

Joseph Lstiburek, Ph.D., P.Eng, ASHRAE Fellow

# Building Science 2008

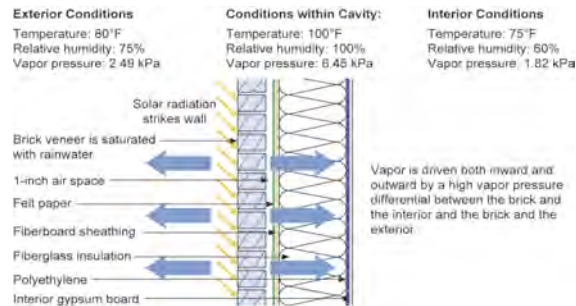
## Walls

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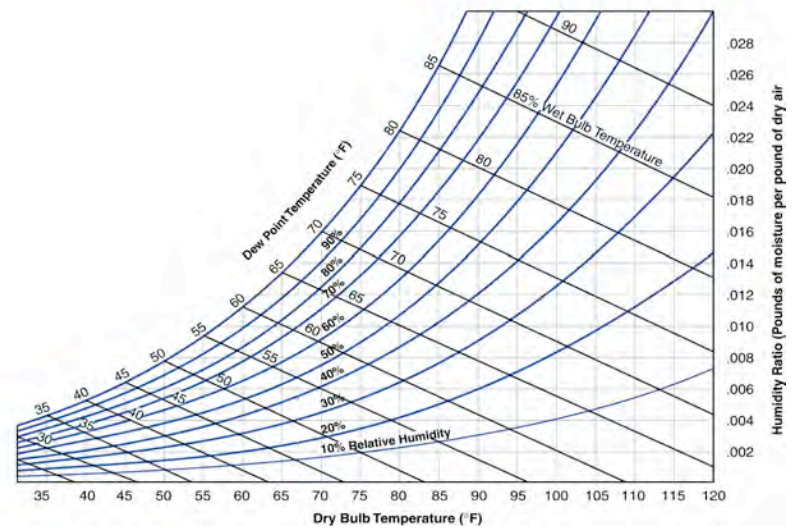
# Confusion About Diffusion

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- It is not a good idea to install a vapor barrier (polyethylene) on the inside of an air conditioned assembly. Vinyl wall coverings and foil-backed batt cavity insulation should also be avoided.
- Vapor permeable exterior sheathings, housewraps or building papers should not be used with absorptive claddings such as brick veneers unless a ventilated cavity is provided in conjunction with high inward drying potentials (i.e. no interior polyethylene vapor barriers).
- Failure will occur when brick is installed over a frame wall constructed with felt paper, fiberboard sheathing and an interior polyethylene vapor barrier. Kraft-faced fiberglass batts should be used in place of unfaced batts and a polyethylene vapor barrier. OSB, plywood or foam sheathing should be used in place of the fiberboard sheathing.
- Similar problems occur with stucco.



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## Aluminium Pressure Vessel Filled With A Cryogenic Liquid On a Beach In Florida In July

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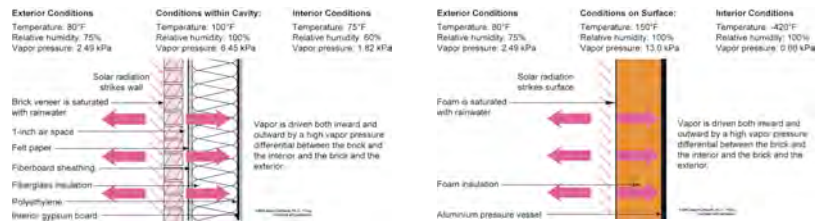
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## Carbon Fibre Nano Tube Kevlar Tang Composite and Micro Porous Polymer Modified Ionised Coating

“the NASA repair”

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## Chicken Wire and Epoxy Paint

“the Home Depot repair”

