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PREHEAT - A CPA STAFF STUDY...

The Whys and Hows of Preheating

Here's what you need to know if you want to make it through the cold-weather flying Season without damaging your Cessna's expensive Powerplant.

By Mike Busch

In less than a minute, a single cold start without proper preheating can produce more wear on your engine than 500 hours of normal cruise operation. If it's cold enough, a single cold start can cause the catastrophic destruction of an engine shortly after takeoff. This is serious stuff, folks!

Although preheating is something most of us first learned about in private pilot ground school, it remains a subject that's poorly understood even by experienced pilots and aircraft owners. There are a lot of misconceptions about why preheating is important, when it's necessary, and how it should be accomplished. But, by the time you've finished this article, I promise that you'll be an expert on the subject.

How cold is cold?

The first question that invariably comes up is how cold it has to be before preheating is necessary. Of course, there's no hard and fast answer to that question. 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, what sort of cylinders it has (steel vs. chrome), and what kind of oil is being used.

Interestingly enough, a brand new factory reman is considerably more vulnerable to cold start damage than a tired old engine near TBO. Surprised? Stay tuned and you'll find out why.

As a general rule, we consider any start in which the engine is cold-soaked to a temperature below freezing (32°F or 0°C) to be a "cold start," and any start below about 20°F (-7°C) *to be nothing short of a capital offense against your* powerplant. The colder the temperature, the worse the crime.

Oil pressure isn't enough!

Most pilots seem to think that the main reason cold starts are bad for engines is that the engine oil is thick and viscous and doesn't flow well. Since it takes longer for oil pressure to come up when the oil is cold, the engine sustains excess wear in the early seconds after start because of inadequate lubrication. That's what my primary CFI taught me when I was studying for my private ticket 35 years ago.

That might have had some validity back then, but not today. Nearly everyone who flies in cold weather nowadays uses multi-viscosity oil such as Shell 15W-50 or Chevron 20W-50, and those oils flow extremely well even at 0°F (-18°C) or less.

Consequently, pilots who use multi-vis oils quickly observe that their oil pressure comes up quickly after starting even in cold weather, and they figure that therefore everything's okay. Big mistake!

Bearings need clearance…

The real culprit in cold-start damage is the fact that our aircraft engines are made of dissimilar metals with radically different expansion coefficients. The crankcase, pistons and cylinder heads of your engine are made from aluminum alloy, while the crankshaft, camshaft, connecting rods and cylinder barrels are made from steel. When heated, aluminum expands about twice as much as steel. Likewise, when cooled, aluminum contracts about twice as much as steel. And, therein lies the problem.

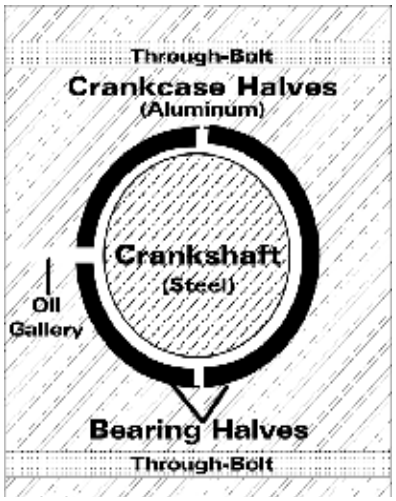

Figure 1 - Crankshaft bearing clearance.

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 crankshaft 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's not enough clearance, then there's no room for the oil, regardless how high the oil pressure gauge reads.

How significant is this problem. Well, take the TCM IO-520-series engines used in Cessna 200-series singles and 300- and 400-series twins, for example. The IO-520 overhaul manual lists the minimum crankshaft bearing clearance as 0.0018 inch (that's 1.8 thousandths) at normal room temperature.

What happens to that clearance when you start cooling the engine down? TCM doesn't say. But tests performed in 1984 by Tanis Aircraft Services in Glen-wood, Minn. (where it gets mighty cold) indicated that an IO-520 loses 0.002 inch (2.0 thousandths) of crankshaft bearing clearance at –20°F. An engine built to TCM's minimum specified bearing fit at room temperature would actually have negative bearing clearance at -20°F—in other words, the crankshaft would be seized tight!

You've probably noticed how difficult it is to pull the prop through by hand before starting in cold weather. Now you know why. It's not that the oil is thick (because if you use multivis oil, it's not). It's that the clearance between the crankshaft and bearings is tighter than normal. If it's cold enough, you might not be able to pull the prop through at all.

Start an 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 engine operation. If bearing clearances are small enough, it's even possible for the bearing shells to shift in their saddles—a so-called "spun bearing—misaligning the oil feed holes and starving the bearing from lubricating oil.

Ironically, this 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 an engine with low time since a sloppy bargain-basement overhaul) might well have plenty of clearance even at sub-zero temperatures.

But, even if your engine is approaching TBO, you can't afford to be complacent about cold starts. That's because inadequate bearing clearance is only one of several evils associated with cold starting.

…And pistons do, too

Consider what happens to your pistons and cylinders when you cold-start an engine. Here, the situation is the opposite of the one we just talked about: instead of a steel crank inside an aluminum case, we have an aluminum piston inside of a steel cylinder barrel. So the clearance situation is reversed: piston-to-cylinder fit is loose when the engine in cold, and tightens up as the engine comes up to full operating temperature. (This is why compression tests are normally done when the engine is hot.)

So why would cold starting be a problem for the engine's top end? Several reasons.

When an engine is started cold and comes up to temperature, the piston and cylinder barrel don't warm up at the same rate. The piston heats up very rapidly after start, while the cylinder barrel may take quite a long time to warm up. Why? Well, for one thing, the piston is small and light, while the cylinder his 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's 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, and the low RPMs of start and idle there's not a whole lot of splash oil available.

The result is that the piston expands to its full operating dimension quite quickly after start, while the cylinder takes a lot 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

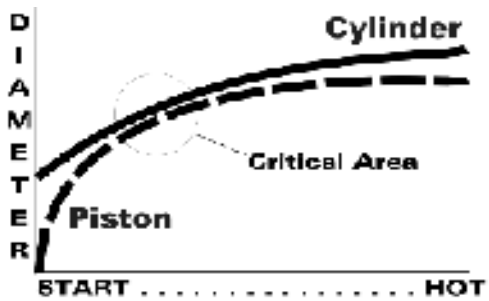

Figure 2 — Piston-to-cylinder clearance.

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's cold enough, the piston-to-cylinder clearance can actually wind up going to zero, resulting in metal-to-metal scuffing between the piston and cylinder barrel.

This problem is made worse by the fact that most cylinder 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 loose fit between the piston and cylinder

barrel right where a tight fit is most needed—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 area at the top of the stroke. As the piston quickly comes up to temperature but the cylinder is still relatively cold, it's easy to see how severe scuffing can occur at the top of stroke.

As you can see from this discussion, warming up the engine oil is definitely 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's 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).

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°F hangar, the oil is at 40°F, the case is at 40°F, the cylinder heads are at 40°F, the gyro instruments are at 40°F (gyros have their own cold-starting problems, by the way), the windshield is at 40°F (so it won't fog up the minute you exhale), and even the pilot's seat is as 40°F (which solves another problem).

