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Building Science

There is No Such Thing as a Free
Thermodynamic Lunch

www.buildingscience.com

A Building is an Environmental Separator

Arrhenius Equation

For Every 10 Degree K Rise
Reaction Rate Doubles

$$k = Ae^{-E_a/(RT)}$$

Damage Functions

Water

Heat

Ultra-violet Radiation

2nd Law of Thermodynamics

Heat Flow Is From Warm To Cold

Moisture Flow Is From Warm To Cold

Moisture Flow Is From More To Less

Air Flow Is From A Higher Pressure to a
Lower Pressure

Thermodynamic Potential



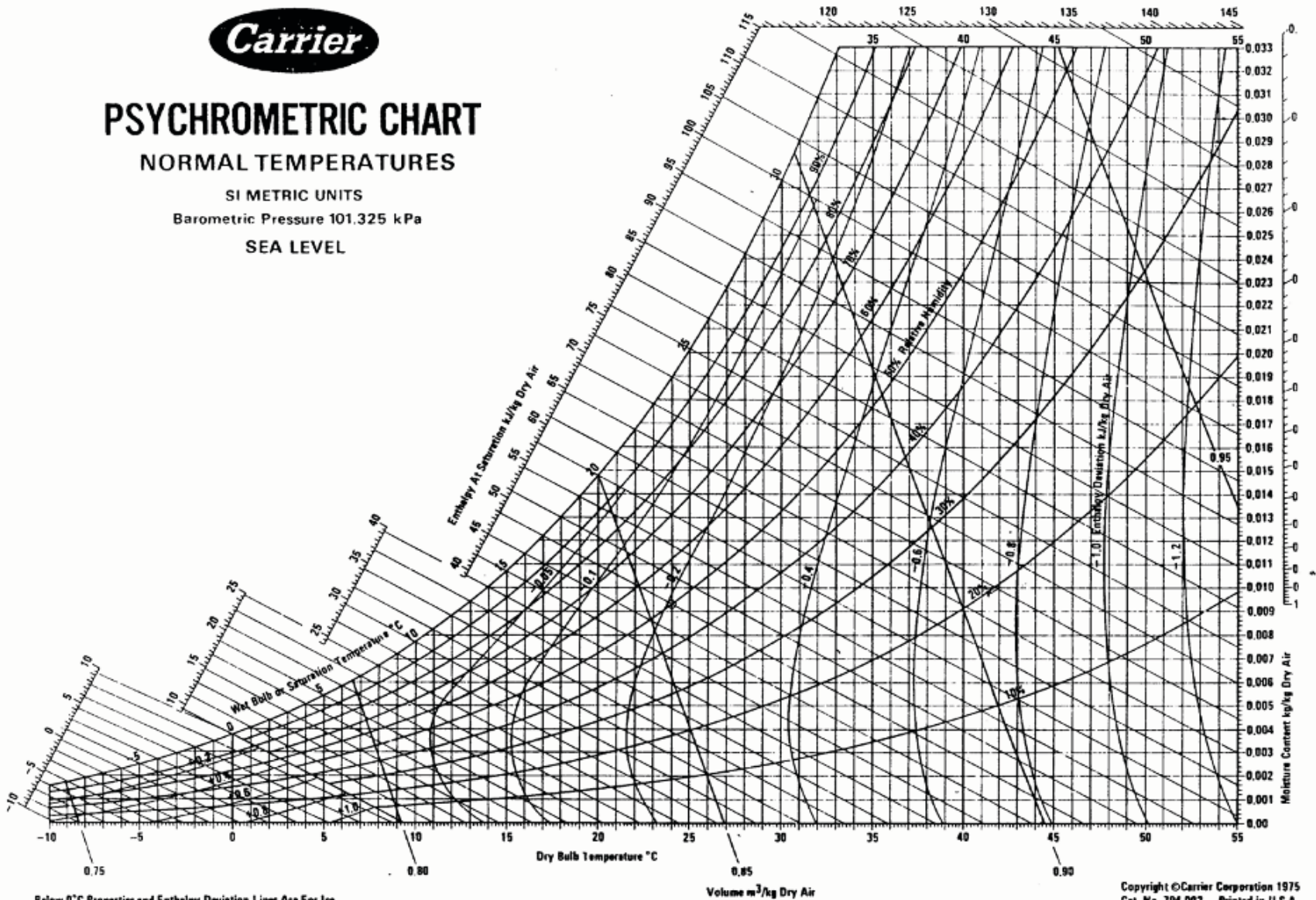
PSYCHROMETRIC CHART

NORMAL TEMPERATURES

SI METRIC UNITS

Barometric Pressure 101.325 kPa

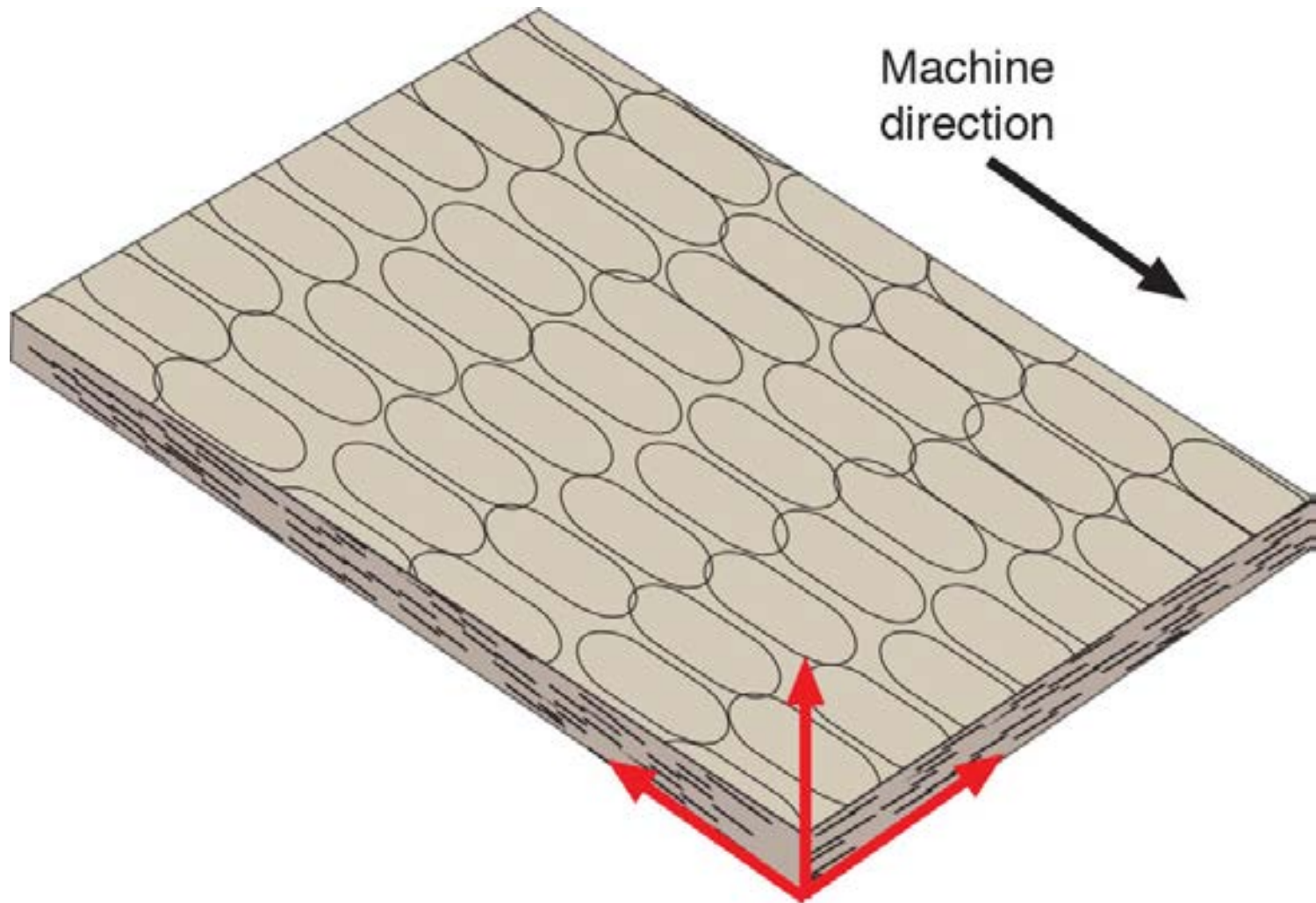
SEA LEVEL



Below 0°C Properties and Enthalpy Deviation Lines Are For Ice