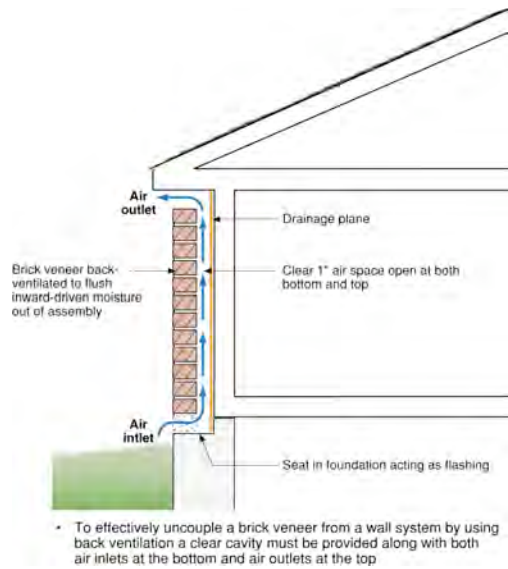
Early Shuttle Flights Had Aluminum Paint  
Over External Tank Foam - Note White  
Color On Tank - Aluminum Paint  
Removed To Save Weight

“value engineering”

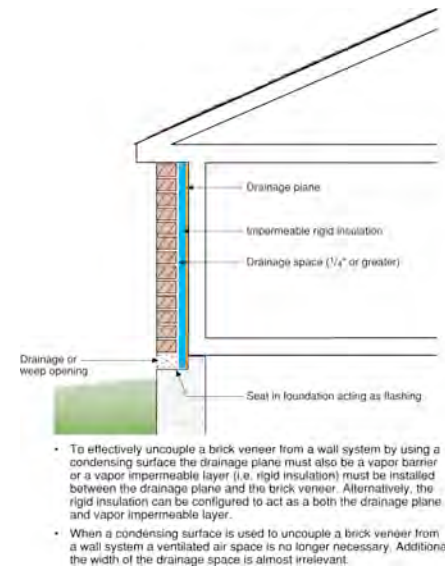


## Don't Do Stupid Things





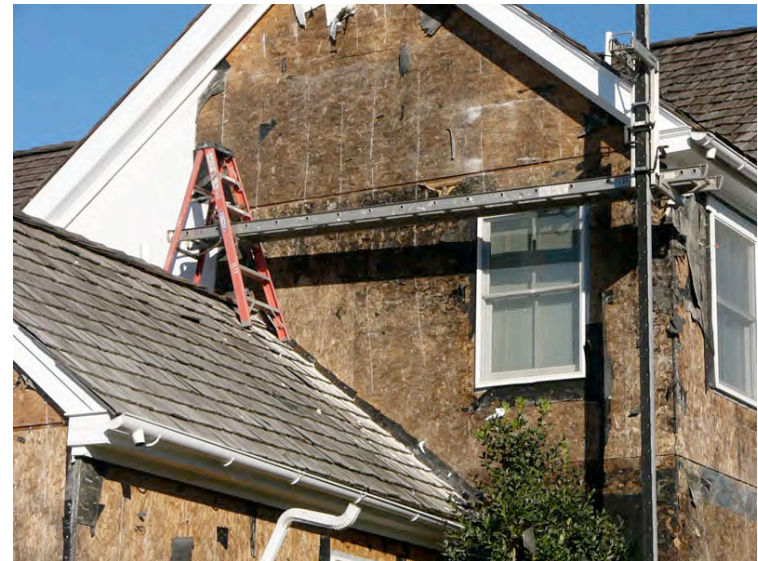
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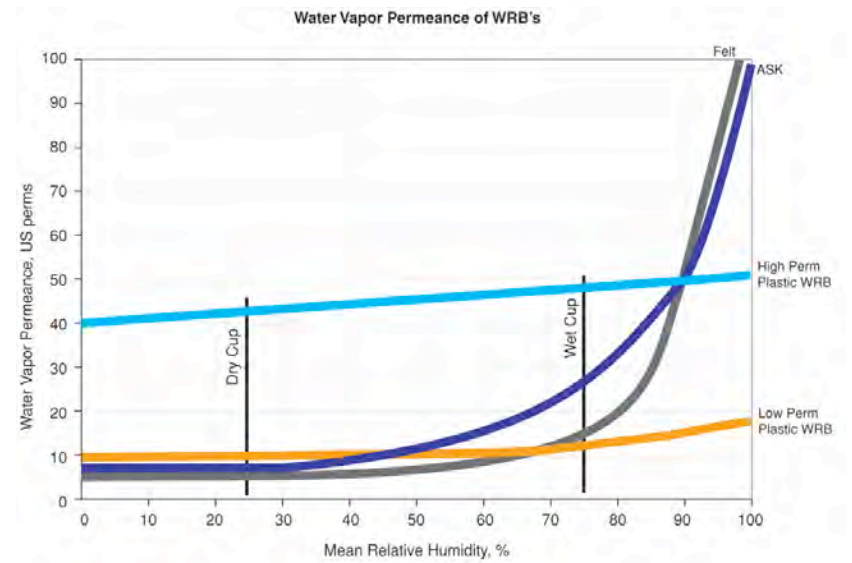
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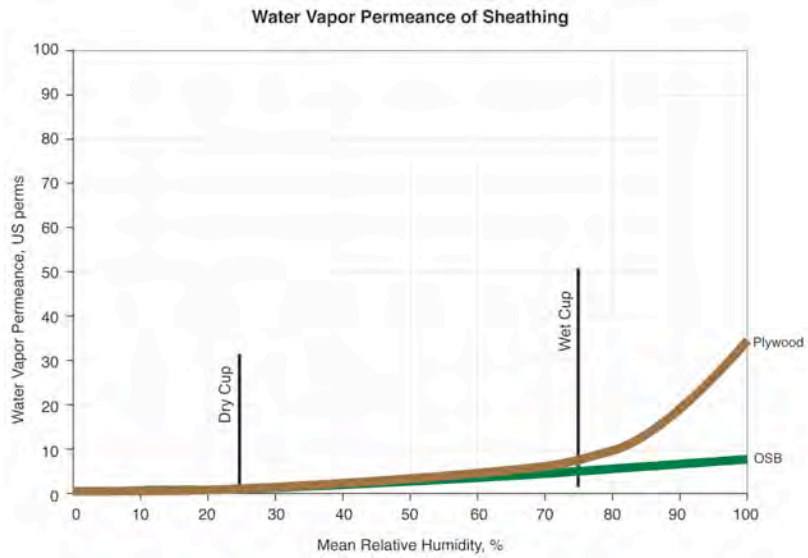
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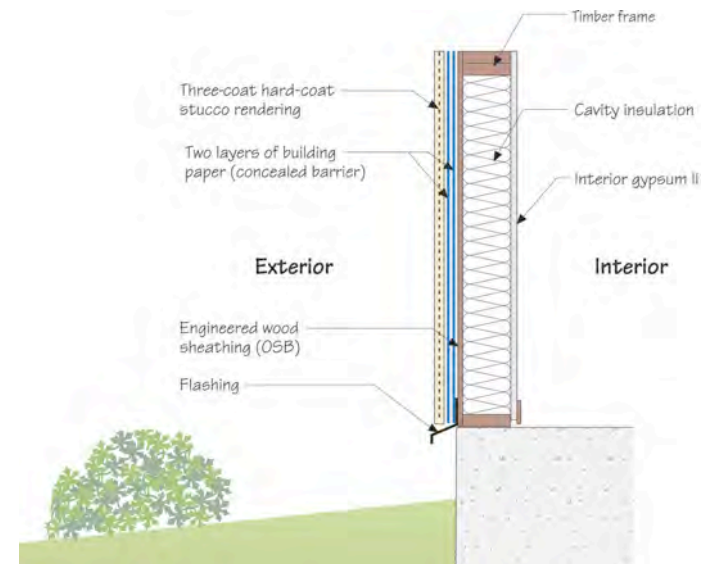
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## Surface Tension



- "non-wetable" surface
- water repellent surface
- hydrophobic surface
- water more attracted to itself than to surface
- surface energy of water greater than surface energy of surface
- water "beads up"
- "greasy" surface
- high contact angle " $\theta$ "

- "wetable" surface
- non-water repellent surface
- hygroscopic surface
- water more attracted to surface than itself
- surface energy of surface greater than surface energy of water
- water "spreads out"
- "non-greasy" surface
- low contact angle " $\theta$ "

