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Building Science

Mass Masonry Buildings

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Deep Energy Retrofits

Deep Energy Retrofits

What does this mean?

Net zero ready...

Get to net zero with conservation and renewables...70:30

Deep Energy Retrofits

70:30

Climate Zones 4,5 and 6....

5 – 10 – 20 – 40 – 60 @ 1.5

ERV

.....plus.....



Don't Kill Anyone....

Don't Kill The Building....

Carbon Monoxide

Soil Gas

Mold

VOC's

Energy Flow



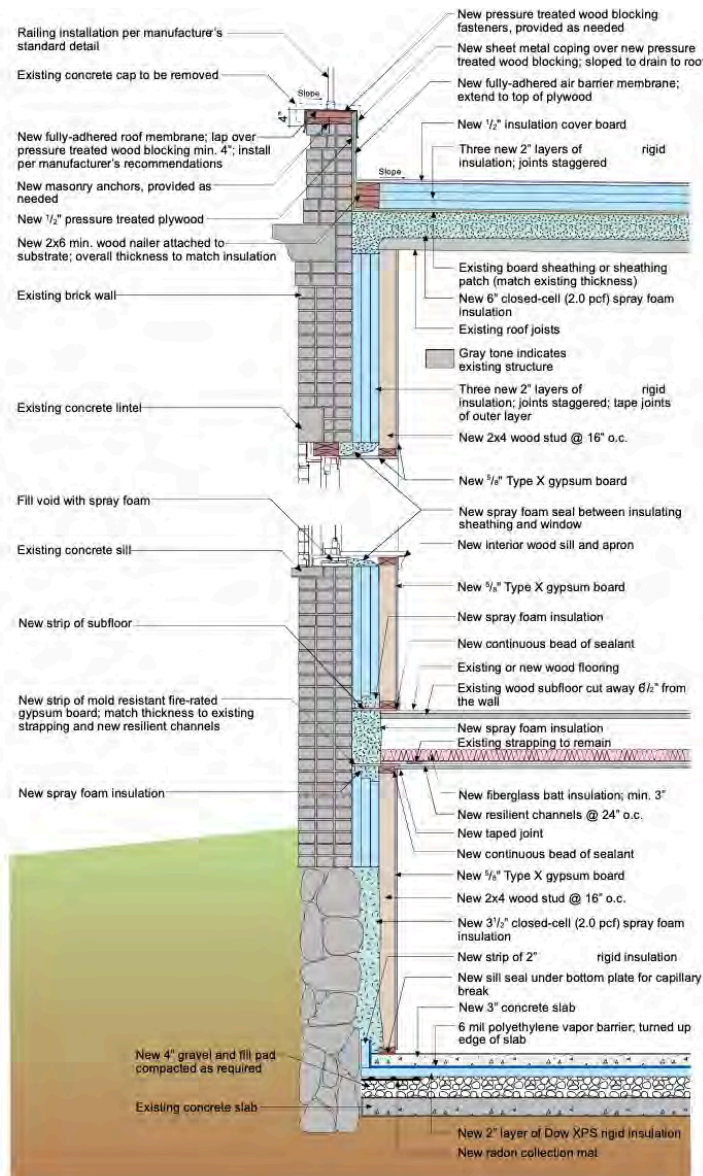


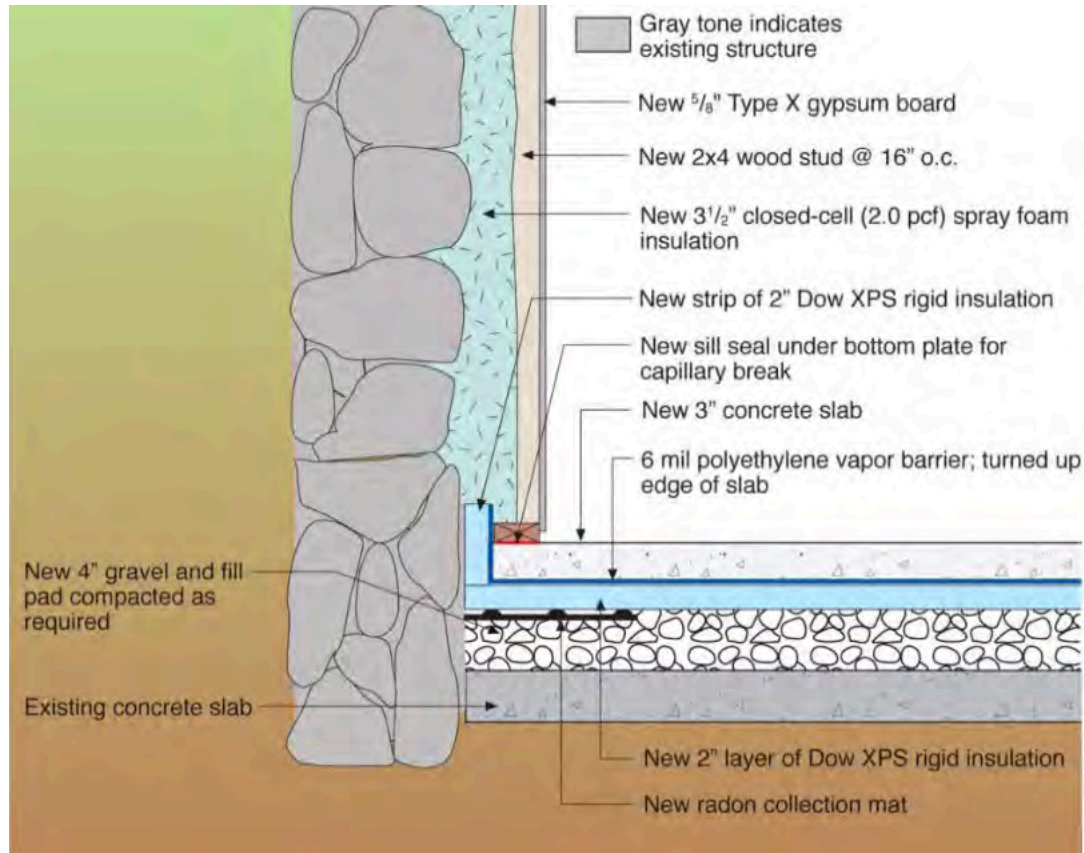


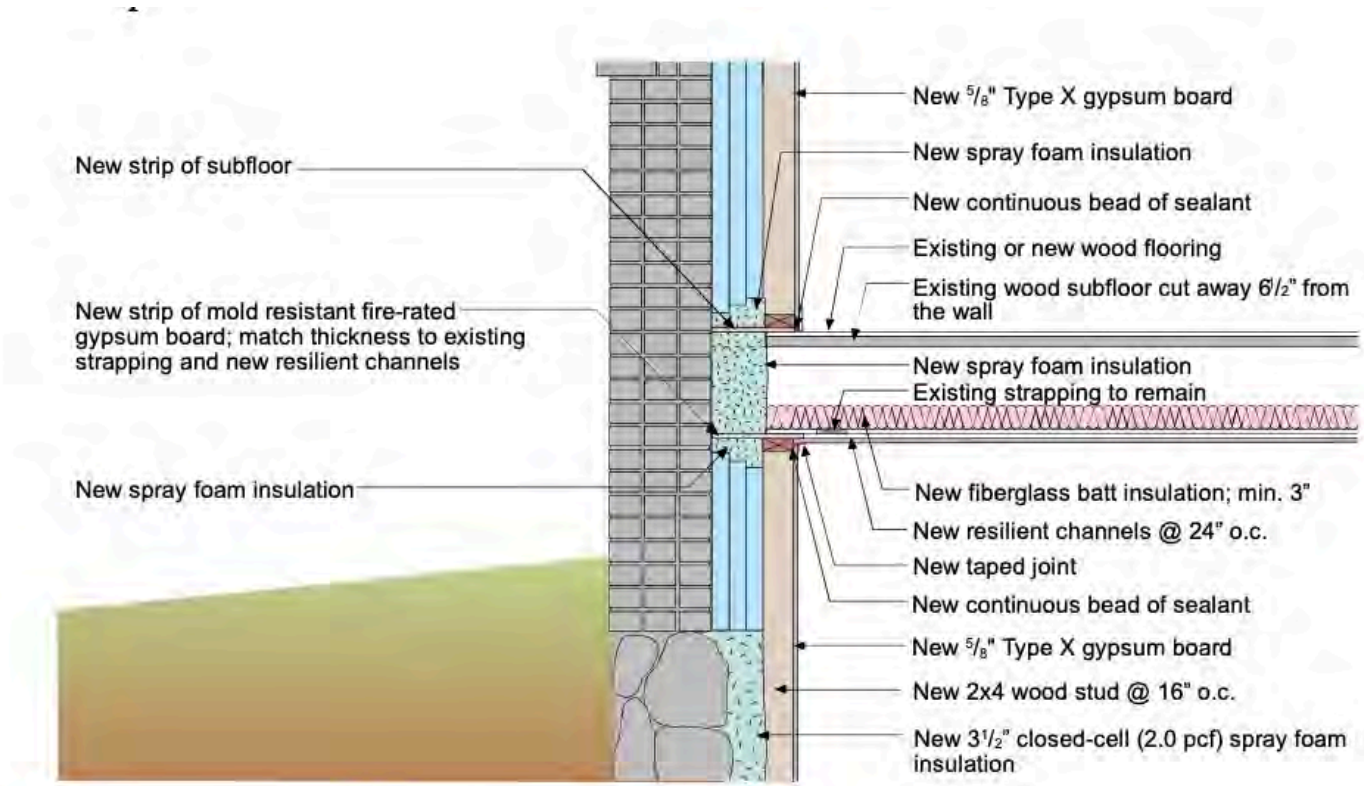


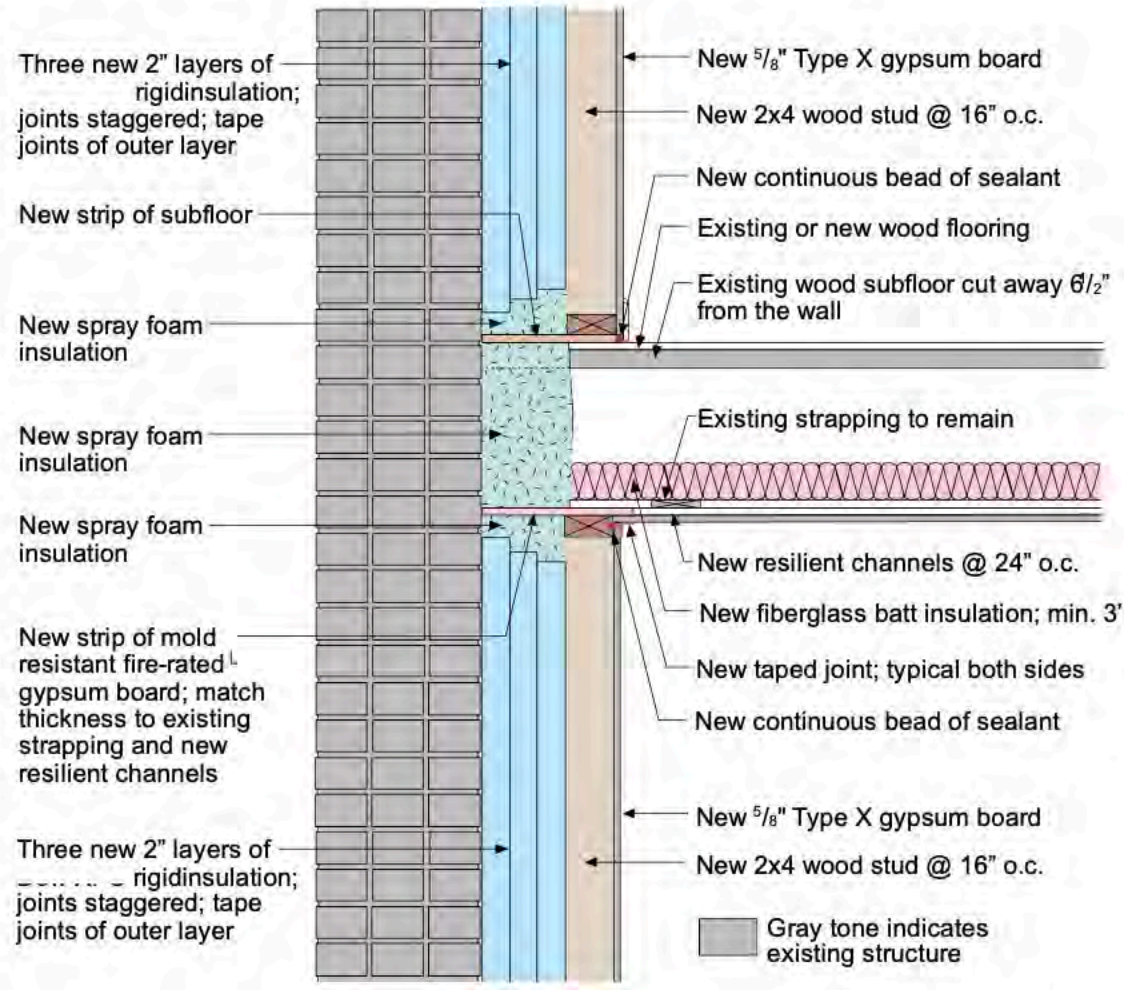


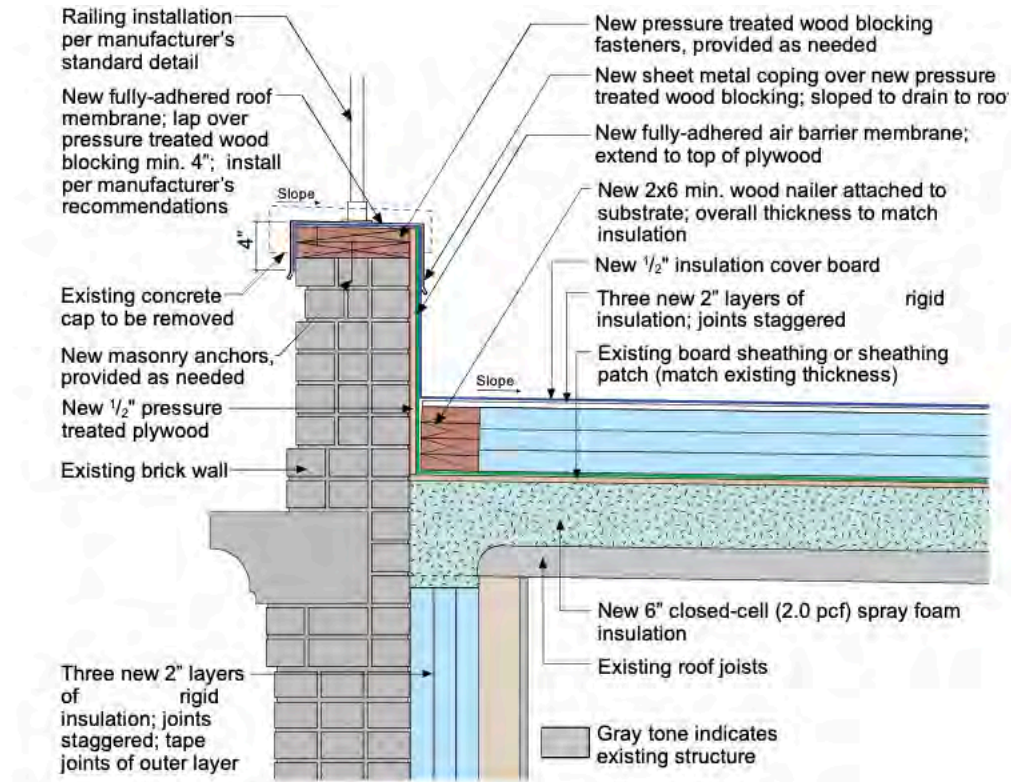


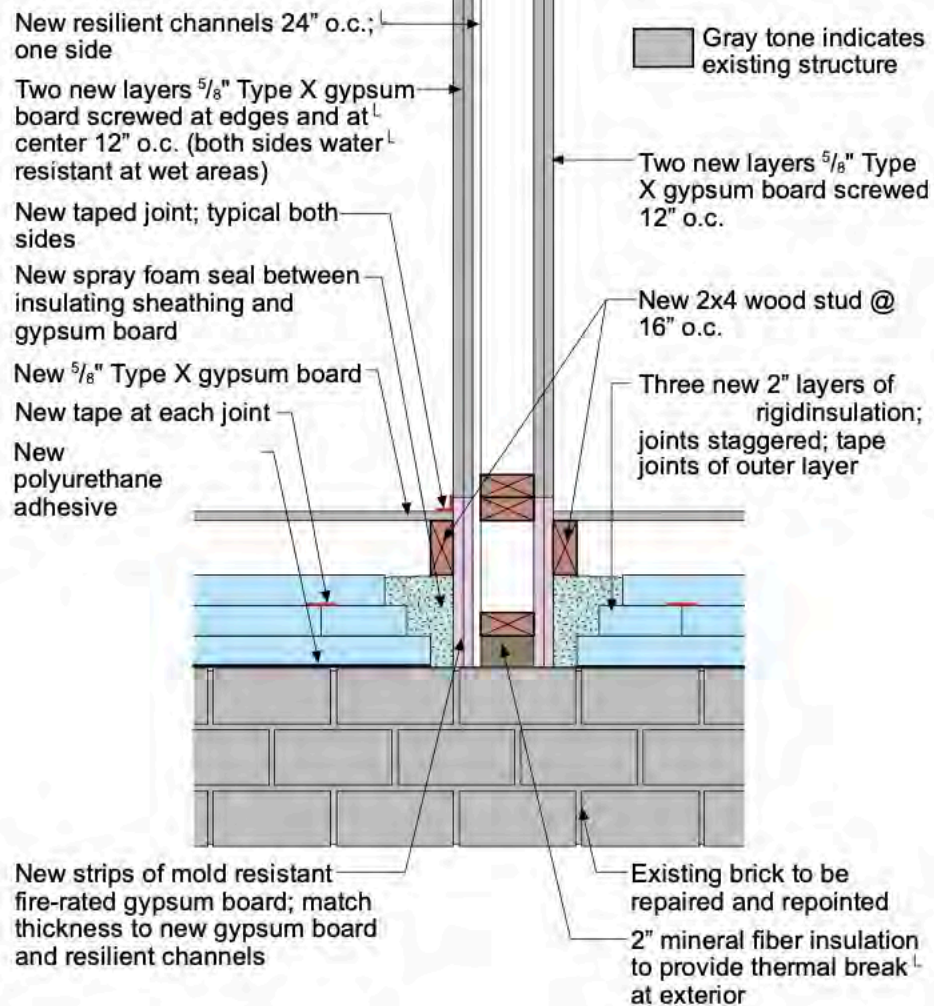


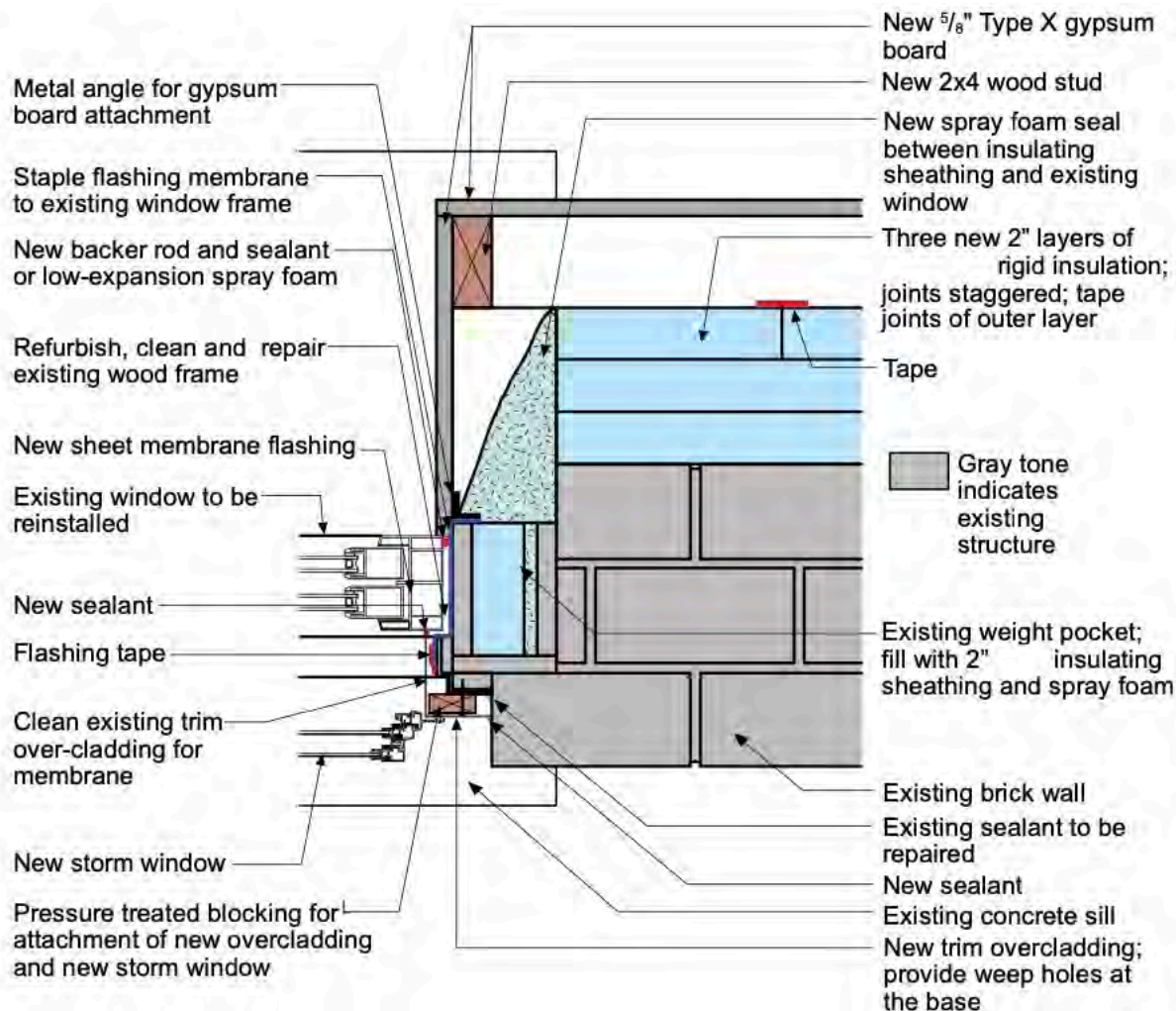










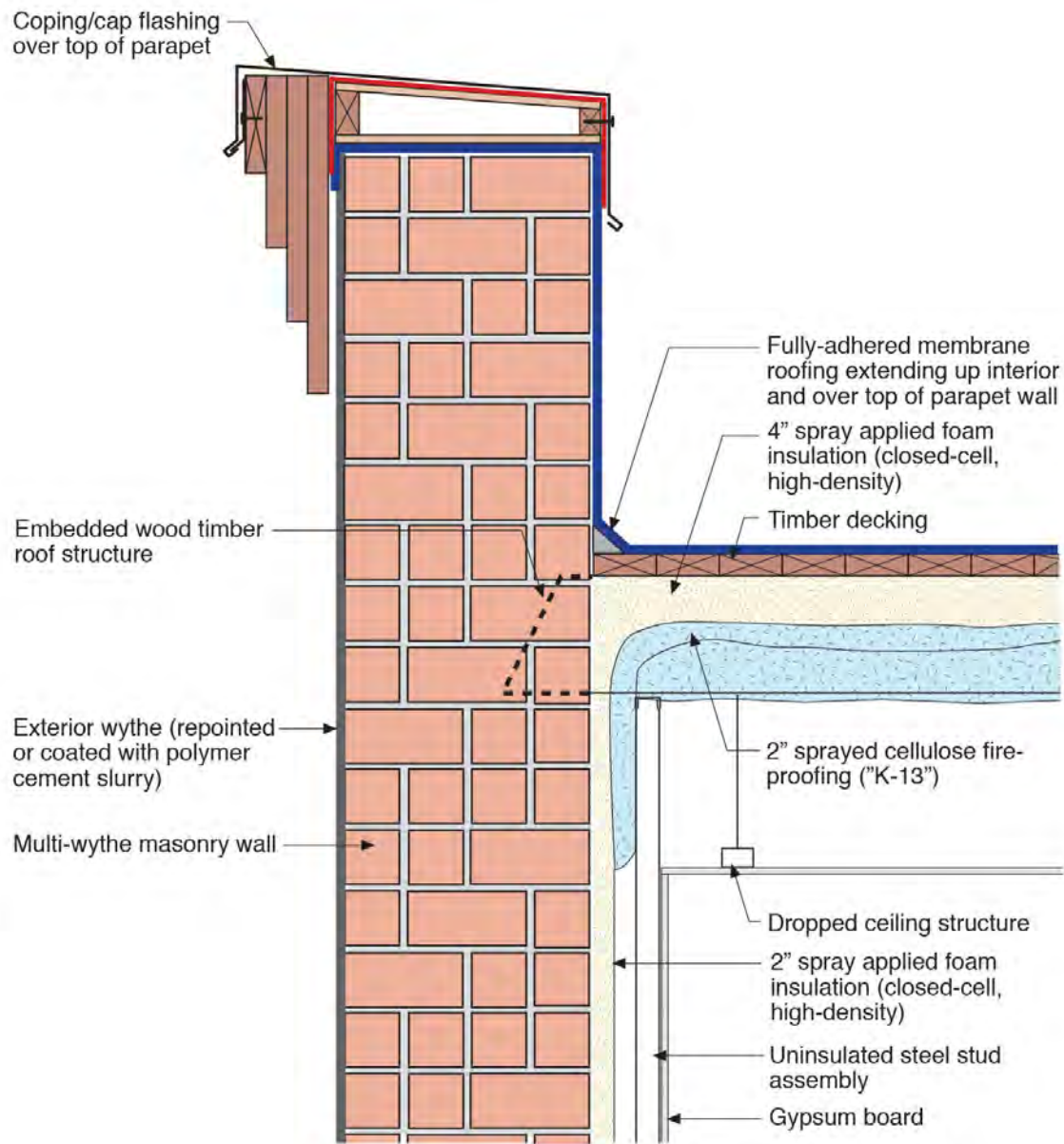






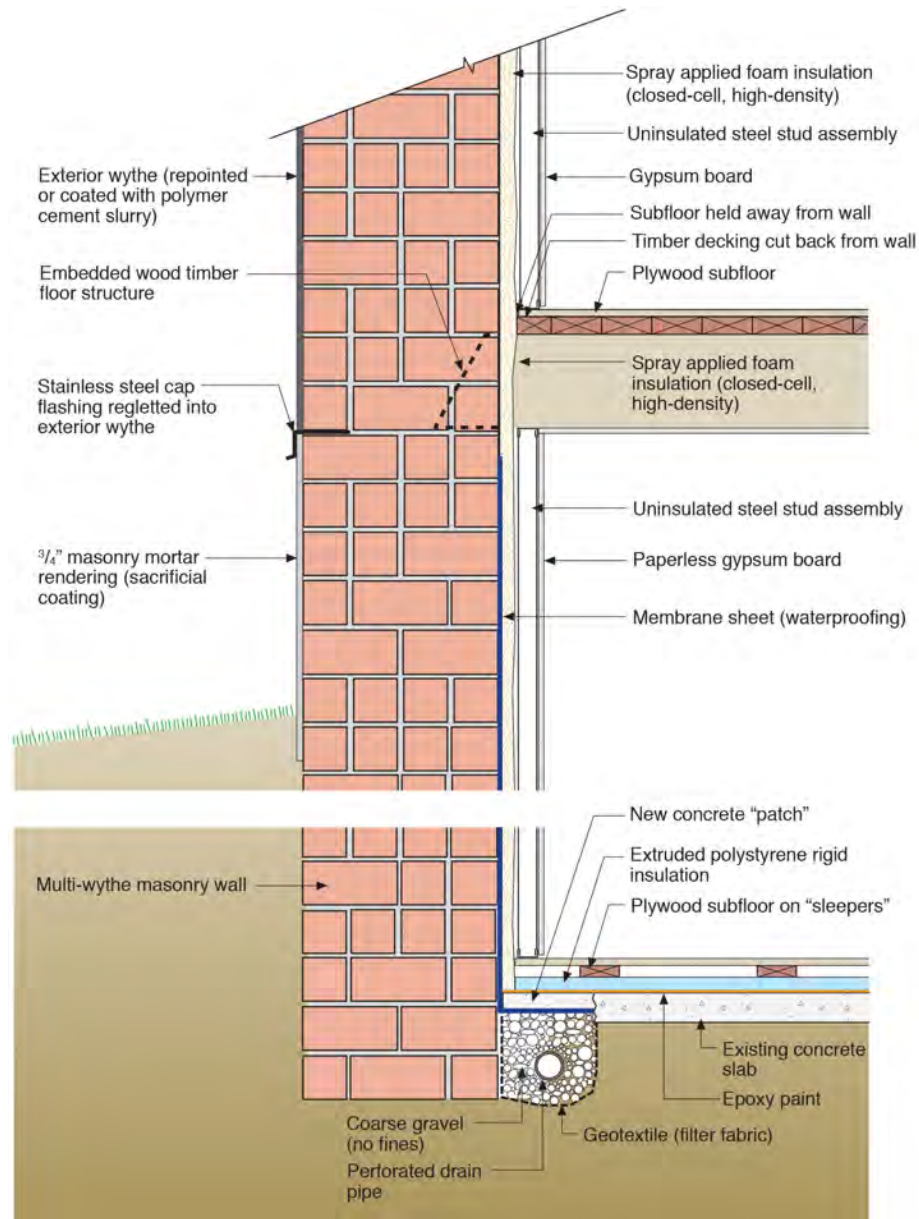


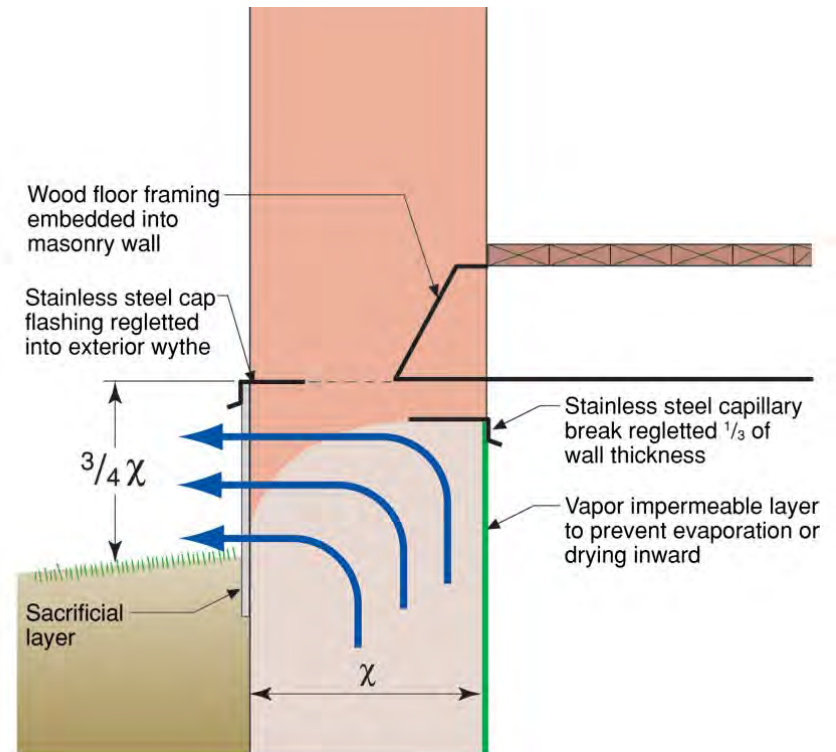
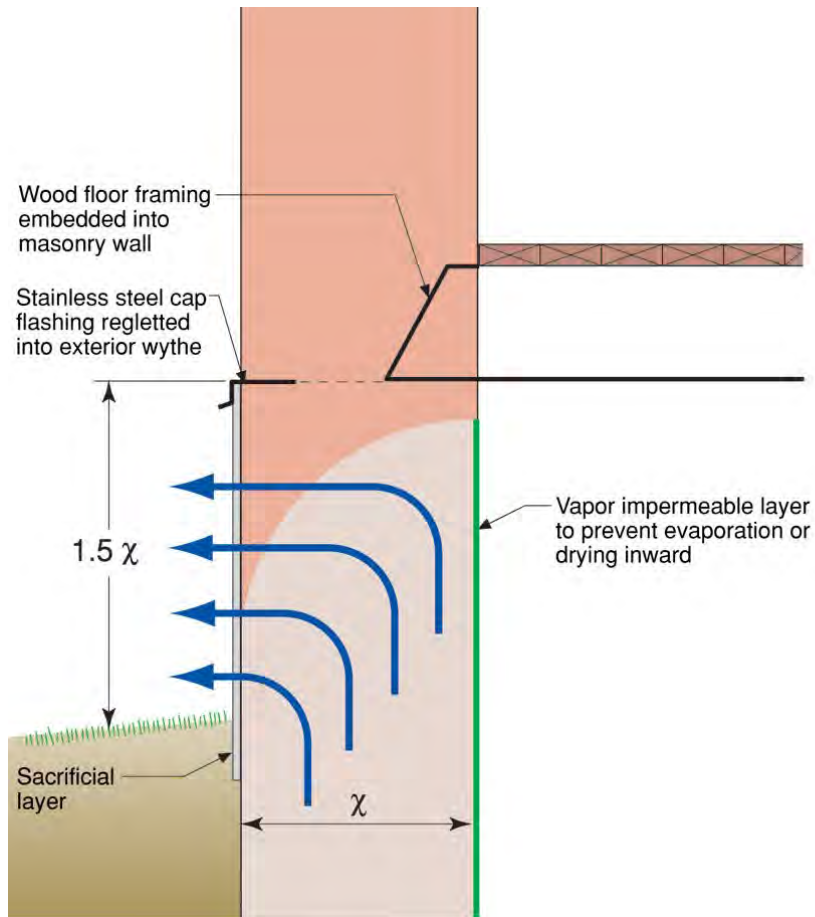


