Author: David Franklin 2009-03-29

What is condensation?

This is the term to describe the point when moist air (water vapour) starts to turn to a liquid state. In technical terms this process is called dew point, when the air reaches 100% relative humidity and can hold no more moisture. When this happens the air will start to release this moisture. This is a natural event and we see it everyday with either dew, clouds, fog or rain which are all water droplets. The problem begins when this happens inside your home. This vapour inside your home will condense or turn to water on the coldest part of the house which is virtually always the glass in your windows and surrounding framework and plaster. This is because as the heavily saturated air hits a colder surface it starts to go to a liquid form.

Homeowners are often too ready to blame the windows or installation company for condensation why is this?

Most people still remember the days when single glazed windows used to pour with water and the daily routine was to mop all this water up. Since double glazing came out the problem was a lot less noticeable hence people came to the conclusion that new windows cured condensation and if you still had it the windows were defective. The less condensation you had the better the windows. This is like having a rusty car and giving it an expensive spray job, the rust is still there its just not visible and will come back to bite you.

It needs pointing out however that not all windows are made to the same standards. Some new windows may use poor-quality parts and poor construction methods that allow the glass temperature of the inner pane of glass to be much cooler than a well-built window. The cooler pane of glass will show condensation before a warmer pane of glass. This is why an empty drinking glass on a kitchen counter or a piece of glass in a picture frame has no condensation while a window two feet away is fogged up or dripping with water

The myth

Later in this article I will explain how water gets into your house but for now please read the following points.

Double glazed windows have helped to prevent condensation from forming on the glass but do NOT reduce the humidity levels in your home, the moisture will just condense somewhere else.

If you have a condensation problem the better the double glazing units the harder it is to expose it.

The humidity levels (amount of water trapped in the air) in your home, the amount of ventilation you have, the external and internal temperature are what determines if

you will get condensation, if levels go above 40% you will find that condensation will form in some locations like single glazed windows, as the levels get to 60% the air will condense on more surfaces like double glazed windows.

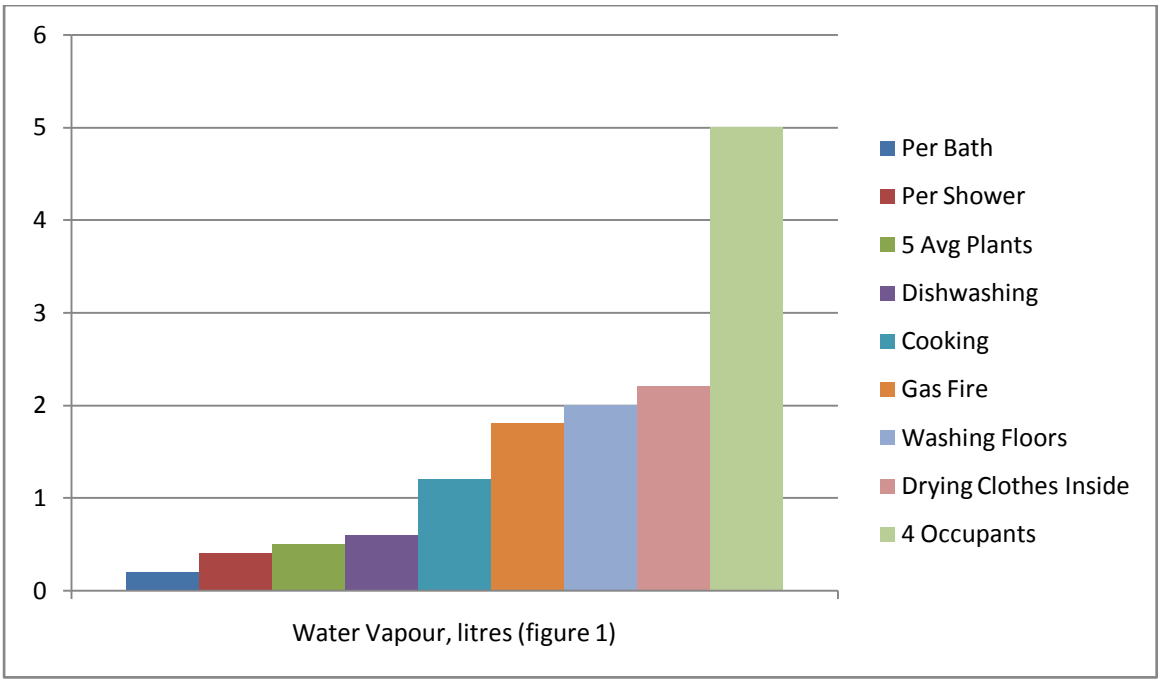
"Windows do not produce the moisture in your home unless they are visibly leaking water into the room. Moisture is produced in all homes but can be controlled, failure to control it will damage the fabric of your home, the items in it and can become a breeding ground for harmful mould growth."