I'm based on the California coast where the weather hardly ever gets below freezing, but when I travel to the cold country, I always try my best to use the overnight-in-a-heated-hangar method of preheating. Most FBOs seem to charge anywhere between $20 and $50 to store my 310

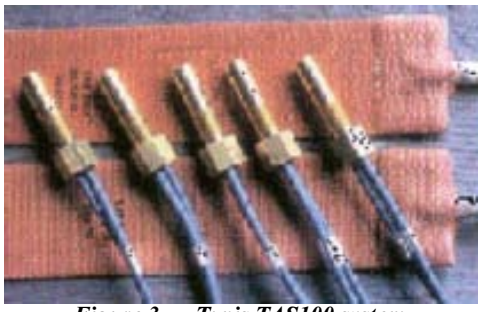

Figure 3 — Tanis TAS100 system.

in their heated hangar overnight. Even at $50, I figure it's quite a bargain compared to the alternative (accelerated wear of my two expensive TSIO-520 engines).

If I'll be staying at a cold-weather airport for awhile, I'm often too much of a skinflint to pay for the airplane to be hangared for the whole duration. Instead, I'll arrange with the FBO to pull the airplane into the heated hangar the night before my scheduled departure. If it's really, really cold out on the morning of departure, I've been known to preflight the airplane in the hangar, climb into the cockpit, secure the door, and then have the line crew open the hangar door and tow the airplane out onto the ramp with me in it. As soon as they unhook the tug, I start the engines before they've had

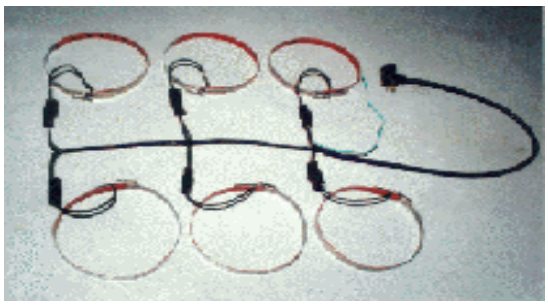

Figure 4 — Reiff HOTBANDD system.

a chance to get cold-soaked.

Multipoint electric heaters

Short of overnight 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 a system into 115V or 230V power a few hours before departure (overnight is even better), you can at least be assured of warm cylinders, a warm case, and warm oil when you start up.

The best-known multipoint electric preheating systems come from Tanis Aircraft Services in Glenwood, Minn. (http://www.tanair.com). The Tanis TAS100-series systems cost about $500 for a six-cylinder engine and consist of eight electric heating elements connected by a wiring harness. Six 50-watt cylinder heaters screw into the threaded CHT-probe bosses in each cylinder head. A flat silicone rubber heating pad is glued to the crankcase with high-temp RTV, and another is glued to the bottom of the oil pan. 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 in the preheating system, and let it cook for a few hours.

Although the Tanis TAS100 is a terrific preheating system, one drawback is that its cylinder heaters displace the normal CHT probe. One solution is to change to a spark-plug-gasket-type CHT probe. Another is to use a combined heater/probe element available from Tanis, but this makes the system more expensive, particularly if you have probe-per-cylinder EGT/CHT instrumentation such as a GEM or JPI 700.

In 1992, Reiff Corporation of Delafield, Wisc. (http://www.execpc.com/reiff/) entered the multipoint electric preheating market with their novel "HOTBANDD" system. In

lieu of cylinder head heaters, the Reiff system uses 50-watt heating elements mounted on large stainless steel clamps that mount on the non-finned portion of each cylinder barrel. As a result, there's no interference with existing CHT instrumentation. The Reiff system also includes an oil pan heater, but not a crankcase heater (the theory presumably being that the crankcase receives sufficient heat by conduction from the oil pan and cylinder heaters). A six-cylinder Reiff system sells for about $400.

Not to be outdone, Tanis recently came out with a new TAS400 preheating system. In lieu of the CHT-boss heating elements, the new system uses a "heated rocker gasket" which fits between each cylinder head and rocker cover, and applies heat directly to the cylinder head. The TAS400 is a significant improvement over the TAS100 system in a couple of different ways. Not only does it solve the CHT-probe interference problem, but it also applies heat evenly to the full circumference of the cylinder head, rather than applying it all at a single point.

Figure 5— Tanis TAS400 heated rocker gaskets.

Both the new Tanis TAS400 system and the Reiff HOT-BANDD system are capable of providing an excellent preheat in a couple of hours. We do not recommend cheaper electric systems that heat only the oil pan. As you now know, heating the cylinders and case is absolutely essential.

Engine and prop 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 all you need to do the job. But if it's really cold, or if you have to preheat outside on an exposed ramp (particularly if it's windy), then you also need some means of insulating the engine compartment and keeping most of the heat from escaping.

At the very minimum, you'll need an insulated engine cover. Although you may be able to make do with a quilted blanket, custom-fitted insulated covers are available from Kennon Aircraft Covers in Sheridan, Wyo. (http://www.kennoncovers.com), as well as from both Reiff and Tanis and a few other firms.

Figure 6 — The Kennon cowl blanket and inlet heaters installed. The pink balls on the fastener cords look silly, but sure make it easy to install the blanket in the cold with gloves on. Total cost for the blanket and two inlet heaters, $485.

In intense cold or windy conditions, the propeller becomes a major source of heat loss during preheating. Kennon, Reiff and Tanis all offer insulated propeller and spinner covers to solve this problem. Figure about $300 for a good insulated engine cover, and $100 more to cover the prop and spinner.

Another compelling advantage of insulated engine and prop covers is that using them may eliminate the need for a preheat altogether if you're going to be making a quick-turn. By installing the covers promptly after shutting down, engine heat can be retained for three or four hours even when the airplane is parked outside on a cold, windy tie-down.

Other electric heaters

If you hangar your airplane and use an insulated engine cover, a single-point electric heater can provide an adequate preheat if it is given enough time to do so (e.g., overnight). A simple oil pan heater can do the trick, and even a couple of 100-watt light bulbs stuck up the cowl flaps may suffice if the engine compartment is well covered.

Kennon offers a novel variation on this theme, consisting of a pair of electrically heated plates velcroed to the inside of cowl plugs. Combined with a good insulated engine cover and possibly an oil sump heater, this can do a good job of keeping the engine warm in all but the most frigid conditions.

These approaches work fine so long as you have plenty of time to preheat, but don't expect them to heat a cold-soaked engine to safe starting temperature in an hour or two. For that, you'll definitely need a multipoint electrical heating system, or a forced-air preheat.

Leave it on all the time?

There has been considerable controversy about whether

or not it's a good idea to leave an electric preheating system plugged in continuously when the airplane isn't flying. Both TCM and Shell have published warnings against leaving engine-mounted electric preheaters on for more than 24 hours prior to flight. However, these cautions are really applicable primarily to single-point heaters such as oil pan heaters.

The concern of TCM and Shell is that heating the oil pan will cause moisture to evaporate from the oil sump and then condense on cool engine components such as the camshaft, crankshaft or cylinder walls, resulting in accelerated corrosion of those parts. However, if the entire engine is heated uniformly by means of a multipoint heating system, or because the engine and propeller are covered with insulated engine and prop covers, such condensation is very unlikely to occur.

In fact, 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.

Figure 7 — Herman-Nelson forced-air

Forced hot air

Most FBOs in the cold country use large forced-air preheating units like those manufactured by Aerotech-Herman-Nelson in Winnipeg, Canada. (http://aerotech-herman-nelson.com). Smaller hot air heaters fired by propane, kerosene or gasoline are also available from a number of sources, including Kennon.

