

Condensation & Frost

What Is Condensation?

Condensation is visible evidence of excessive moisture in the air. It is the process of change and is a naturally occurring phenomenon. Condensation commonly occurs when a vapor is cooled to its dew point. "Dew point" is the temperature at which the air will no longer hold its moisture vapor. When an air mixture has reached its dew point temperature, its relative humidity is 100%. All air contains a certain amount of moisture, even indoors. The colder the air, the less water vapor it will hold. New windows and doors are not causing the moisture but because modern windows are more energy efficient, air flow through the house is reduced and existing moisture is manifested on the windows and doors.

Exterior Condensation

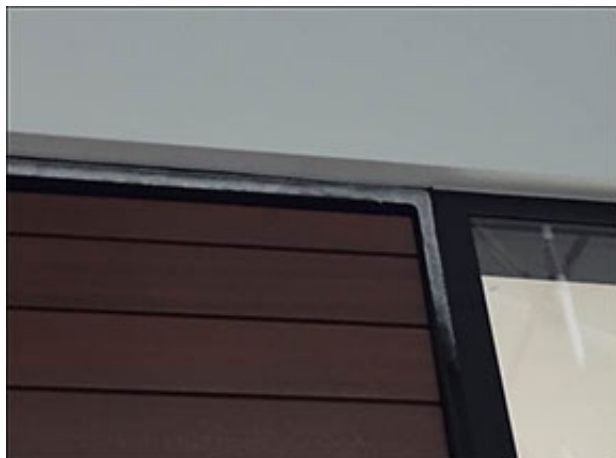
Exterior condensation forms on the outside glass pane and is more common during summer months. Condensation on the exterior glass surfaces of windows and doors occurs because of the increased efficiency (U-value) of the better products produced today. On clear nights with still, humid air, condensation occurs when moisture-laden air comes in contact with a glass surface, which is below the dew point temperature. In higher performance windows with low-E glass, the outside glass surface can actually be colder than the glass on lower performing windows. This is because the high performance window is doing its job – reducing heat flow to the outside and preventing the warming of the exterior glass surface above the dew point. This is not a window defect, but rather proof that the window is energy efficient.

Interior Condensation

As the outside temperature drops during the winter months, interior condensation can form on the pane window or door. Condensation usually occurs first on windows and doors because these surfaces typically have the lowest temperature of any of the interior surfaces in the home. When the warm moist air comes into contact with the cooler surface, the moisture condenses. The colder the air outside, the more likely condensation is to occur because there will be greater extremes between indoor and outdoor temperatures. See below for ways to decrease the occurrence of this kind of condensation.

Frost vs. Condensation: Frost varies from condensation in a few ways. Perhaps the biggest difference is that *condensation can occur regardless of whether or not the window frame is insulated whereas frost seldom occurs with insulated frames*. In new construction it is common for building materials to have a "drying out" period for at least a year. During this time the humidity levels are high because the building materials are out gassing water vapor. What exacerbates the condensation is that areas nearest the windows are typically the coldest places in the room and may not have enough air circulation. These areas are therefore susceptible to humidity condensing on the frames and/or glass. Most can relate to this condition as it relates to car windshields. Drivers battle condensation (inside and outside) until the surface temperature changes, and/or more air moving across the surface.

Interior Window Frame Frost: The manifestation of condensed ice, beginning as water vapor, by exterior cold is frost. Though a common occurrence with high conductive metals this rarely happens on insulated aluminum framing (thermal break) if the rest of the dwelling has implemented mitigating steps (see Preventive Design below).



Preventive Design

Though metal windows and doors may never perfectly avoid frost and/or condensation, builders and architects can minimize the affects. Below are steps that you can take to reduce the conditions that cause condensation and/or frost.

1. Increase Air Temperature

- Raise the temperature inside the house.
- Insulate under the seat and over the head of bay, bow, and garden windows to keep the window area warmer. Air circulation around these types of windows is usually more restricted, and since they hang away from the insulated house wall, could be a few degrees cooler in temperature.
- Direct warm-air supply ducts toward windows or use a fan for increased air circulation at windows.
- Radiant heating in walls and floors.

2. Increase Ventilation

- Open windows after steam-producing activities such as showering, laundry, and cooking. This allows the stale, humid air to escape, and fresh dry air to enter.
- Run kitchen, bathroom, and other fans more frequently and for longer durations.
- Improve or add a ventilation system in your home. Ensure that everything vents to the outside.
- Open blinds and drapes. Heavy window coverings restrict the flow of warm air over the interior glass surface.
- Operate ceiling fans to improve air circulation.

3. Reduce Moisture Source

- Stop or severely limit the use of humidifiers, or adjust them to an appropriate setting.
- Run a dehumidifier if needed.
- Limit plants, aquariums, and pets.
- Have your gas appliances checked. Malfunctioning gas appliances can deliver excessive water vapor into the air along with more dangerous contaminants. Be sure you have a carbon monoxide alarm.
- Store firewood outside.
- Don't air dry clothes indoors.
- Correct grading and drainage problems around the exterior of your home.

Proactive Manufacturing

Fleetwood provides an aluminum sill pan for each of its insulated frame (thermal break) products. If concerns exist for either frost transfer or condensation through the sill pan, we recommend taking steps to "de-bridge" the pan or use other flashing. In the case of the latter the installer takes full responsibility to make sure the flashing is a design replicating the factory provided pan.

Note: While considering thermally broken aluminum framing, consideration should be applied to the potential for [Solar Expansion/Thermal Twisting](#).