How does moist air get into my home?

It is commonly thought that household occupants activities are generally the cause of high humidities and thus the cause of many condensation problems. There is no doubt that, in some cases, this may be true; however, recent findings from a major study undertaken by Canada Mortgage and Housing Corporation suggest that this is the exception rather than the rule.

In another project done some years ago, household occupancy was studied to determine the moisture production by people and the input rate of moisture for several types of household activities. Consideration was given to the activities of a family of four; it was found that although the activities of the residents may vary, the amount of water vapour produced by metabolic processes such as respiration and perspiration will average about 0.2 litres per hour or five litres per day. This is 1.25 litres per person per day.

A number of activities were also investigated including bathing, showering, cooking, clothes washing and drying, and floor washing (Figure 1). Each of these activities contributes moisture, however, the average increase in moisture input was 2.4 litres per day over the five litres contributed by the occupants.



When one examines the total moisture input by a family of four and their activities, it is interesting to note that few sources contribute as much as the occupant. If all of these moisture-producing activities were to occur in the same day, and included clothes drying indoors, floor washing, cooking, etc, the combined load would approach 18 to 20 litres per day.

Condensation in Newly Built Houses

Construction Moisture

The typical house is constructed from timber, blockwork and plaster that is usually quite wet, concrete, which requires substantial water in its fabrication, and numerous other products including sheathing, insulation, air and vapour barriers and cladding materials. Concrete and timber may contribute significant amounts of moisture after completion of construction.

Framing timber

Using an average two-storey house, it has been calculated that the total weight of framing timber used to construct the partition walls and all floor joists of the first and second floor would be about 2100 kilograms. If the timber used in the construction had a moisture content of 19% (and this would not be unusual), and if it eventually dried out to 9% moisture content, it would release over 200 litres of moisture. This moisture is given off to the interior of the house and mixed with other sources of moisture.

Concrete foundations

Most new houses are built on concrete foundations. Assuming that the floor slabs and foundations would contain 22 cubic metres of concrete. The basement floor contains about four cubic meters of concrete, for a total of 26 cubic metres. In a general mix of concrete, one cubic metre requires 210 litres of water or more during the mix, but with hydration, eventually retains slightly less than 120 litres of water. This concrete therefore releases 2340 litres of water during the curing process. This water would be released within the first two years and probably most of it within the first year.

When timber and concrete are drying they may contribute from 2000 to 3000 litres of water to the indoor space, depending on the size of the building, the moisture content of the framing lumber and the surface area of the concrete which is exposed. Assuming an 18 month drying period, this represents from four to five litres of moisture per day, a significant contribution compared to the occupancy-generated moisture. **It is not surprising therefore, that many complaints of high humidity and condensation problems appear in the first two years after construction.**

Seasonal Storage of Moisture

There is another phenomenon which can augment the moisture input rate during the condensation season. This is the cyclical storage and release of moisture from furnishings and various construction materials inside the house. Given that most houses are vented in the summer, the warm humid air from the outside will impose a high water vapour pressure on all materials inside the house. Including some rainy days when the outside humidity is near 100%, the outdoor humidity level may very