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Change In Materials

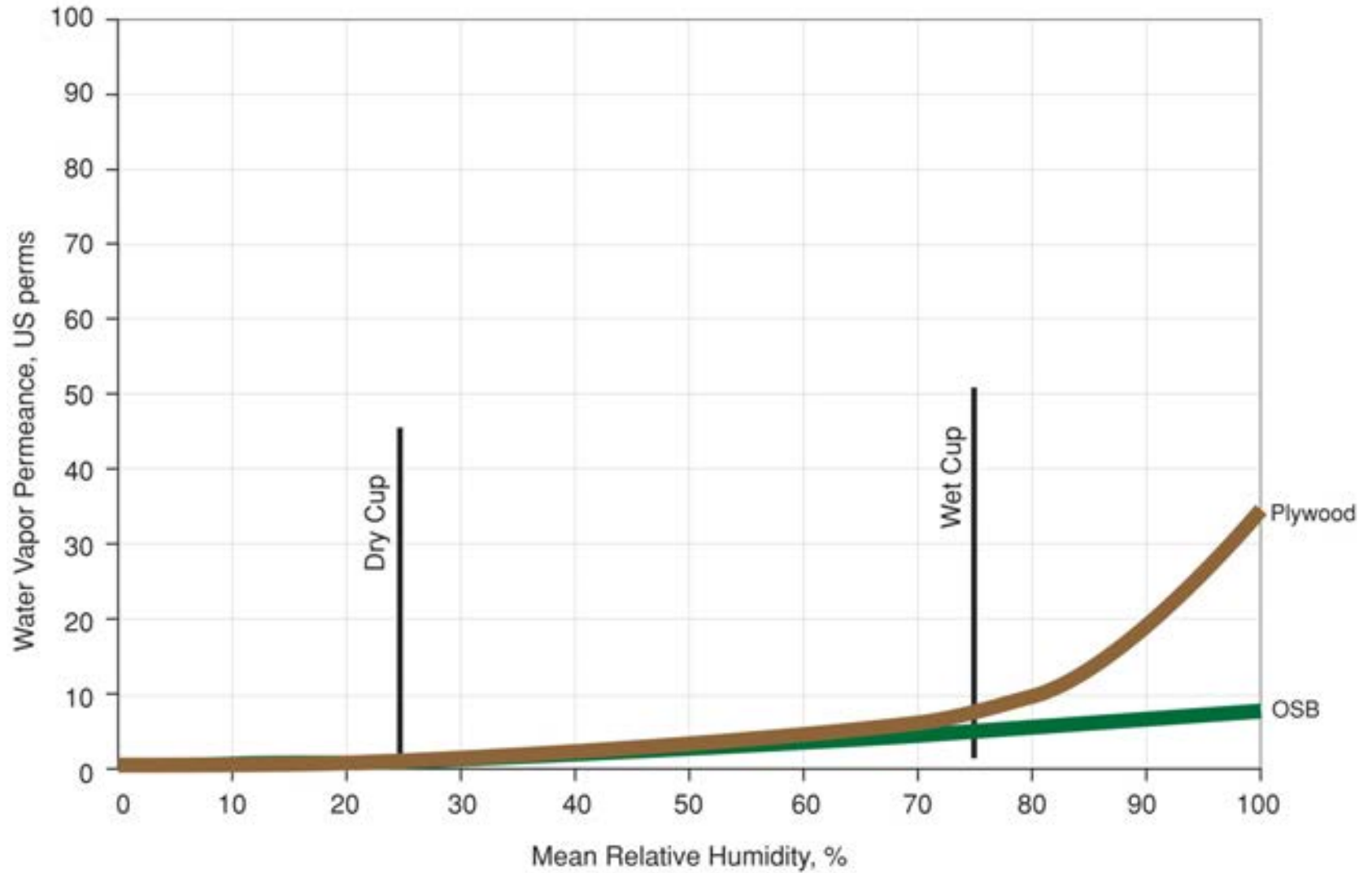


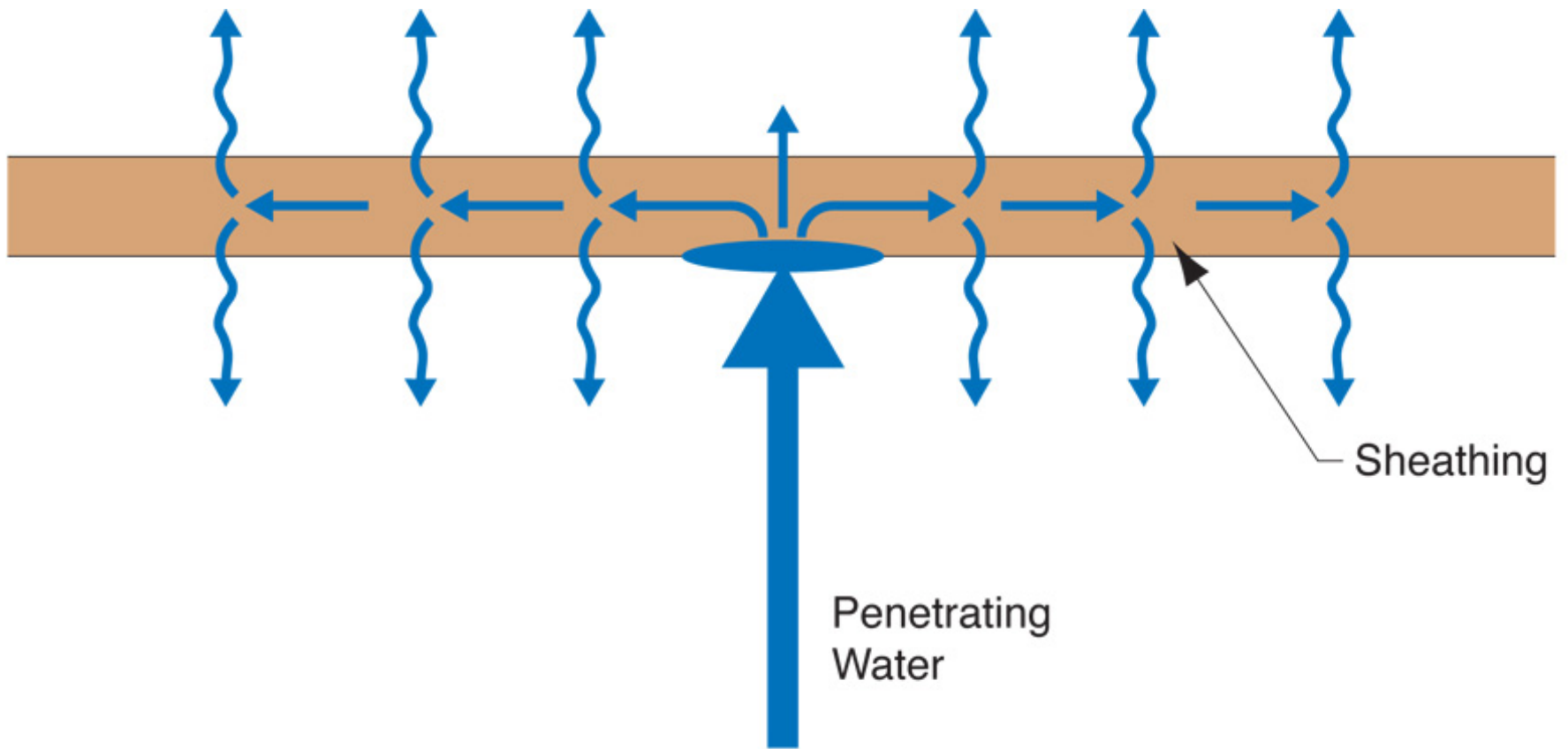


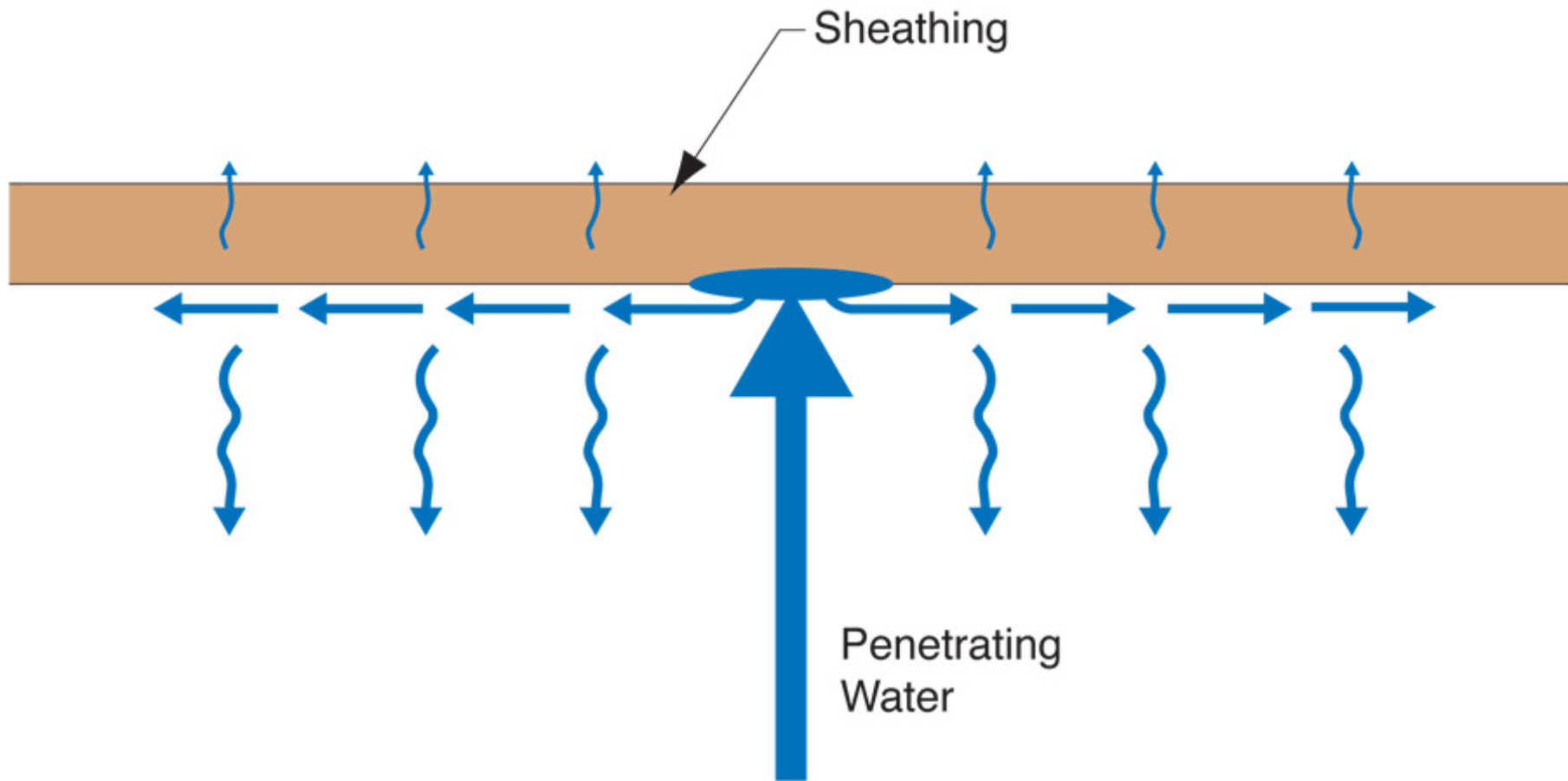




Water Vapor Permeance of Sheathing Materials

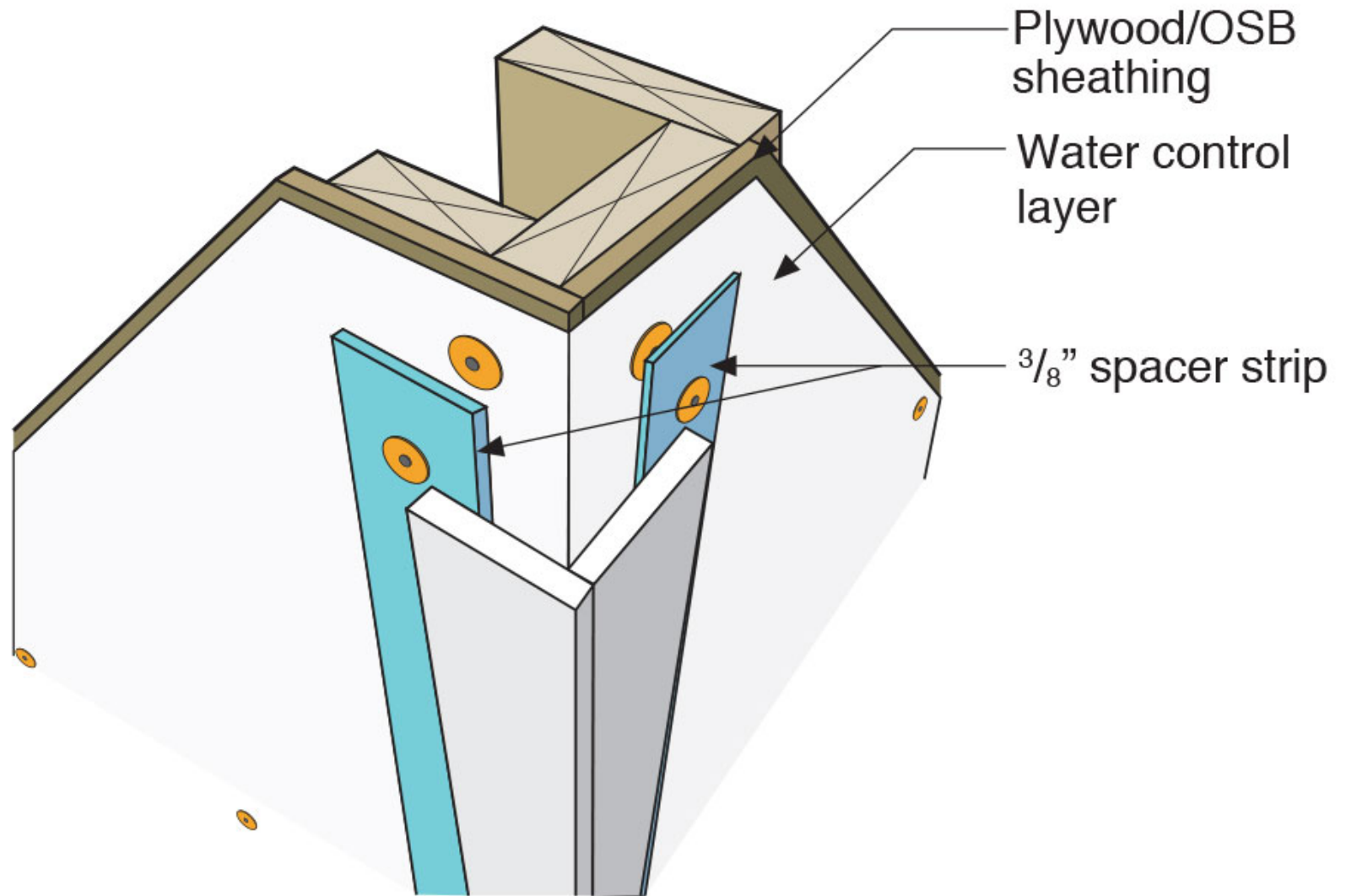


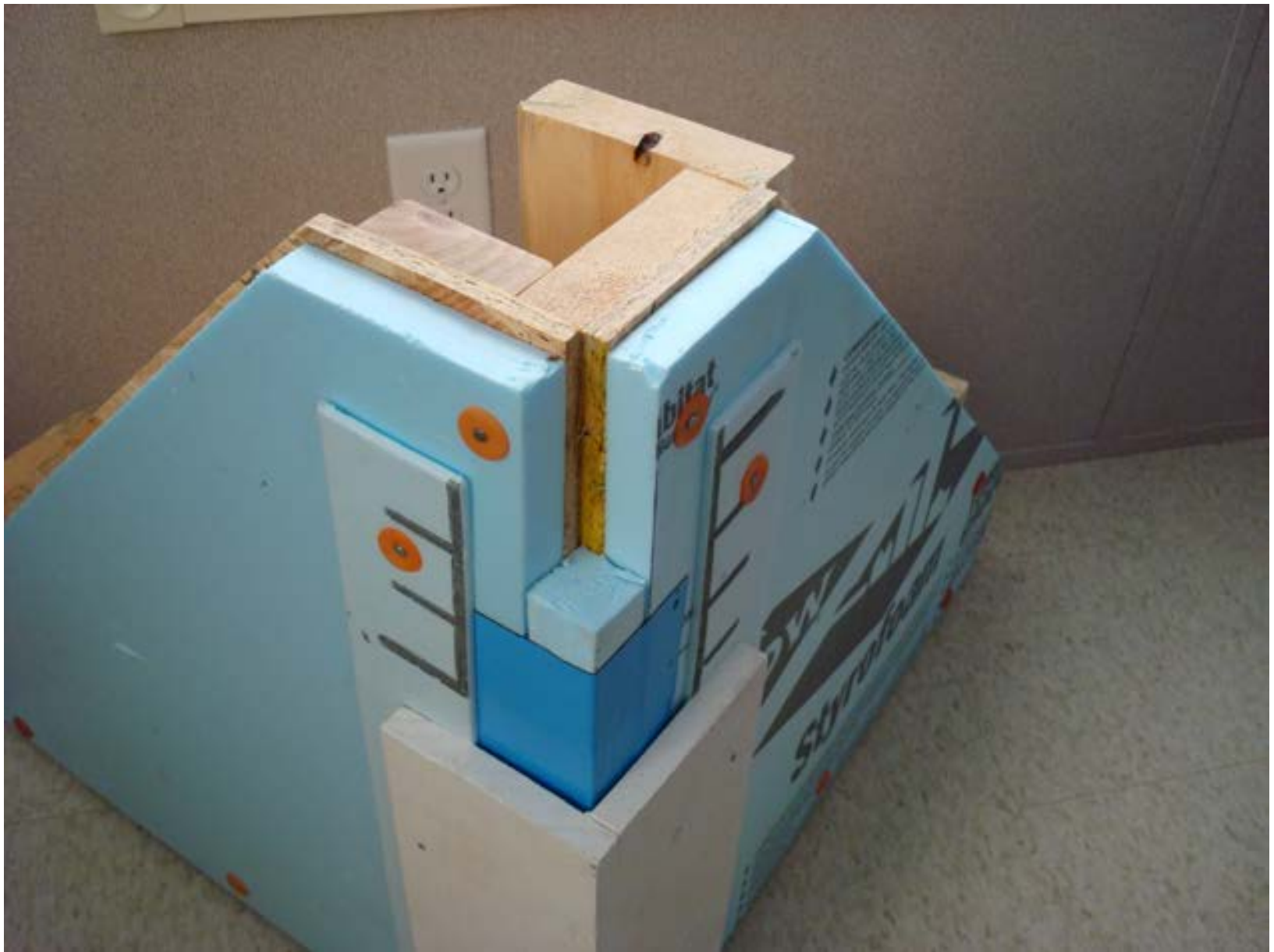




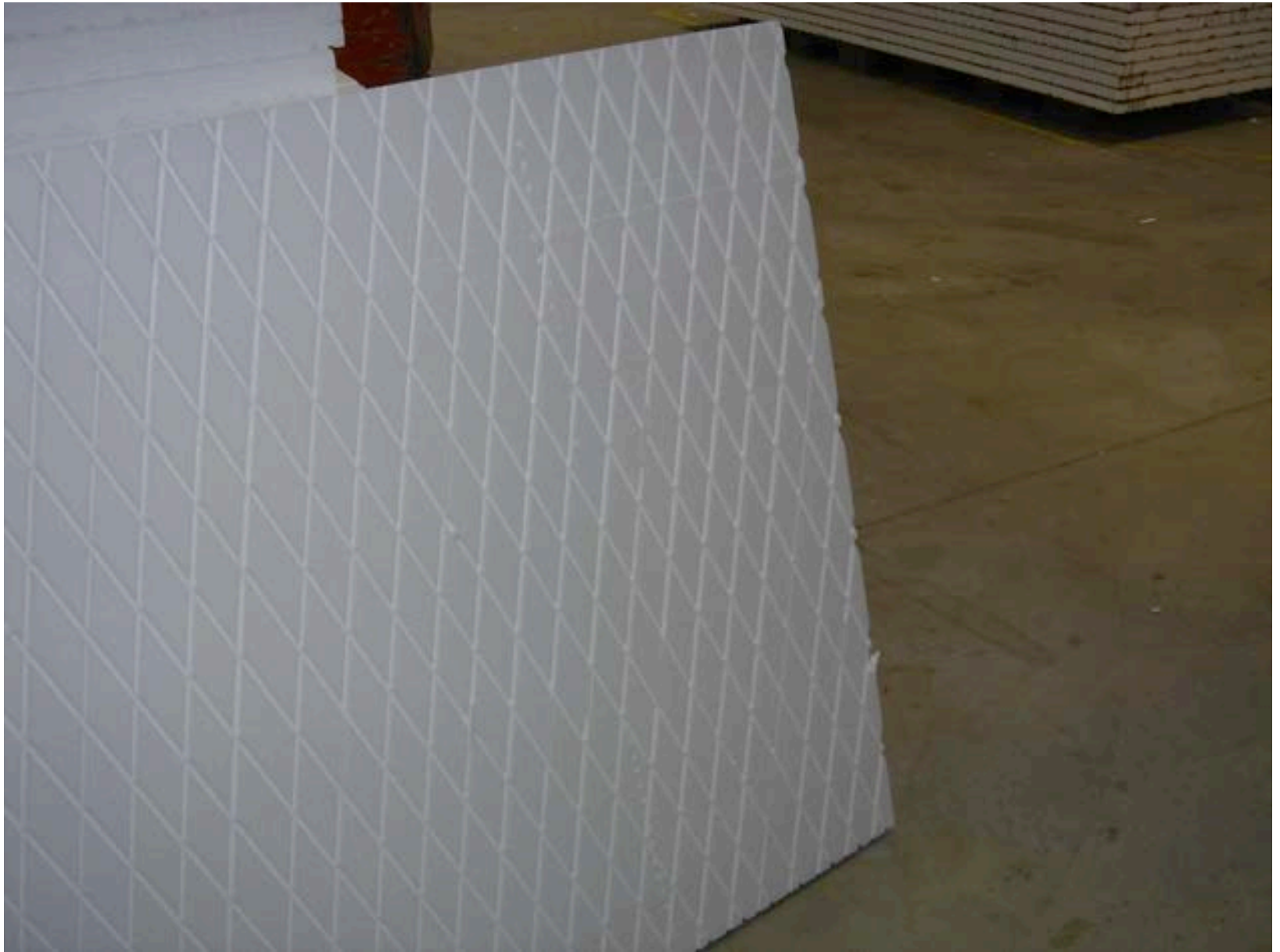




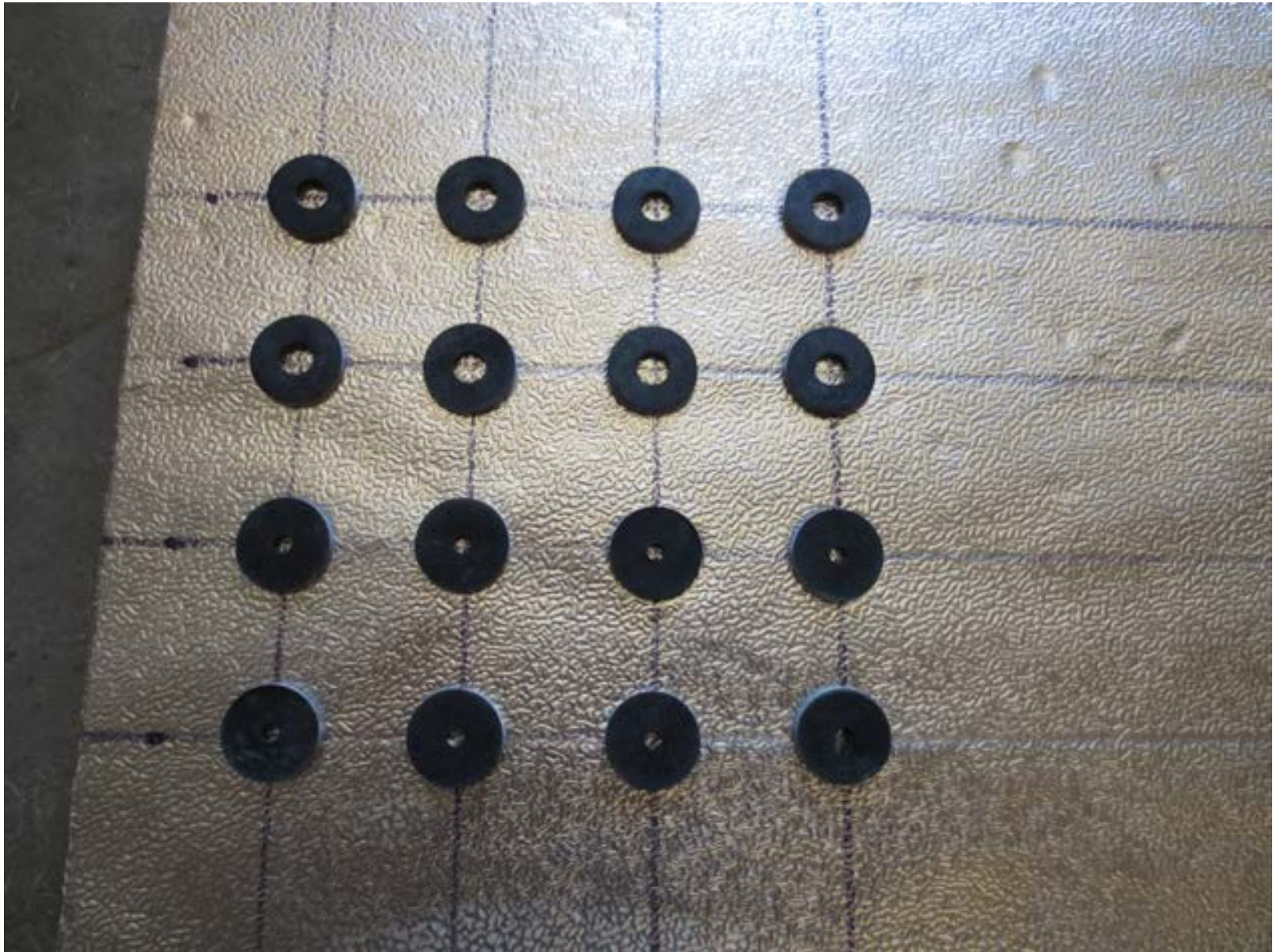