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's 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.

PREHEAT - A CPA STAFF STUDY...

Preheat Point - Counter Point

by John Frank

Mike has stated in his article that "Short of overnight in a heated hangar, the best preheating method is a multi-point electric heating system." Not exactly correct from my experience. The best method short of a heated hangar is to heat the air in the engine compartment as opposed to the engine itself. There are a couple of good reasons for this. One is that by heating the air you will reduce the possibility of moisture condensation as the temperature of the air in the engine compartment will always be above the dew point of the larger mass of air that it is within. When you heat the engine components such as with a cylinder or pan heater the air immediately adjacent to those components is warmer than the air a little further away and will absorb moisture, primarily from the oil. Warm air holds more moisture than cold air. Then as the air cools a bit in rising away from the warmer engine component the moisture will precipitate out of the air, that is condensation. By heating the air mass within the engine compartment rather than the engine itself the air in the vicinity of the oil sump will be slightly cooler than the overall air mass in the engine compartment and thus will not precipitate out whatever moisture it might pick up from the oil.

The second advantage can be one of cost. When I was based in Wichita, KS I used two 100 watt light bulbs in mechanic's light holders that I would put up the cowl flaps and lay on the bottom of the engine compartment. The mechanic's light bulb cages are important for protection if a bulb should break. I then wrapped an insulated blanket around the engine compartment. For testing I put a thermometer sitting on top of the cylinders. When I compared the temperature difference to ambient I found that the light

bulbs were giving a consistent 40 degree F temperature rise in the cowling, which meant that I had adequate pre-heat down to zero or so outside temperature. Cost of this pre-heat system is around $30. After I published this in the magazine ten years ago a number of people have started using light bulbs.

Since CPA came to California I haven't had to worry about pre-heat much, the few times that I travelled at times and locations that required it I would simply pay to be in a heated hangar or use hot air blown in. However, my family recently acquired a ski condo in Mammoth Lakes, CA so I will be doing a lot more cold weather operations.

The cheapest pre-heater of them all. A couple of light bulbs in caged holders up the cowl flaps and air inlet with an insulated blanket wrapped around the cowling. Results are a 40 degree temperature rise in the engine compartment for an investment of $30.

To handle this I have shifted to using Shell 15w50 oil in the winter and I have acquired an insulated cover with heaters from Kennon. I like the cover very much, it fits well and their fastening system holds it in place. I am less enamored with the heaters, mainly because of the location which is in the cowling air inlets up high. Because heat rises these heaters don't seem to do a very good job of heating the oil sump. My intention is to make brackets for these heaters so that they can be located lower, similar to the light bulbs, and take advantage of heat rising. I am also giving some serious consideration to installing the Reiff system. While the light bulbs work fine, they draw to much attention when the aircraft is parked outside and the light bulbs are on.

The new Kennon units are electric heaters in pockets in the inlet plugs. A cowl blanket of some kind is required to be effective.

Several of our members mentioned the Northern Companion pre-heater manufactured in Alaska. This unit uses a Mountain Safety Research camp/survival stove as it's heat source. This unit can be fueled with auto gas or avgas, so no propane, kerosene or white gas needs to be carried in the aircraft for the preheater. Heat flow is by convection so no blower fan or electricity is required. It will work no matter how cold it is while propane vaporizes very slowly if at all when you get to sub-zero temperatures. The unit is extremely compact and light. This would appear to be a good device to have in your aircraft even if you normally use some other form of pre-heat. Cost is around $365 and is available from Preheat Specialites, Chugiak, Alaska Phone 907-688-2130, e-mail nc5a@aol.com. No web site yet.

What the members say

This past November we asked those members that receive our weekly E-mail newsletter "CPA E-ATIS" to tell us their experiences with pre-heaters. Below are some representative comments.

DEAR CPA...

I own a 1971 Skylane. I keep it in an unheated hangar. I had the Tanis crankcase heater installed several years ago. It has proven to be satisfactory. I have left it plugged in for several days waiting for the weather to clear with no adverse results. The carburetor temperature indicator typically shows between 50 and 80 degrees F depending on OAT, after several hours of having plugged in the Tanis heater. I usually insert the cowl plugs and close the cowl flaps while using the heater.

I did have on bad experience with the heater due to adverse circumstances. The aircraft sat out all night at another airport in below freezing temperatures with the heater plugged in. There was a stiff wind and the temperature did not rise above 39 degrees F.

Previous to purchasing the Tanis heater, I used to insert a couple of 75 watt light bulbs through the cowl flaps, covering the cowl with a blanket and the temperature would rise to between 50 and 70 degrees based on a thermometer hung from the dip stick.

Ray Wells

DEAR CPA...

I have a 182 and live in Indianapolis In. After a few years of using a forced air kerosene heater and six inch ducting I decided to try two 200 watt light bulbs stuck up the cowl flaps and a couple of blankets over the cowl and covering the air inlets . I also place a thermometer just inside the oil fill door so I can check the temp. This has proved to work excellent and maintains 40 to 50 degrees above ambient so at zero your in the 40 degree range . This is an over night process but has worked so well I am no longer tempted to purchase the more expensive solution . I use this method even when I travel.

M. Thompson,

DEAR CPA...

I purchased a Red Dragon in 1982 and have used it ever since on a variety of planes from C-150s to a C-340…I push the hose up inside the engine compartment from either the cowl flaps or behind the nose gear trying to aim at the oil pan. I put in the cowl plugs and open the oil filler door. 15 to 20 minutes later the oil is 100 degrees and I can start like it was July.

Richard G. Clark

DEAR CPA...

I've got one of those small pads that glue to the bottom of the oil pan. But I did not get the ones that sell for about $160 in the magazines. I got the one from the local farm and ranch store for $30. On my first plane, as winter neared, I took it to my mechanic and said I needed a heater. He said he had just the ticket. The only difference between mine and the expensive one is mine isn't thermostatically controlled. We see this as a good thing. The pad heats up to a certain temperature and stays there. No temperature variations and the heat soaks up thru the rest of the engine. I didn't measure it, but you could touch the pad briefly without burning your fingers. I'd guess around 200 degrees. The local FSDO was called and their only concern was that the cord not interfere with the throttle cable, no problem there. I'm on my second plane now, 67 182, and I installed another pad about 2 months ago. Very easy for the owner. Clean the oil pan, smear the pad with red RTV and stick in place. Let sit overnight and check in the morning. I routed the plug up to the oil dipstick door and cable tied it in a few spots. My pad draws 100 watts, so around here that amounts to 12 cents a day. My plane is hangared, I fly 2-3 times per week and it is always plugged in whenever the temps fall below 30F, which of course, is most of the winter. From now till early March my plane will be either flying or plugged in.

Scott Newpower

DEAR CPA...

I have a Reiff heater installed on my 182E based in Vermont. I have been absolutely delighted with it. I use it any time the temperature falls below 40 degrees and the engine starts like it was midsummer. I have had the plane for 2-1/2 years, and installed the heater before the first winter. The first year I had the plane it was tied down outside)due to lack of available hangar space) but the heater performed superbly. I had initially purchased a Tanis, but discovered it would only heat five cylinders and at that time they had no way to heat this sixth. My mechanic told me about the Reiff, so I returned the Tanis and bought the Reiff, and saved $100 in the bargain.

