

Any structure we live in needs 4 primary control layers. The rain control layer, the air control layer, the vapor control layer and the thermal control layer. The best place to position these layers is on the outside of the structure so those things don't damage all our stuff, duhh. When we alter this basic concept and practice, bad things happen. If rain water gets in, if we can't separate the outside air from the inside air, if we can't stop the migration of water vapor and if we can't keep the hot air out in Florida, bad things happen. Obvious to even a Darwin Award winner.

I paraphrase Dr. Joe Lstiburek, we can't control air until we enclose it. The more breaches in the envelope, the less we can control it. Duhh. Besides the air conditioning battle, air is a good transporter of water vapor (water). Transport water into the structure/interior environment, bad things happen. The air transfer barrier must be inside of the insulation barrier though so the temperature won't change along this thermal gradient. Still with me? Don't worry, read on.

If we put the insulation on the inside we don't protect the structure system/components from heat/cold. Results of uncontrolled temperature are expansion, contraction, condensation and the like. Results of those results are corrosion, rot, decay, biological growth and the like. Simple right?! Now structures built with metal studs assist/promote thermal transfer from the outside to the inside because metal is a good conductor. So hmmm, wood frame construction is better than metal frame construction? From a thermal transfer point of view, yeah. If the insulation layer were on the outside, the thermal transfer would be drastically reduced. Results of controlled temperature are greater and easier control, reduced moisture issues, structure longevity...ya know, good things. Try to convince the building industry is something Lstiburek and Straub have been trying for years. There is an absolutely amazing article called The Perfect Wall by Dr. Joe Lstiburek I would encourage you to check it out at [www.buildingscience.com](http://www.buildingscience.com). As a matter of fact, much of this material I refer to was learned from various articles from this author and/or this web site.

Need an example? Case in point. Recently and quite often I get the ol' "I've got a moisture intrusion issue, can you help me identify the problem" call. I love this stuff. From the client's front door, I was being briefed on the problem, symptoms and home owner diagnosis. At first glance, the problem was obvious to me. Following the physics...a visqueen vapor barrier was installed on the interior of the wall assembly which is a bad thing to do in hot humid climates (in case you Yankees were wondering). As water would diffuse through the wall, water vapor would condense on the visqueen, gravity would pull it down, capillary action would cause horizontal and vertical migration, water and cellulose (carpet/baseboard/tack strip) would enable mold growth which was Le Grande Manifestation on the interior. Ouil, diagnosis easy...cure simple too but big pain in the butt! BUT...now it can be fixed.



OK, that's all well and good and interesting but most houses we buy/rehab are already built. Duhh. Since we're not constructing, lets deal with the construction. Let's start with the all mighty rain barrier, the paint job. I coined the phrase "The better we caulk, seal and paint, the better the house performs." Period. Try taking one of those items away if you don't believe me. In realty world, paragraph N of the FAR-BAR contract states "Working Condition means operating in the manner in which the item was designed to operate" and "Cosmetic Condition means aesthetic imperfections that do not affect the Working Condition of the item, including, but not limited to :...chips or caulking in ceilings, walls, flooring ...." Now that sounds kinda vague to me but if we were to interpret it literally, failing caulk and paint that does not keep the rain out is by definition not operating in the manner in which the item was designed to work. I disagree with realtors who defend that paint and caulk are aesthetic. Science and physics also disagree. Besides, if paint and caulk were purely aesthetic, no production builder would ever paint a house. Paint, sealer and caulking is a function of the building envelope. Since the 2004 hurricanes and the 2008 TS Fay, most practical people understand the value of a good quality paint job. (There are now sounds of cheering in my head.)



Now barring other things we do to screw up the whole physics thing, a quality caulk, seal and paint job will provide a great rain control mechanism. Florida Building Code also has an opinion, FBCR 703.1 states "Exterior walls shall provide the building with a weather-resistant exterior wall envelope." Cracks, gaps and a poor paint job don't provide a weather-resistant exterior wall envelope. Water penetration to a substrate then causes other physical damage besides a cornucopia of other fun stuff.

