CONDENSATION

The definition of condensation is when a material goes from a less to a more dense state. In the case of water, it is when water vapor turns into a liquid. For this to occur, the air holding the water vapor that is next to a surface must have a dew point that is the same or higher than the temperature of the surface. An example of this is a glass of a cold beverage on a warm day. The glass will have a coating of condensation on its exterior because the air directly against the glass has been cooled by the glass, therefore the air's ability to hold water is reduced and the air's dew point is higher than the skin of the glass causing water to precipitate out onto the glass. If we wanted to change the conditions such that the glass stayed dry, we would have to change the relationship between the dew point of the air next to the glass and the temperature of the glass. As long as the dew point is lower than the temperature of the skin of the glass, the glass will stay dry. To change the dew point of the air we would have to change the ability of the air to hold water. This can be done by warming the air or reducing the amount of water in the air, or a combination of both. We could also warm the glass so it is warmer than the dew point of the air next to it.

There is another term that is used to describe the water content in air; this is the relative humidity of the air. The relative humidity is a percentage of the maximum amount of water that air can hold at the temperature and pressure it is at. So if a given volume of air could hold 10 grams of water at the pressure it is at and it only has 5 grams of water in it, then it is at 50% relative humidity.

We could change the relative humidity of this same air by either warming or cooling it at constant pressures. If we cool the air, we will raise its relative humidity and raise its dew point. Conversely, if the air is warmed it will cause the relative humidity to drop and lower the dew point temperature.

How does this all effect windows? If the air next to a window has a dew point temperature that is higher than the glass it is next to, the air will deposit water onto the glass until its dew point is the same as the glass.

So how do we control the deposition of water onto the glass? The solution is the same as that of the beverage glass. We either have to warm the glass or lower the relative humidity of the air next to the glass so the air's dew point is lower than the glass's temperature.

To a homeowner, this can be done in a series of ways. You can use a glass that is a better insulator so the glass unit does not lose heat as fast; therefore the glass surface is easier to keep warm. This means the high performance glass will lose heat slower than regular glass. Although, it still loses heat and a source of heat is needed to keep the surface of the glass above the dew point temperature of the air. In the case of high performance glass, it will need less heat added to it to keep above the dew point. The other solution is to reduce the relative humidity of the air next to the glass. This will lower the dew point of the air next to the glass; therefore reducing the need for the glass to be warm.

This is where life style comes into play for the homeowner. If the conditions in and around the house allow for air to sit in one area and cool, then the air in that area as it cools will experience a rise in relative humidity and the air in that area will experience a rise in dew point. This will mean that any surface with a temperature at or below the air's dew point will have condensation on it. In a house, this area, where the ambient air is allowed to cool, could be a room that is closed off and allowed to cool or next to a window behind tight drapes or blinds where room air is trapped and stays still without an external source of heat and its temperature drops. Drapes can cause two problems; not only do they trap room air and allow it to cool, they also do not allow warmth from the room to get to the window surface to possibly raise it above the dew point of the air next to it.

One method of reducing condensation on windows is to allow the window to be open a crack. This allows outside air to displace the cooled room air.

This works to reduce condensation because the relative humidity of the outside air is lower than the house air that would have been trapped behind the drapes and allowed to cool to almost outside temperature. This can also be why when new windows are put in and the air leakage in and around the house is reduced there is an increase in the amount of condensation on the windows.

So, to reduce condensation, one effective way is to allow or promote air movement up against the window to both warm the window surface and keep warmer house air with a lower relative humidity next to the glass. The use of either blowing or making it very easy for warm room air to scrub the inner surface of the window will raise the window temperature. And therefore, to cause condensation the dew point would have to be higher. The use of air circulation keeps the air next to the window closer to room temperature and therefore the dew point and the relative humidity are kept down. In rooms where the heat has been turned off, not only can the windows be at or below the dew point temperature of the air in the room that has been cooled, but elements of the wall assembly can also be cool enough to cause condensation, which could lead to potential mould growth.

Condensation is also not restricted to the interior of a building, it also occurs on cool external surfaces of buildings. If air with a high relative humidity and a high enough dew point, compared to the exterior surfaces, comes into contact with a cool surface, condensation will be created just like it does on a car. There is more condensation appearing on high performance glass windows because the glass reflects more heat back into the room causing the outer surface to be cooler than regular glass. This reduced outer temperature makes it more prone to condensation.

Article by Charlie Gould
Director: WDMA-BC