AROUND THE HOUSE

Causes and Solutions of Condensation Problems In Crawl Spaces, Wet Basements and Attics

Condensation is caused when warm, moist air moves into a cooler air space or comes in contact with a cooler object. The warmer the air is, the more ability it has to hold water. The cooler the air is, the less ability it has to hold water (i.e., when warm, interior air comes in contact with a cold surface, such as a metal window frame or cold water pipe, the vapors in the air turn to liquid on the colder surface).

In an attic in the winter, moisture or ice may form on the roofing nails and the roof sheating for the same reason.

Mold/fungus developes in attics and bathrooms when vapors permeate through the surface of drywall or plaster and turn to moisture before it exits the other side of the wall material. This is due to the change in temperature between the living space (or warm side of the wall or ceiling) and the exterior (or cold side of the wall or ceiling).

Some people install insulation between the rafters without installing any vents. While installing thicker amounts of insulation in their attics is excellent from a conservation and financial point of view, this can be a costly investment in the future if the attic ventilation has been blocked off. Blocking off the airflow from the attic area can cause condensation to build up which can, over a period of time, cause the framing and sheating to mildew, rot and/or delaminate. Most homes breathe through the soffits and out the gable end or ridge vents. By stapling vents to the underside of the roof, (between the rafters) with an end protruding into the soffit area, you can then add as much insulation as needed and still have airflow from your soffit area to the ridge vent or gable vent whichever you choose to use.

The best way to ventilate an attic:

The air in attics is warmer than the outside air in summer or winter. It is obvious how warm attics are in summer, but it may not be so obvious in the winter. Assuming the outside temperature is 35 degrees, the thermal loss from the house will raise the attic temperature 5–10 degrees, depending on insulation, wind, etc. Based on this information, the air in the attic will always be lighter than the outside air because it is warmer.

The best way to ventilate an attic would be with high-low ventilation because the only condition we can be sure of is that warmer air will be lighter and has a tendency to rise.

With high-low ventilation, the warmer air rises out of the high vents, preferably ridge vents, and this air is replaced by cooler air from low vents, typically soffit vents.

The amount of air and the speed it moves is dictated by the temperature difference between the attic space and the exterior. This is called thermal convection. When the ventilation is correct, mother nature will control the air changes based on temperature differentials and mechanical help is unnecessary.

General criteria for improving attic ventilation:

1) For every 300 square feet (SF) of attic floor space, you need at least one (1) SF of clear air. If the clear air is not distributed 50% high and 50% low, you will need additional ventlation and without a proper vapor barrier, it may be necessary to have considerably more ventilation.

1) Louvers and vents are typically only 50-60% of their total measurement in clear air. Be sure to calculate this when you buy these appliances.

Note: If you cannot develop high-low ventilation, you will have to increase the horizontal or high ventilation by 100% or more, or approximately two (2) SF for every 300 SF of attic floor space.

Crawl Spaces:

A 1200 square foot house with a family of four generates 7.4 to 12.7 quarts of water into the house per day. With a crawl space, it goes up to four times

greater than the occupants generate in the house, which can be as high as 47.5 quarts per day.

Where there is saturated soil or ponding bulk water beneath a house or where the house is built on a crawl space through which water can migrate to the surface, water will move by the most fundamental mechanical process of a molecule of water transferring to adjacent air molecules. As the molecules of air become burdened with many molecules of water the air pases water to adjacent molecules. The process of water molecules moving through the air is called *vapor diffusion.*

Water in air will always move from molecule to molecule to achieve an equal distribution of water in the air available. This tendency of water to distribute from areas of high concentration of vapor to lower concentrations of vapor is referred to as *partial pressure of vapor.*

In the crawl space water will move from the pond by evaporation, through the air by vapor diffusion. When the vapor laden air meets the floor above it will continue on driven by partial pressure of vapor or move through construction material such as lumber by capillarity in the same way oil moves through a wick.

If you have fiberglass insulation between the floor joists of the crawl space it will become moisture laden and will eventually fall to the ground or will cause the lumber to mildew, brown rot or delaminate.

Remove the fiberglass insulation and replace it, if you feel you need insulation, with Styrofoam board as it will not absorb moisture.

Add ventilation of 1 square foot for every 400 square feet of area and do not block the vents at any time of the year. If you have water pipes in the crawl space get the pipe properly insulated to prevent breakage. If the pipe is in front of an air vent put a diverter on the vent to prevent the cold air from blowing directly onto the pipe, but make sure the pipes are properly insulated.

A vapor barrier should be placed on the dirt floor, overlapping by at least 3 feet so moisture from the ground beads up under the vapor barrier and goes back into the ground and does not enter the home.

A fan in the crawl space blowing outside should have a thermostat and a humidistat so it will operate in all four seasons to move any moisture-laden air out of the crawl space.

If you have a high water table, a sump pump should be installed pumping the water out of the crawl area and away from the foundation and should be regularly maintained.

Basements with stone or block foundations sometimes have the same moisture problems as a crawl space, especially if it has a dirt floor or few or no basement windows for air circulation and light.

Stone and block foundations will absorb water much like a sponge, it just takes longer to release the water during the wet season. Many stone and block foundations were not built with foundation drains.

Several precautions should apply whether the foundation is stone, block or poured concrete. All gutters and leaders should be cleaned every year and the leaders should be diverted away from the foundation. If the basement windows are below the grade, window wells with stone should be installed to prevent water going over the top of the windows. The grade around the foundations should be at least a 3% grade going away from the foundation on grass and at least 1% on a hard surface. If the grade cannot be corrected a swale or curtain drain may be your answer.

If you have a high water table a French drain on the interior of the basement with a sump pump if you cannot grade it to the outside is another answer for wet basements.

Dirt floors should have concrete poured on them to prevent moisture buildup coming up from the ground.

Call a professional if you cannot handle any of these problem areas. Failure to eliminate water migration from beneath a building or in the attic will result in a slow progression of component failure of the construction lumber. Attic sheathing will become blackened with fungal rot and delamination and will been to be replaced within 8 - 10 years at double the cost of a typical re-roofing.

If a family member suffers from allergies, asthma or frequent repiratory infections, correcting water handling and improving indoor air quality is just as important as the building component failures.

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