

EZ Heating System

During my recent plane upgrade, I decided to install an oil heat cabin system. Previously, I had the typical heat muff, and a 12v electric heater. It has been so cold in the plane that my water bottle froze solid and some of my instruments stopped working during the course of my flight!!

The original heat muff was good to about 30 deg F and with the addition of the electric heater (35+ amps) the cabin was comfortable to about 20 def F, OAT. Even with these heaters, I still had a lower OAT temp limit of about +10F. Canards DO NOT stay warm in the winter with “plans” type heaters. The basic problem is, the small surface area and short contact time with the heat source (the exhaust pipe) only allows for about a 60 F temp increase, additionally only a meager amount of air then goes into the cabin (even with my booster fan) which is then immediately discharged overboard. The key to any heating system is BTU capacity and and/or the ability to re-circulate the air through the heater to reheat the warm cabin air neither of which is available in the ‘plans’ heaters.

The system I built is it completely solved the cabin heating of my plane and now have tremendous amounts of exhaust free heat. The air is recycled in the cabin so the longer it is in operation, the hotter the cabin gets. Make sure you have a way to slow the fan down otherwise you will cook in the winter.

NOTE: this install does not take the place of an engine oil cooler. It does not have any overboard outlet so you will still need an external oil cooler. It is a quick and EZ install to solve the problem without modifying the plane in any structural way. Ideally, for a new install, you can build in the ducts use only one cooler for both engine cooling and heater needs.

FINALLY I can fly up north in the winter for holidays and not freeze. My mother is happy too, as I told her I would NEVER fly up to PA in the winter as I was just TOO cold in my plane. Now I can!

Installation Costs:

The cost to upgrade your heat system is minimal.

- You’ll need a small oil cooler (mine was left over from my engine upgrade),
- West Marine bilge blower (\$60),
- A rotary switch,
- Some relays, connectors, wire, fuses.
- Nichrome wire if you want to make your own resistor network for fan speed control.
- Finally some fitting and hose for the oil
- [Perma-cool external vernither website](#) Install Instructions (.pdf)

Most of the items I already had sitting around the shop. The Perma-cool remote oil thermostat to regulate the amount of cooling provided by the external cooler so the

interior heater remains at a constant 185F. It is critical for cold weather operation as you excessively cool the engine oil with both units in operation.

<http://store.summitracing.com/default.asp?target=partdetail.asp?part=PRM-1070>

Operation:

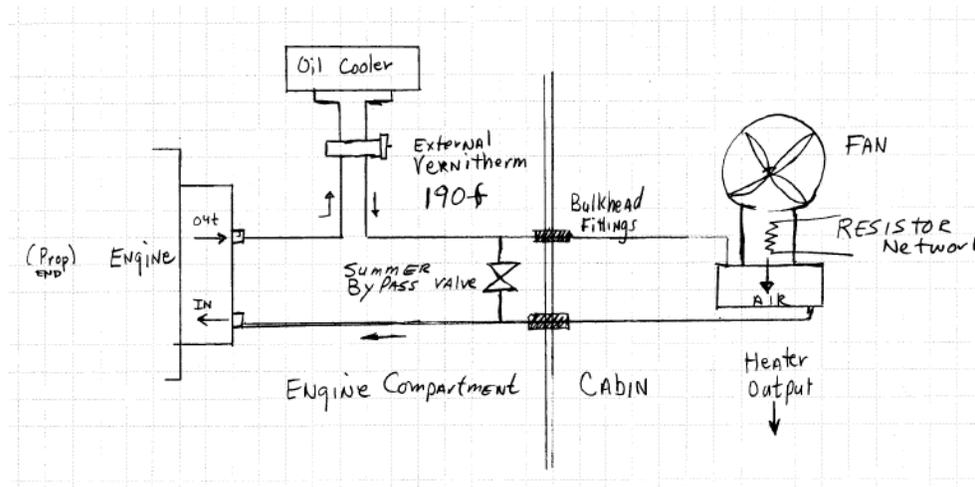
Note:

Engine oil cooler will be termed the “cooler”.

Cabin oil cooler will be termed the “heater”

In operation, oil only flows from the engine (center fitting of accessory case) to the cooler/heater at an oil temp of >185 F (as controlled by the engine veritherm). It first flows to the oil heater. The cooler veritherm controls the quantity of oil flowing through the cooler (essential to keep the oil temp hot in the winter). If the oil temp is <180 F the oil bypasses the cooler, if > 190 F the cooler veritherm closes and directs oil into the cooler. The cooler veritherm is essential to ensures the oil leaving the cooler is 185 F (summer or winter). The oil then leaves the cooler, enters the cabin supplying the cabin heater. You'll remove some more heat and the oil returns back to the engine return (the fitting near the oil filter).

