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# Building Science

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Adventures In Building Science

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# What is a Building?

# A Building is an Environmental Separator

- Control heat flow
- Control airflow
- Control water vapor flow
- Control rain
- Control ground water
- Control light and solar radiation
- Control noise and vibrations
- Control contaminants, environmental hazards and odors
- Control insects, rodents and vermin
- Control fire
- Provide strength and rigidity
- Be durable
- Be aesthetically pleasing
- Be economical

# Arrhenius Equation

For Every 10 Degree K Rise  
Activation Energy Doubles

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

Damage Functions

Water

Heat

Ultra-violet Radiation

# 2<sup>nd</sup> Law of Thermodynamics



In an isolated system, a process can occur only if it increases the total entropy of the system

Rudolf Clausius

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

Gravity Acts Down

# Thermodynamic Potential



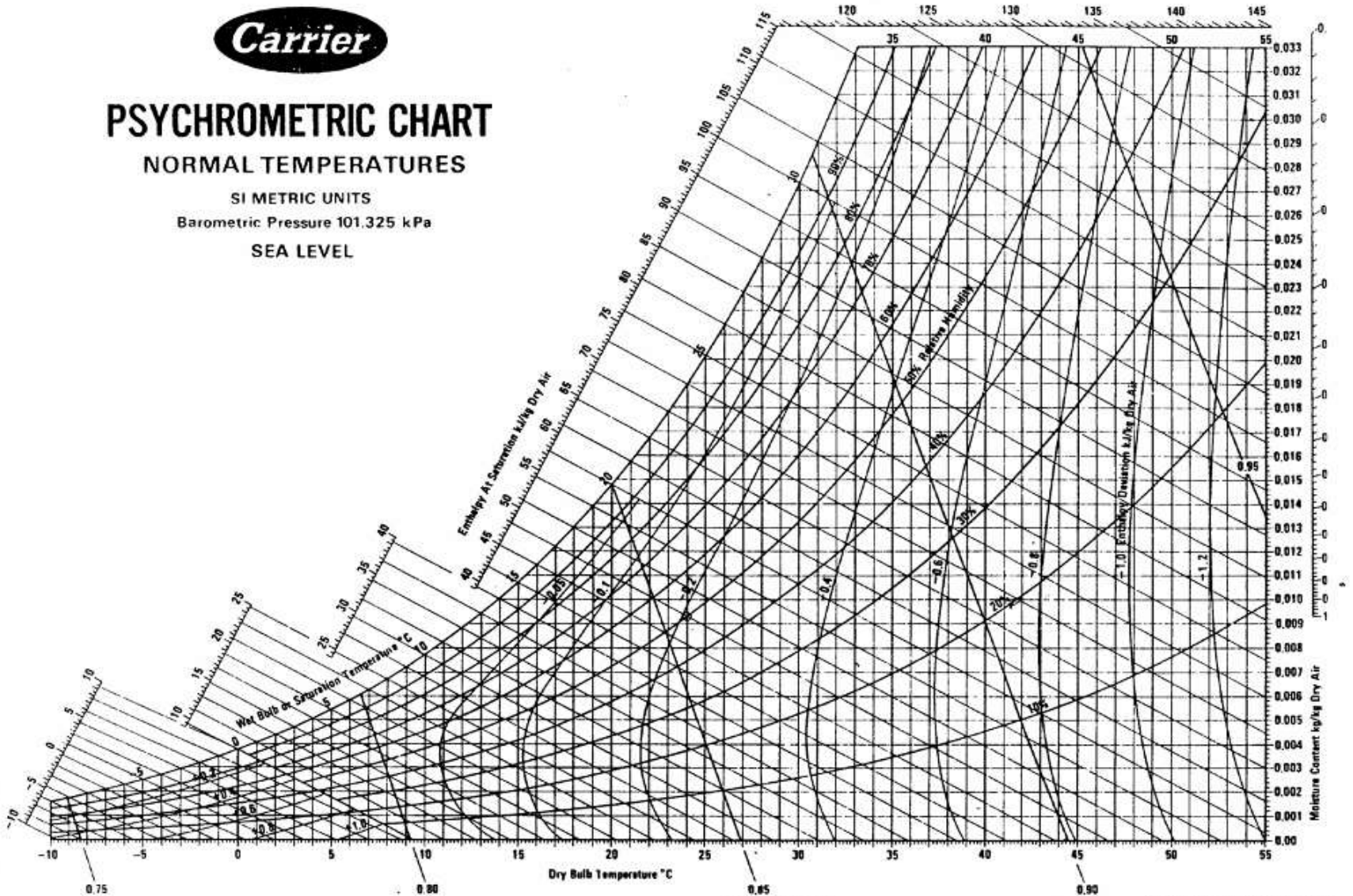
# PSYCHROMETRIC CHART

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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**Exposure**

Extreme		Over 60"
High		40" - 60"
Moderate		20" - 40"
Low		Under 20"

Water Control Layer

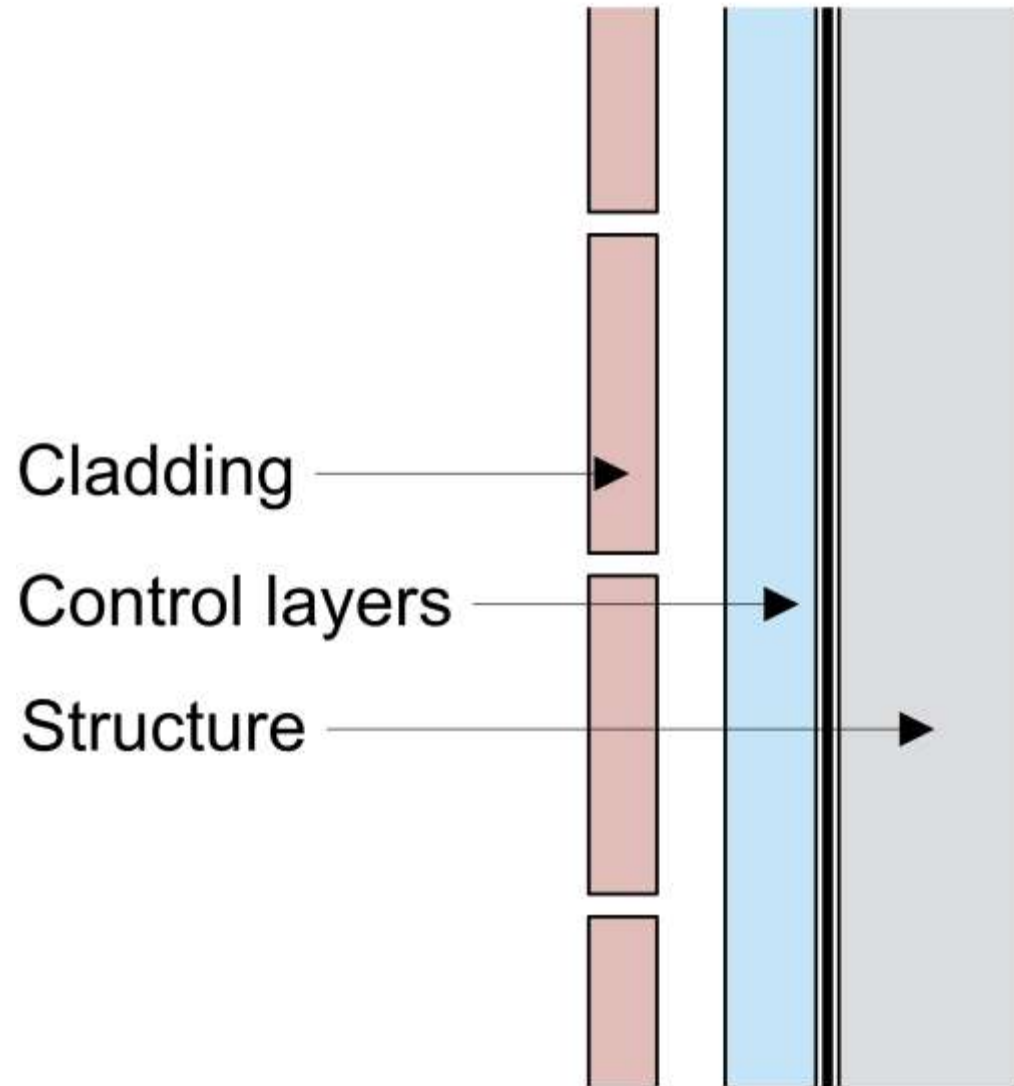
Air Control Layer

Vapor Control Layer

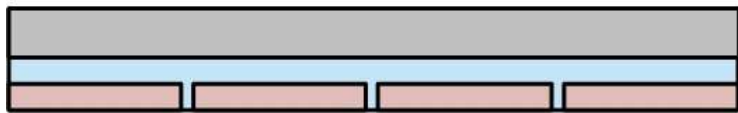
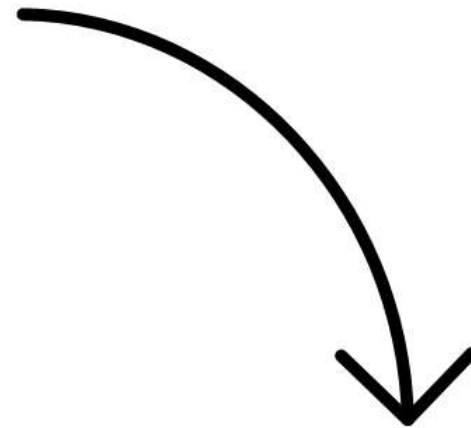
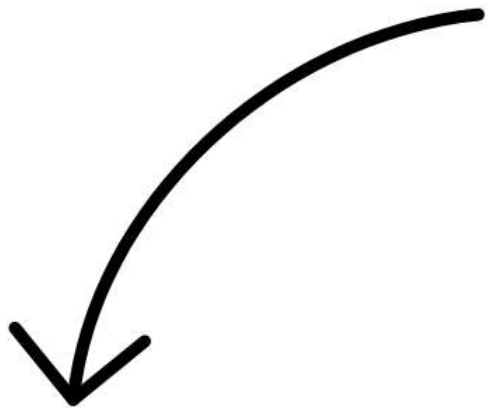
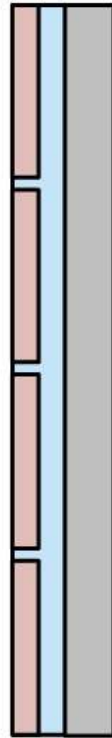
Thermal Control Layer

