



STYROFOAM Lowers Risk of Wall Condensation Versus Plywood, OSB, or Fiberboard Sheathings

STYROFOAM* brand insulation in frame wall sheathing applications

Compared to Plywood, OSB and Fiberboard, STYROFOAM* brand insulation has a higher insulation value, so it keeps the wall cavity warmer and warmer cavities lower the risk of condensation.

Eminent Researchers Write:

" The insulated effect of the foam sheathing does have the effect of keeping the stud cavity at a higher temperature during the winter than a similar cavity using plywood or fiberboard sheathing."

- U.S.D.A. Forest Products Laboratory, Research Paper FPL 433

" These laboratory tests showed that the addition of an exterior low-permeability insulation retrofit system (STYROFOAM brand insulation and aluminum residing) would result in a reduction in the moisture accumulation within the existing wood siding and (wood fiberboard) sheathing.

These findings are consistent with the results of a limited field survey. The model showed that the addition of the exterior retrofit insulation system raised the temperature at the interface between the (wall) cavity insulation and the (existing) wood-fiber sheathing."

- National Bureau of Standards Report DE-79-3 No. 3

"Use exterior insulating (foam) sheathing in place of or in addition to plywood or fiberboard sheathing to greatly reduce the chance for high wall cavity moisture levels and the long-term potential for wood decay."

- Northwest Wall Moisture Study, George A. Tsongas, Ph.D., P.E.

UNDERSTANDING WALL CONDENSATION

What is a dew point?

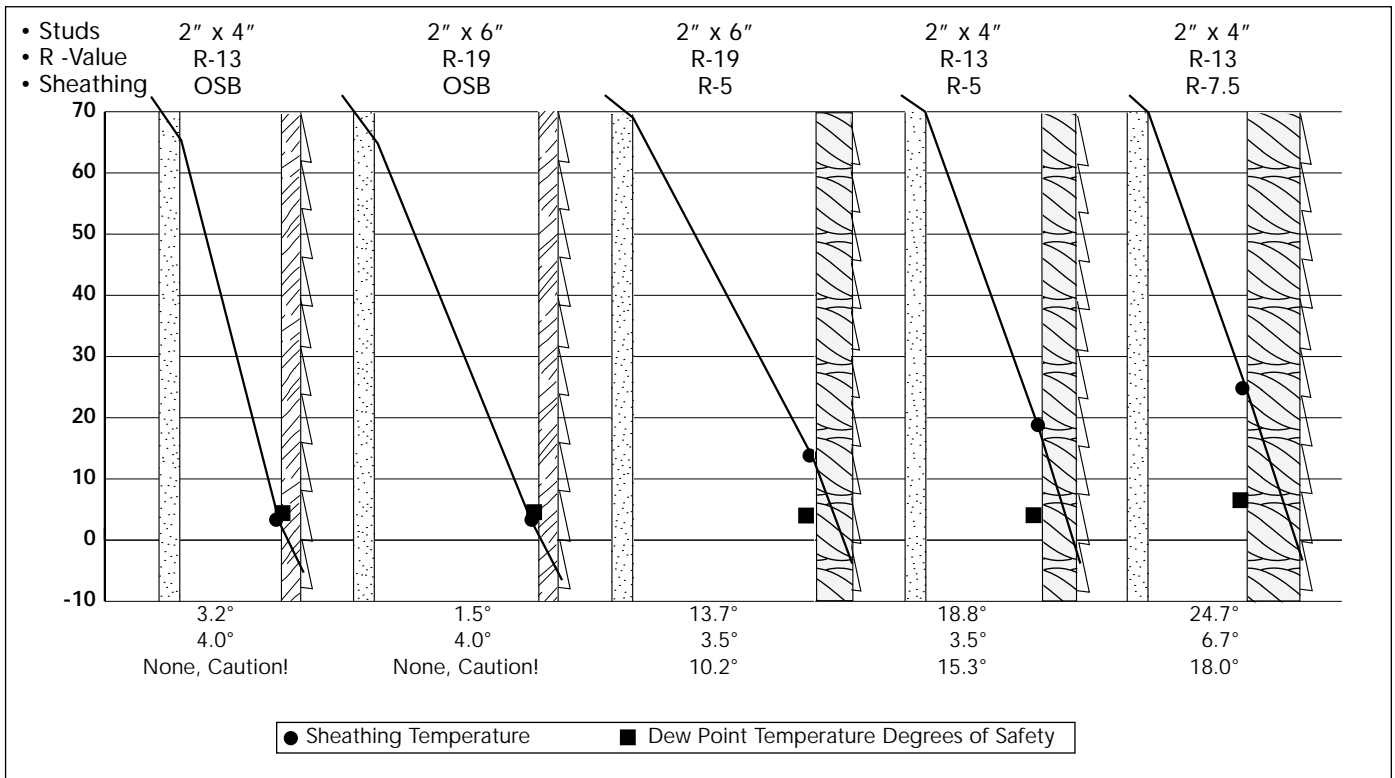
A dew point is the temperature at which water vapor in the air begins to condense. Water vapor does not harm the wood framing or other wall components. It is only after water vapor has condensed into liquid water that it can begin to cause damage.

Why does water vapor try to move into the wall cavity?