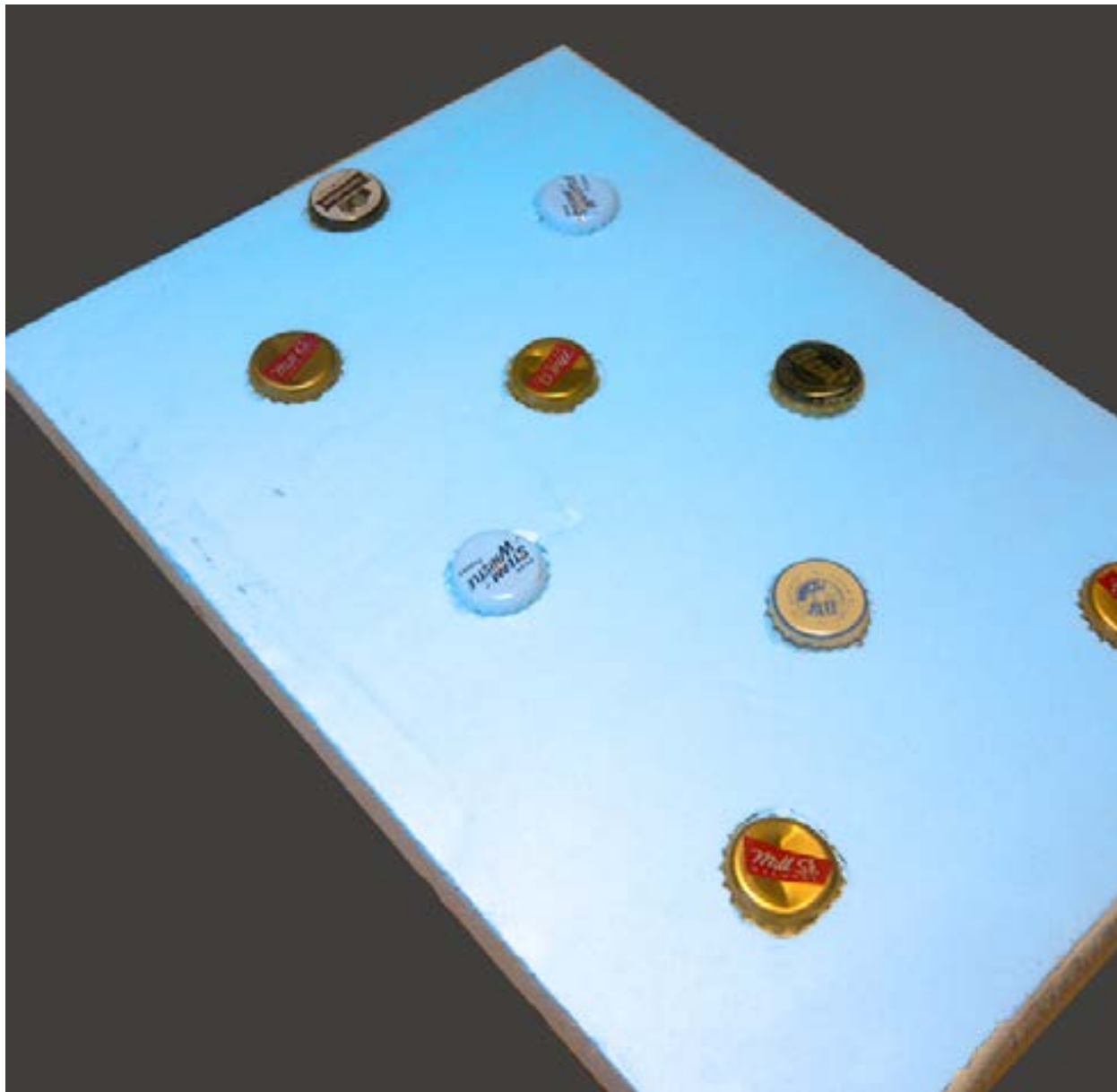


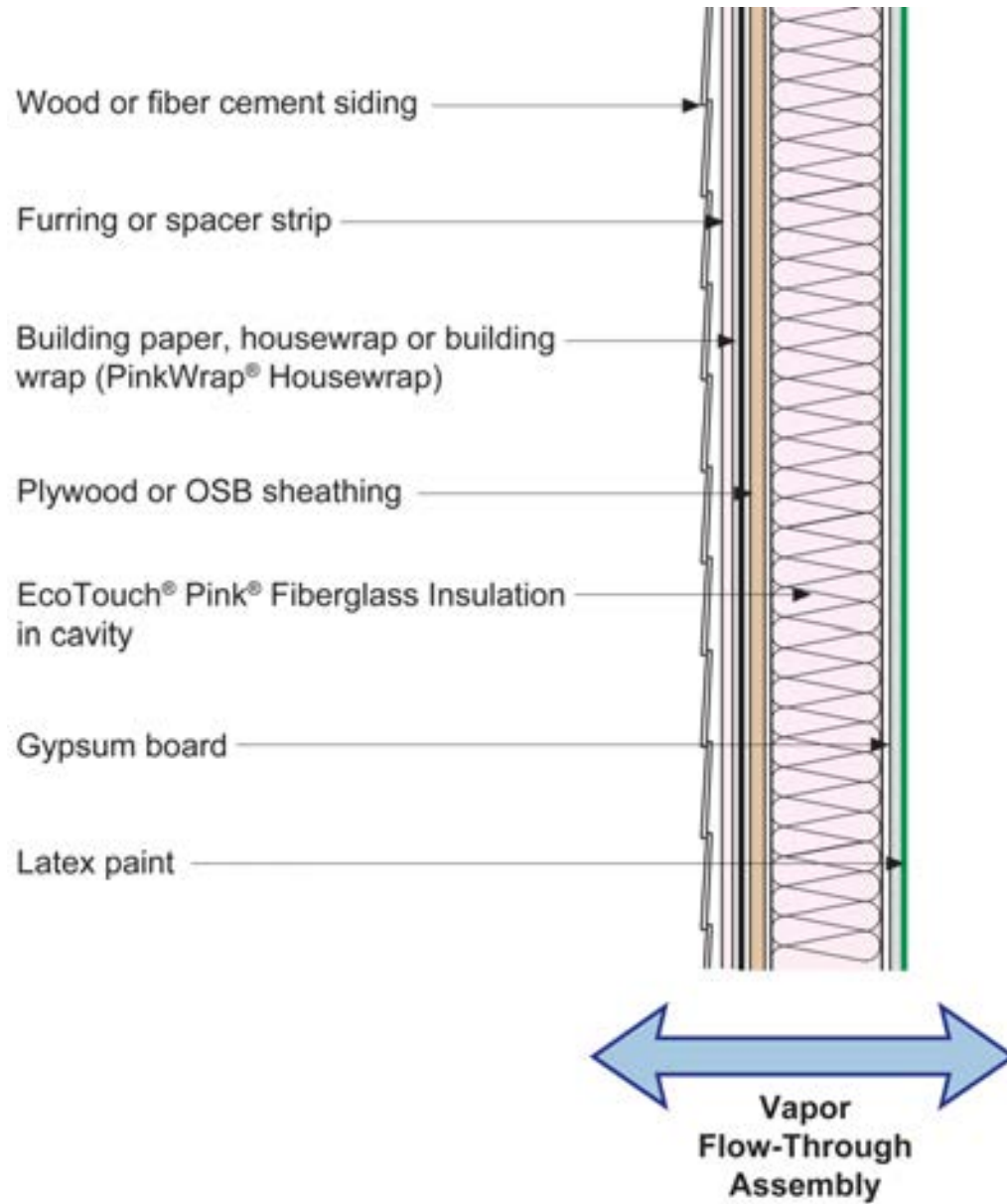


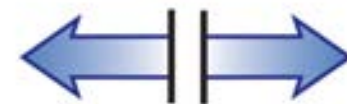
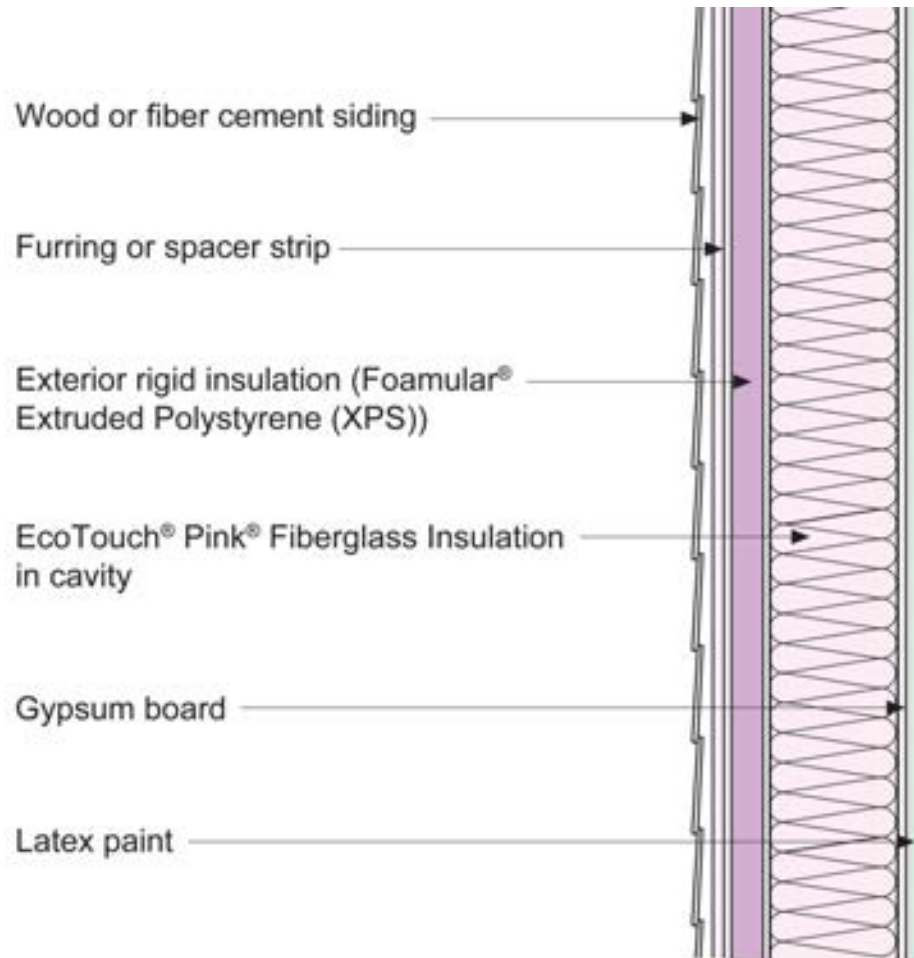
Rain Screen



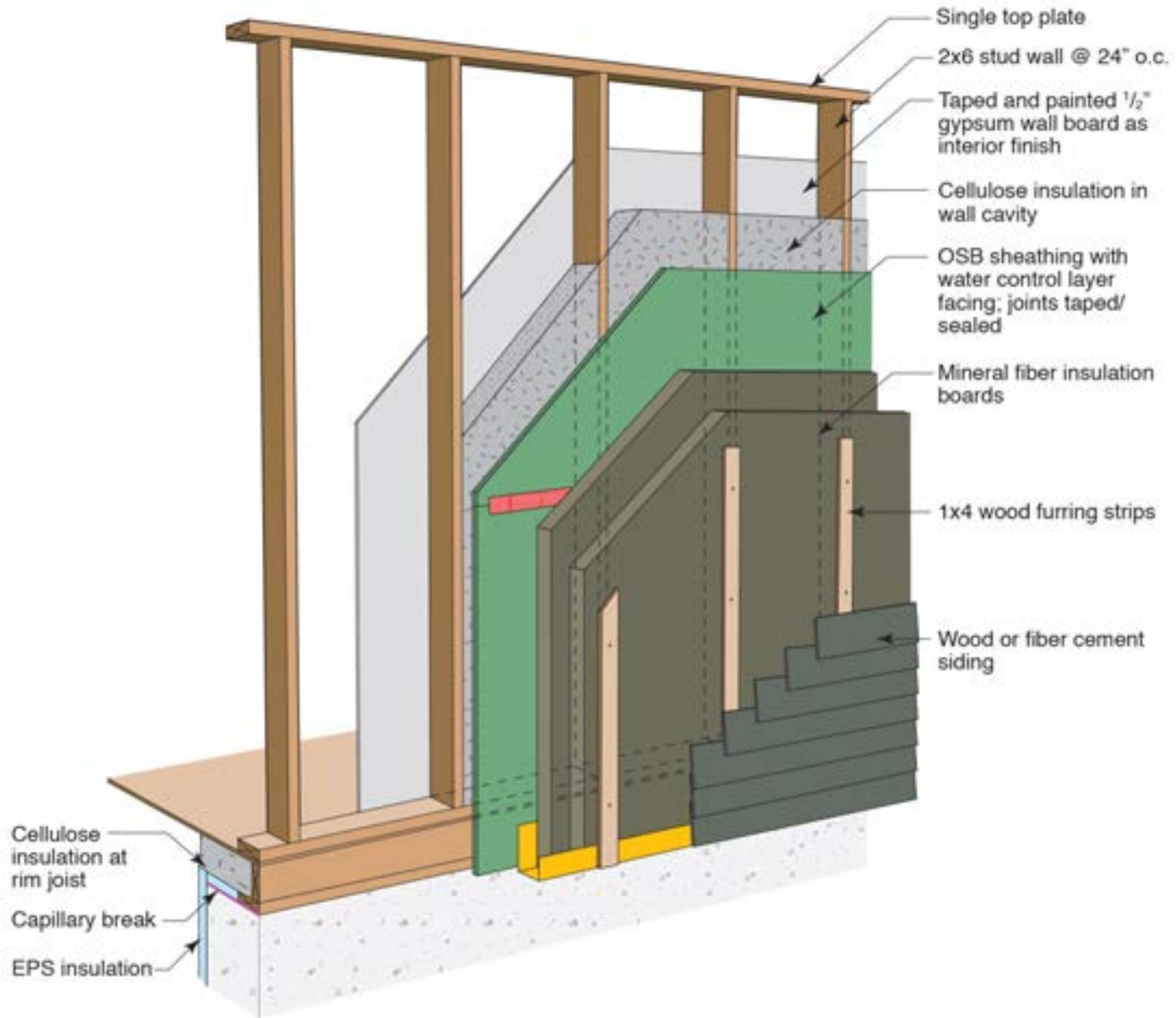
Beer Screen?

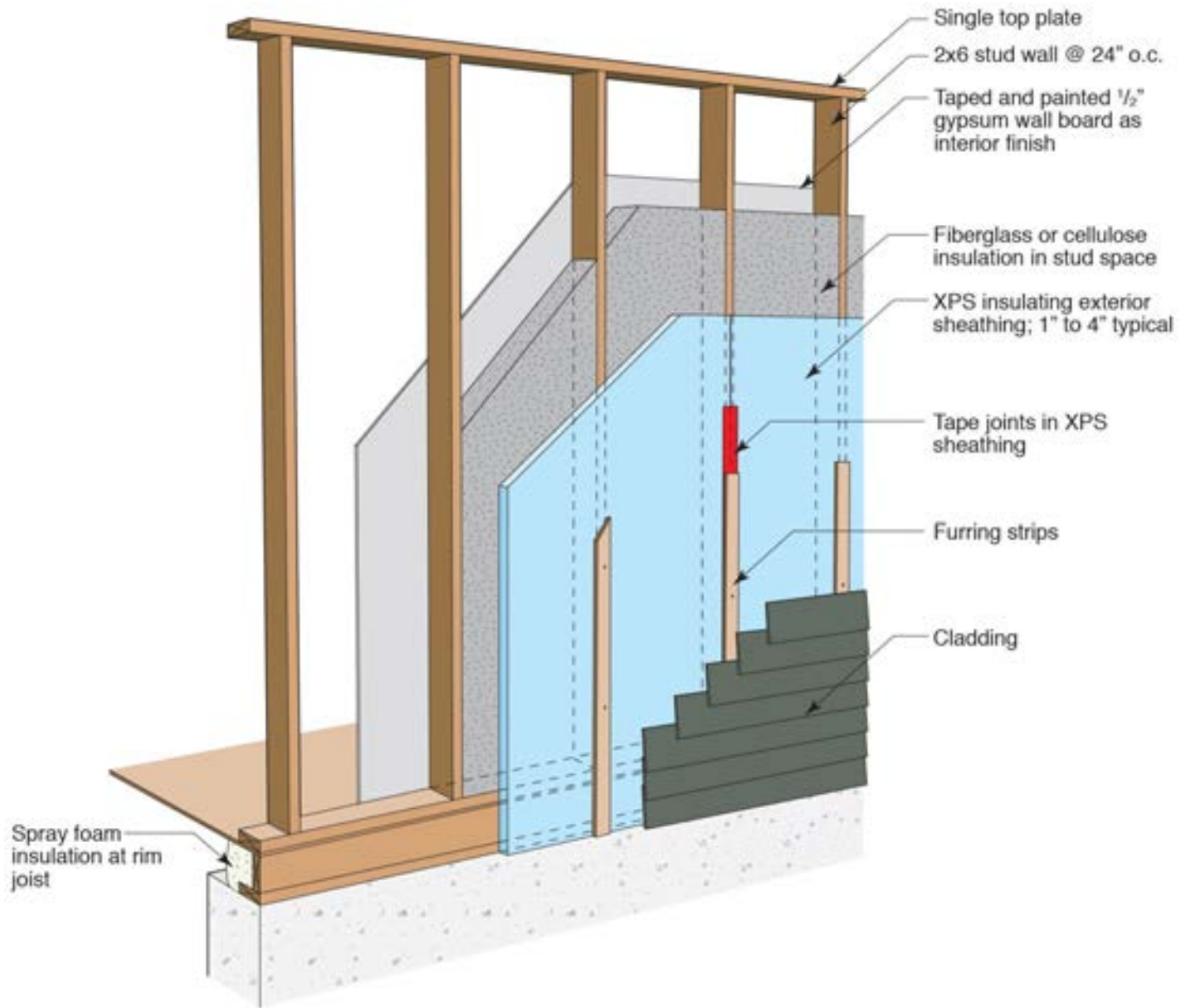






**Control of Condensing
Surface Temperature
Assembly**





Exterior Insulation Finish Systems EIFS....aka “Synthetic Stucco”