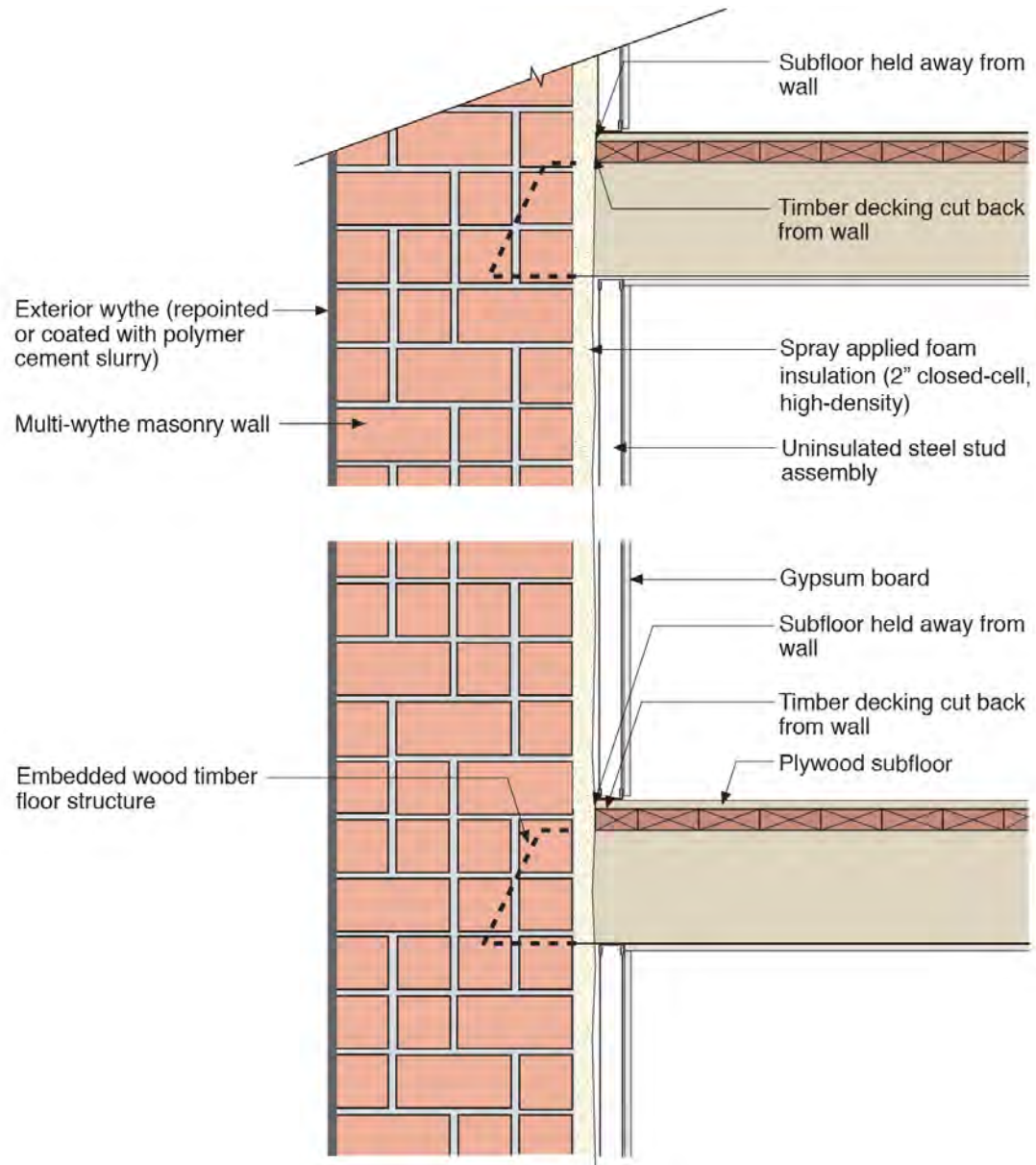




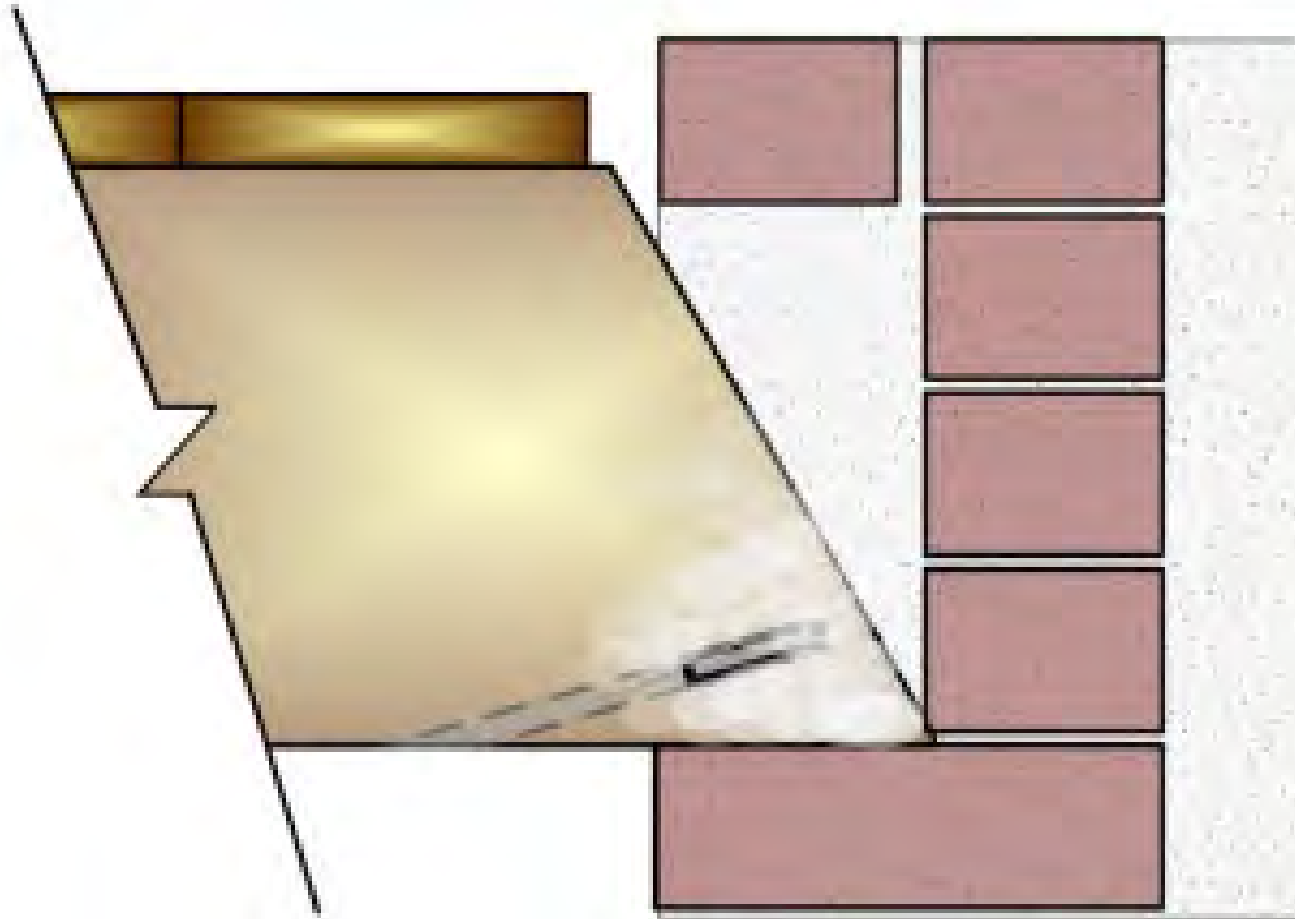










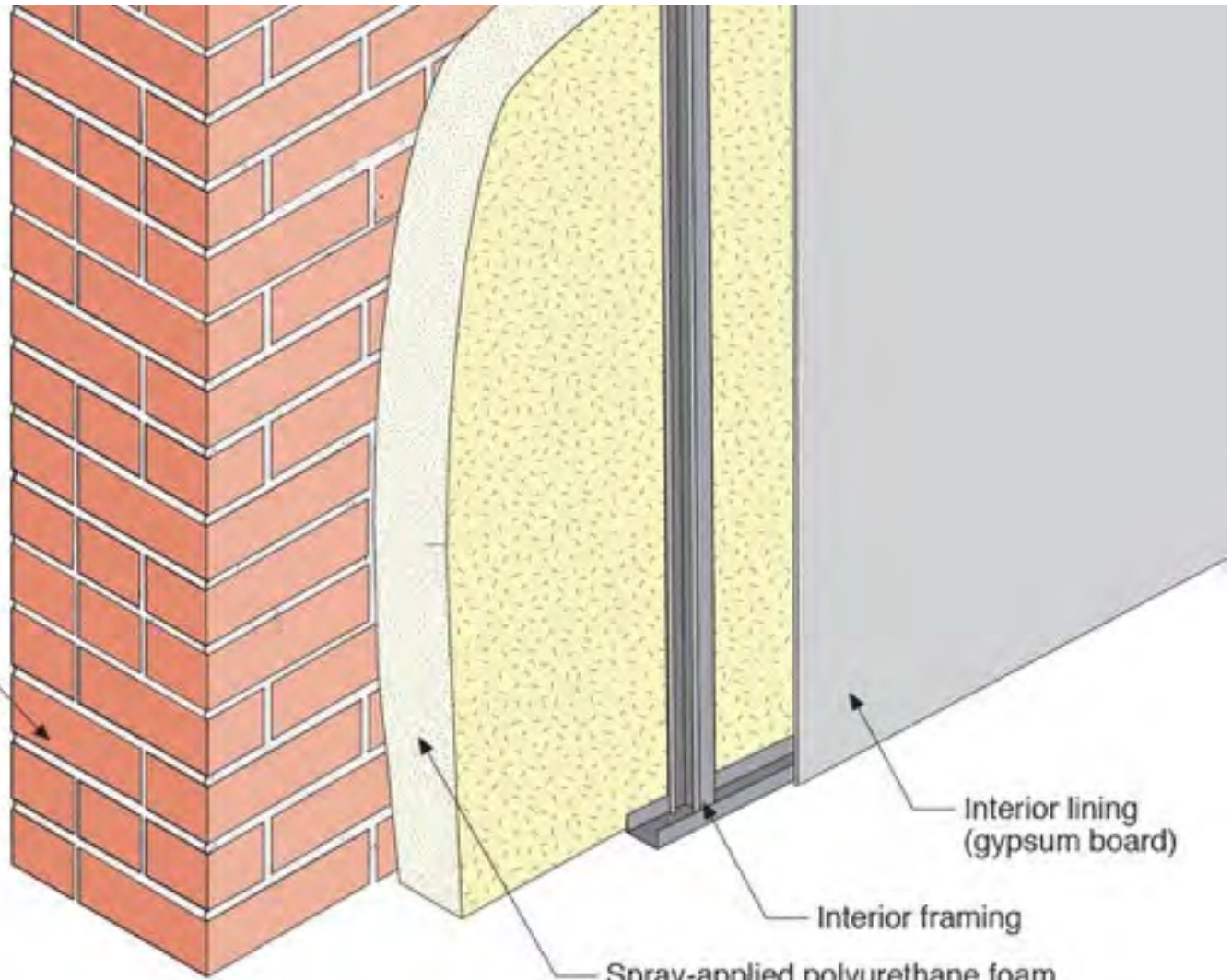








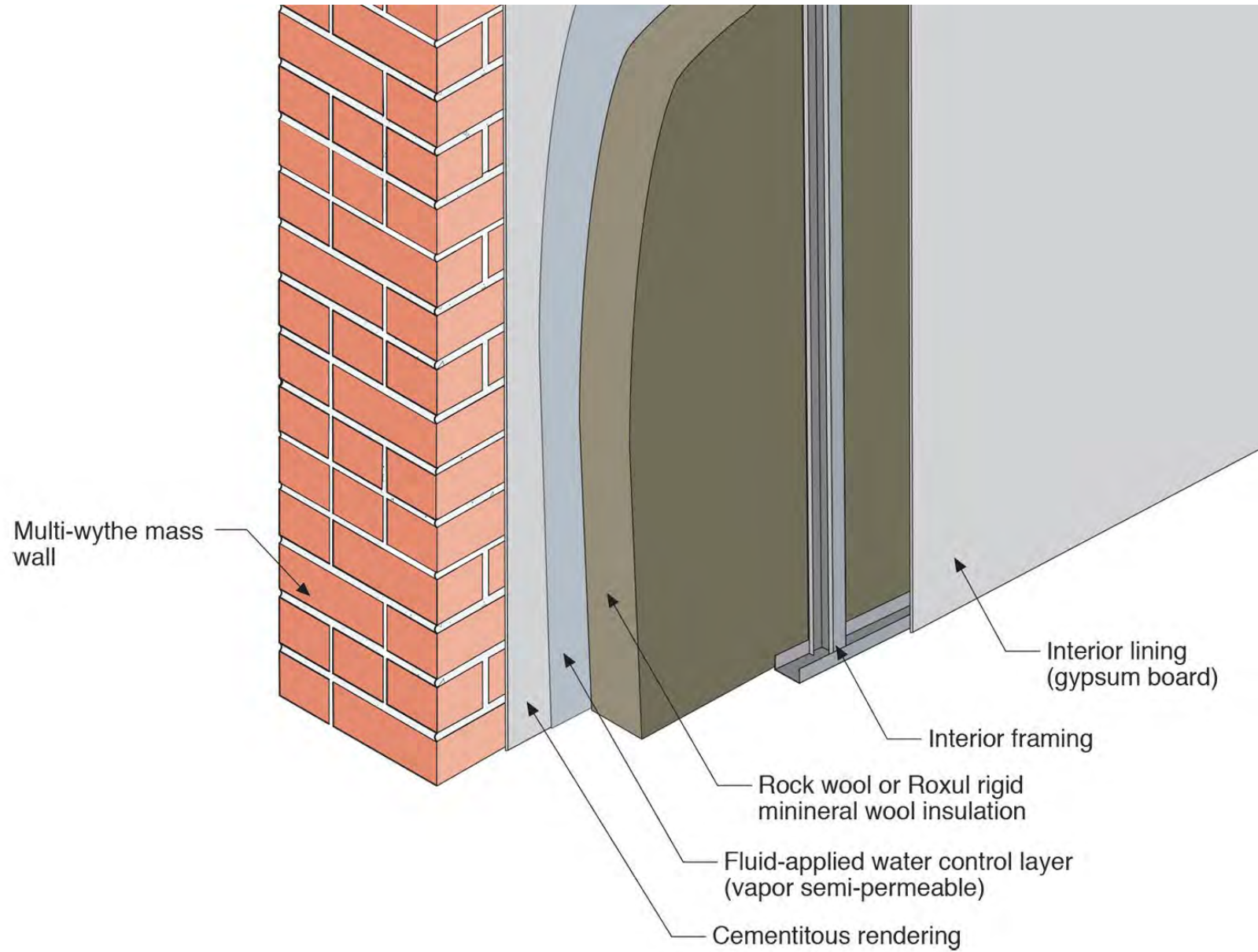
Multi-wythe mass wall

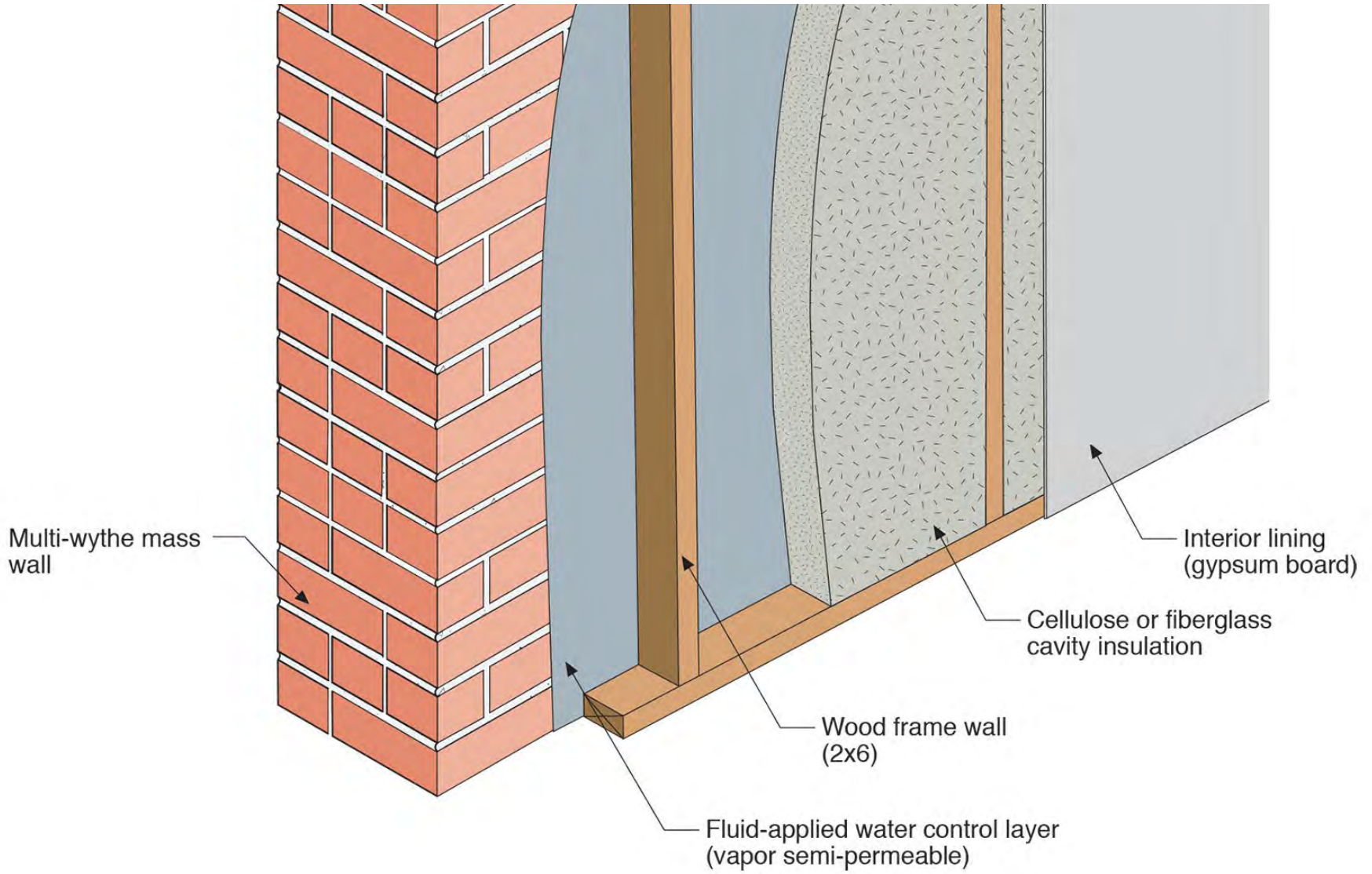


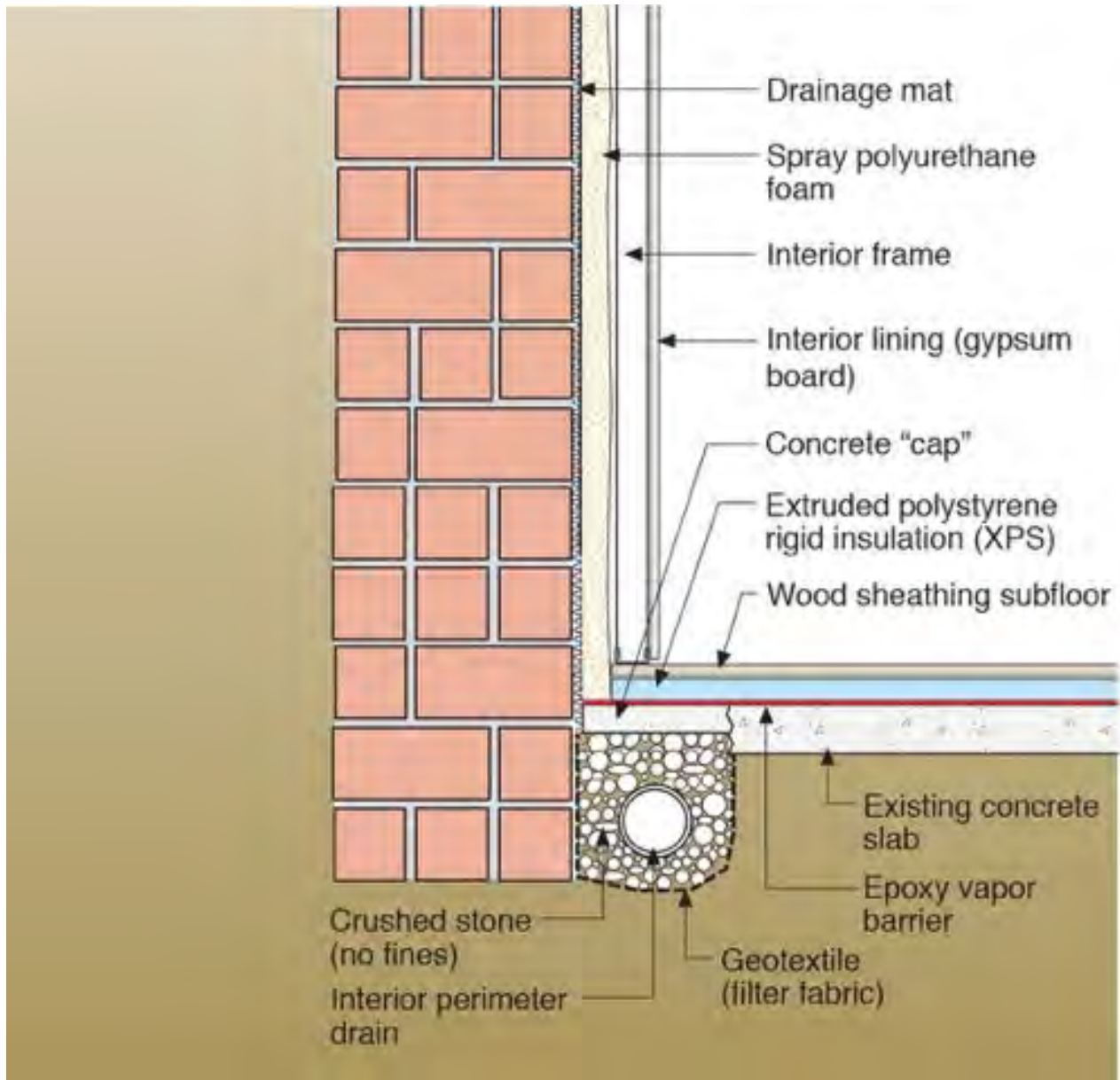
Interior lining
(gypsum board)

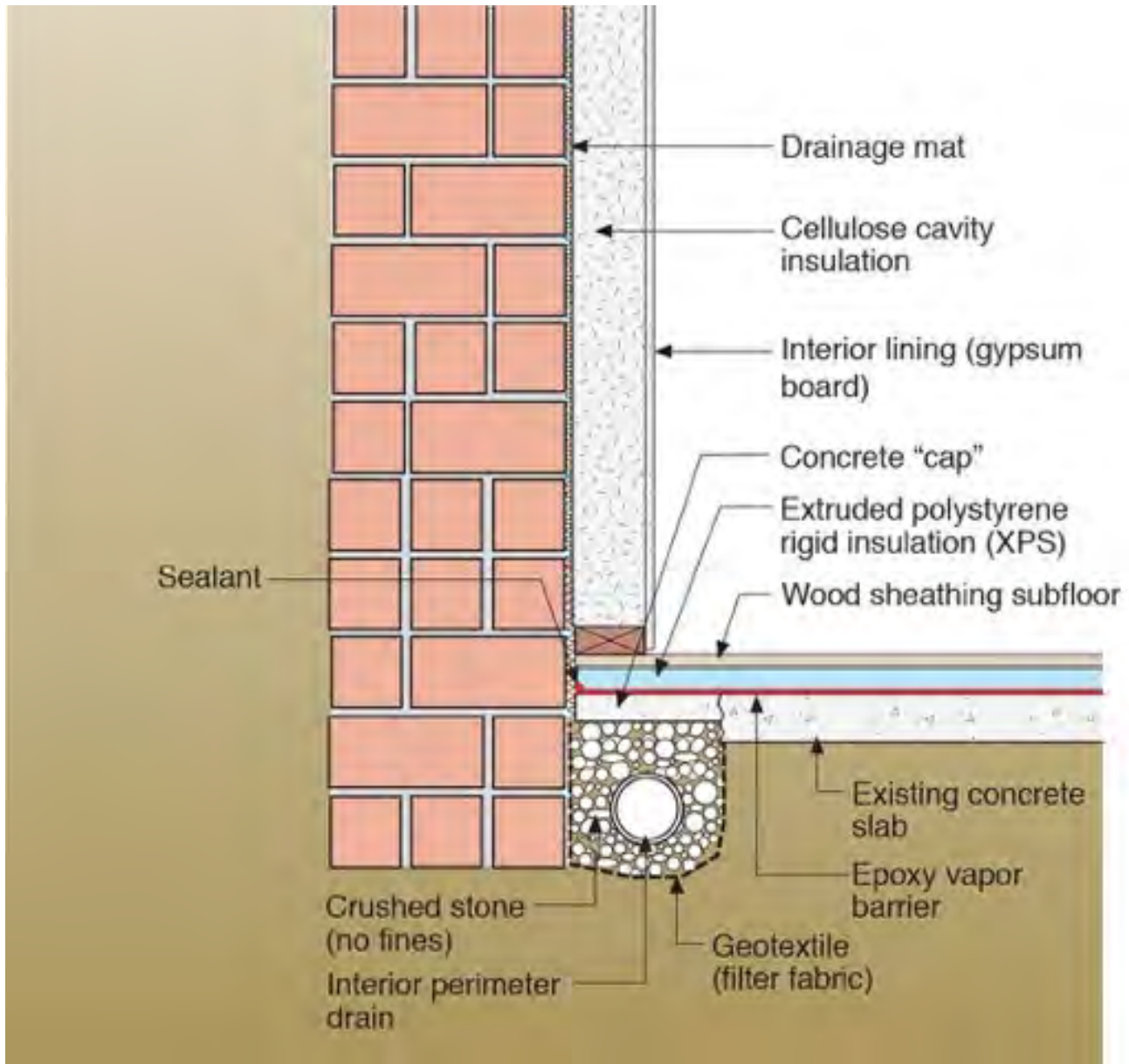
Interior framing

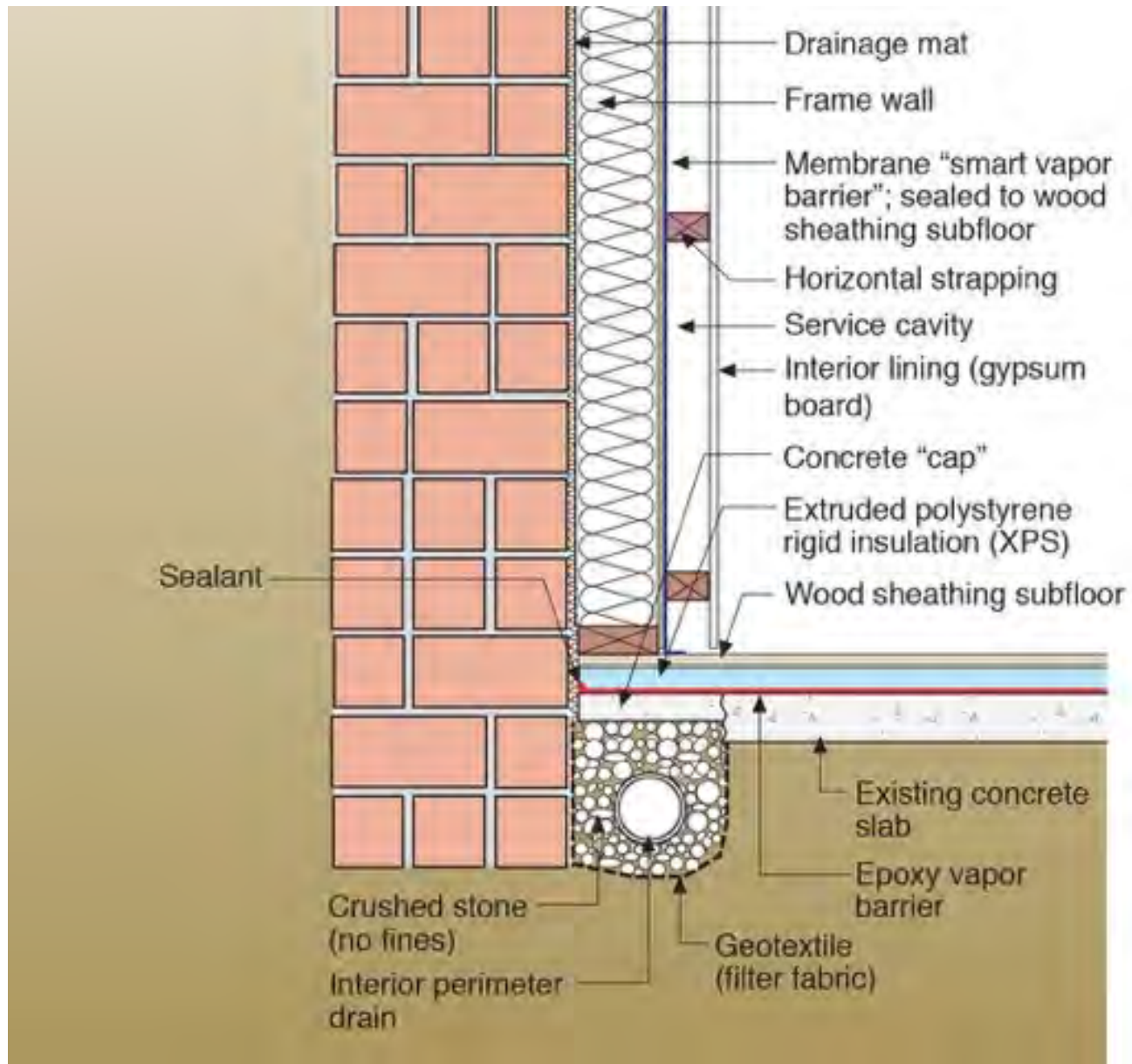
Spray-applied polyurethane foam
(2 lb/ft³ density)