# The Three Biggest Problems In Buildings Are Water, Water and Water...





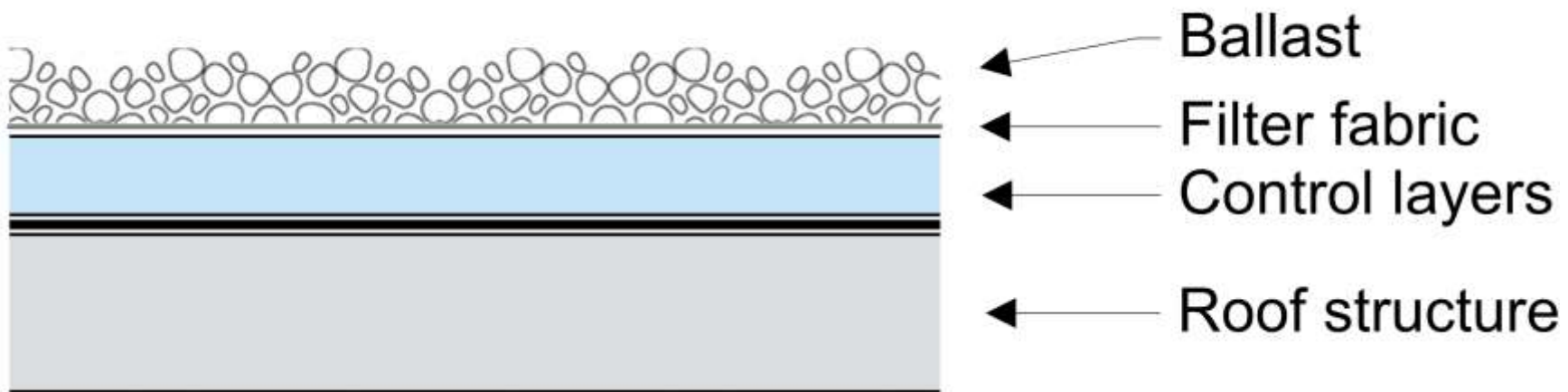
# Wall

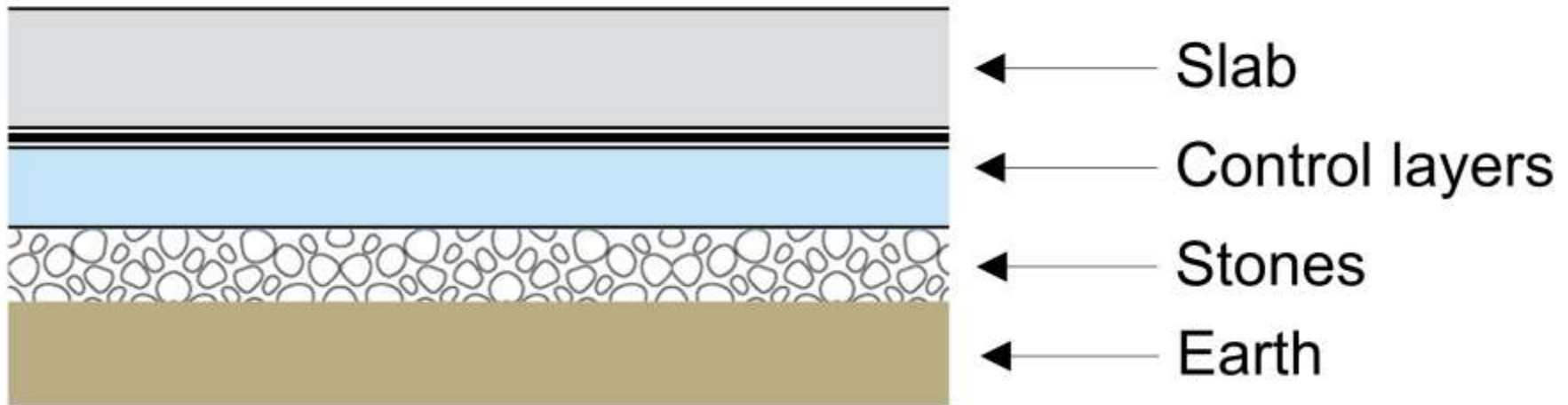


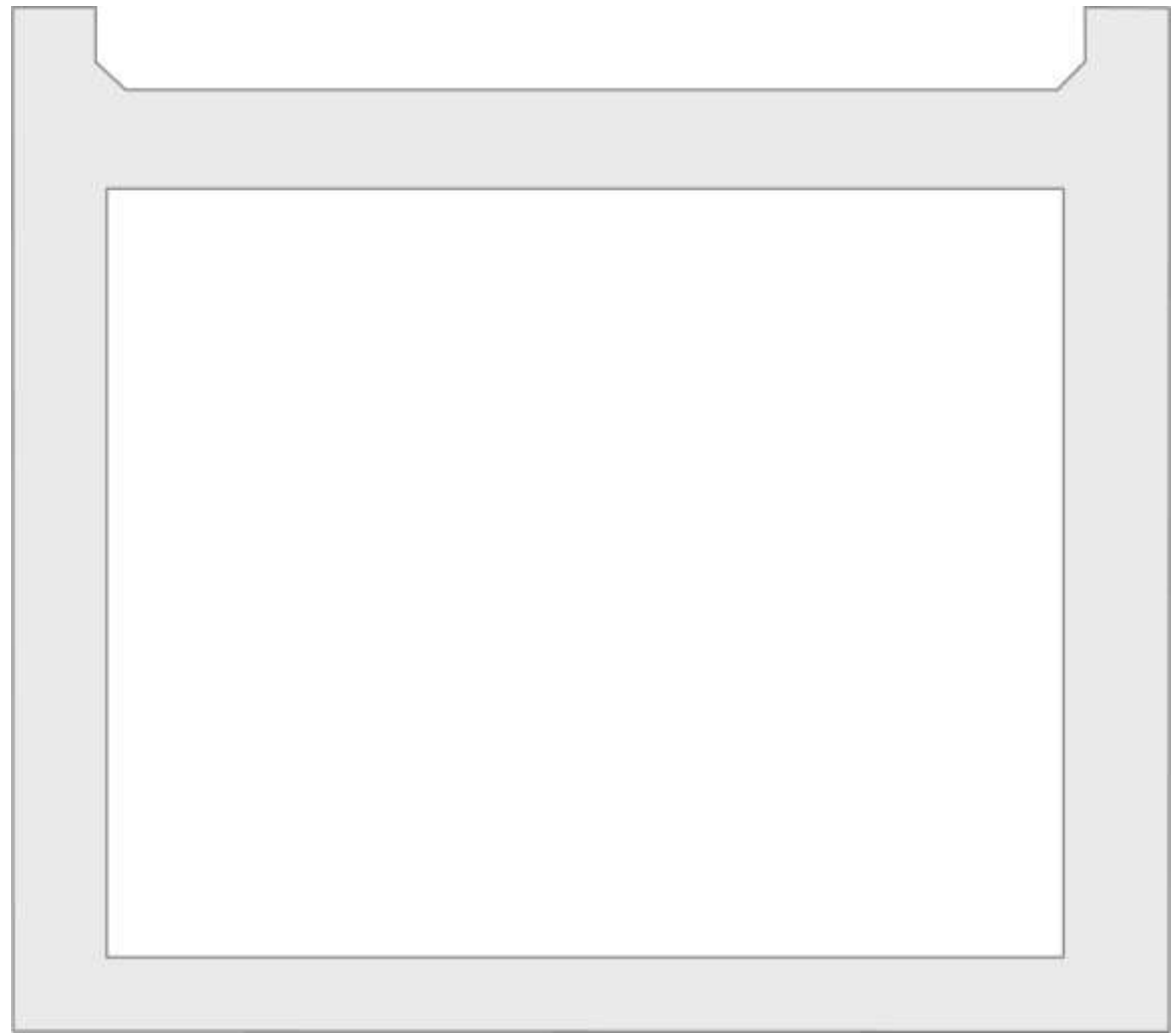
# Slab



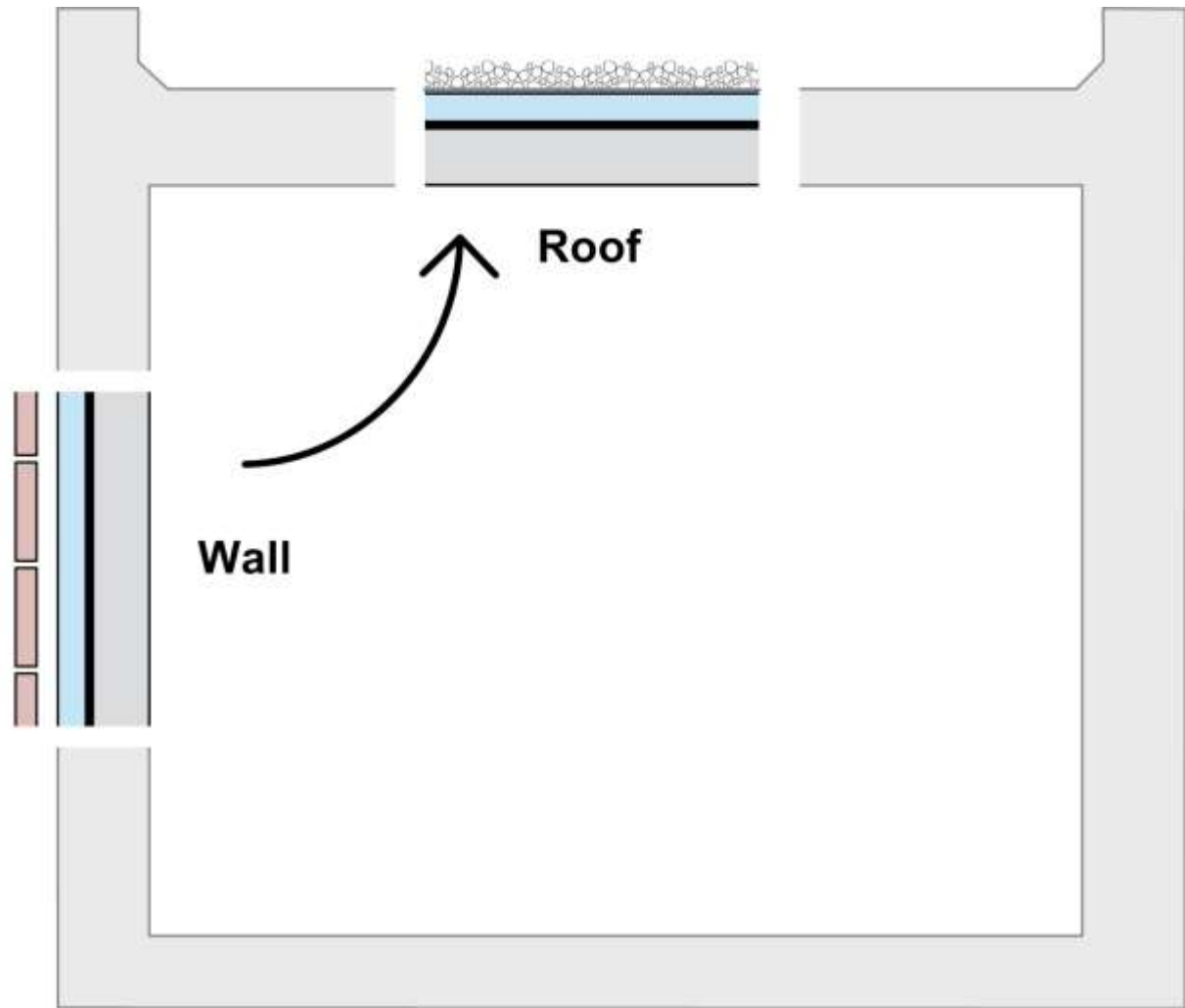