Exterior Insulation Finish Systems

EIFS

Barrier System

Face-Sealed Not Water Managed

















Stucco









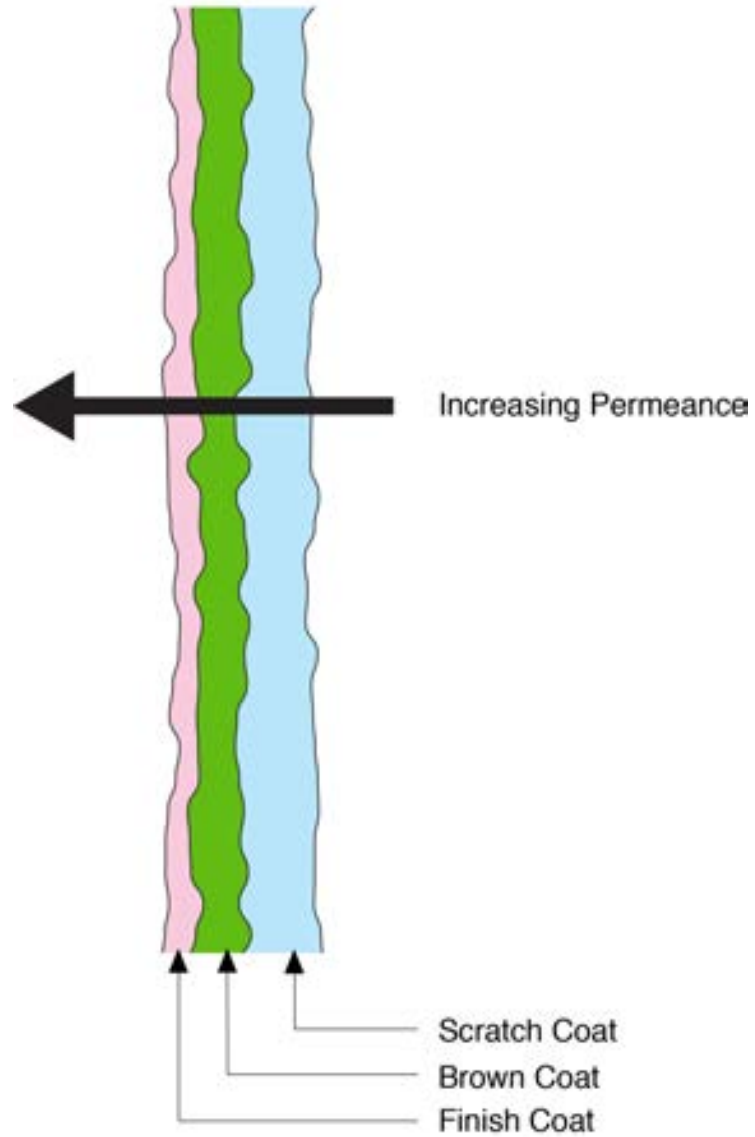


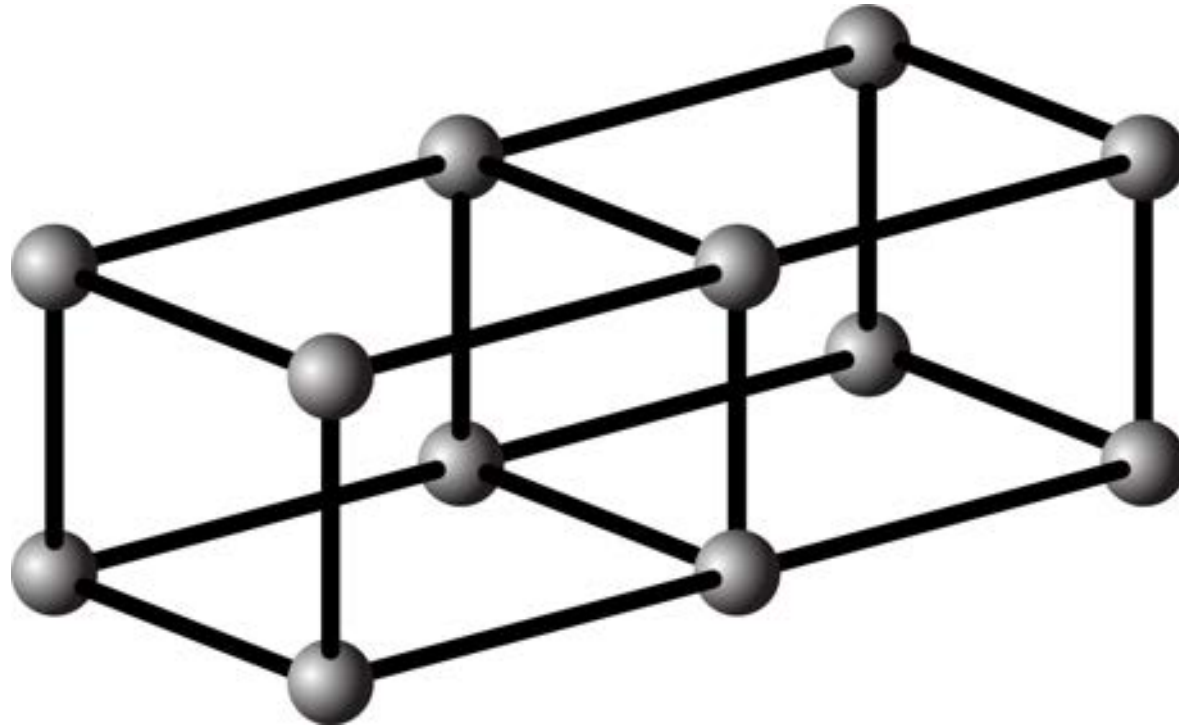


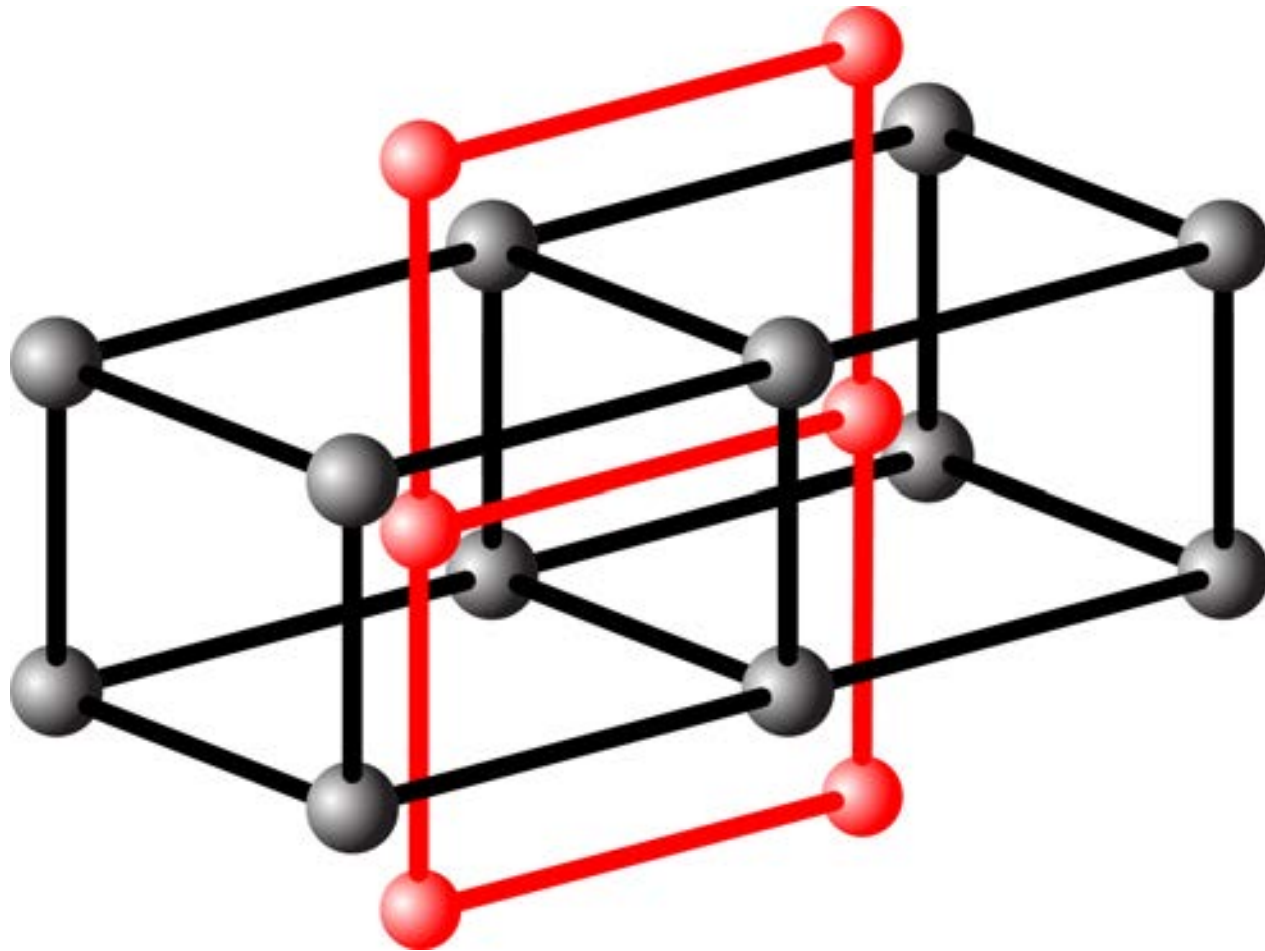


Materials Inward Drive Energy

Traditional Lime Stucco	Greater than 20 perms
Lime/Portland Cement Stucco	5 to 10 perms
Portland Cement Stucco	1 to 5 perms
Polymer Modification	Less than 1







Ancient Modification Additives

Cow Dung

Egg Whites

Pig Blood

Non Traditional Building Wraps









































Back To Lumpy Stucco....

