

### **About carburetor heat:©**

You may not be familiar with is a NTSB study showing that there are 35 'unexplained' engine failures every year. By the time the airplanes are inspected there is no 'explanation' for the engine stoppage. NTSB suspects carburetor ice. If your life's ambition is to become an old pilot, I would become sensitized to the conditions causing carburetor icing; sensitized to the first unexplained drop in rpm; and start using anticipatory carburetor heat .

Carburetor icing occurs when the air/moisture/temperature in the carburetor is modified after ingestion so as to be capable of freezing moisture and adhering it to the internal parts of the carburetor. The initial effect of adding carburetor heat will be an even greater loss of power, soon to be followed by a rough running engine, and an increase in rpm as ice is removed as water. The final increase occurs when carburetor heat is removed.

I often use carburetor heat as a cruise descent device. It will decrease power by about 200 rpm and allow a fuel saving leaner mixture throughout the descent. You can reduce some power as well. Don't mess with the trim. You will probably be leveling off at pattern altitude on arrival and by just removing carburetor heat or adding power you are already trimmed for level. When conditions warrant, I use carburetor heat when rolling into position on the runway for takeoff.

There are exceptionally cold times when you should not use carburetor heat. Partial heat applications are never recommended. Carburetor heat use should be limited to operational checks while on the ground as a standard procedure since air going to the carburetor will be unfiltered and allows dust and abrasives into the internal engine. However, some ground temperature dewpoint conditions may require the use of carburetor heat on the ground, regardless. Having a carburetor air temperature gauge is highly recommended to increase awareness and accuracy in the use of carburetor heat.

Carburetor heat is intended as a preventative rather than a cure. Heat should be applied early and fully. On first start, there may not be sufficient heat to either prevent or melt any carburetor icing. Leaning will raise engine temperature. The more moisture in the air, the greater the likelihood of icing. A humid hot day is just as likely to cause icing as is a cold day with water on the ground. When conditions indicate that icing is likely, the prudent procedure is to apply carburetor heat in anticipation rather than as reaction. Using the carburetor heat every time you reduce power is a good operating procedure and much safer than the POH suggestion for use when required.

When carburetor heat is turned on there is normally a slight drop in rpm because heater muff heats the air going into the carburetor. Hot air has a lower density which means less oxygen is getting into the engine. The mixture of air and fuel is made richer. On occasions when the outside temperature is quite near that of the engine, no drop in rpm may occur. This is normal because the expected drop in rpm is due to a marked difference in outside air temperature and engine heated air. Some pilots will add power prior to the use of carburetor heat so maintain engine temperature and power should a sudden ingestion of water occur. More conventional wisdom indicates that such power involves movement of the carburetor butterfly and may result in sudden blockage and engine failure. Pilots have been surprised by sudden engine roughness or

stoppage in what they considered to be non-icing conditions. The temperature inside the carburetor can drop to freezing level in the carburetor venturi making ice a possibility in all but the driest air conditions.

There is more to becoming an old pilot than just being lucky. The concept of relative safety extends itself to all matters of flying. The emergency procedures for engine failure in all carburetor aircraft includes the application of carburetor heat, immediately and fully. Required pilot knowledge should be knowing why you use carburetor heat in this way, what the effect will be in the near term and what future benefit is to be expected. The initial effect will be an even greater loss of power, soon to be followed by a rough running engine, and an increase in rpm as ice is removed as water. The final increase occurs when carburetor heat is removed. Failure to understand what is happening and what to expect can be a fatal deficiency.

The carburetor on a Lycoming engine is mounted at the very bottom of the engine in such a way that any heat it gets is from direct contact with the engine and very little from elsewhere. The engine's putting out enough heat at higher power where the use of carburetor heat will prevent the formation of ice in the carburetor and given time it'll melt any existing ice. Even the position of the butterfly valve helps. Carburetor ice can occur at any power setting, it is most likely to occur in the green arc.

In Continentals the carburetor is suspended below the engine so that there is no residual heat transferred between the engine and the hanging carburetor. Lycomings, on the other hand, have the carburetor secured to the oil pan. The carburetor is heated by the hot engine oil. For this reason Piper recommends carburetor heat be used only as necessary. The pilot determines just where and when necessary exists. Lycoming engines are much less susceptible to carburetor icing than Continentals because of their design. However, because of pilot complacency, the icing of a Lycoming is going to be more traumatic.

