

## External Condensation

External condensation (often referred to as dew) is a natural phenomenon which can occur on all surfaces, but will only happen when the temperature of a surface falls below the dew point of the surrounding air. We have all experienced the formation of condensation on the wind shield of our cars in the morning after a clear night. In the case of a building this can happen when the exterior surface is thermally insulated from the warmer interior, and the cooling effect of the surrounding air and sky is not compensated by heat losses from the inside. Modern high performance windows (double or triple glazed units) have such a low thermal conductivity (low-U-value) that the external glass surface can reach a temperature below that of the surrounding air during a clear cloudless night with no wind.

The condensation of water on the external surface of a window results in the formation of small water droplets spread across the surface. This has a detrimental impact on the visual appearance of the window – particularly a loss of visual clarity when looking out of the window. The effect is caused by light scattering in the water drops and is shown in the photograph below.



**Photo showing visual impact of external condensation on glass.<sup>4</sup>**

External condensation on windows usually occurs under two scenarios:-

1. External condensation on poorly insulated windows in hot climates in air conditioned buildings [3]. In this instance the poor thermal insulation allows the exterior pane of the glass to be cooled to an extent where external condensation can occur
2. External condensation on well-insulated windows in cold climates [2]. In this instance the excellent thermal insulation qualities of the window prevent heat loss from the building resulting in a cooler external window temperature and the onset of external condensation

The first of these scenarios can be addressed by improving the thermal insulation of the window by improvements in the U value.

In the second case, however, the problem is exacerbated by the need to move to better performance windows. The use of Low Emissivity coatings and triple glazing

windows has resulted in very low U value windows. As a result of this higher thermal efficiency the external glass temperature is lower and the risk of external condensation increases.

External condensation is influenced by a wide range of external factors including for example:-

1. Outdoor temperature
2. Cloud cover
3. Wind direction and speed
4. Humidity
5. Surrounding buildings, trees etc

Whilst the construction and glass types used in a window can influence the occurrence of external condensation, its appearance is not an indication of any fault in the window and its detrimental impact is only limited to a loss of visual clarity. In actual fact external condensation is an indication of the high thermal efficiency of the window.

Work is now underway to identify whether coatings on the exterior surface of the insulated glass unit can reduce this loss of visual clarity due to external condensation. Initial results have demonstrated that whilst not affecting the onset of external condensation, the use of Pilkington Activ™ self cleaning glass can improve the visual appearance of the glass when exterior condensation occurs. Pilkington Activ™ is a dual action coating which when exposed to natural sunlight is photoactive and hydrophilic. The photoactivity aids the decomposition of organic dirt on the surface, and the hydrophilic action causes the condensed water droplets to spread out more on the surface than on ordinary glass. The water droplets then tend to form a sheet of water which has been observed to reduce the visual impact of the external condensation as well as allowing it to dissipate quicker.



**Photo Showing Pilkington Activ™ With External Condensation. Note deterioration in visual impact is significantly reduced due to sheeting of water over surface.<sup>4</sup>**

## References

1. Quote from Wikipedia - <http://en.wikipedia.org/wiki/Condensation>
2. B. Jonsson, Utvändig kondens på fönster, Sveriges Provnings- och Forskningsinstitut SP Rapport 1995:01 (1995) – Update with English ref of similar type
3. R. El Diasty, I. Budaiwi, External Condensation on Windows, Construction & Building Materials, Vol.3, No.2 (1989)
4. Work completed at Uppsala University Angstrom Laboratory by Prof. A.Roos and Dr. A.Werne