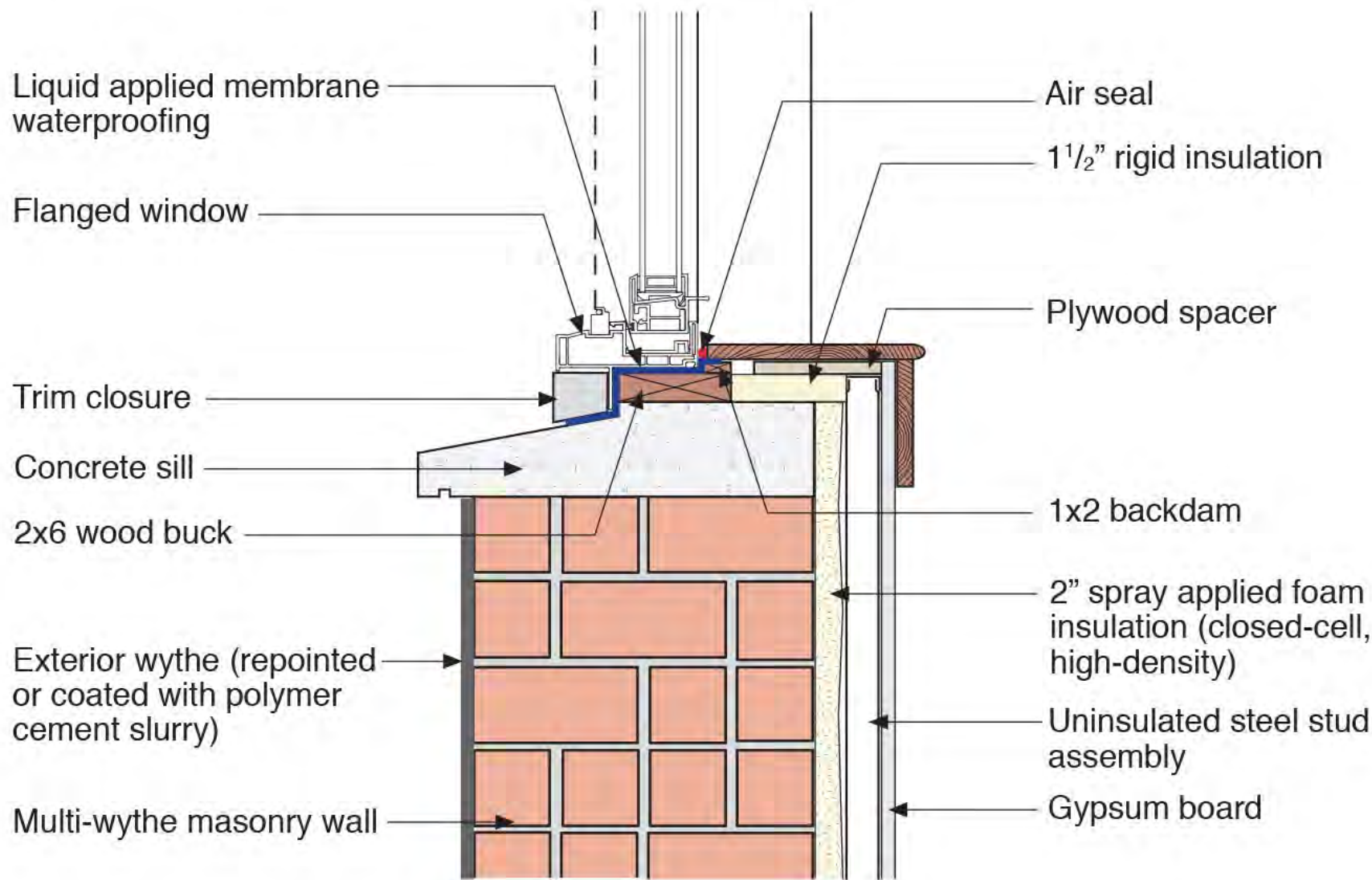


















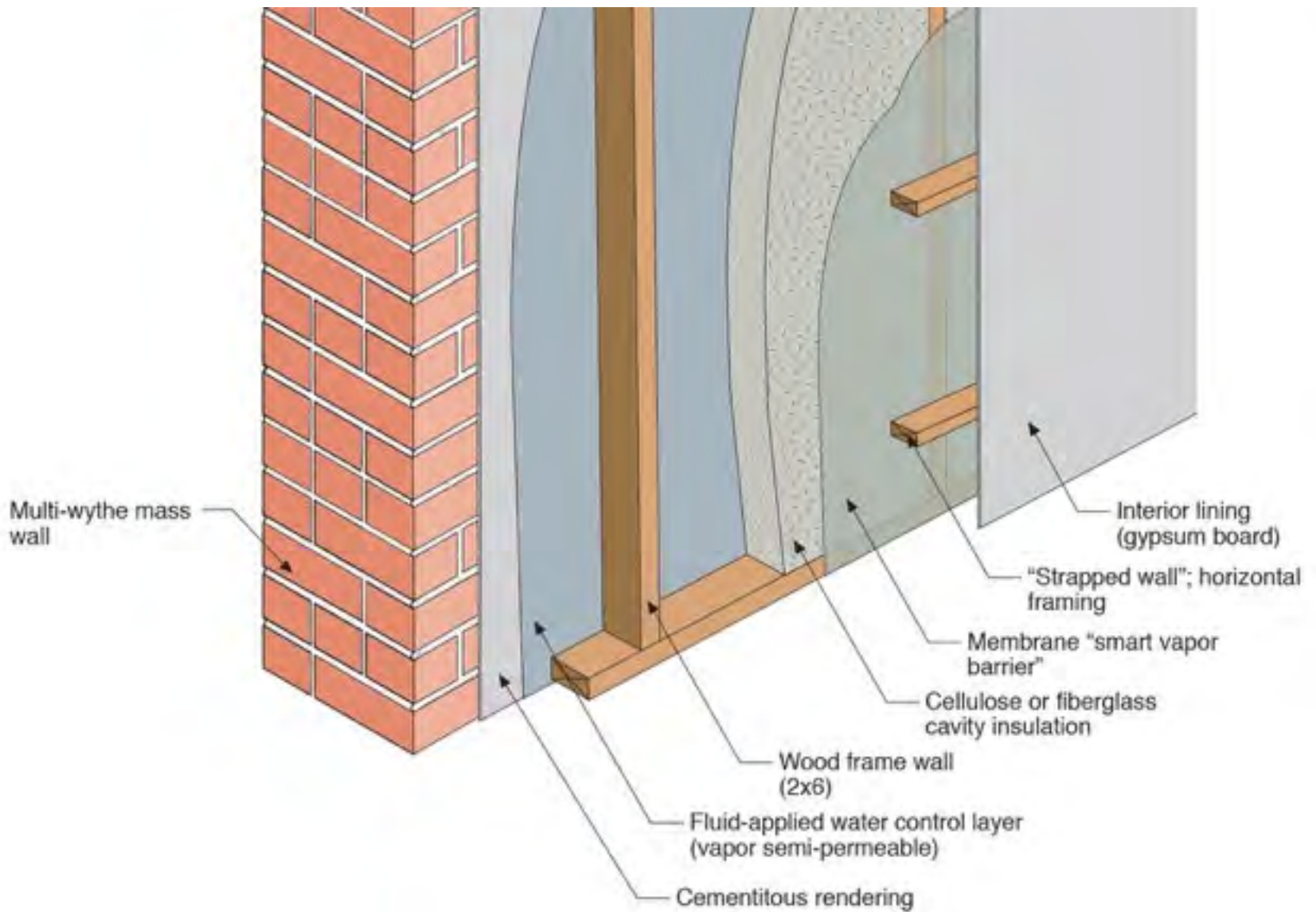








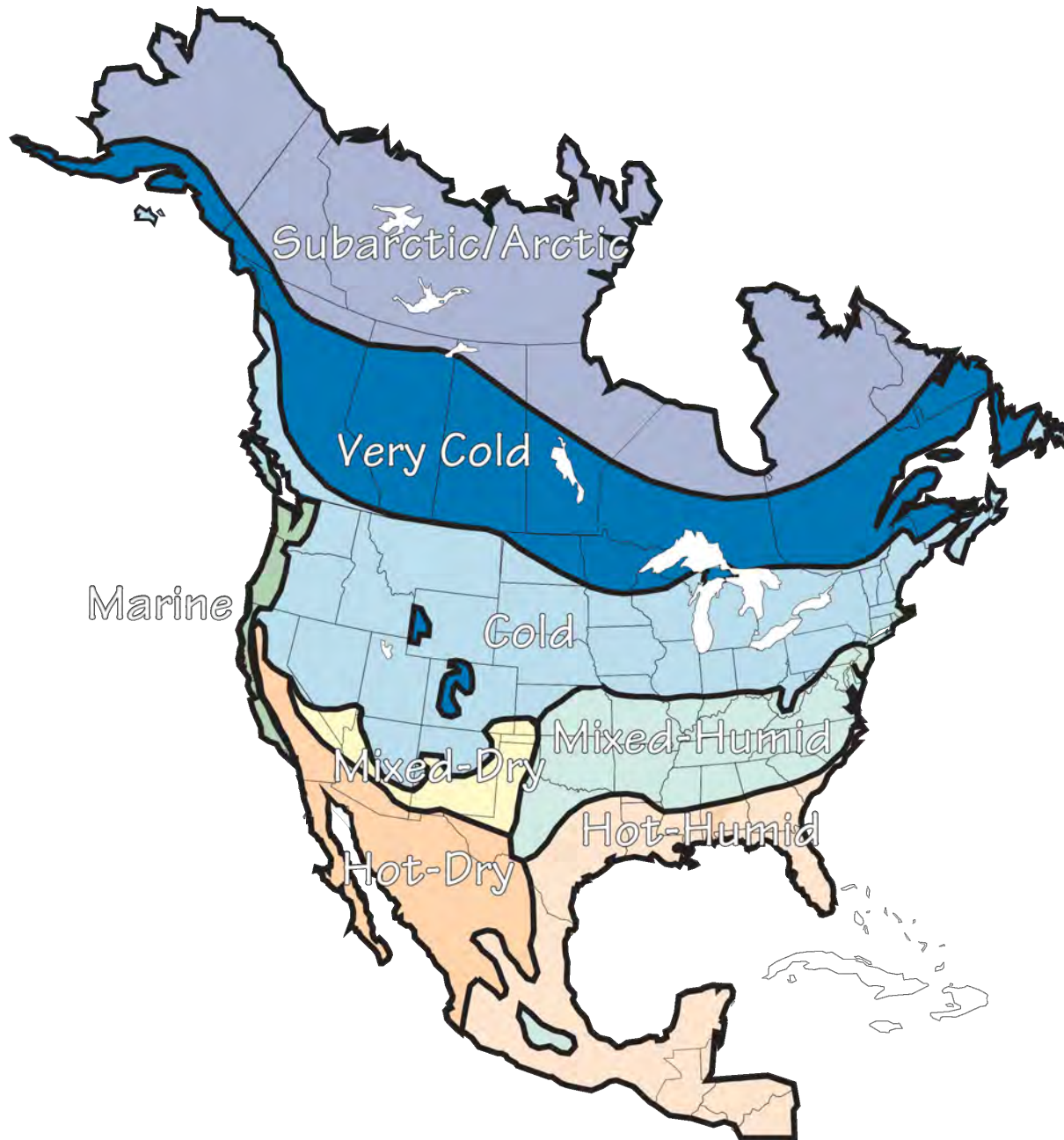


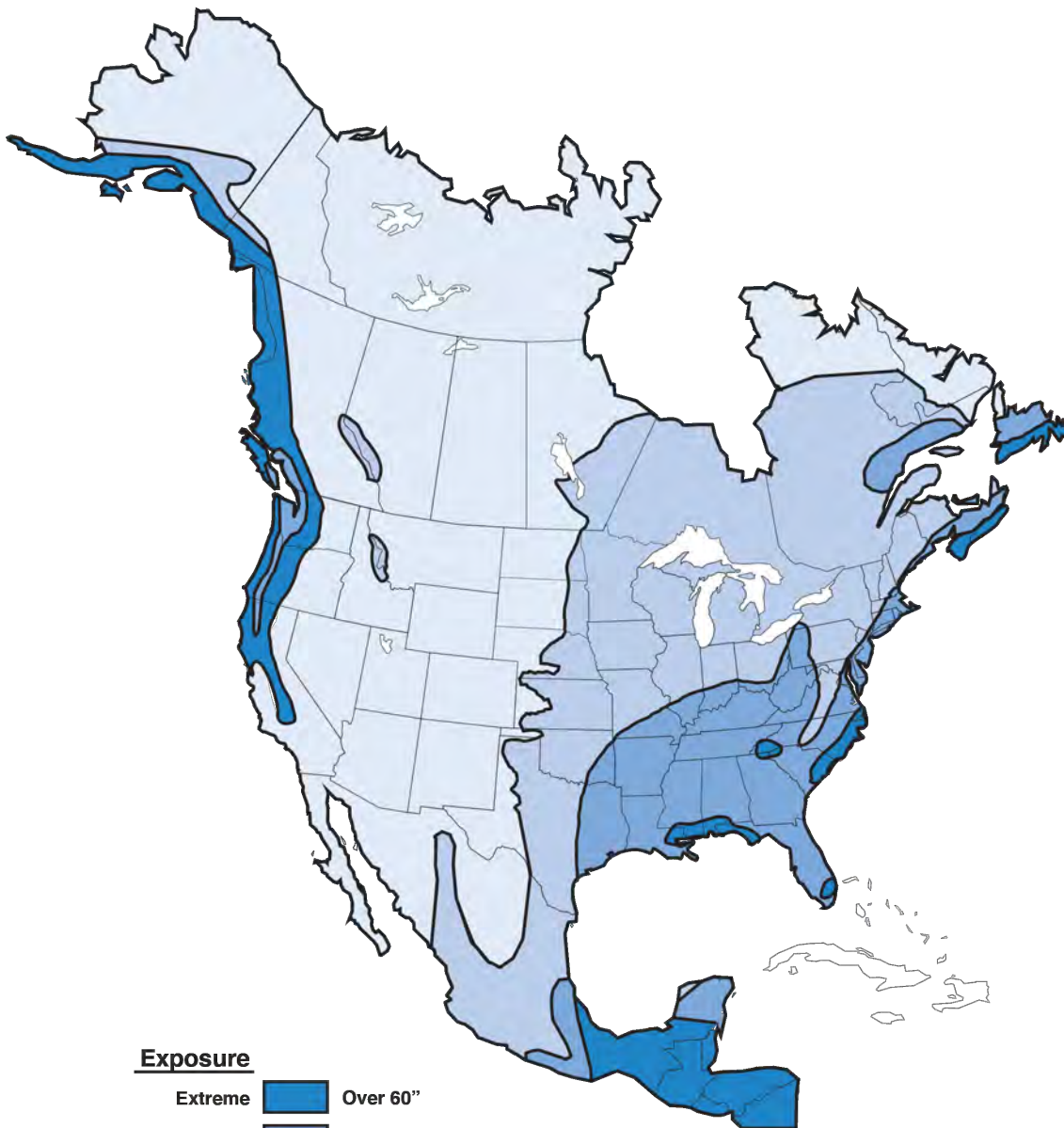


Freeze-Thaw Damage







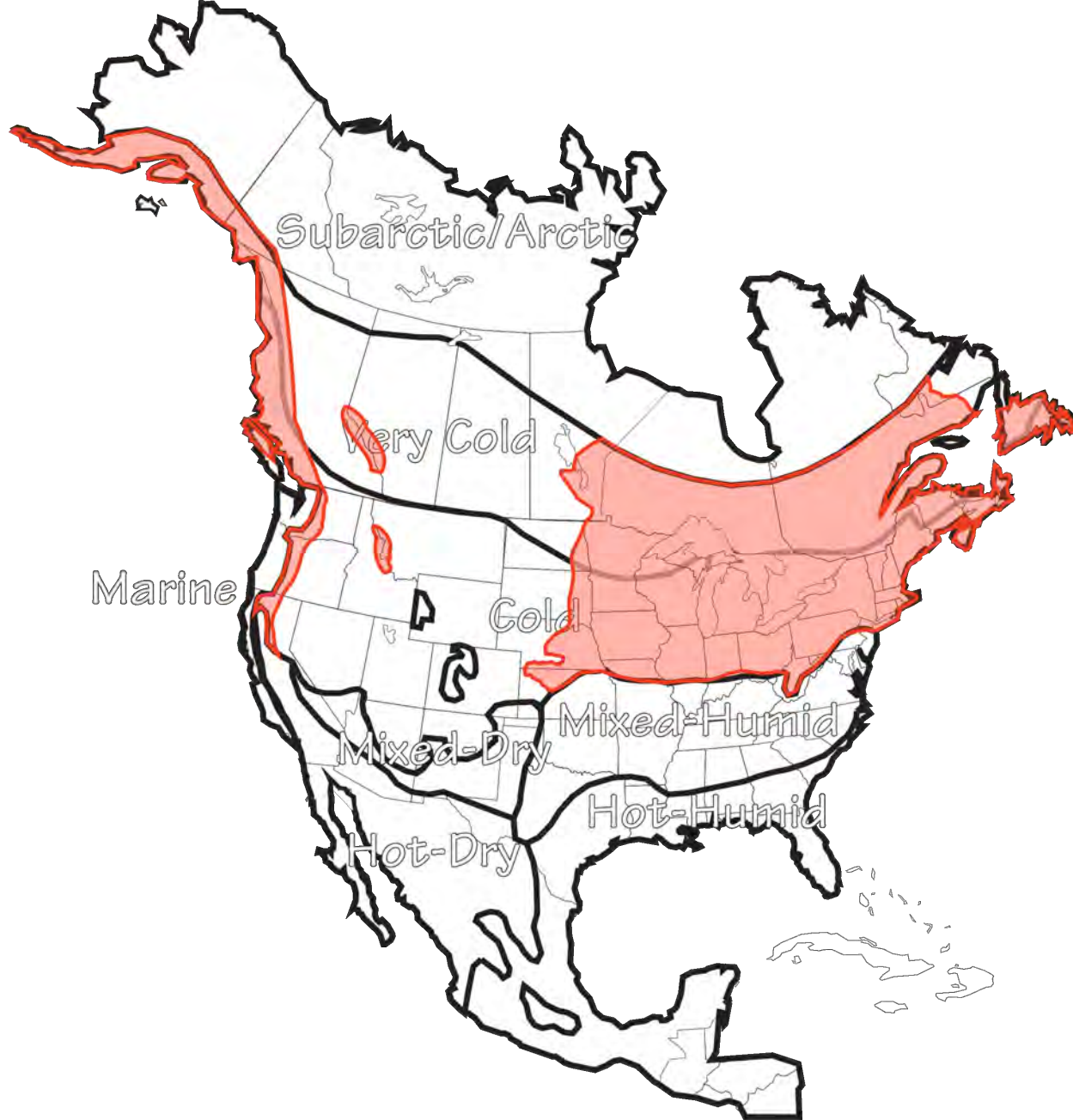
Freeze-Thaw Damage
Freezing Temperatures
Water
Susceptible Brick

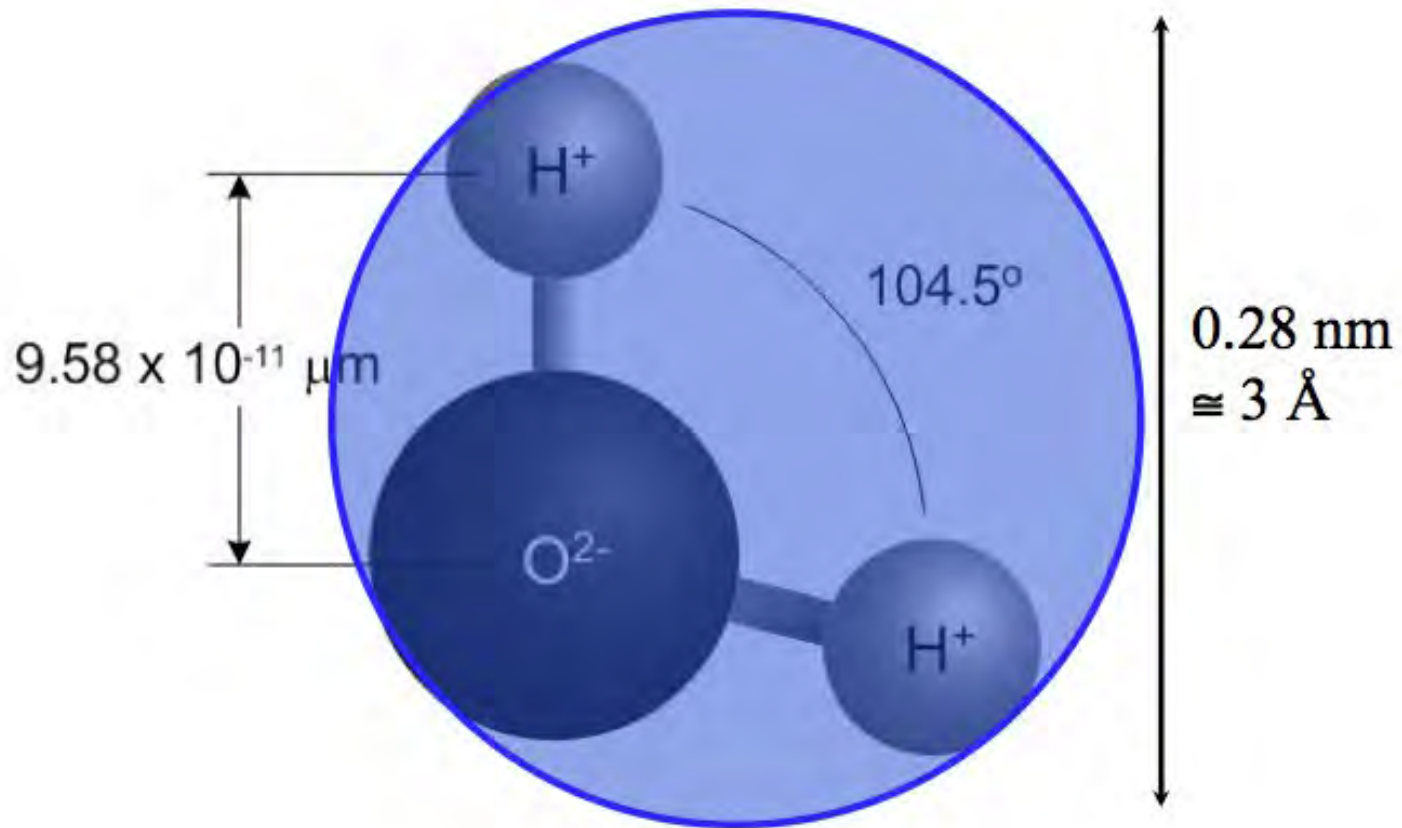


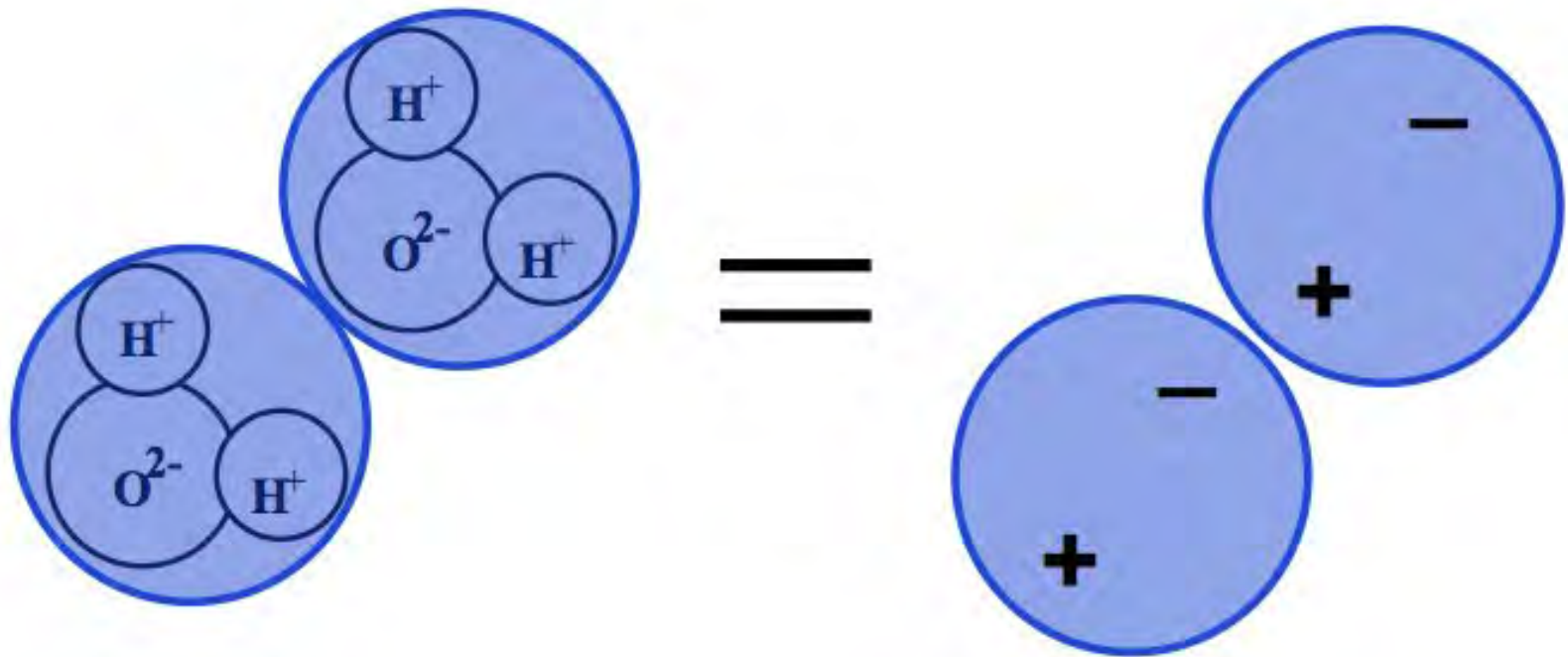


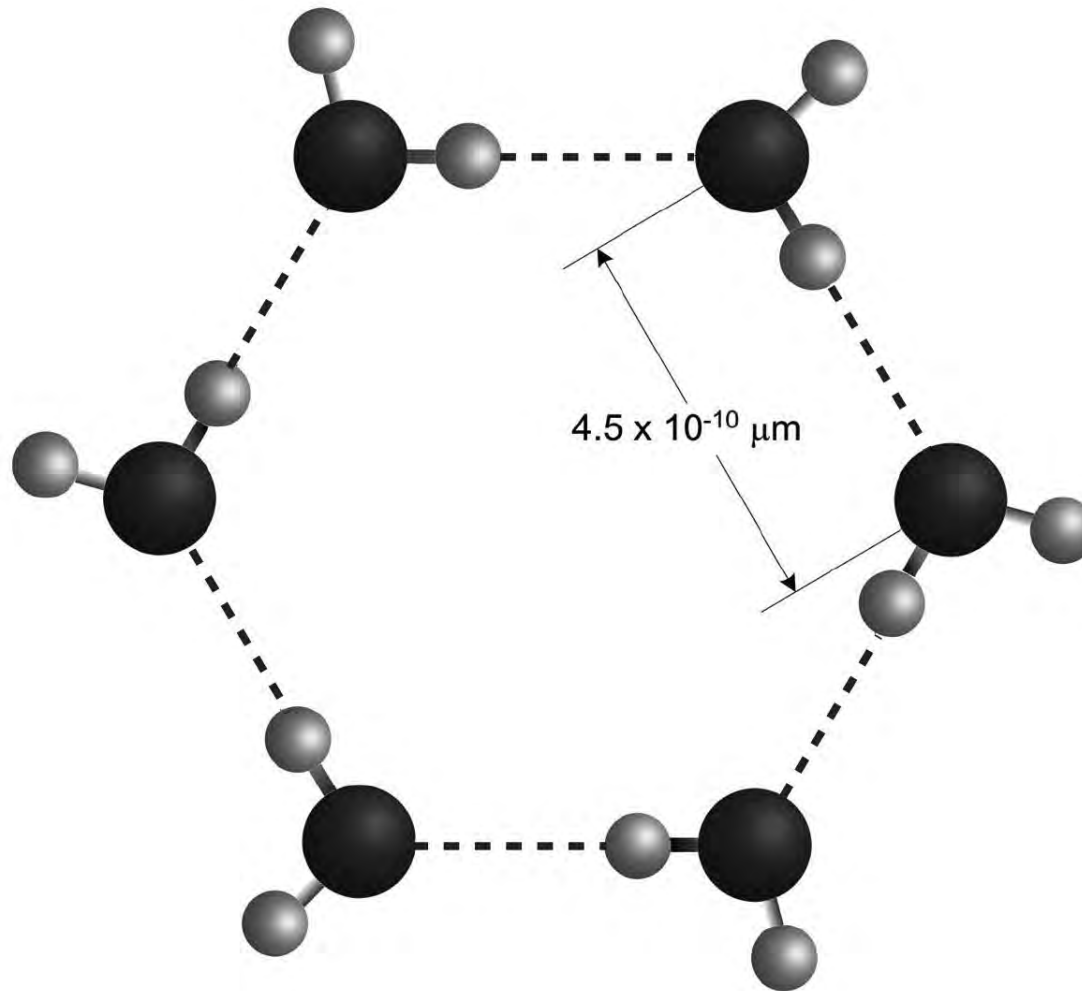
Exposure

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

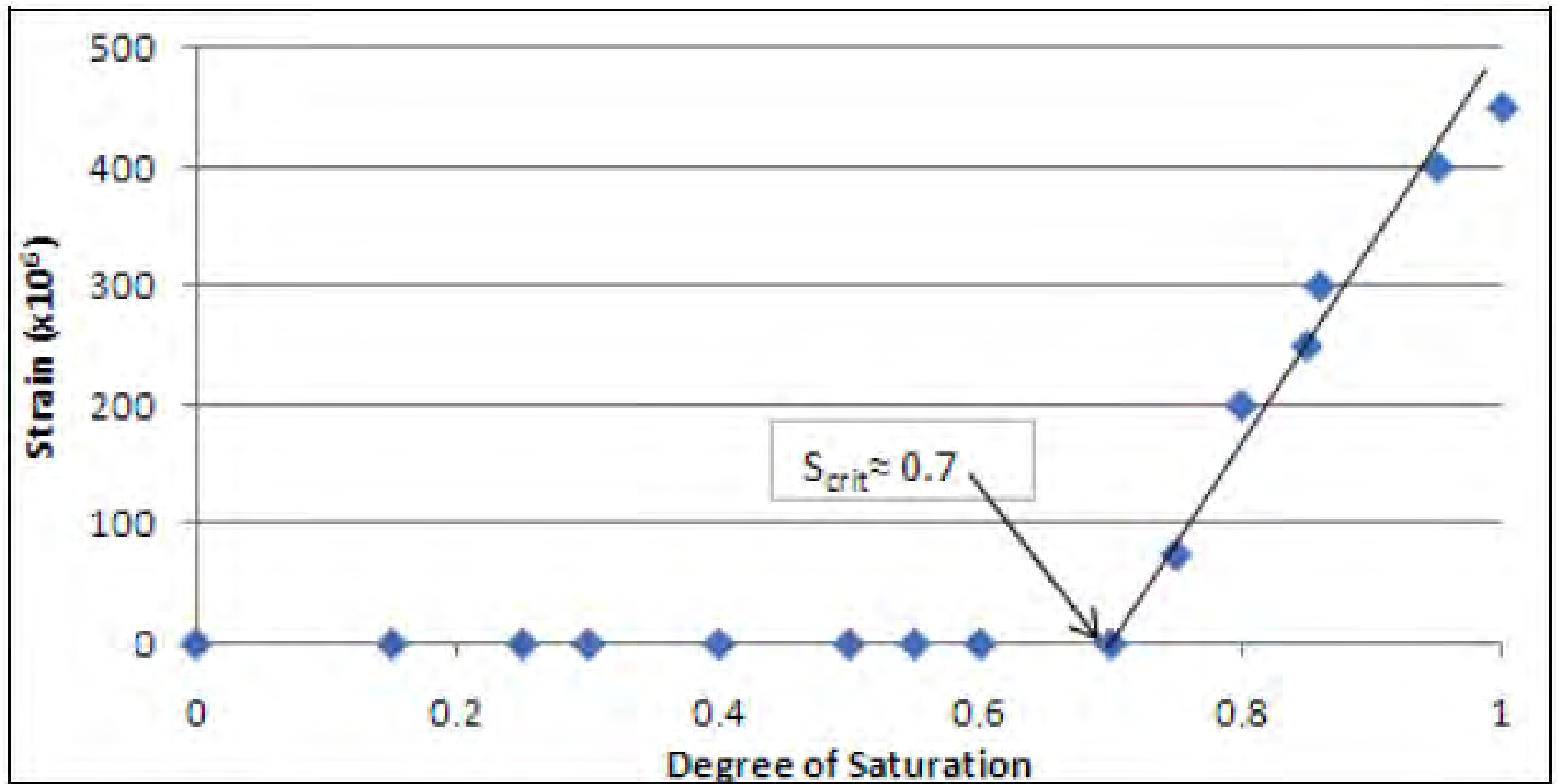








Susceptible Brick Firing Temperature Vitrification















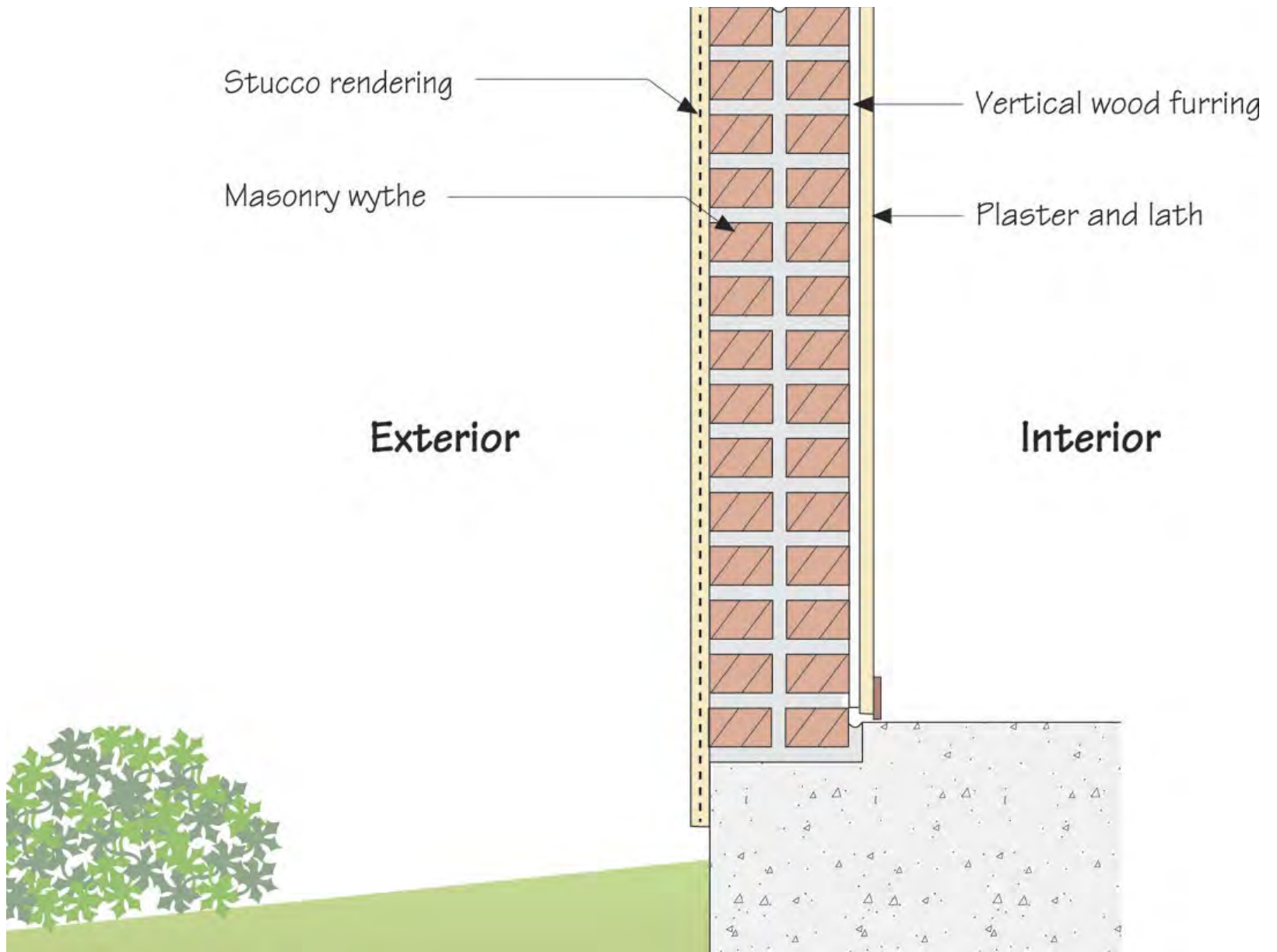








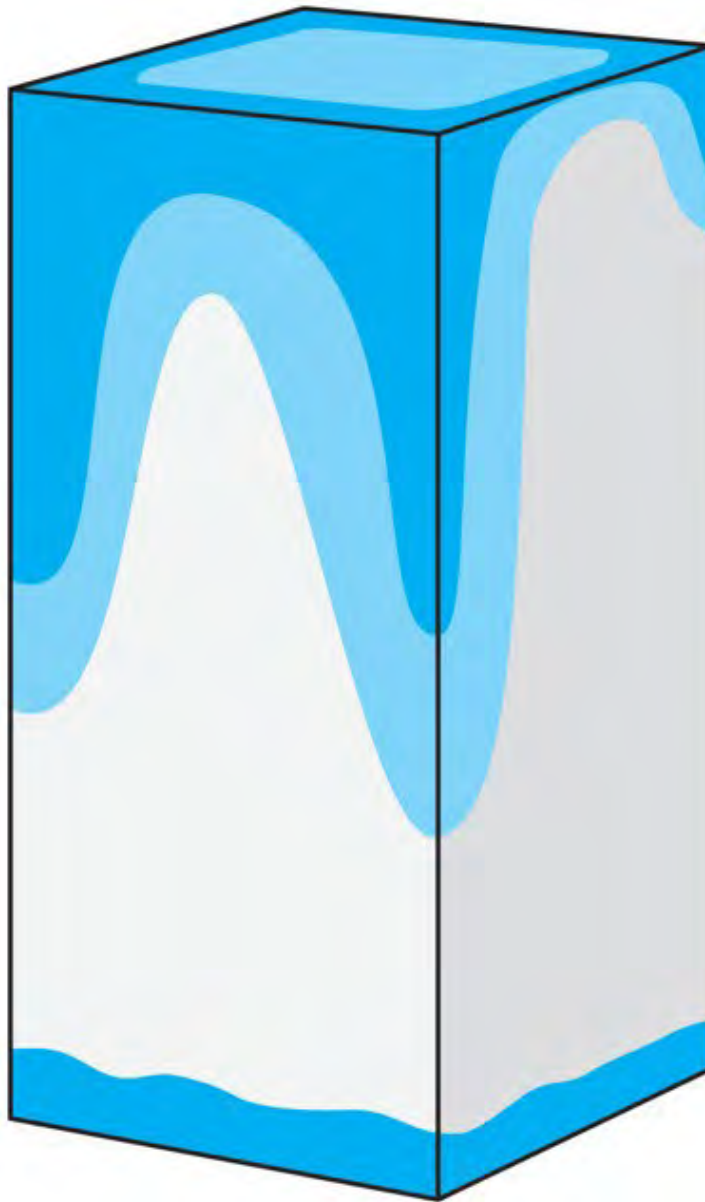


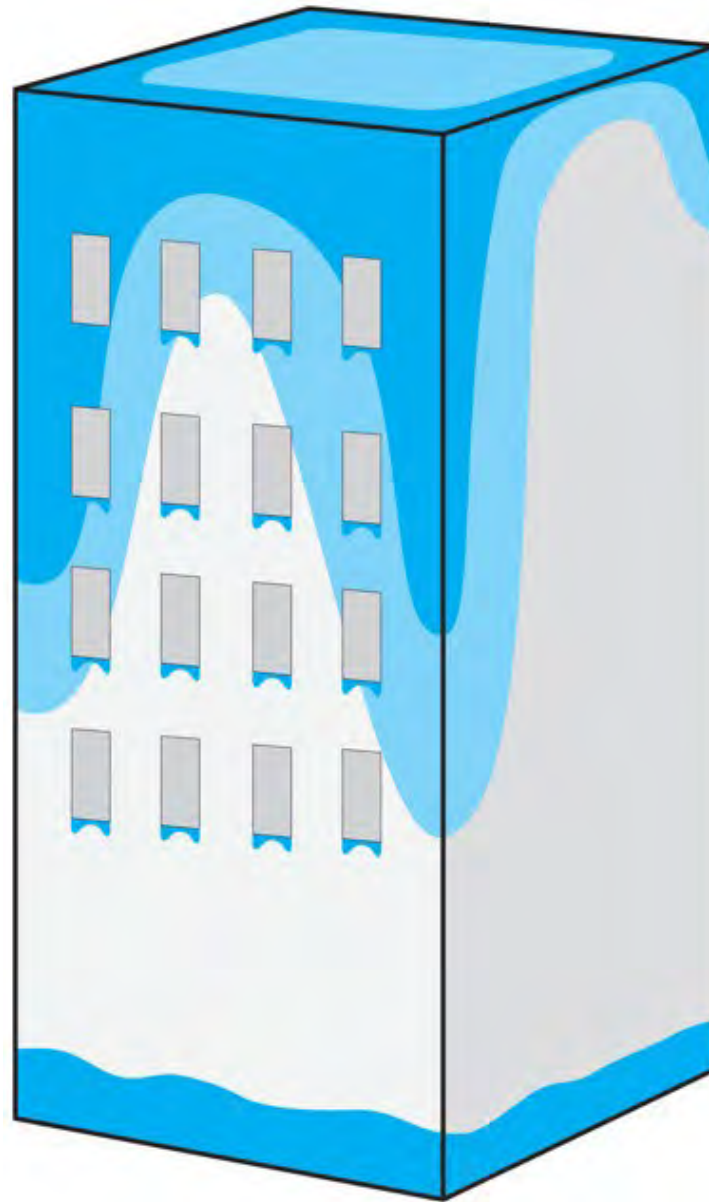


























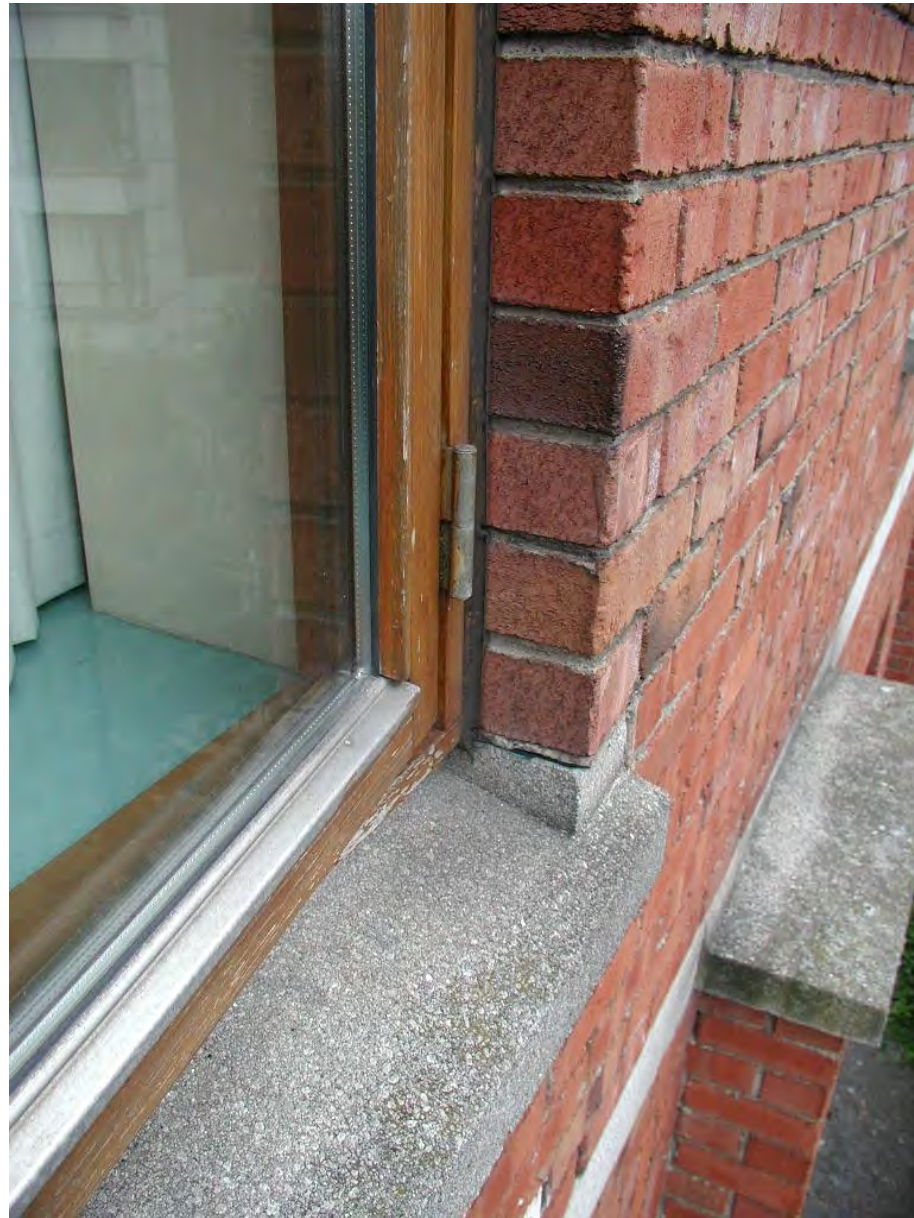










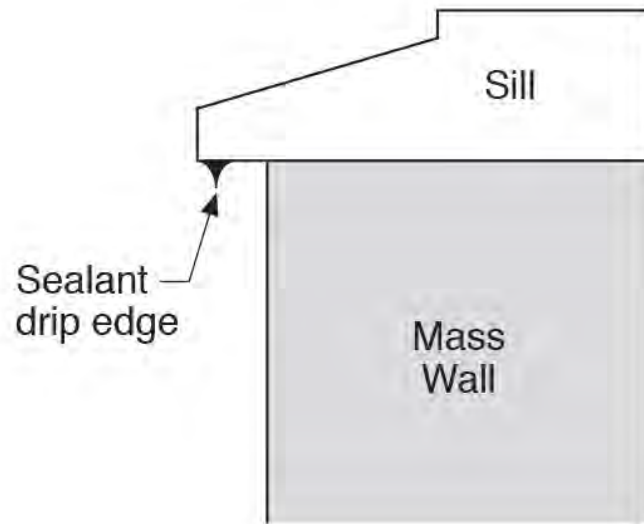
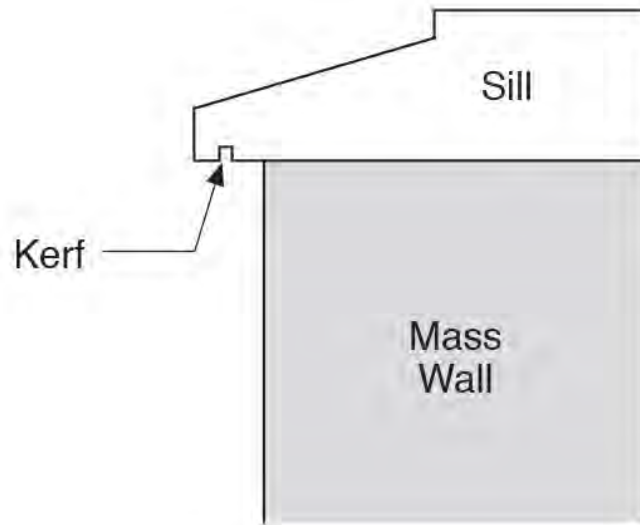








