Any recommendations regarding the use of carburetor heat should be qualified by reference to the specific model of aircraft. Cessna POH's usually recommends carburetor heat in operations below the green arc, Piper does not; instead, Piper's usual recommendation is to use only when indicated. The reason behind the operating differences has to do with the way the carburetor is mounted below the engines and operational experience.

Just where icing occurs in the carburetor is a variable. Icing can occur before the butterfly, in the carburetor intake, on the butterfly valve or afterwards. When impact icing blocks the air intake filter as induction icing, then the carburetor heat source serves as alternate air for the engine. The different design of carburetors, engines, and induction systems all make a difference however indeterminate. Some cowling designs are better than others in reducing the occurrence of carburetor ice.

Using the carburetor heat every time you reduce power is a good operating procedure and much safer than the POH suggestion for use when required. Some aircraft are equipped with a carburetor air temperature gauge to warn if the internal temperature of the carburetor is conducive to icing. This serves notice to use carburetor heat as the icing preventative which is its primary purpose. Carburetor heat effects engine operation and power only as does a higher density altitude. No harm to the engine

occurs beyond that which may occur through the ingestion of unfiltered air. It is never wrong to use carburetor heat as an icing preventative prior to any power reduction. The use of carburetor heat is too late if the engine has become cooled to the point where it is unable to melt any existing ice. If you need as much engine heat as you can get, set up a climb attitude even if you cannot climb. This will be a much better option than one that would increase speed and engine cooling. Aggressive leaning and use of the magneto switch to cause a backfire are emergency measures.

At idle power, in the air or on the ground an aircraft can ice up in a very short time. There is no logical safety reason behind the concept of removing carburetor heat on short final as a go-around safety measure. There is nothing so urgent about a go-around that makes it necessary to remove carburetor heat prior to landing as a time saving or safety procedure. The closer to the ground you are when initiating the go-around the greater will be the ground effect and aircraft acceleration. The go-around is initiated first with a mixture check, full throttle, and finally with carburetor heat. Always first with the most. These forward movements can be accomplished nearly simultaneously in one motion.

There are two very important training aspects related to carburetor ice and the use of carburetor heat. First, the pilot must train to be aware of the weather conditions that have a proclivity for causing carburetor icing. Being aware of the likelihood is the primarily aspect of the anticipation required. Recognition is important but it comes after the fact. Depending on the circumstances, after the fact, may be too late. Like pitot heat, prevention is the name of the winning game. Waiting five minutes for pitot heat to remove ice can be done, not easily but 'do-able'. Carburetor heat will not allow the time because as you lose power you are losing the engine's ability to produce the required heat. Planning your options now is better than a spur of the moment decision that can be wrong.

There are no complex operations in flying for which there are not several simple, straight forward, and WRONG ways to perform. One such combination of operation and solutions is the use of carburetor heat. The warning indicators for the need of carburetor heat are deceptive, variable, and inconsistent. The actual application of carburetor heat will produce results that are deceptive, variable, and inconsistent. Every student pilot is going to have opportunities to make carburetor heat mistakes. The learning process will consist of both successes and mistakes in the use of carburetor heat. The training process is designed to reduce the probability of a mistake resulting in an unpleasant event. It takes an act of faith to stay with your initial application of carburetor heat when it only makes things worse. Very often the worst thing that can happen to a pilot is to 'get away' with a mistake. this applies to the use of carburetor heat as well as any other aspect of flying.

**Instructional aid:**

The simplest demonstration of venturi action coming from accelerated air and lower pressure can be done with two sheets of paper. Suspend each sheet from one end between the thumb and forefinger of both hands. Hold the sheets about two inches apart so that you can blow between the sheets. Blow and observe that the sheets close together. You have created a venturi and made it work as such. Put a few drops of gasoline on the back of your hand and then wave the hand about. Notice the cooling effect. With these two experiments you have most of the

essentials for carburetor icing. Lacking are only the evaporative powers of the fuel and the presence of moisture. Try it.