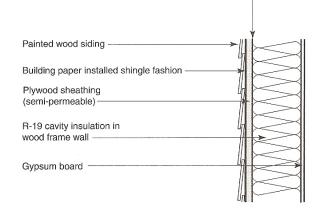
Advanced Building Science

Moisture Control in Insulated Assemblies

- Evaluating various wall assemblies
- Preserving drying potential
- Enhancing storage

Readings
– HPE: Chapter 4

BBE 4414/5414: Advanced Building Science Fundamentals The back side of the plywood sheathing is the first condensing surface _____



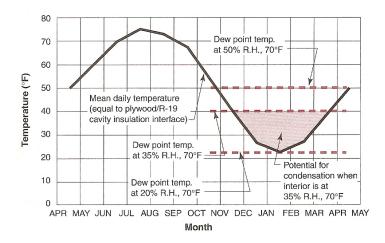
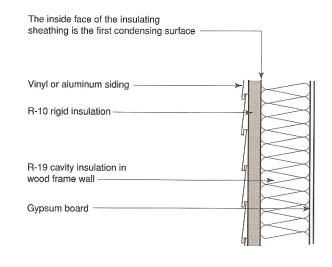


Figure 111.9 Potential for Condensation in a Wood Frame Wall Cavity in Chicago, Illinois (Cold Climate)

- By reducing interior moisture levels, the potential condensation is reduced or eliminated
- \bullet No condensation occurs if interior moisture levels are maintained below 20% RH at 70°F

Source: Lstiburek, Builder's Guide for Cold Climates, 2001

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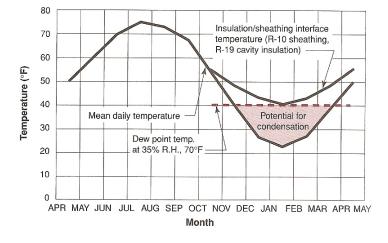


Figure III.10

Potential for Condensation in a Wood Frame Wall Cavity Without an Interior Vapor Diffusion Retarder in Chicago, Illinois

 The R-10 insulating sheathing raises the dew point temperature at the first condensing surface (cavity side of the foam sheathing) so that no condensation will occur when interior moisture levels are less than 35% relative humidity at 70°F

Source: Lstiburek, Builder's Guide for Cold Climates, 2001

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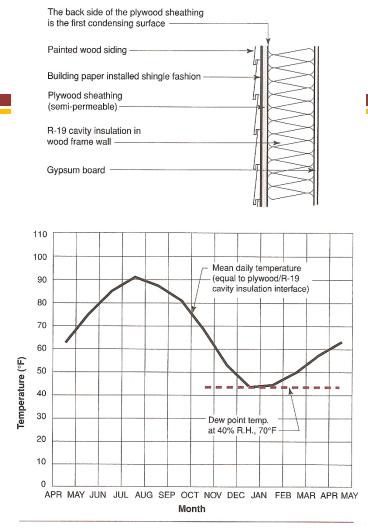


Figure III.12 Potential for Condensation in Las Vegas, Nevada

- There is no potential for condensation until interior moisture levels exceed 40% RH at 70°F during the coldest months of the year
- An interior vapor diffusion retarder is not necessary in building assemblies in Las Vegas where interior moisture levels are maintained below 40% RH at 70°F during the heating period

Source: Lstiburek, Builder's Guide for Cold Climates, 2001

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4

Vinyl or aluminum siding (perforations along bottom edge allow drainage and drying to the exterior)

, 3	
Building paper drainage plane (permeable) —————————————————————	
Asphalt-impregnated fiberboard or gypsum sheathing (permeable)	
Cavity insulation in wood frame wall —	
Polyethylene vapor diffusion retarder (impermeable) Gypsum board with any paint or wall covering	
Polyethylene sealed to top	
retarder system)	Drying to exterior

 \ast

3

Figure III.5 Classic Severe-Cold Climate Wall Assembly

- Vapor diffusion retarder to the interior
- Air flow retarder to the interior
- Permeable exterior sheathing and permeable building paper drainage plane
- Ventilation provides air change (dilution) and also limits the interior moisture levels