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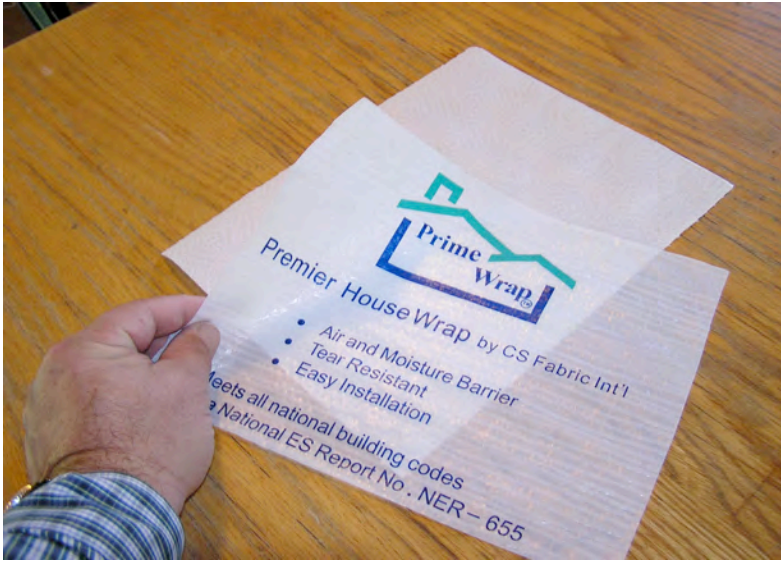




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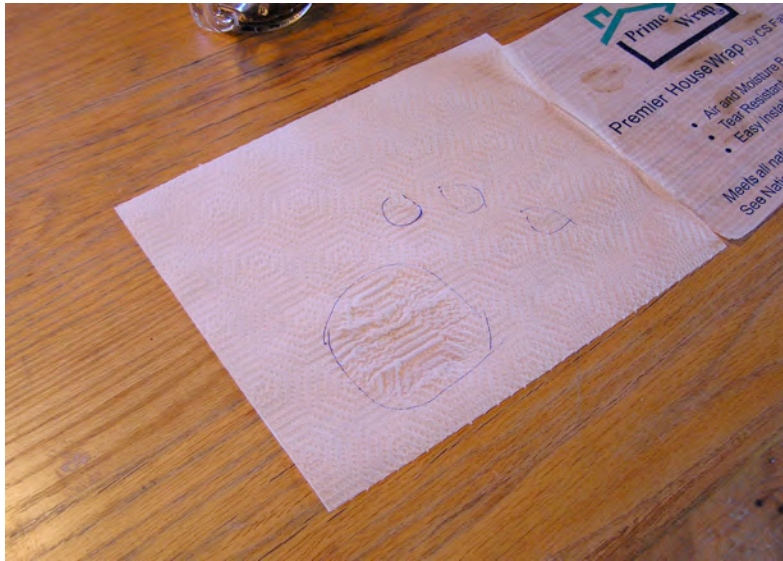