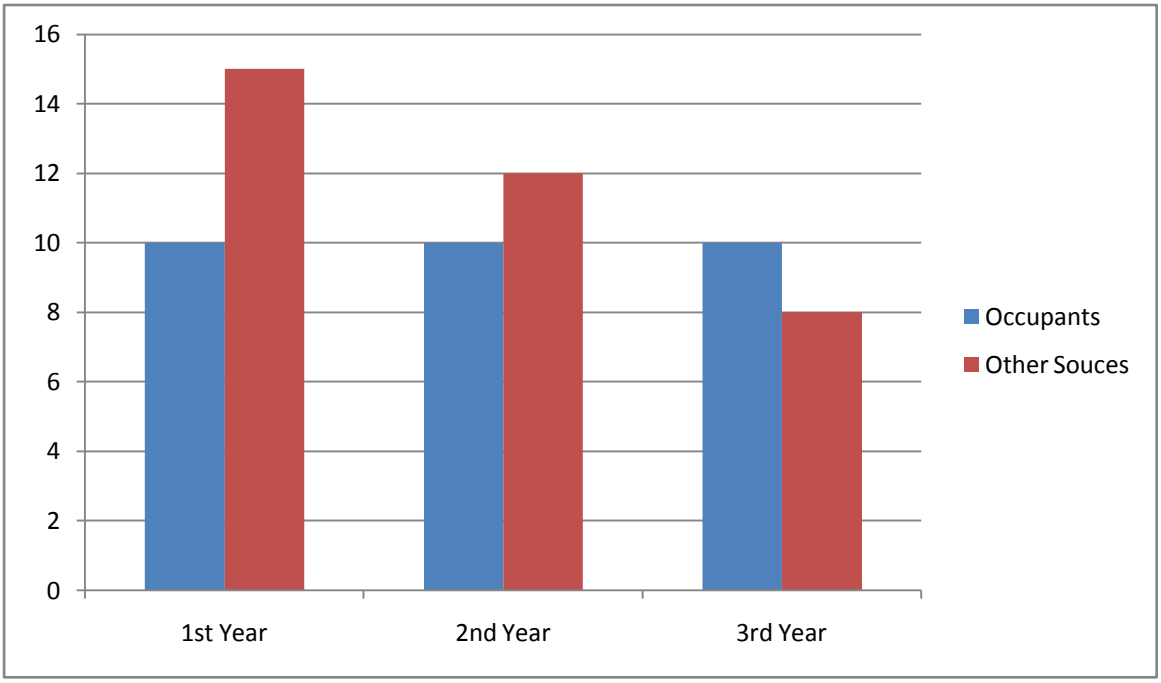
well hover in the range of 60 to 90% for several months during the summer. Thus with ventilation, it is quite likely that the indoor conditions of the house will also be at fairly high humidities, but because of the warm summer temperatures, there will be little or no condensation occurring anywhere within the building envelope except perhaps on cold surfaces in a basement. However considerable moisture may be stored within the building structure.

When winter conditions arrive, the indoor humidities will be much lower. This is because air leakage and ventilation carry away most of the indoor moisture, leaving a humidity level which is usually in the 30 to 40% range; this can cause much of the hidden moisture to reappear in the indoor air.

Framing timber, plywood, furnishings

If the outdoor humidity during summer were around 75%, then the moisture contents of cellulose and wood furnishings would increase up to 11% (Figure 5). In comparison to this, if the indoor humidity were lowered to 30% during winter, then materials and furnishings would tend to give up the stored moisture and try to reach a new equilibrium moisture content (at about 6%). This is a 5% change in weight and would release 105 litres of water vapour during the 16 winter period. This stored water would be released at a rate of about 0.9 litres of water per day, assuming a four-month decay period until spring and summer conditions arrive once more.

Finally, when considering the probable moisture input rate in a new house, the following guide is suggested to a probable moisture load for the first, second and subsequent years of operation of a typical new house (Figure 2). In the first year, the total moisture input from occupants and other sources may average 20 or more litres per day during winter. As the building materials dry out, the total moisture input rate may drop to 15 litres per day during the second year and settle eventually to a rate of about ten litres per day in the third and subsequent years.



Hence from a third to half of the total input of moisture is generated by sources other than the occupant and his activities. It is not practical to suggest that the occupant lifestyle has to change, except in special circumstances, but it is feasible, and it will be necessary to address the many other sources of moisture to control humidity levels in new as well as retrofitted houses.