Source: Lstiburek, Builder's Guide for Cold Climates, 2001

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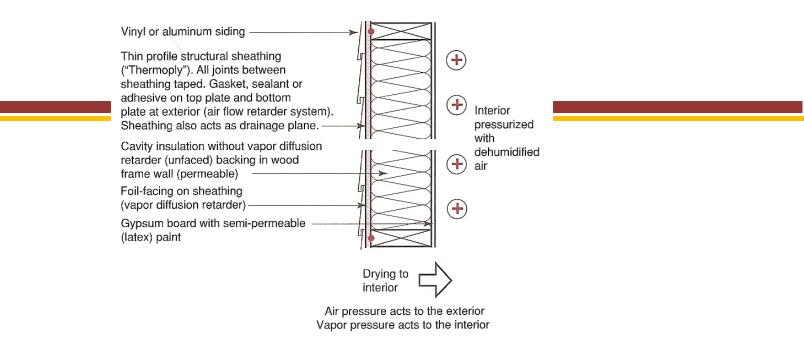


Figure III.6 Classic Hot-Humid Climate Wall Assembly

- Vapor diffusion retarder to the exterior
- · Air flow retarder to the exterior
- Pressurization of conditioned space
- Impermeable exterior sheathing also acts as drainage plane
- Permeable interior wall finish
- Interior conditioned space is maintained at a slight positive air pressure with respect to the exterior to limit the infiltration of exterior, hot, humid air
- Air conditioning also provides dehumidification (moisture removal) from interior

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Source: Straube and Burnett, Building Science for Building Enclosures, Chapter 5

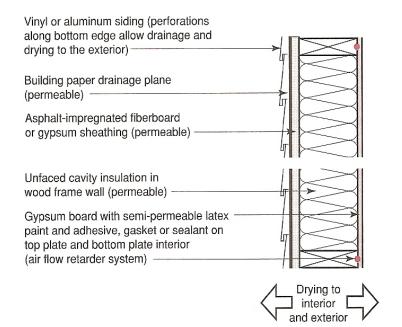


Figure III.7 Classic Flow-Through Wall Assembly

- Permeable interior surface and finish and permeable exterior sheathing and permeable building paper drainage plane
- Interior conditioned space is maintained at a slight positive air pressure with respect to the exterior to limit the infiltration of exterior moisture-laden air during cooling
- Ventilation provides air change (dilution) and also limits the interior moisture levels during heating
- Air conditioning/dehumidification limits the interior moisture levels during cooling

Source: Lstiburek, Builder's Guide for Cold Climates, 2001

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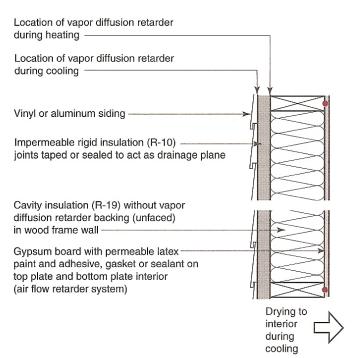


Figure 111.8 Vapor Diffusion Retarder in the Middle of the Wall

- Air flow retarder to the interior
- Permeable interior wall finish
- Interior conditioned space is maintained at a slight positive air pressure with respect to the exterior to limit the infiltration of exterior moisture-laden air during cooling
- Ventilation provides air change (dilution) and also limits the interior moisture levels during heating
- Air conditioning/dehumidification limits the interior moisture levels during cooling
- Impermeable exterior sheathing also acts as drainage plane

Source: Lstiburek, Builder's Guide for Cold Climates, 2001

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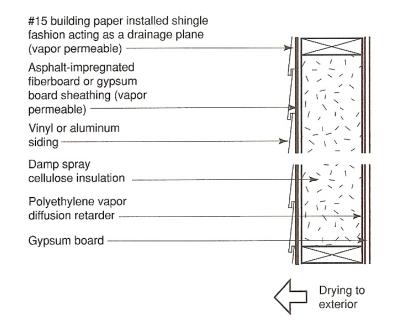


Figure III.14 Drying to Exterior

- If wood siding is used in this assembly with the damp spray cellulose, furring strips should be used to provide an airspace to promote drying and the wood siding should be back-primed to prevent wetting from the back side.
- The airspace associated with the back of vinyl or aluminum siding, due to its profile, permits drying of the wall assembly.
- · Recommended for severe cold climates, not cold climates
- Polyethylene on the inside of building assemblies in cold, mixed-humid, mixed-dry, hot-humid and hot-dry climates is not generally a good idea.