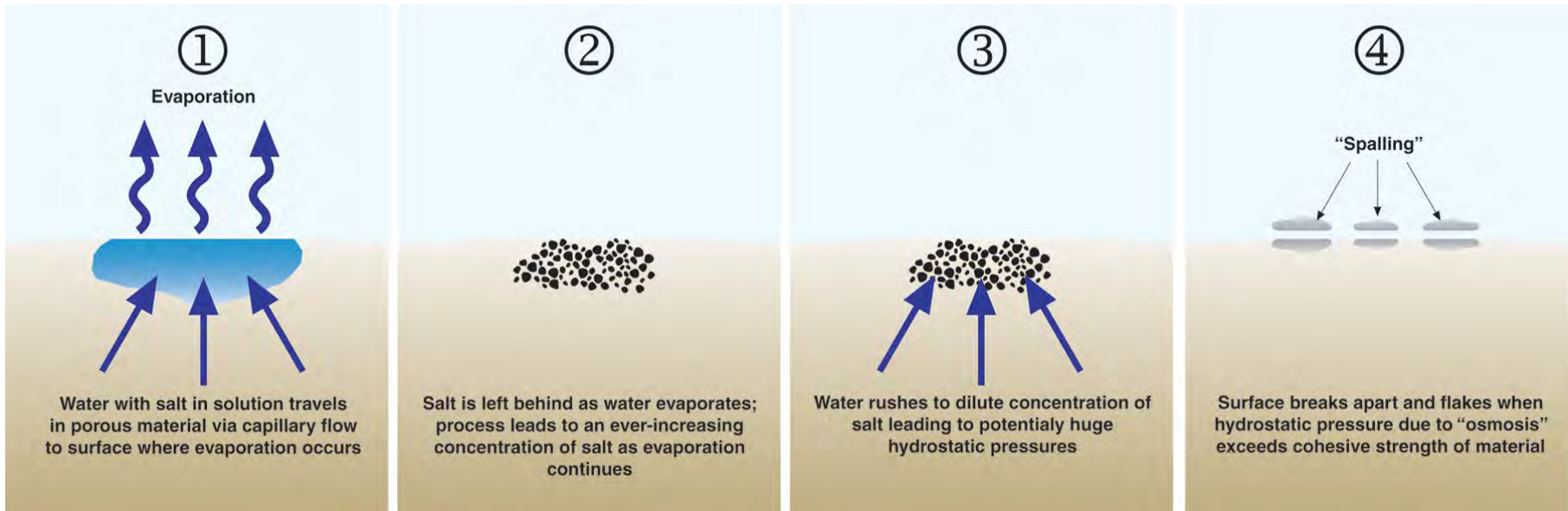










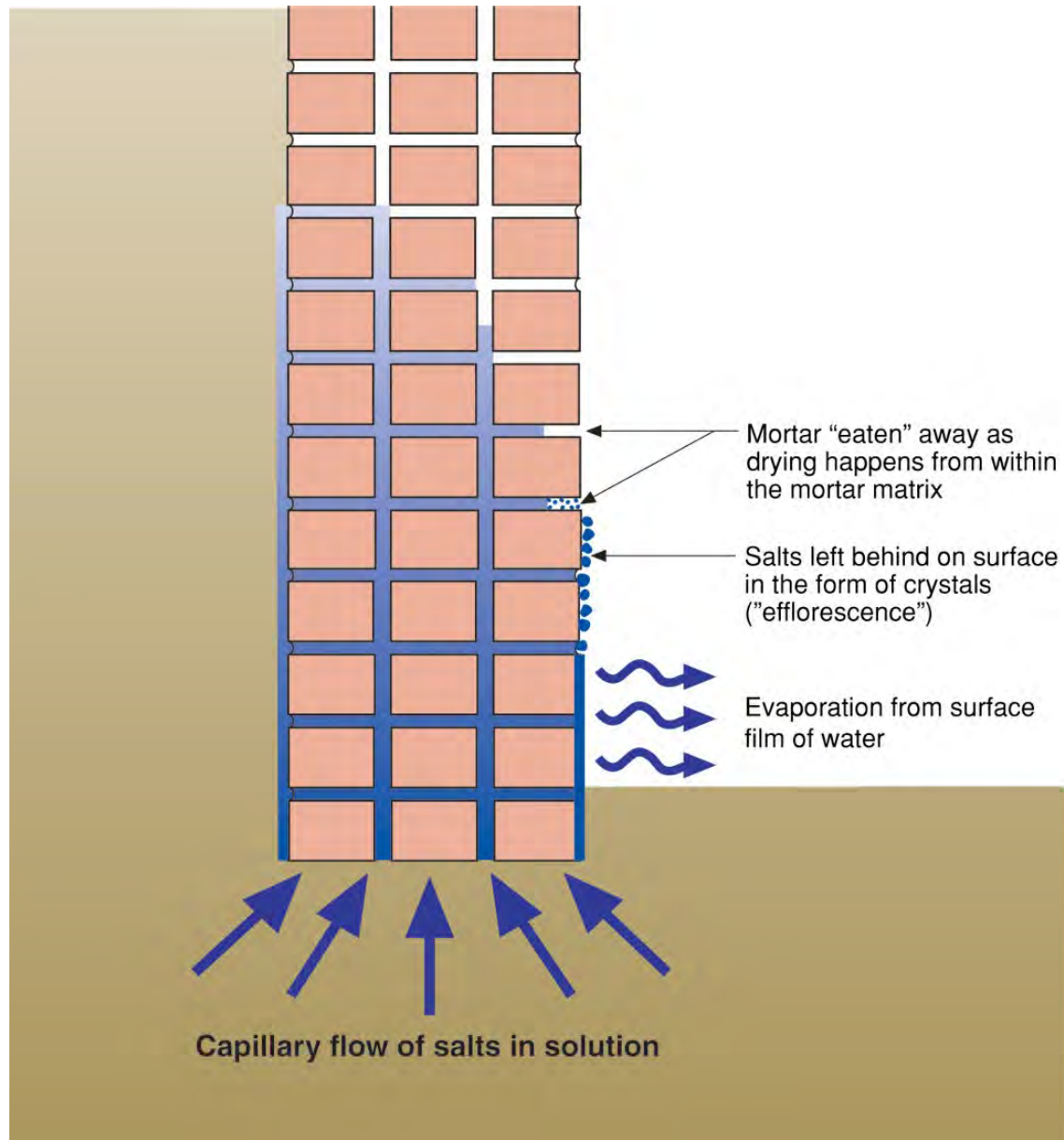


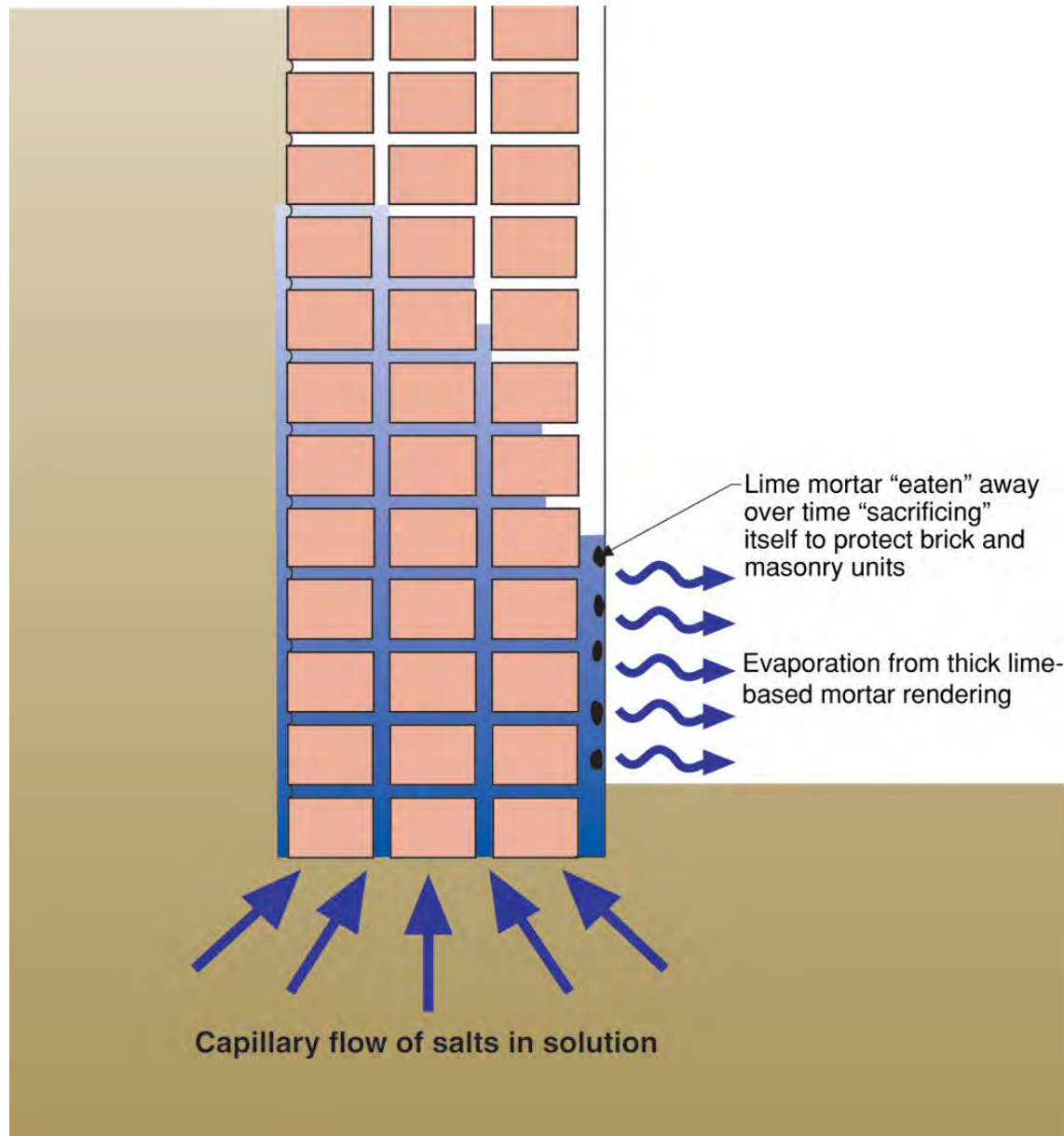
Diffusion + Capillarity + Osmosis = Problem

- Diffusion Vapor Pressure 3 to 5 psi
- Capillary Pressure 300 to 500 psi
- Osmosis Pressure 3,000 to 5,000 psi











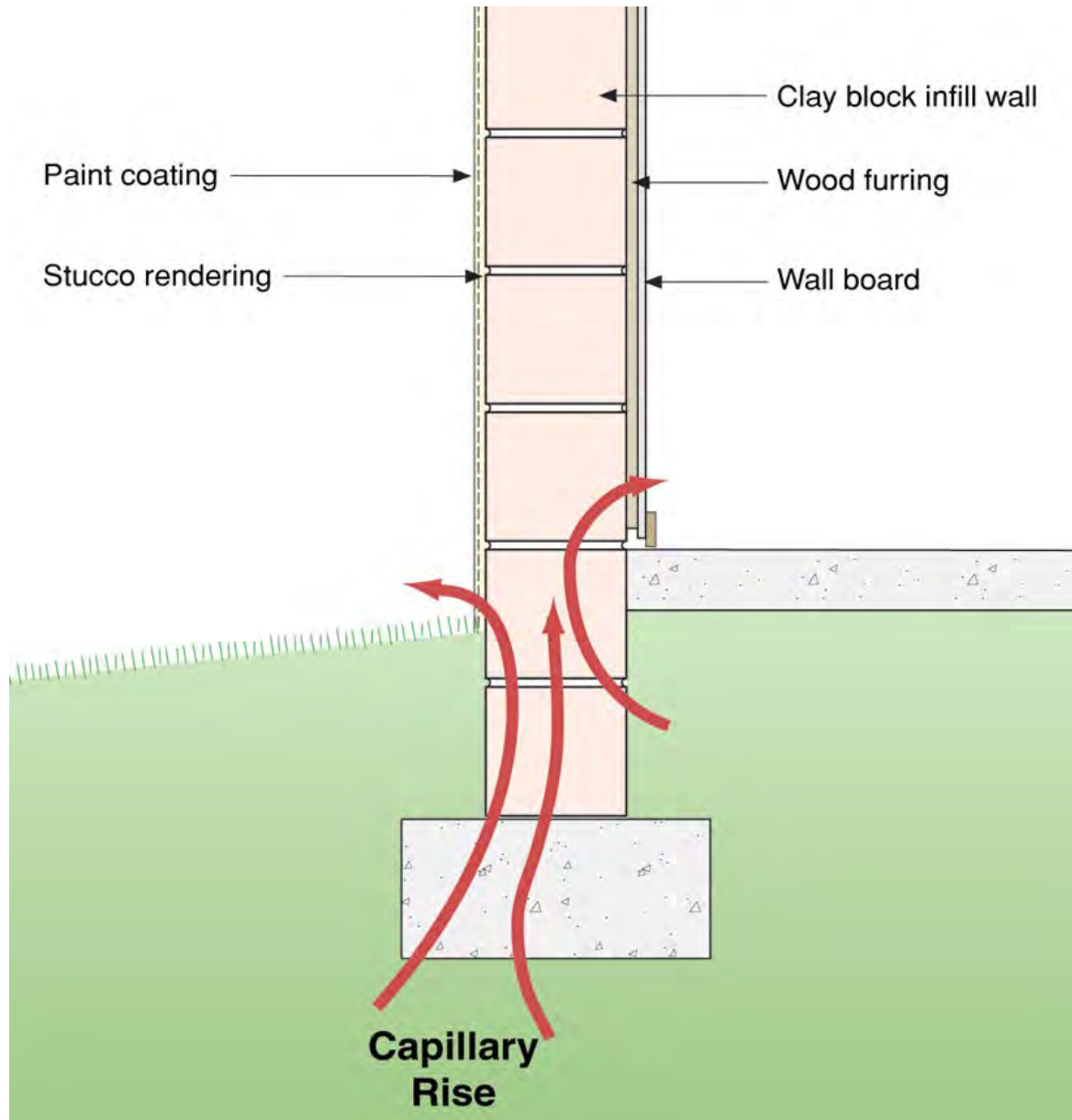


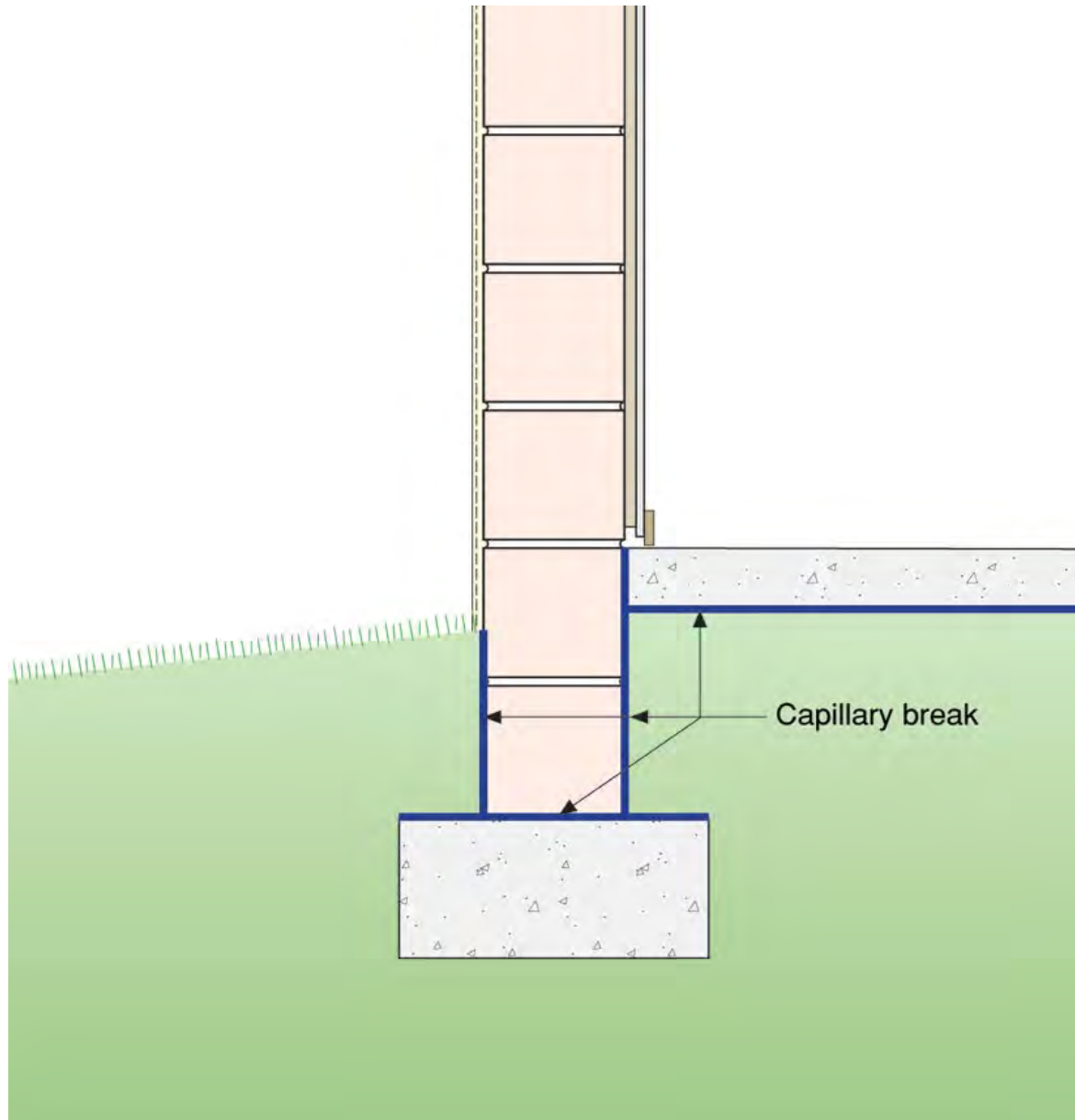




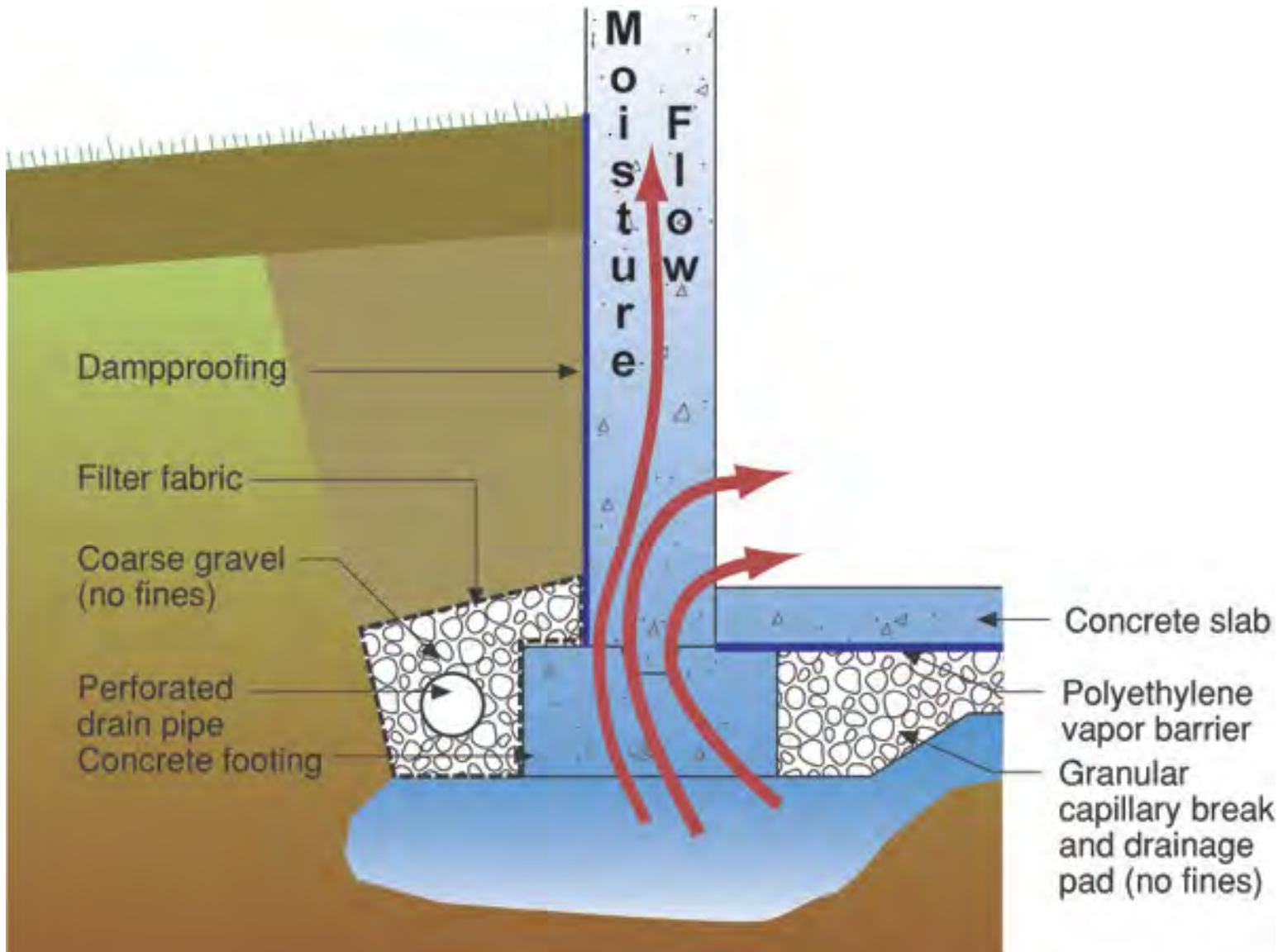










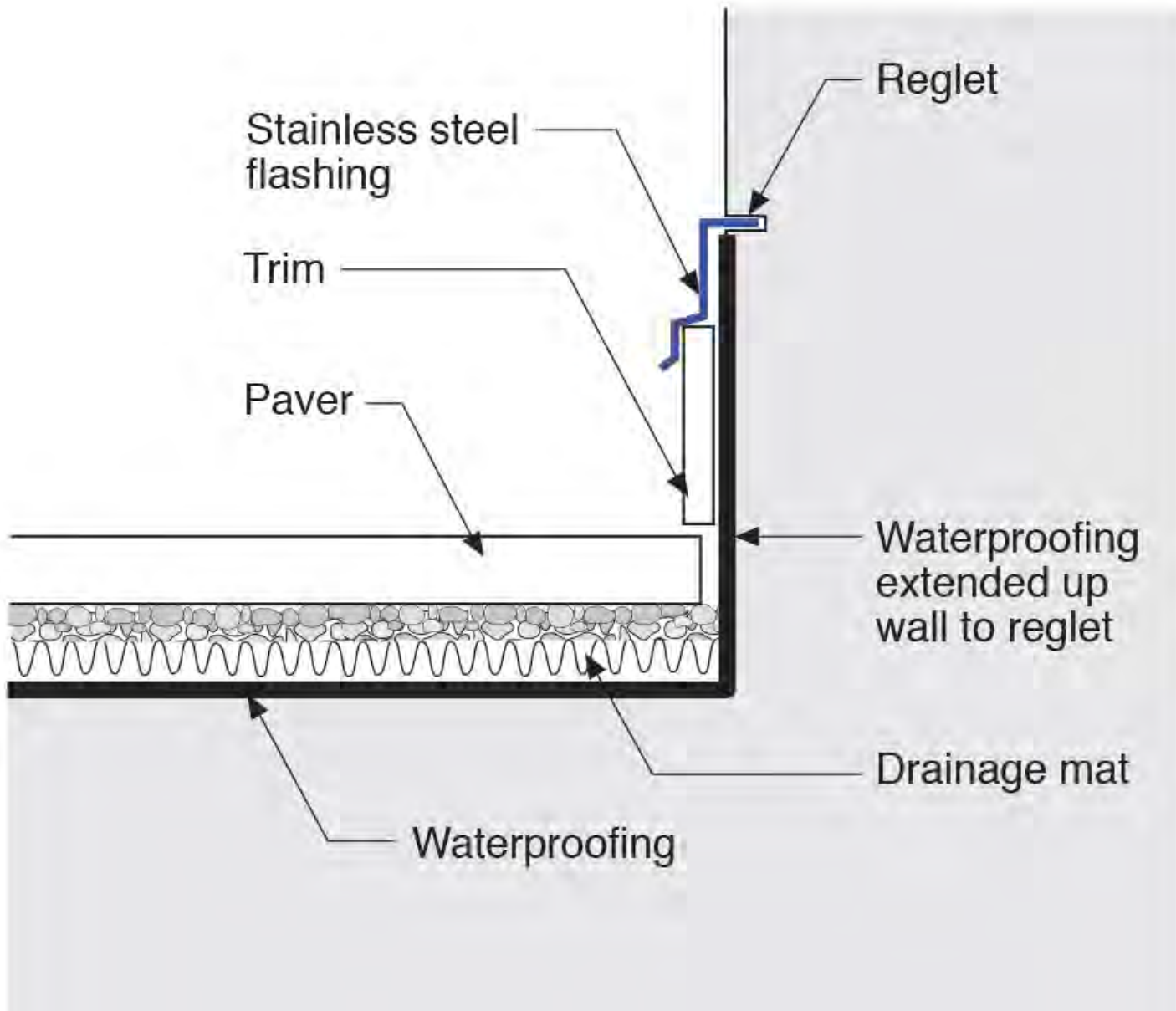














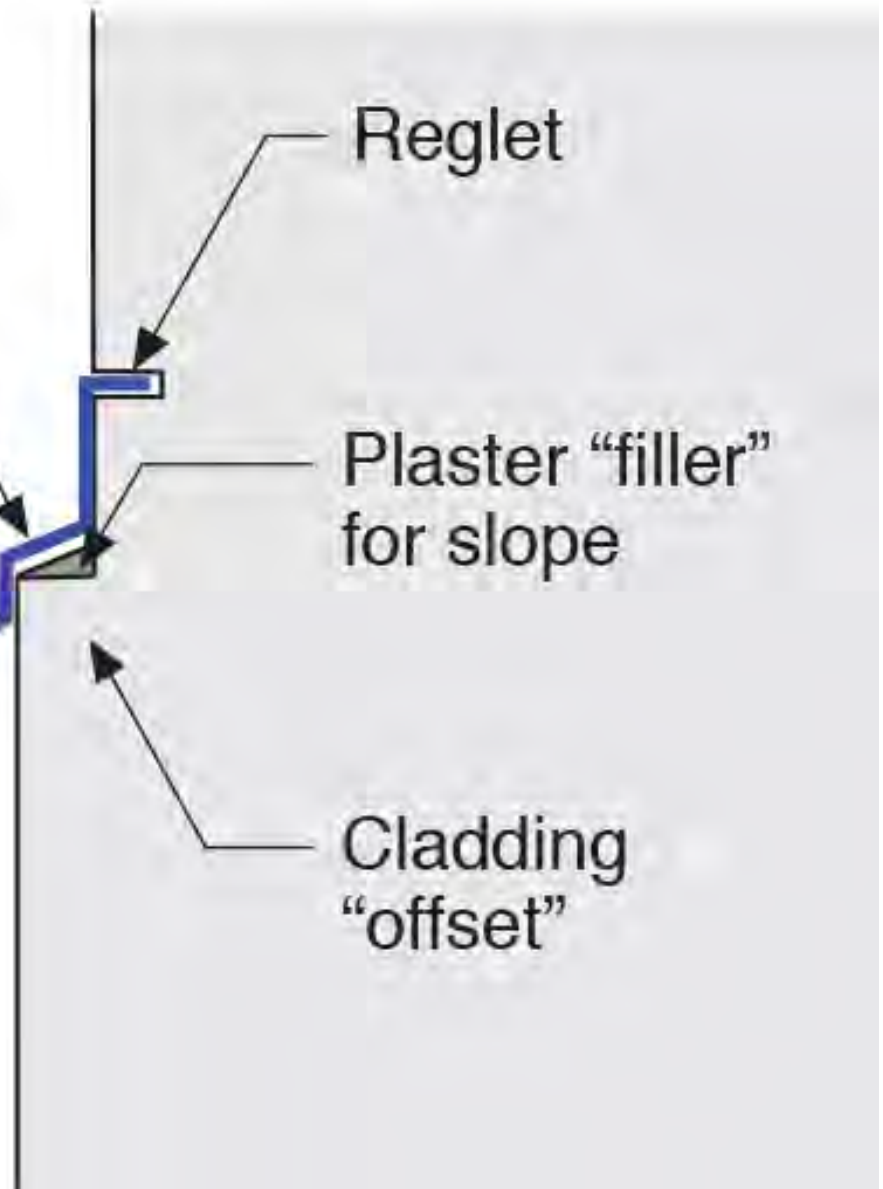


Stainless steel
flashing

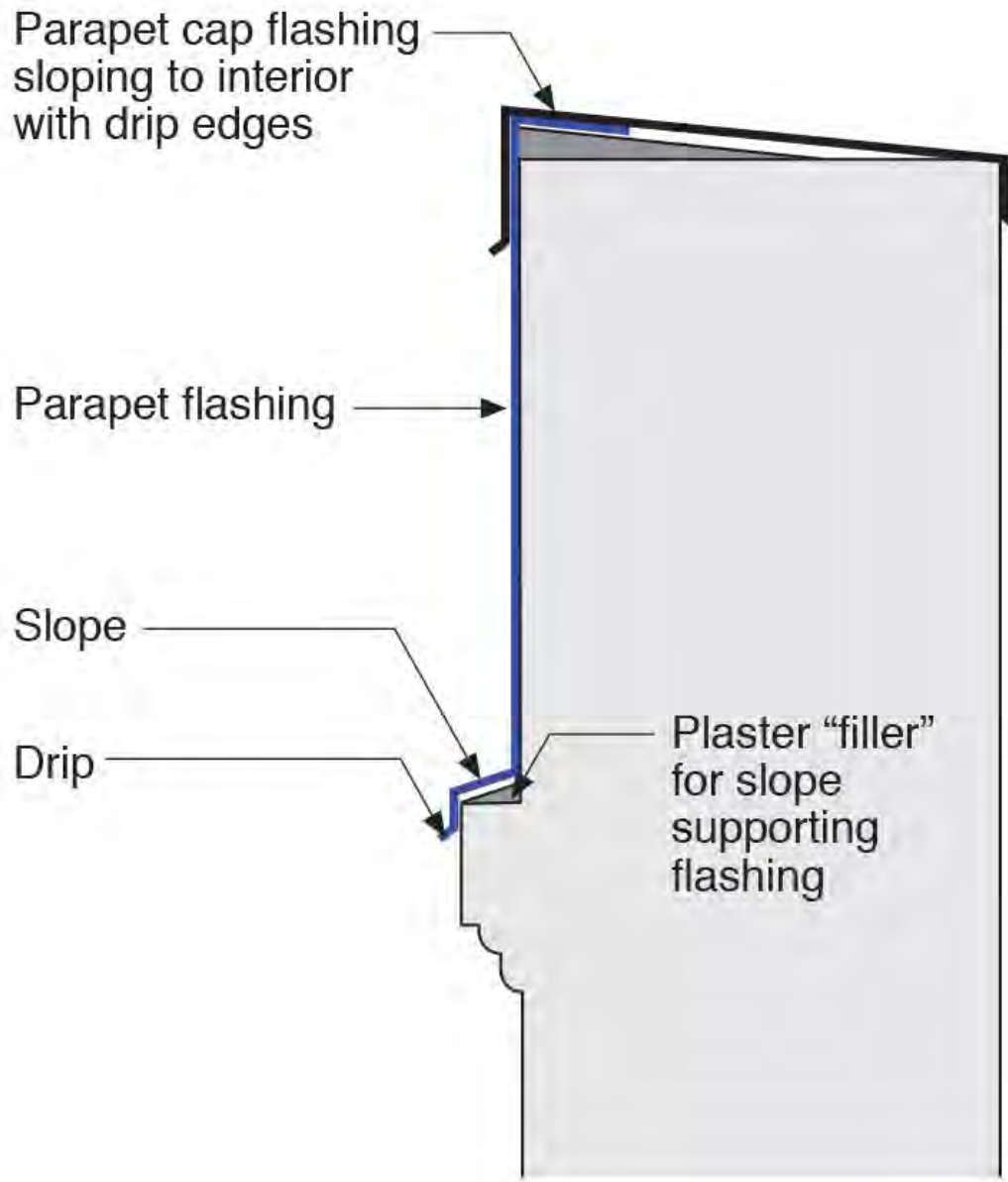
Reglet

Plaster "filler"
for slope

Cladding
"offset"