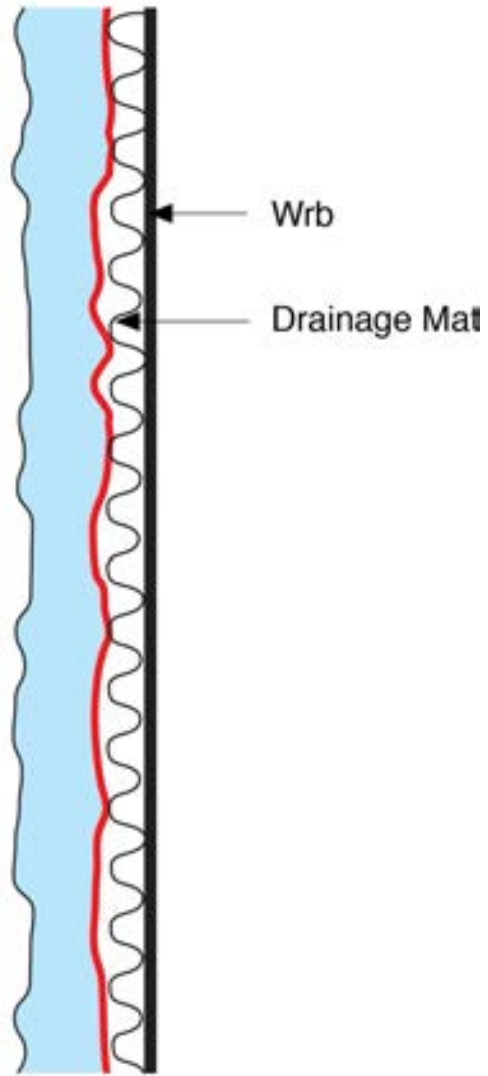






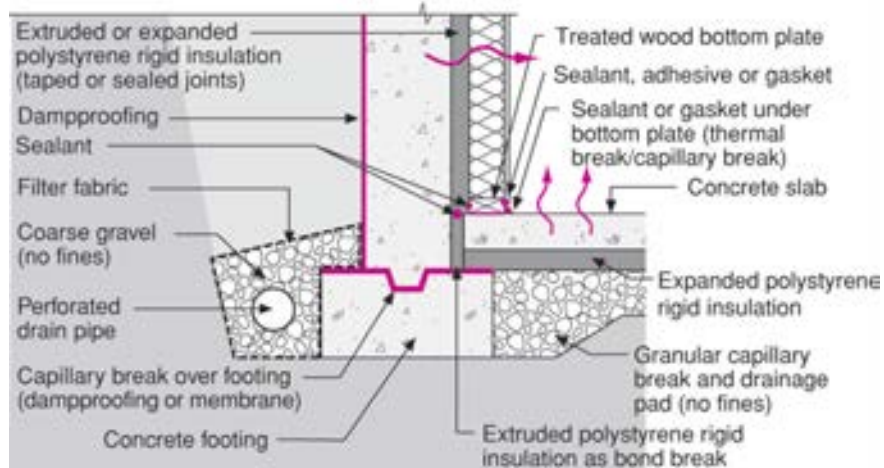
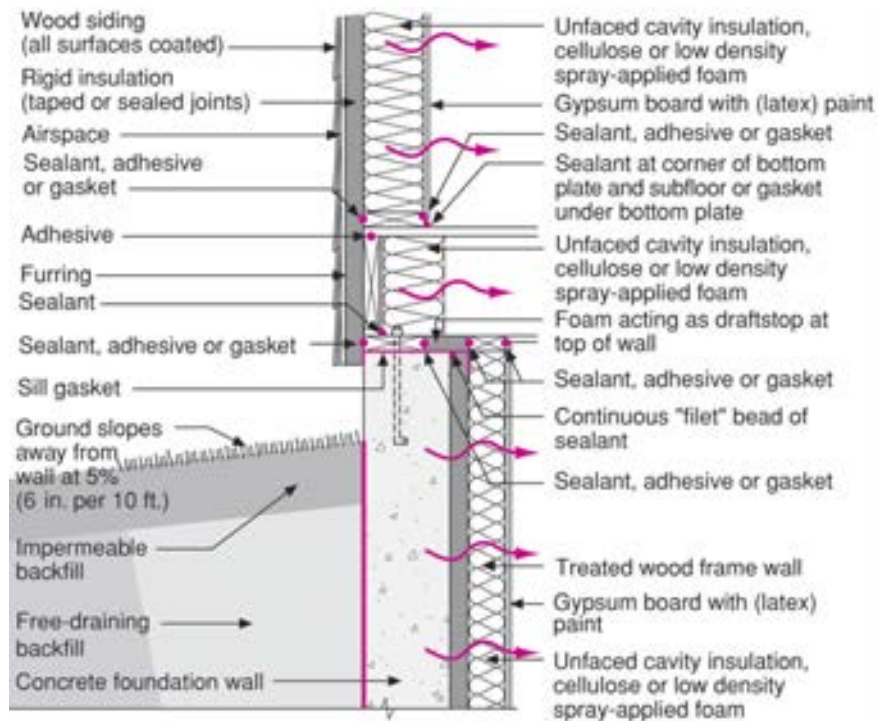


Easy Solution....