So hopefully now your convinced. And I bet your wondering what my paint recommendations are. According to the Phd's at UCF (Mullens, Hoekstra, Nahmens, Martinez- UCF Housing Constructability Lab August 2006) who did the water intrusion studies after the 04 hurricanes, their paint recommendation is:

- Use a premium, high build, acrylic coating with the following characteristics:
- Meets Federal Specifications for resistance to wind driven rain (TT-C-555B).
- Allows water vapor transmission (high perm rating) permitting water to evaporate from the wall to the exterior.

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- High flexibility/elongation to cover existing and new cracks.

Now primers are always recommended whether on wood or masonry. They help contain “bleeding” of materials and assist with adhesion. Oil-based primers are typically used on wood while latex or water-based primers are typically reserved for masonry. Sean King, paint specialist with Sherwin Williams, almost always advises use of a primer, they call theirs a conditioner. It helps assist with the adhesion and gives a smoother, not-so-splotchy look. The random splotchy are usually the affects of chalking and different porosity of spots.

Speakin’ of, ever wonder why paint chalks? More pigment than resin or... more of the less expensive color than the glue that makes the paint stick to a substrate. With a breakdown of the paint, a wood substrate would suck, so would concrete block and so would stucco. As a matter of fact, in ASTM 926 (standard for stucco application) A2.1.1 states that “Plaster shall not, however, be considered to be water proof.” Once the water gets past the paint, all those bad science things happen.



According to Dr. Joe in his article “Painting”, as he refers to paint vs stain, “Gloss paints have more resin than semigloss paints, and semi-gloss paints have more resin than flat paints. Gloss paints have the most resistance to ultraviolet radiation and moisture; flat paints have the least. Stains are not as hydrophobic or resistant to ultraviolet light as paints but are more vapor permeable. Since stains break down more rapidly due to ultraviolet light than do paints, re-coating more frequently with stains will be likely.”

For wood frame veneers, wood decays/deteriorates with exposure to water, UV and heat so Dr. Joe recommends a paint “that is hydrophobic (sheds water), vapor permeable (breathes), resistant to ultraviolet light (sunlight), has good adhesion (sticks to wood) and cohesion (stretching) properties. Acrylic latex top coats coupled with premium latex primers are recommended as they are more vapor permeable than other paint finishes while providing similar hydrophobic, ultraviolet resistance, adhesion and cohesion properties. Two coats of acrylic latex paint over a premium latex primer are recommended.” Now this means ALL sides of the wood. What happens when the carpenter cuts wood to fit in a certain space? Now you’ve got bare wood on one or more ends. Exposing bare un-primed wood invites moisture absorption and subsequent decay regardless of the quality of paint on the exposed surfaces.

For masonry veneers the same paint is advised, one that repels yet breathes. A quick physics lesson may make sense. Water and water vapor travel along pressure, thermal and concentration gradients. It’s almost always hot outside because it’s Florida and cold inside because we run our air 11.5 months a year. Well there’s more rain outside than inside. As typical in Florida, when it rains the wall gets wet, the sun comes out and now the exterior surface of the wall is wet and “hot” from the rain and sun. So...water/water vapor always wants to naturally migrate toward the interior of the house like world wide refugees headed for the US. Now since the ambient air will most likely be a little “cooler” than the wet/hot surface temperature of the wall, there will also be some drying to the exterior. If there is a vapor barrier (impermeable paint like elastomeric), that vapor barrier (impermeable paint) will tend to blister. That’s why exterior acrylic latex paints are recommended for almost all stucco applications.

