

Exterior Condensation

Energy-efficient windows will occasionally have condensation on the exterior glass surface. This usually happens during periods of warm weather and high humidity near the time of sunrise. Because energy-efficient windows greatly reduce the amount of heat escaping to the outside (which is good during the long periods of cold weather), the exterior glass surface is cool enough to allow condensation to form for a short period of time.

Exterior condensation is usually observed Under the following conditions:

- high relative humidity (i.e. outside temperature near the dew point)
- high performance glazing system (e.g. Double glazed I.G. with Low-E glass or better)
- early morning
- unobstructed exposure to a clear sky to the North, West or South
- no wind

What causes Exterior Condensation?

But how can an exterior object become cooler than the surrounding air? This is what must occur in order for condensation to form on an exterior surface. The answer is that all objects naturally lose heat in the form of radiation. Everyday objects radiate energy at a rate proportional to the temperature they are at. In other words, a hot object will radiate more than a cool object. When an object is surrounded by other objects which are at similar temperatures to it (e.g. a person or object in a home) there is no net change in the object's temperature, since the surrounding objects are radiating towards it at the same rate it is radiating towards them. But when an object is surrounded by other objects which are at lower temperatures than it, it will cool down as it loses its heat through radiation.

As a result of developments in insulating glass over the last number of years interior condensation occurs somewhat less frequently. Improvements in the insulating value of glazing systems has resulted in higher inside glass temperatures when it is cold outside. The onset of incidences of exterior condensation in recent years suggests that there may be a link between these two developments. There is.

As explained above, when an object is surrounded by other objects which are cooler than itself, it will lose heat. When the exterior glass surface of a window is exposed to a clear sky, it will radiate towards it (as well as towards other surrounding objects). Since the sky is at a very cold temperature (close to absolute zero), it will not radiate back towards the window to a significant extent. As a result, the exterior glass surface cools down. As this is happening, the trees, grass, and surrounding buildings also lose heat and the air typically cools down as well. However, when the sun rises, the surrounding objects are typically warmed. If a particular object, such as a window surface, is not warmed by the sun during that period, it may remain cooler than the surrounding air. If the surrounding air temperature is just above the dew point and the glass surface temperature remains just below, condensation will form on the glass surface.

The phenomenon does not occur on windy days because air movement past the outer pane of glass will warm it to the outside air temperature quite quickly. It does not occur on eastern exposures because the sun will warm the window pane on that side as it rises. It does not occur on "dry" days because the dew point temperature on dry days is significantly lower than the outside air temperature. It does not occur on windows which do not have a clear exposure to the sky because whatever obstructs the exposure (e.g. trees or clouds) prevents the outer pane from cooling down significantly.

It should be noted that the condition can occur in winter when frost, rather than condensation may occur.

Exterior Condensation is a recent phenomenon resulting from high-efficient windows

Exterior condensation has only recently become an issue. Why has this not been seen until now? With less insulative glazing systems, heat flows from the inside of the house, through the interior pane, to the exterior pane of glass, raising its temperature to a point somewhat above that of the outside air. This process ensures that condensation will not occur as the exterior glass temperature is almost always above the dew point. It is the high insulation value of recently available glazing systems, preventing heat from escaping to the outer glass surface which allows exterior condensation to form.

In fact, exterior condensation is seldom seen, even on very high performance glazing systems. This is because the above conditions do not coincide very frequently in most locations. When it is seen, it is evidence that a high performance glazing system has been installed.

Sources

- Interior Condensation Reproduced from the Energy Star web site
- Exterior Condensation reproduced from a technical brief produced by IGMAC (Insulating Glass Manufacturers Association of Canada).

Home Owner' Guide to Window Condensation



- What is Condensation?
- Interior Condensation
- Humidity in Your Home
- Exterior Condensation



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What is Condensation?

The cause of condensation in general is due to the temperature of a surface being lower than the dew point of the surrounding air. The dew point is the temperature at which a given volume of air with a given water-vapour content is completely saturated. Since air can hold an increased amount of water-vapour with increased temperature, and vice-versa, lowering the temperature of air below the dew point will cause condensation to occur. This can happen when the air comes into contact with a cooler surface (e.g. the side of a cool beverage glass), or simply through cooling of the air itself, which is how rain and snow form.

Interior Condensation

A common example of this process in the window industry is condensation on the inside of windows. This occurs when the indoor humidity in a house is such that the dew point temperature is higher than the temperature of the glass at the bottom of a window. (When this temperature happens to be below 0 C then frost, rather than condensation, forms.)

How to reduce or stop condensation

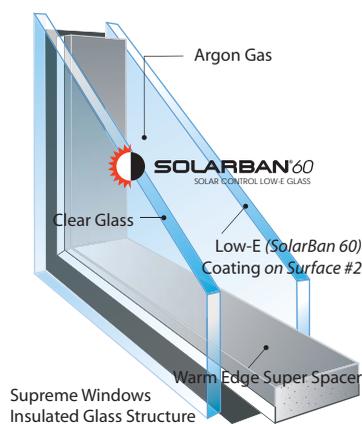
You may have to consider one or more of the following techniques to reduce or stop condensation:

- Condensation resistance
- Shading
- Curtains and blinds
- Hot air registers and heaters

Condensation Resistance

Manufacturers use several techniques to increase the condensation resistance of windows. These include:

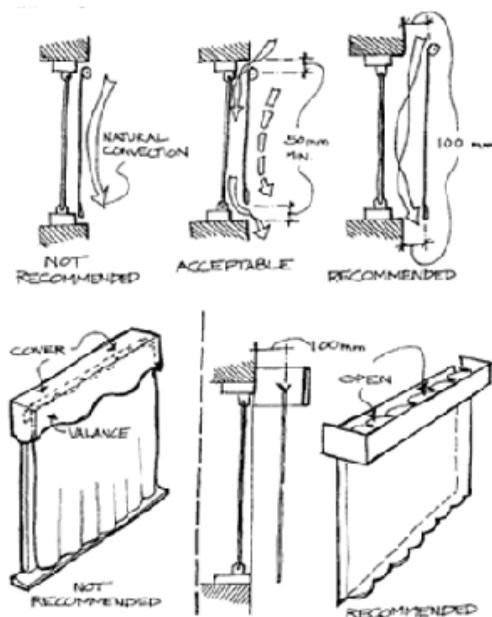
- insert gas between glazings
- low-emissivity (low-e) coatings that increase the temperature of the glass
- insulating spacers that reduce heat conduction
- non-conducting sashes and frames



Energy-efficient windows are least likely to have condensation. Their resistance to condensation, however, depends on the indoor humidity level.

Curtains and Blinds

Interior window accessories such as curtains, blinds and valances must not prevent air from moving around the surface of the window. Any restriction of air movement will increase condensation on the window.



Hot Air Registers and Heaters

Heat loss through windows is greater than through the adjacent walls, even if the windows are energy efficient. This is why windows that have heat sources located below them are less susceptible to condensation than other windows.

When the heating system is in operation, the air temperature will be higher in the vicinity of the window than in the centre of the room, resulting in increased condensation resistance. You must take care, however, to keep hot air from the registers or baseboard heaters from flowing directly onto the interior surface of the glass. Resulting thermal stress problems could cause the glass to break.

Humidity in Your Home

A certain amount of humidity in your home is desirable for comfort during the colder months. Windows, doors and skylights that are not energy efficient will often collect condensation or frost even when the indoor humidity is at a reasonable level. Besides obscuring the view, this condensation can lead to mould formation on the frames and sashes. With an energy-efficient ENERGY STAR® qualified product, it will take a higher indoor humidity for condensation to form.



With well-controlled humidity in your home, you may even be able to turn down your thermostat and still feel comfortable. Because humidity levels are normally higher in bathrooms and kitchens, consider installing an appropriate ENERGY STAR labeled product in these rooms to reduce or eliminate condensation on windows.

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Condensation Chart:

(Maximum Humidity Before Windows Condensation Occurs)

Outside Temperature	Standard Window	Energy-Efficient Window
0°C	50%	63%
-10°C	38%	50%
-20°C	26%	40%
-30°C	18%	30%
-40°C	12%	23%

Be aware that high indoor humidity can lead to the formation of mould in areas of the house other than the windows, doors or skylights.

Supreme Windows Energy Star Certified Windows

Product	Insulated Glass Unit	U-Value (W/m ² K)	Energy Rating
Picture	Low-E/Clear	1.50	25
Picture	Low-E/Low-E/Clear	1.15	33
Fixed	Low-E/Clear	1.48	24
Fixed	Low-E/Low-E/Clear	1.17	30
Casement	Low-E/Clear	1.49	21
Casement	Low-E/Low-E/Clear	1.20	27
Awning	Low-E/Clear	1.48	22
Awning	Low-E/Low-E/Clear	1.19	27

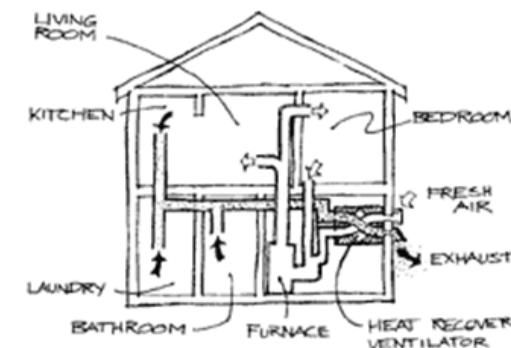
* Legacy Series Vinyl Frame Windows.

** Insulated glass units with 3mm glass no grills.

*** Please check Energy Star Canada website for full product list.

Controlling the Relative Humidity of Indoor Air

If there are signs of excessive humidity in your house, you should increase ventilation. If you have a problem only once or twice during the winter, you can reduce or eliminate the problem by briefly opening two windows located on opposite walls or by turning on a kitchen or bathroom exhaust fan. If your home has persistent condensation problems, think about installing a controlled mechanical ventilation system. Try to use a system that incorporates a heat recovery unit and controls relative humidity control.



Humidity Reduction Tips

- Disconnect humidifiers that are either fixed to your heating system or are portable.
- Make sure that the clothes dryer is vented to the outside.
- Use bathroom and kitchen fans that vent to the outside when bathing or cooking.
- If you have a crawl space under your house, cover the beaten earth with 0.15 mm (6 mil) polyethylene. The crawl space may have to be ventilated during the summer.
- Make sure that your basement is well drained and protected against excess moisture, and make sure that gutters and the slope of the land around the house drain water away from the house.
- Store firewood outside.
- Some airtight houses were built without mechanical ventilation systems. If high humidity is a chronic problem, consider having a heat recovery ventilator system (HRV) installed.
- If you have a mechanical ventilation system, make sure that it is working properly and that it is turned on.