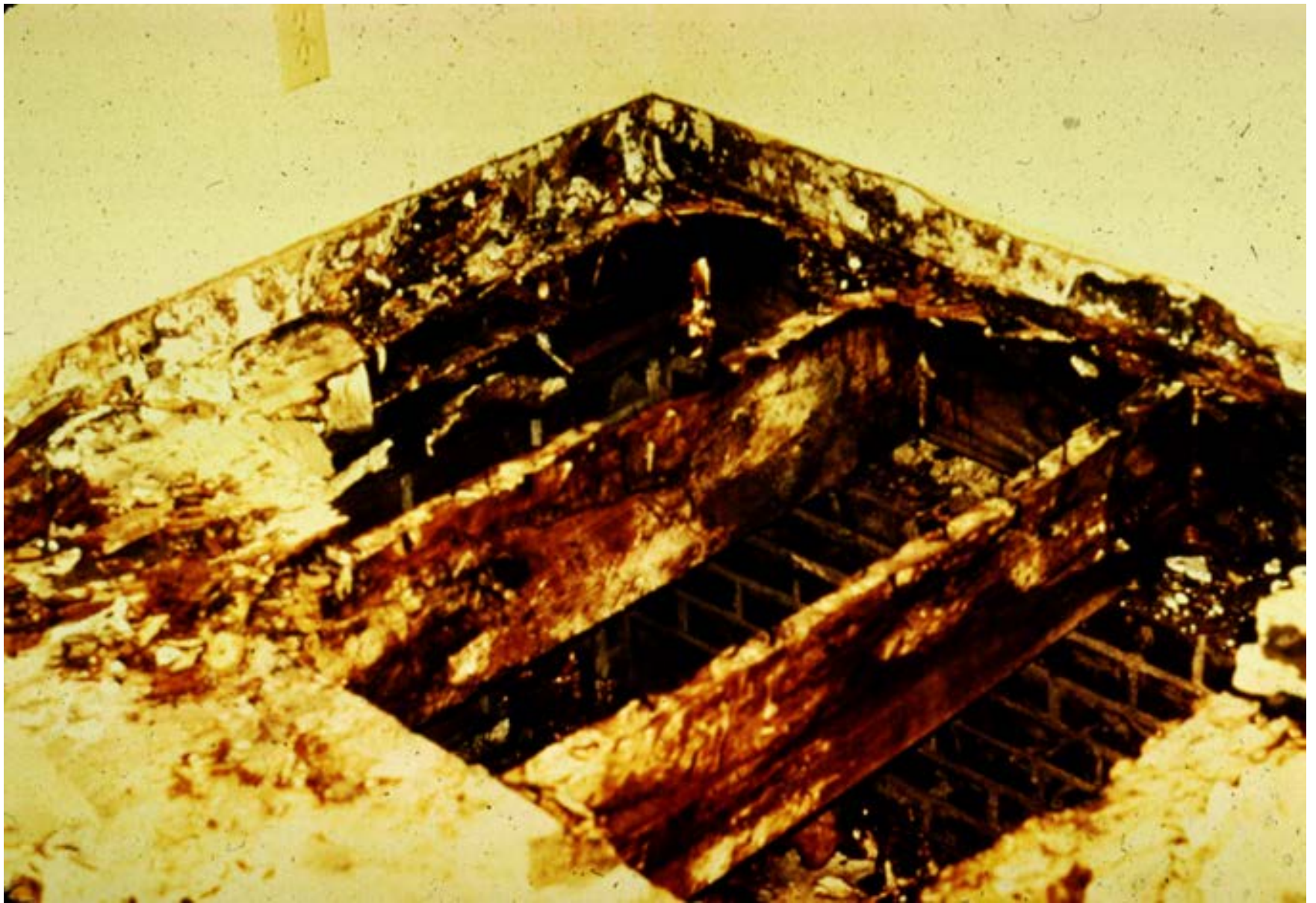














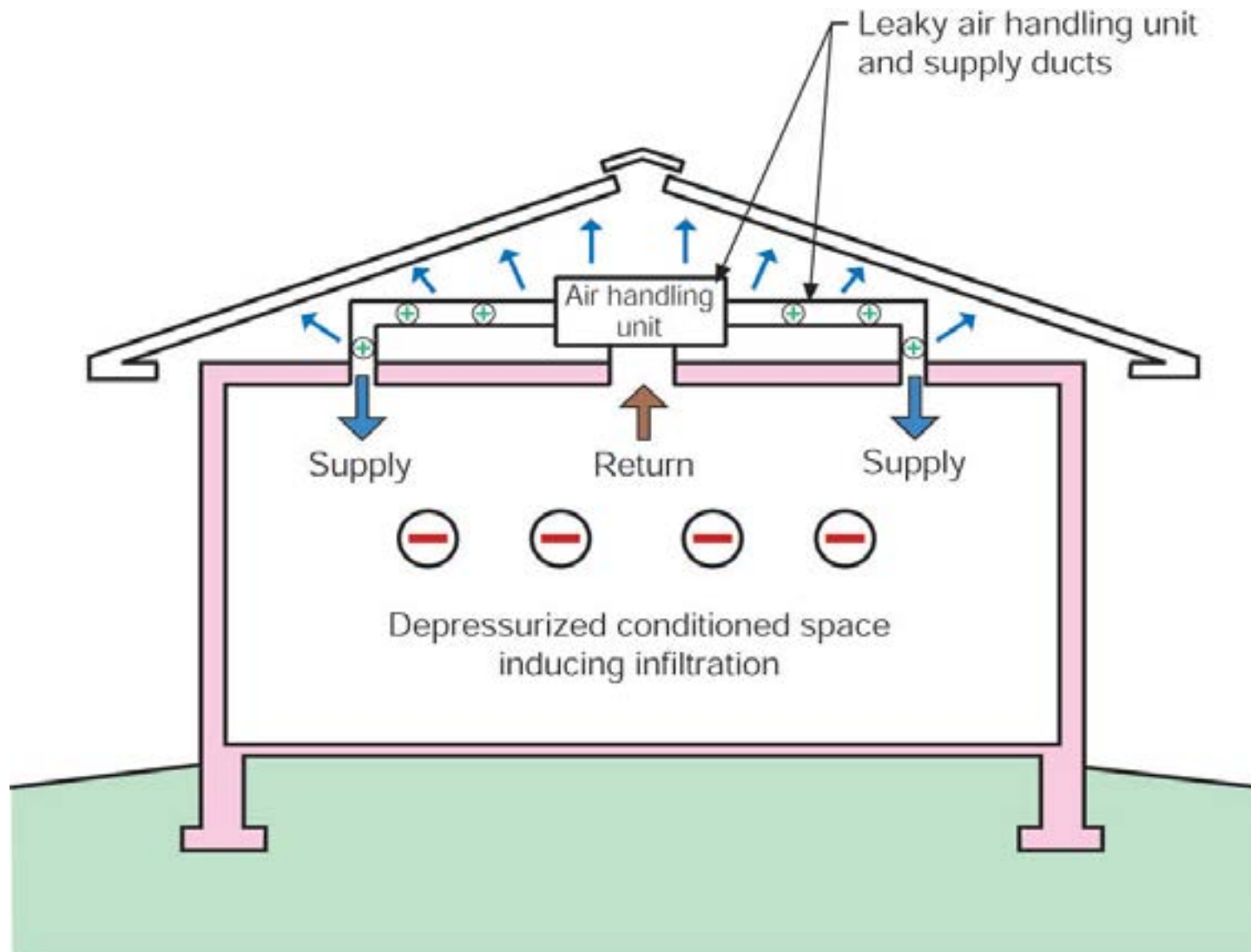




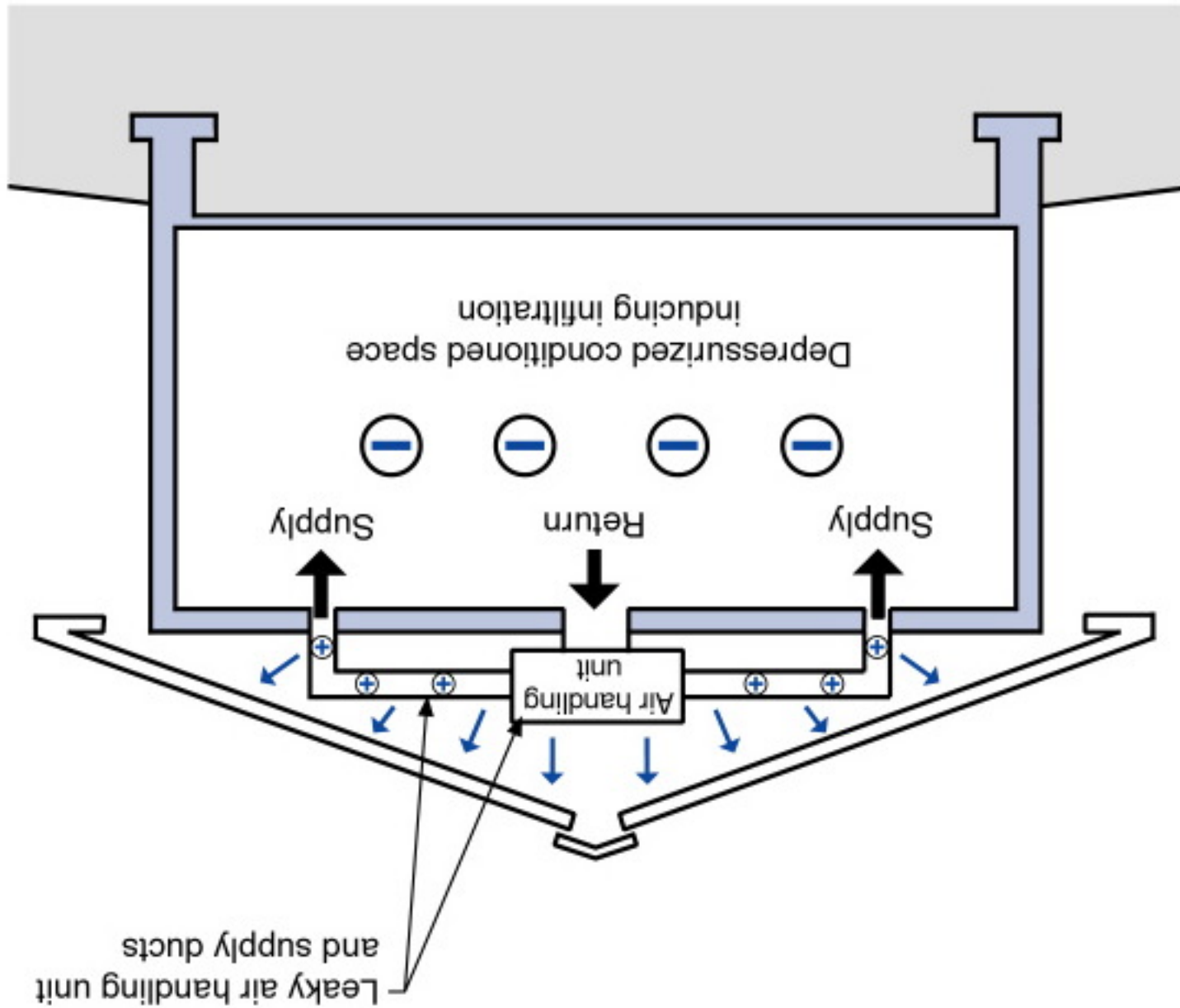


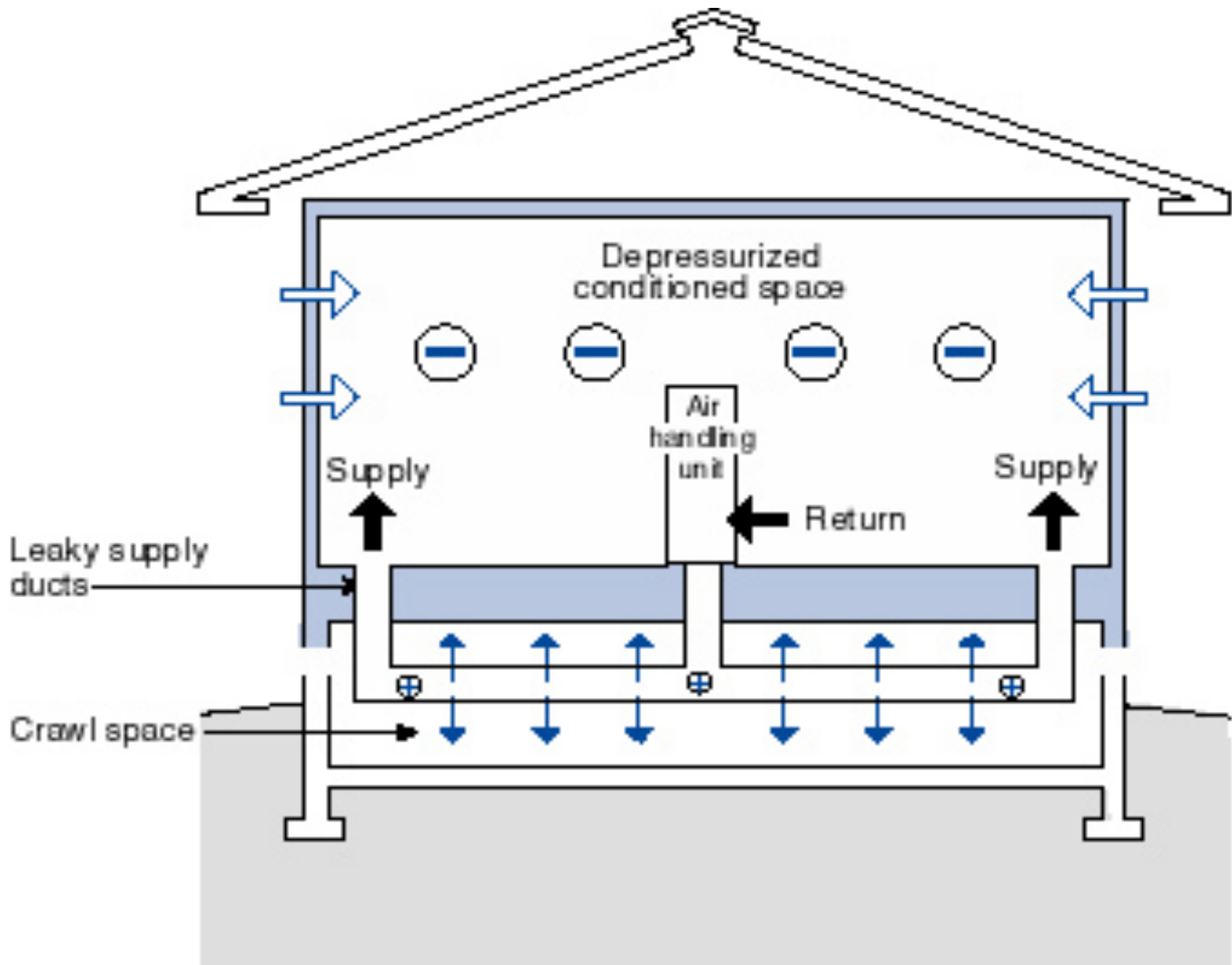






Note: Colored shading depicts the building's thermal barrier and pressure boundary. The thermal barrier and pressure boundary enclose the conditioned space.