Stephen S. Buckingham

DEAR CPA...

I've owned a Cessna 182D and my present Cessna 205. I installed a Tanis system in both. I've been extremely happy with the Tanis system and wouldn't have anything else. I leave it plugged in from the first frost until I put the long johns away. My experience has been the following:

1) Tanis heaters are the best unless you plan on adding a G.E.M. or other engine monitor.

2) Reiff heaters run a very close second because they will heat the entire engine even if you have an engine monitor already installed. They can also be added to an engine that may have a sump heater already installed. I will always try to convince my customers to use a Reiff heater rather than Tanis (when they already have a GEM or want to add one) because the Tanis alternatives are too much money and don't stand up well to the engine environment.

3) I've had good success with Symtec sump heater pads because they are durable but they still only really heat the sump (regardless of what their ads say).

4) All other sump heater pads are my least favorite simply because I find that they don't last and only heat the sump anyway.

I hope this info is useful. Feel free to contact me.

Ed Novak,
Director of Maintenance
Shoreline Aviation Inc., Marshfield, MA

DEAR CPA...

Up here in Alaska, pre-heating is a fact of life. I often use a Red Dragon heater, when starting up at my home airport. Otherwise I use & carry with me, a locally made commercial heater called a "Northern Companion". It is powered by a multi fueled camp stove, made by Mountain Safety Research (MSR) and is run off avgas right out of the sump while sampling fuel. It requires no electrical power, needs no propane or pressurized tanks, and folds up into itself to take along (it's about 8 pounds or so). At zero degrees F, it heats up my 182 to 50 - 60 degrees F in about 45 minutes, as I complete the rest of the pre-flight & clean off the airplane. I bring it with me to preheat at other locations, and to have as a survival stove & heat source in the event of an 'unscheduled' stop. In all the articles done in aviation publications on pre heating, I've never seen it mentioned. I

think it's one of the best all around heaters, especially when you consider its portability & potential survival uses.
Ted Smith

DEAR CPA...

I operate a Cessna 182 year 'round in Central Alaska and on the north slope for the US Census Bureau, so per-heating is a must from September though April. I have a Tanis Heater installed and plug in through a recessed male plug permanently mounted in the side of the fuselage, just aft of the firewall. I have an LED light also installed near the plug that shows at a glance whether I am indeed plugged in. The Tanis heater is used, of course, with a thick engine cover. The external male plug is also connected to a short extension cored in the cabin, with a receptacle for a small electric heater that I put on the floor aft of the rudder pedals to keep the instruments warm and warm up the cabin a little bit. The cockpit heat is important so the plastics are not brittle to the point of shattering when I jump in in the morning. The Tanis heater works quite well. Even after I unplug and pull the cowling blanket cover, I still have 10 or 15 minutes to fire up before the engine cools off too much.

I have to stay out in the village's overnight quite often, and used to use a Red Dragon propane heater. You use these heaters by attaching a 4" stove pipe elbow and piece of pipe to direct hot air up into the cowling flaps. You have to clip the 12-volt alligator clips to a battery. I used a large motorcycle battery - good for about 30 minutes. The Red Dragon heater works quite well down to about -10F, but not very well when it's colder than that. The problem is that the evaporation of the propane in your small portable tank cools the propane down to the -35F point where propane is happy being a liquid and doesn't evaporate. You have to stand around pouring hot water on the propane tank every couple of minutes to activate it, getting colder all the time. Now that almost all of the village strips have lighting, and electricity run out o the snowplow shack, I can usually find some place to plug in for the night. I finally gave my Red Dragon away. However, for less austere climates, say from -10F to +40F, where you don't have electricity, the Red Dragon may be just the thing. Still though, you have to lut it around with you and a propane bottle and battery, too. I hope this is informative!
John Dailey

DEAR CPA...

I had a Tanis on my 150 (O-200) for three years and sold it to get the Reiff. Reason: on the O-200, Tanis uses a replacement bolt at the bottom of the rocker cover with a heating element attached to the back side of the cylinder head. Problem was, the bolt and bolt head and associated nut was a lesser diameter which created a problem tightening the rocker cover evenly. Also a little more prone to leaks. Otherwise a good heater and probably no problem for the low-use a/c of 100 hours or less per year. But for me doing 300 to 350 hours annually, it was a hassle so I switched to Reiff which uses a band at the cylinder base. No problems with it, works fine without getting in the way. You are the Best!
Dave Wills

DEAR CPA...

Here in the frozen North, some sort of engine heat is an absolute necessity if you're going to fly an airplane between October and May. When it's warm (above zero F.), you might be able to start without pre-heat (if the battery is warm and fully charged, and the engine is in good tune, and the starter is not good shape, and...and...and...), but even if it starts, those thirty to sixty seconds without oil pressure CAN'T be doing anything any good. When it's cold (below zero F.), it just isn't going to start, period, without pre-heat. I've owned a Cessna 182D and my present Cessna 205. Both arrived without pre-heat. I installed a Tanis system on both. I've been extremely happy with the Tanis system, and wouldn't have anything else. I leave it plugged in from first frost (sometime in September, usually) until i put the long johns away (sometime in may, usually). I used to just plug it in 24 hours before a flight, but that meant a separate trip out to the airport, and planning ahead. Now, just leaving it plugged in all the time means that airplane is ready to fly when I want (well, the engine is, anyway). My hangar has electricity (obviously), and I've had pretty good luck with FBOs away from home allowing me to string my 100-foot extension cord from the plane to an outlet when I'm parked on their ramp away from home. Over the years, I've broken a fair number of wires off the cylinder heating elements, since they're so close to the lower spark plug. This is something which requires some care, since this seems to be a point of fragility. Those leads just WON'T put up with any undue tugging or being bashed with the handle of the spark plug socket wrench.

The biggest problem I have is climbing into an airplane that's frozen solid, grabbing that cold, cold yoke with my brittle fingers, and forgetting the engine is WARM. Believe it or not, at minus ten F., a WARM ENGINE start technique is needed. So I usually forget, flood the engine, and perform a flooded start.

Vendor support has been first rate. Parts Availability is not a problem, since Tanis has been in business a long time, and most FBOs stock the heating elements. Each time I install a new system, or a new cylinder element, I get a chuckle out of the drawing of the mechanic/ape with the wrench in his hand on the instruction car. I'll never own an airplane without the Tanis heaters installed.
Tom Skelton

DEAR CPA...

The following has been my new experience with engine pre-heating as requested in this weeks ATIS.

I've recently moved to St. Louis from the Southeast. This will be my second winter here. Before last winter I had a Reiff sump pad and hot-band cylinder heaters installed on my R182. After a major overhaul by Victor, I wanted to protect my investment from cold weather starts.

The installation was very straight forward and my mechanic did a very clean job. I have the one plug for both wired up to the oil check door adjacent to the oil dip stick. My procedure is to put cowl plugs in the nose and a heavy blanket over the cowl top and prop. My home is close to the airport so I come out the night before and plug in the heater to a wall timer set to usually 2-3 hours before scheduled take-off the next morning (I do keep my airplane in an un-insulated hanger, which helps). This procedure warms the cylinders and exhaust areas into the 60's (I have a multi-probe egt/cht). With the battery being in the engine compartment it gets heated as the engine warms up as well.