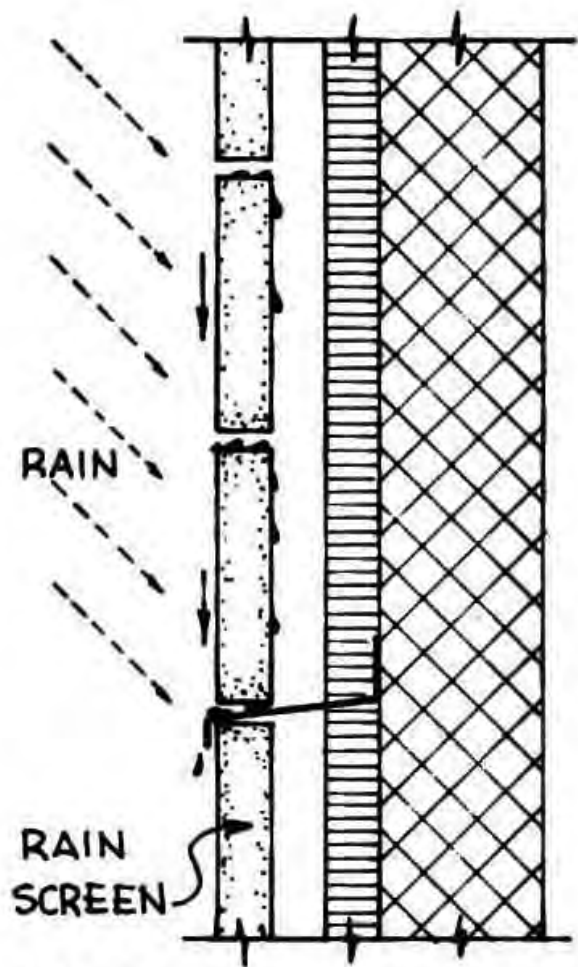




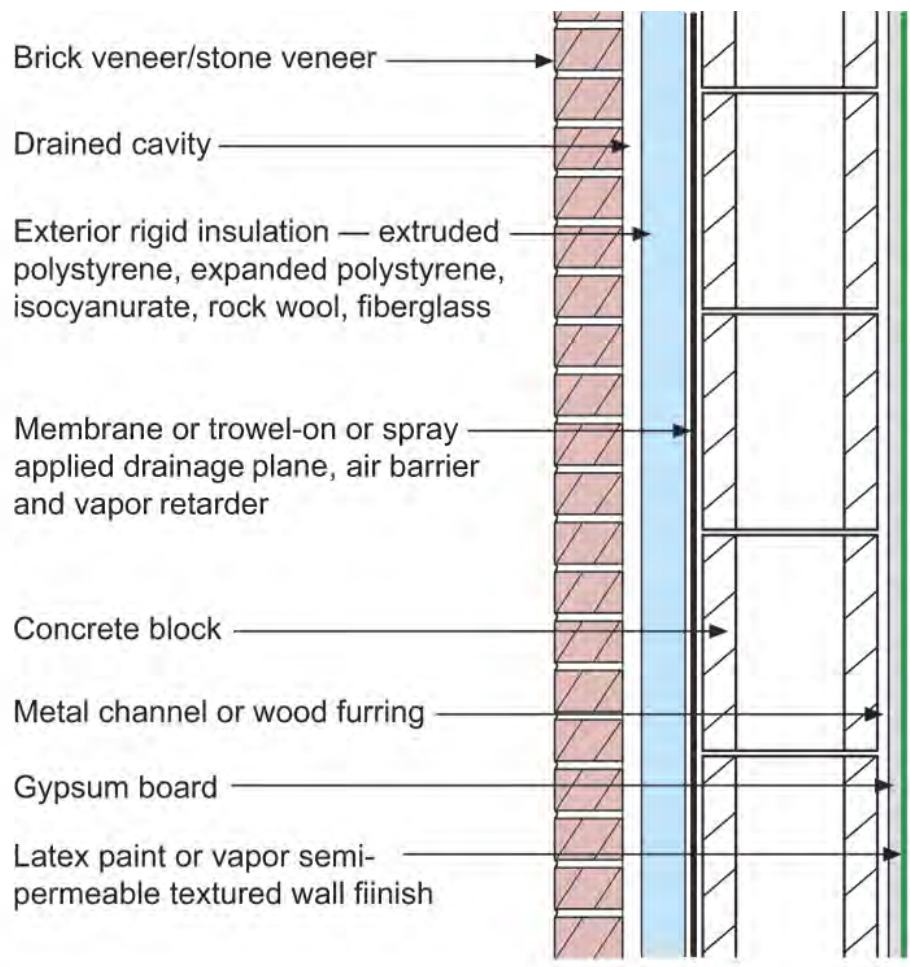




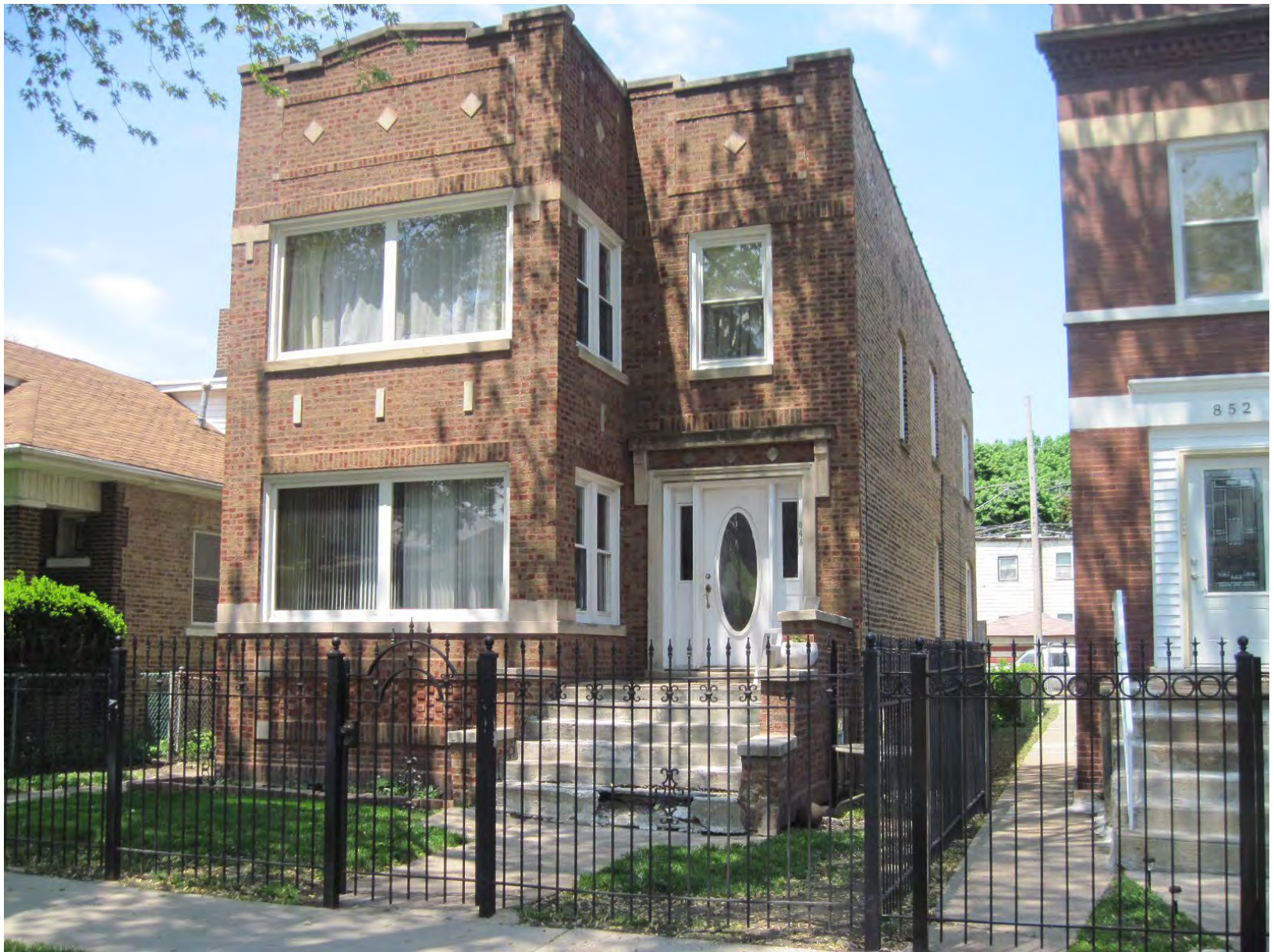




WATER THAT PENETRATES IS DIVERTED OUTWARD BY FLASHINGS



Vapor Profile





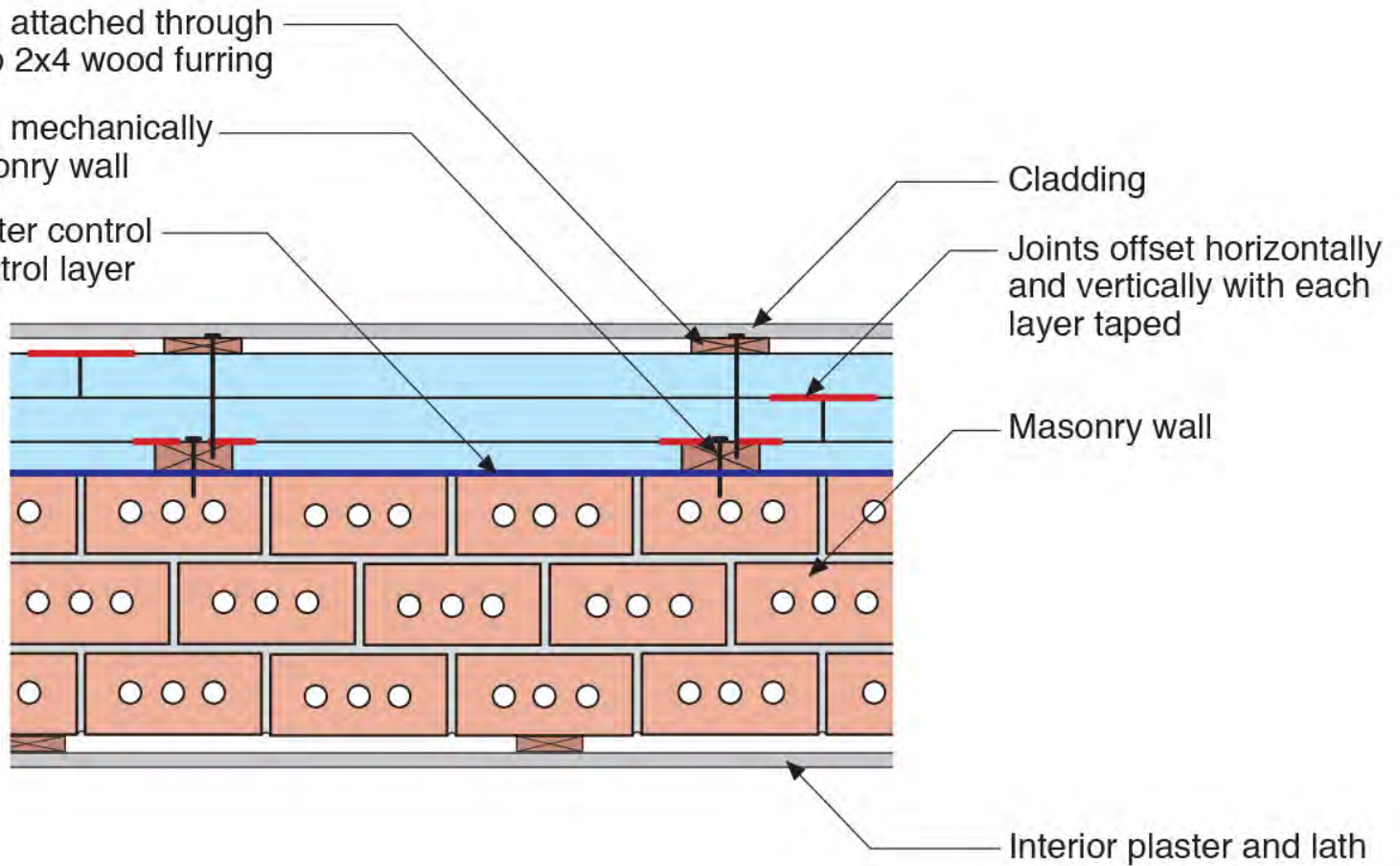




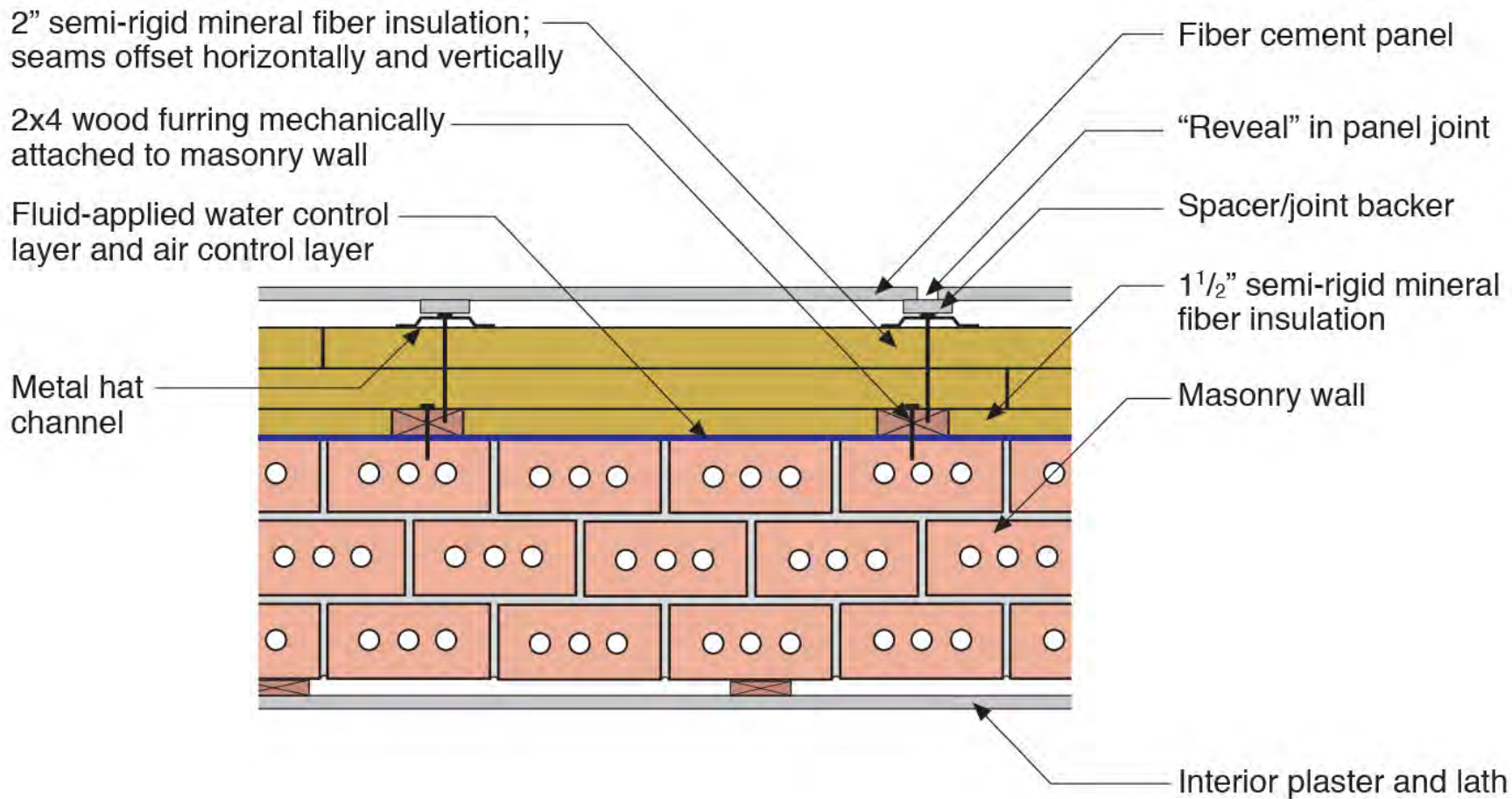
1x4 wood furring attached through rigid insulation to 2x4 wood furring

2x4 wood furring mechanically attached to masonry wall

Fluid-applied water control layer and air control layer



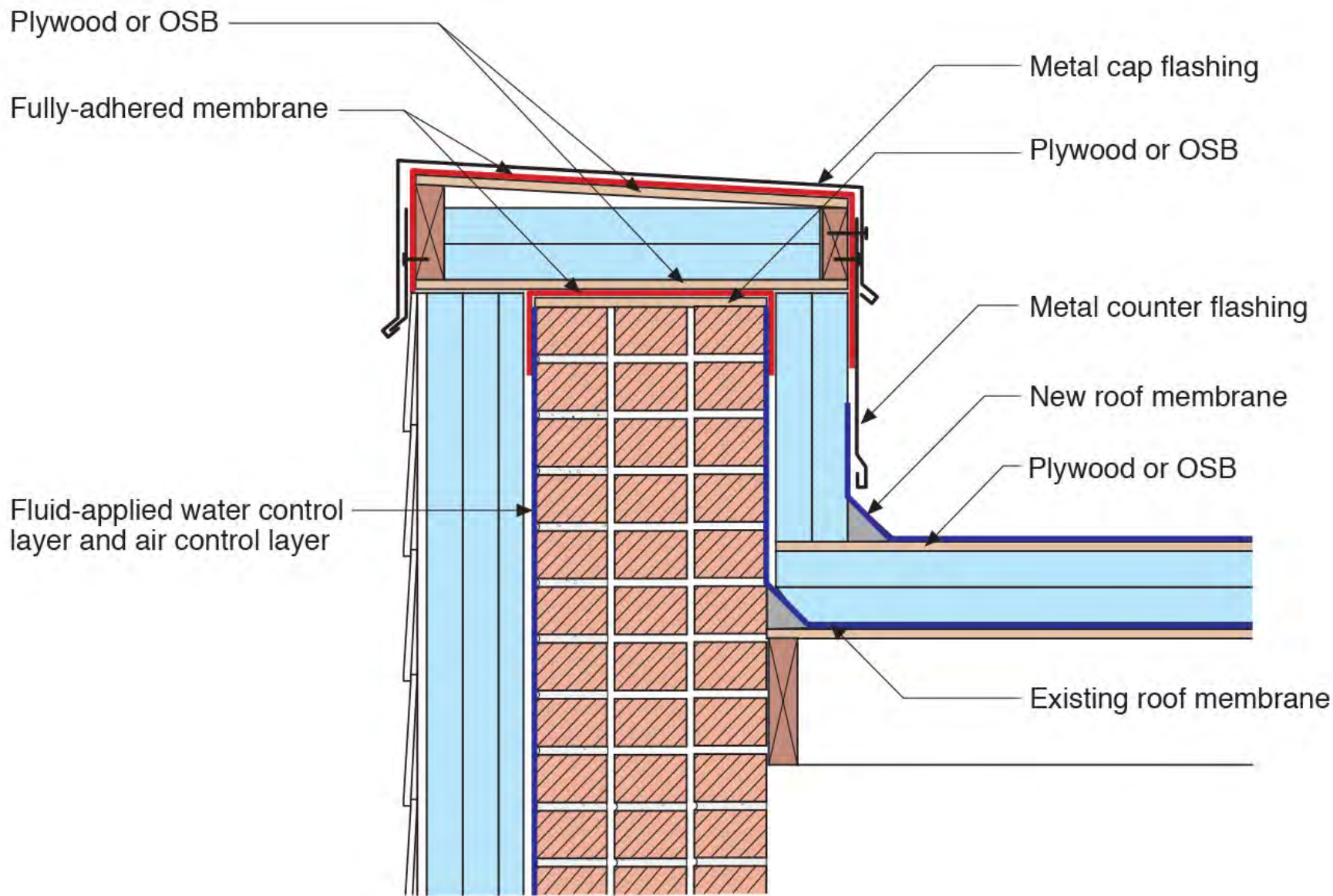
















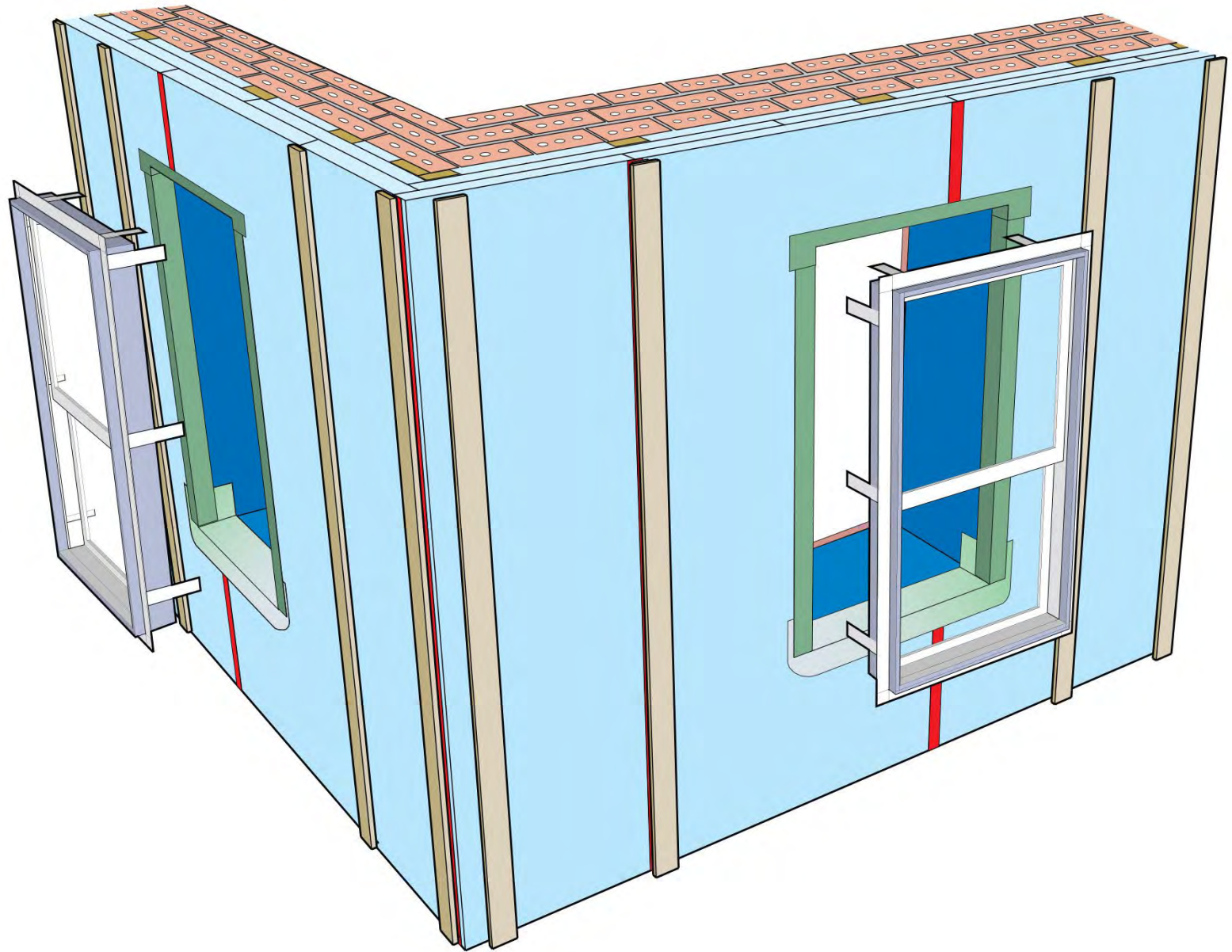


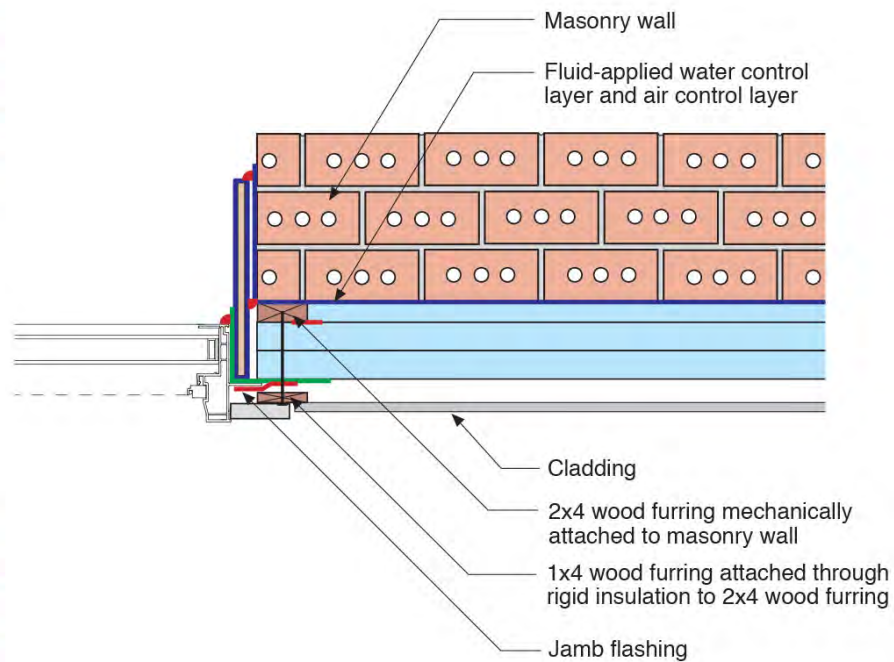
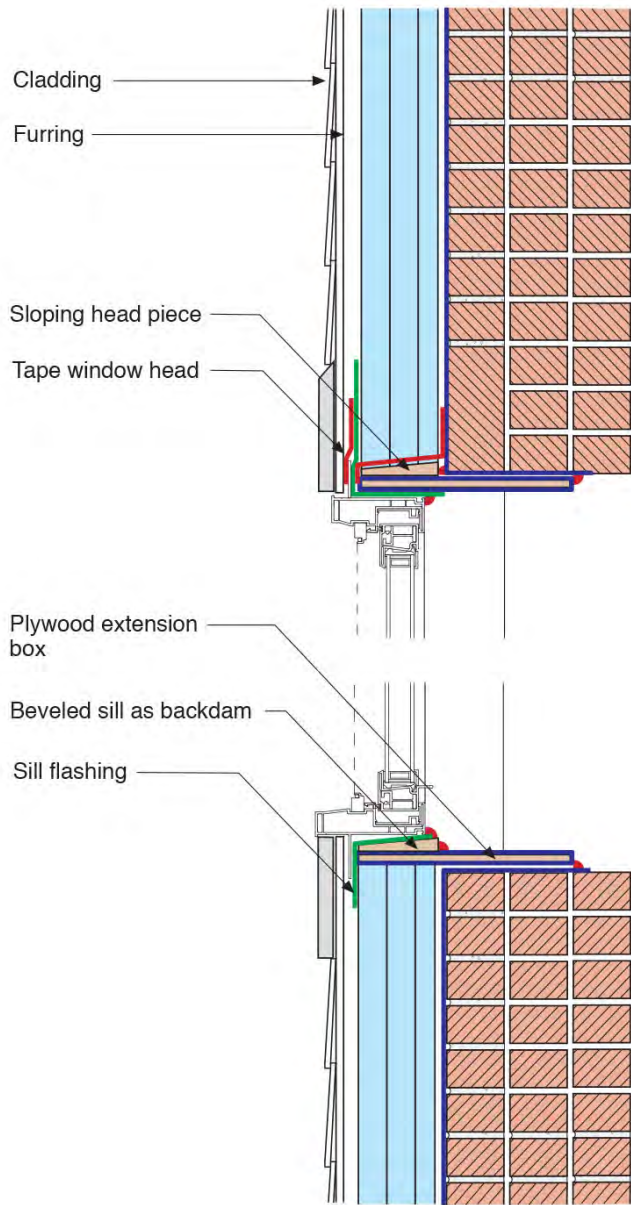






