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Carburettors

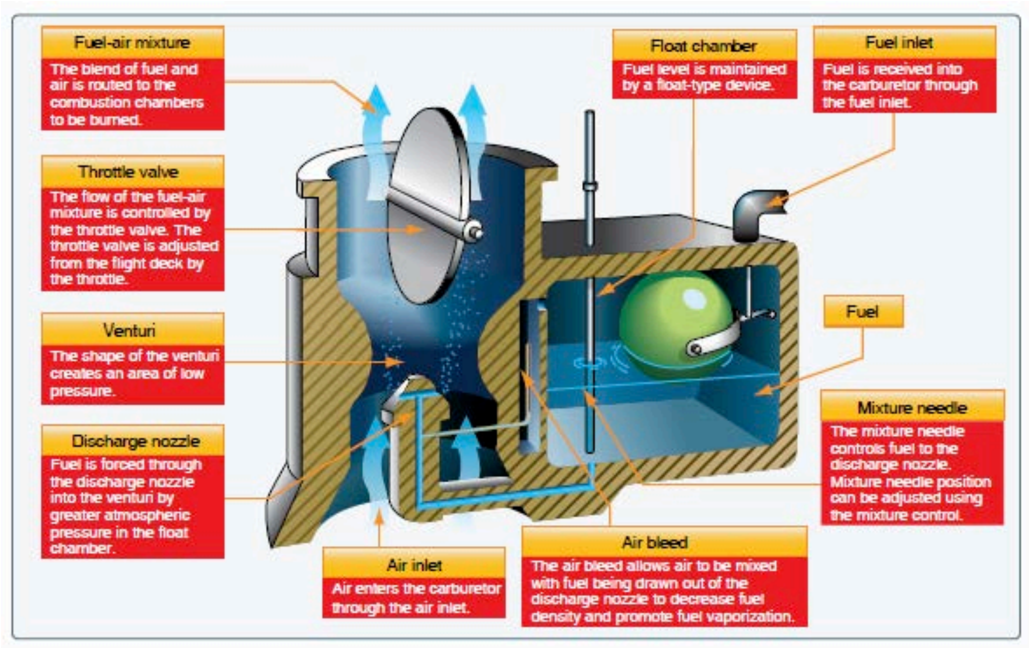
Contents

Introduction

The carburettor is an essential part of the engine components of the Cherokee, and of many other light aircraft. Because combustion in the cylinders relies on a mixture of fuel and air (1:14.7 for the chemically correct or stoichiometric mixture), we need a method to deliver a charge of air and fuel to the cylinders.

Highlighted in yellow we have the updraft carburettor on the Cherokee’s Lycoming O-320. Fuel flows through the brown fuel lines into the carburettor, while intake air flows in the side. The fuel-air mixture then flows upwards into the engine.

Principles of Operation



The carburettor relies on the venturi principle – when a fluid, such as air, passes through a restricted section, the velocity increases, and the static pressure decreases.

In a float type carburettor, such as in the Cherokee, fuel sits in bowl or chamber, with a float used to keep the level constant. Air flows from the air inlet towards the cylinders - the engine creates a partial vacuum on the engine side, with the pressure differential causing the movement of air from high pressure to low pressure. As this air flows past the venturi, the reduction in static pressure causes the fuel to flow out through the discharge nozzle, with the vapourised fuel mixing with the air.

You have three engine controls related to the carburettor.

The throttle, conventionally black and smooth, controls the position of the throttle butterfly valve, which determines how much air / fuel mixture flows to the engine. The diagram above shows the butterfly in the full closed position – minimum air will flow past the butterfly, and the engine will produce minimum/ idle power.

