



WINDOW CONDENSATION

What is Humidity?.

Each winter sees more and more homeowners vitally interested in the subject of window condensation. It's not happy interest. It stems from bad experiences with window condensation, which range from irritating to downright expensive

It may strike you as odd, but the growing condensation problems of the nation are caused by progress. Yes, if you have trouble with window condensation it's probably because you live in a "tight" modern home that you can heat for a fraction of the money it takes to heat the house your parents lived in - a home that's cleaner and more comfortable besides! A "tight" home is one that is insulated better and sealed from all outside elements better than older homes that have less problem with condensation. The older *less tight* homes have many ways for the moisture to escape and therefore cause less problems with moisture. Your condensation problems also result from widespread use of several labor saving appliances that make life easier than it use to be.

This is information that explains the moisture problem of the "tight" home. It offers suggestions for curing condensation problems in existing homes. It provides additional suggestions for you who are planning a home. You unquestionably will build a "tight" home, and there are more things you can do to **PREVENT** excessive moisture when you build than can be done in a home where the problem already exists.

What Causes "Trouble" Condensation

A little fog on the lower corners of your windows now and then probably doesn't bother you. It shouldn't. By the time you've thought about it a second time it has usually gone away.

What we're talking about is **EXCESSIVE** or troublesome condensation. Condensation that blocks whole windows with fog or frost. Water that runs off windows to stain woodwork.... or in serious cases even damage the wallpaper or plaster. It's natural and easy in such cases to blame the paint, or the insulation, or the windows, but it's wrong to blame them.

What is Humidity?.

The real villain is invisible. *It's water vapor ... too MUCH water vapor.* The best, usually the **ONLY** way to prevent this trouble is to get rid of excess water vapor. Once you've equipped you windows with good storm windows or double glazing, there isn't very much more you can do to the windows to lick condensation. Humidity, water vapor, moisture steam, they're all the same. They are all one form of water. Humidity is an invisible gas. It is in varying quantities in nearly all air. **THIS MOISTURE IN WET AIR TRIES TO FLOW TOWARD DRIER AIR AND MIX WITH IT.**

Scientists describe this force as "*vapor pressure*" It is often a very powerful force indeed. It can act independently of the flow of the air that holds the moisture. Vapor pressure can force moisture easily through wood, plaster, brick, cement ... right through most of the materials we use to build our homes. That's exactly what happens when moisture seeks to escape from the humid air usually found inside your home to the drier winter air outside. More Moisture Trapped in Less Space certain building materials stop water vapor. Glass is one of these. Also on the list are some varnishes, paints, tiles, plastic wall coverings, Vapor-seal insulation is designed specifically to stop the escape of water vapor and protect the insulation and your walls from the ravages of water.

Increased use of these "*moisture trapping*" materials in the last few years has created the modern "*tight*" home. Moisture created by bathrooms, kitchens, laundries and occupants no longer flow easily to the outside. The modern insulation and construction that keep cold air **OUTSIDE** also keep moisture in. So it is very easy to build up excessive and even harmful moisture levels in such homes. **AMERICAN BUILDER** magazine calls the problem a combination of many causes that build excessive moisture in the modern home. First, more washing, more bathing, more showers, more appliances, more gas furnaces - all pour more water vapor into homes than in former years.

HEATING AND VENTILATION magazine provides builders with reference data on sources of water vapor. For instance,

cooking for a family of four adds 4.5 pounds of moisture a day to a house. Each shower contributes half a pound; a weekly laundry, 30 pounds; human occupancy contributes 6 to 3 pounds per day; dish washing 1.2 pounds, etc.

All of this moisture **MUST** eventually escape from you home. So you see that the modern living of a family of four can easily release 150 pounds, or more than 18 gallons of water per week into the air in your home! House's with no basements have further moisture problems. Now increased production of humidity is only part of the story.

Houses generally have been growing smaller and this means an even greater concentration of water vapor which is trapped by modern "tight" construction. It means **MORE** moisture contained in **LESS** space. No wonder we've created a condensation problem for ourselves!

