many of us, it is that dreaded time of year again, winter. Many pilots sit out the next few months, even though there are some significant advantages to cold weather flying. Engines, propellers, and wings are more efficient, the air is usually more stable and the ride smoother.

One of the major disadvantages to winter flying is preheating the engine. It is also one of the most important steps that should never be skipped. In less than a minute, a single cold start without proper preheating can produce more wear on a piston aircraft engine than 500 hours of normal cruise operation. If it is cold enough, a single cold start can cause catastrophic destruction of an engine shortly after takeoff. The following article originally appeared in the Cessna Pilots Association magazine. As a former C177RG (Cardinal) owner, this really made me sit up and take note!!

Although preheating is something most of us first learned about in private ground school, it remains a subject that is poorly understood even by experienced pilots and aircraft owners. There are a lot of misconceptions about why preheating is important, when it is necessary, and how it should be accomplished. But by the time you are finished reading this article, you should be a little better informed and ready to tackle the subject.

1. How Cold is Cold?

The first question that invariably comes up, is How cold does it have to be before preheating is necessary? Of course, there is no hard and fast answer. The degree to which a cold start will damage an engine depends on a variety of things, including the type of engine, its age and condition, the type of cylinders it has (chrome or steel), and what kind of oil is being used. Surprisingly enough, a brand new factory remanufactured engine is far more at risk than a tired old worn out engine nearing TBO. Hopefully you'll understand why later.

As a general rule, you should consider any start in which the engine is cold-soaked to a temperature below freezing to be a "cold start", and preheating should be used. The colder the temperature, the more important it is.

2. Oil Pressure is Not Enough

Most pilots think that the main reason cold starts are bad for engines is that the oil is thick and viscous and doesn't flow well. Since it takes longer for the oil pressure to come up when the engine is cold, the engine sustains excess wear in the early seconds after starting because of inadequate lubrication. (That's what I was taught in basic training).

While that might have had some validity back then (30 some years ago), nearly everyone who flies in cold weather nowadays uses multiviscosity oil, and those oils flow extremely well even at 0 degrees F or less. Consequently pilots using those oils see their oil pressure come up fairly quickly, and figure that everything must be okay. But


is it?

3. Bearings Need Clearance

The real problem in cold start damage is that our engines are made up of dissimilar metals with radically different expansion coefficients. The crankcase, pistons and cylinder heads of our engines are made from aluminum alloy, while the crankshaft, camshaft, connecting rods and cylinder barrels are made

*(continued)*

from steel. When heated, aluminum expands about twice as much as steel. Likewise, when aluminum cools, it contracts about twice as much as steel, and therein lies the problem.

Consider your steel crankshaft, which is suspended by thin bearing shells supported by a cast aluminum crankcase. As the engine gets colder, all of its parts shrink in size, but the aluminum case shrinks twice as much as the steel crankcase running through it. The result is that the colder the temperature, the smaller the clearance between the bearing shells and the crankshaft. That clearance is where the oil goes to lubricate the bearings and prevent metal-to-metal contact. If there is not enough clearance, then there is no room for oil, regardless of how high the oil pressure gauge in the cockpit reads.

How significant is the problem? Let's look at the TCM IO-520 series

engine that is used in many Beech and Cessna singles and twins as an example. The IO-520 overhaul manual lists the minimum crankshaft bearing clearance as 0.0018 inch at normal room temperature.

What happens to that clearance when you start cooling the engine down? TCM doesn't say, but tests conducted in 1984 by Tanis Aircraft services indicated that an IO-520 loses 0.002 inch of crankshaft bearing clearance at –20 degrees F. An engine built to TCM's minimum specified bearing fit at room temperature would therefore have negative bearing clearance at –20 degrees F, in other words, the crankshaft would be seized tight.

Ever noticed how difficult it is to pull the prop through by hand before starting in cold weather? It's not that the oil is that thick, but that the clearance between the bearings and crankshaft is tighter than normal. If it's cold enough, you might not be able to pull the prop through at all.

Start the engine in this condition, and you're likely to experience accelerated bearing wear and possible damage to the crankshaft journals in the first minute or two of running. If the bearing clearances are small enough, it is even possible for the bearing shells to shift in their saddles, a so called "spun bearing", which misaligns the oil feed holes and starves the bearing from all lubricating oil!!

Ironically, the problem is at its worst with a fresh from the factory engine built to the tightest new engine tolerances. A tired, loose, high time engine with worn bearings (or a low time sloppy bargain-basement overhaul) might well have plenty of clearance even at sub-zero temperatures. But, even if your engine is approaching TBO, that doesn't mean you can afford to be complacent about cold starts. Inadequate bearing clearance is only one of several evils associated with cold starting.