Water vapor always moves from warm air towards colder air because warm air holds more water vapor (so has higher vapor pressure). Nature always tries to equalize pressure differences. So in winter, water vapor from the warm interior of a home tries to move toward the colder exterior. Then in summer it reverses, and water vapor moves from the hot, muggy exterior to the cool, dehumidified interior of the air conditioned home.



Wall Cavity Temperatures



Inside Conditions 72°, 40% RH
 Outside Conditions -3°, 80% RH

Wall assembly consists of: interior air flow, 1/2" drywall, 6 mil. poly, fiberglass batts, sheathing, vinyl siding, outside air film

	EFFECTIVE R-VALUE	SHEATHING TEMPERATURE	DEWPOINT TEMPERATURE	DEGREES* OF SAFETY
2" x 4", R-13, OSB	11.8	3.2	4	None Caution, Dew Point
2" x 6", R-19, OSB	15.8	1.5	4	None Caution, Dew Point
2" x 6", R-19, R-5 TGW	20.7	13.7	3.5	10.2
2" x 4", R-13, R-5 TGW	16.7	18.8	3.5	10.2
2" x 4", R-13, R-7.5 TGW	19.4	24.7	6.7	18.0

*Degree of safety indicates how many degrees above the dew point temperature is the sheathing temperature

Where does water vapor condense?

In walls, water vapor condenses on cold surfaces. If the temperature of a surface is colder than the dew point temperature (such as OSB sheathing in

the winter), water vapor will condense on that surface. If the temperature of the surface is warmer than the dew point temperature (such as STYROFOAM brand insulating sheathing), the water vapor

will not condense. Good examples are the hot and cold water lines in a home. On a warm, humid day, water vapor will condense ("sweat") on the cold water line, because the temperature of the line is colder

than the dew point temperature. However, water vapor will not condense on the warm water line, because its temperature is warmer than the dew point temperature.

How does water vapor move through the wall?

Water vapor moves through the wall in two ways: by vapor diffusion and by air leakage. Diffusion is the relatively slow movement of water vapor directly through the wall components. Air leakage is the flowing of humid air into wall cavities through cracks and holes in the wall components, such as the cracks around window frames, holes for piping, electrical outlet boxes, etc. It is important for you to recognize that air leakage conveys much more water vapor than does diffusion. A good example is a canvas bag filled with water. Water will slowly seep through the bag, similar to diffusion. But if a hole is made in the bag, the water will rapidly pour through the hole.

How do I prevent water vapor from moving into the wall during the winter?

By reducing both the vapor diffusion and the air leakage noted above. Diffusion is reduced by using a vapor retarder on the warm side of

the wall. Air leakage is reduced by caulking or taping any cracks or holes in the wall construction. Acceptable vapor retarders include paper-faced batt insulation, vapor-retarding paints, polyethylene film, etc.

What happens if water vapor somehow does enter the wall cavity through a crack or a hole?

Nothing happens, so long as the cavity temperature remains above the dew point. It simply remains in the cavity in harmless vapor form. However, as shown in the example on page 2, when the exterior sheathing has very little insulating value, such as OSB or plywood, the sheathing surface is quite cold, which increases the potential for condensation. This condition is even worse in 2" x 6" stud walls, because the thicker fiberglass makes the plywood or OSB sheathing even colder. On the other hand, an insulating sheathing such as STYROFOAM brand insulation helps keep the wall cavity warmer, which greatly reduces the potential for condensation.

But aren't OSB and plywood better than STYROFOAM brand insulation because they can "breathe"?

No, there is a common misconception that OSB and

plywood sheathings are more "breathable" or more permeable to water vapor than STYROFOAM brand insulation. Permeability is a measure of how fast water vapor diffuses through a material, i.e., the higher the permeability, the faster the water vapor diffuses. Many people don't realize that OSB and plywood contain adhesives which dramatically reduce their permeabilities. Hence, the permeabilities of all three sheathings are roughly the same: 1" STYROFOAM brand Tongue and Groove is 1.0 perm, 1" STYROFOAM brand Residential Sheathing (film faced) is 0.3 perm, and 7/16" OSB and plywood are both around 0.8 perm.

What about wood fiberboard?

While it is true that 1/2" wood fiberboard is breathable, it still has a cold surface. In fact, the National Bureau of Standards research which is quoted on the front page, found that a similar wall sheathed with wood fiberboard and STYROFOAM brand insulation contained less moisture than a wall sheathed with wood fiberboard alone. The reason – STYROFOAM brand insulation warmed the wall cavity, thus reducing condensation.

So the way to prevent moisture problems in walls is to caulk drywall penetrations, apply a vapor retarder, and use STYROFOAM brand insulation as the exterior sheathing to warm the wall cavity?

Exactly!

What about summertime?

STYROFOAM brand insulation brings an additional benefit when it's hot and humid outside. It helps keep the outdoor heat and humidity outdoors. STYROFOAM brand insulation performs three functions:

(1) it reduces heat flow into the house, and also reduces moisture flow into the house

(2) it reduces vapor diffusion through the wall

(3) it reduces moist air leakage through the wall. Thus STYROFOAM brand insulation reduces the cost of dehumidifying the house as well as the cost of cooling it.

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