

External condensation on windows appears mainly during clear nights with no wind and high relative humidity.

The better the heat insulation (lower U-value) and the more exposed to the sky the window is, the more frequently condensation is formed.

Self cleaning glass improves the view

The two windows (triple glazed high performance windows) below have identical U-values ($\sim 0.9 \text{ Wm}^2\text{K}$). Under certain weather conditions condensation is formed on the external surfaces of the glass. On the window to the right, which has an ordinary float glass surface externally, the condensation forms small water drops. Light is refracted by the drops, which causes light scattering and the external view deteriorates drastically.



The window to the left has the self cleaning glazing Pilkington **Activ** as the outside pane, and the external view is considerably improved. Furthermore, the condensation disappears much faster from the surface with Pilkington **Activ**, see picture below.



This leaflet is the result of co-operation between Pilkington and Uppsala University, where a project on external condensation is being conducted.



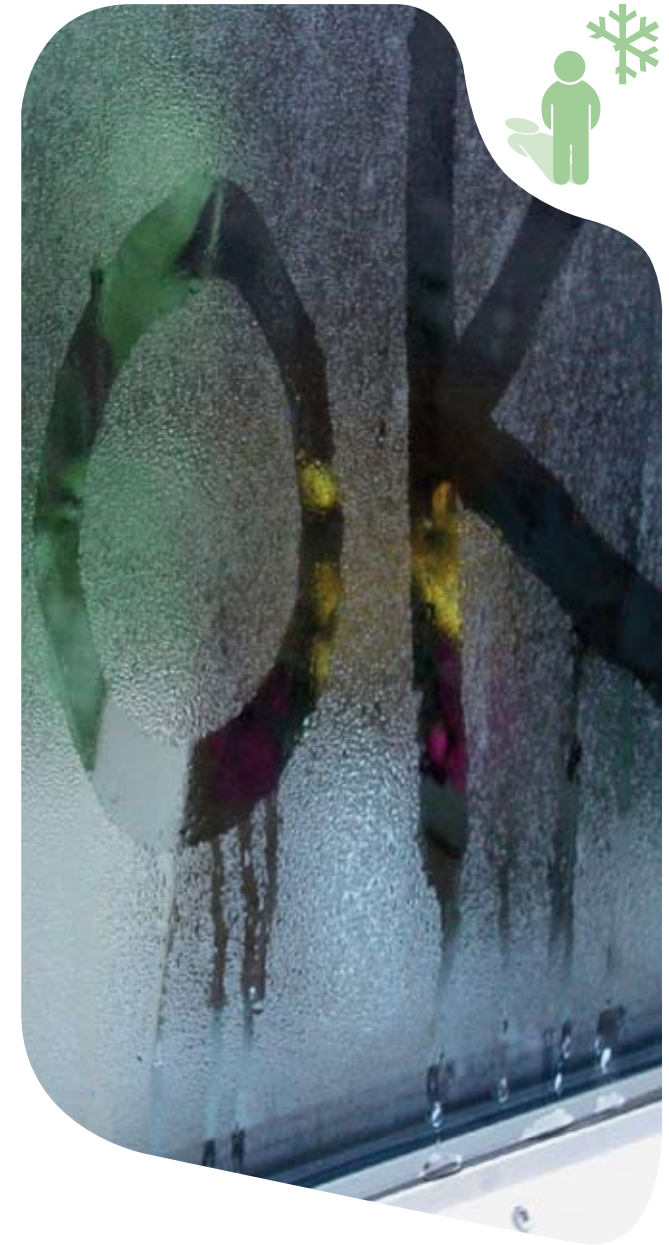
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External condensation is visible evidence of a low U-value and very efficient heat insulation



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The choice is between some condensation now and thenor higher heating costs, a higher environmental load and poorer indoor comfort

It would appear to be a simple choice, especially since the condensation is no more harmful to the window than a rain shower. This natural phenomenon mainly appears during the winter half of the year, and usually during the night. The condensation is still present in the early morning, but when it gets warmer during the day, it always disappears. There are a few measures that can prevent the formation of condensation and reduce the visual discomfort it may cause.

Shielding

During a clear night the sky temperature can be as much as 30 degrees lower than the air temperature, due to radiation losses to the sky. These losses can be reduced by various forms of shading, such as roof overhangs, external blinds, trees or nearby buildings. This reduces the cooling effect of the sky and thereby also reduces the risk of condensation.

Self cleaning surface

It has been demonstrated that the surface of the self-cleaning glass, Pilkington **Activ**, has two positive features influencing external condensation. The surface is hydrophilic,

which makes the condensed water form a film on the surface rather than small water drops. This reduces light refraction and scattering and the visibility is improved. It also makes the condensed water disappear from the surface much faster than from an uncoated glass surface. See pictures on the reverse side of this leaflet.

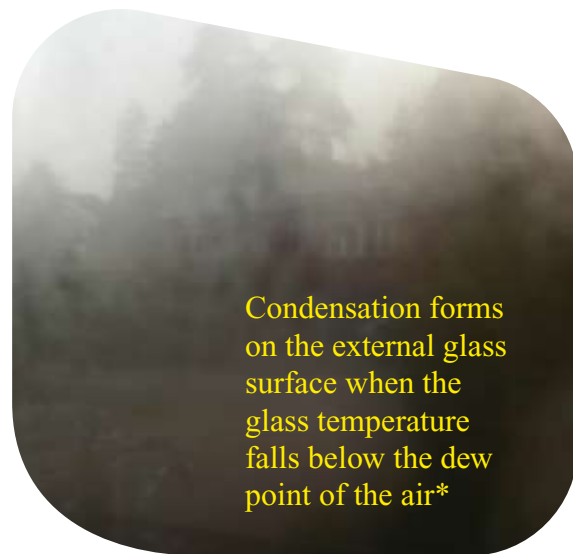


You have probably often seen how dew has formed on grass during the night. Dew can also be formed on the external surface of a well insulated window. This reduces the visibility through the window, because of light refraction in the small water drops.



In this case heat from the external glass surface is free to radiate towards the clear sky. Condensation can then often be formed on high performance windows during cool, clear nights with no wind, especially during the winter half of the year.

In this case condensation is rarely formed on high performance windows since the external surface is efficiently shielded from the sky by a blind, a tree and a nearby house.



Condensation forms on the external glass surface when the glass temperature falls below the dew point of the air*

A natural phenomenon

External condensation is a natural phenomenon, which can appear on all surfaces as soon as the surface temperature falls below the dew point of the surrounding air*. A familiar example is when condensation has to be cleared away from the wind-screen and rear window of cars in the morning after a clear night.

The same thing can happen on the windows when the cooling effect from the clear sky is not balanced by heat losses through the window. Modern double- or triple-glazed insulated glass units have such good heat insulation (low U-values) that this can happen during clear and calm nights. If external condensation appears on your windows, it is proof of a high performance window.

For external condensation to appear on a high performance window not only a clear and calm night is needed, but also high relative humidity, a relatively low temperature and free exposure to the clear sky.

* For certain air pressure and humidity, the dew point is the temperature when water vapour in the air condenses and forms water drops on cold surfaces or as mist in the air.