Specific Recommendations:

- Keep the humidity level in the new house between 40% and 60%.
- Use a dehumidifier during build process.
- Avoid use of gas or paraffin heaters to gain rapid heat without extraction
- If weather is warm and dry ventilate well during build.
- Try to budget for installing a heat recovery system with humidity controls
- If any mold becomes visible treat with a recommended mold remover like HG Mold Spray.
- Add mold inhibitors to paints before application
- Do not carpet bathrooms and basements
- Leave on manufacturers product protective sheeting if possible

Controlling Condensation in Older Homes:

Remove mould = Reduce moisture:

- Cover pans while cooking
- Dry clothes outdoors if possible
- Vent your tumble dryer to the outside
- Avoid using paraffin or flueless bottled gas heaters

Ventilate to remove moisture:

- Ventilate all the time, especially when someone is in
- Increase ventilation of the kitchen and bathroom when in
- Ventilate cupboards, wardrobes and blocked chimneys

Heat your home a little more:

- If possible, keep low background heat on all day, with background ventilation.

Mould and Condensation

Do

- Ventilate your home by opening windows to allow a change of air
- During cold weather, try to leave your heating on a low level all the time

- If you have a tumble dryer without a vent to the outside, you will need to increase the ventilation in the room when you use it
- Close kitchen and bathroom doors when in use and after use, so that the moisture does not go into cold rooms. As part of planned capital works programmes any properties that do not have mechanical ventilation in the bathrooms and kitchens will have some form of ventilation installed as part of any electrical upgrade. Your area Housing officer may be able to advise if and when such programme is planned for your area.
- Wipe down surfaces where moisture settles (on walls, mirrors, wall tiles and windows) to prevent mould
- If you can, leave a small bedroom window ajar when you are asleep
- If your windows have trickle or night ventilators, try and leave these open at night or when you are out

Do Not

- Do not block up chimneys fully or air vents AT ALL
- Do not use paraffin or calor gas heaters as they produce lots of moisture and it is also a breach of your tenancy conditions
- Try to avoid drying clothes on radiators, unless you open a window to allow air to circulate
- Do not let kettles or pans boil any longer than necessary
-

External Condensation

Condensation on external glass surfaces

External condensation (dew) can occasionally occur on highly insulating glass units in temperate climates. Such occurrences will only happen on cloud-free nights when there is little or no wind and usually when a warm front follows a dry spell.

The combination of several factors, namely external air temperature, localised microclimate and the thermal transmittance of the glazing itself may all contribute to the formation of external condensation. **As a consequence of variable temperatures and localised conditions, it is possible to experience a situation whereby both clear and 'misted' windows exist at the same time in the same development.**

This phenomenon is influenced by the thermal insulation of the glazing. Single glazing offers poor thermal insulation therefore heat escaping from inside a room readily passes through the glass to the outside environment. Consequently, the external surface temperature of single glazing is generally higher than the' dew-point' temperature of the outside air, thus prohibiting the formation of condensation on that surface.

With conventional double glazing the thermal insulation is improved, but sufficient heat still escapes through the glass so as to warm the external surface of the outermost glass, thereby precluding the formation of condensation in most circumstances.

In common with other low emissivity glasses, Pilkington K Glass reflects heat back into the room and as such the quantity of heat passing through the glazing is reduced. Consequently the external pane of low emissivity double glazing is not warmed by escaping heat (which instead is retained within the room) and therefore presents a colder surface to the outside environment.

In such cases, and in situations where the external glass surface temperature is lower than the 'dew-point' of the air, (and when weather conditions are comparable to those mentioned previously) condensation can form on the external glass surface.

However, the combination of these contributing factors is largely unpredictable and therefore it is not possible to quantify the number of occasions when external condensation will occur.

Instances of external condensation are relatively rare and in all cases it will be a transient effect. Upon any one of the climatalogical variables changing, the condensation on the glazing will usually dissipate within a short period of time in much the same way as morning dew.

Please also see: http://www.pilkington.com/europe/uk+and+ireland/english/default.htm

.