David Bareuther, Associated Press Building editor, sums up the problem of reducing humidity this way. He says there are only three ways to reduce humidity:

- o **1. CONTROLLING SOURCES OF HUMIDITY:** For instance, venting gas burners, clothes dryers, etc, to the outdoors. Use of kitchen or bathroom exhaust fans.
- o **2. WINTER VENTILATION:** Because outside air usually contains less water vapor, it will "dilute" the humidity of inside air. This takes place automatically in older houses through constant infiltration of outside air.
- o **3. HEAT:** The process of heating our home will reduce the relative humidity - providing it's **DRY HEAT**. It will counterbalance most or all the moisture produced by modern living. Now, before we summarize specific steps for reducing humidity in your home, let's include some basic data about *RECOMMENDED MOISTURE*. You can refer to it if you are inclined to test the moisture levels in your home. The table below is the result of long and careful experiments at the University of Minnesota Engineering Laboratories. It shows the maximum safe humidity's for your home ... not just for the windows. Even **MORE** for your paint, insulation and structural members. In most cases, reducing moisture to these humidity's will cure troublesome condensation on window. If not, you can reduce humidity further without discomfort to you or your family. If you test humidity in your home, be sure to use an accurate instrument, preferably a good *sling psychrometer*. Remember, too, that these relative humidity's are for 70 degrees F. For higher temperatures, lower humidity's are required.

Outside air temperature	Inside relative humidity for 70-deg. F Indoor air temperature
-30° F or below	not over 15%
-20° F to -10° F	not over 20%
-10° F to 0° F	not over 25%

0° F to 10° F	not over 30%
10° F to 20° F	not over 35%
20° F to 40° F	not over 40%

These humidity's are comfortable. They are about the average of humidity's you would expect to find in a spring month in Phoenix, Arizona. Here, arranged from easy to more difficult, are the steps you should take to reduce condensation on you windows.

1. Put on storm windows or double-glazing.
2. Shut off furnace humidifier and any other humidifying devices in your home.
3. Be sure that louvers in attic or basement crawl spaces are open and that they are large enough.
4. Run kitchen or other ventilating fans longer and more often than has been you custom.
5. Open fireplace damper to allow easier escape for moisture. 6. Air out your house a few minutes each day. Air out kitchen, laundry and bathrooms during use or just following use. 7. If troublesome condensation persists, see your heating contractor about outside air intake for your furnace; about venting of gas burning heaters and appliances, or about installation of ventilation fans. If the commoner remedies we suggest (number 1 through 5) don't work, you REALLY have a condensation problem. The changes your heating contractor may recommend, to further reduce humidity in your home, should not be very expensive. Certainly they will be less expensive than a big paint job caused by excessive water vapor!

You see, the basic principle of reducing window condensation is extremely simple. When there's too much condensation on your windows, it means that humidity is too high in your home, You should take steps to reduce humidity until condensation disappears. In practice, window condensation and reducing humidity may become very complicated, because a score or more of entirely different conditions may affect the way the condensation problem works out in different homes. Let us just mention a few:

- o The number and type of windows in the home
- o The type of double glazing system used in the windows
- o The heating system -- Hot air or water perimeter or interior wall heating.
- o The type of insulation and vapor barrier
- o Type of soil and quality of drainage

Because of so many variables, a condensation problem can sometimes be very tough to solve. That's why we recommend that you put an expert to work on your problem if the simpler steps to reduce humidity doesn't solve your condensation problems. See your architect or your heating contractor first. If they can't help, we suggest that you ask tour general contractor or lumber dealer to put you in touch with a qualified expert. They are available both at engineering schools and from the staffs of heating, insulation, wallboard or window manufacturer. Before we leave the subject of reducing humidity, we would like to add the following:

There are two causes of condensation that are **TEMPORARY**. They will disappear after a few weeks or at most a season of heating. First, there is the moisture that comes from new construction or remodeling. There's much moisture in the wood, or the plaster or the other building materials of a new home. California now requires all paints to be a water base. When the heating season starts, this moisture will gradually flow out into the air in the home. Then it will disappear and not cause any more trouble.