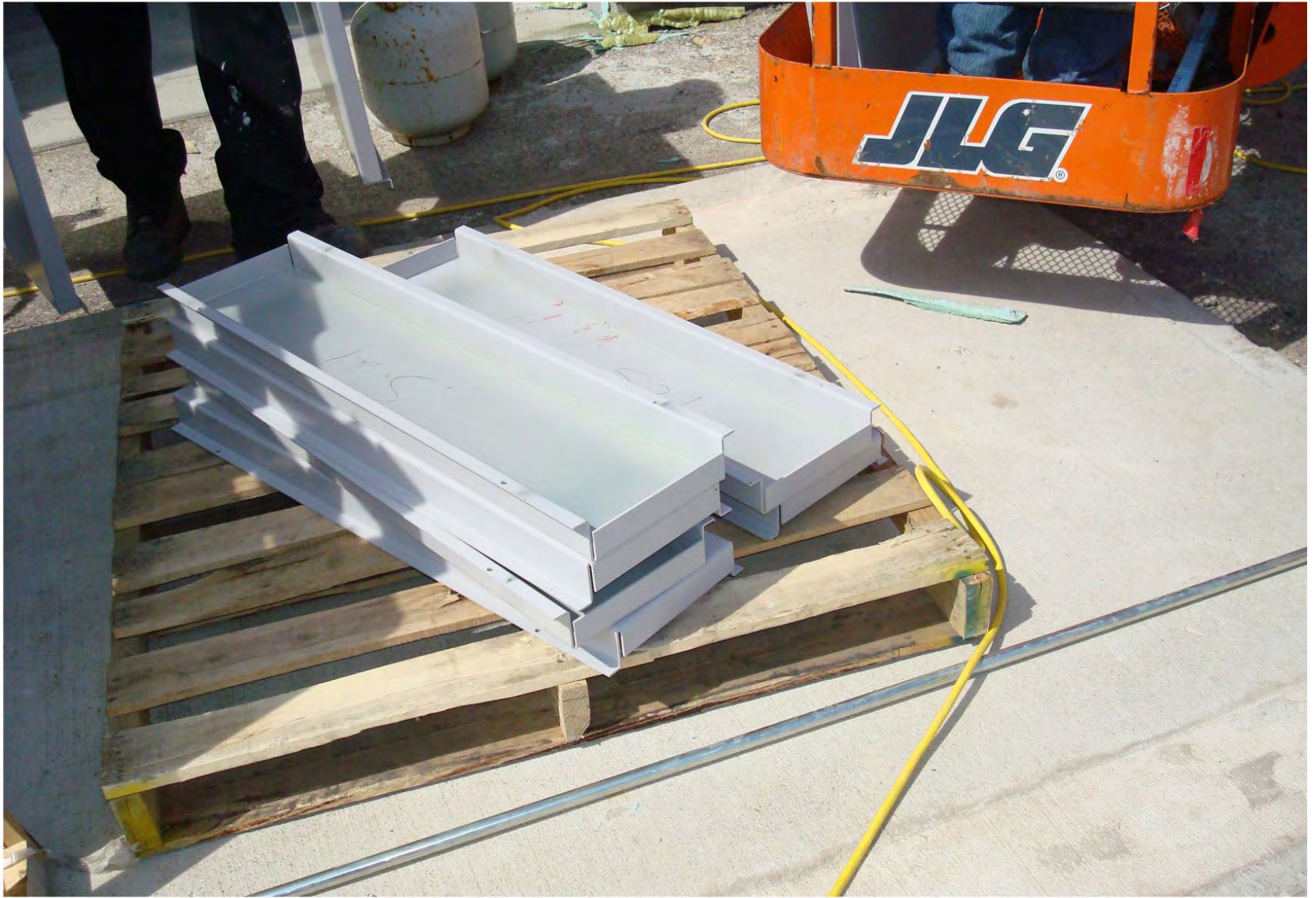












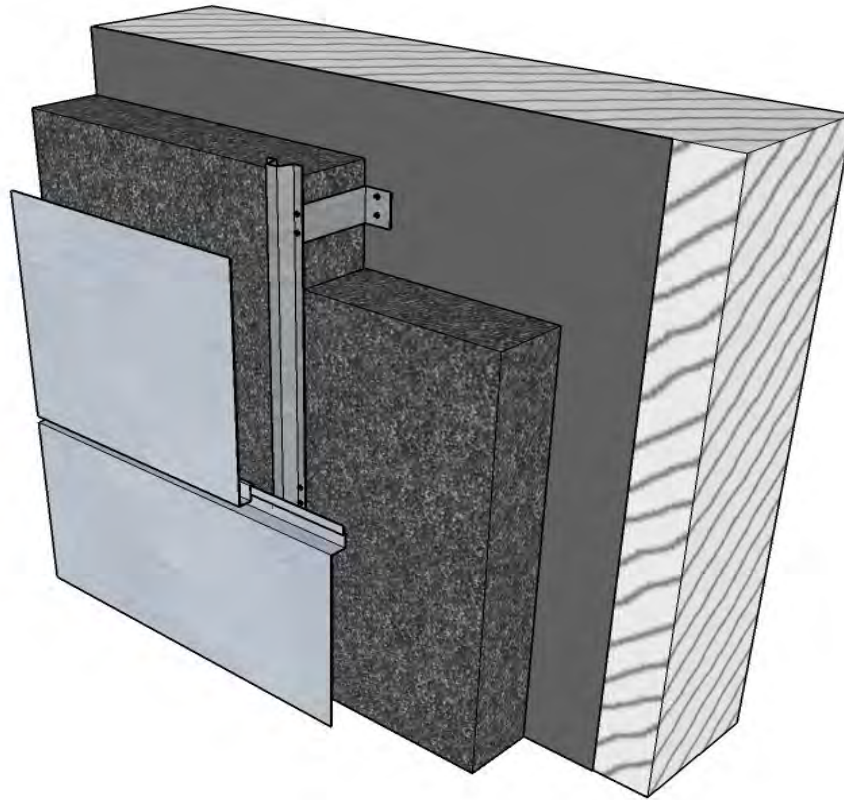


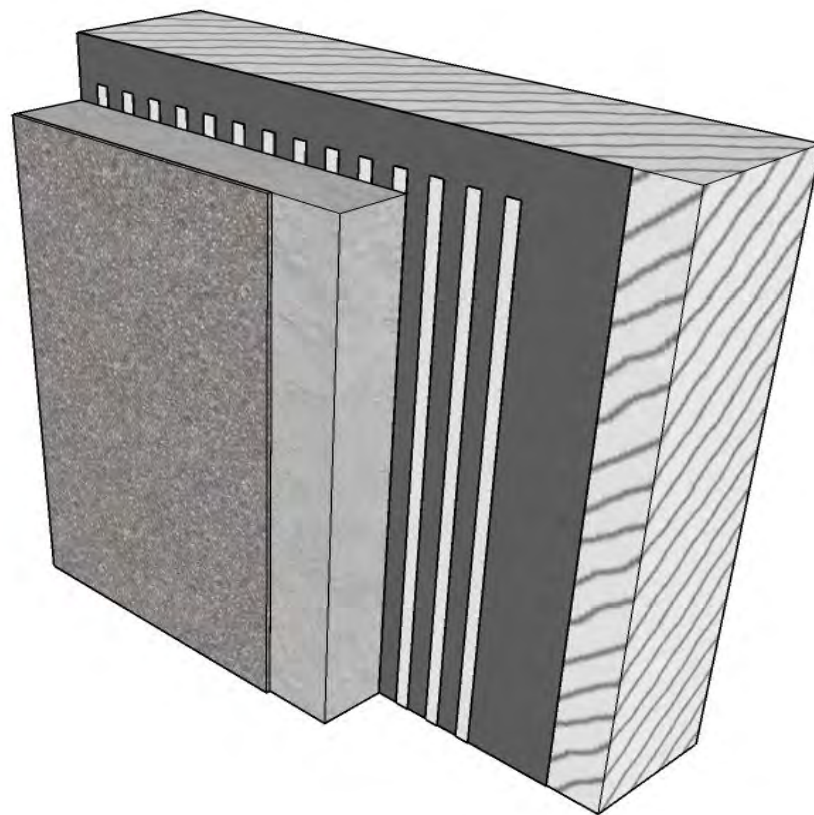


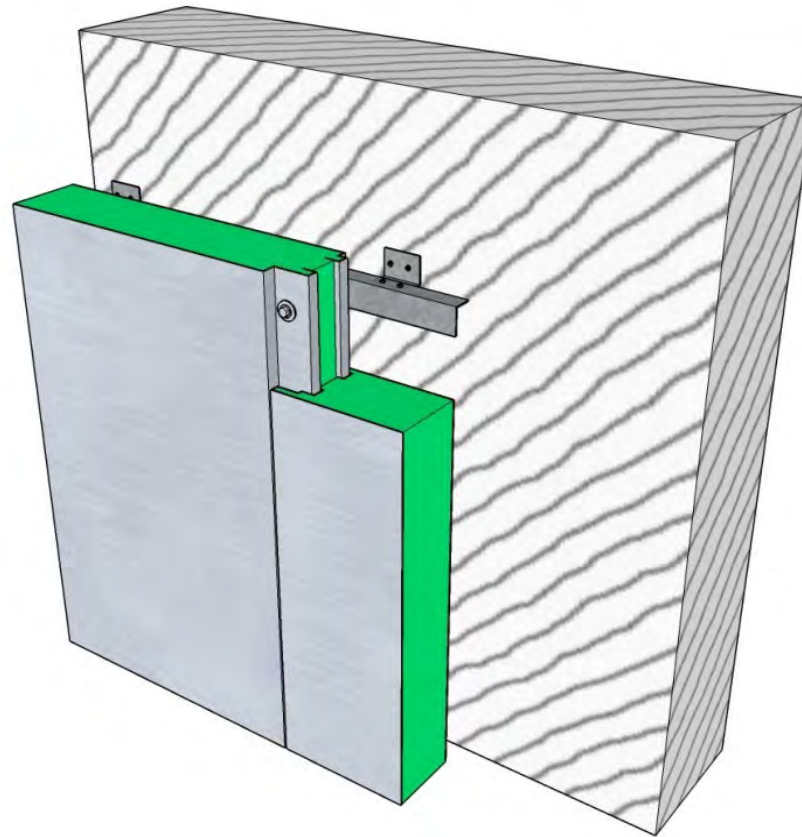


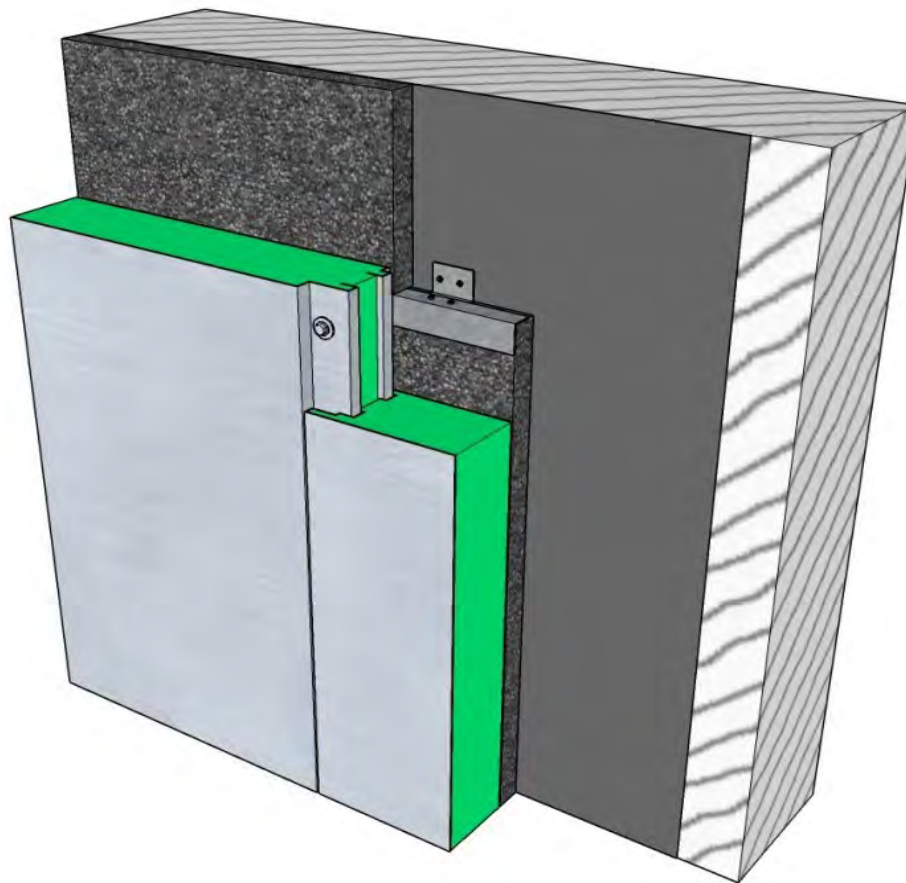


Overclad Options
Drained Cladding
Drained EIFS
Drained Panels



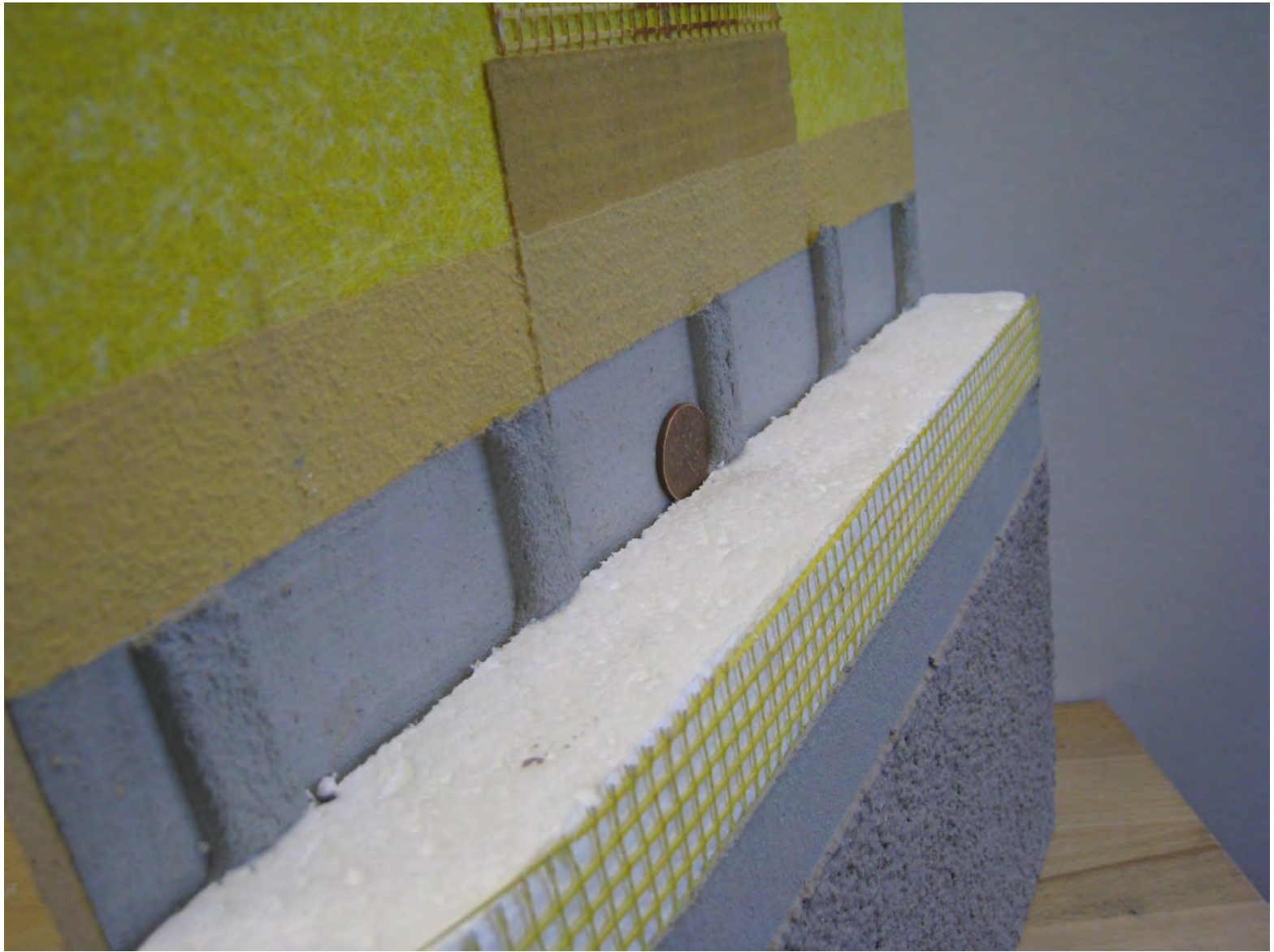
























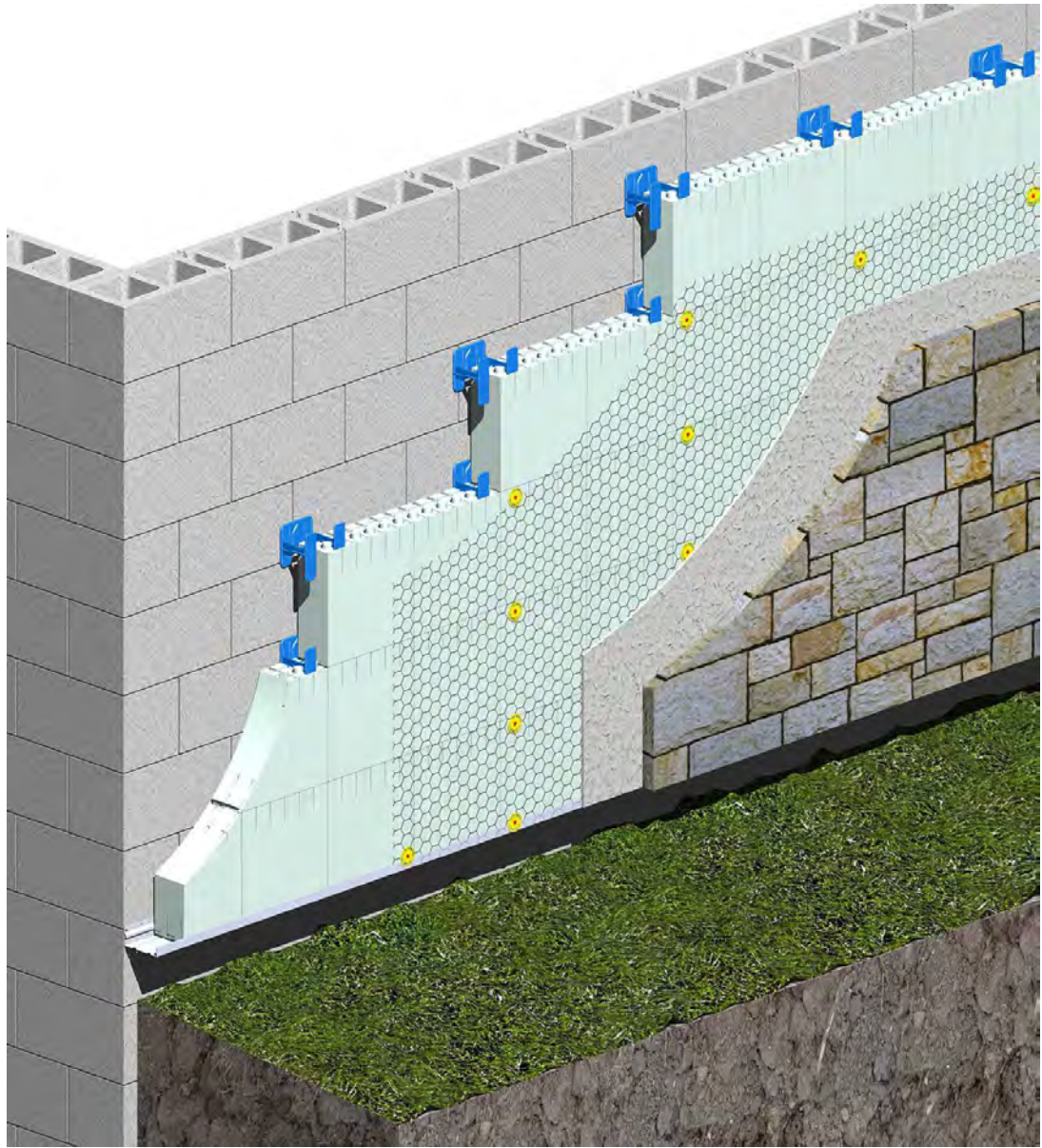


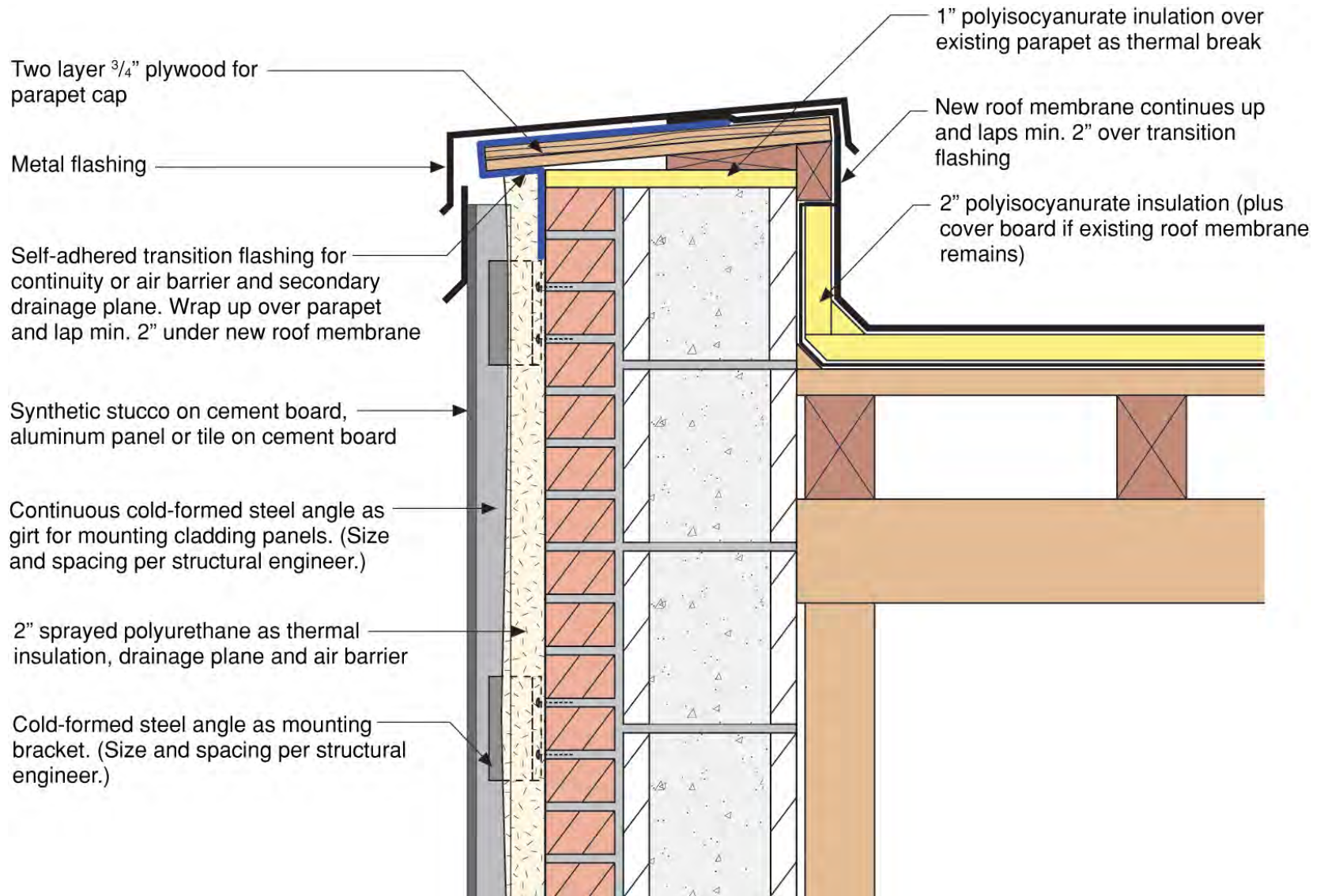
Before

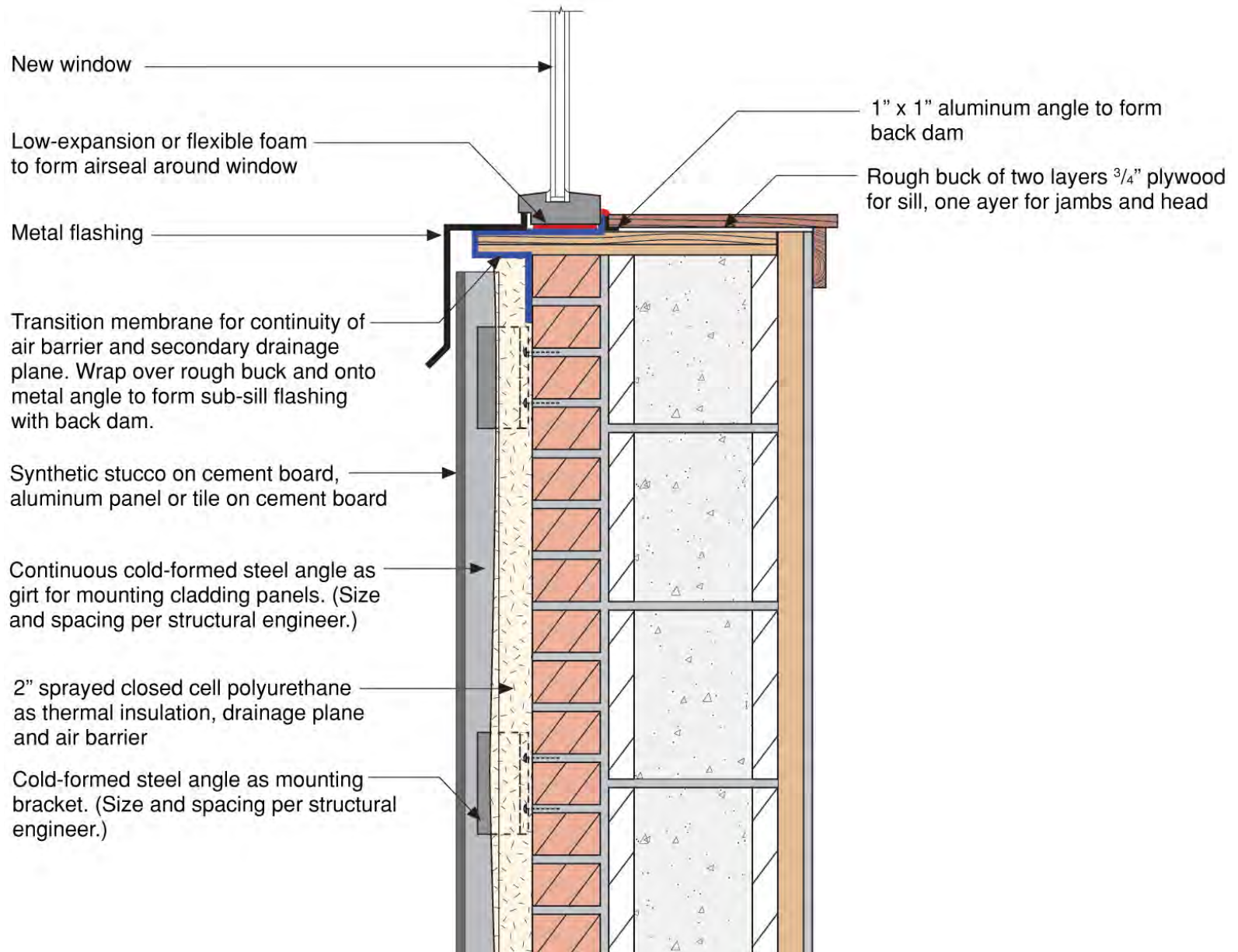


After









Synthetic stucco on cement board,
aluminum panel or tile on cement board

Continuous cold-formed steel angle as
girt for mounting cladding panels. (Size
and spacing per structural engineer.)

2" sprayed closed cell polyurethane
as thermal insulation, drainage plane
and air barrier

Cold-formed steel angle as mounting
bracket. (Size and spacing per structural
engineer.)

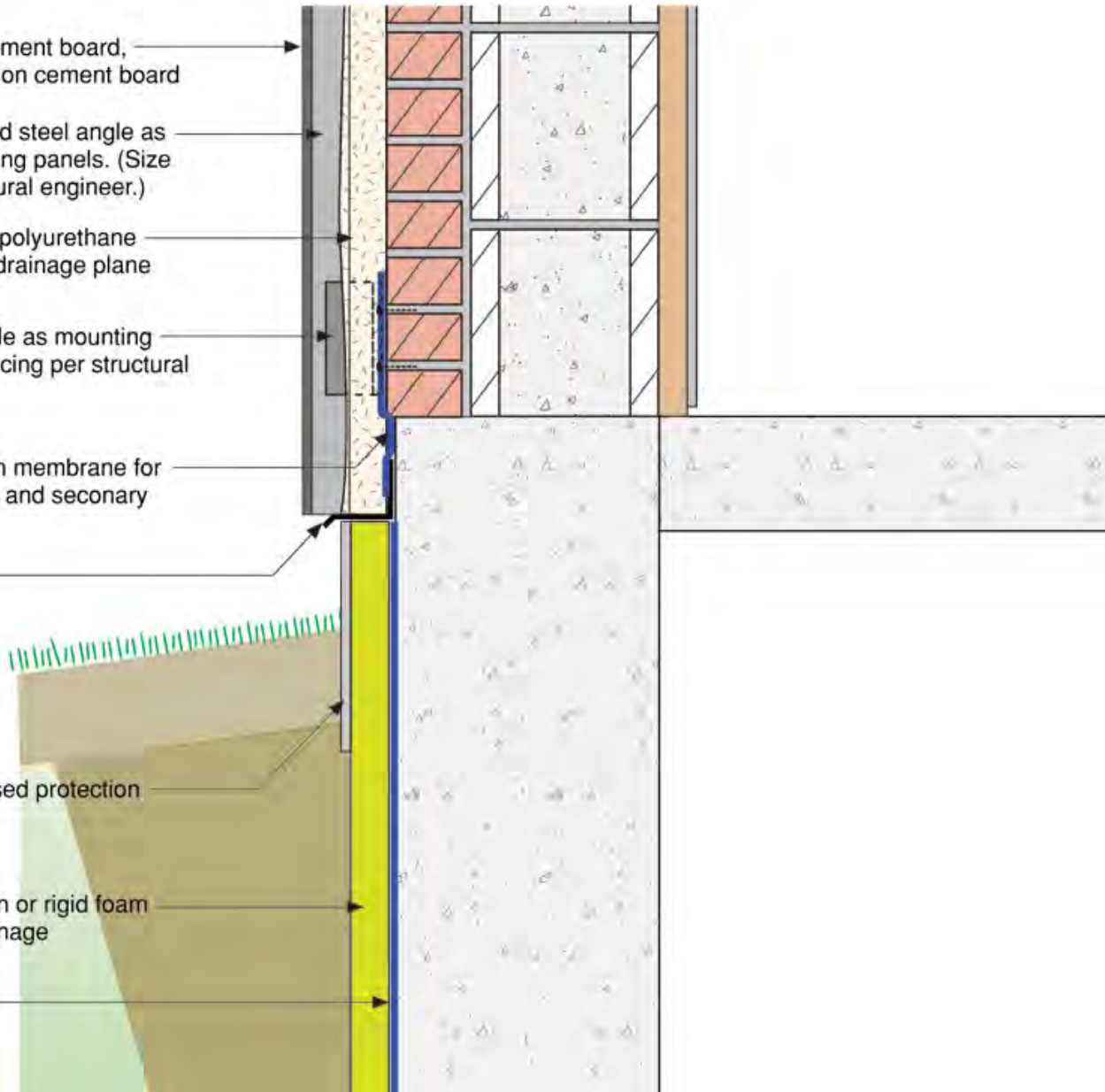
Self-adhering transition membrane for
continuity or air barrier and secondary
drainage plane

Metal flashing

Parging or cement-based protection
board

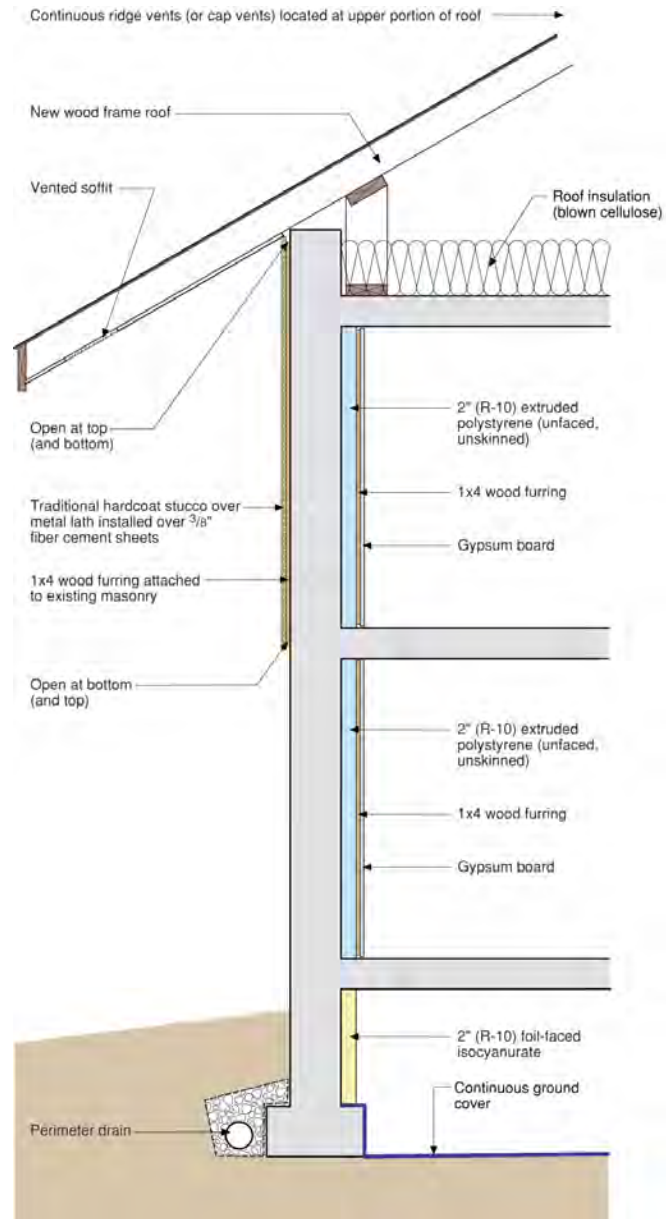
Free draining insulation or rigid foam
over dimple sheet drainage

Dampproofing







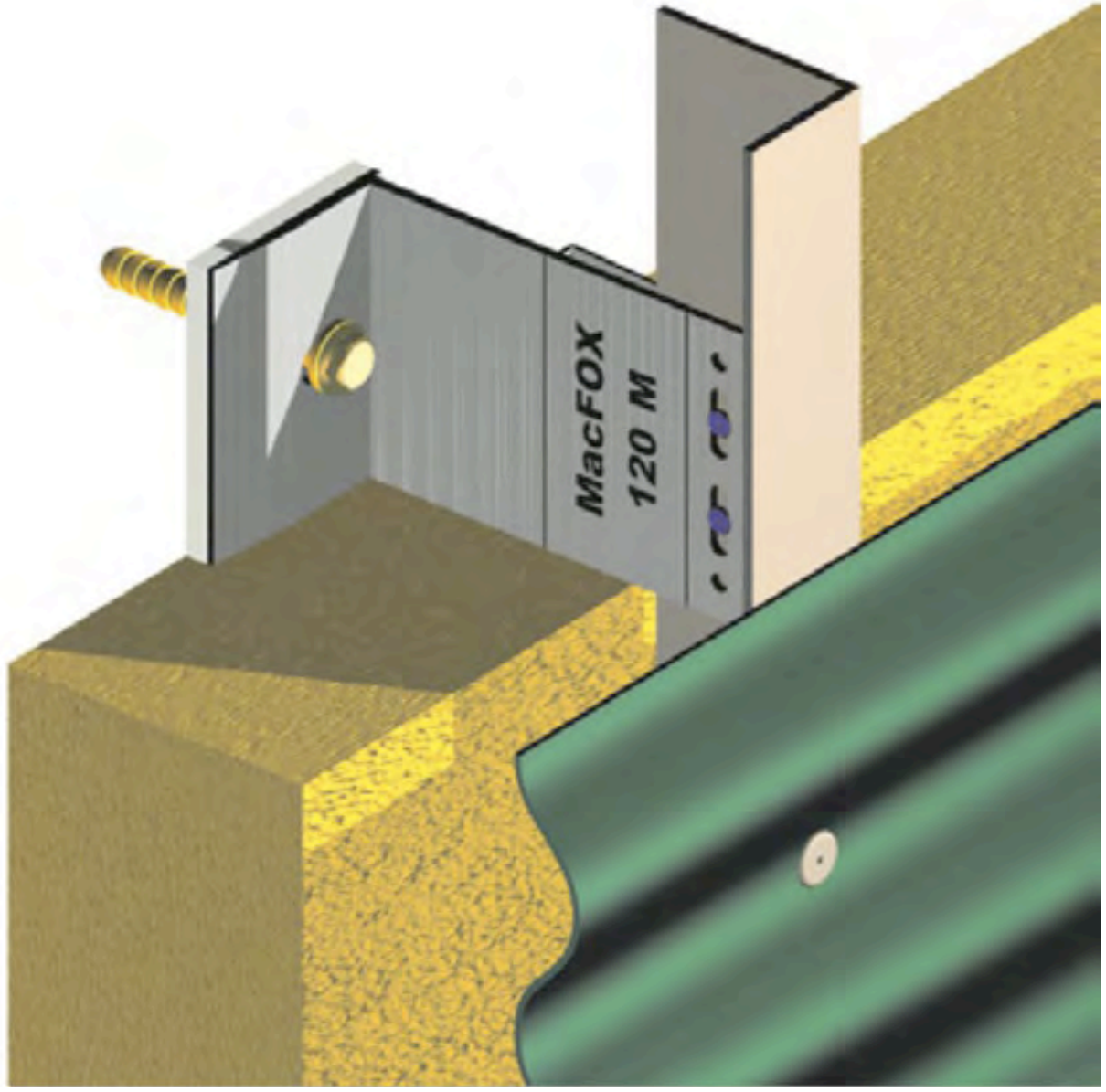






Fiber Cement











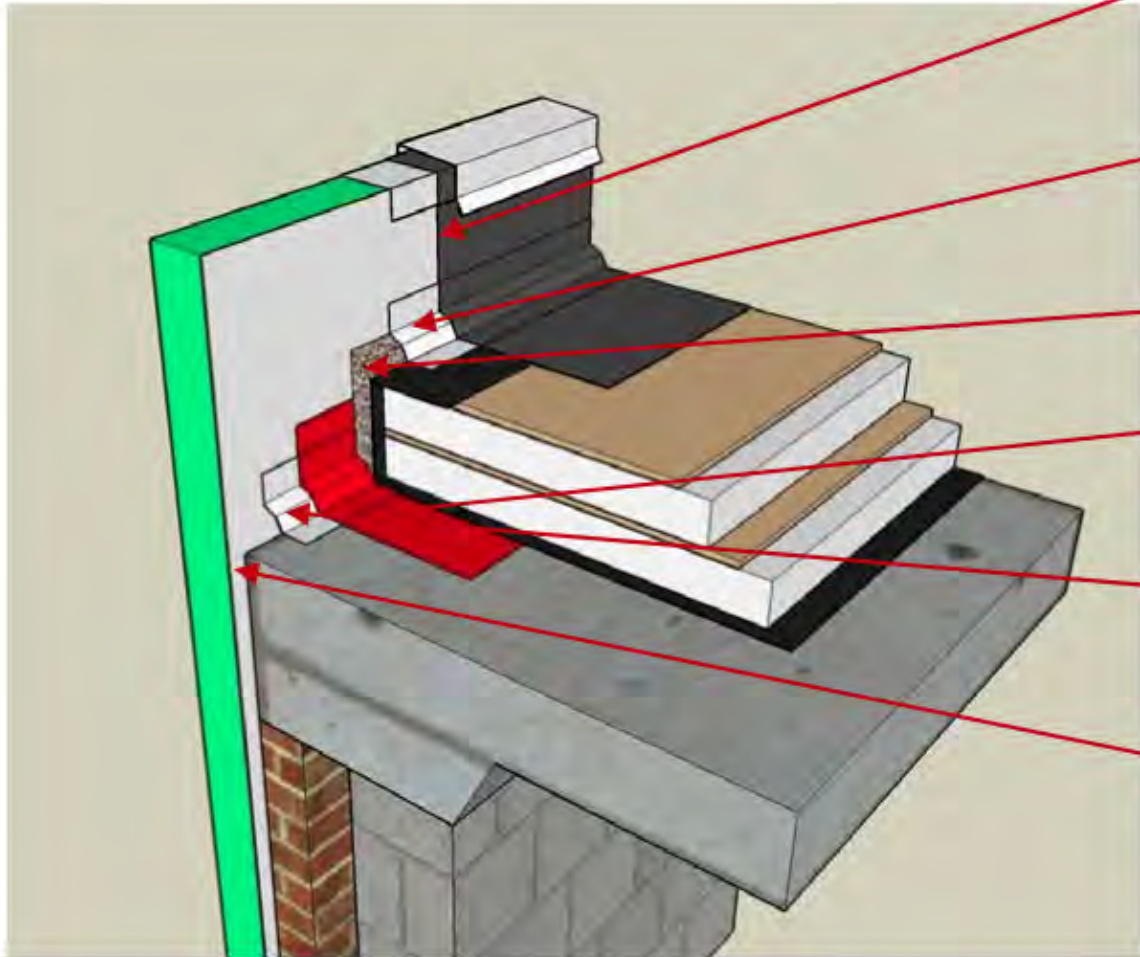


KS1000 MM
with AWP Top Hat
Option A (Recess)

KS1000 MR
with AWP Top Hat
Option A (Flush)

KS1000 WV
with AWP Top Hat
Option A (Flush)

**Parapet detail with panel held off wall (~1" to 2")
to allow for variations in existing building wall
alignment.**



Membrane up and over
panel parapet

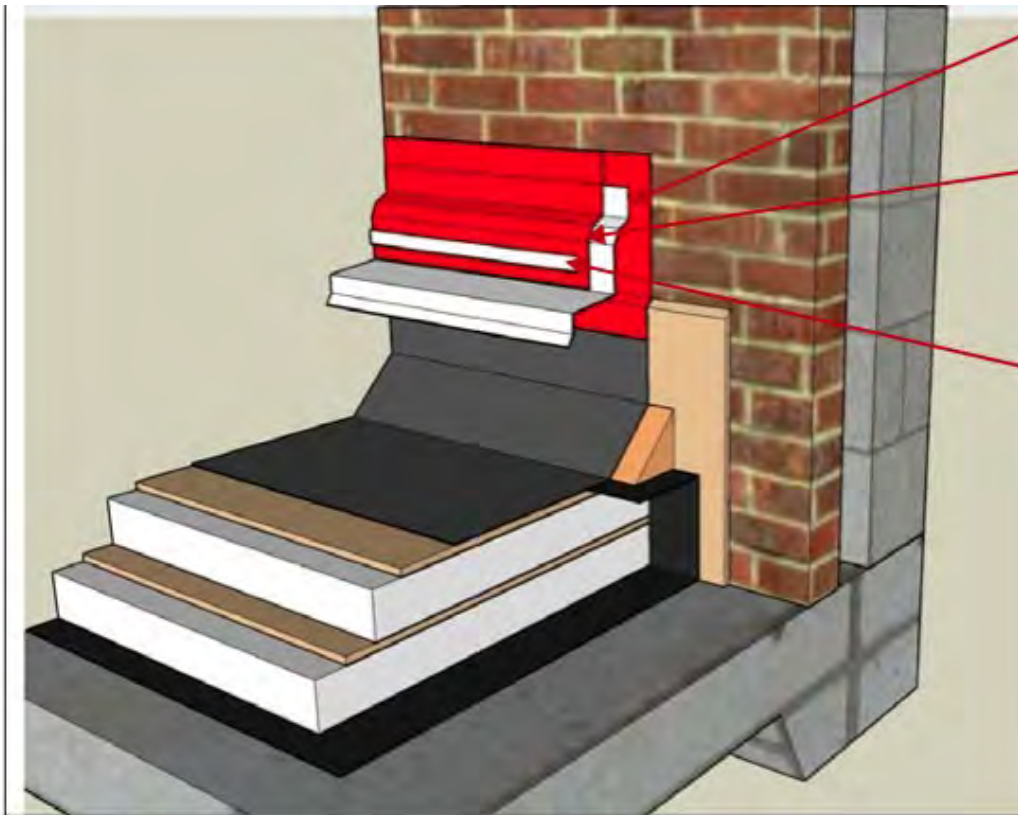
Bent sheet metal membrane
support flashing

Mineral fiber insulation

Air barrier transition
membrane

Bent sheet metal membrane
support flashing

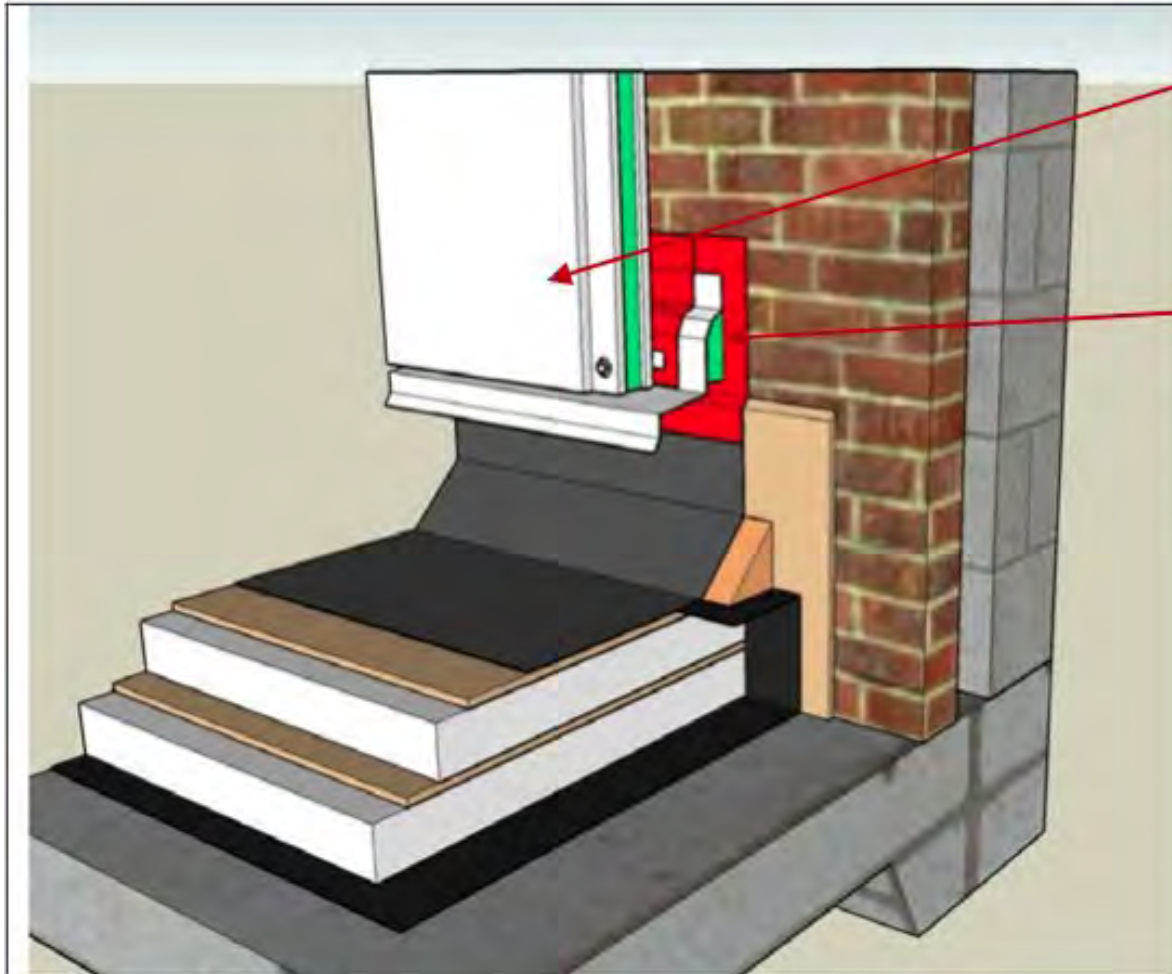
1 to 2" gap between slab
edge and back of panel



Metal curb flashing installed over panel anchor

Membrane flashing sealed to air barrier transition membrane

Sealant to seal between membrane flashing and back of panel



Install panel attached back to anchor, clamping assembly together

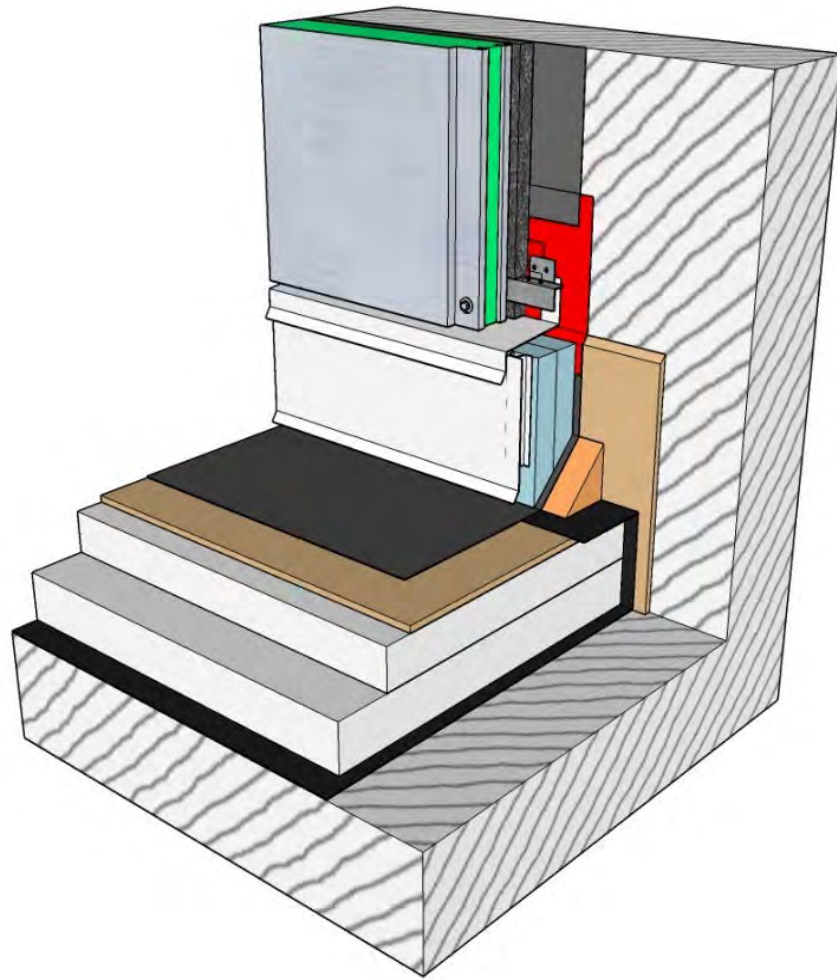
Closed cell spray urethane foam air seal and insulation for condensation control (not sure if this is needed).