In addition to the engine, I warm the cabin with a small electric heater. When I get to the airport to preflight, final weather check, etc. I put the heater in the cabin on the floor pointed towards the instrument panel so the heat rises up into the instruments and radio center section. After about a half hour the cabin is nice and warm ready to go flying.

The above procedure has worked well for me, albeit for one season so far. I've used this well down into the low 20's and a few times in the high teens. I just have to set the timer an hour earlier. So far I'm very pleased with the Reiff system. The multi-probe cht system allows a quick check on the status of the cylinder band heaters function (more uses for this great tool). It gives me peace of mind that my engine will not be damaged during cold weather starts and keeps me flying during the winter months.

Now if I can figure out how to un-thaw the lock to the hanger door on those nights it freezes after a rain! Cold weather living!

Michael J. Griffin

DEAR CPA...

I just purchased a Symtec sump heater ($150) but have not installed it yet. Kurt is scheduled to install it next week. The unit looks really well constructed high quality, durable, etc. and a better solution for a sump heater than a pad. You can contact Kurt for his impression of the unit - he has it in his shop. Symtec guy was very helpful - their number is 612 571-9193.

Bob Remington

DEAR CPA...

In Canada where it is really cold, there is available a interior car warmer which mounts under the dash, ruins on 110 volts, has a fan and a thermostat. They fit nicely under the hood, and can be easily removed before starting the engine. It works in northern Minnesota too.

R.M. Martinson, MD

DEAR CPA...

I have a Tanis heater in my TR182 and belonged to a club that had Tanis heaters in a 150, 2-172's, and 2-182R's. Never thought much about them except when I did not plug it in and it got cold. A mechanic suggested to me that I get a thermostatically controlled switch that will turn it on at about 32F so that it would not be on at warmer temperatures. The warmer ambient temperatures allow for more moisture and the possibility of corrosion. I noticed on the Tanis web page that they are selling a device to deal with that problem. If you can tell me where I could find a thermostatically controlled switch, I would be thankful.

Mike Burk

DEAR CPA...

I purchased a Red Dragon about 1982 and have used it ever since on a variety of planes from C-150's to C-340. I only had it back to the factory once about 4 -5 years ago because it wasn't getting very hot. They cleaned the spider nests out of the orifice - no charge - cleaned and adjusted it and it still works great. It seems that I have to replace the hose (get some of the red silicone impregnated style) and battery (I use a small motorcycle one) every few years due to wear and tear and normal aging. My method of use is to push the hose up inside the engine compartment from either the cowl flaps or behind the nose gear trying to aim at the oil pan. I then put the cowl plugs in the nose, open the little oil filler door and go inside and get a cup of coffee. 15 - 20 minutes later I put it away, start the engine using my July starting method, the oil temp is usually above 100 at start up. The outflow of hot air is very very hot. The hose will also get very hot. Be careful where you point it and what it touches.

I don't recommend it but I have seen people use one to warm the interior and thus reduce the condensation moisture on radios, instruments etc. If you decide to do this besides being careful with where the hose is pointing because the outflow is very hot BE VERY CAREFUL TO COMPLETELY AIR OUT THE INTERIOR AND RID IT OF ANY RESIDUAL CARBON MONOXIDE. If you have one of the small spot CO detectors you will need to remove it temporarily or replace it. The Red Dragon can help in the airing out by running just the fan without the burner going. Again, NOT RECOMMENDED.

If the airframe is cold soaked I would advise not powering up the avionics until the heater has had a chance to warm the interior. It won't help the gyro's but might save a piece of avionics.

Richard G. Clark

DEAR CPA...

I have been using Tanis heaters for several years. This is my fourth airplane and I would not fly without a pre-heater. (I am based in Michigan) I have been very happy with the Tanis. I considered the Reiff the last time but decided that the price difference wasn't worth the savings.

I leave my heater on all winter. The only draw back I had was that I want to know if there is actually electricity going to the unit. The standard installation gives no indication if the power is turned on or if it is plugged in properly. I installed a watt meter that is in a box on my T-hangar wall. It tells me if power is going to the unit or not. On another airplane I wired an in-line light, the type for testing wall outlets, on the Tanis cord so when plugged in the light would go on. It seems this should be standard on these type of preheat units.

Gary Soloway

DEAR CPA...

I live in Southwest Alaska, on the Bering Sea coast and have lived in the Interior (where it's colder) for many years. The propane heaters work well, but you have the problem of propane not working as well as it might in the cold and the problem of electricity to run a blower.

I've also used Coleman type stoves of different sorts with stovepipe and catalytic heaters.

For a couple of years now I've been using a NC5 pre heater designed by a fellow in Wasilla, AK. It uses an MSR stove which puts out 20,000 btu using any available fuel. It doubles as your survival stove. The system uses stovepipe and flexible ducting and folds up into a compact unit weighing only a few pounds. It heats our plane up nicely down to temperatures beyond which you wouldn't want to be flying. The thing is kind of pricey (around $400), but it beats anything I've ever built myself.

Bill Martin-Muth

DEAR CPA...

Jer/ Eberhard here, partner Joel Larner as "Colorado Mountain Aire" have N9513F, a ~4500 hour 1972 C-206 (not for sale), with an oil pan heater.

During the winter, we keep in the hangar and plugged in all the time. However, I created a "turn-down" device for it. The oil pan heater is a 300 watt, 120VAC unit. I have it plugged into a "500 watt variable light control", turned down to 70%, as tested and measured with a volt meter, with it controlling 2-60 watt bulbs in parallel (120watts/ 120VAC) = voltage reads directly as percentage.

We keep a thermal blanket over the cowl. Even at -10 F, the engine is about 50 F and starts in the first 3 blades, all winter.Then, if I'm away from the hangar, I plug the oil pan heater directly to 120VAC and cover the cowl with the thermal blanket for 2 hours and the engine is "pre-heated".

Jer/Eberhard

DEAR CPA...

This is in response to the ATIS reader's inquiry on preheater options. I originally installed the Tanis system in my 182N 4 years ago. It worked fine for Kansas City winter operations. I park it in an un heated open T hangar at Kansas City Downtown Airport and simply had the line crew plug it in the night before I planned to fly the airplane.

I subsequently wanted to install a JPI engine monitor with individual cylinder head and exhaust gas temp probes but was faced with the added expense of purchasing special tanis probes that would accept the temperature probes. I recall those to be priced at around $125 each or $750 in addition to the cost of the JPI and installation.

I elected to remove the Tanis preheat probes in favor of the Reiff heating bands which are placed around each cylinder. The cost was much less than going with the Tanis probes and definitely warms the cylinders more effectively.

I also ordered a very slick insulated engine cover from Reiff for the below zero time of year. This set up allows me to run straight 50W year round. I keep a long extension cord in the aircraft and take special care to park the plane within reach of an outlet when over nighting at other airports. I also get many compliments on the attractive look of the black fitted engine cover. It cost about $350. Install and remove in 2 minutes.

I'm very happy with this set up.

Fred Oram

DEAR CPA...

I have just installed my third Hot Padd in 4 years. The first lasted 1 year and was replaced under warranty. The replacement lasted 3 years and burnt out at the connection to the thermostat. Bob Reiff says that eliminating one of the thermostats has relieved the problem.