4. And Pistons Do Too

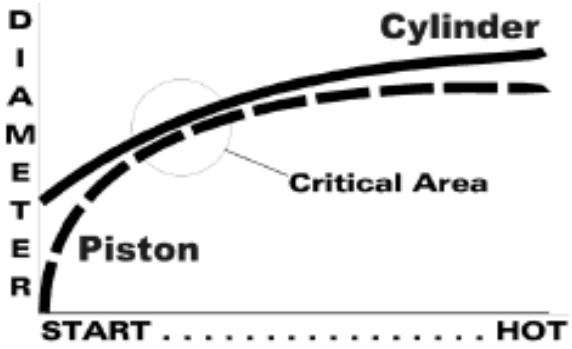
Consider what happens to your pistons when you cold start an engine. Here, the situation is opposite of the one we just covered. Instead of a steel crank inside an aluminum case, we have an aluminum piston inside of a steel cylinder barrel. So the situation is reversed, piston to cylinder fit is loose when the engine is cold, and tightens up as the engine comes up to full operating temperature. (this explains why compression tests are done when the engine is hot).

So why would cold starting be a problem for the engine's top end? When an engine is started and comes up to operating temperature, the piston and cylinder barrel don't warm up at the same rate. The piston heats up very quickly after startup, while the cylinder barrel may take quite a long time to warm up. Why? For one thing, the piston is relatively small and light, while the cylinder is big and heavy,

so when both are exposed to the heat of combustion, the piston heats up a great deal faster.

In addition, the cylinder has a very effective mechanism for shedding heat—it is covered with cooling fins bathed in what is presumably frigid air while the piston's only real cooling comes from the splash of engine oil. Consider the low RPMs of starting and idle, and there's not a whole lot of splash available.

The result is that the piston expands to its full operating dimension very quickly after startup, while the cylinder takes more time to expand to its full operating diameter. The colder the OAT, the longer it takes for the cylinder to reach operating temperature. The result is that although the fit of the piston in the cylinder is quite loose when the engine is cold, it may quickly become tighter than normal shortly after starting when the piston has come up to temperature but the cylinder still has a long way to go. If it is cold enough, the piston to cylinder clearance can end up going to zero, which again results in metal-to-metal scuffing between the piston and cylinder barrel.




The problem is made worse by the fact that most cylinders barrels are designed with a taper, or "choke" in the top one-third of piston travel. This is done to pre-compensate the barrel for the fact that, as the engine comes up to operating temperature, the top of the cylinder (where the combustion process takes place) is a lot hotter than the bottom of the cylinder, and therefore expands considerably more. If cylinders were perfectly cylindrical at room temperature, then they'd become flared at the top when the engine was hot, resulting in a loose fit between the piston and cylinder barrel right where a tight fit is needed most –at top dead center. By giving the cylinder barrel a slight taper at the top when at room temperature, the cylinder winds up being cylindrical at operating temperature. When an engine is started in cold weather, the cylinder choke starts out considerably greater than normal. After start, the piston starts being repetitively forced up into the choked down are at the top of the stroke As the piston quickly comes up to operating temperature, but the cylinder is still relatively cold, it is easy to see how severe scuffing can occur at the top of the stroke.

By now you should see that just warming up the oil is not enough to avoid cold start damage. All the warm oil in the world won't help if the crank to bearing, or piston to cylinder clearances go to zero. To avoid this, it is essential for a preheat to warm up the crankcase and the cylinder barrels (especially the top of the cylinder barrels near where they mate to the heads).

5. The World's Finest Preheat

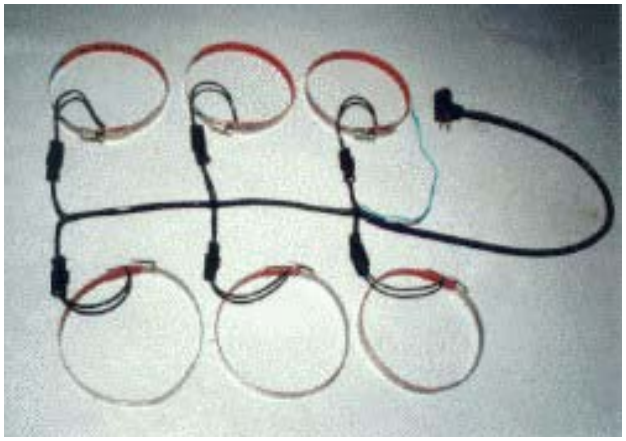
The best way to accomplish this is to put the airplane in a heated hangar overnight. Why? Because this preheats every part of the airplane to an even temperature. After 8 to 12 hours in a 40 degree hangar, the oil is at 40 degrees, the case is at 40 degrees, the cylinder heads are at 40 degrees, the gyro instruments are at 40 degrees (they have their own cold starting problems), the windshield is at 40 degrees, and even the pilot's seat is at 40 degrees (which solves another problem).

