THERMOS
Rive-Nord inc.

EXTERNAL CONDENSATION ON INSULATING GLAZING

High-performance windows are experiencing a relatively recent phenomenon which consists of condensation outside the insulating glazing. Although consumers sometimes worry about such phenomenon, it is in fact the normal reaction of certain glazing to certain atmospheric conditions.

External condensation usually takes place when the following items are combined.

- Presence of high relative humidity (e.g. when outdoor temperature reaches dew point).
- Presence of a high-performance window (e.g. double-glazed windows with low energy loss or higher energy efficiency).
- Early morning.
- Total exposure (unobstructed) to clear skies (north, west, or south).
- No-wind conditions.

Condensation is usually caused by the difference between a surface's low temperature and a higher temperature where dew point or ambient air occurs. Dew point is the temperature where a liquid drop appears in completely saturated steam. The cooler the air is the fewer water vapors it contains. If temperature drops below dew point then condensation will form. This may occur when air meets a cooler surface (e.g. the sides of a cold beverage glass) or simply when air cools down (this is how rain and snow are made).

A well-known example in the glazing industry is condensation formed on windows' inner surface. It occurs when a house inner temperature is such that dew point temperature is higher than the window bottom glazing temperature (if such temperature is below 0°C, it is no longer condensation, but frost forming).

How can an outside object get colder than ambient air? This indeed happens when condensation forms on the object's surface. The answer lies in the fact that every object undergoes a natural heat loss through energy radiation, from which the rate is proportional to the object's temperature. Thus, the hotter the object, the greater the radiation. When the object is surrounded by other elements (people or other objects in the house), there will be no significant temperature drop because the object goes through the radiation emitted from these elements, which is equivalent to his own

radiation. This does not apply if the surrounding elements' temperature is lower; then the object will lose heat.

Given the progress made in terms of insulating glass technology in recent years, indoor condensation seldom occurs. The glazing insulation property improvement ensures that the inner glazing temperature is higher in cold weather. The recent outbreak of outside condensation may indicate that there is a link between this progress and the phenomenon. That is indeed the case.

As previously stated, any object surrounded by colder elements will lose heat. When a window is fully exposed to clear skies, it emits certain radiance towards itself (and all its surrounding). If the sky does not produce enough heat (e.g. if ambient air comes close to absolute zero), the window cools down. Trees, grass, and surrounding buildings also lose heat and air cools down. As the sun rises, surrounding elements will warm up. If the window temperature is above dew point and the glazing temperature is below such point, condensation will form on the surface.

In windy conditions, the phenomenon does not occur because air circulating on the glass surface warms it up and allows it to quickly reach ambient temperature. The phenomenon does not occur either when the window is facing east, because the rising sun will warm it up gradually. It is not observable in dry weather, as dew point takes place when temperature is lower than outside air. Furthermore, no condensation will occur when sky exposure is blocked by trees, clouds, etc., which prevent the temperature from significantly decreasing.

Note that during wintertime, such condensation type may appear as frost.

Such phenomenon is relatively recent. Why didn't it ever happen before? Conventional windows leak heat outside the house, when it passes through the two glazing while heating them and brings the outer pane to a temperature slightly higher than air. Since the outer glazing temperature is nearly always superior to dew point, no condensation is formed. Such phenomenon occurs thanks to the great insulating power of new glazing, which prevents the heat from escaping outside.

In fact, such phenomenon is quite rare, even with high-performance windows, since all the conditions listed above rarely come all at once. When such phenomenon occurs, it bears witness to the presence of a high-performance window.

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