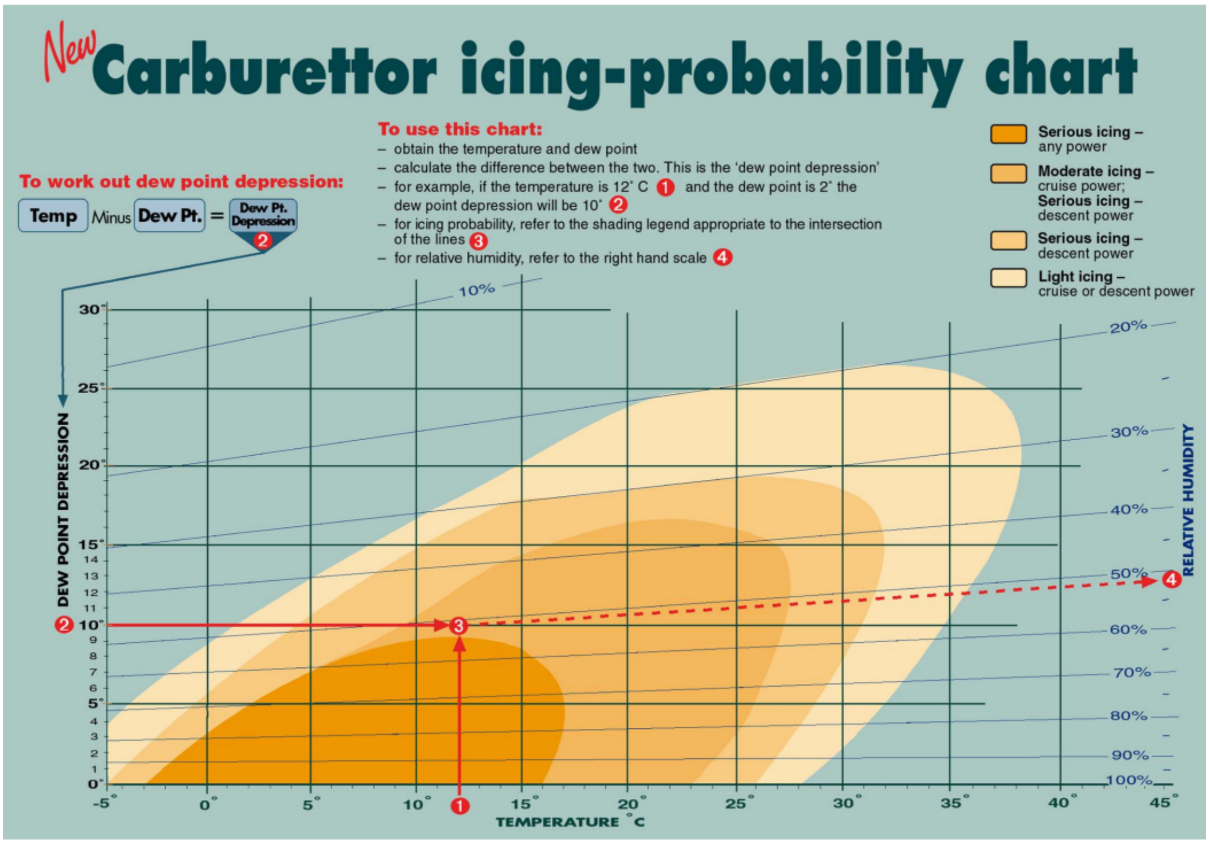
The mixture, conventionally red and crinkled, controls the position of the mixture needle, which determines how much fuel will flow from float chamber to the discharge nozzle. At idle cut off, no fuel will flow, and the engine will stop. You should lean the mixture in the cruise as per the POH, in order to improve efficiency and power output.

The carburettor heat changes the source of air for the air inlet from the ambient air to the exhaust air – see below on carburettor icing.

Also shown is the **primer**. These squirts fuel directly into the intake manifold, bypassing the carburettor, and is used for starting, particularly when cold, as the cold fuel will not vapourised as easily in the carburettor.

Carburettor Icing

As per the combined gas law, the reduction in pressure through the venturi also causes a reduction in temperature of up to 20 degrees or more. If the air / fuel mixture is cooled to its dewpoint temperature, and this is below 0 degrees, then water may be condensed as ice around the venturi, blocking the flow of air, and potentially stopping the engine.



We have the carburettor heat to redirect the intake air into the carburettor from being sourced from the ambient air to the exhaust air. This hot exhaust air should melt any ice that has formed. However, you should generally not use the carburettor heat unless you suspect icing, indicated by rough running, as the hot air is less dense, and reduces the available power.

Reference Material

Piper PA28 Pilot Operating Handbook – Particularly Section 7 (Systems Description).

Lycoming O-320 Operator’s Manual

FAA Pilot’s Handbook of Aeronautical Knowledge – Section 7 – Aircraft Systems (Available free online – more in depth than most Australian textbooks)

Trivia

- While the typical float type carburettor is unable to be used for extended periods of inverted flight, a pressure type carburettor was developed during World War II to allow inverted operation. Although this was a form of fuel injection, it still relied on the venturi principle.

- The combined gas law relates the temperature, pressure and volume of a gas – it can be expressed as $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$.