Source: Lstiburek, Builder's Guide for Cold Climates, 2001

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#15 building paper installed shingle fashion acting as a drainage plane (vapor permeable)	
Rigid fiberglass insulation sheathing (vapor permeable)	
Vinyl or aluminum siding —	→
Damp spray cellulose insulation ————————————————————————————————————	
Polyethylene vapor diffusion retarder	
Gypsum board ————————————	
	Drying to exterior

Figure III.15 Drying to Exterior

- If wood siding is used in this assembly with the damp spray cellulose, furring strips should be used to provide an airspace to promote drying and the wood siding should be back-primed to prevent wetting from the back side.
- The airspace associated with the back of vinyl or aluminum siding, due to its profile, permits drying of the wall assembly.
- · Recommended for severe cold climates, not cold climates
- Polyethylene on the inside of building assemblies in cold, mixed-humid, mixed-dry, hot-humid and hot-dry climates is not generally a good idea.

Source: Lstiburek, Builder's Guide for Cold Climates, 2001

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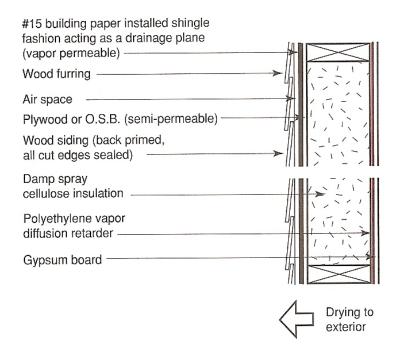


Figure III.16 Drying to Exterior

- If vinyl or aluminum siding is used in this assembly wood furring providing an airspace is not necessary.
- Recommended for severe cold climates, not cold climates
- Polyethylene on the inside of building assemblies in cold, mixed-humid, mixed-dry, hot-humid and hot-dry climates is not generally a good idea.

Source: Lstiburek, Builder's Guide for Cold Climates, 2001

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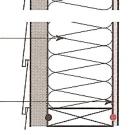


Seams taped to provide drainage plane

Rigid insulation (expanded polystyrene, unfaced extruded polystyrene semi-permeable)

Cavity insulation (R-19) without vapor diffusion retarder backing (unfaced) in wood frame wall

Gypsum board with vapor diffusion retarder paint and adhesive, gasket or sealant on top plate and bottom plate interior (vapor diffusion retarder)



Limited drying \checkmark_{-}^{4} $_$ $\overset{}{\sim}$ \searrow_{-}^{1} Limited drying to exterior \checkmark_{Γ} $__{1}$ to interior

Figure III.17 Limited Drying to Exterior and Interior

- Although paint is used as an interior vapor diffusion retarder (1 to 2 perms) it is not as impermeable as a polyethylene vapor diffusion retarder (0.3 to 0.5 perms) so that some drying to the interior is possible.
- The semi-permeable rigid insulations permit some drying to the exterior.
- If wood siding is used, it should be installed over furring strip and be backprimed, all cut edges sealed.

Source: Lstiburek, Builder's Guide for Cold Climates, 2001

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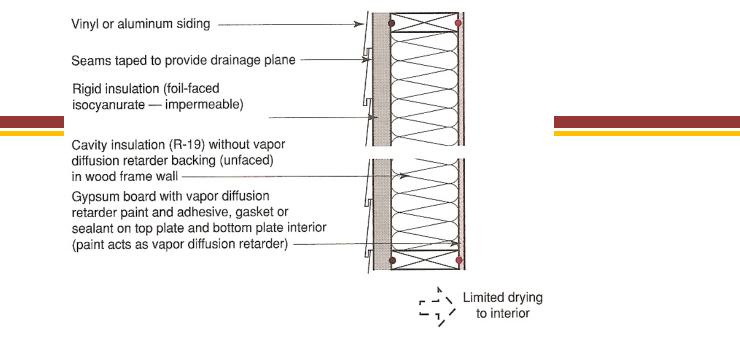


Figure III.18 Limited Drying to Interior

- Although paint is used as an interior vapor diffusion retarder (1 to 2 perms) it is not as impermeable as a polyethylene vapor diffusion retarder (0.3 to 0.5 perms) so that some drying to the interior is possible.
- If wood siding is used, it should be installed over furring strips and be backprimed, all cut edges sealed.