# Roof

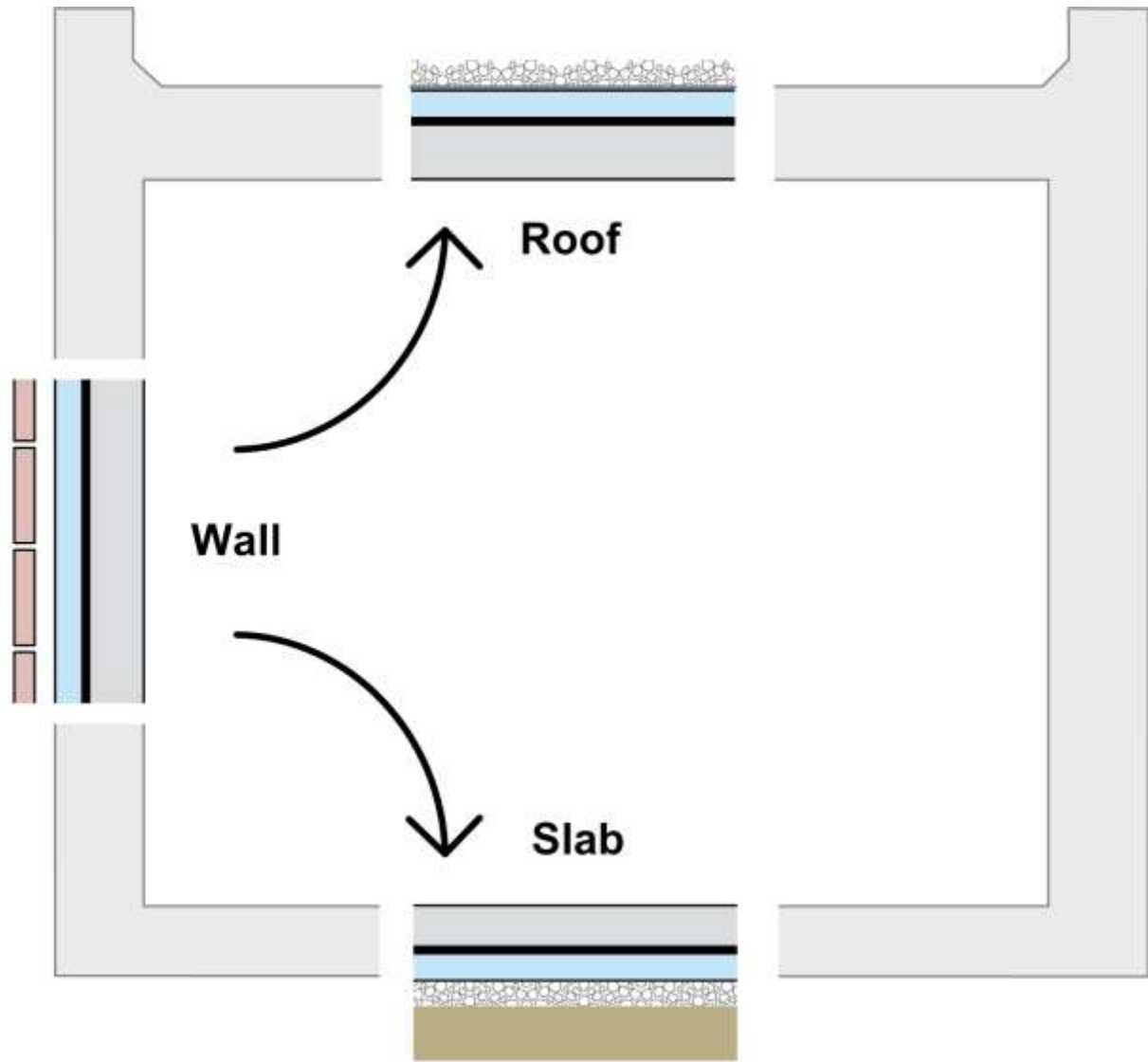




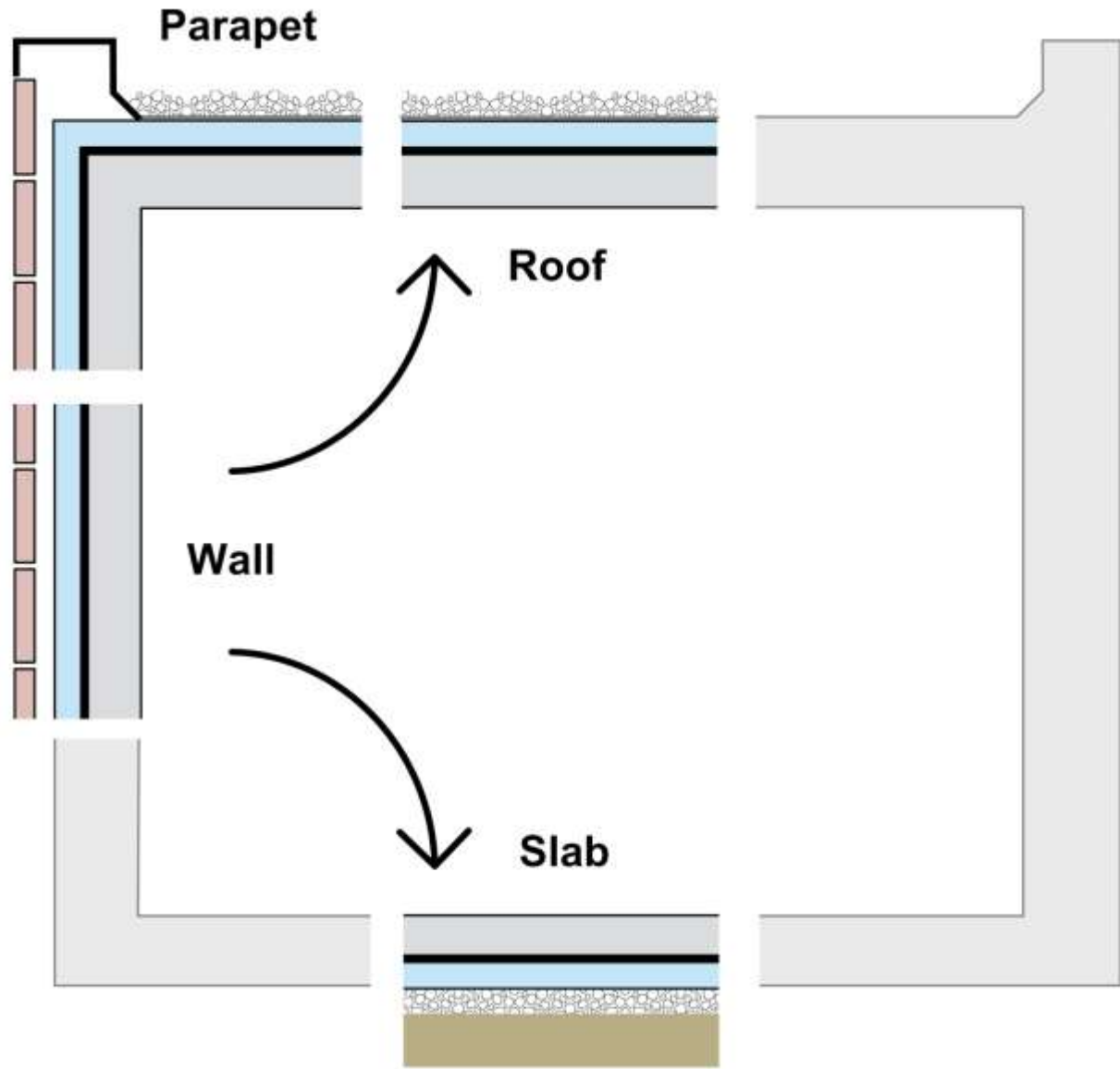


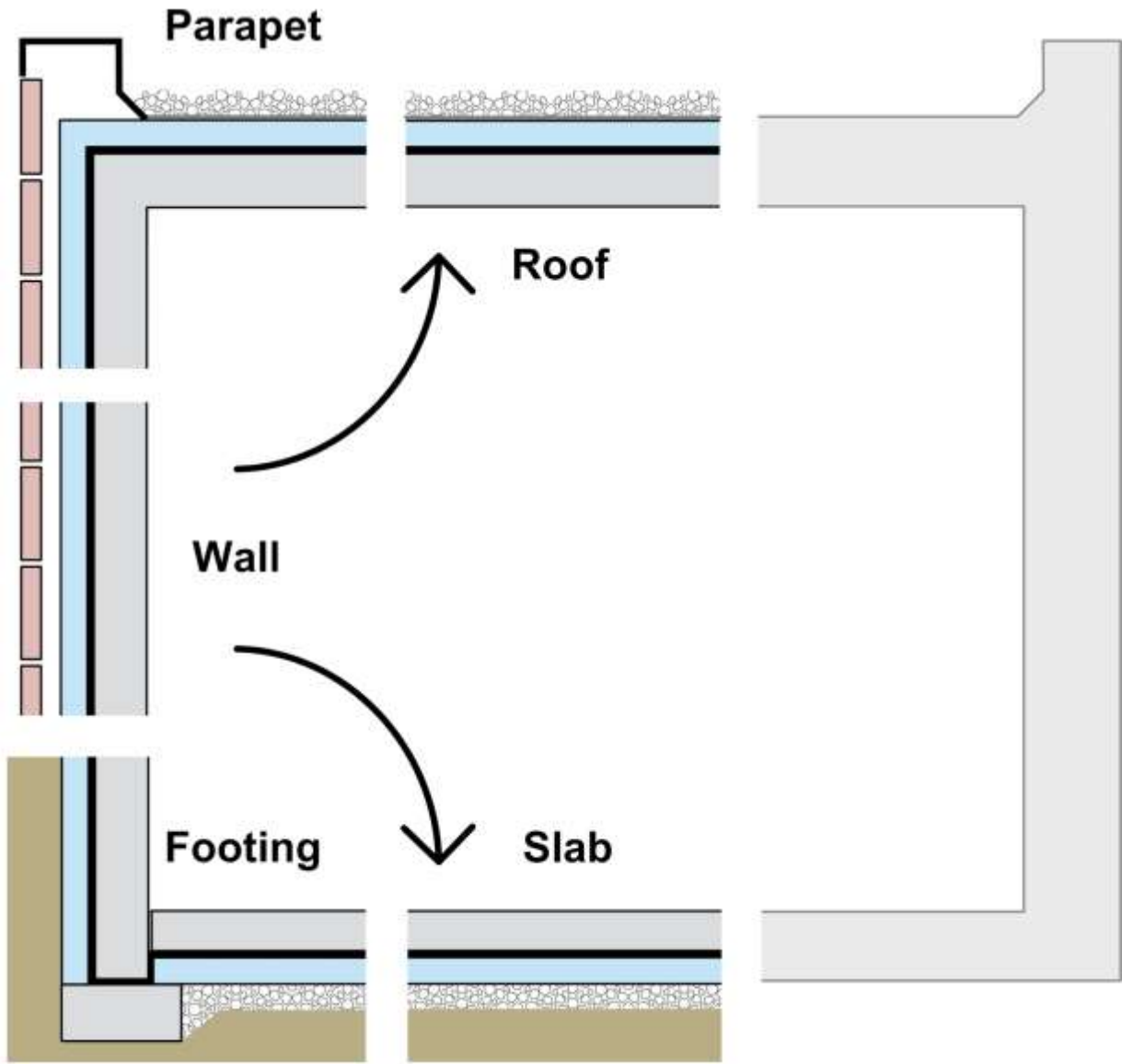


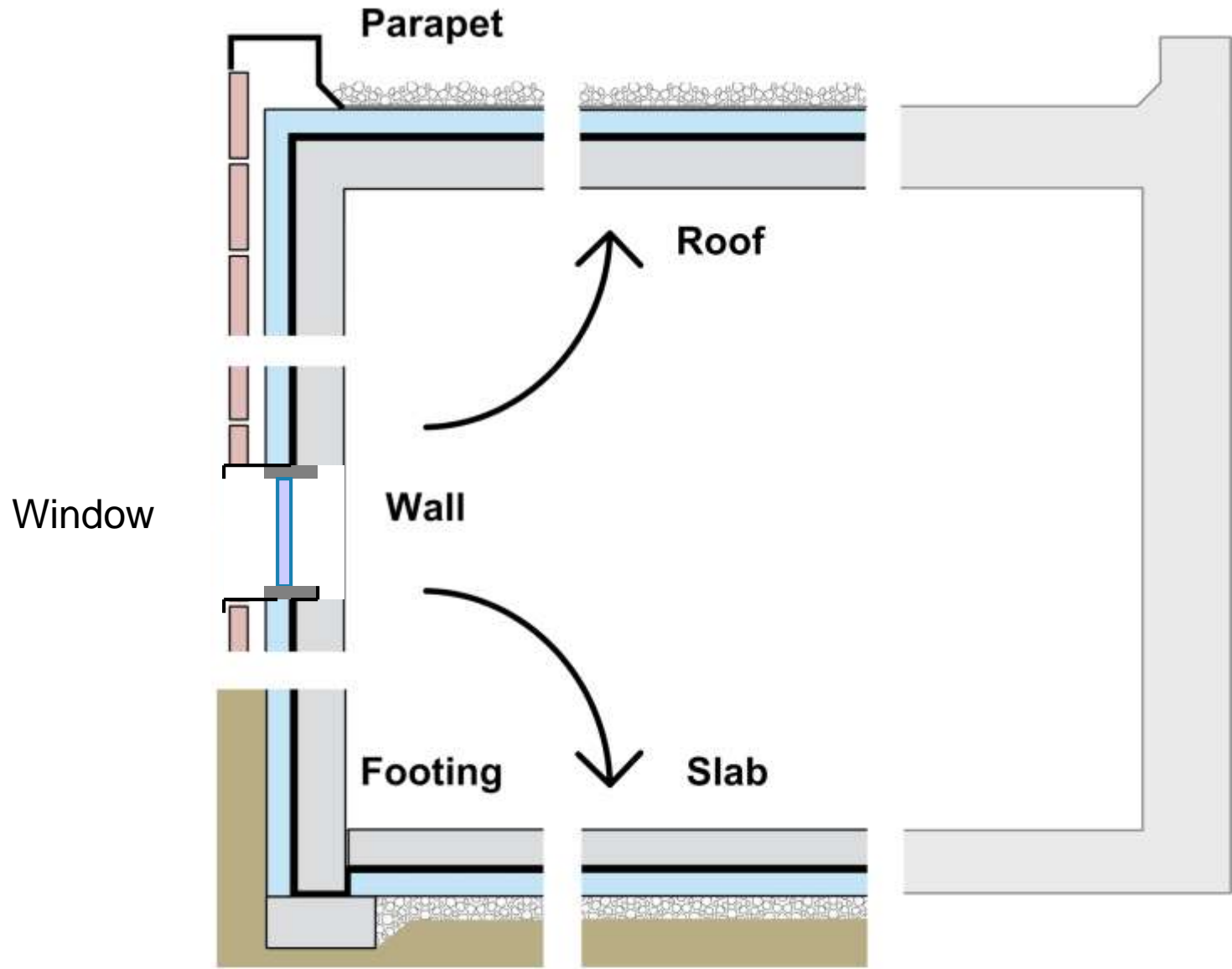




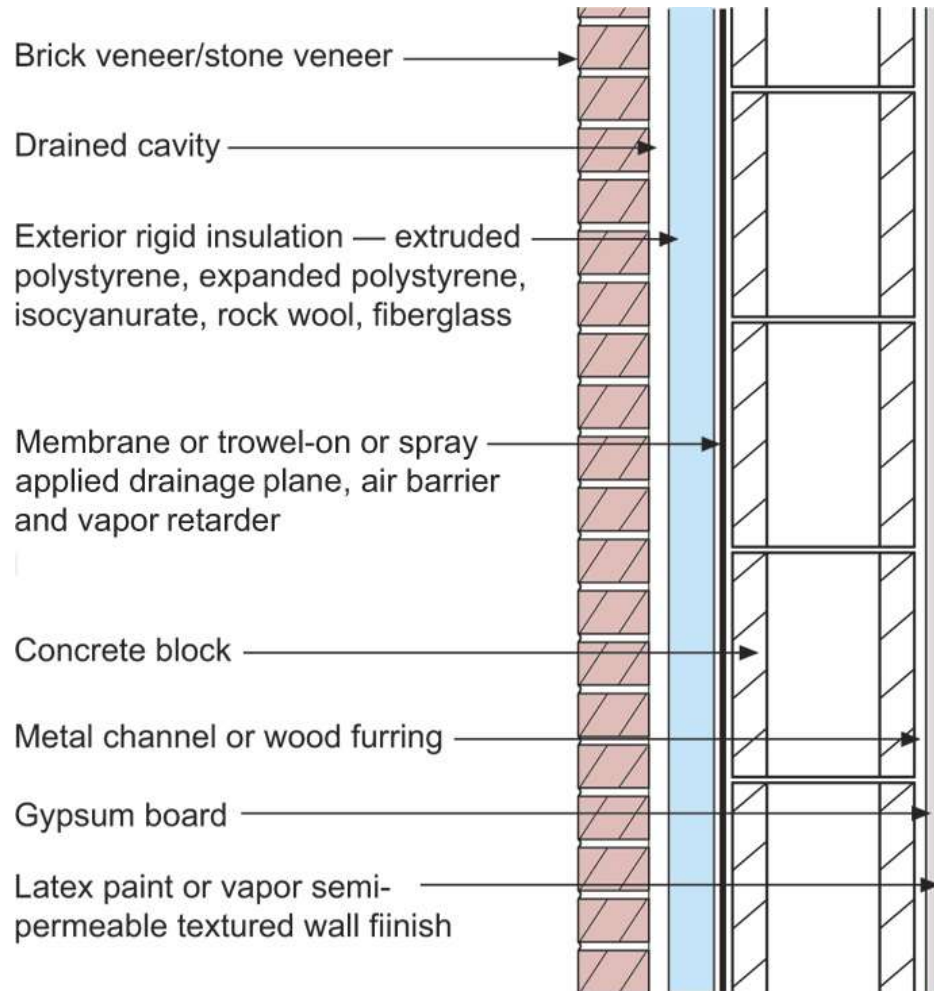




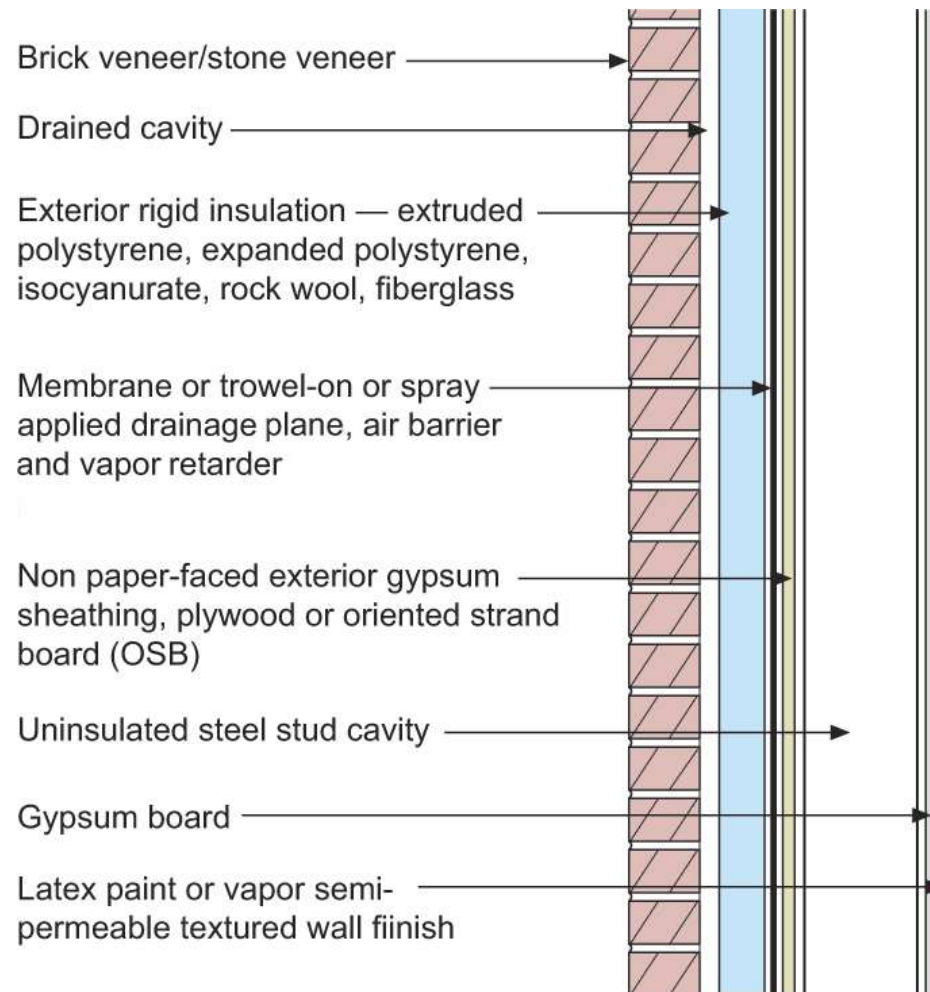


