ADVANCED WINDOW CORP.
4935 W. LE MOYNE ST. • CHICAGO, IL 60651 773-379-3500

WINDOWS & CONDENSATION

Condensation in the form of water or ice on your windows is not only a destructive nuisance. It can be a sign of energy waste.

Every year with the arrival of cold, winter weather questions about condensation arise. The moisture that forms on window glass, obscuring the view, freezing or even collection in puddles on the windowsill, can be irritating and possibly even damaging. The first reaction may be to blame the windows for this problem, yet windows do not cause condensation.

Excessive water vapor, the temperature and air circulation are the three factors involved in the formation of condensation. Today's homes are built very "air-tight" for energy efficiency. They provide better insulating properties and a cleaner, more comfortable living environment than older structures. Unfortunately, these improvements in home design and construction have created some new concerns.

The more "air-tight" a home is, the less fresh air that home circulates. A typical HVAC system only circulates the existing air already within the home. This air becomes saturated with by-products of normal living. One of these is water vapor. Excessive vapor in the home will most likely show up as condensation on windows. This is a warning sign that the relative humidity (the measure of water vapor in the air) in your home is too high. You may see it develop on your windows, but it may also be damaging the structural components and finishes throughout your home.

WHAT IS WINDOW CONDENSATION?

Window condensation is the result of excess humidity in your home. The glass provides a cold surface on which humidity can visibly condense. The fog on your windows is a form of condensation; so is the water that forms on the outside of a glass of iced tea in the summer and on the bathroom mirror and walls after someone takes a hot shower.

Condensation usually occurs first on windows because glass has the lowest temperature of any interior surface in the home. When the warm, moist air meets the cooler glass, it condenses. The important thing is, your foggy windows are trying to tell you to reduce indoor humidity before it causes hidden, costly problems, like peeling paint, rotting wood, buckling floors, insulation deterioration, mildew, even moisture spots on ceilings and walls. Foggy windows and sliding doors are the indicators, the warning signs, that humidity could be damaging your home.

WHAT CAUSES WINDOW CONDENSATION?

Condensation is caused by the air temperature becoming too low to hold the water vapor that is in it. The factors involved in condensation are as follows:

1. The amount of water in the air of the home (measured in relative humidity)
2. The circulation of the air within the home
3. The air temperature both in the home and outside

The air in a room contains water vapor. The amount of water vapor in the air varies and is commonly expressed in terms of relative humidity. Relative humidity is the measure of the amount of water vapor in the air compared to the amount of water vapor the air can hold at that temperature and pressure.

The fundamental principle concerning air and relative humidity is, that the warmer the air temperature, the greater its capacity for holding water vapor. When warm air in a room encounters a cold surface the air around that surface begins to cool. As it cools, its ability to hold water vapor decreases. Eventually, it reaches a temperature at which it can no longer hold the vapor. This is sometimes referred to as the dew point. When the air reaches this point the water vapor begins to condensate, forming as tiny droplets of water on the cooler surface. Often the glass in your windows is the coolest visible surface and therefore you may see condensation develop there first.

WHERE DOES WATER VAPOR ORIGINATE?

Water becomes vapor by a process known as evaporation. Evaporation is the opposite of condensation. The air in a home gains water vapor by evaporation from several sources. The most obvious are running water in sinks, baths, showers, washing machines, humidifiers, heating systems, even houseplants. Cooking three meals a day adds four to five pints of water to the air. Each shower contributes half a pint. In fact, every activity that uses water, like dishwashing, mopping floors, doing laundry, adds moisture to the air. More water vapor in the air means a higher indoor humidity.

High indoor humidity means condensation during temperature fluctuations. Newly built or remodeled homes will acquire excessive amounts of water vapor from the new materials and finishes used in the project. As the water evaporates from these materials it will cause high levels of relative humidity in the home until the materials stabilize and the humid air is properly vented.

HOW AIR CIRCULATION AFFECTS CONDENSATION

Air circulation affects the supply of fresh air to the living areas of your home. Poor air circulation within your home will cause the air next to your windows to cool down quickly. When air remains still, next a cool surface, it cools down faster than air that is well circulated. As the 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 circulation to the glass area slows the cooling process and reduces condensation.

Drapes, blinds or other coverings attend to trap air next to the window, greatly reducing the air circulation in those areas. Bays, bows and other windows that protrude outward from the walls of the home are also susceptible to air circulation problems.

DOES TEMPERATURE AFFECT CONDENSATION?

Yes, the amount of water vapor air can hold is directly related to the air temperature. Warmer air can hold more water vapor than cooler air. When warmer air is cooled, it loses its capacity to hold water vapor and, if it cools enough, it will begin to condensate. It is important to remember that relative humidity is not the measurement of the actual amount of water vapor in the aur, but rather the amount of water vapor present compared to the maximum amount of water vapor the air can hold at that temperature and pressure.

