Service & Maintenance:
CONDENSATION

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Introduction

Moisture on windows and doors is commonly referred to as condensation. While it can be concerning or frustrating, the good news is you can minimize or prevent condensation by controlling the humidity inside your home. We're glad to help by providing you with information and resources.

Roomside Condensation

Condensation on the interior of windows and doors is not caused by the window or door product. Condensation is the result of high humidity levels in your home. Air with high humidity holds water vapor until it comes into contact with a surface temperature less than or equal to the dew point (the temperature at which air becomes saturated and produces dew). Because glass surfaces are usually the coldest part of the home, condensation appears on windows first, generally in the form of water droplets or frost on the roomside of your window. As interior air becomes drier or as the glass surface becomes warmer, condensation begins to dissipate.

Replacing drafty windows and doors or installing a new roof or siding reduces air infiltration into your home making it tighter. Because a tighter home retains more humidity, condensation on colder surfaces in the home may occur more frequently than before the changes in the construction.

Conditions which CAUSE condensation

Inside	Outside
Temperature: 70° F Humidity: 40% Dew Point: 44° F Glass Temperature: 43° F	Air Temperature: 0° F



- Humidity is higher than recommended amount.
- High humidity causes dew point to be higher.
- Condensation appears on interior glass because glass temperature is below dew point.

Conditions which PREVENT condensation

Inside	Outside
Temperature: 70° F Humidity: 30% Dew Point: 37° F Glass Temperature: 43° F	Air Temperature: 0° F



- Humidity is at recommended amount.
- Lower humidity also lowers dew point.
- No Condensation on interior glass because glass temperature is above dew point.

Maximum Recommended Humidity Levels

Outside Temperature	Inside Humidity
20° F to 40° F	Not over 40%
10° F to 20° F	Not over 35%
0° F to 10° F	Not over 30%
-10° F to 0° F	Not over 25%
-20° F to -10° F	Not over 20%
-20° F or below	Not over 15%

Based on engineering studies at 70° F conducted at the University of Minnesota Laboratories.

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Exterior Condensation

Exterior condensation generally occurs in the summer months. It is caused by three main conditions: high outdoor humidity, little or no wind and a clear night sky. It forms in the same way as roomside condensation when the temperature of the glass is cooled below the dew point of the outside air (as opposed to inside air in roomside condensation).

To combat exterior condensation, open window coverings at night to warm up exterior glass and remove or trim shrubbery near windows or doors to promote air circulation. Increasing the air conditioner setting by a couple degrees warmer might also help.

Triple-pane Low-E Insulated Glass with Argon

Outside

Air Temperature: 50° F
Dew Point: 48° F

Glass Temperature: 47° F



Inside

Air Temperature: 70° F

- Heat loss to the night air and sky cools outside glass.
- Energy efficient window keeps heat inside the home so exterior glass stays cool.
- Condensation appears because exterior glass temperature is below dew point.

Double-pane Clear Insulated Glass

Outside

Air Temperature: 50° F
Dew Point: 48° F

Glass Temperature: 55° F



Inside

Air Temperature: 70° F

- Heat loss to the night air and sky cools outside glass.
- Non-energy efficient window allows heat from inside the home to warm up exterior glass.
- Condensation does not appear because exterior glass temperature is above dew point.

Between-the-Glass Condensation

Condensation between two pieces of Insulated Glass is not controllable and is an indication of glass seal failure. Contact your nearest Pella Service Center for this situation.

Effects of Condensation

High interior humidity can lead to structural damage to your home and health hazards. Because these effects frequently occur unseen in the wall cavities, attics and crawl spaces, the visible sign of condensation on glass is a good clue humidity levels are too high.

Problems like window condensation and musty odors are nuisances while others can be more serious such as water stains on walls and ceilings or structural damage. The important thing to remember is that your windows are trying to tell you to reduce indoor humidity before it causes hidden, costly problems elsewhere in your home.