My unit is installed on a Continental IO-520-L on a 1973 210-L. It has performed very well here in Central Ohio. I have left it plugged in continuously during the winter months with foam plugs in the nose and three heavy moving pad blankets over the cowl. I have monitored the temperatures inside the cowl by laying a thermometer on top of the engine before installing the foam plugs and checking it immediately after removing the plugs prior to flight. I have consistently maintained a temperature about 40 degrees above ambient.

I recently thought I might be in need of a replacement engine and since I might have to install the Hot Padd on the new engine instead of the existing one I was concerned over Continental's position on the matter. Bob Reiff has pretty good information on his web site which cautions against leaving the system on continuously without the cylinder heaters as well. My own FBO/charter operator claims an engine on a 400 series Cessna was denied warranty coverage due to corrosion blamed on a continuously operated Ta-

nis system. I contacted the tech rep for Continental and he confirmed that Continental does not recommend continuous operation of systems and could in fact deny warranty coverage if so operated.

I do not believe I have had a problem. I have discussed the situation with Tom Carr and he has concurred based on his experience around the Detroit area. I do not have any condensation or rust inside my oil filler cap (or anywhere else for that matter) and my oil analysis does not show any elevated signs of Fe. I have chrome cylinders and the Continental rep has suggested that the internal parts of the engine have probably been "coked" over the years and therefore more resistant to rust and or corrosion. His suggestion, when I get a new/reman engine would be to operate by preheating only prior to flying for the first 3 years or so and then possibly going to continuous operation (out of warranty by then?). Factory engine will come with steel vs. chrome cylinders also.

I look forward to your article. It would be of great benefit to have a safe and convenient method of preheating. I really don't relish the thought of making a 20 mile round trip the night before I want to fly every time in the winter.
Steve Field

DEAR CPA...

Using a Kenmore engine cover. I have a gasoline powered blowtorch and three sections of 3" diameter stove pipe (about seven feet). When in a remote location (the bush) or at an airport without preheating equipment this comes in handy. The blowtorch is filled from the wing tank drain sump and will burn 50 - 60 minutes. One cowl flap is dropped and the stove pipe is inserted. The blowtorch is placed on the ground in the other end and away from the plane. The engine cover is configured such that the opposite side air intake (just behind the prop) is open to let warm air flow through. When the blowtorch runs out of fuel, the engine is toasty warm. Works well down to temperatures around 10 - 15 degrees F.
Bob Waldron

DEAR CPA...

The Airplains STC O360 engine I put in several years ago absolutely refuses to start when the temperature falls below 32 degrees--don't know if the problem is frosted plugs or not. The fact that it only primes on one cylinder probably doesn't help the cause either. In any case, after moving to Oklahoma with colder winters I went ahead and installed a Tanis pre-heater, with heating elements in the cylinder heads as well as the the oil plug. Haven't had a chance to test it in real cold weather, but on the subfreezing days I've flown so far, the engine turns right over without the need to even cover the cowling. I'm very satisfied with it and my mind is a bit more at ease if we have to move to a much colder climate. The only real disadvantages I see with the system is having a source of electricity and making the effort to plug it in several hours (or the night before) you need to fly. Probably not a good option if your airplane sits on a ramp, several hundred feet from the nearest outlet. For a cross country I'm planning in the near future, I am taking along 50 feet of extension cord, and the FBO at the small airport I'm staying at says they'll make sure I find a place to plug in.
David McClurkin

DEAR CPA...

I am EXTREMELY pleased with my Tanis Heater. It was one of the first items I installed on my 1983 210N when I purchased the plane in 1993. I live in Columbus, Ohio, so our winters are not extreme, but still cold enough to cause havoc. By the time the first frost rolls around, I keep the Tanis plugged in 24 hours x 7 well into early Spring.

The heater takes a very "gradual" approach to engine warmth. It's certainly not something that produces immediate heat when you need the quick "get up and go". Instead it generates a constant warmth to the engine block, which I believe is a preferable method. I do keep the plane hangared which is a better environment for the Tanis product. Planes stored outside may need a more "forceful" heater to provide sufficient results.

In my opinion, the Tanis product works a lot like a wine cellar cooler - it keeps the engine at a mild constant temperature between flights, thus creating an environment that promotes extended engine life.
David S. Heutel

DEAR CPA...

My solution for my hangared plane is a twenty nine dollar 1500 watt box heater set on a stool and blowing warm air into the cowl flap opening. I just let it run all the time in the winter and no matter how cold it is outside the whole engine is warm all the time. It is typically 70-80 degrees Fahrenheit according to the digital oil temp gauge I have. This has worked fine for ten years, the box heaters last about five years each running about six months of the year. Corrosion has not been a problem as the engine is always hotter than the OAT. No debate about what to warm either, the whole engine as well as the oil are warmed this way. Pretty neat, huh?
Jeff Axel

DEAR CPA...

I've been using an oil pan style heating element for about 6 years on my 182F. No problem ever. I don't remember the original price but know it was the least expensive way to go other than the "light bulb" method.

There are two ways to do this. The first is to plug it in (my plane is hangared at FNL) the night before or I'll set it on a timer to go on two or three hours before the flight. With a blanket over the cowl, the cylinders are slightly warm to the touch the next morning no matter the temperature.

The second way is to plug the heater in just before the flight (about an hour seems right) and also use the "light bulb" method you know so well. It takes a bit longer but still seems worth the wait as far as engine wear is concerned.
Dan Evans

DEAR CPA...

I have used E Z Heaters (type that go on the bottom of the oil pan) with great success, I have one on my C-180 and it really works well. With a blanket over the top of the engine and the prop wrapped also the heater will heat the entire engine overnight. That is it will go from about 10 degrees or so to the point that you can feel heat in the cylinders and the oil temp. gage will show an indication. This unit will also heat the oil pan so that it feels warm to the touch in about 30 min. I have installed these on other planes that are both hangared as well as tied down outside with similar positive results. I believe the key is to cover the engine AND the prop. Someone once said that that big hunk of aluminum really pulls out the heat as we are heating the oil. All in all I have been very happy with this unit and would highly recommend it
Bart Welsh

DEAR CPA...

I owned a Skymaster which I installed a set of Reiff hot bands and a Reiff hot pad for the crankcase. The company originally sent me the wrong size hot bands for the cylinders (too large) but they cheerfully exchanged the bands without any fuss.

Once I had the right bands, the installation went rather smoothly. My only complaint is the bands would have been twice as easy to install if they had been just 1/4 inch longer. Getting the first tooth in the band turned out to be a two man job on 4 of the cylinders in front and two in the back. The oil pan pad installed quickly and easily. Routing the wiring for the bands was simple and all connections fit properly. Once everything was secured, the system was tested and worked perfectly. The Reiff system installs in less than 1/2 the time of the Tanis system.

During that winter 1997-98, the bands and pads on both engines worked perfectly. I think the engines felt warmer under the cowl than with Tanis heaters I had previously used on three other aircraft. Often when the planes with Tanis systems sat out overnight in the winter, I had to make sure the cowl was covered or the engine never warmed up enough. With the Reiff system, the engine felt warm even without a cowl cover. The Reiff heater was far less expensive than the Tanis setup. This year the plane had a double overhaul and that is when I really appreciated the Reiff system. When I had previously used Tanis systems, it seemed that every time I had to remove the components, at least one of the plastic connectors would get damaged (no matter how careful I was). The Reiff system disconnected easily and reinstallation was a breeze.

