Carburettor Icing On UL Engines

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1) General information:

Carburetor icing with the dreaded consequences like engine failure and emergency landing happens unexpected and without warning.
The following explanations should help to clear up the matter and to point out preventive measures.

Generally, distinguish between two completely different situations, actually the formation of ice in float chamber and icing on venturi:

2) Formation of ice in the fuel system and in the float chamber:

The water in the fuel will collect in the lines and at the bottom of the float chamber, since water is heavier than the fuel. At temperatures below zero this water will freeze, blocking most likely the main jet with consequent engine stop straight afterwards.

As the contradicting demands on fuel, once for good transition behaviour on a cold engine and the one for low inclination for icing, can't get by with the saturation characteristic on its own, nearly all the registered fuels marketed by the larger oil companies contain anti-icing agents.

As preventive measure, plan installation of a water trap, generally combined with fuel filter and regularly maintained, between fuel pump and carburetor. The fuel lines have to be routed with continuous descent towards water trap.

Additionally, inspect float chamber for dirt and water at every periodical check.

◆ NOTES: Anyway, to ease the engine start after an out-of-operation period of 1 to 2 weeks, it is highly recommended to drain off the old fuel and replenish with fresh one, as all the easy volatile ingredients of the petrol, essential for easy engine start, have long been evaporated.

Prior to a longer out-of-service period drain carburetor and fuel system.

With increasing alcohol content, the water absorption power of the petrol rises too. Part of this water segregates again and will settle around the main jet.

With proper maintenance and observation of the quoted points, you will not encounter this problem.

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3) Icing on the venturi:

Carburetor icing in the vicinity of the venturi and at fuel egress in carb, due to flow expansion and cooling down because of loss of heat by the evaporation process of petrol.

This problem might occur already below +15°C (60°F) [(mostly between 2°C (36°F) and 8°C (46°F)] and becomes acute especially at high humidity of air and can be extremly treacherous for the pilot, as completely unexpected at this temperature level.

3.1) Explanatory details:

At the atomization of the fuel in the carburetor and the subsequent vaporization, heat is withdrawn from the surrounding components of the venturi. The raised speed of the airflow combined with the pressure drop in the venturi intensify the heat loss, causing in extreme cases a temperature drop of as much as 20°C (80°F).

This leads to the precipitation of the water in the humid air aspirated. At temperatures low enough with humidity of the air still sufficiently high, formation of ice might take place on the inside of the carburetor at certain operating conditions.

Distinguish between:

— Formation of ice bordering the smallest section of the venturi at low load, possibly leading to engine stop at idling due to shortage of air

— Icing of the mixing tube, possibly leading to loss of performance at continuous full load, due to lack of fuel.

Prevention:

Generally alcohol composition in low concentration is used to lower the freezing point of the humidity in the air charge, accordingly. Also fuel additives acting on surface to reduce adhesion of the ice on the surface concerned, are used.

Never the less, refrain from further additives as todays fuels, especially unleaded fuel contain already up to 10 % alcohol to increase octan rating (besides some aromatics as substitute for lead), which again increase the cooling effect because of the 3 1/2 times bigger evaporation heat of alcohol.

3.2) For a better perspective read the following:

Evaporation heat and temperature drop of various fuels

Fuel	Evaporation heat		Theoretical temperature drop of the mixture without heat input	
	kcal/kg	Btu/lb	°C	°F
Petrol	80	144	20	68
Benzene	95	171	30	86
Ethane	220	396	83	181
Methane	284	511	140	284

4) Counter measures:

4.1) For prevention of water in the fuel pay attention to the following:

- ☛ use only quality fuel of a registered brand
- ☛ store fuel for short periods only
- ☛ install a water trap in the fuel system
- ☛ use a fuel tank furnished with water drain plug at the lowest point
- ☛ Frequently check and drain float chamber of carburator.

4.2) To avoid formation of ice, the following needs attention and leads to success:

- ☛ Aspiration of preheated air. On fan cooled engines duct warm cooling air to intake filter.
  On liquid cooled engines provide jacket around muffler for preheating of intake air.
  See sketch on page 4.
- ☛ External preheating of carburetor with warm air.

▲ ATTENTION: Preheating of carburetor with preheated fuel is not permitted.

Proposal for preheating of the carburetor on air- and liquid-cooled engines