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Condensation Prevention

QUICK TIPS FOR CONTROLLING HUMIDITY AND CONDENSATION IN YOUR HOME

SOURCES OF HUMIDITY	ACTION REQUIRED
Cooking and dishwashing	Vent stove range hoods to the outside, cover cooking pots to reduce steam
Showers and baths	Vent bathroom exhaust fans to the outside and use fans for at least 15 minutes after taking a shower
Ironing, washing and drying laundry	Properly vent appliances to the outside, use clothes dryer instead of hanging wet clothes indoors, use exhaust fans
Inadequate ventilation of windows	Open window coverings and make sure interior doors are left open during the day to allow air circulation; remove inside screens
Moisture producing areas	Close doors and windows to greenhouse areas, hot tub or pool, cover large aquariums
Moist air trapped in attic and crawl space	Be sure soffit vents are clear of dirt and debris, seal around indoor light fixtures to prevent warm air rising to the attic; Use vapor barriers to prevent moisture in the soil from rising into the home
Furnace	Make sure furnace is working properly and serviced regulary. Look into dryer heat sources such as gas or electric furnaces
Stale, damp air	Install an Air-to-Air exchanger to vent moist air outside and make sure its openings are not blocked. Don't cover or deflect warm air registers, don't close off rooms, open windows slightly to let in cool, dry air
Groundwater seeping through foundation	Install gutters, flashing and downspouts and channel water away from home's foundation
Excessive humidifier use	Monitor humidity levels with hygrometers to keep moisture in air at optimum levels, turn humidifier off or down
Indoor plants	Circulate air with small fans
Damp basement	Run a dehumidifier in the basement to reduce excess moisture
Firewood	Store firewood outside
New wood, plaster, cement, and other building materials	Building materials contain a lot of moisture. The first heating season causes this moisture to flow into the air and settle on cool surfaces. This type of condensation may last a few heating seasons.

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Frequently Asked Questions

WHAT IS CONDENSATION?
Condensation is the process of changing a gas into a liquid. As air becomes saturated with too much humidity, it cannot hold the water vapor. Moisture is in the air all around us. When warm, moist air contacts a cooler surface, such as window glass, it cannot hold as much water vapor so it condenses onto the cool surface.

DO WINDOWS OR DOORS CAUSE ROOMSIDE CONDENSATION?
Windows and doors do not cause condensation. Typically the first place condensation can be seen is on window and door glass. Just like your bathroom mirror doesn't cause condensation after a hot shower and your car windows don't cause interior frost in the winter when several passengers are in the vehicle; the cooler surface is where it collects.

WHY DOES ROOMSIDE CONDENSATION OCCUR?
Condensation is water appearing on the roomside of windows and doors because conditions are just right for this to happen. The roomside glass surface temperature is at or below the dew point for the amount of moisture (humidity) in the inside air. When warmer air, which can hold more moisture than cooler air, contacts the cool surface of the glass, the air condenses and squeezes the water out onto the cool surface.

WHAT IS DEW POINT?
The temperature of air at which it can no longer hold all of its water vapor and some of the water must condense into liquid water.

WHAT CAUSES EXCESS HUMIDITY IN THE HOME?
Everyday living: Showers, baths, cooking, washing dishes, laundry, dog water bowls and cleaning all add moisture to the air in your home; as much as 4 gallons or more per day in some homes. People even exhale moisture into the air as they breathe.
Home construction: Today's energy efficient, well-insulated homes help hold down heating and cooling costs however, the same building techniques that help block outdoor air from entering our homes also keep moisture from venting to the outdoors

IS ROOMSIDE CONDENSATION MORE LIKELY TO OCCUR IN CERTAIN CLIMATES OR TIMES OF YEAR?
In areas where January temperatures average 35°F or less, condensation is more likely to occur. In the summer and fall months, homes pick up moisture from damp air. As the heating season begins and windows are closed, the indoor air will have more moisture, so temporary condensation for the first few weeks is possible.

ARE THERE OTHER CASES WHERE WINDOW CONDENSATION IS ONLY TEMPORARY?
Building materials used in new construction or remodeling such as wood, cement, dry wall, plaster and paint contain moisture which is gradually released into the air of the home. This excess moisture can cause condensation but will usually disappear after the first few heating seasons.
Homes also absorb moisture during humid summers. This moisture condenses during the first few weeks of heating until the house dries out. Additionally, anytime there are quick and sudden drops in temperature during the heating season, condensation may temporarily appear.

WHY DO I HAVE CONDENSATION WITH MY NEW WINDOWS WHEN MY OLD WINDOWS DID NOT?
Windows do not cause condensation; however, they are an indicator of high humidity levels. The older less efficient windows allowed air to move across the glass by letting air inside or allowing inside air to escape outdoors, preventing the air temperature of the glass from reaching dew point.

WHY DO I HAVE CONDENSATION ON MY WINDOWS AND MY NEIGHBOR DOES NOT?
Indoor temperature, ventilation, air exchange, window coverings and floor plans as well as everyday life can vary from home to home. It is not unusual for a family of four to contribute 15 to 20 pounds of moisture per day to their indoor environment depending on their habits. The typical family of four can produce 12 pounds of moisture per day just breathing. Washing dishes for three meals a day can produce one pound of moisture. One shower can add ¼ pound and there are many other activities or situations where moisture is added to the indoor air.

