NK WINDOWS
uPVC Systems

Understanding and Managing Condensation

Version: 02 **Date:** August 2016

Most people living in New Zealand are familiar with condensation on windows and glass doors. It's important to understand the factors affecting condensation before attempting to manage the problem. The factors are: exterior temperature; interior temperature; relative indoor humidity and window energy efficiency. 3 out of 4 of these factors are easily controllable – the exception of course being exterior temperature.

Terminology

Relative humidity – is the measure of how much moisture is in the air compared to how much moisture the air can hold at a given temperature. Warmer air can hold more moisture than cooler air.

Dew point – is the temperature at which a given sample of air will have a relative humidity of 100% i.e. the air cannot hold any more moisture. At this temperature, moisture in the air visibly forms into liquid.

R-value – is a measure of thermal resistance used in the building and construction industry. The higher the R-value, the greater the thermal resistance.

Low E – glass coatings that have been developed to minimize the amount of ultraviolet and infrared light (warmth) that can pass through glass without compromising the amount of visible light that is transmitted. When the interior heat energy tries to escape to the colder outside during the winter, the Low E coating reflects most of the heat back to the inside, reducing the radiant heat loss through the glass. The reverse happens during the summer time. Low E is always quoted as an option by NK Windows and is selected by 75% of all clients. The use of Low E is compulsory in many European countries.

Argon – a gas often used between panes in a double- or triple-glazed window. Argon is denser than the atmosphere, providing more thermal efficiency than having air between the panes. Argon is always quoted as an option by NK Windows and is selected by 75% of all clients.

Warm edge space bar – a thermally resistant component used to separate panes of glass around the edge in a double- or triple-glazed window. A warm edge space bar is installed on all NK Windows solutions as standard.

Condensation conditions

Condensation can be expected to form on windows and doors given the right conditions.

If the surface temperature of an object falls below the dew point, water will form or condense on the surface of the object.

Condensation will regularly form on cold internal surfaces, causing mould, risking health and damaging the building fabric.

At a specific amount of moisture in the air, the relative humidity will rise as the temperature falls.

The simplest example of condensation happens when a cold bottle of wine sits in a warm room. The cold bottle soon creates a pocket of cooler air around it. The relative humidity of that air quickly increases to 100% so moisture can no longer be held in the air and it condensates on the cold glass surface.

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Condensation on aluminium windows

Aluminium is a very good thermal conductor i.e. has very low thermal resistance, meaning internally generated warmth easily moves to the outside through the aluminium. The aluminium will be cold and creates a cold feeling close to the aluminium and will cause an unpleasant downdraft of cool air that many people will be familiar with. The cold aluminium will cool the air around it and therefore raise the relative humidity and force moisture to condensate on it.

Condensation on glass

Glass is also a very good thermal conductor and it too will quickly allow internally generated warmth to easily transfer to the outside, creating a cold internal surface that invites condensation. There are many houses in New Zealand with single glazing and poor examples of double-glazing i.e. very small gap between the panes and/or poorly designed or manufactured double-glazed units.

Fixing the problem

The 3 controllable factors contributing to condensation are: interior temperature, relative indoor humidity and window energy efficiency.

Solutions from NK Windows contribute significantly in terms of window energy efficiency and controlling interior temperature. Additionally, they also help you control indoor humidity via secure ventilation.

Window energy efficiency - PVC window frames are much more thermally resistant than aluminium options. Smart glazing choices also play a critical role. The table below[1] shows R-values (a measure of thermal resistance) for common NZ residential windows – both current situation and common renovation or new build choices. There is a direct correlation between R-value and the likelihood of condensation forming. PVC frames with double-glazing, a Low E coating, argon gas and a warm edge spacer is the optimal solution providing warmer internal frame and glass surfaces, plus a warmer living environment with considerably less energy wastage.