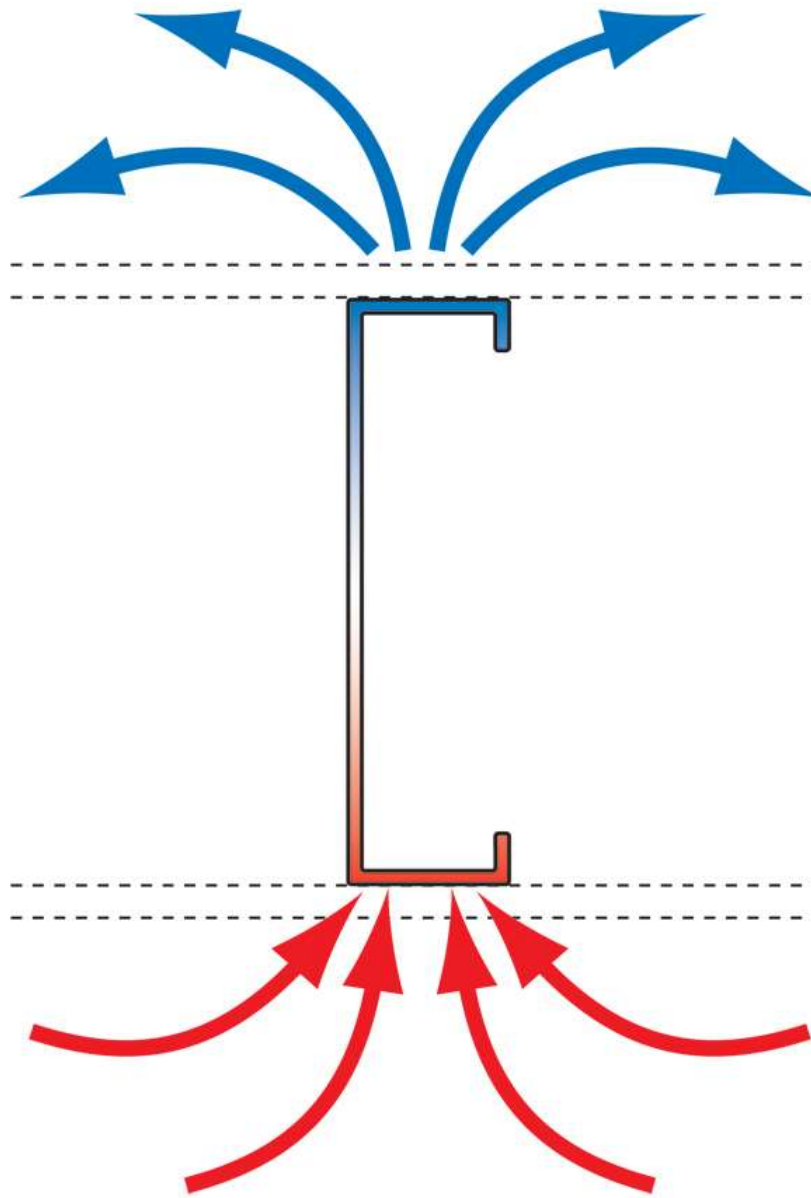


# Configurations of the Perfect Wall



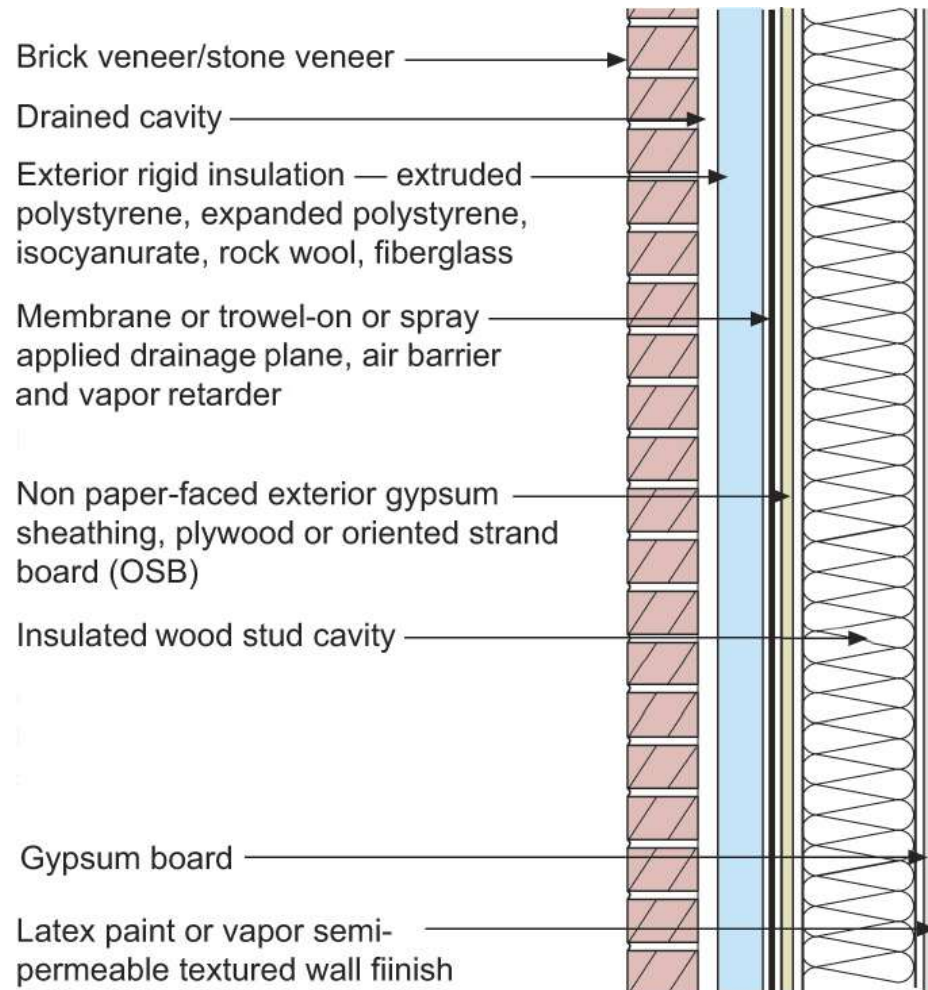
Vapor Profile







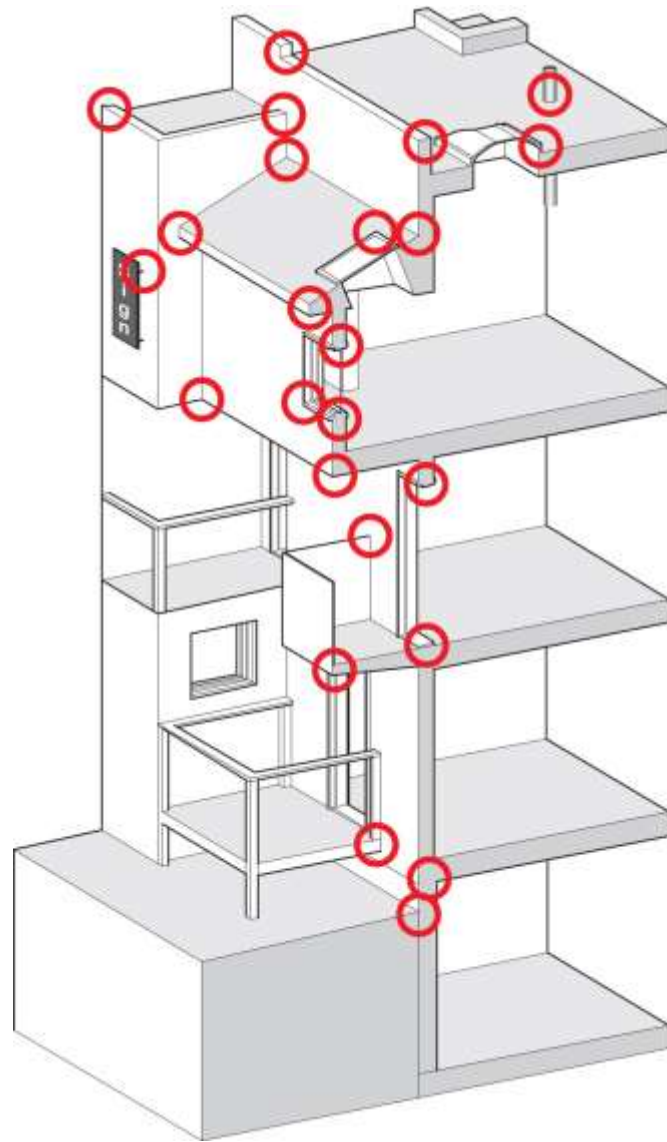




# Commercial Enclosure: Simple Layers



- Structure
- Rain/Air/Vapor
- Insulation