But, but, but my painter, my friend, my handyman recommends elastomeric to cover all the cracks. Pure elastomeric paints may stretch (elongation if you want to sound smart) and span but typically give up some/all of the permeability that allow water vapor out, hence you are vulnerable to blistering. But, but, but my painter, my friend, my handyman says water/vapor can’t get in. Hmmm, what if water enters the stucco at joints, penetrations, transitions or other flaw? According to the Grand Puba Dr. Joe, elastomeric paints “should be reserved for special conditions where substrates are severely cracked and crack spanning coatings are necessary and no other coating approaches are practical.” Sean King adds, coastal areas may benefit from a good elastomeric. So as long as you “get it”, that walls “breathe”, you get it.

Ok, this perm thing. Materials that allow for easy migration (diffusion) of water vapor would be considered to have a higher permeability rating, referred to as perm rating. Building materials such as block and drywall have a higher perm rating (allow for greater water vapor diffusion). Contrasted with materials like visqueen, rolled foil or vinyl wallpaper that resist diffusion and are considered vapor retarders. I found some examples of perm ratings in an article titled [Not in my building, moisture and mold growth](#) by Larry Gelin, Research Engineer with Johns Manville. Don’t get stuck on the numbers, those may vary with testing method or other factors, just “get it”.

½” Gypsum Wallboard	38.0 – 42.0 perms
Latex Primer	7.0 – 10.0
7/16” Oriented Strand Board	0.77 – 3.48
1” Thick Extruded Polystyrene	0.40 – 1.60
Kraft Paper Facing	1.0
2-mil Polyethylene Film	0.06 – 0.22
Alkyd-based or vapor retarder paint	< 0.05
1-mil Aluminum Foil Laminate	< 0.05

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Sean King also offered some rule of thumb numbers for perm ratings of paint. Remember, don't get stuck on the numbers, those may also vary with manufacturer, just "get it".

Elastomeric paints	7 -12 perms
Hi-build acrylics	12-15
Standard paints	18+

I heard a building scientist suggest that stucco is a 14-15 perm product.

Now as you would expect, the thickness (mil- if you wanna sound smart) will be greater as ya move on up the price ladder. For the standard stuff, 1-2 mils dry. The high build maybe 8-10 mils.

The next obvious question is which color is The Best? Let me tell ya. Orange-n-Blue of course. Ok, ya knew that was comin'.

How 'bout caulk. Let me tell ya, again there's a lot to know about caulk. First thing, the 99¢ stuff, well, it is what it is and shouldn't be expected to perform well in anything but an interior environment.

Polyurethane caulk products have become pretty popular. They are excellent for exterior jobs as they adhere well to dissimilar products (like window frames and stucco) and really stretch with even structural movement. Polyurethane is the thick rubber looking caulk lines you see on many commercial buildings. There are even "green" versions that have low VOC (volatile organic compounds) emissions. They are, however, subject to UV degradation and must be painted soon after full cure. Silicone, on the other hand, tends to perform very well with regards to UV degradation and mold/mildew growth due to their inorganic dna. Porous products like stucco...well not in the list of preferred substrates for adhesion. At the bottom of the list is your basic acrylic latex caulks. Multi-purpose as long as you don't need it to move much. Interior use best, not exterior apps that would be subject to elongation, expansion and contraction. Now there are more caulk flavors than Baskin Robbins but those are good rules of thumb, maybe we'll cover the other stuff in another article.



Special thanks so Sean King of Sherwin Williams, he has graciously offered to answer your questions if you give him a call. 407.468.9671. And if Sean's boss is reading this...the man knows his paint and caulk, I say he deserves a raise.

So, somewhere along the way, if I haven't insulted every realtor/painter/handyman reading this and been referred to as "who's this idiot" by now, I'd be surprised. Now hey, there are always exceptions, new techniques or new products that may contradict stuff I have said or quoted so spare me the finger pointin'. Like the talk master Boortz says, never believe a word I say, confirm it for yourself. This is information based on the opinions of top professionals in the building and painting world as well as what Jon has confirmed with his own eyes. Your welcome to try things on your own but going through life via trial and error sucks. You don't have to. If we all stick together, nobody gets burned. Call me or email me with other questions/concerns. 407.678.HOME or [jon@inspectagator.com](mailto:jon@inspectagator.com).