Much the same sort of thing happens in a milder form, at the beginning of each heating season. During the

summer, your house has absorbed some moisture. After the first few weeks of heating, your house will be dried out, and you'll have less trouble with condensation. While we have been discussing the control of condensation we've mentioned just about everything EXCEPT windows. There's good reason. There is nothing much that can be done with WINDOWS to cut down condensation.

As the building experts have often pointed out, the windows are not to blame for condensation. In the moisture content of the inside air, lies both the cause and cure.

Construction materials in new homes are required to be water base products. (In California.) This would include paint and caulking compounds. As all of these products dry or cure, this moisture is combined with the normal moisture that your household normally produces.

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Understanding and Preventing Condensation

What is condensation?

Condensation is fog or moisture appearing on window or door glass in a home – usually on the room side glass. It's a common – but misunderstood – complaint of many homeowners who think the problem is caused by their windows or doors. In fact, this annoying condensation is actually an indicator that inside relative humidity – or the amount of moisture in the air -- is too high and may be damaging your home. Excess humidity may even affect your health.

An analogy is morning dew on the grass. After a humid summer day, warm, moist air comes in contact with the night-cooled grass. The cool air around the grass can't hold as much moisture as the warm air, so the excess moisture is deposited on the grass. The condensation does not come from the grass itself -- it's merely an indicator of excess moisture in the air.

What causes condensation?

Moisture from the air will condense on any surface that is colder than the dewpoint of the air. When humidity is too high in a home, condensation will form first on the coolest surface – most likely the glass on windows and doors. This condensation should not be blamed on the windows & doors. If inside humidity is high enough to form large amounts of condensation on window glass, most likely it is also causing moisture to condense on other, perhaps hidden, areas.

How does condensation differ between older and newer homes?

Most condensation problems occur in newer homes that are tightly sealed for energy efficiency. If you own a home in its first heating season, you may also experience some condensation because the home must get rid of many hundreds of gallons of water from masonry and plaster or texturing processes. Moisture from these sources should escape by the second heating season. Condensation is usually not a problem in older homes because moisture is allowed to escape through leaky windows and doors. Since many older homes do not have vapor barriers, moisture can also penetrate the walls and escape – making it difficult to build up higher levels of moisture in the home. In addition, the warm moist air is replaced by cool, dry air entering through cracks around and through old, inefficient windows and doors. This air exchange keeps inside relative humidity low

because cool air holds less moisture than warm air.

Where does all of that humidity come from?

All air has moisture in it; you just can't see it. Moisture inside a home comes from many things. People and pets breathing and perspiring, cooking, showers, dishwashers, washing machines and dryers all add moisture to the air. Other sources of moisture include humidifiers set too high, poorly insulated crawlspaces and new building products.

How can I measure indoor humidity?

There are two types of instruments you can use to measure inside humidity accurately: a sling psychrometer or a hygrometer utilizing mercury thermometers. However, the easiest way to accurately know if the inside humidity is too high is to watch your windows. When condensation begins to form, the inside humidity should be reduced before it causes hidden, costly problems elsewhere in the home.

What are the maximum recommended humidity levels?

The following information is based on engineering studies at 70° F conducted at the University of Minnesota Laboratories. Note that as the outside temperature drops, so must the interior relative humidity if condensation is to be prevented.

MAXIMUM RECOMMENDED HUMIDITY LEVELS	
<i>Outside Air Temperature</i>	<i>Inside Relative Humidity</i>
-20° F or below	Not over 15%
-20° F to -10° F	Not over 20%
-10° F to 0° F	Not over 25%
0° F to 10° F	Not over 30%
10° F to 20° F	Not over 35%
20° F to 40° F	Not over 40%

Why is keeping the proper level of humidity in my home important?

There are several reasons. The first is comfort. Doctors say dry nose and skin can begin to show up when indoor humidity falls to 25%. The chart of recommended maximum inside humidities indicates that when the outside temperature is below 0° F, humidity levels should be lower than 25%. So during extremely cold temperatures, a decision must be made to temporarily put up with dry conditions or temporarily allow window condensation.

The second reason to keep indoor humidity at the proper level is its effect on health. Health experts say that the drier the air the more likely a person is to get a respiratory illness. However, these same health authorities agree that the humidity levels in the chart to the left are normally adequate for good health.