Most existing NZ homes current situation		
Frame	**Glass**	**R-value**
Aluminium	Single	0.15
Wooden	Single	0.19
Aluminium	Double	0.26
Common renovation or new build options		
Frame	**Glass**	**R-value**
Aluminium	Double	0.26
Thermally broken aluminium	Double	0.31
	Double plus Low-E	0.40
	Double plus Low-E and argon	0.43
PVC frames[2] from NK Windows	Double plus warm edge spacer	0.40
	Double plus Low-E and warm edge spacer	0.73
	Double plus Low-E, argon and warm edge spacer	0.84
	Triple plus 2x Low-E, argon and warm edge spacers	1.20

Interior temperature – internal heat sources, external solar gain plus the thermal resistance of the building envelope determine the interior temperature. Again, PVC frames with double-glazing, a Low E coating and argon gas is the optimal solution to keep internally generated warmth inside.

[1] Source: https://www.designnavigator.co.nz/WERS2.html

[2] NK Windows standard offering of Aluplast Ideal 4000 frame. All windows and doors from NK Windows are fitted with a high performance warm edge spacer.

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Indoor humidity - New Zealand crown entity Energy Efficiency and Conservation Authority (EECA) entity state 40% to 60% relative humidity is ideal in your house[3]. Figures below 30% and above 70% put the health and well-being of you and your family at risk and can also be detrimental to the building fabric. A large number of everyday activities cause the air humidity to rise in your house e.g. cooking and cleaning, showering, clothes drying, humans and pets breathing, aquariums and plant transpiration. Additionally, building materials introduce a lot of moisture to new houses and need to be well vented for several months. A draughty house unintentionally self ventilates (and of course loses warmth) whereas a tightly sealed house requires intentional ventilation. It is recommended to do this for a few minutes each day by fully opening a window or door on both sides of the house to provide a flow of air. A good time to ventilate is after you turn off the heating, e.g. before you leave the house in the morning and / or just before you go to bed. Alternatively NK Windows tilt function on tilt and turn windows and doors allow for secure street-level ventilation.

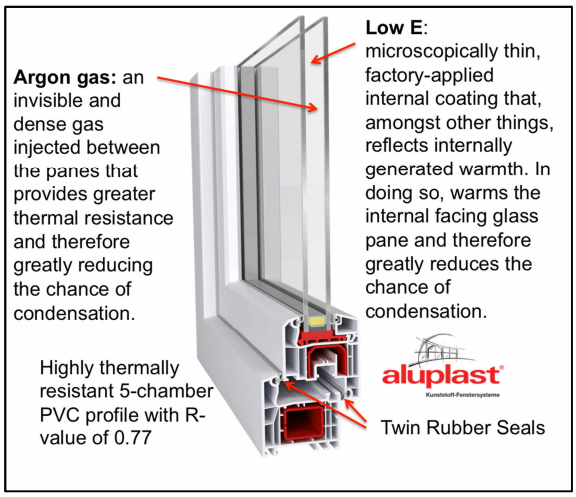
Could I still get condensation with PVC windows and high performance glass options?

Under normal circumstances you will not suffer condensation problems. Under extreme circumstances you could see condensation form. Such circumstances include: internal moisture levels are too high; a damaged or faulty glazing unit; and a damaged or faulty PVC frame or seal. Given correct internal moisture levels and no damaged or faulty frame or glazing components it is very unlikely anywhere in NZ would get cold enough for the external temperature to cause condensation.

Internal moisture needs to be removed at the source as much as possible by extracting steam from bathrooms, laundry and kitchen, not drying clothes inside and regularly ventilating your home.

Impact of blinds and curtains

Many people fit blinds to PVC frames for shading and blackout - and of course the use of curtains in New Zealand is widespread. Along with blocking light and providing greater privacy, blinds also create a thermal barrier. Condensation may occur when there is no solar thermal gain and there is a divider (i.e. curtain or blind) between the warmth of the room and the window. Again, managing humidity levels by systematic ventilation and smart glazing choices will greatly reduce the opportunity for condensation to form.



[3] Source: https://www.energywise.govt.nz/at-home/dampness/