



Condensation is becoming much more of a concern in recent years. New technology and improvements in the thermal performance of buildings means today's homes are becoming more air tight and excess humidity in the air can be trapped inside. Windows are usually blamed for excessive condensation because they are the first place the condensation can be seen, but what about between the walls and in the insulation? The moisture is there too. Your windows may actually be serving as a warning sign.

## **What Causes Condensation?**

Condensation arises because warm air can hold more moisture than cold air. For example, air at 25°C can hold about 20 grams of water per kilogram of air. This is its maximum water content so it corresponds to 100% humidity. If air in this state is cooled to 15°C, then its maximum water content falls to about half this value and about 10 grams of water must condense out of each kilogram of air. This will occur as a fog of liquid droplets if the air is cooled as a mass, or as condensation on a surface if that surface provides local cooling of the air around it.

Condensation is defined as the physical process by which a gas or vapour changes into a liquid. If the temperature of an object (e.g. grass, metal, glass) falls below what is known as the "dew point" temperature for a given relative humidity of the surrounding air, water vapour from the atmosphere condenses into water droplets on its surface. This "dew point" varies according to the amount of water in the atmosphere (humidity).

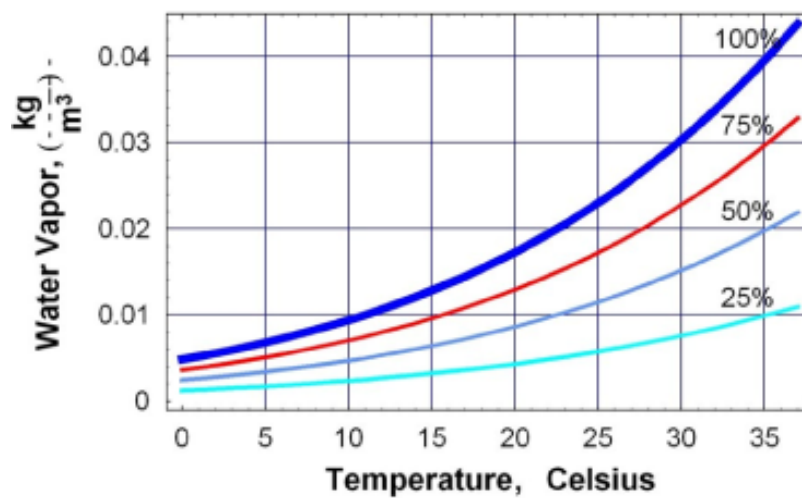




Condensation on windows occurs when the surface temperature of the window is low, and the interior of the room is warm and has high relative humidity. Condensation is not caused by a problem with the window system itself but rather the level of humidity in the room, often due to a lack of appropriate ventilation in the room or house. The point at which condensation will occur depends on three variables;

- The inside air temperature,
- The relative humidity of the inside air, and
- The surface temperature of the window or glass

This combination of factors is often referred to as the "Dew Point".



At 23°C inside air temperature, and 50% relative humidity, the dew point is around 12°C.

Some humidity is necessary for comfort and health, but too much humidity can present real health problems. High humidity promotes the growth of dust mites and fungi (mould), both of which produce compounds that are injurious to human health. Equally so, too low humidity is not good either. Cool, dry conditions lead to dry, cracked lips and irritated nasal passages and airborne viruses like influenza tend to spread, possibly because of their ability to survive longer in dry, cool conditions and infiltrate those inflamed nasal passages.



Photo courtesy of Magic Seal

## Humidity.

Some condensation can be expected in cold weather. The colder the outdoor temperature, the more likely you are to have condensation. A little fog on our windows on an especially cold night does not represent a problem, and it usually goes away fairly quickly.



## How Can Condensation be Managed?

Typical domestic activities such as cooking, bathing, showering, drying, high occupancy, high indoor plant concentrations, uncontrolled moisture ingress and domestic appliances such as gas fired stoves, burners and heaters all have an effect on relative humidity level and therefore the potential for condensation within the building.

Typical quantities of water vapour produced in the home:

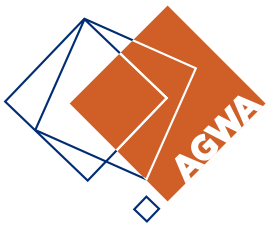
ACTIVITIES	LITRES
Breathing (active)	0.2 Per Day (per person)
Cooking	3.0 Per Day
Showers and Baths	1.5 Per Day (per person)
Clothes Drying (unvented)	5.0 Per Day
Gas Heater (unflued)	1.0 Per Day

A typical home may produce in excess of 20 litres of water vapour per day

The easiest way to control condensation is to keep the relative humidity low. When there's too much condensation on your windows it means that humidity is too high in your home. The glass of single glazed windows are usually the coldest surfaces in a room and may actually be serving as a warning sign to the condensation related problems. You should take the necessary steps to reduce humidity until condensation disappears.

Bathrooms, kitchens and other areas where humidity levels are high are particularly susceptible. In order to control condensation, consideration should be given to improving the ventilation in these areas. The best solution is to gather as much water vapour at its source (for example in the kitchen, bathroom or laundry) and evacuate it straight outside through the use of exhaust fans etc.