Lastly, proper indoor humidity levels are vital for the preservation of a house. Air that's too dry can cause furniture to crack and dry out, joists and studs to shrink and twist, and paint and plaster to crack. Too much humidity is also a danger. Condensation moisture on windows can damage windowsills and trim. Excessive moisture in the home can cause paint to peel, insulation to deteriorate, and unsightly moisture spots to appear on walls and ceilings.

What steps can I take to reduce inside relative humidity if it's over the recommended levels?

- Shut off furnace humidifier and any other humidifying devices in you home.
- Be sure that louvers in the attic, basement and crawl spaces are open, are of adequate size and are cross-ventilated.
- Run kitchen, bathroom and laundry room exhaust fans longer and more often than normal.
- Be sure chimneys are free and clear to provide escape for moisture produced by combustion. Provide outside venting for gas appliances, including stoves and dryers.

- If you have a forced-air furnace, make sure your home is properly ventilated by installing a fresh air intake and an air-to-air heat exchange.
- Don't store firewood inside.
- Air out your house a few minutes each day. Crack a door or window on opposite sides of the home to exchange warm, moist inside air with cool, dry outside air.
- Treat basement floors and walls with efficient waterproofing. Vapor barriers should be provided for crawl spaces. Moisture allowed to enter here evaporates into the air and contributes to high inside relative humidity.
- Open curtains during daylight hours to increase air flow over the glass. This will lower inside relative humidity near the glass and can lessen room side window condensation. Removing inside screens can also increase the airflow over the glass.
- Install energy-efficient windows.

Condensation

What Causes Condensation?

Indoor moisture is caused by a variety of factors. Common household activities such as cooking, showering, running washing machines and dishwashers - every activity that uses hot water - adds moisture to the air.

New homes are more often subject to condensation because they are constructed with more weathertight materials than homes built before energy costs were a concern.

Weather-stripping, improved insulation, vapor barriers and modern construction techniques are designed to reduce air leakage. At the same time, however, these can act to seal in moisture. Unless provisions are made to allow this moisture to escape, moisture buildup can result.

Condensation on windows is an alarming signal of excess humidity in a home. When water, fog or ice forms on a window, the consequences can be devastating. Peeling paint, rotting wood and rusted metal can all result from this excess humidity.

Condensation occurs on windows when warm moist air comes in contact with the colder surface of the window. Although it is natural to assume that the windows are to blame, the fact is that the windows are merely a visible sign that humidity exists in the home.

Windows do not cause condensation. On the contrary, the right windows can be a great help in controlling and reducing it.

Can Window Condensation Be Only Temporary?

There are several instances when temporary window condensation can occur, including:

- During showers and baths, cooking, dishwashing and other steam-producing occasions.
- During the start of each heating season. Houses absorb moisture during humid summers. This will dry out after a few weeks of heating.
- During sharp temperature changes. Sudden drops in temperature, especially during the heating season, can create temporary condensation problems.
- During new construction or remodeling. Building materials contain a great deal of moisture. When the heat is turned on, this moisture will flow into the air inside the home. It usually will disappear after the first heating season.

What Can Be Done to Reduce Condensation?

There are many simple steps that can be taken to reduce the humidity level in the home:

- Vent clothes dryers, gas burners, etc. to the outdoors.
- Check that all ventilation equipment is adjusted properly.
- Use kitchen and bathroom exhaust fans.
- Air out the kitchen, bathroom and laundry room during and after use by opening a window for a few minutes.
- Make sure attic louvers remain open all year round and that crawl spaces are properly ventilated.
- Consult a local heating and ventilating contractor to help determine whether ventilation is adequate and whether it can be improved.



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Doors

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Sliding Patio Doors

Garden Doors

Industry Resources

Homeowners

- Insure humidifiers are correctly set according to outside temperature.

Vinyl Windows Resist Condensation

Windows with vinyl frames help guard against the damaging effects of window condensation because of the higher insulating value of the vinyl. Double and triple-glazed windows are far more effective than single-pane windows in reducing window condensation because they allow higher percentages of relative indoor humidity.