



Carburettor icing is a potential killer in VFR and IFR operations, writes John Chesterfield.

**E**XAMPLES ABOUND world-wide of fatal accidents in which carburettor icing has been cited as a primary cause.

The carby is designed to deliver the correct amount and ratio of fuel and air to the engine cylinders. It is the primary means of controlling power in engines, including those in most light aircraft, without fuel injection.

It is also a very efficient refrigerator.

Water vapour in the air passing through the carburettor can freeze. If the relative humidity is high, ice will form in the carburettor at ambient air temperatures as high as 35° C.

When the throttle is open and when the relative humidity is high, ice can form in the venturi, restricting air flow. This reduces power without the pilot's control.

If enough ice forms, the venturi throat can be completely blocked, causing total engine failure.

When the throttle valve is closed to lower the power during a descent or practice forced landing, for example, ice will form at the edge of the throttle valve in the area of reduced pressure and fuel vapourisation.

To overcome carburettor icing, engine

manufacturers provided a system to heat the incoming air and prevent water condensation. A metal "muff" around the hot exhaust system leads the hot air to mix with the normal induction air downstream of the air filter which keeps abrasive dust out of the engine.

The pilot controls the mixing of heated air with a carby heat control, which moves a valve to adjust the amount of hot air passing into the induction system.

**Indications:** If ice forms in the carburettor of a fixed pitch propeller aircraft, the restriction to the induction airflow will reduce power and force a drop in RPM, which might be accompanied or followed by rough running as the fuel/air mixture ratio is upset.

If RPM drops unexpectedly, apply carburettor heat fully and immediately. The hot, less dense air will initially cause a further drop in RPM. If ice is present, the hot air will melt it and the RPM will rise again.

De-select carburettor heat to restore normal power, but then apply it intermittently to prevent further icing

If you delay applying carburettor heat until the engine runs rough, the exhaust gas temperature might not be high enough to produce hot air in the exhaust muff,

and opening the carby heat valve will not melt the ice.

Carburettor ice in engines driving constant-speed propellers is insidious, lacking the telltale RPM loss at cruise power settings. That's because the constant speed unit moves the propeller blades to a finer pitch to compensate for the RPM drop.

There might be a slight drop in manifold pressure but this might not be obvious. As the engine power continues to drop, so does indicated airspeed. This might be noticeable, but if the pilot misses it, he or she will not pick the problem up until the engine starts to run roughly. Engine failure and loss of hot air capability might follow rapidly.

Low power settings: Throttle valve ice can form rapidly at low power settings even when the humidity is relatively low. The indications of ice formation in this case will probably be the same for both fixed and variable pitch propeller aircraft. At low power settings, the variable pitch propeller will be on or close to the low pitch blade stops and react like a fixed pitch propeller.

If operating at low power settings, in prolonged cruise descent or practice forced landings, for example, select full

# New Carburettor icing-probability chart

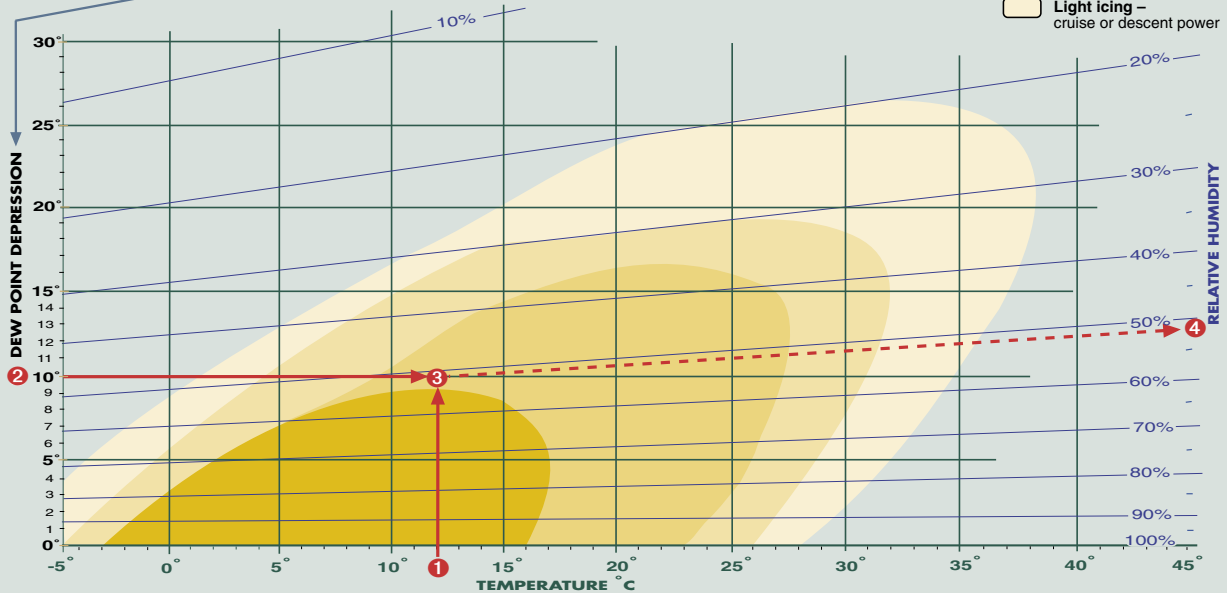
To work out dew point depression:

$$\text{Temp} \text{ Minus Dew Pt.} = \text{Dew Pt. Depression}$$

**To use this chart:**

- obtain the temperature and dew point
- calculate the difference between the two. This is the 'dew point depression'
- for example, if the temperature is 12° C ① and the dew point is 2° the dew point depression will be 10° ②
- for icing probability, refer to the shading legend appropriate to the intersection of the lines ③
- for relative humidity, refer to the right hand scale ④

- Serious icing – any power
- Moderate icing – cruise power; Serious icing – descent power
- Serious icing – descent power
- Light icing – cruise or descent power



carburettor heat with throttle closure and check the engine's response to throttle movement frequently – on passing each 1,000 ft in a descent, for example.

You can predict carburettor icing with reasonable certainty and take preventive action.

Intuitively, cloud or rain and operation at low power settings are preconditions for the formation of carby ice, so use carburettor heat continuously.

Charts based on knowledge of dry (ambient) air and wet (dew point) air temperatures, or relative humidity, from met forecasts help you predict carburettor icing. These data appear in METAR forecasts for specific locations – METAR YBCG 120730Z AUTO 30011KT 9999 // // // // 32/06 Q1008 RMK RF00.0/000.0 CLD:CLR BLW 125, for example. In the figure shown, 32 is the dry bulb temperature (32°C), and 06 is the wet bulb temperature (6°C), giving a dew point depression (dry bulb minus wet bulb) of 26°C.

You can read the probability and likely severity of carburettor icing (for various power settings) off the chart from the dew

point depression temperature and the ambient (dry bulb) temperature. Or you could use the chart above.

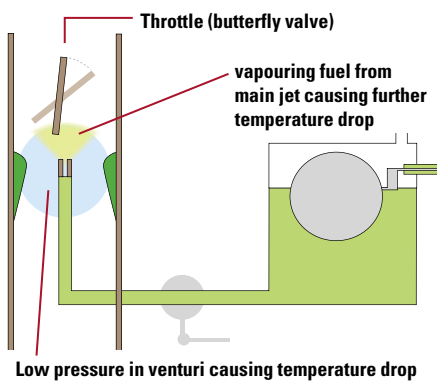
On the web version you can enter different data for typical winter conditions in your part of the country. The results might surprise you.

**Carburettor heat:** If a carburettor air temperature gauge is fitted to your aircraft, you may use the carburettor heat control at intermediate positions to maintain the air temperature above the level at which icing might occur (usually shown as a yellow band on the air temp gauge). Without this optional extra, you must use full carburettor heat continuously or intermittently to ensure that the induction air temperature is high enough to prevent icing.

However, don't use carburettor heat at maximum power, at take-off or missed approach, for example, because the combination of high induction air temperature and high manifold pressures could cause detonation, possibly causing major engine damage within seconds.

*John Chesterfield is a former head of training for the RAAF.*

**Cruise, max-power condition**



**Low power condition**