Both the Tanis and Reiff systems work great. The Reiff system doesn't block a 6 probe EGT, installs faster and costs less. My choice: Reiff!
Mike Sankey

DEAR CPA...

I live in CA, so my exposure to real cold is infrequent, maybe 4 or 5 times each winter. I have done the pre-heat stuff, and I've done heated hangars. I have not used the special-purpose heaters or the light bulbs.

Pre-heats are a pain. You have to wait your turn, then wait some more while your engines heat up. Of course, you may be using that time to dig your baby out of its tie-down. This method gets the engine started, but does nothing for the interior (read gyros, fuel selectors, ball-point pens, autopilots, baggage doors, or anything else that stops working well when its temperature is really cold). It doesn't get the ice and snow off the flying surfaces, either.

Heated hangars are the way to go. They'll cost you 2-3 times a pre-heat, but the engines are warm, the inside is warm, everything works, all the surface snow/ice/frost is gone, and you can preflight and load your pax in comfort. Getting the airplane towed out takes only a couple minutes. In my experience, you can almost always get space in a heated hangar, even if it's just for the night before departure. Just make sure they really have it in the hangar all night, not just the two hours before departure.
Pierre Wildman

DEAR CPA...

I have a 79 T210 that i fly to Blue River BC four to five times a year and park it at the airstrip for one to two weeks. The temps are always below freezing sometimes drastically so. It snows a foot or two every week and generally I land on a snow packed runway with snow plowed berms on the side of the runway higher than the wing! I heat the engine four to five hours prior to departure with a Honda portable generator supplying the power to the Tanis and a sleeping bag covering the cowl and air inlets with the cowl flaps closed. The plane is covered with ripstop coated nylon covers that I cut out myself. The end result is a warm instrument panel via a blow dryer and a hot to the touch engine that fires without priming. So far over five winters I haven't been stranded. Now what about running lean of peak 25-50 degrees using a JPI, with regard to cylinder temps and EGTs. Also if you had to replace your VAR equipped engine how would go about it the most cost effective/quality way.
Mark Parent

DEAR CPA...

I have Tanis heat in my 1977 Cessna Turbo 210 and have had it now for several winters. Install required muti-purpose probes as my 210 is equipped with a GEM and the

cylinder probes were in place. I have had no problems with the system.

I highly recommend that the insulated blanket covers be used with the Tanis heat for maximum effectiveness. In pricing the covers I found that the Kennon covers were just as good ... and about 2/3 the cost.

My hanger is unheated. I plug the system in if I plan to fly the following morning and if temperatures are expected to be under 40 degrees. I do not leave it on all the time ... as Tanis does not recommend it and several engineer friends of mine have advised to do so risks greater potential for internal corrosion, contrary to what one might think. I find it particularly useful for flights to my vacation home in Northern Wisconsin in the Winter. Even if below zero ... engine is toasty warm and ready to go when I am.

I highly recommend the Tanis system.

Doug Engel

DEAR CPA...

I have a T337 with Tanis heaters. I recently bought the cowling blankets as I don't yet have a hanger to put the plane in. I have the pan warmer and the cylinder head probes.

I was shocked after putting on the blankets to see the temperature they maintain. In 30 degree weather, I put a temperature probe in on top of the cowling to see what the temperature was. This was after the shock I had when I stuck my hand in to see the how warm the temp was. It was holding 95 degrees! Shocking. When I start the engines, it is as though I were starting them in the middle of the summer- mild prime, immediate start and smooth run off the bat. In fact better, the engine oil temps are already in the green! and ready for immediate runup.

The blankets can easily installed alone, this says something for a Skymaster, in just a few minutes and come in nice little bags to store them in. I am told, but yet to prove it first hand, that they will maintain engine heat for 5 hours when not plugged in making them ideal for holding heat while out to lunch with the plane in cold weather.

I have to believe this is good for the life of the engine. It sure makes starting it nice if nothing else.

Needless to say, I am completely impressed.

Del Christensen

DEAR CPA...

I have had a Tanis heater on my C-182/Q since 1990. It was originally installed on the aircraft's original engine shortly after i purchased it in 1989. In 1995 I replaced the engine with a FREM and had the original Tanis heater reinstalled. The only maintenance expense has been a cylinder head heater replaced. It is hangared in central Illinois and the heater is on Nov.-March. I am very satisfied with this product and recommend it to others.

Mike Rippel

DEAR CPA...

I have had a Tanis heater installed on my T210M for 19 years. I transferred it from my first engine to the next without difficulty. I use single weight oil all year long and spend time in Indiana and Florida. I used to keep it plugged in all the time when the temperature was below 50F, but now I plug it in the day before flight. Its the best thing I have ever done for my engine, I never have a cold or even cool start, e.g., 48F Florida morning. The hardware has been trouble free, I think I changed one probe in 19 years. I use cowl stuffers and a blanket in temps below 32F. I have flown two TC Continentals past TBO and I give much of the credit to Tanis.

Paul Palombi

DEAR CPA...

I live in Western Alaska on the Yukon River delta. I see that today the temps are a little below +20. That is my magic mark for preheating. Since 120v power is not readily available and a generator did not seem practical, I purchased a Sure Fire. It came in a red tool box much like some of the Milwaukee power tools I've purchased.

The unit works fairly well. I have however had problems at various times. Perhaps the most persistent problem is getting the unit to generate heat at it's optimum potential. That may be my fault however, as I refill these disposable bottles from a camper trailer sized propane tank. I may have overfilled the bottles, though I am not sure. The propane refill adapter was purchased from J.C.Whitney. This saves money as propane bottles can run as high as $16.00@ here.

Another problem is the 12v power supply needed. The first time I used the heater, I plugged it into the panel cigar lighter. That required turning the master on. This seemed to drain the battery a bit. Since, I have changed strategies and take the battery home to keep if warm. The 182c battery box is in the tail section. The battery is brought to the airplane in a bail handled cooler (to keep it warm), set at the left side of the engine and the heater power leads are hooked to the battery and the lid is replaced to keep in the heat. Following the preheat the battery is installed and start-up follows.

The only other problem relates to the units heat generation which I suspect is related to my overfilling bottles. As the unit was heating, I busied myself scrapping ice. Unnoticed by me, the heater begin putting out at it's full potential. With only manual controls this meant that it begin to put out at it's maximum. Fortunately I did check and turned it down, though too late to prevent some burned paint around the heater controls.

I notice there is a review of this heater in Aviation Consumer, April 96,p13-14.

Would I purchase this unit again? If propane was my option, Yes ! If electricity was available I'd go that route.

I will be looking forward to your article.
Richard Dennis

DEAR CPA...

Love my Tanis heater, expensive, but does a great job. Jugs, oil, all nice and toasty warm. My question is: Is it better to leave it plugged in all the time, or is it better a few hours before. I would think that leaving it on all the time would be better as the engine is basically at one "constant" temperature, rather than fluctuating with the weather. This has been debated in the news groups with no conclusion.
Ken Read

DEAR CPA...

In August of 1977 issue of THE AOPA PILOT, page 55, was an good article on how to make your own engine heater. I built one as described and have found it to be a real nice unit. Hope someone else can use the data too.
Harris B.

DEAR CPA...