Even at $50 a night to store an airplane in a heated hangar, its still quite a bargain compared to the alternative (accelerated wear) of an engine. If you're planning on staying for a while, arrange for the FBO to pull your airplane into the heated hangar the night before your scheduled departure.

6. Multi-Point electric heaters

Short of overnighting in a heated hangar, the best preheating method is a multipoint electric heating system that has individual heating elements attached to the oil pan, the crankcase, and each cylinder. By plugging such as system in a few hours before departure (overnight is better), you can at least be assured of warm cylinders, a warm case, and warm oil when you start up.

The wiring harness terminates at an ordinary AC plug that is usually mounted near the oil filler door in the cowling. You simply run an extension cord out to the airplane, plug it in, and let it cook for a few hours. There are several excellent systems on the market today.



7. Engine and Propeller Covers

If the temperature is not too frigid, and the aircraft is being preheated in a tee-hangar or other protected area, then a multipoint electric heating system is probably all you need to do the job. But if it is really cold, or if you have to preheat outside on an exposed ramp in the wind, then you will also need some means of insulating the engine compartment and keeping most of the heat from escaping.

At the minimum, you'll need an engine cover. You may be able to

make do with a quilted blanket, or you may want to invest in custom fitted covers. If it is intensely cold or windy, the propeller can become a major source of heat loss during preheating. Several companies offer custom insulated engine and prop covers to solve this problem. Another advantage of insulated prop and engine covers is the "quick turn-a-round". By installing the covers promptly after shutting down the engine, the engine heat can be retained for three or four hours even when the airplane is parked outside on a cold, windy day. Come back ready to depart in a couple hours, and chances are the engine is still warm.

8. Other Electric Heaters

There are several other adequate systems on the market today, especially if you give them plenty of time to work. Even a simple oil pan heater can do the trick, or a couple of 100 watt light bulbs stuck up the cowl flaps can suffice if the engine compartment is well covered.

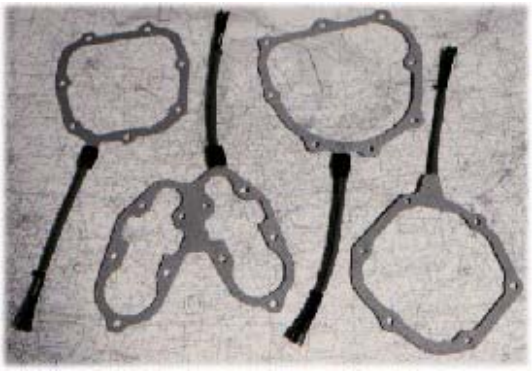
9. Leave it on All the Time?

Using an insulated cover and a multipoint preheating system that is plugged in continuously is one of the most effective methods of eliminating internal engine corrosion, particularly if the aircraft is kept in an unheated hangar rather than outdoors. If the entire engine is maintained above the dewpoint, condensation simply cannot occur.

10. Forced Hot Air

Most FBOs in the country use forced air preheating units. Forced-air preheating can do an effective job, provided the machine has sufficient BTU output for the job (some small propane fired heaters simply don't), and the machine is left hooked to the airplane for enough time to heat the engine thoroughly. Unfortunately, if you're depending on an FBO for a hot-air preheat one chilly morning, chances are a bunch of other pilots are too. Unless the FBO is willing to devote sufficient time to preheating your aircraft (and how long that is depends on both the capacity of the heater, and the OAT), you may wind up with a partially-heated engine that has hot spots, and cold spots.

How can you tell whether you've received an adequate preheat? It is not easy, but if you can manage to



get your hand inside the engine compartment and if all the rocker covers and the crankcase feel warm to the touch, you're probably okay.

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*Thank You!!*


# CLASSIFIEDS

For Sale:

Pre-fabricated composite components for the GP-4. Cowling, Exhaust Blisters, Inlet Ramps, and Tailcones. Individual parts or complete package available.

Cowls are constructed with West System Pro Set 125 Resin and 225 Hardener. They are hand lay-ups of 4 layers of 6 ounce cloth, and 2 layers of 10 ounce cloth.

I get great discounts on shipping and I pay for the packaging. For current pricing, please call or e-mail: Bob Ringer—Halifax, Canada.

Phone: 902-876-2871.

Cell: 902-483-4611.

E-mail: bobringer@eastlink.ca.


For Sale:

Quality custom fabricated metal components for the GP-4. State of the art equipment used by a certified welder to construct parts on the jigs obtained from Darry Capps. A complete price list is available from: Raymond Beazley, Dartmouth, Canada.

Phone: 902-465-6141

Cell: 902-497-4187

E-mail: ray1beazley@accesswave.ca

Have an item to sell, or something that you're looking to buy? Send to: gp4@woh.rr.com