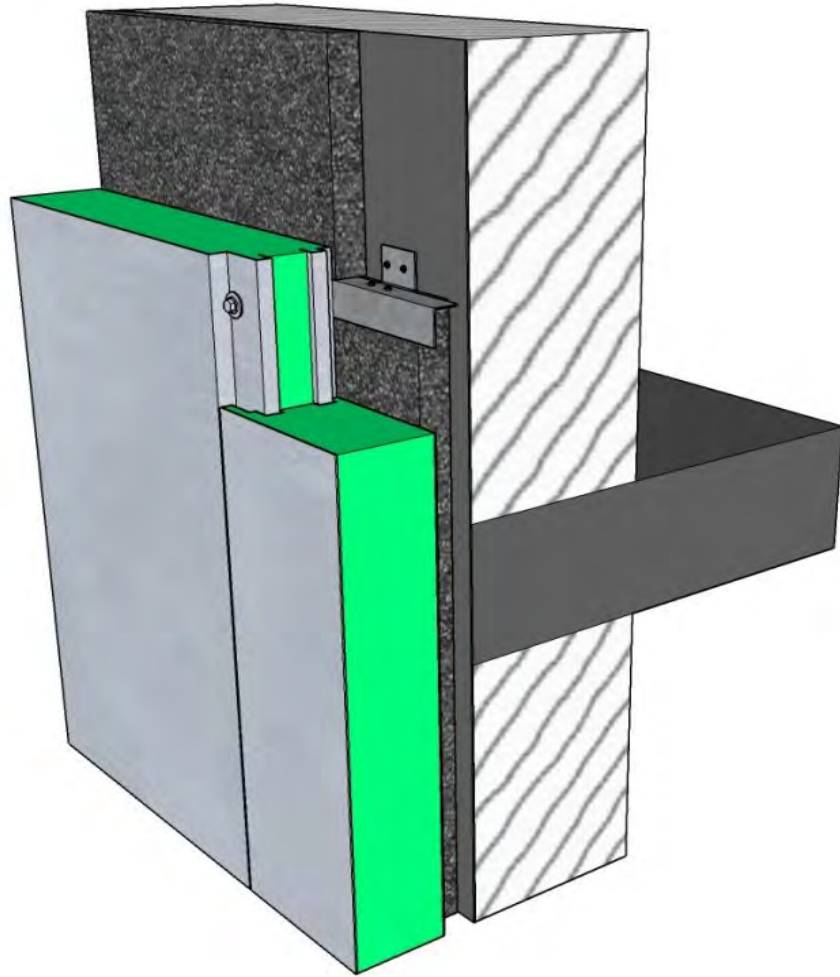
Castle Square DER

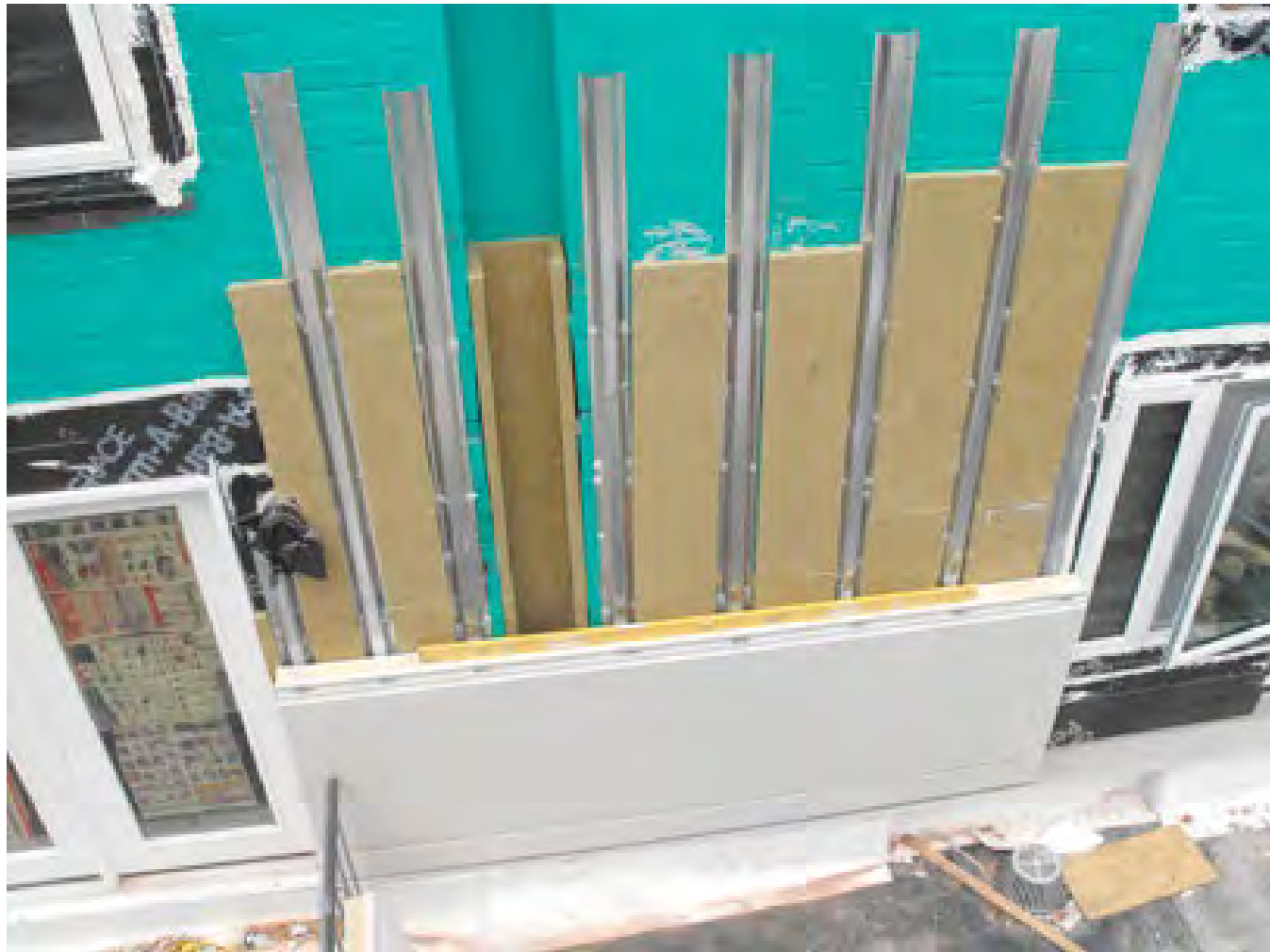


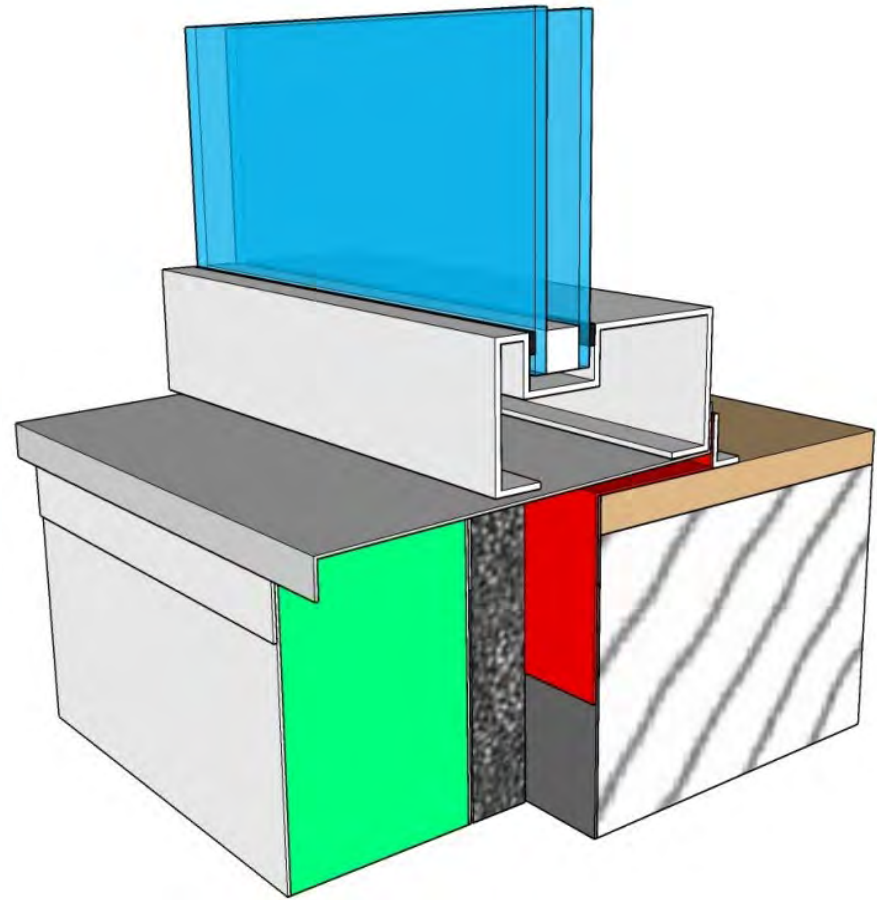
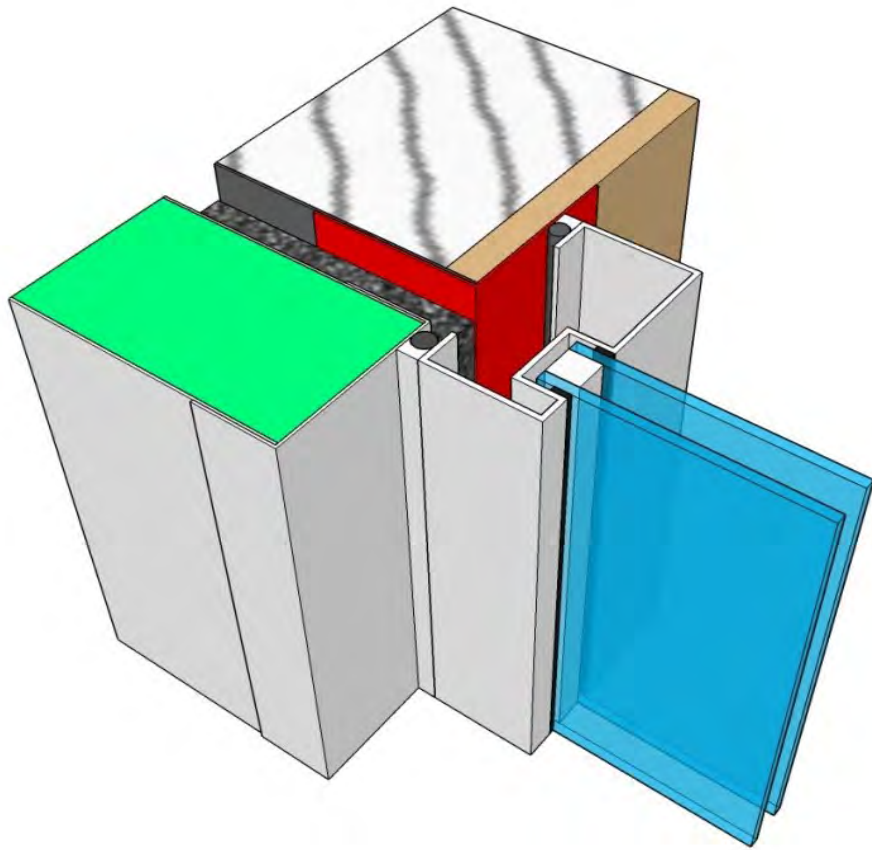
- Enclosure Option Selection
 - IMP (as an insulated cladding)
 - Moderate cost
 - Able to address compartmentalization and transitions
 - Had to convince manufacturer that it was OK to do this







