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## Aviation Winter Safety pocket guide

# Ice Clear Vision

Our expert de/anti-icing team answer some common questions about winter safety. For more advice and guidance – or to discuss the perfect product for you – please visit [www.kilfrost.com](http://www.kilfrost.com), email [info@kilfrost.com](mailto:info@kilfrost.com) or call +44 (0)1434 320332.

## When does ice form?

The heaviest ice tends to form when the water content in the air is highest, so close to 0°C. This is a real danger time because it may not appear to be ‘cold enough to worry’ - in fact, as the temperature drops further, the air becomes drier so actually produces less ice.

## Why should commercial aircraft worry about ice?

It's true that commercial aircraft do fly at altitudes which are high enough above the cloud base to not be troubled by ice in-flight, but during take-off and landing exposed surfaces are at risk of ice and frost accumulation, and it is when the aircraft is actually on the ground that it's at most danger from winter conditions. Even a small amount of build-up can substantially degrade an aircraft's performance.

## What other kinds of ice are there?

Hoar frost is easier to spot but is all too often underestimated. It commonly accumulates on aircraft overnight, particularly when the sky is clear, and forms because the aircraft's body becomes cooler than the outside air. This process is known as radiant cooling, and while only a few degrees difference is needed, it's not uncommon for the aircraft skin to actually be as much as 5°C or, in very severe conditions, 10°C cooler than the outside air temperature. This is why frost will readily form on an aircraft even when the outside air temperature is as much as 4°C above zero.

## What about safety checks?

Initial safety checks are imperative, and you should give particular attention to critical surfaces like the flying wing, especially its leading edge as this is where the majority of the lift is produced. Most airports and major airlines will have their own operating guidelines, and where these differ we would always advise to err on the side of caution and if in doubt, treat the aircraft's exposed surfaces.

## Why is ice so dangerous?

If the leading edge becomes contaminated with ice, this has been shown to substantially reduce the effectiveness of lift. Contrary to some thought, it is not the weight of the ice which causes the problems, but the surface roughness – even something that's only as rough as the finest emery paper is enough to cause a distortion of the aircraft's aerodynamic properties.

## How do we de-ice an aircraft?

To de-ice an aircraft we need to remove the rough surface and leave the wings – particularly the leading edges – as clean as possible. There are various methods of de-icing but it's most common for an aircraft to be sprayed, and a number of fluids are available. De-icing fluids typically consist of glycol and water mixtures that are heated in advance and applied hot. The heat melts the ice while the residual glycol prevents re-freezing. The degree of protection against re-freezing depends on the type of liquid that is applied.

## What type of de and anti-icing fluids are available?

There are three core families of fluids: Type I, Type II and Type IV and they differ according to their function and the holdover (ongoing anti-icing protection) they provide.

### Type I

Primarily used for de-icing Type I fluids don't offer any significant holdover protection, so are often used as part of a two step de-icing / anti-icing procedure. A range of this type of fluid is available – Kilfrost offers four: DF Plus, DF Plus 80, DF Plus 88 and the first ever fluid derived from a sustainable source, DF<sup>sustain</sup>. The fluids are all coloured orange for ease of recognition, offer good sprayability with minimal foaming, and have a pH around 8.5 to 9.5. Type I fluids are always applied diluted and heated.

### Type II

Type II fluids can be used for de-icing purposes, but unlike Type I fluids, they also offer extended anti-icing holdover protection and can be used unheated and diluted or undiluted for anti-icing, heated and undiluted for de and anti-icing as a one step process, diluted with water and heated for de and anti-

icing as a one step process, or diluted with water and heated as the de-icing stage in a two-step process when used with unheated and undiluted fluid. We offer two types of Type II fluid: ABC-3 and the triazole-free ABC-K Plus. Both fluids offer good shear and storage stability and are non-hazardous and fully biodegradable. These fluids are a light straw colour for ease of recognition and have a pH around 7.0.

### Type IV

Type IV fluids offer maximum anti-icing holdover protection but can also be used for de-icing purposes, similarly to Type II fluids, Type IV fluids can be used in a variety of ways. Our new Type IV fluid, ABC-4<sup>sustain</sup> offers maximum holdover against freezing precipitation – especially snow – and can be used cold to prevent the build-up of frost, ice and snow, or applied hot as a one-step de and anti-icer. Very useful at airports which experience severe weather conditions and / or long taxi times, Type IV fluids offer extended holdover times, excellent aerodynamic flow off properties and good dry out characteristics, as well good shear and storage stability. These fluids are coloured green.

## How do de/anti-icing fluids work?

All of the fluid types are designed with a low immediate viscosity, and when applied to frozen deposits they melt and dissolve the ice which then drains away. With Type II and Type IV fluids, a small amount does remain on the wings, however, as the aircraft takes off this shears completely away to leave the wing clean and smooth.

Aircraft de/anti-icing is safety critical and there is really no reason to take a chance. Ultimately it is the pilot's responsibility to ensure that his or her aircraft is correctly and comprehensively de-iced, and that any fluid applied has sufficient holdover to protect it until it reaches altitude, but we all play our part in ensuring that the many thousands of aircraft worldwide operate safely.