## Tips for Builders

- Duct gas appliances, kitchen rangehoods, clothes dryers and bathroom exhaust fans to outside air. Hot water heaters, gas boilers, bathrooms, clothes dryers, range hoods in kitchens and any other sources of moisture vapour should be fitted with adequate mechanical ventilation systems which should be flued to the outdoors. Ducts leading from air conditioners, heaters and other penetrations should be enclosed completely by ceiling insulation product.
- Use vapour permeable wall wraps (not punched sarking). Ensure vapour permeable and moisture control membranes are installed in the correct locations, sequence and orientation. Be sure to select the right materials for the intended purpose and choose reliable products from the market. For example, vapour permeable products specified by Australian Standard (AS) – 4200.01 cannot be substituted.
- Consider building in trickle ventilation where appropriate in high performing or poorly ventilated spaces.
- Create air spaces and ventilate cavities where hardboard, cement sheet or other solid materials are used for external wall claddings.
- Use eaves and soffit vents to vent roof voids.
- Finishing items in construction such as screed laying, plastering, plasterboard jointing, and tiling should be allowed to cure for the longest possible time before the building is occupied.
- Shelter materials on-site from rain and prevent them from getting wet prior to application/installation.
- Avoid the use of un-flued gas heaters .
- Air conditioning units which can control both temperature and humidity are recommended. Systems that can meet the dehumidification requirements should be preferred to avoid surface condensation.

### Scoping Study of Condensation in Residential Buildings

#### Final Report

23 September 2016

Research funded by:  
Australian Building Codes Board  
Department of Industry, Innovation and Science  
Commonwealth of Australia

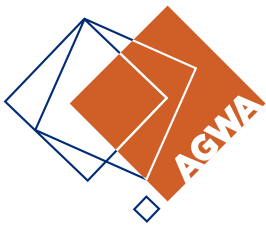
Dr Mark Denbury  
Dr Tim Law  
Schools Program  
Dr Deborah Pitt-Corsett  
Dr Dennis McCoskie  
Thomas Chandler  
Abdel Soudeh

(1) School of Architecture and Design  
(2) School of Maths and Physics

University of Tasmania

Based on the nationwide condensation survey, more than 40 % of new buildings have condensation and mould.

# 40%



## Tips for Homeowners

- Occupants in a new building should be more cautious about condensation related problems, especially during the first winter after it has been built. New structures may need extra heating and ventilation compared to older ones because of the relatively high moisture level in the new materials. Use a fan in short cycles within a room when the condensation problem is excessive or use the dehumidifying setting on your air-conditioner. Over time, these materials will dry to reach a normal moisture level. For instance, a new 150 mm thick concrete floor may take up to eight months to dry while a 100 mm thick slab can reach the same level of dryness in just four months.
- Open windows during and after showering and when cooking in kitchens. Use bathroom exhaust fans during and after showers and baths, and ensure they are vented externally and not just into your roof cavity.
- Dry clothes in rooms that are well ventilated and warm and shut off from the rest of the building. Vent clothes dryers to the outdoors where possible. You don't want moisture being removed from clothes to get into the rest of the house. Alternatively keep windows and doors open during the cycle.
- Keep lids on pans during cooking, avoid unnecessary steam production.
- Open windows and ventilate for short periods of time in any room with condensation.
- Airing out the kitchen, bathroom and laundry during and after use by opening a window for a few minutes is another good way to control condensation.
- Wiping down wet surfaces (use an old towel) and keeping the windows and walls as dry as possible are some easy ways to avoid condensation problems near windows and doors.
- Avoidable sources of water vapour in any room should be looked for and eliminated as far as possible.

Finally, always consider an investment in high performance, energy efficient windows that not only reduce energy costs but make homes more comfortable as well. Double glazed windows create warmer interior glass surfaces, reducing frost and condensation.

Condensation will tend to form less readily on double glazed windows and doors. Condensation may form on metal window frames before it appears on the glass, however it is likely to be noticed first on the glass of timber or uPVC framed windows and doors.

Be alert to condensation forming on the glass and frames of windows. These are usually the coldest surfaces in a room and condensation on them is an early warning of high Relative Humidity that can support dust mite infestations and mould growth.

Glass with a Low-E coating on the internal surface (surface#2 for single glazing and #4 for IGUs) promote condensation more readily than uncoated glasses.

Surface condensation should always be wiped up to discourage mould growth or decay of timber frames, window sills or architraves. Even painted timber can absorb water which is left to sit and the paint will be at risk of bubbling or flaking when the water later evaporates.

For further detailed information on condensation management, please refer to the ABCB's Handbook on 'Condensation in buildings'.

Disclaimer: This key message has been developed to provide general guidance, awareness and education to AGWA members only. It should not be viewed as a definitive guide and should be read in conjunction with the requirements of the National Construction Code (Visit [www.abcb.gov.au](http://www.abcb.gov.au)). While every effort has been made to ensure the information is accurate the AGWA expressly disclaims all and any liability to any person for anything done in reliance on this publication. No responsibility is accepted by the AGWA for any mistakes, errors or omissions in this publication.

### **Australian Glass and Window Association (AGWA)**

a: Pymble Corporate Centre, Suite 1, Level 1, Building 1, 20 Bridge Street, Pymble NSW 2073  
t: +61 2 9498 2768 f: +61 2 9498 3816 e: [info@agwa.com.au](mailto:info@agwa.com.au) w: [www.agwa.com.au](http://www.agwa.com.au)