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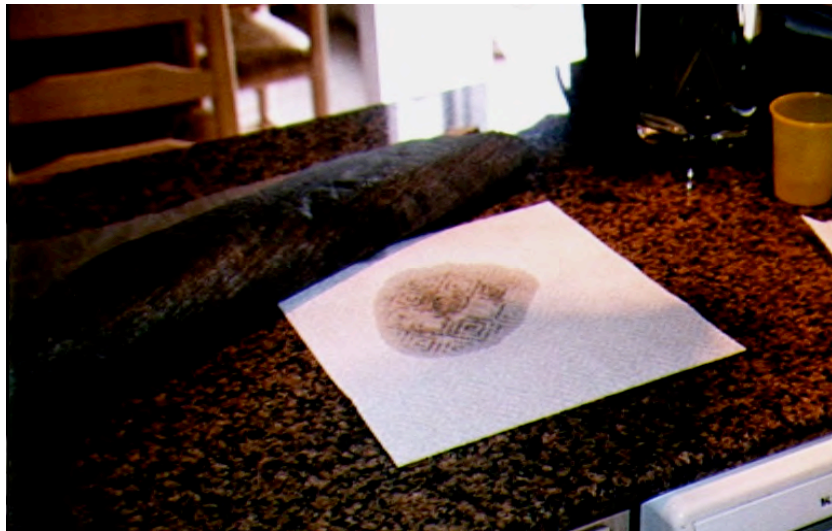
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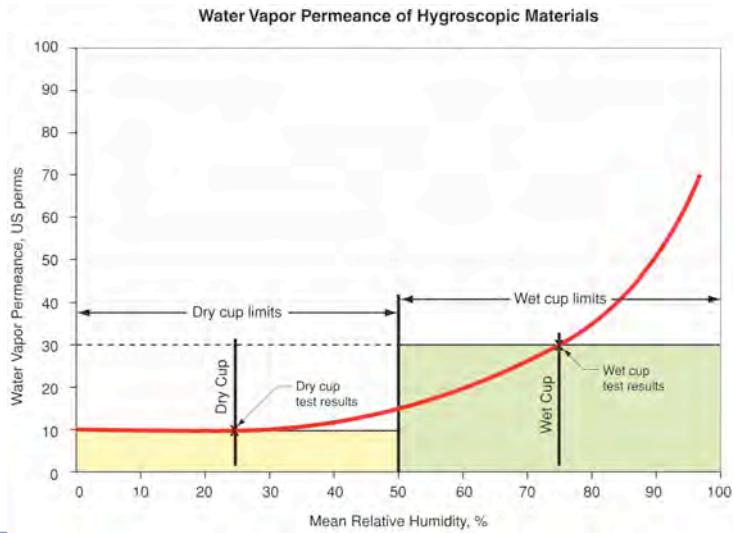
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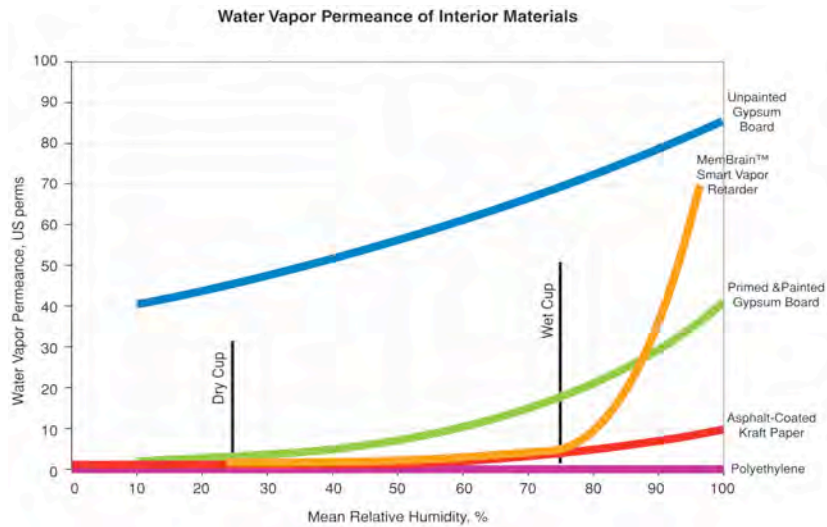
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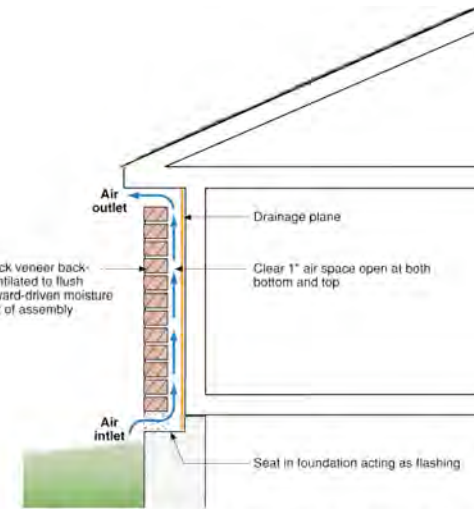
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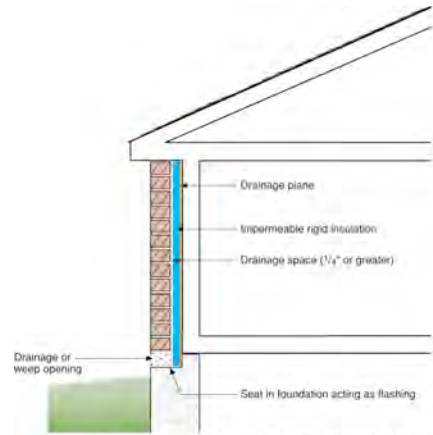


• To effectively uncouple a brick veneer from a wall system by using back ventilation a clear cavity must be provided along with both air inlets at the bottom and air outlets at the top

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- To effectively uncouple a brick veneer from a wall system by using a condensing surface the drainage plane must also be a vapor barrier or a vapor impermeable layer (i.e. rigid insulation) must be installed between the drainage plane and the brick veneer. Alternatively, the rigid insulation can be configured to act as a both the drainage plane and vapor impermeable layer.
- When a condensing surface is used to uncouple a brick veneer from a wall system a ventilated air space is no longer necessary. Additionally, the width of the drainage space is almost irrelevant.