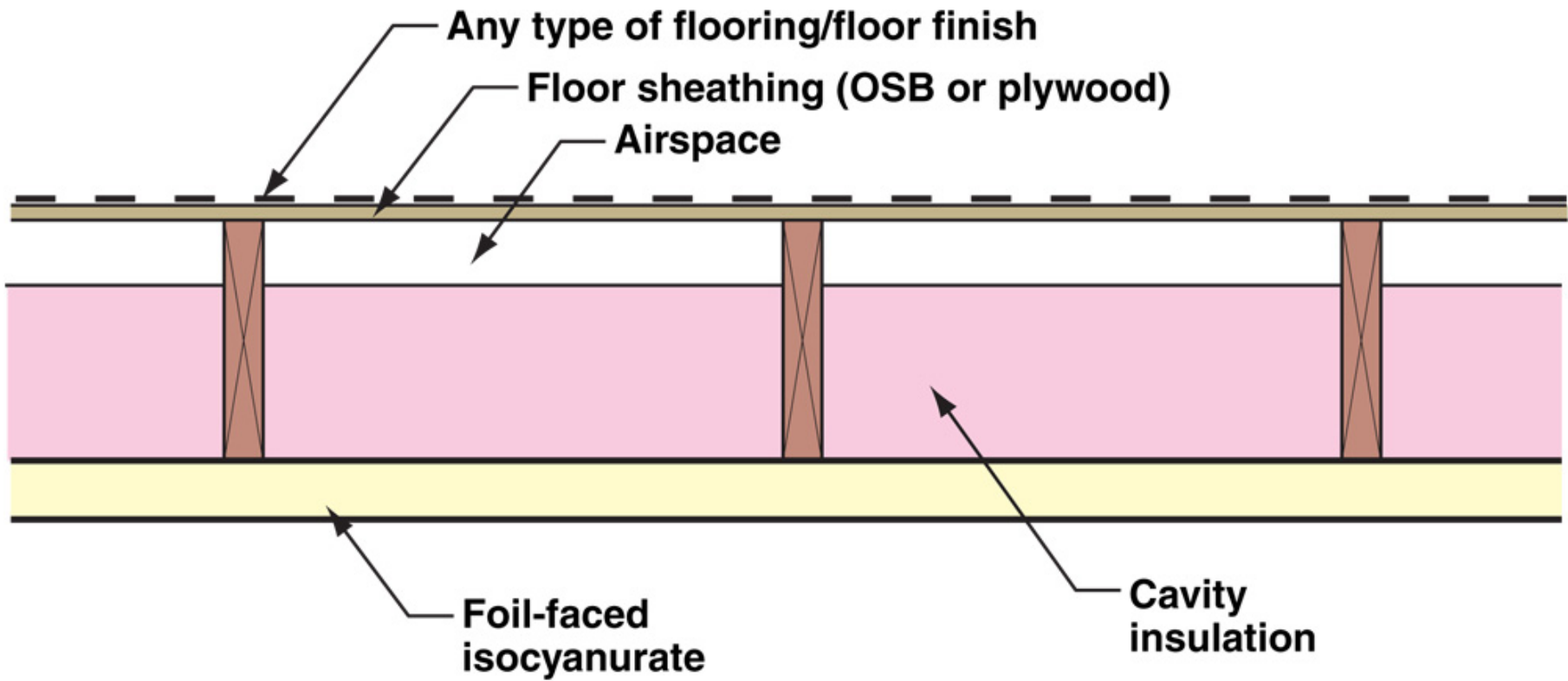










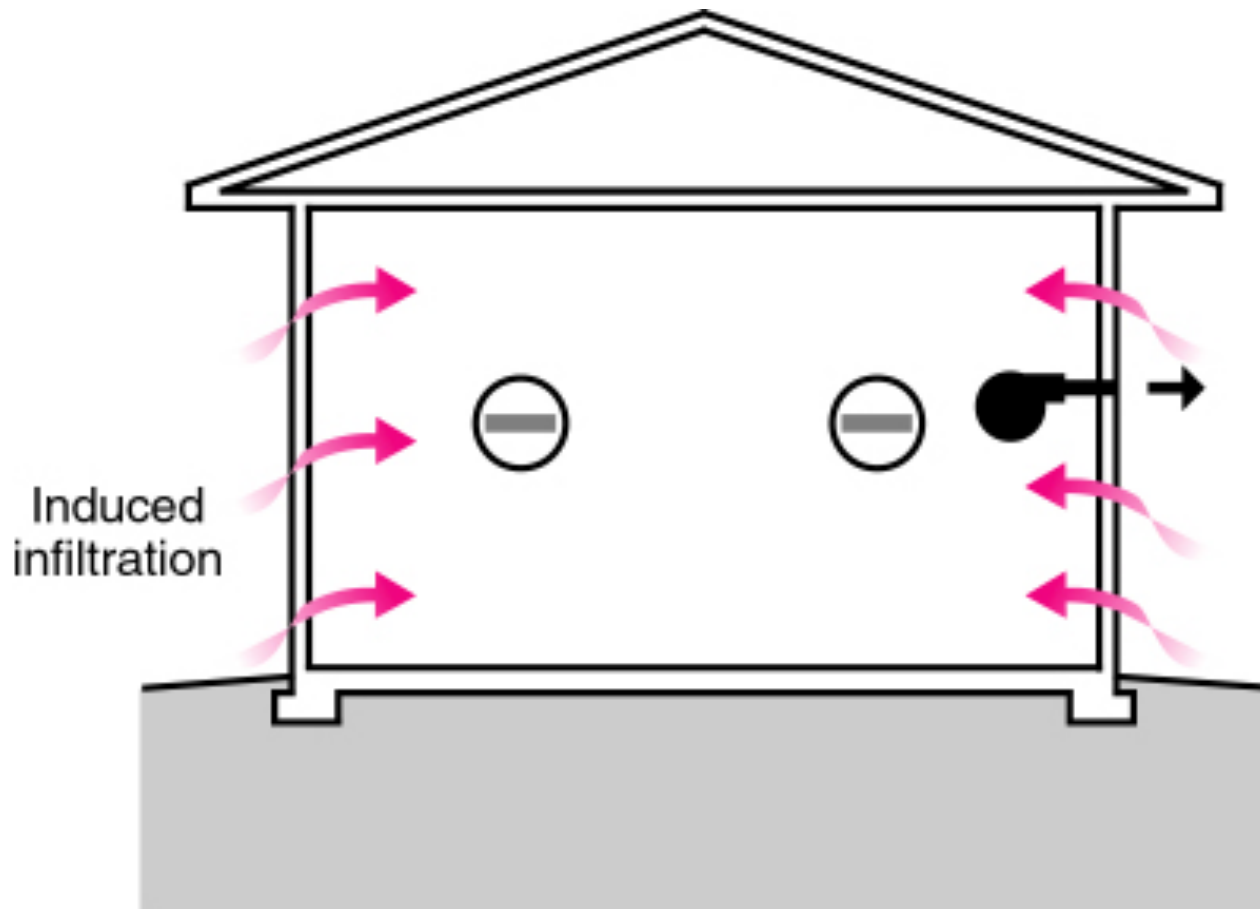


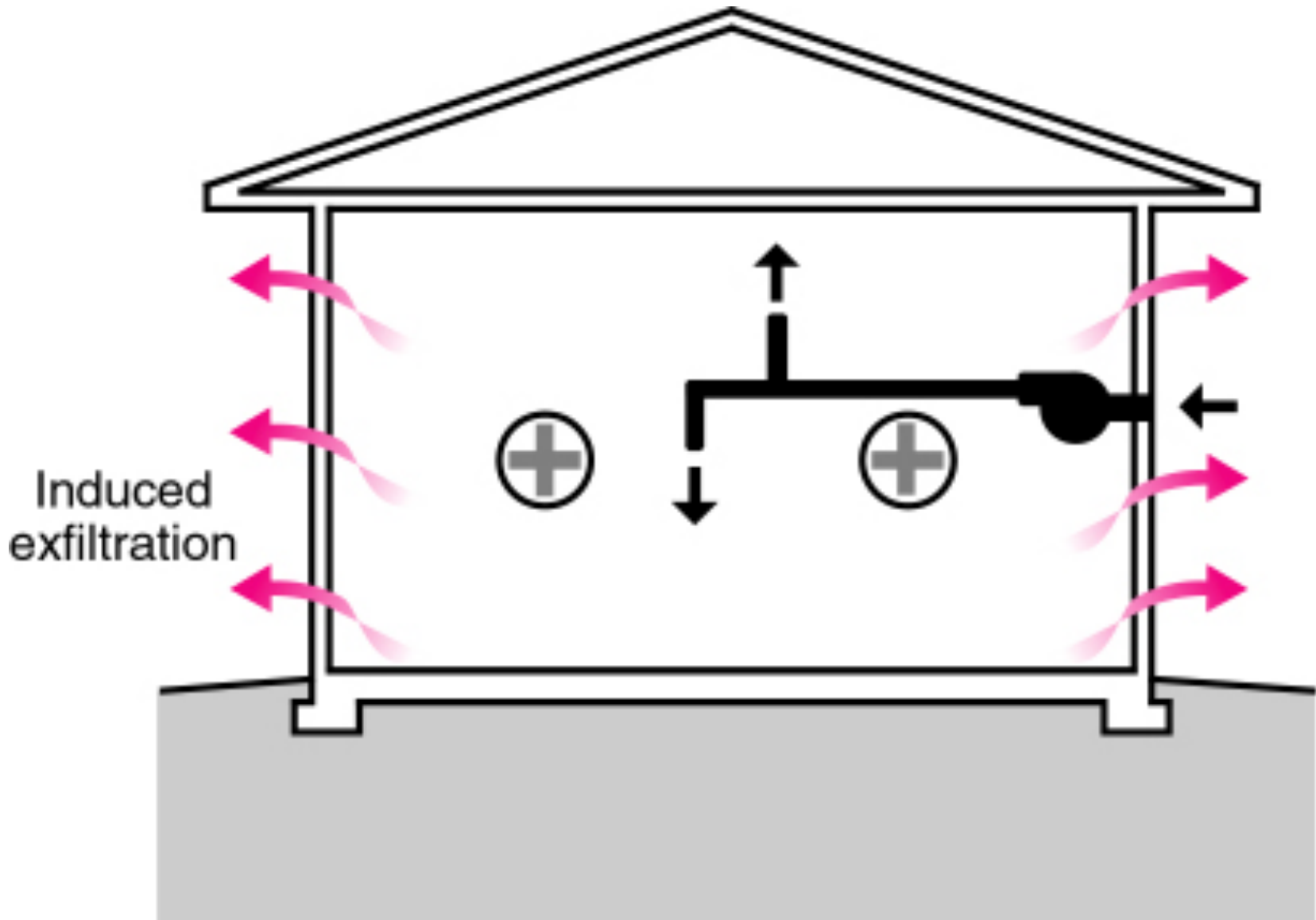
Three Types of Controlled Ventilation Systems

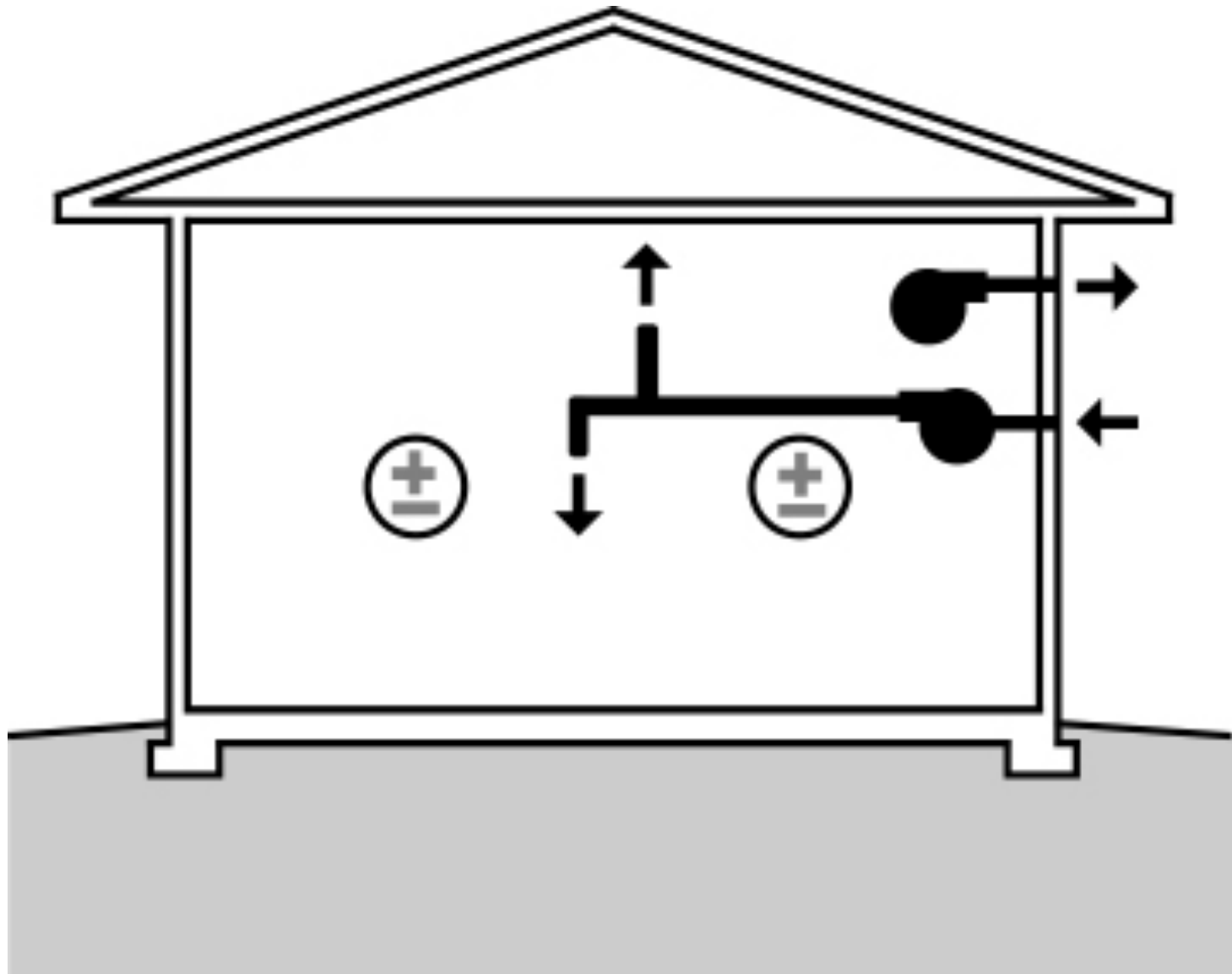
Exhaust Ventilation

Supply Ventilation

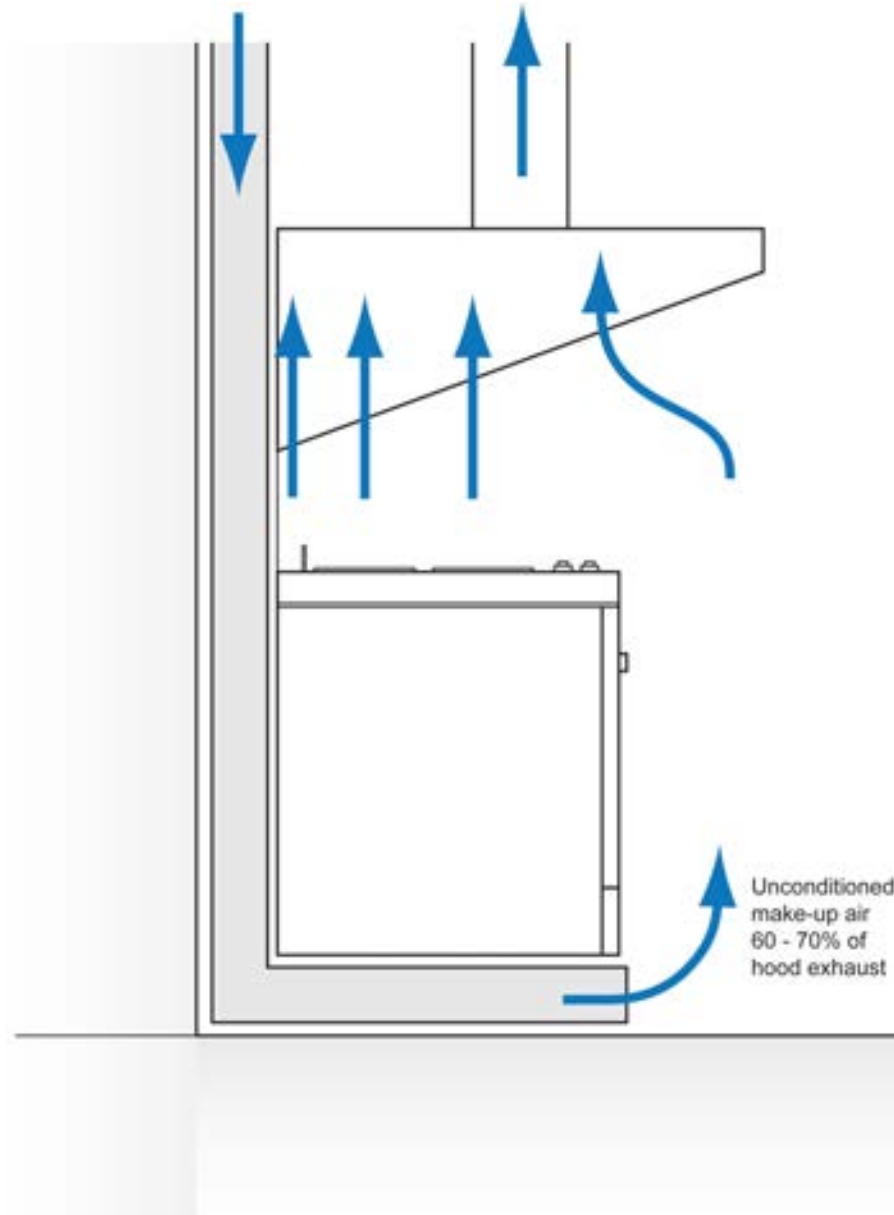
Balanced Ventilation







Kitchen Exhaust Hoods





Clothes Dryers





Fireplaces

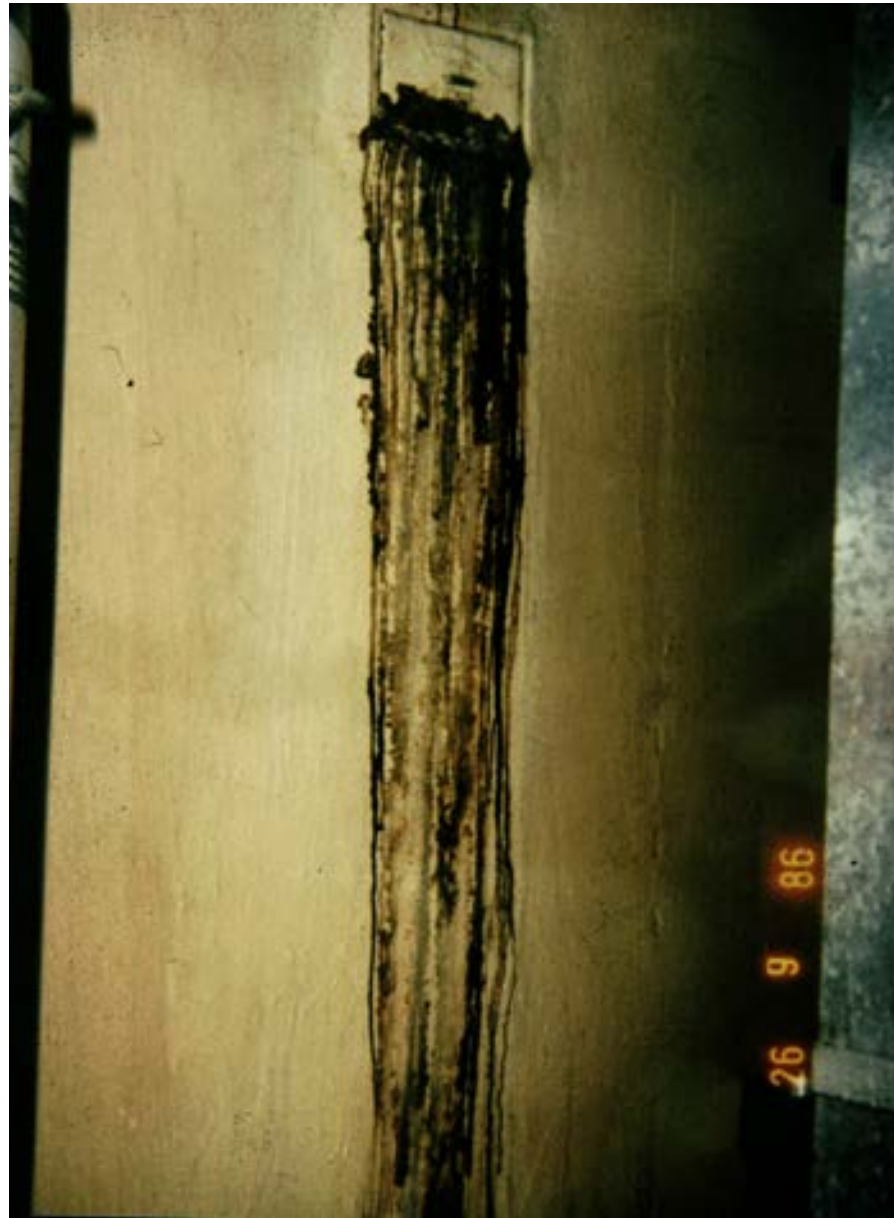
















Sweating Ducts

Sweating Ducts

Light Colored Roofs

Cool Roofs

Radiant Barriers

ACCA Manual J, S and D

ASHRAE 62.2

Ductwork Attic Dehumidification System