Source: Lstiburek, Builder's Guide for Cold Climates, 2001

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Intermittent wetting due to solardriven moisture flow out of rainwetted brick veneer

#30 building paper installed shingle fashion acting as a drainage plane (semi-vapor permeable) OSB or plywood Polyethylene vapor diffusion retarder Cavity insulation (R-19) without vapor diffusion retarder backing (unfaced) in wood frame wall Brick veneer Air space Gypsum board Weep opening (open vertical joint every other brick) Drving to exterior Intermittent wetting from exterior

Figure III.19 Drying to Exterior

- Recommended for severe cold climates, not cold climates
- Polyethylene on the inside of building assemblies in cold, mixed-humid, mixed-dry, hot-humid and hot-dry climates is not generally a good idea
- A rigid, impermeable or semi-permeable insulating sheathing can be used to prevent the wall cavity from getting wet due to solar-driven moisture allowing the removal of the interior polyethylene vapor diffusion retarder
- The heavy #30 building paper (semi-vapor permeable) is preferred over permeable building papers when used with wood siding, brick or stucco due to the potential for moisture flow through the permeable building papers under solar heating with rain-wetted claddings

Source: Lstiburek, Builder's Guide for Cold Climates, 2001

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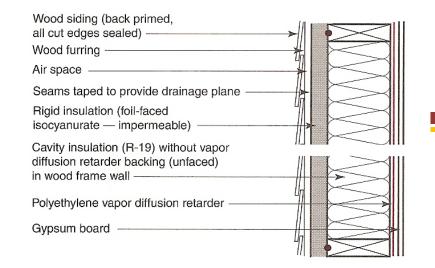




Figure III.20 No Drying

- •Only dry materials should be used in the construction of this wall assembly.
- If vinyl or aluminum siding is used in this assembly wood furring providing an airspace is not necessary.
- Airspace in this assembly behind the wood siding is to permit drying of the wood siding.
- This is an extremely unforgiving wall assembly.
- Recommended for severe cold climates, not cold climates
- Polyethylene on the inside of building assemblies in cold, mixed-humid, mixed-dry, hot-humid and hot-dry climates is not generally a good idea.

Source: Lstiburek, Builder's Guide for Cold Climates, 2001

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				Compatible with:
Permeable	Non-insulating	Asphalt Impregnated Fiberboard	Building Paper Required	Damp Spray Cellulose
		Gypsum Board	Building Paper Required	Damp Spray Cellulose
	Insulating	Rigid Fiberglass	Can Come with Building Paper Attached	Damp Spray Cellulose
Semi-Permeable	Non-Insulating	Plywood	Building Paper Required	Damp Spray Cellulose only with Airspace Between Cladding and Building Paper
		O.S.B.	Building Paper Required	Damp Spray Cellulose only with Airspace Between Cladding and Building Paper
	Insulating	Expanded Polystyrene	Building Paper Not Required	Damp Spray Cellulose Not Recommended
		Extruded Polystyrene	Building Paper Not Required	Damp Spray Cellulose Not Recommended
		Fiberfaced Isocyanurate	Building Paper Required	Damp Spray Cellulose Not Recommended
impermeable	Non-Insulating	Thermoply	Building Paper Not Required	Damp Spray Cellulose Not Recommended
	Insulating	Foil Faced Isocyanurate	Building Paper Not Required	Damp Spray Cellulose Not Recommended

Figure III.13 Cold Climate Wall Assembly Characteristics Source: Lstiburek, Builder's Guide for Cold Climates, 2001

* All wall assemblies compatible with dry applied cavity insulations

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In Summary

Questions and Discussion

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Next Class

- Fenestration
 - Basic Components
 - U-Factor
 - Solar Heat Gain
 - Visible Transmission
 - Air Leakage
 - Condensation Resistance
 - Standards
- Readings
 - HF: Chapter 15
 - HPE: Chapter 3.3.5 to 3.3.8

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