- Finish



























































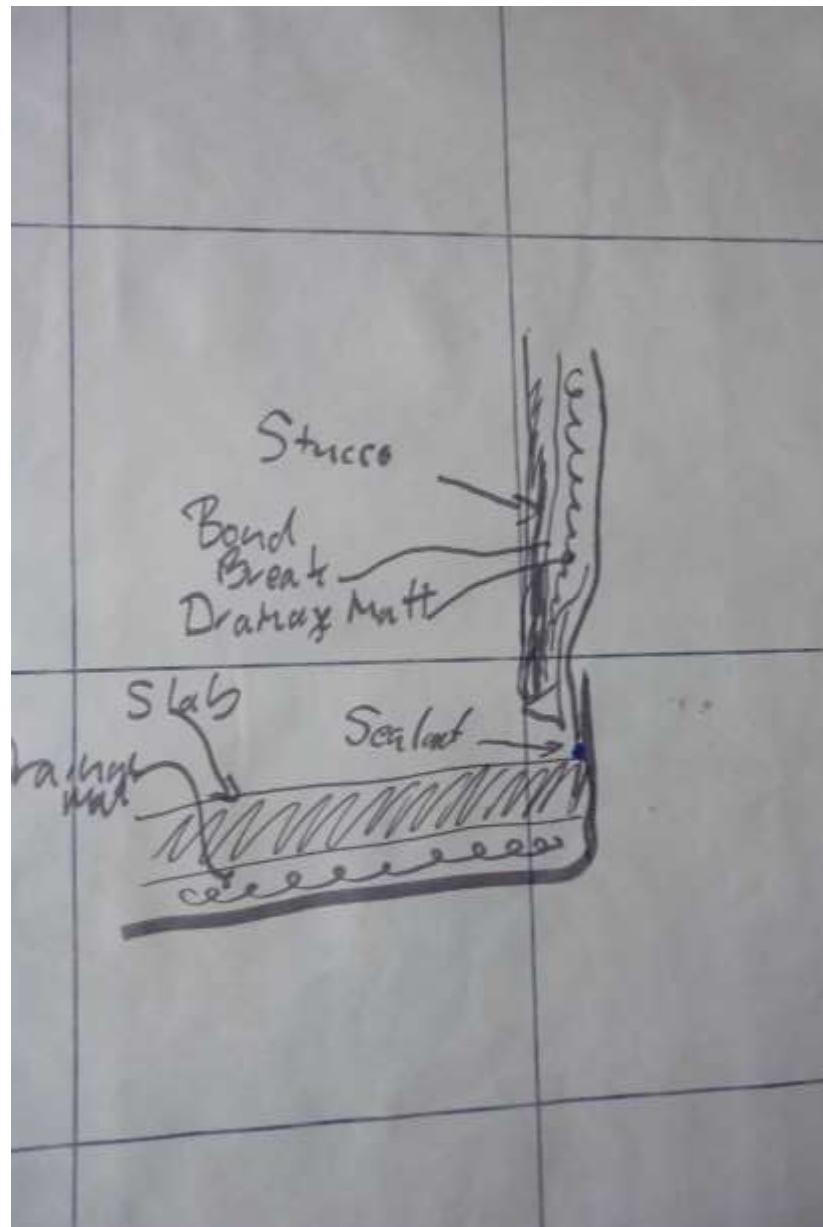
































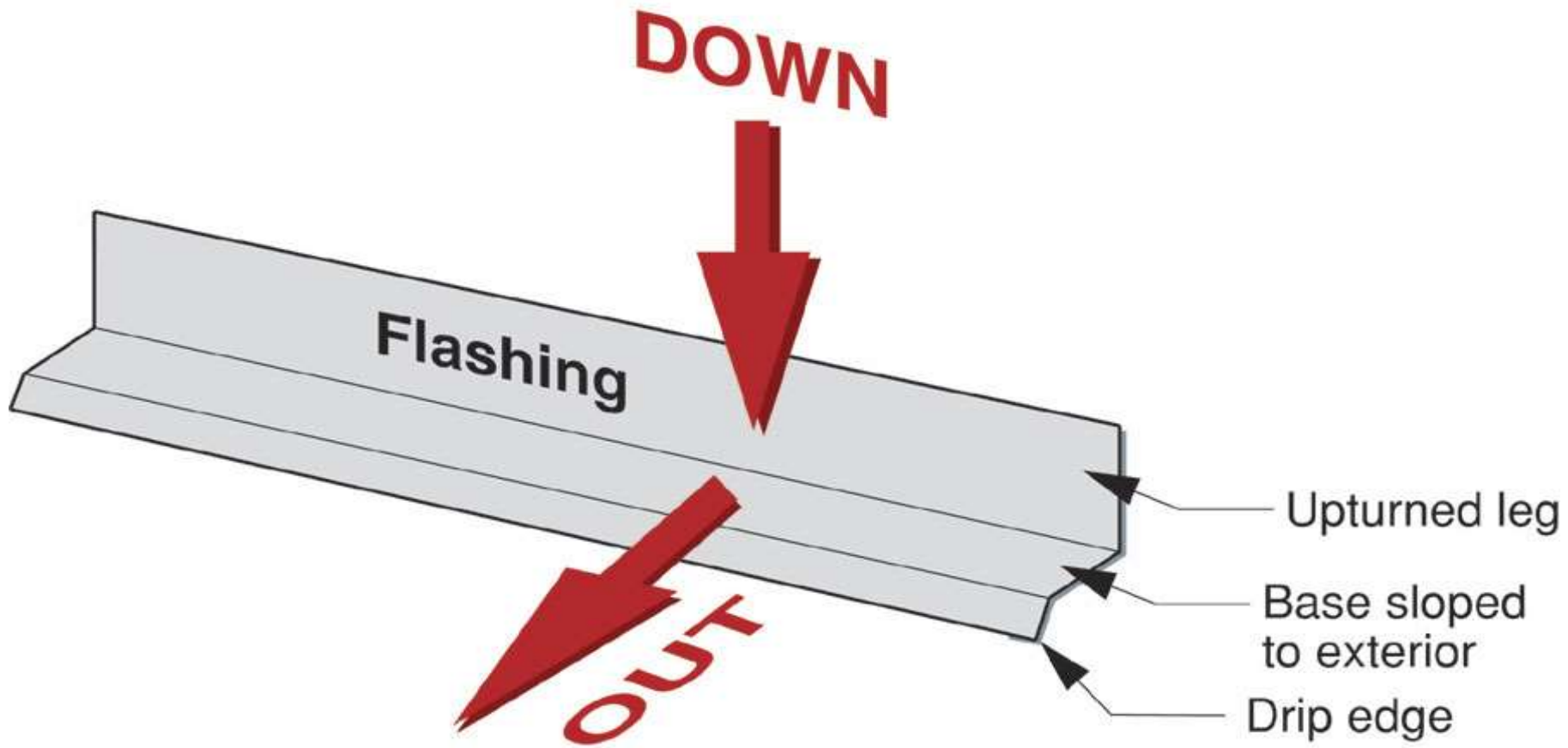




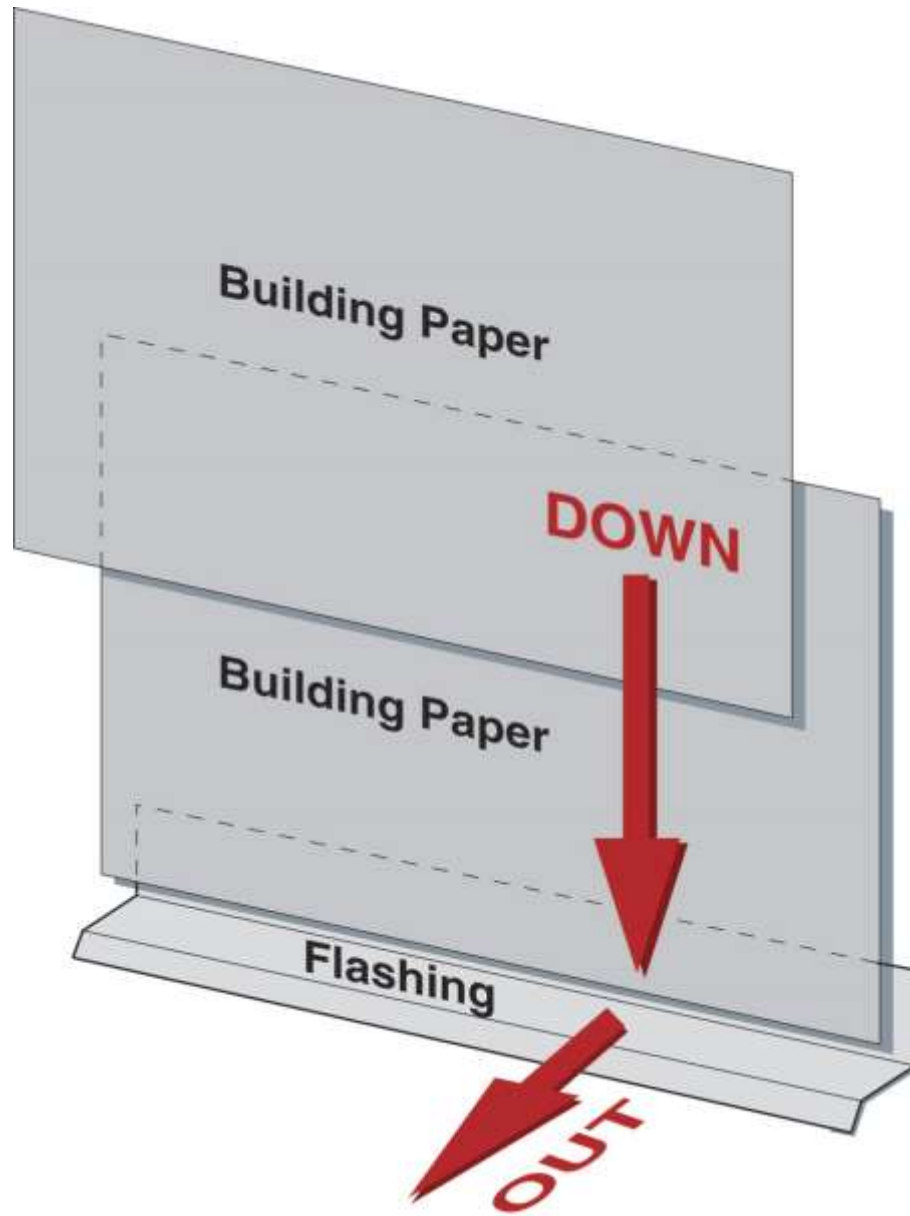


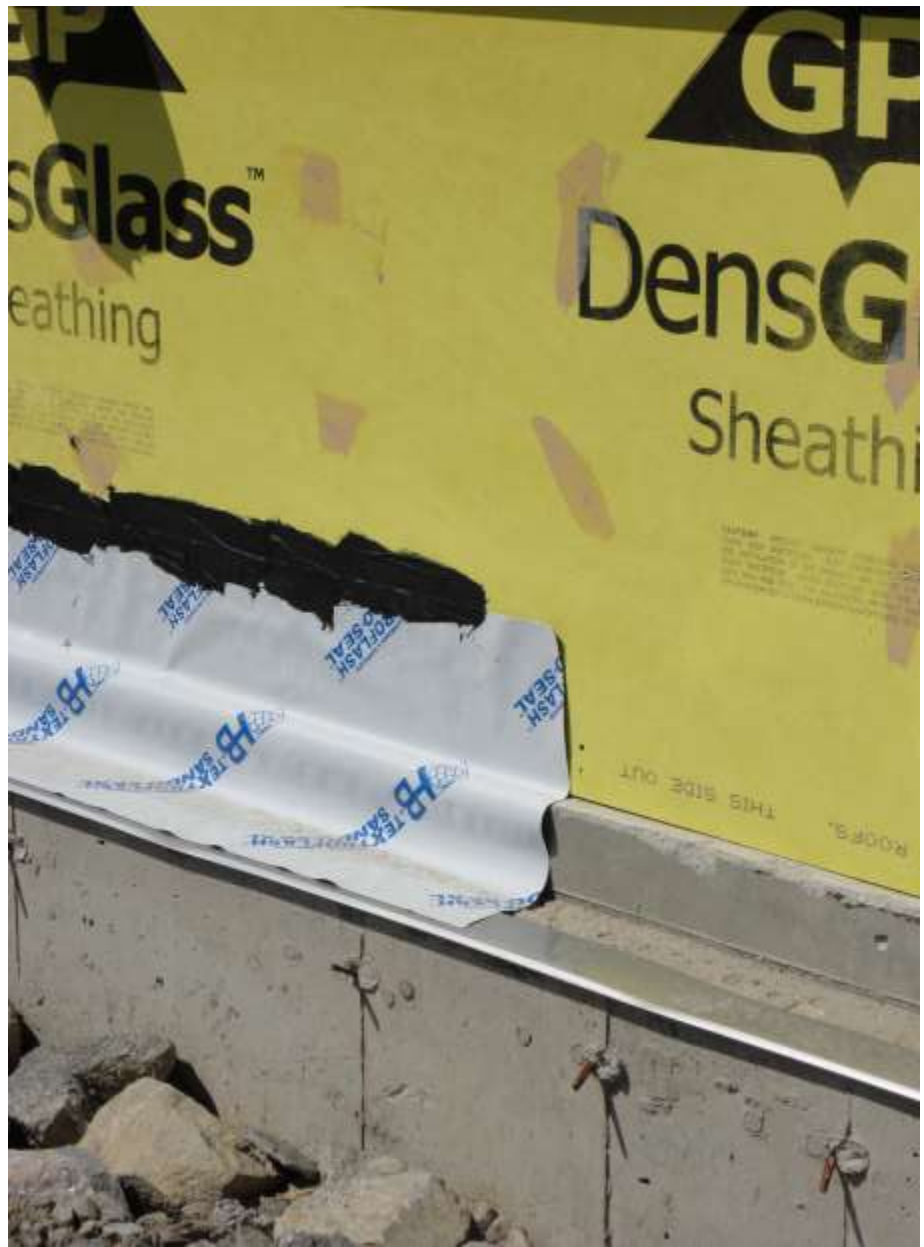