For example, the air temperature in a room is 70° and it has an amount of water vapor that produces a relative humidity of 50%. Without changing the amount of water vapor, the air temperature is lowered to 50°. This changed the relative humidity to 100%. The air is now holding its maximum amount of water vapor for that temperature. It has the same amount of water vapor, but because of the lower temperature, the relative humidity becomes greater.

During the heating season the air in your home will probably be maintained at a constant temperature. The real effect of temperature will be the relationship between the indoor air temperature and the outdoor temperature. The colder the temperature outside, the colder the glass surface will become, as well as the air temperature in the hidden structural areas of your home. As these areas cool down the air near them begins to cool as well. The air temperature in the room may be relatively unaffected, but the air next to the windows glass or in these hidden areas will be colder. This air may cool below its maximum vapor saturation point and condensation will begin to form.

ADVANCED WINDOW CORP.
4935 W. LE MOYNE ST. • CHICAGO, IL 60651 773-379-3500

WHAT TO DO WHEN CONDENSATION OCCURS

It is important to first identify the cause of condensation before a solution can be implemented. Here is a list of possible explanations.

1. Is the home new or newly remodeled? These homes will often have high levels of water vapor present in the air for the first year or longer. This occurs because the new materials used are slowly stabilizing and water is evaporation from them into the air of the home. In the case of new windows, doors, or other exterior wall elements such as siding or roofing, drafts have suddenly been dramatically decreased and moisture now stays inside with the heat. During the first heating season, condensation will often appear on windows until the high level of water vapor in the air is dispersed.

2. Check the relative humidity in each room of the home. Your windows are your first gauges for measuring relative humidity. When you see condensation on the windows, it is a warning sign that excessive water vapor is present. The best way to measure relative humidity in a home is to use a sling psychrometer. It will five accurate readings when properly used. Take reading in every room, even if the windows in other rooms do not have condensation on them. Relative humidity levels will often vary significantly from room to room. Keep a record of your readings, the time of day, the weather condition, and the temperature outside and inside. It may be necessary to take readings more than once a day, especially if condensation occurs at a particular time each day.

3. Where is the window located? Windows that do not receive direct sunlight will probably develop condensation before windows that are exposed to direct sunlight. Windows, such as bay and bows, that extend out from the main walls of the house, may be more exposed to the cold elements outside and may be isolated from good air circulation inside the home.

4. Consider other conditions. Window treatments like drapes, mini-blinds, and shutters can prevent good interior air circulation, cutting off air exchange near the glass surface. These should be opened regularly on cold days to allow trapped moisture to evaporate into the room. Windows in different rooms are likely to have different environments due to relative humidity levels, the location of the registers and other physical factors.

SOLUTIONS

To control condensation, it is necessary to control the relative humidity levels, air temperature, and air circulation within the home. Follow these guidelines to maintain an ideal environment in your home.

CONTROLLING RELATIVE HUMIDITY

Controlling the amount of water vapor in the home controls relative humidity. The best way to control the amount of water vapor in the home I to properly vent the home with a fresh air exchange system. Fresh air exchangers can work in conjunction with your heating/cooling systems, or they can function independently, depending on the system. These systems will exhaust the moisture-saturated air and continually provide a fresh air supply to the home. Additionally, use exhaust fans in the kitchen and bathrooms to remove excess moisture from those areas. Make sure the basement or crawl space is properly sealed or protected from ground moisture. Ventilate the attic and crawl spaces to promote evaporation. Ventilate all appliances to the outside, not to the attic or crawl space. In extreme cases a dehumidifier may need to remove high levels of water vapor. Dehumidifiers should only be considered as a temporary solution because they do not affect the source of the moisture.

CONTROLLING AIR TEMPERATURE

During the heating season it is important to keep your heating system in good, efficient operation. Remember, the temperature of the air directly affects the relative humidity and the amount of water vapor the air can hold.

CONTROLLING AIR CIRCULATION

Air circulation will primarily be controlled by the heating/cooling system. The registers and return air vents should be located to provide good crossflow. Locating the registers under windows is highly recommended. Ceiling fans and other portable fans can be used to increase the circulation. Be careful with the use of window treatments not to isolate windows from good air circulation.

RECOMMENDED INSIDE HUMIDITY LEVELS

To control window condensation, it is recommended that the humidity levels in the home be controlled. The general rule is to reduce the humidity levels as the temperature outside decreases.

To avoid excess condensation, the following winter humidity's are recommended in the house:

Room Inside Temperature	Room Outside Temperature	Relative Humidity Temperature
70°F	-20°F	15% to 20%
70°F	-10°F	20% to 25%
70°F	0°F	25% to 30%
70°F	10°F	30% to 35%
70°F	20°F	35% to 40%

Remember that energy efficient vinyl windows resist condensation!

Upgrade your windows to one of Advanced Window Corp.'s certified products, all of which feature high performance Low-E glass options. These Energy Star windows and patio doors are designed to maximize energy efficiency as well as provide the most insulating power. The warmer you can keep your window glass, the lower your chances of experiencing excessive condensation on your windows.

Visit us online or in person to learn more about energy efficient windows and doors.

ADVANCED WINDOW CORPORATION