I just wanted to reply to your call for experience with winter heaters. My wife and I own a beautiful 1977 172N in Northfield, Minnesota. The aircraft has always been hangared in an unheated hangar. We fly it about 100 hours per year and love winter flying, even here in Minnesota. We have always been great believers in the Tanis engine preheat system. We have had great luck with it, not only on this aircraft which we have owned since 1989, but also with a previous Cessna 172M.

Our current aircraft was converted with the Air Plains 180 hp conversion two years ago. Our old Tanis heater was remounted from out old O-320H2AD onto our new O-360 A4M. The old H2AD gave us 2350 trouble-free hours, and we finally changed it because we do a lot of mountain flying and wanted the extra performance, not to mention the safety factor. But I digress.

Since the day we have had our airplanes in the winter we leave our Tanis heater on a timer. It comes on at 5:00 am, so the engine is toasty warm by 7:30 am. The heater times off at 5:30 pm when it gets dark. Sometimes, we don't fly for a couple of weeks but when we want to go it's nice to have a warm engine. Our hangar electric bill goes from $11 per month in winter to $16 per month, about $5 a month to heat our engine. We have heard that this heater can cause rust to form in the cylinders by the alternate heating and cooling process in cold weather. I'm here to tell you that our engines have never exhibited these characteristics, witness the fact that our previous engine was running perfectly at 350 hours beyond TBO.

Our current Tanis heater is 14 years old and runs perfectly. It uses very little electricity and does a much better job keeping the oil and the cylinders warm than a lot of those clunky, paint-blistering, maybe it'll start, maybe it won't types of heaters. It is trouble free and I even installed a little external plug on the cowling for it. We also use an insulated cowl blanket in the winter time. I'm sure this helps to keep the operating time on the Tanis down.
Roger Sothman

DEAR CPA...

I have operated my C172F from Merrill Field, Anchorage AK since 1990. First project when I bought it was to have a Tanis heater installed. In spite of our AK winters, with airport temps currently 0F. at night and 10+F. during the day a two hour preheat plug in warms the engine up to clean starting temps and warm oil and cylinder temps. I have an insulated engine cover used all the time and Merrill has electricity plumbed to my parking spot at a cost of 55 a month vs 50 PM for non electric parking. I do not normally leave it plugged in all the time, just prior to flying for a couple or three hours. I fly with a Cessna cold weather kit installed, a plate that covers the bottom of the cowl and that maintains oil temp at normal operating altitudes for me. I believe in the Tanis so much that if I did not have access to electricity at the spot I would invest in a portable generator set. My system seems much safer than a propane type Red Dragon type set up considering the plane is a carbureted non injected system.
Bill Fisher

DEAR CPA...

I purchased a Red Dragon Engine Pre-Heater in 1988. It was the LPG, 12 volt model. I used it for one season before it failed to light and after trouble shooting it replaced the high temp. over limit switch. I then used it for one more season (maybe 8-10 uses) before the gas valve failed. That item was expensive to replace (approx. $70) and a lot of trouble to find. The igniter failed the following year. In all, the service history of this unit was not good. I have since replaced this item with a heated hangar (even more costly but a lot nicer to work in during winter months). I no longer use the red dragon mainly because it was cumbersome, although if mounted on a dolly with a battery and the LPG tank it would be more manageable. If I had it to do over again I would do what a friend of mine did, and buy a small ceramic electric heater and build ducting for it to direct the heat up the cowl flaps (Cessna T210). PS I live in UTAH (home of the 2002 Olympics and some pretty cold winters)
Gary Silver

DEAR CPA...

I have a Tanis heater in my 172 "Superhawk" with Lycoming O-360. There are only 3 cylinder heaters with the 4th cylinder having a CHT probe. It works very well, I never have trouble starting the engine, although I do find that the plugs foul more easily when I'm using the heater (any idea why?).

I leave it plugged in all the time, unless I know I won't be able to fly for longer than a week. I've never seen condensation in the oil, and my oil analysis has always been fine.

I live in NJ, and we have moderate winters.
David Landset

DEAR CPA...

For the past several years we have used a 200Watt dehumidifier coil in the muffler of our C-180H (like a light bulb but no glass) We have it mounted on a shaft we clamp in the exhaust pipe and leave it on continuously and put a moving blanket over the engine cowl. Logic being that it is the next best thing to a heated hangar. Our hangar is enclosed but not heated. We have a hi-lo thermometer in the engine compartment and it always reads between 40 and 50 degrees F. We think that we avoid the temp swings that contribute to condensation during the spring and fall of our New Hampshire climate. Any thoughts you have as to wether this is good, bad or indifferent would be appreciated.
RG Robinson

DEAR CPA...

We have used three types of pre-heaters on our 182RG. We have a Red Dragon propane heater that we used before purchasing a hangar, and for use in remote locations. It worked well but we always had the concern for it being dangerous. We then used a light bulb and tube into the cowl flap, along with a heavy blanket on top of the engine cover, and that was effective. We recently (last 5 years) have installed and used a Tanis electrical heater that has been excellent. The convenience of the electrical heater cannot be beat, as long as you have good access to electricity.
Paul Holden

DEAR CPA...

I keep my 182 outside at Boulder, CO, and fly almost every week, year round. A few years ago I built a preheater that works very well. I started with a single-burner propane camp stove, which purports to put out 40kbtu/hr. I removed the cast iron burner and mounted it in a section of eight-inch galvanized pipe. To move the air, I attached the air-conditioning blower from an old Chevy Suburban. Above the burner I made a flow divider, feeding two four-inch pipes. I lay the unit down under the airplane and put the four-inch pipes into the cowl past the open cowl flaps. I power the blower off my car battery. Total cost was just under $100, and could have been lower with more careful shopping for the burner. I have not yet installed a thermal switch, so I can't let the thing run unattended.

I lucked out, because I'm able to run both the burner and fan at full blast, and the air coming out of the pipes is between 130F and 170F. After 30 to 40 minutes, which is about how long it takes to do a wintertime preflight, the entire engine is warm to the touch. If the OAT is below zero F, I'll preheat for a full hour. Probably overkill, but I still get a full season out of a 20 pound tank of propane.

The only improvement I can think of is to augment the hot air with an electric pad heater on the oil sump, but I don't think it's necessary. The best thing would be for several aircraft operators to get together and buy a Herman Nelson. Now THATS a heater.
Dave Finamore

DEAR CPA...

I own a 1978 C182RG based in Cleveland Ohio. My long time pre-heater is a flood light bulb raised up so it is about 1 foot below the engine compartment. I leave it on all the time during the winter months. Also I use a dip stick heater. Oil used is Aeroshell 15-50. I usually get oil pressure in under 10 seconds with this method of preheat. I have a torpedo heater, and sometimes use it to warm the interior on the really cold days. This combination seems to work really well, without much expense.
Russ Otto

Summary

We received over 50 responses from members. All possible systems seem to work well. Tanis was considered to be the premier unit though several members have removed them to install Reiff cylinder heaters because of the cylinder head temperature probe situation. The light bulb system received very high marks from those users as did the pan heaters. The Red Dragon was the system of choice for those that had to pre-heat in the field without electricity available.

The message is clear, expensive or cheap, sophisticated or simple, pre-heaters work. There is simply no reason not to use one when the temperatures call for it.

In a separate handout, we have listed the names and addresses of vendors and manufacturers of the pre-heaters mentioned here. **SOURCES FOR..No. S-07 PreHeaters**.