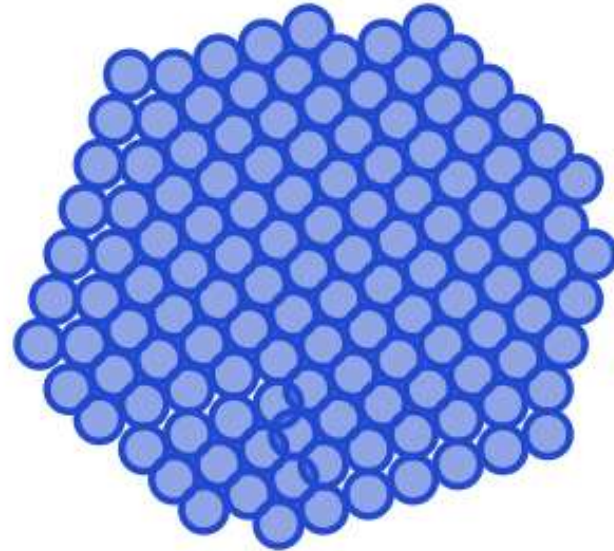






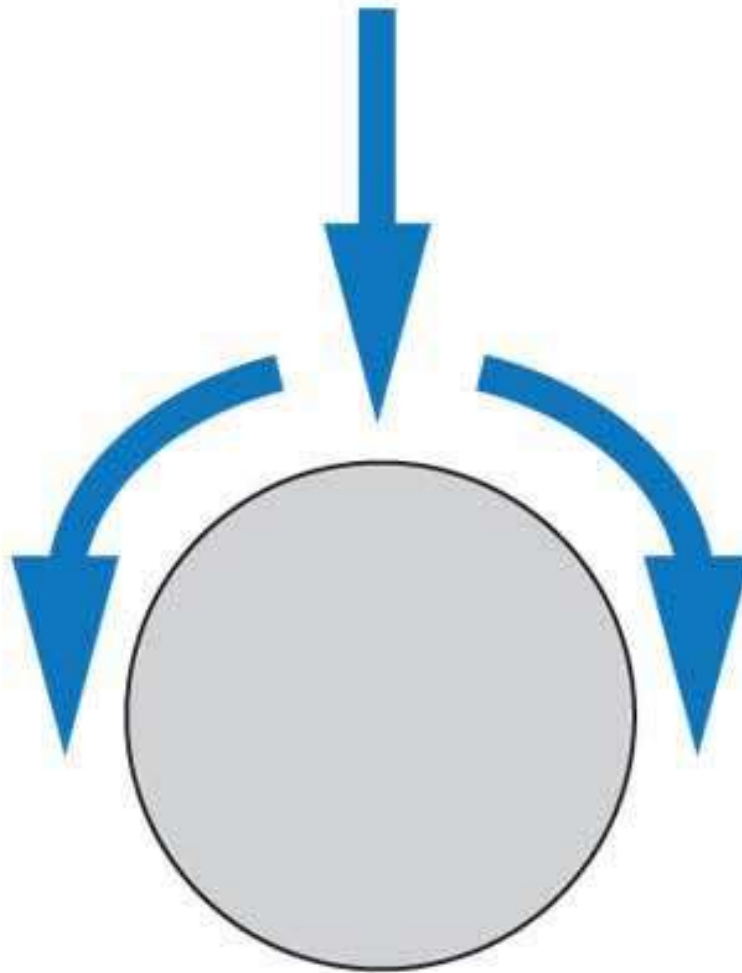


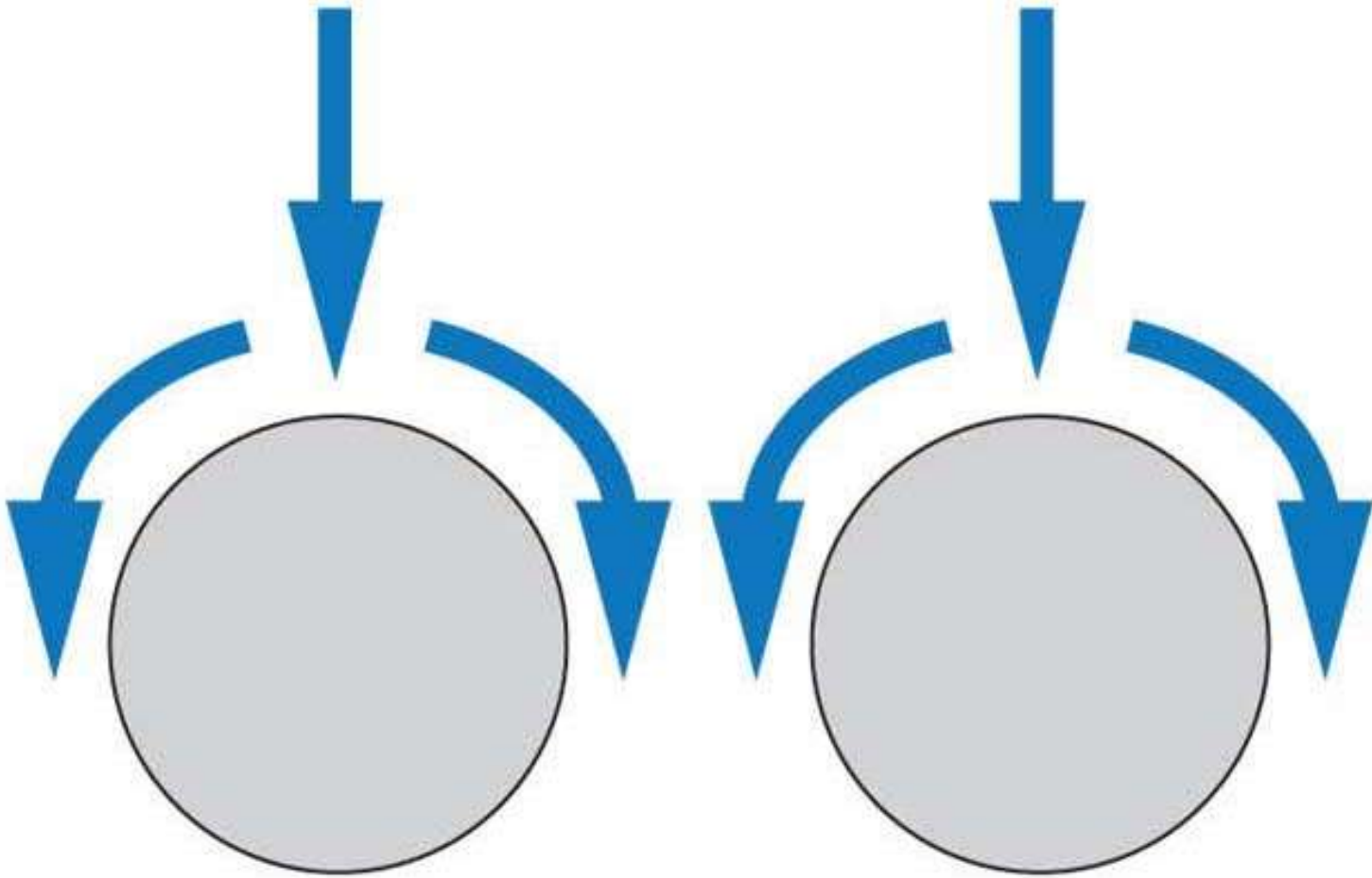
**Vapor**

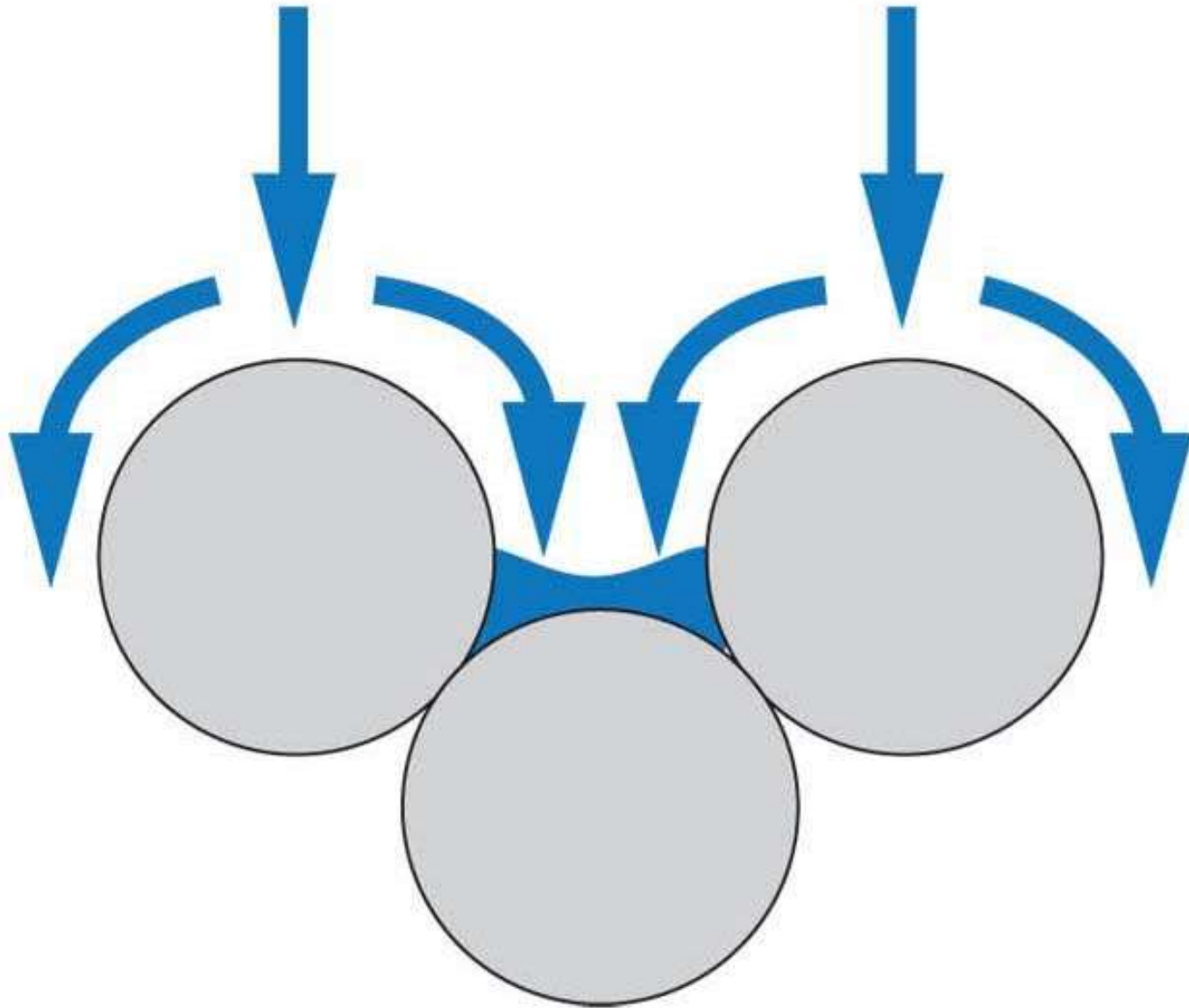


**Liquid**



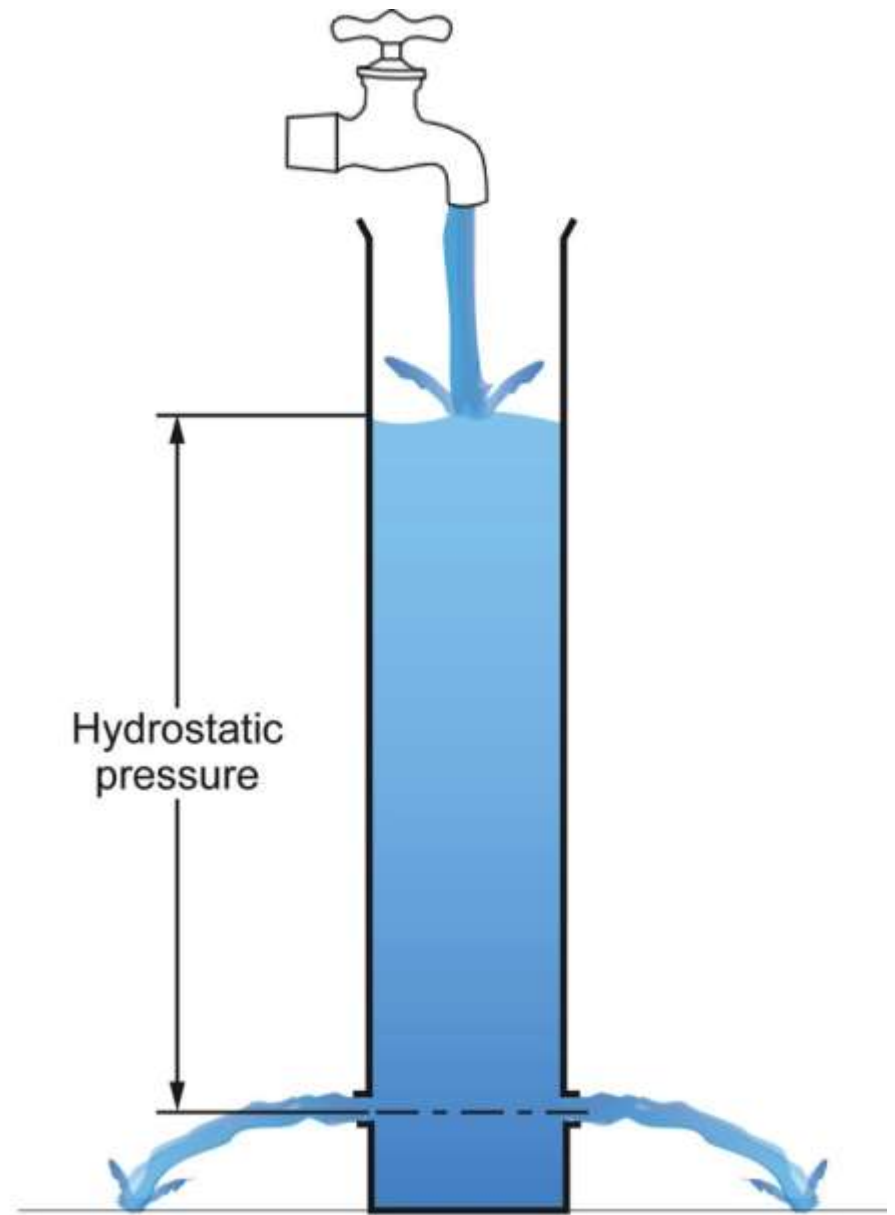
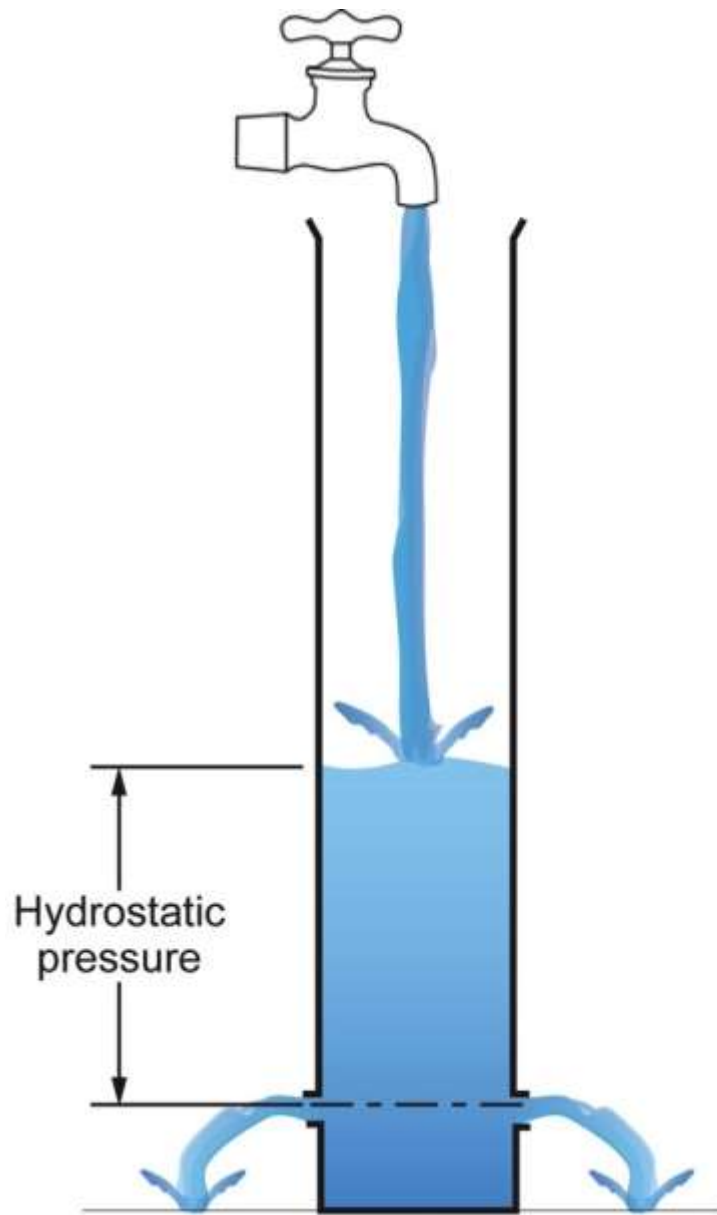