The reason for both veritherms are installed: the engine one bypasses the oil cooler/cabin heater system until the engine oil is warmed up to 185 F. This protects the oil filter from the high viscosity of cold oil. The cooler veritherm regulates the oil flow to maintain 185 F in the winter when you have ice cold air through your external cooler while you are also taking lots of heat away from the system in the cabin. Your system is completely automated, and there is no need to cover the oil cooler in winter to maintain oil temperatures.



Installation:

First let me say, this install can be as EZ or as complex as you want. A fan and heater core box can be made outside the plane. The hoses can be routed though the hell hole

(with bulk head fitting or not), and the wiring is easy. The heater can be set in the back seat area, in the nose, or installed with duct work. I elected to do a more permanent installation with the heater in the back and ducts to the nose.

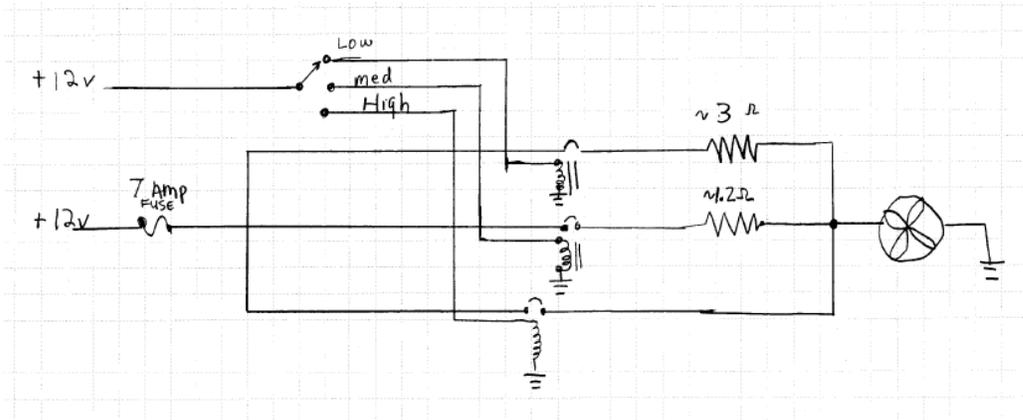
Jack Wilhelmson, installed his "heater box" in his Cozy 3, behind the front seat rest and tied his into the original cozy heat ducts. He pre-built the heater box, and we installed it in the plane in about 3 hrs (for hoses and wiring).

I elected for a more little complex install under the rear seat thigh support. I was able to package the heater core, fan, resistor network in a previously unused area. The heater exhaust manifold is used to direct heat to the foot area of the pilot, and the eye ball vent control volume and direction for the passenger. Overall weight about 9 lbs. Current requirement <5 amps. Build time: 1 wk. Install time: 7 hrs.

Instead of trying to describe what I did, just look at the pictures to see how to adapt it to your plane. I used 1/2" thick walled tubing between the firewall and the cooler and hoses on the engine side and covered them with fire stop. The lines get very hot (oil temp hot) so you need to put them in a duct or somehow shield them from the passenger's body parts. You can use hoses, but I would recommend getting them professionally made to avoid leaks at the fittings (sometimes it is a problem for self built hoses).

Fan Speed Control:

I decided to go the EZ and cheap way. A resistor network. I made my own (\$0) after finding Toyota wanted \$19 for one. I happened to have some nichrome wire sitting around. Just hooked some up the fan (12v->nichrome->fan->ground) with alligator clips. By changing the length of nichrome wire the fan will change speed. When a comfortable fan speed is found, cut the wire off, and wrap it around a screw driver to make a coil. It took about 4" for slow speed, and 1.5" for med speed. You might even try SS safety wire as I have used it for resistor bridges before. Crimp the ends in some 1/4" push on connectors and flox the network into the discharge of the fan to help keep the resistors cool. Wire them up according to the diagram. Overall I found the bilge fan only takes about 4 amps max, so you probably don't even need the relays (cars don't have them). If I did it again, I would just direct wire them to a heavy duty switch, or go to the junkyard to recycle a switch from a car.



Bypass Valve

This is optional. It allows the hot oil to bypass the cabin area in the summer (if you live in the south like I do). Nothing wrong with not installing one, but where I live cooling is generally more an issue than heating for most of the year. In spring you open the valve (bypasses the cooler), in fall you close the valve.