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COMMENTARY / THE CLASSIC INSTRUCTOR

Carburetor Heat

Problem, solution, or a question mark

BY STEVE KROG

I WAS FLYING ON a sunny winter day. The temperature was about 45 degrees Fahrenheit, humidity 48 percent, and the temperature/dew-point spread was 6 degrees. Suddenly it got quiet. No warning of any kind. The preliminary speculative cause — "carburetor ice," explained the pilot.

This situation occurs more often than one would speculate and is not exclusive to the northern climes. It can and does happen in most all areas throughout the United States.

The carburetor heat system and its function are probably the most often used but least understood system in the whole airplane. When checking the fuel system, for instance, the fuel valve is "ON," and for most of those aircraft with a mixture control, the control knob is pushed to full forward. The engine starts and runs, so the fuel system works.

The same can be applied to the brake system. Once the engine is started and you begin to taxi, a light even tap on the brake pedals will tell you if the brake system is working.

But the carburetor heat system is quite different. It doesn't necessarily tell you if it is working properly or even only partially so. Without a more thorough understanding of the system, the pilot doesn't know if it is functioning as it was meant to do.

Why do we check carb heat? To see if we have carb ice is the usual response. How do we tell if we have carb ice? The rpm will drop. How long do you apply carb heat? It's not good to apply it for more than a few seconds on the ground because the intake air is not filtered is a common response. How do we know then if we had carb ice and got rid of it? Blank stare. The biggest mistake I see is that the carb heat isn't left on long enough to determine if there might be any carb ice. A two or three second application only shows an rpm drop

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How do we check for carb ice while in flight? Apply carb heat. Okay, but what are we looking or listening for? If we happen to have some carb ice, the rpm will show a decrease and then a slight increase. The engine may run a bit rough for a few seconds, too. What do you do as the pilot in command if the engine begins running rough? Again, a blank stare.

Little time during the training of a sport or private pilot student is spent on truly understanding carburetor ice. We're taught to follow the checklist but never think beyond it. We apply carb heat, check for an rpm drop, and then remove the carb heat for the pretakeoff check. Then, when entering the traffic pattern for landing, the pre-landing checklist calls for applying (or checking) carb heat. When asked why, the student usually comments that we do this to prevent carb icing. Throughout the hour or so of the dual flight, the student never once checks for carburetor ice because it isn't called for on the checklist.

When is carburetor icing most likely to occur? Before answering that question, the cause of carb icing needs to be understood. A huge rush of intake air is being forced into the restricting carburetor venturi, significantly lowering the air temperature. At the same time, atomized fuel is introduced into the venturi. These two elements together can cause a temperature drop of up to 70 degrees Fahrenheit (40 degrees Celsius) in the venturi. Add to that fuel/air mixture a bit of humidity and there is a significant potential for carburetor icing.

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Before a student is allowed to solo at our flight school, they must know how the carb heat system works, why we have and use it, and then verbally explain the system. We also spend a lot of time practicing simulated engine loss in the traffic pattern.

Then when preparing a student for the private pilot checkride, we spend a good deal more time reviewing and understanding all aircraft systems. The fuel system, hydraulic system, air induction/carburetor system, and carburetor heat system. If one is to be a safety-oriented, conscientious pilot, it's important to know and understand the systems before leaving the ground rather than trying to figure them out while in the air.

Ask most general aviation pilots when carburetor ice is most often to occur, and they will tell you when the outside air temperature is around the freezing level. Sadly, that belief has destroyed or damaged many good airplanes over the years.

Shockingly, carb ice can accumulate when the outside air temperature is as high as 80-90 degrees Fahrenheit. Of course, there needs to be some humidity in the air as well for this to occur. According to data I have reviewed, if the humidity is at about 35 percent or greater, there is the potential for carb ice to form.

A simple rule of thumb to follow as a GA pilot is to check the outside temperature before the flight and subtract 70 degrees from it. Then check and confirm the humidity percentage. If it is about 35 percent or greater and the temperature you have calculated by subtracting 70 degrees from the outside air temperature is 32 degrees Fahrenheit or less, you have a condition that could cause carburetor icing.

What are the first telltale signs of carb ice while in flight? Usually, one will notice a slight drop in the rpm setting. A pilot's first reaction will be to push the throttle in a bit more, bringing the rpm back to the desired cruise flight setting, but several minutes later, the rpm will have again dropped. Many pilots would just continue to advance the throttle while failing to recognize the buildup of carburetor ice.

When finally realizing that carb ice has accumulated, carb heat is applied. The engine spits, sputters, and runs quite rough, causing the pilot a good deal of anxiety. To alleviate the anxiety and get rid of the carb ice, the best thing a pilot can do is leave the carb heat ON. If a mixture control is installed in the aircraft being flown, lean the mixture until the ice is gone and the engine runs smoothly again. This is done because the restricted fresh airflow is causing a much too rich fuel/air mixture, adding to the engine roughness. Once the carb ice has melted away, readjust the mixture for the desired cruise flight setting.

Many of the single-engine pleasure aircraft we fly do not have a mixture control. Normally these airplanes have the carburetor adjusted for fairly low altitudes about 3,000-5,000 feet AGL in your geographic area. This shouldn't cause a problem when adding carb heat in flight. The J-3 Cub or the 7AC Champ are good examples of aircraft of this type.

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There can be a notable difference in how an engine handles carburetor icing depending on the engine manufacturer. We have two types of engines for our small aircraft, Lycoming or Continental. The Lycoming engine is designed to have the carburetor mounted to the bottom of the oil pan and the intake tubes running through the oil pan. Consequently, some heat is provided not only to the carburetor but also to the fuel/air mixture leaving the carburetor.

The Continental engines have the carburetor mounted in front of the oil kidney, so it is not getting any heat given off by the kidney. These smaller Continental engines are a bit more prone to experiencing carb icing.

Depending on the make and model of the aircraft you're flying, the manufacturer's recommendations for carb heat application may differ. For cold weather operations, some may recommend applying carb heat during takeoff until in the air and the engine is developing what appears to be full power. Then remove the carb heat.

Other manufacturers may state that carburetor heat should be checked but never left on when reducing power and landing. It is important that you get to know your aircraft and the manufacturer's recommendations to ensure continued safe flight.

Many of the pleasure aircraft we fly were manufactured in the '40s and didn't come with a pilot's operating handbook. Aircraft type clubs are a good source for tracking down information about your aircraft and recommendations for dealing with carburetor icing and/or cold weather operations.

Here at our flight school in southern Wisconsin, we follow the rule of thumb of applying carburetor heat when reducing the power below 1800 rpm on all of our Continental-powered aircraft. And we apply it before making the power reduction. What good would we get from the carb heat if the engine is already at a much-reduced power setting? Then, when returning to either the cruise or full-power setting, carb heat is removed after applying power. If flying in conditions conducive to carb icing, I want to hit the carb venturi with a good hot blast of air after being at idle or a reduced power setting for a period of time.

One last rule of thumb we employ when doing pattern work in cold weather conditions is this. Never reduce the power to full idle until you are over the runway. Keep the engine rpm at 100-200 above idle during the approach to land so that the engine is generating a bit of power but, more importantly, generating heat. Should a power increase be needed to make the runway or correct for a go-around, the engine will respond as needed.

And finally, if you have some time, do a Google search for a carburetor icing chart. There are a number of them available. You'll be amazed at the temperature and humidity ranges where carb ice can occur.

Be a vigilant, safe pilot and continue to learn to be proactive. EAA

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