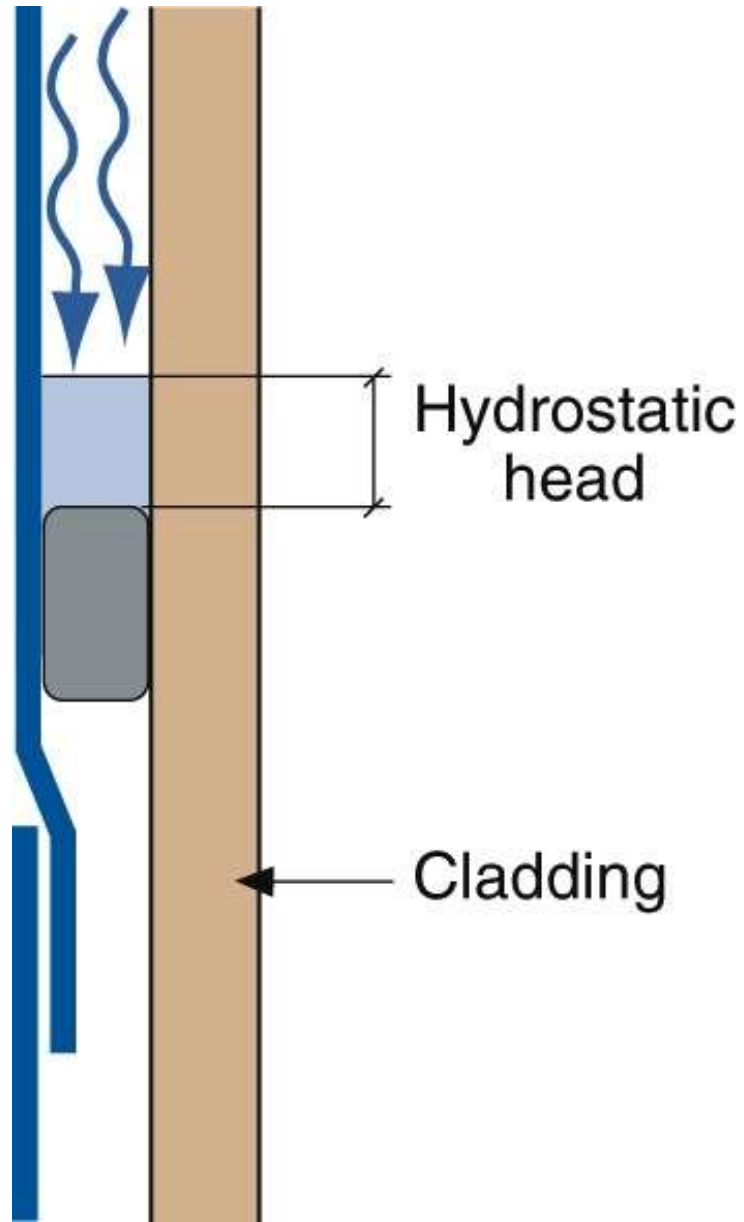


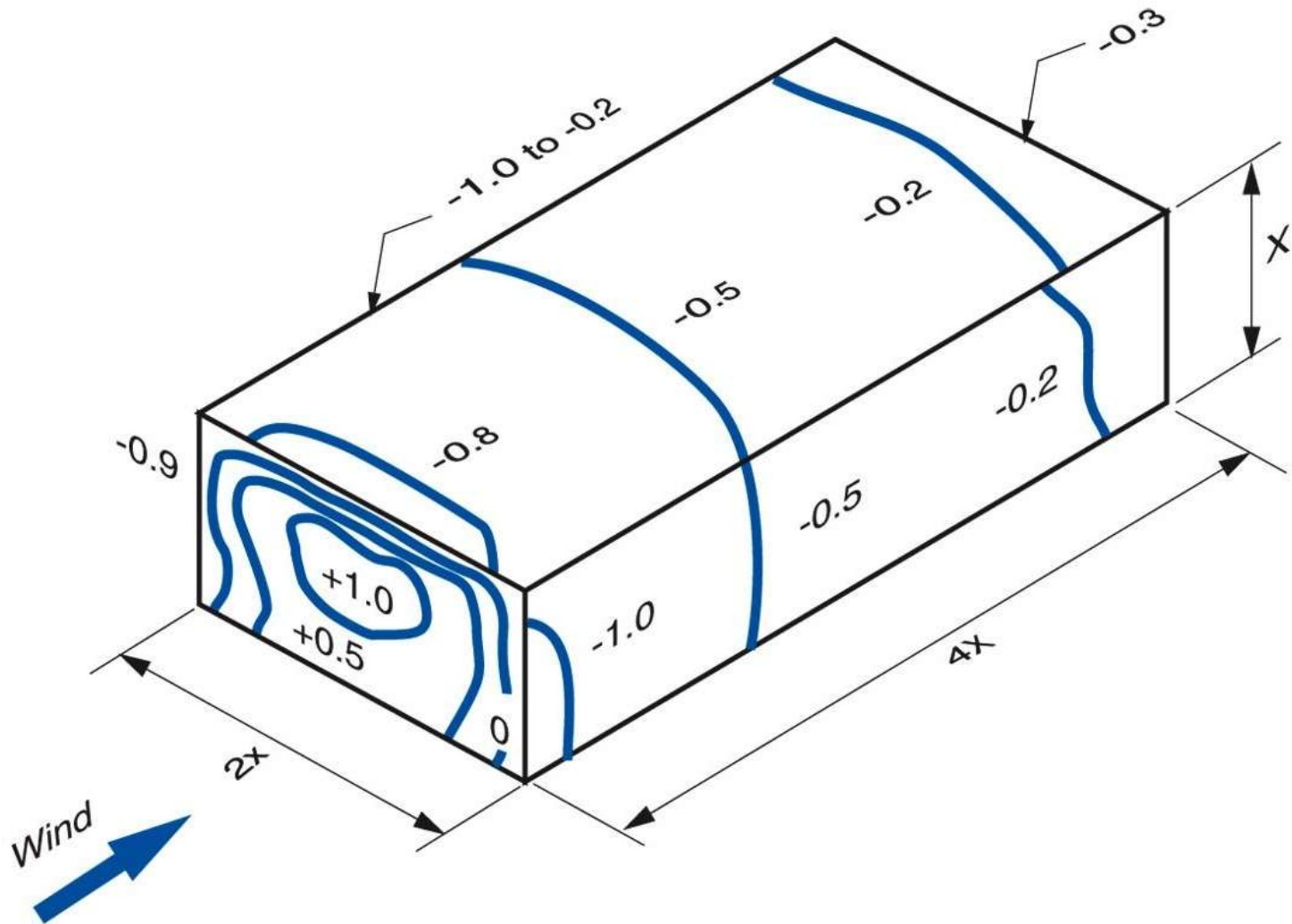






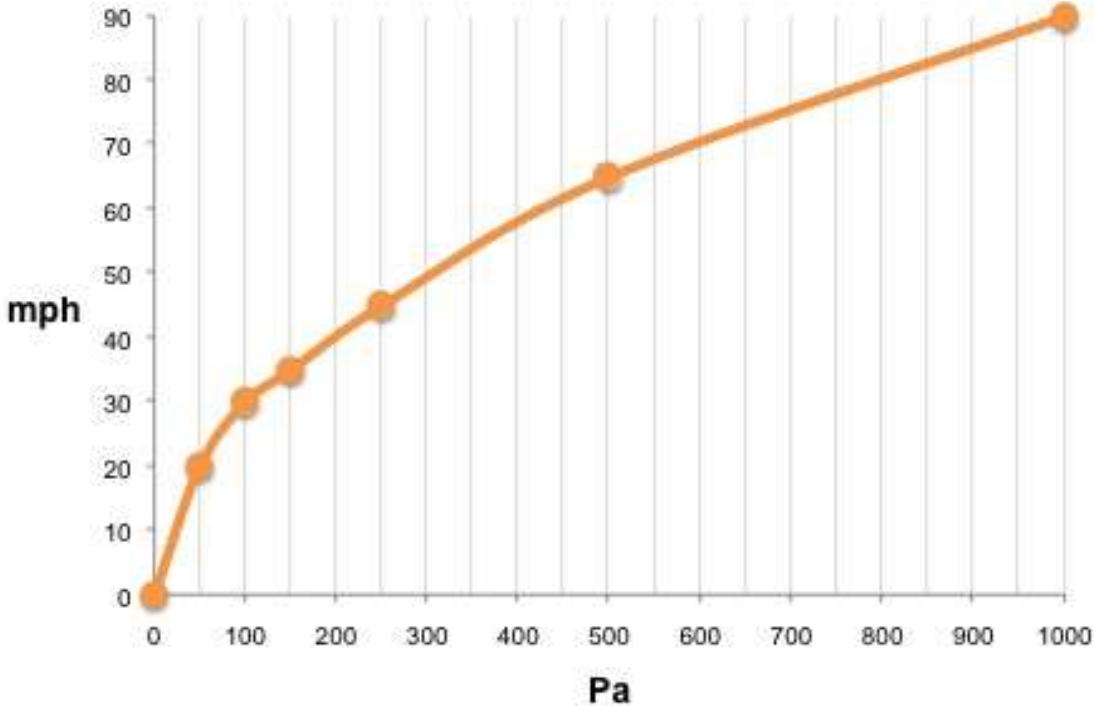




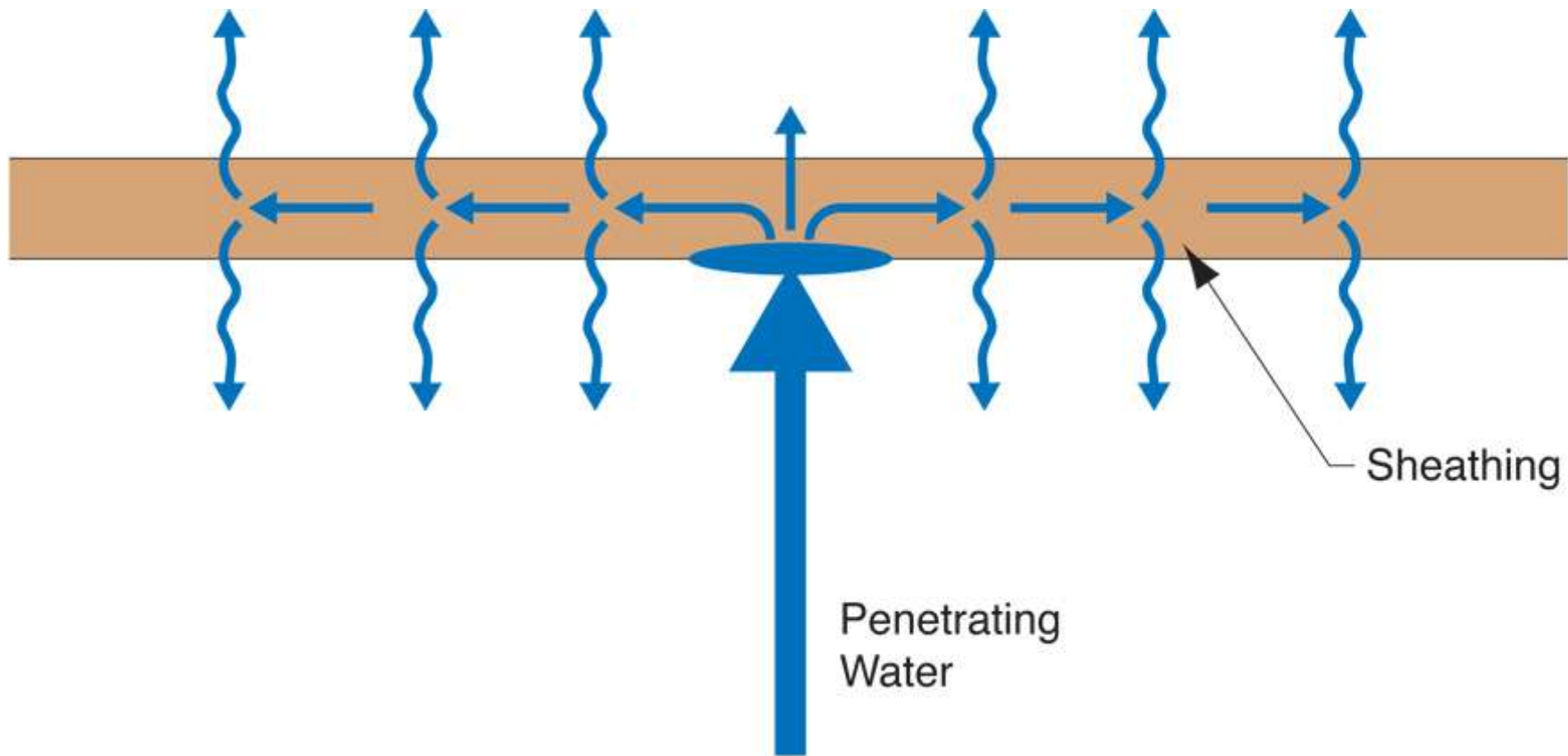


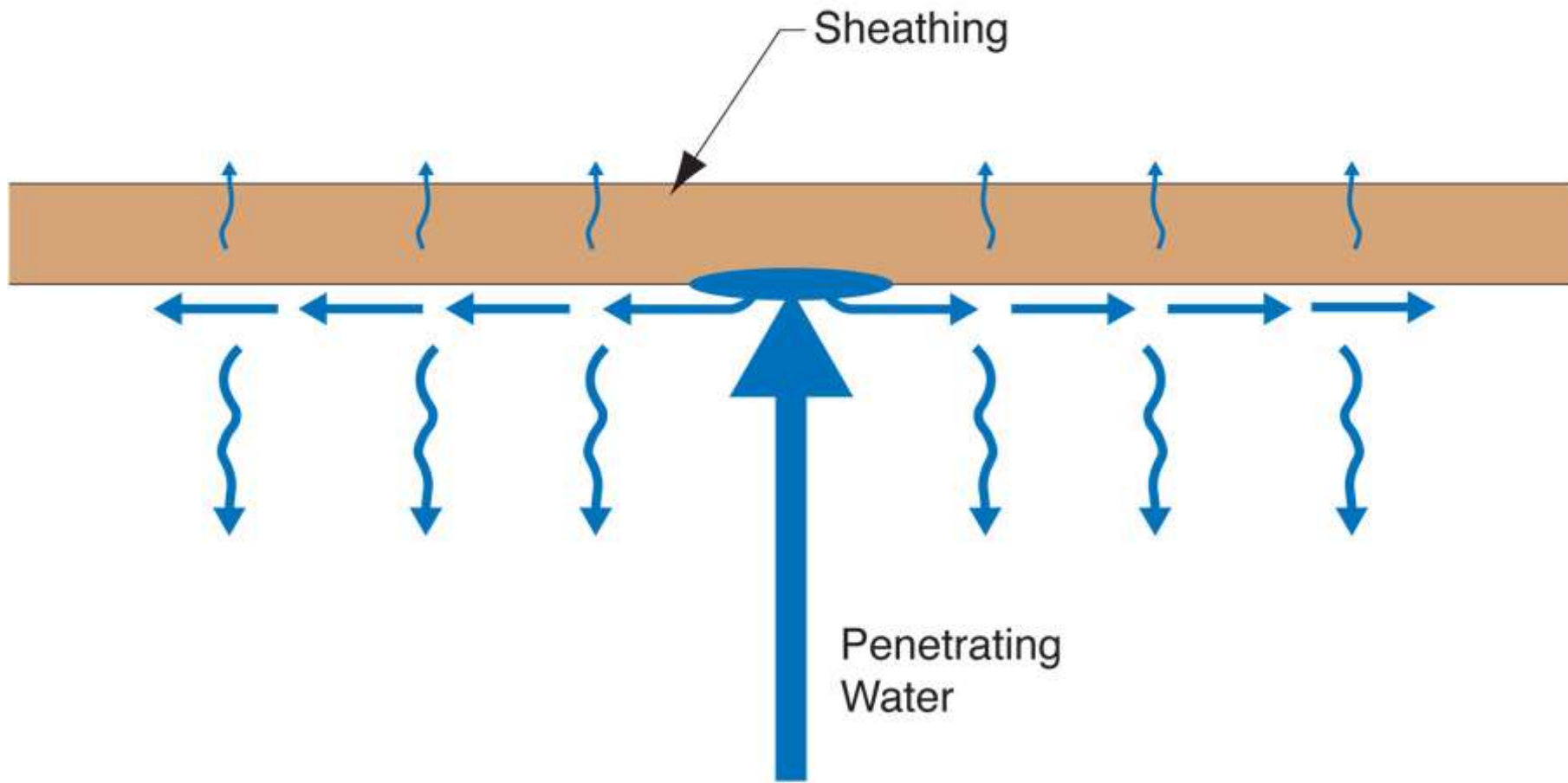
Pascals	mph
50	Pa = 20 mph
100	Pa = 30 mph
150	Pa = 35 mph
250	Pa = 45 mph
500	Pa = 65 mph
1,000	Pa = 90 mph