IN THE SAME ROOM, WHY DOES ONE WINDOW HAVE ROOMSIDE CONDENSATION AND OTHERS DO NOT?
There are many factors attributing to this phenomenon including any number of the following: Air circulation within the room or home, varying room temperatures, air register location, type of window (Bay or Bow may be colder), window size, glass type (Low-E versus clear), window coverings, window screens, water source closer to one window than another (ie. plants), the direction the windows are facing, elevation of the windows, wind direction, direction of the sun or partial blocking of the sun due to trees, buildings, etc.

DO WINDOW COVERINGS OR DRAPES CAUSE ROOMSIDE CONDENSATION ON WINDOWS OR DOORS?
Drapes and other window coverings do not cause condensation; however, they can contribute to the problem by restricting the flow of air over the glass surface. Therefore, condensation is more likely to occur when drapes are closed and shades are pulled down.

Continued on next page

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Frequently Asked Questions

HOW DOES AIR CIRCULATION IMPACT ROOMSIDE CONDENSATION?
Air circulation affects the supply of fresh air to all areas of your home. Poor air circulation within your home will keep the air next to your windows cooler. When air movement is restricted next to a cool surface the air will cool down sooner than well circulated air. As room air temperature decreases, its ability to hold the water vapor decreases. Using the same principle as a defroster in an automobile, supplying fresh air to the glass area slows down the cooling process and reduces condensation.

DOES THE AMOUNT OF ROOMSIDE CONDENSATION DEPEND ON WINDOW TYPE?
Sometimes; Bay and Bow windows may experience more condensation than other window styles because they are typically installed away from the insulated house wall where inside air circulation is usually more restricted. Bays and Bows could be a few degrees cooler in temperature than other windows in the same room. Insulating between the window head and seat board is recommended to help reduce condensation. In extremely cold climates additional insulation above the head board and below the seat board may also be necessary. Additionally, glass above the checkrail on a single or double-hung window may be a few degrees cooler than the bottom sash because of restricted circulation of interior air.

DOES THE AMOUNT OF ROOMSIDE CONDENSATON DEPEND ON GLASS TYPE?
Sometimes; certain low-e coatings are applied to the interior of glass and are designed to redirect interior heat back into the building rather than let it escape through the window. This increased efficiency may allow the interior glass to stay cooler which may increase condensation risk during winter.

WHY DOES A STRIP OF CONDENSATION SOMETIMES FORM ALL THE WAY AROUND THE ROOMSIDE OF THE WINDOW?
The center of the glass stays warmer than the glass close to the edge. The strip of condensation is NOT an indication the window is leaking air or not functioning correctly.

HOW CAN HUMIDITY CAUSE PROBLEMS?
Excess humidity can create problems; some are just nuisances like condensation on windows, musty smells, others can be more serious such as blistering or peeling paint, damage to insulation, stains on walls and ceiling or structural damage to the home.

WILL ROOMSIDE CONDENSATION RUIN MY WINDOWS?
If condensation issues are not addressed, window problems may appear over time.

WHY DO I STILL HAVE ROOMSIDE CONDENSATION EVEN THOUGH I AM RUNNING A DEHUMIDIFIER?
The humidity is most likely still too high. There are a variety of reasons condensation may still be appearing including but not limited to; varying air temperature in the home, air circulation, window coverings and other sources of water placing more moisture in the air than the humidifier is removing.

WHAT CAN I DO TO CONTROL ROOMSIDE CONDENSATION?
Reduce humidity. See table on page 4 for specific examples.

DO WINDOWS OR DOORS CAUSE EXTERIOR CONDENSATION?
No, windows and doors do not cause condensation. Exterior condensation is dew; the same condensation you see on car windows, lawns and streets on many mornings. Dew on windows is a natural atmospheric phenomenon, and it doesn't mean your windows are leaking air or malfunctioning in any way. Actually, exterior condensation is a sign of energy efficiency, indicating the outside pane is thoroughly insulated from the heat indoors

WHY DOES EXTERIOR CONDENSATION OCCUR?
Exterior condensation happens when the exterior surface temperature of the glass falls below the dew point of the air. This type of condensation is more likely to occur when outside humidity levels are higher. It typically occurs in the spring and fall when cool nights follow warm days.

HOW CAN I CONTROL EXTERIOR CONDENSATION?
Open the drapes or shades at night, increase the interior temperature a few degrees at night or shield the windows or doors from direct line of sight to the sky using trees, awnings, etc.

WHAT DOES CONDENSATION BETWEEN THE GLASS MEAN?
Condensation between the two sealed panes of insulating glass is an indication of seal failure and the insulating glass will need to be replaced.
Condensation behind the Hinged Glass Panel on a Lifestyle or Designer Series® window is usually an indication of excess humidity in the home, follow the steps listed above.

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Sources

http://www.wdma.com

http://www.extension.umn.edu

http://www.uwex.edu

http://www.efficientwindows.org

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