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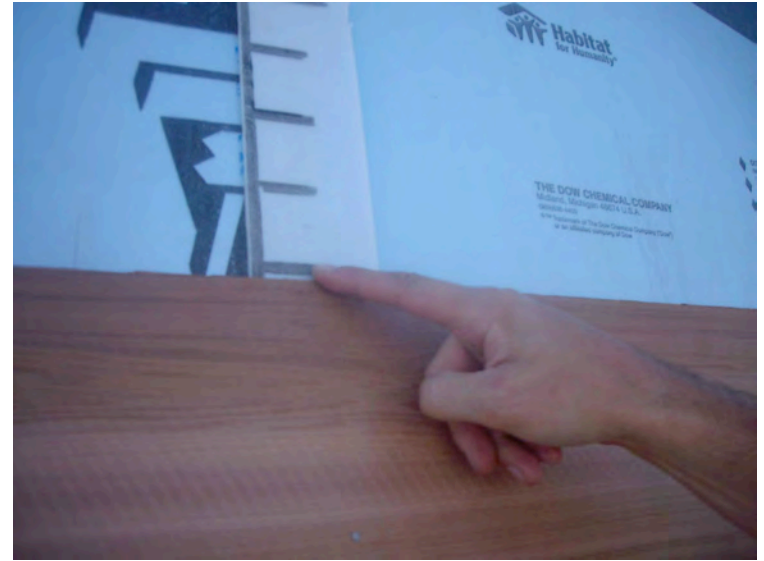
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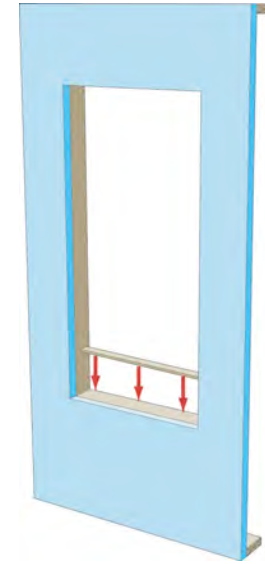
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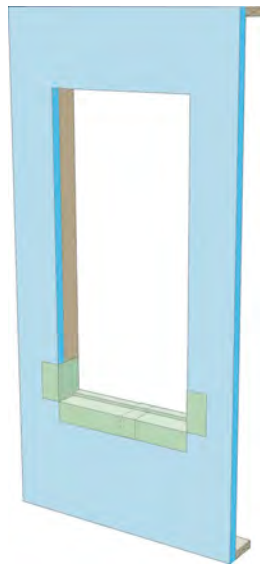
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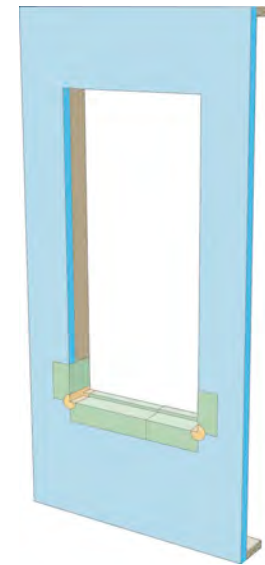
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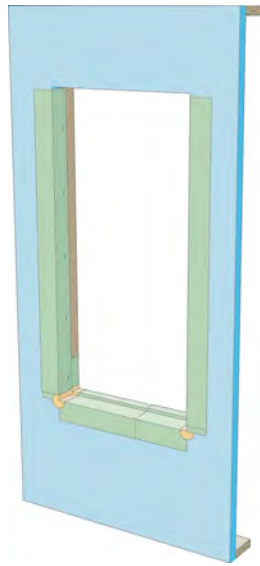
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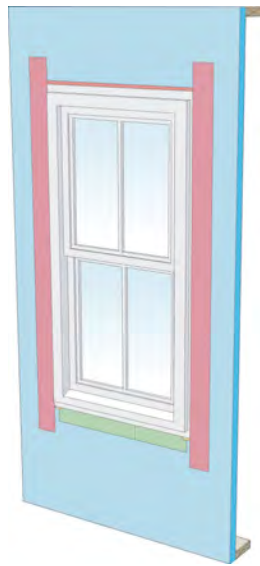
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