**Wind Speed (mph) vs. Stagnation Pressure (Pa)**



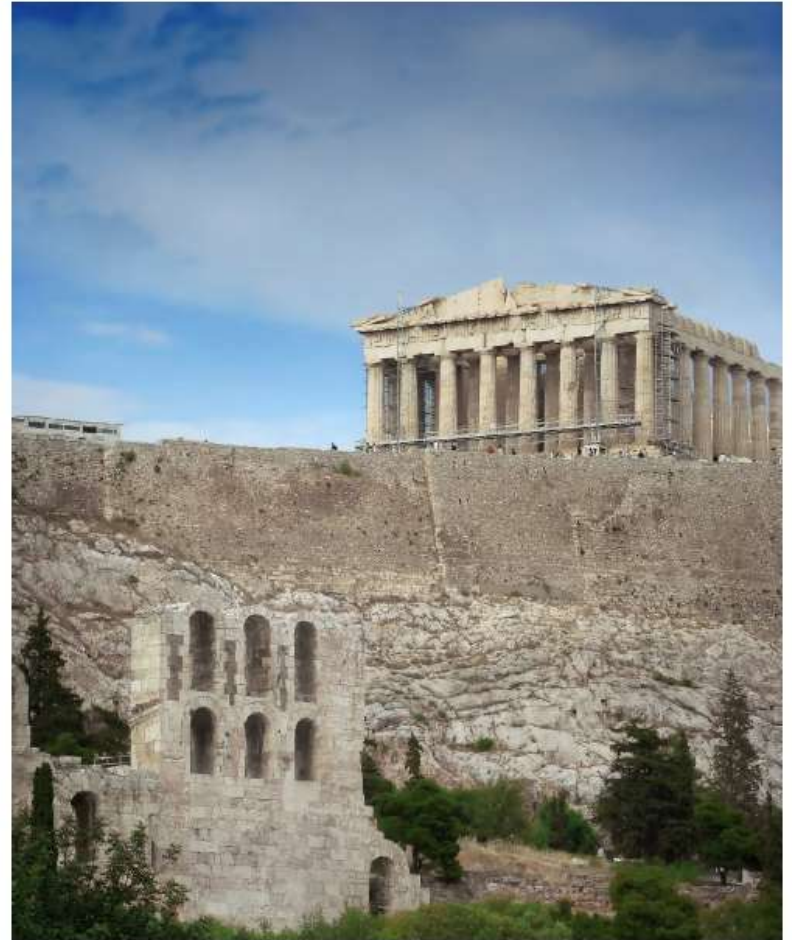
All We Have To Figure Out Is How Much Hits  
The Wall

















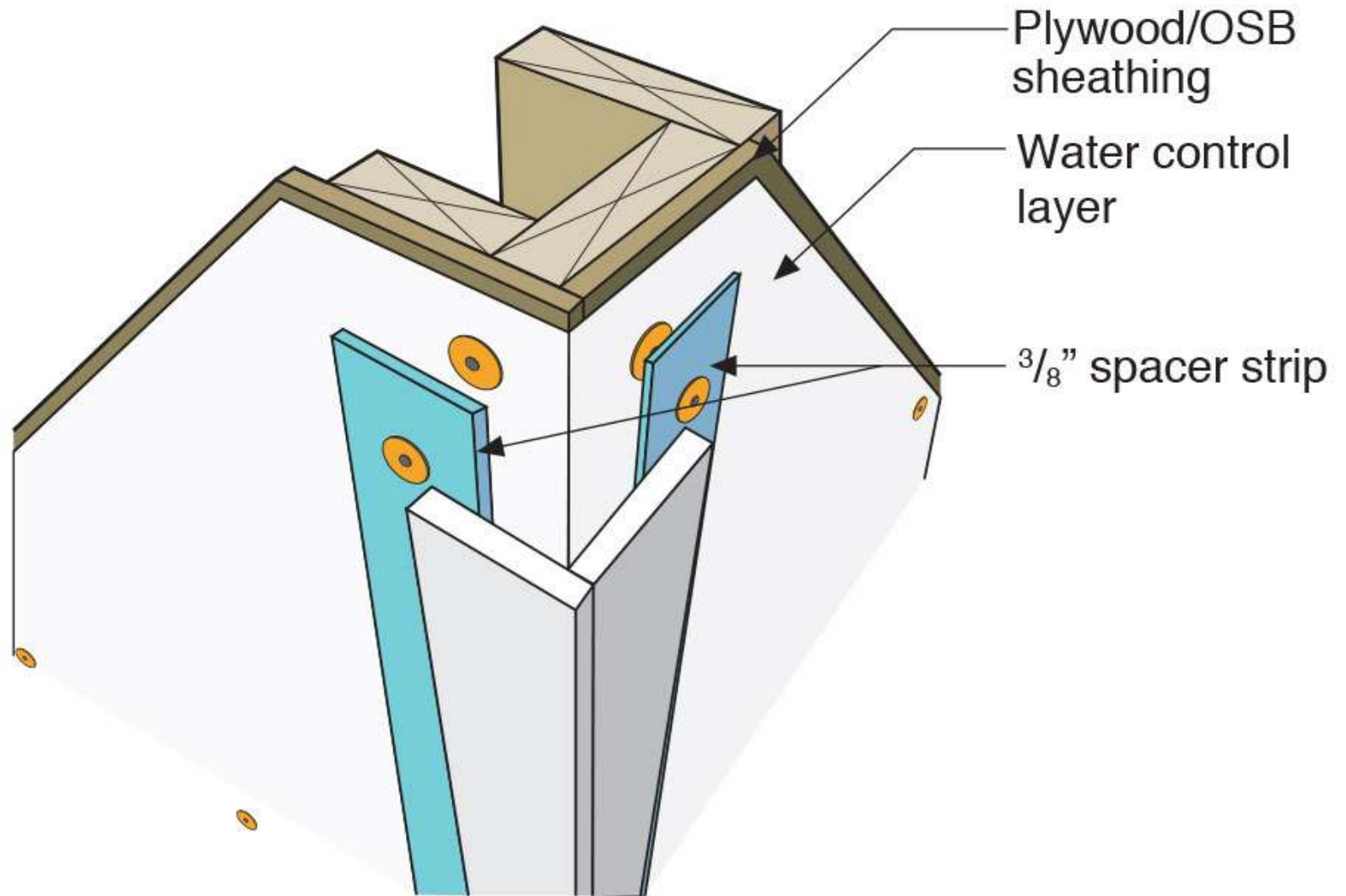


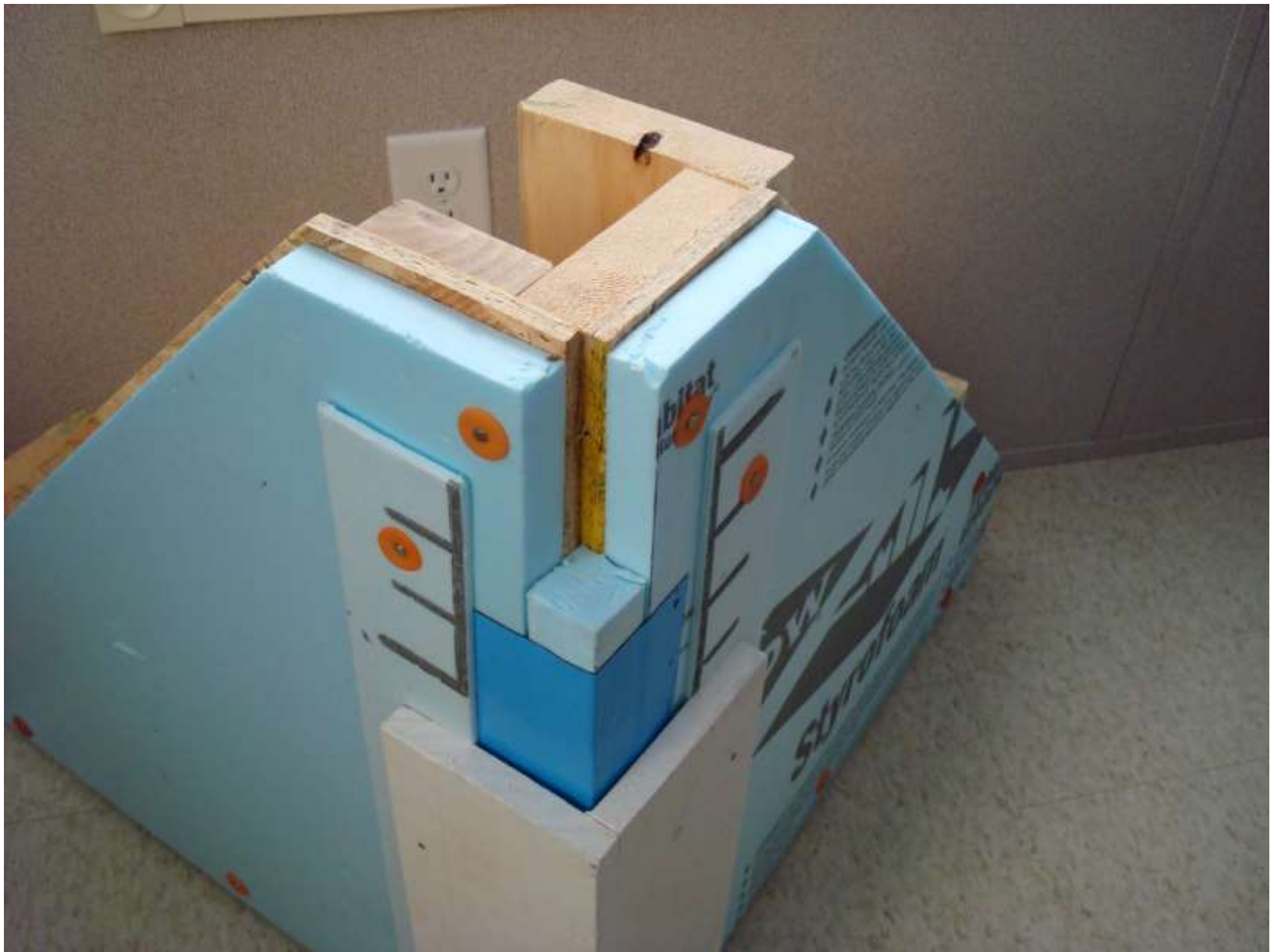








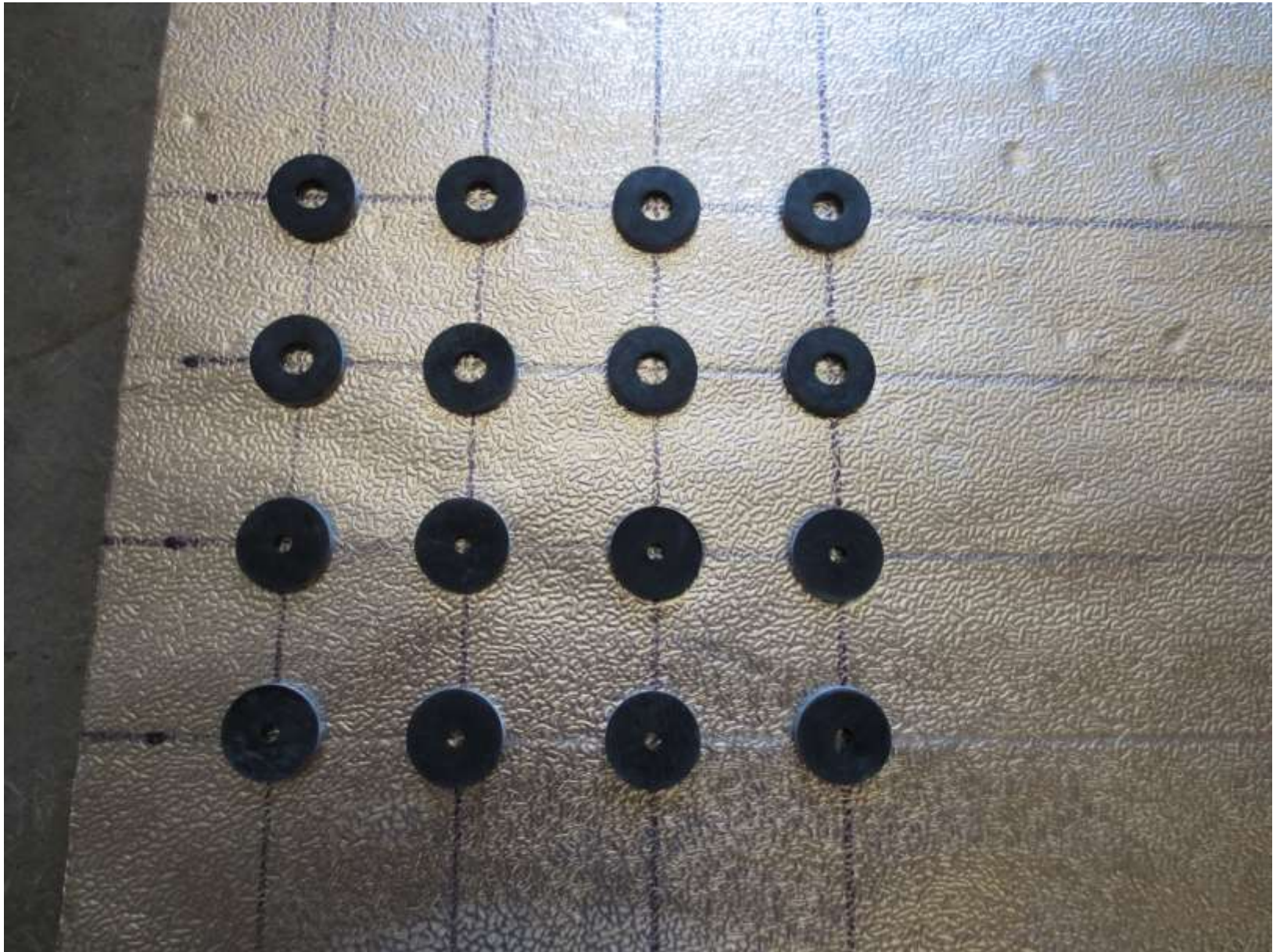








# Rain Screen



# Beer Screen?