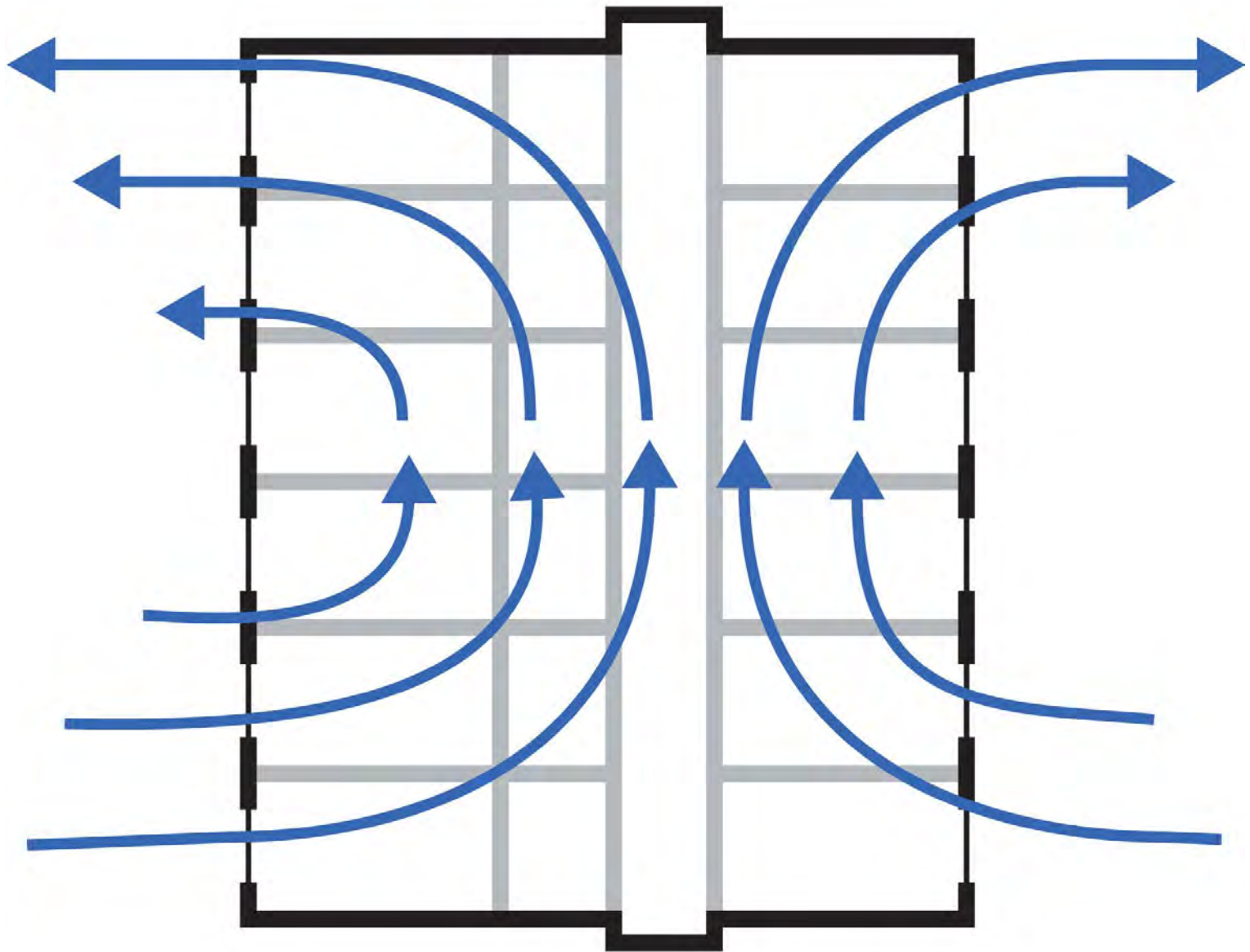


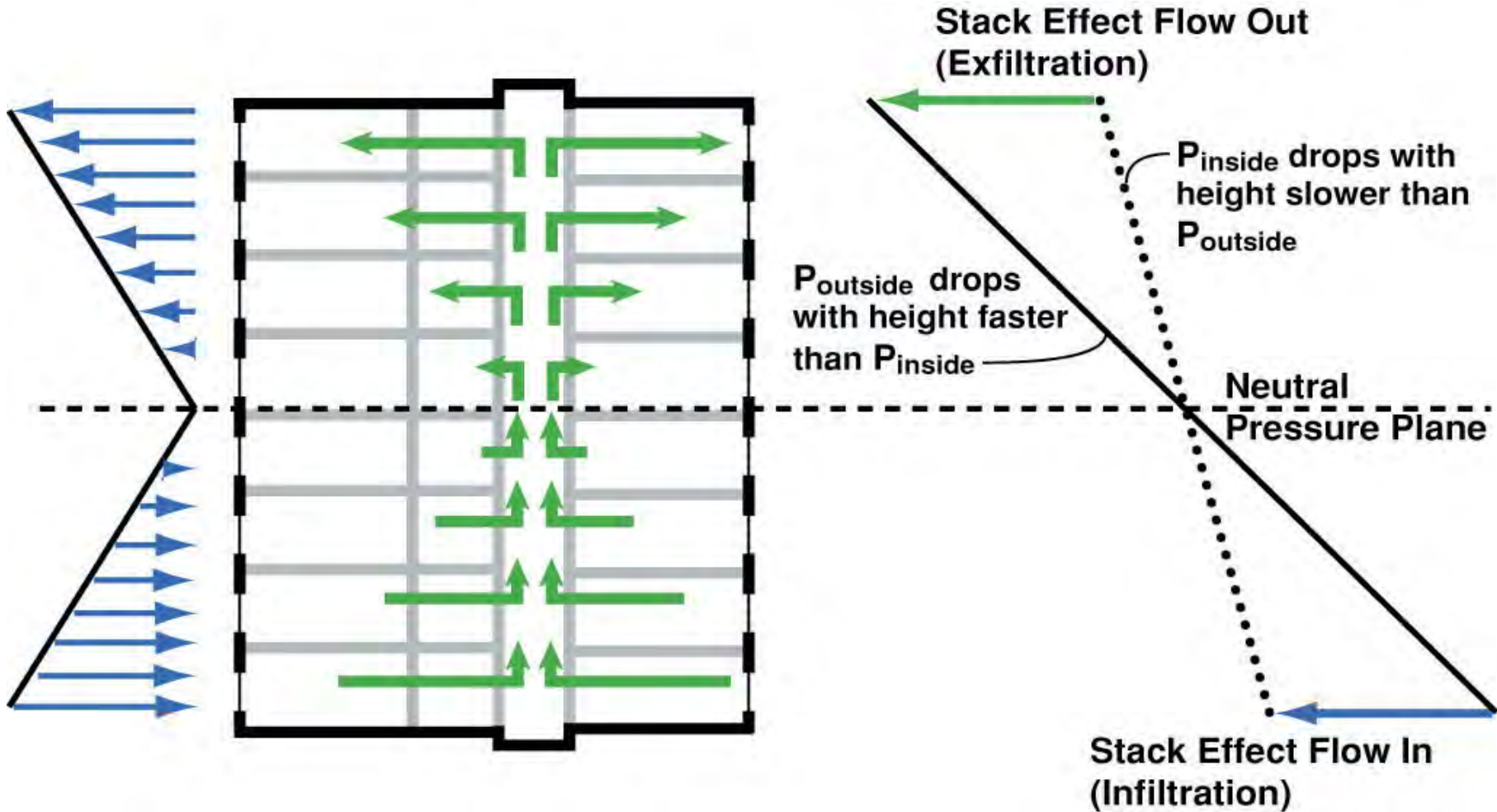




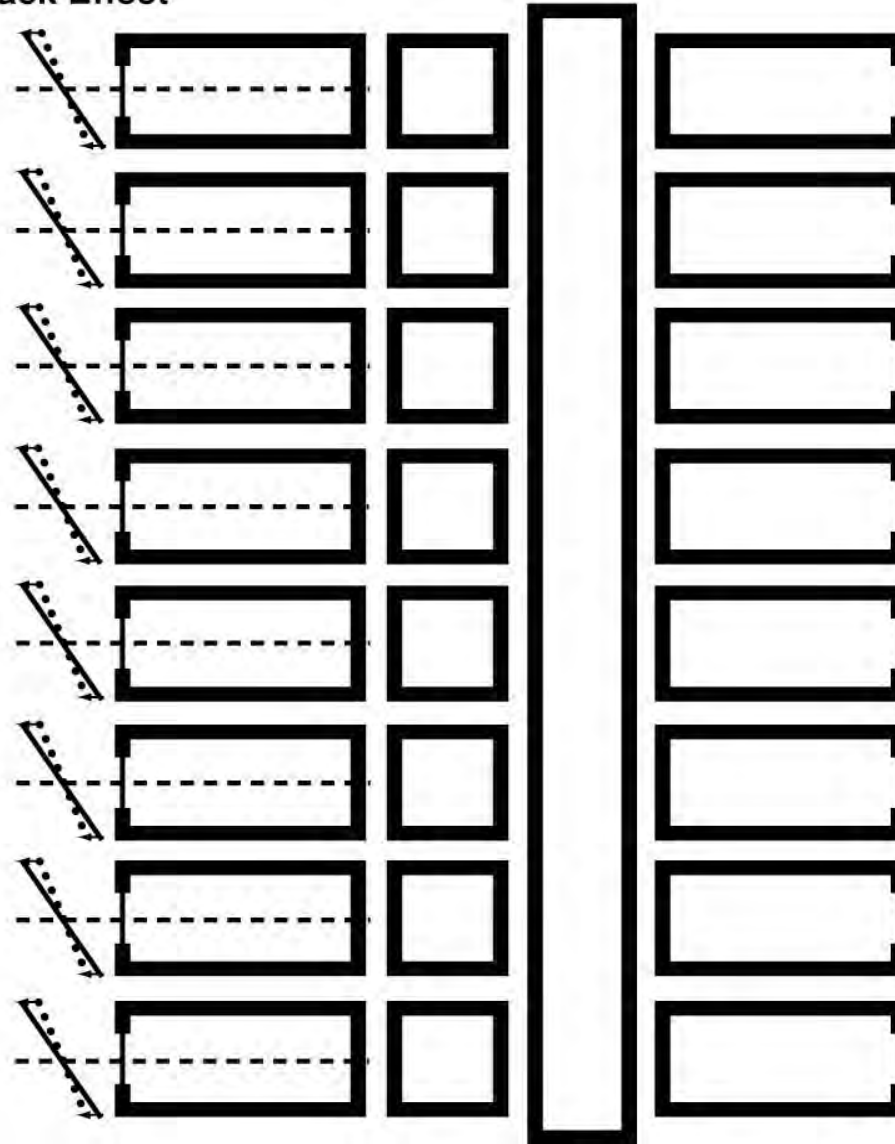


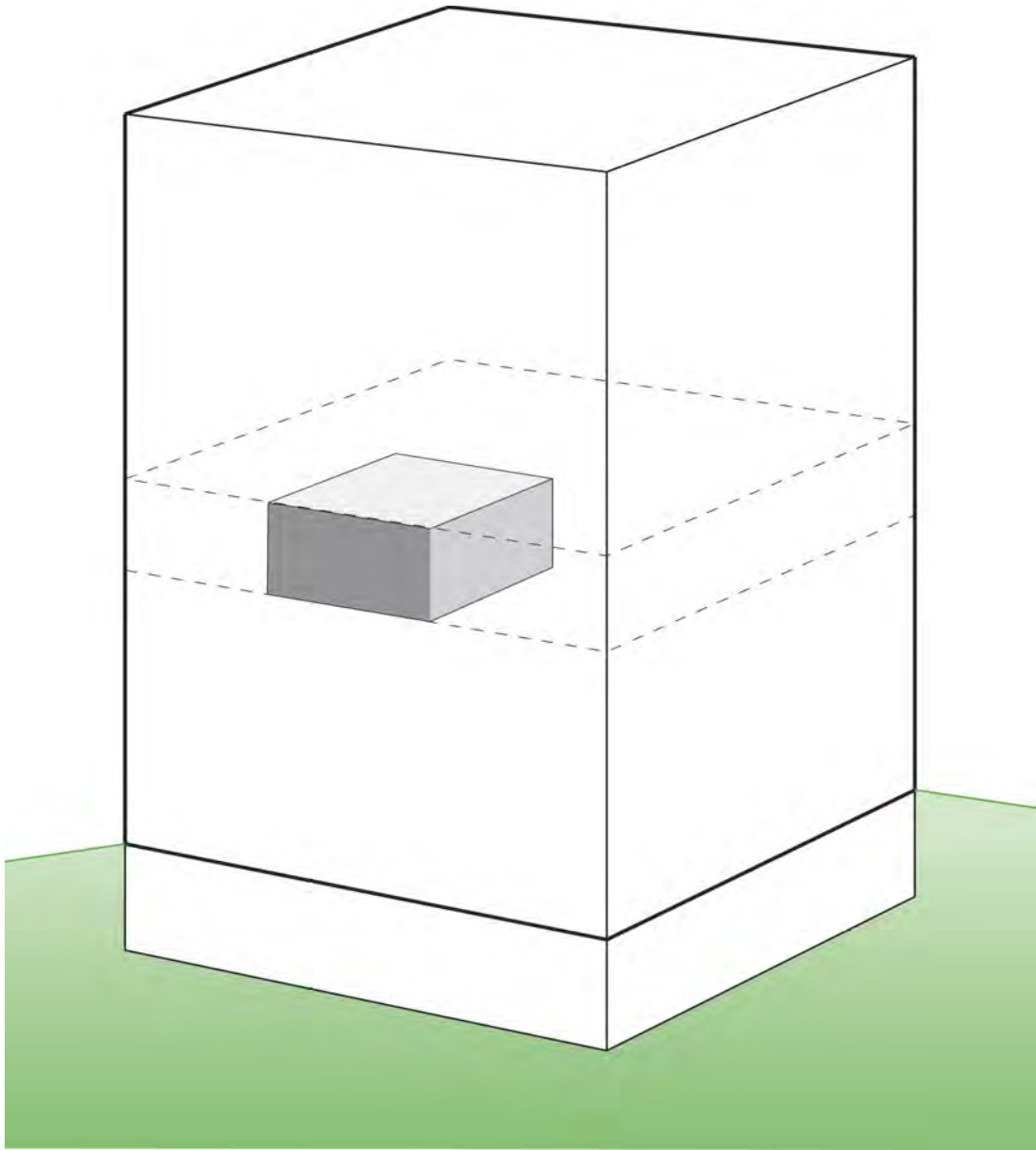
Air Flow Compartmentalization

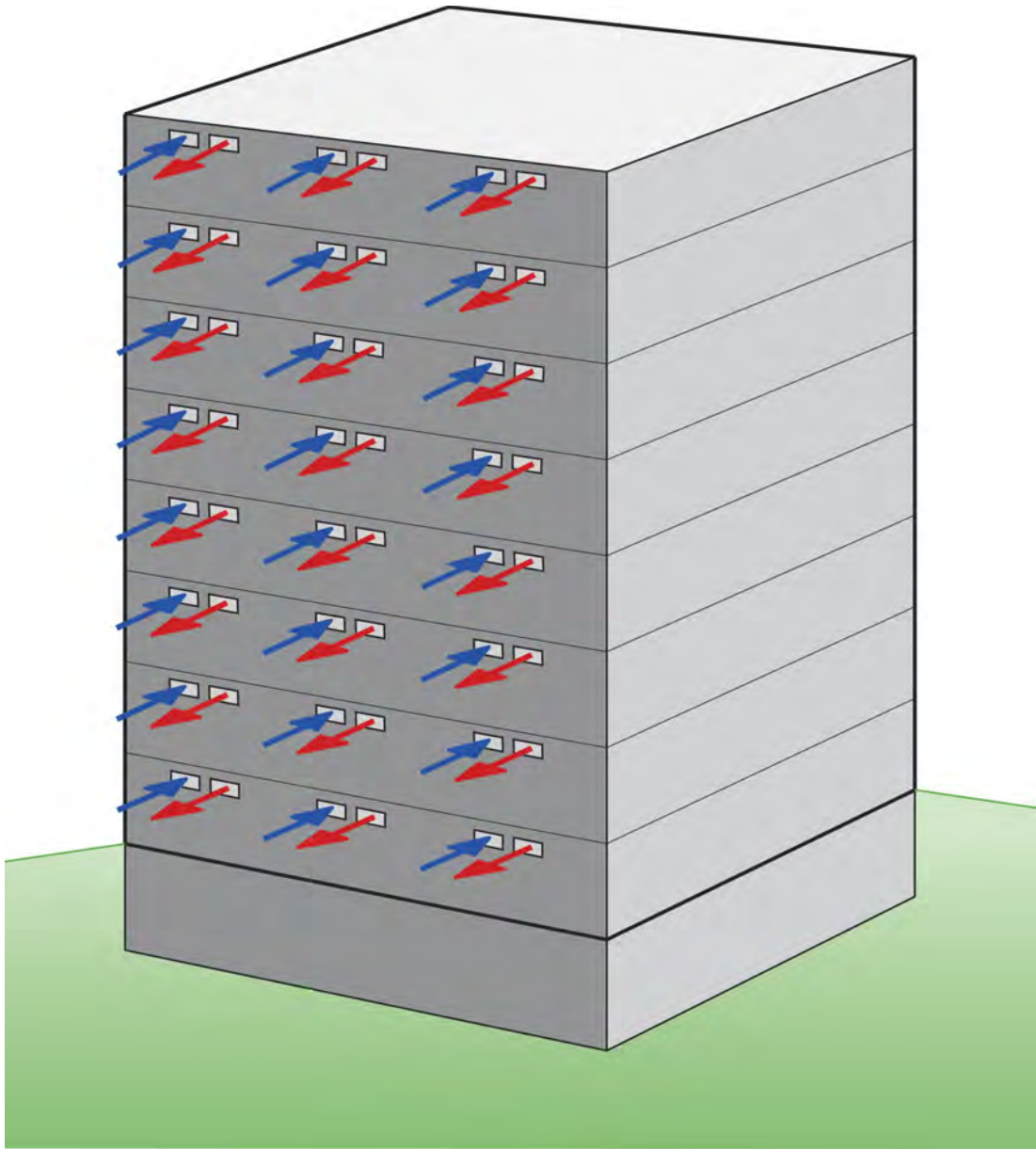




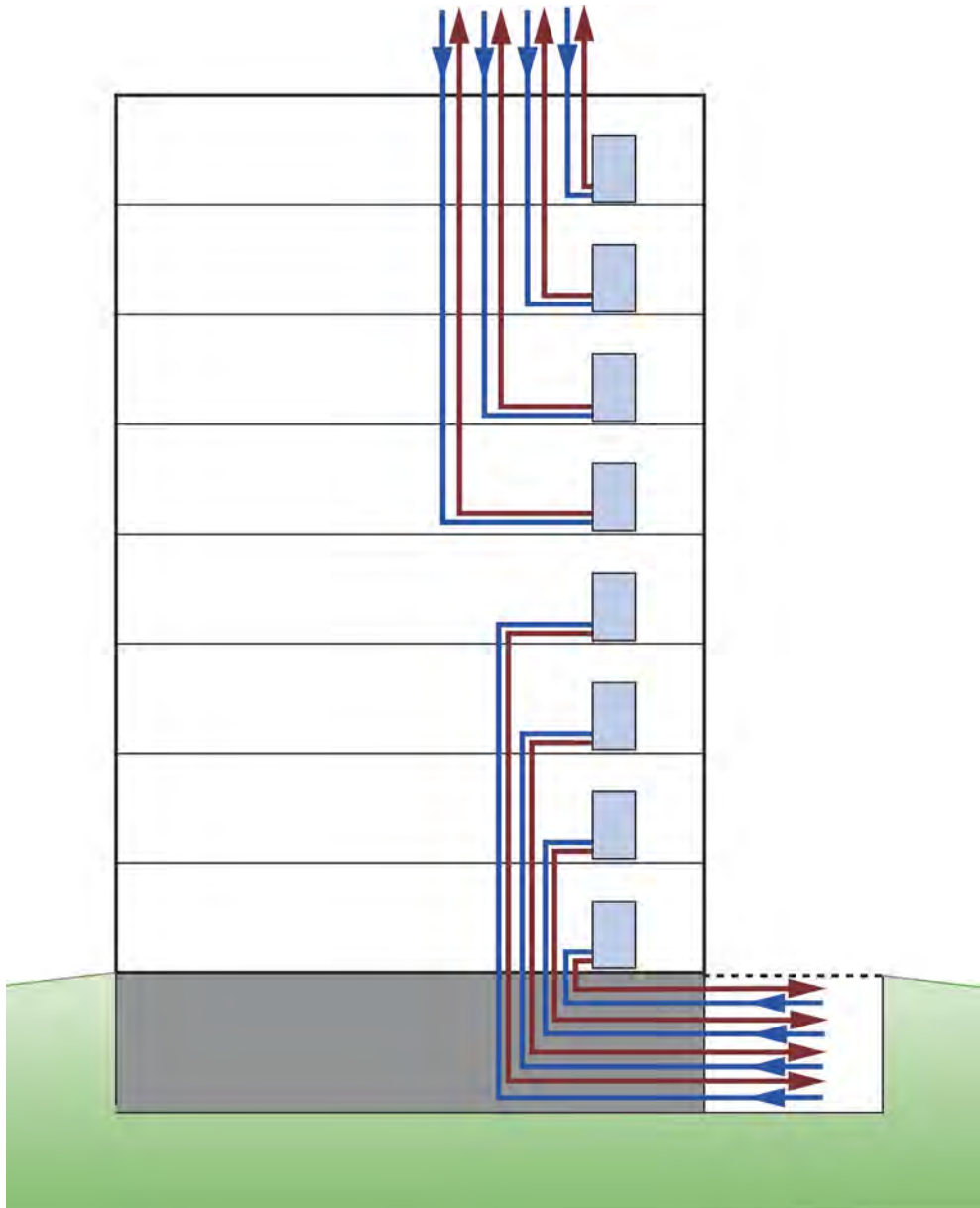
Reduced Individual Unit Stack Effect

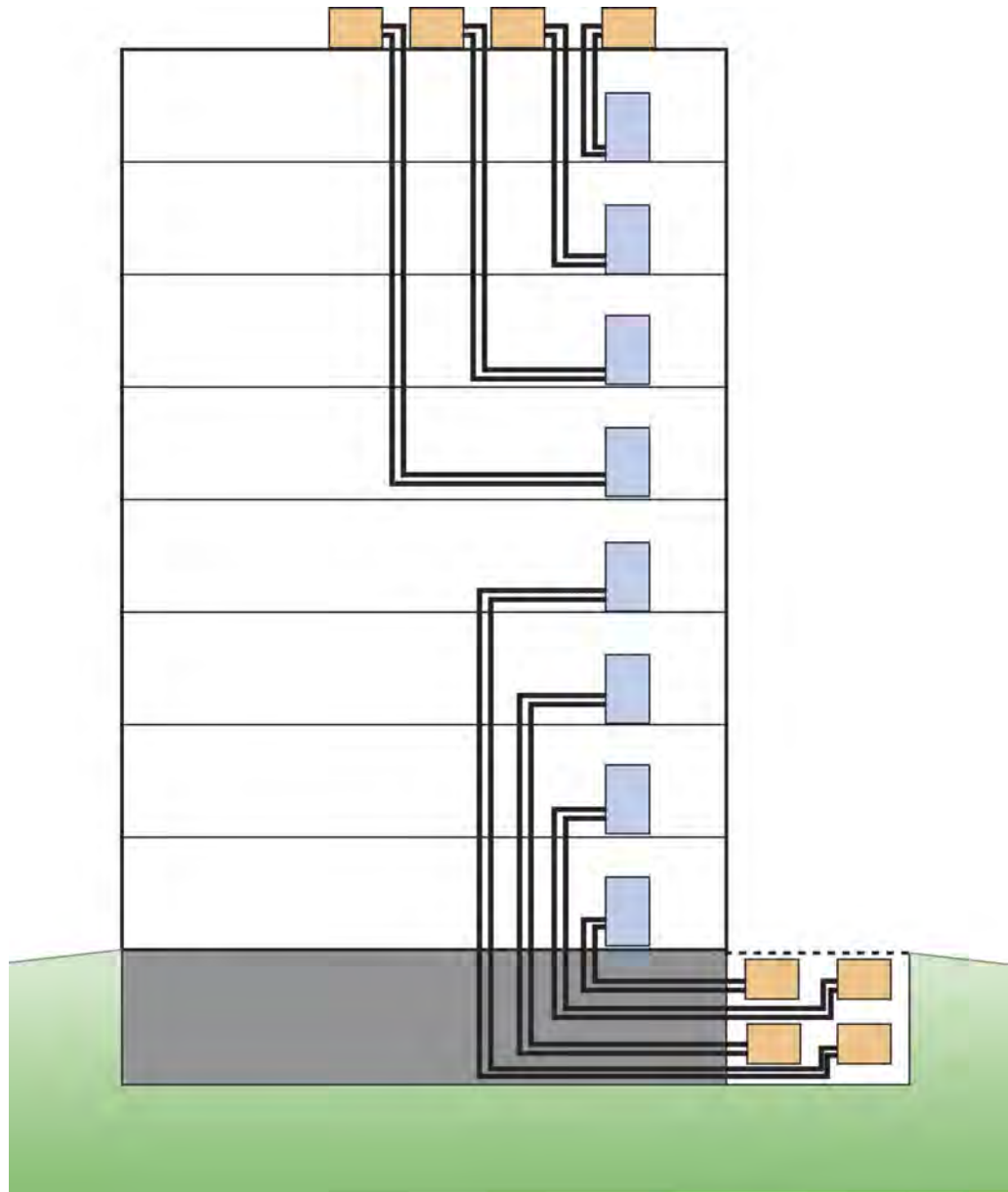


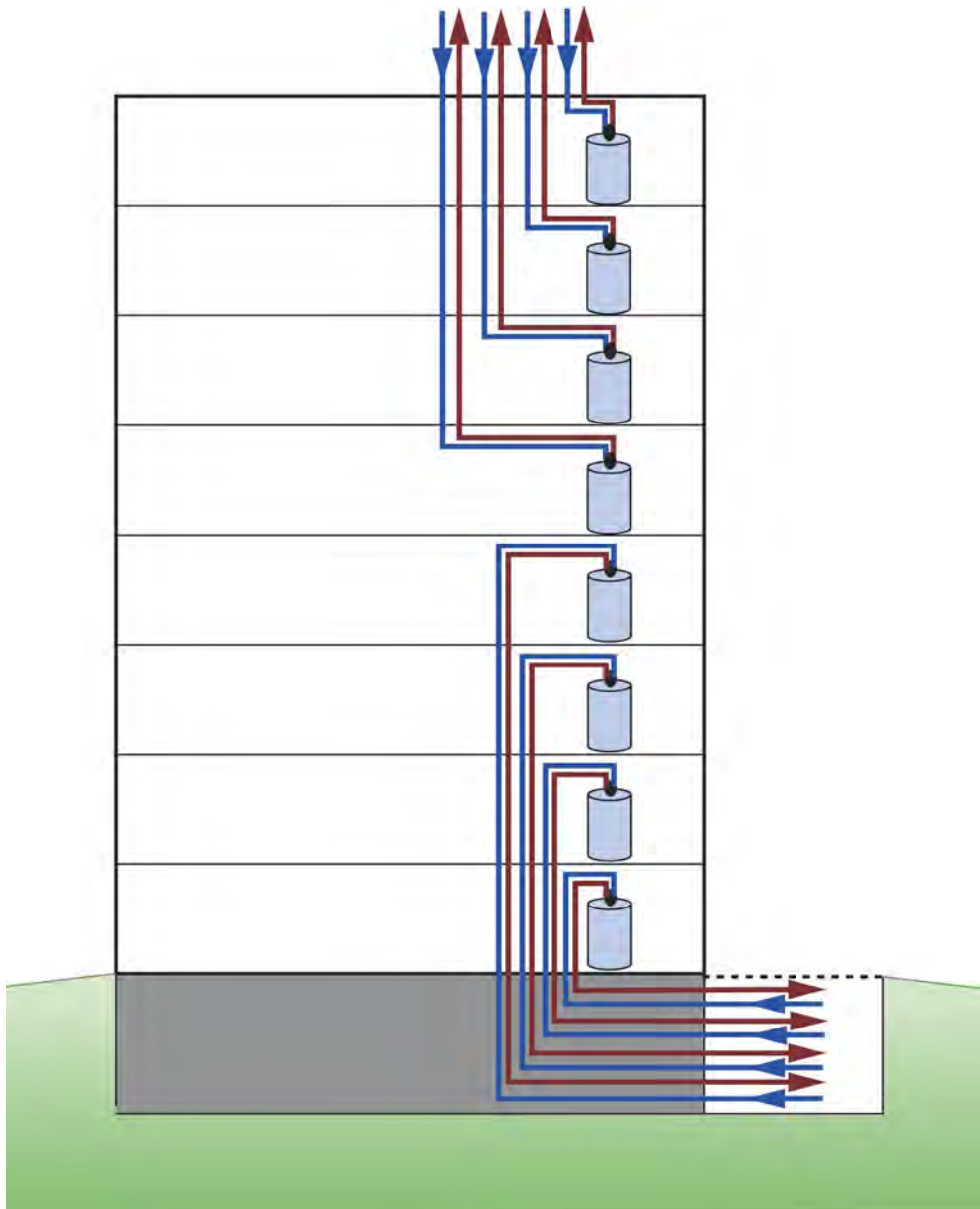














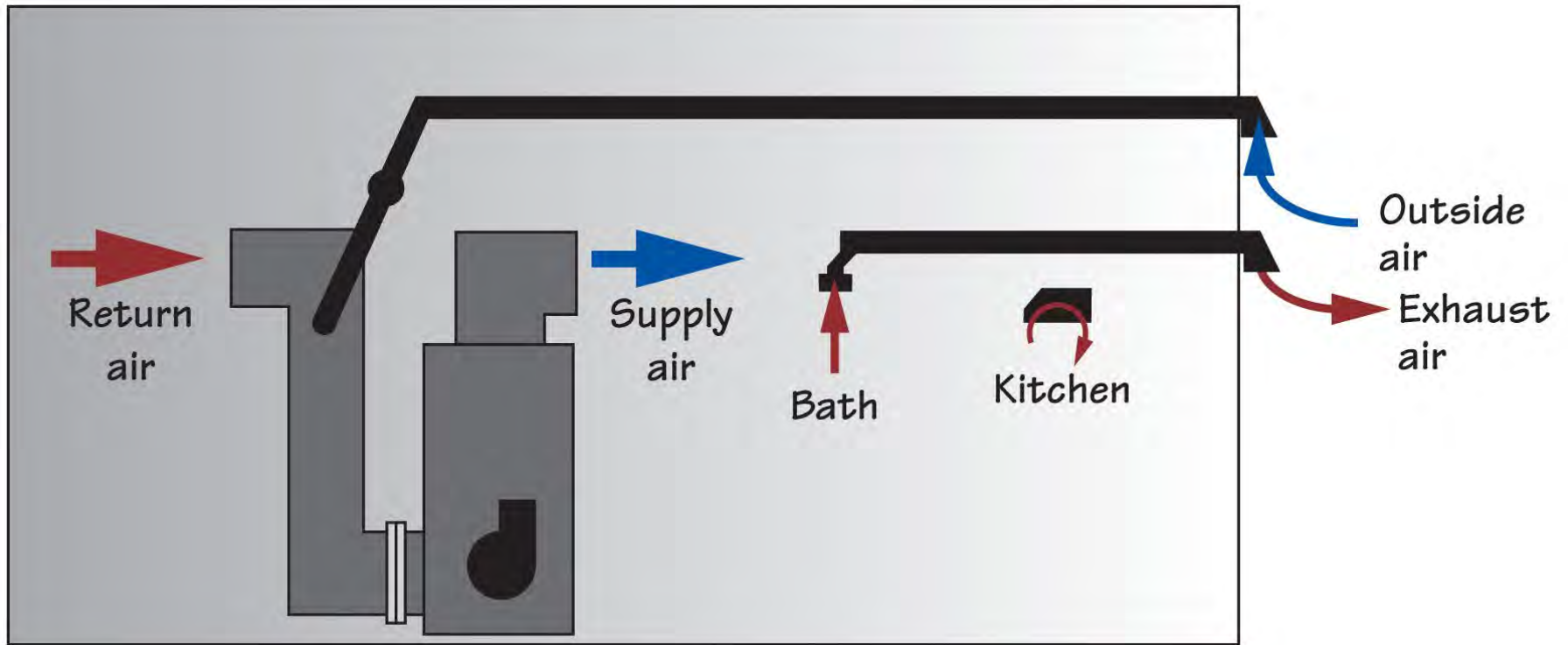


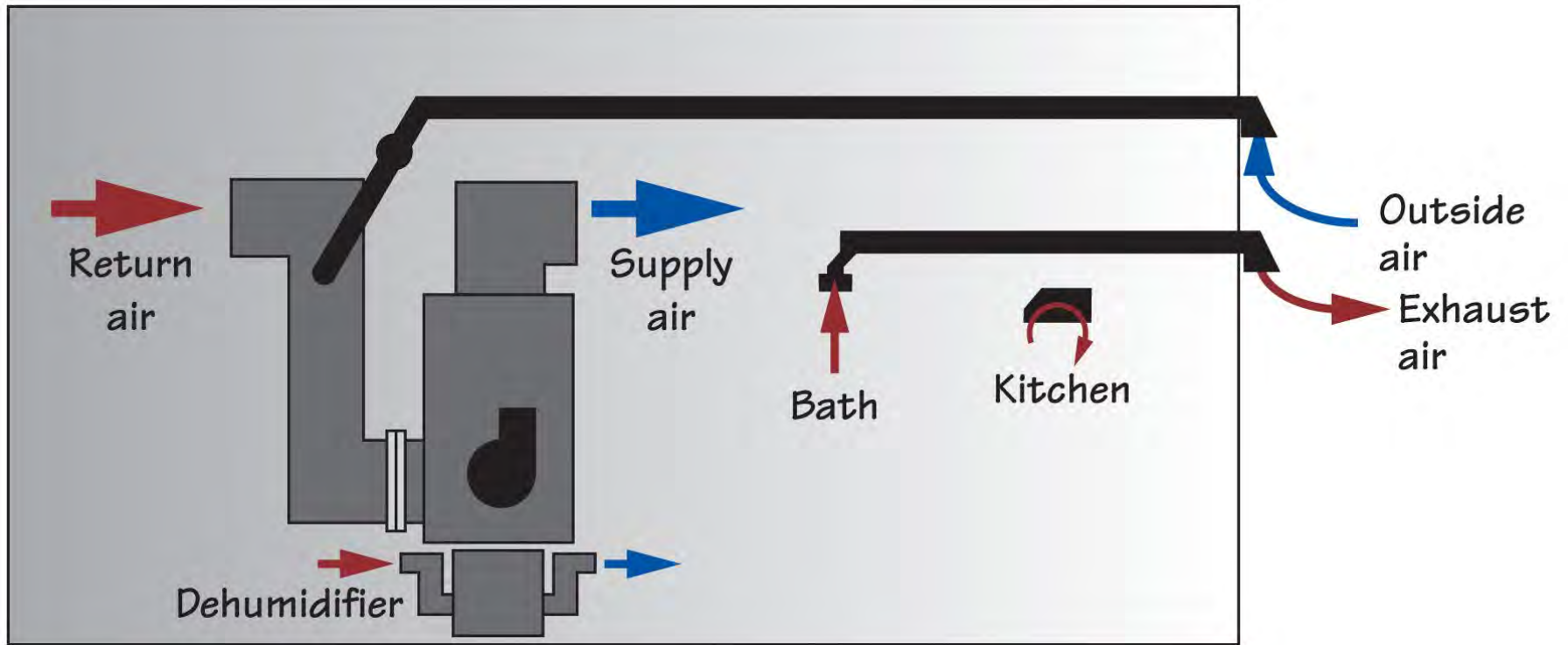


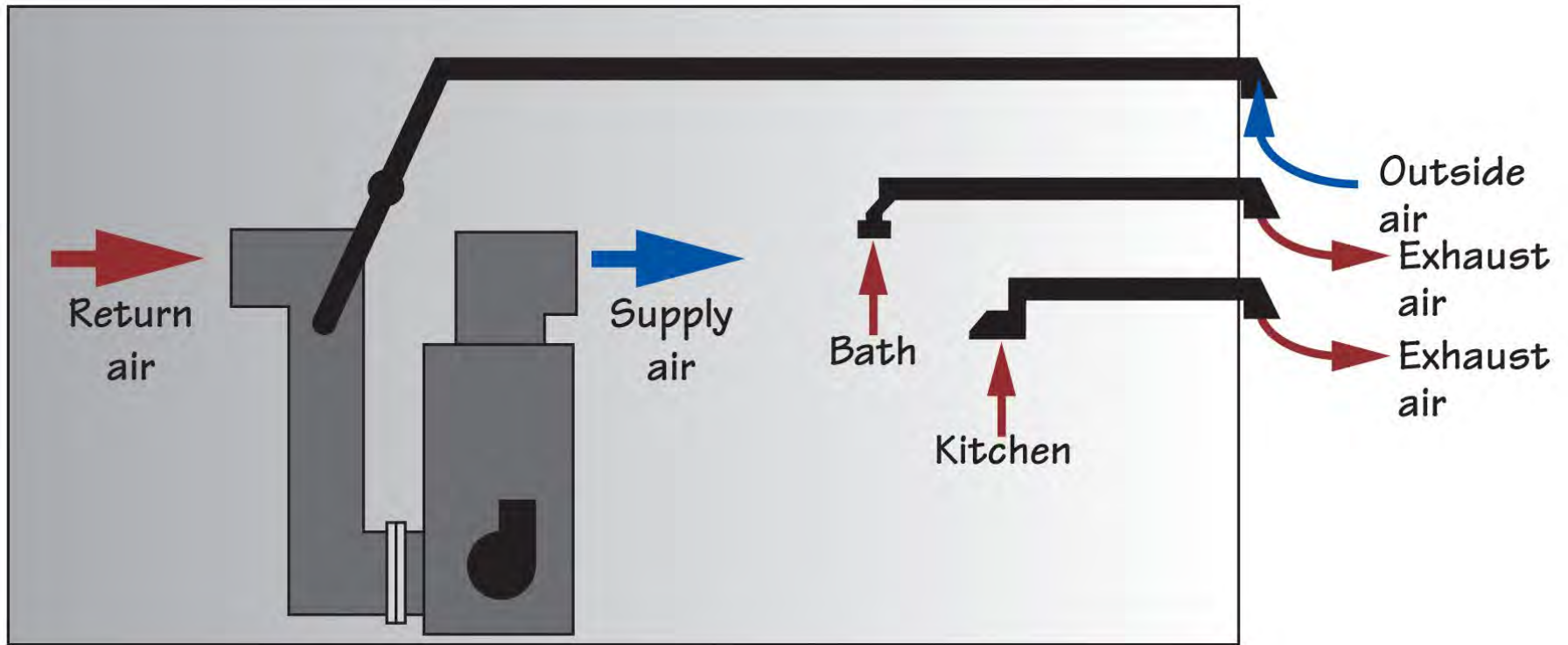
Dilution For People

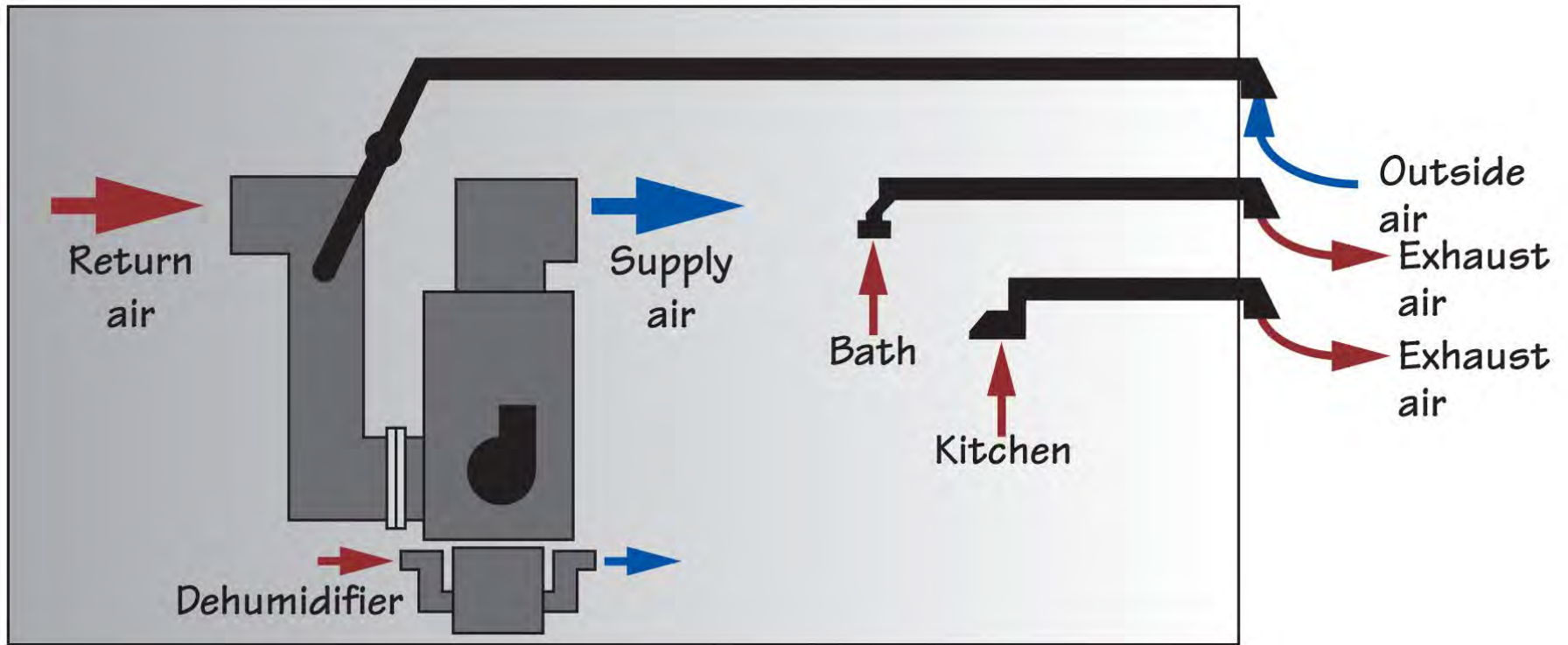
Source Control For The Building

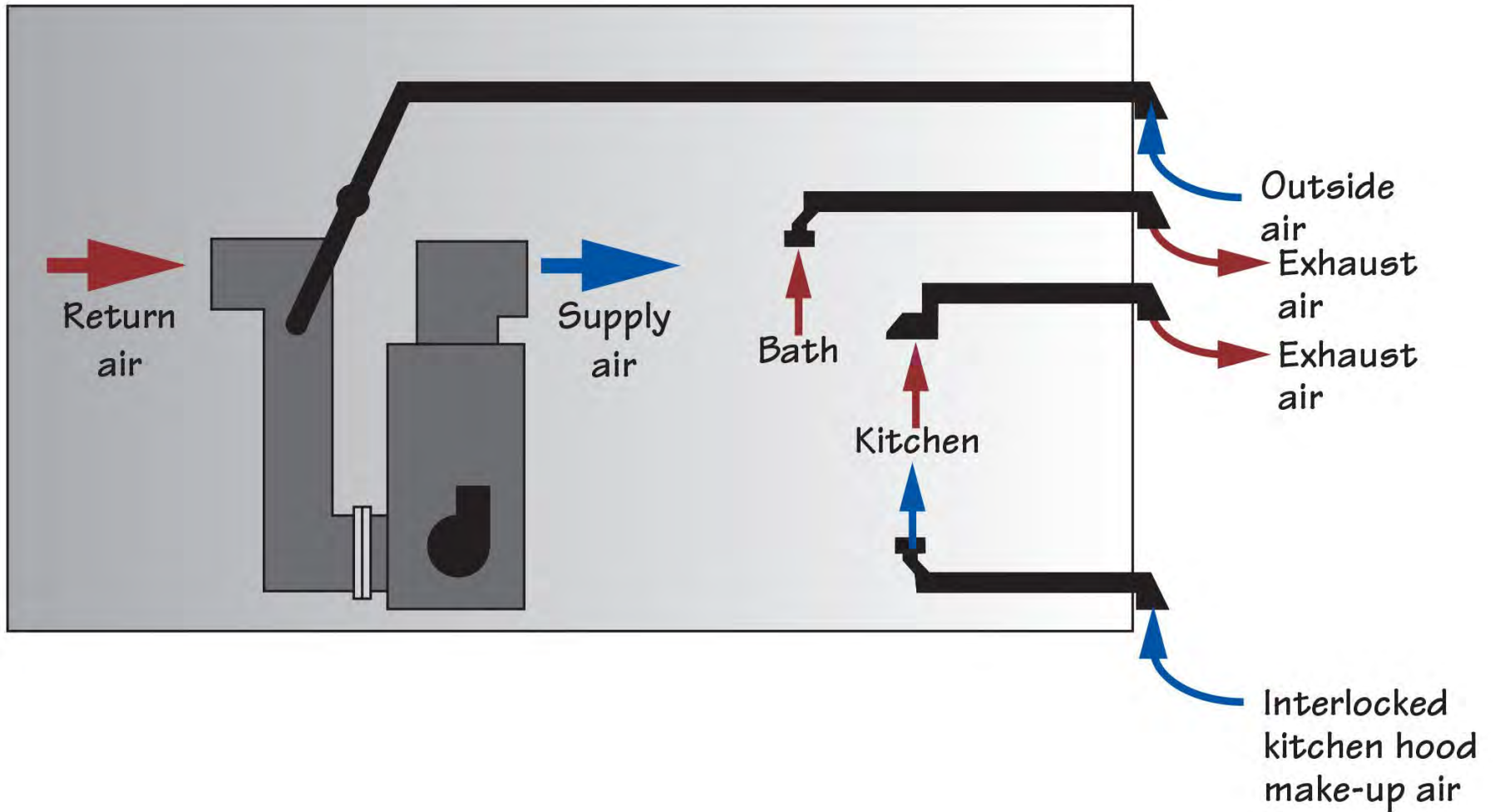
Approaches

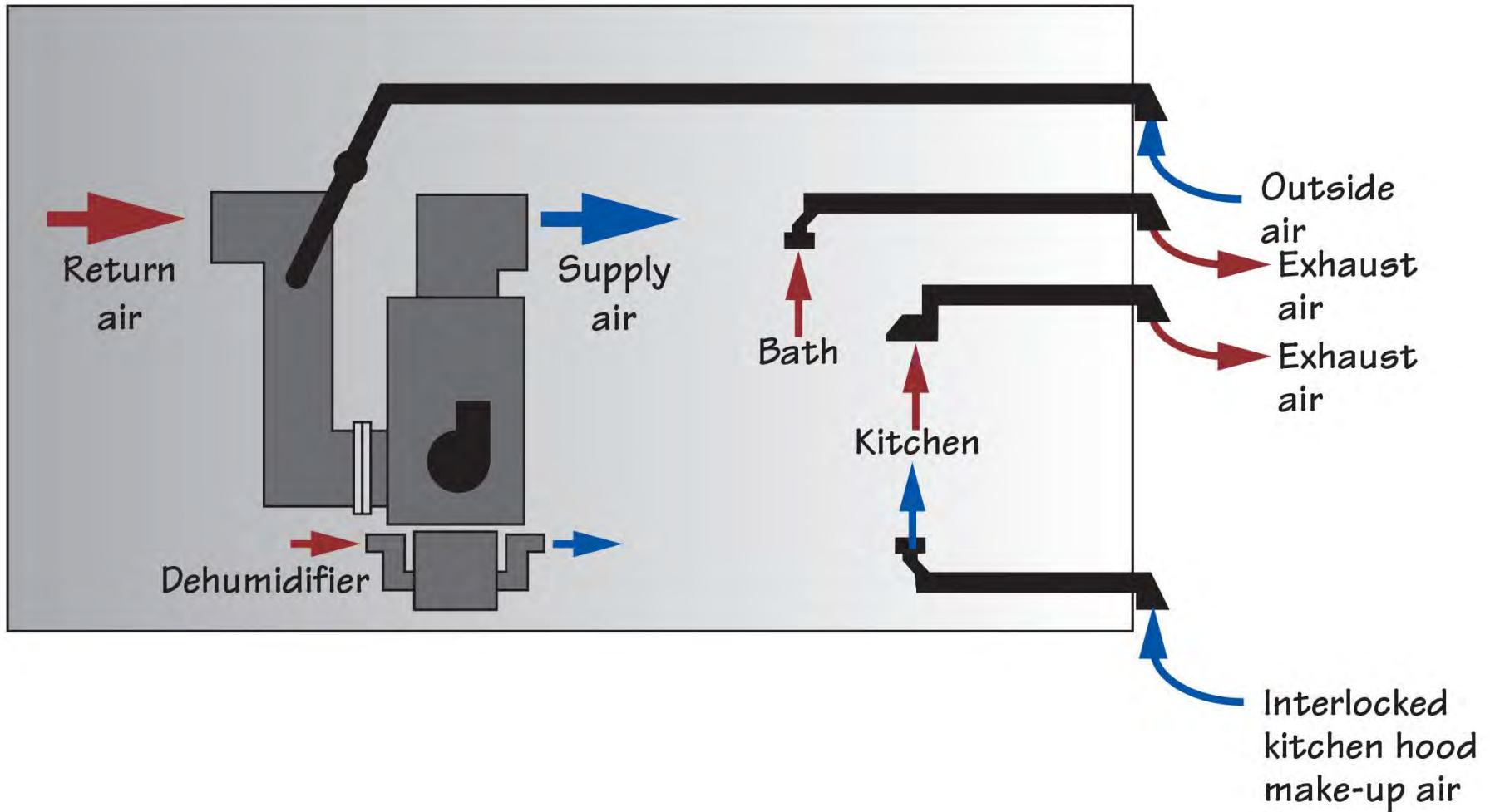


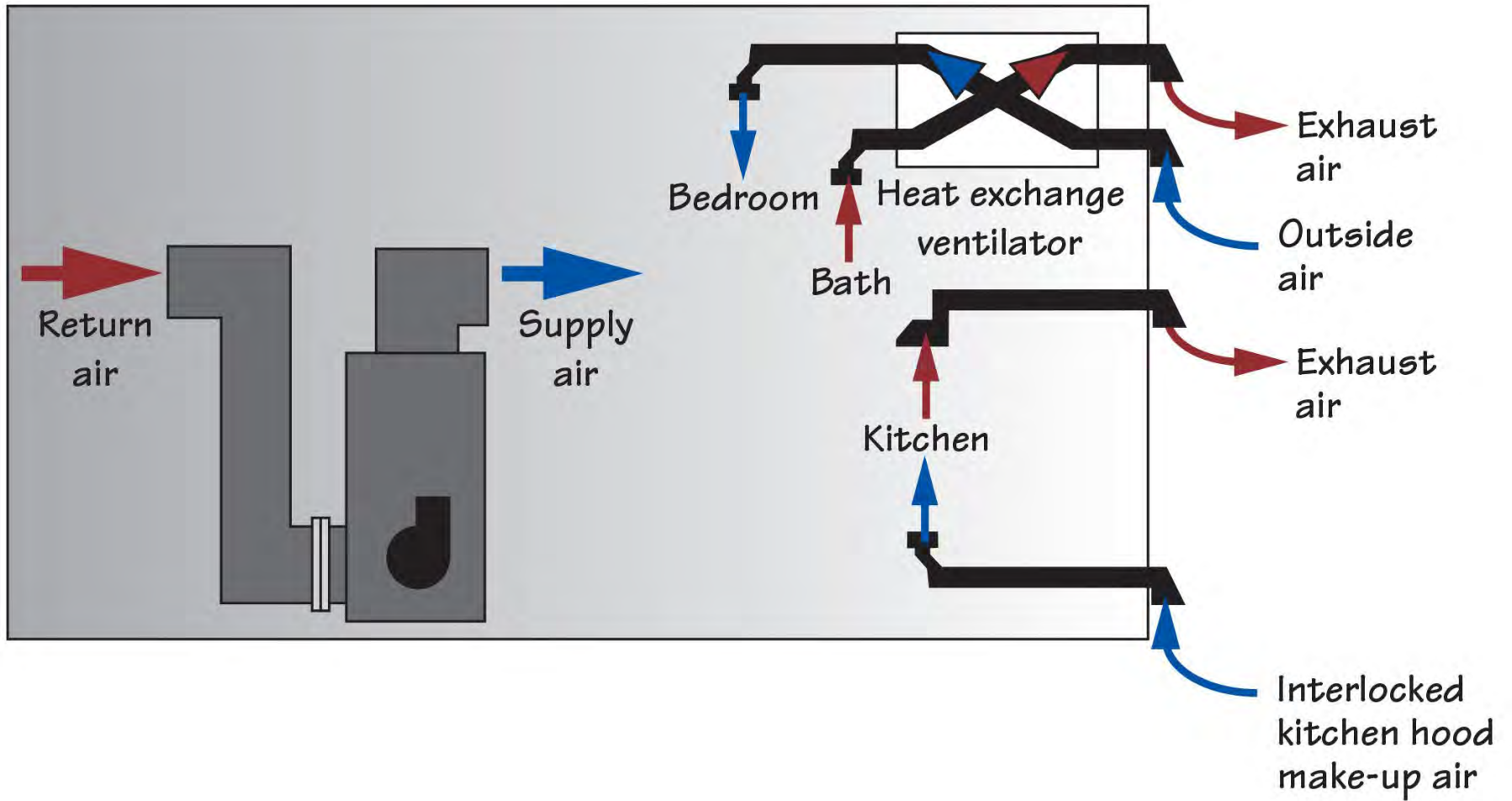


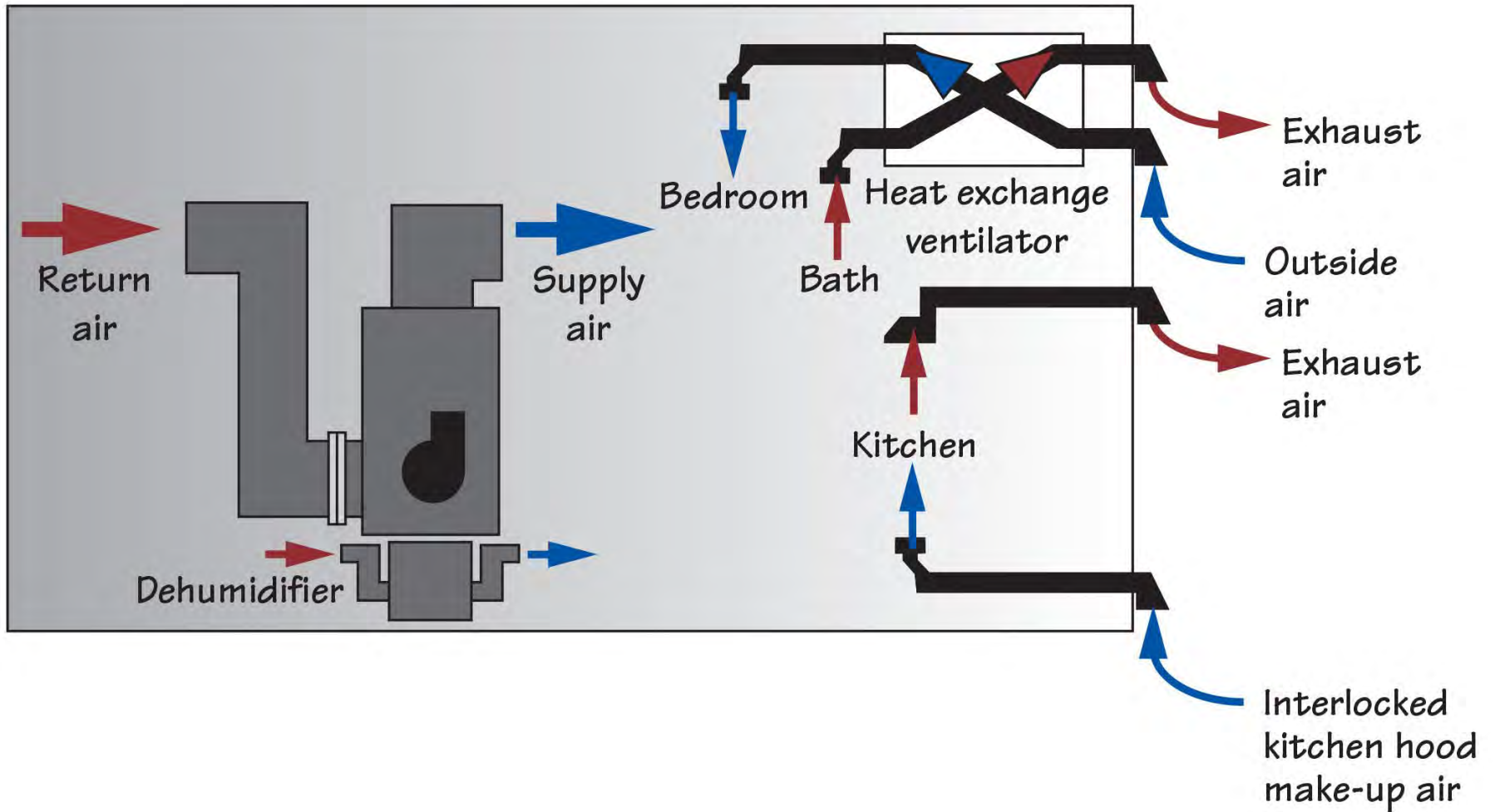


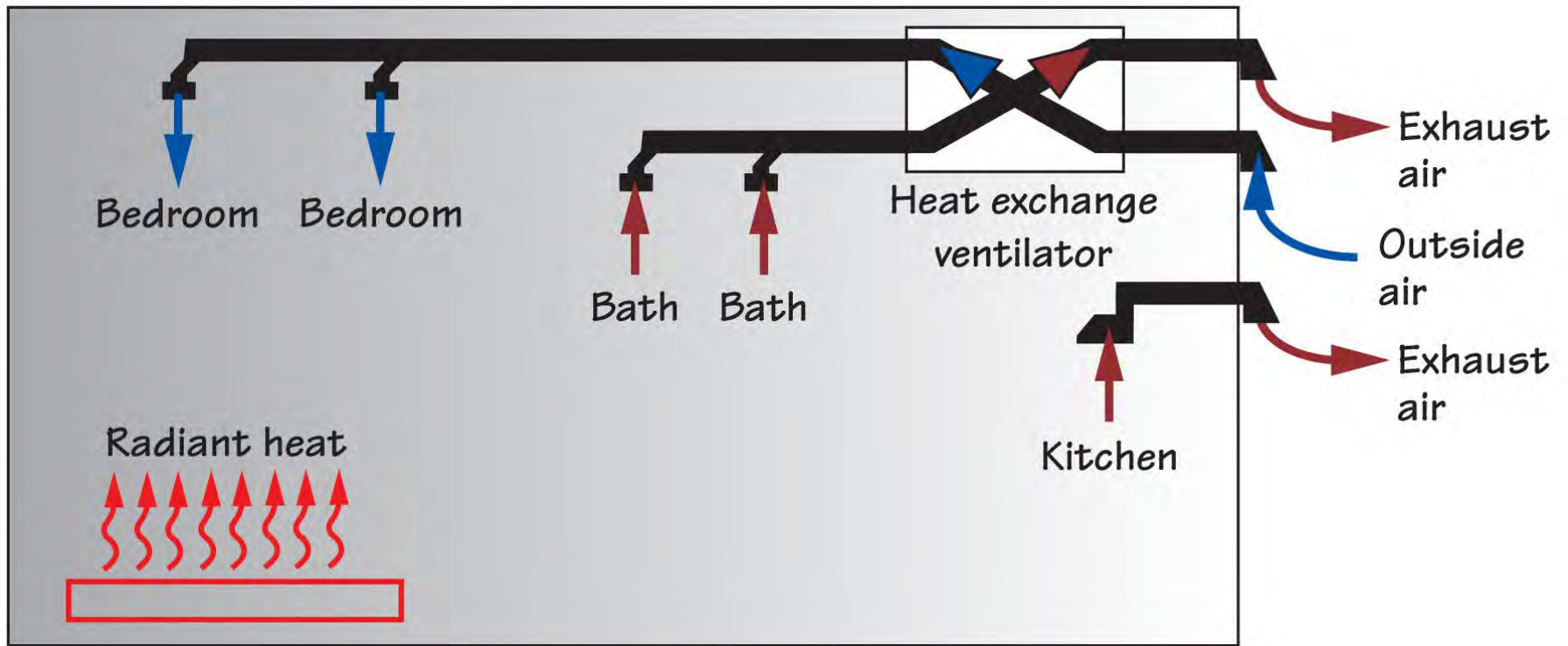


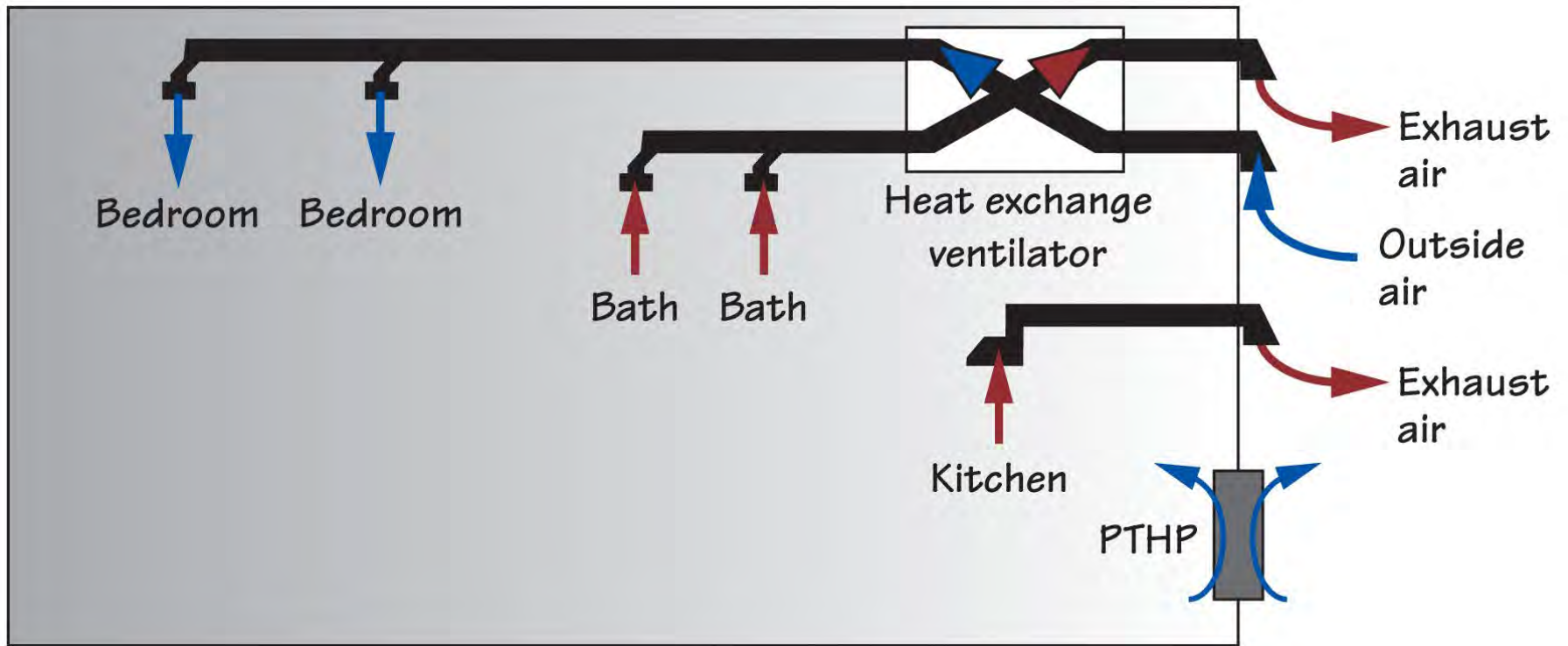


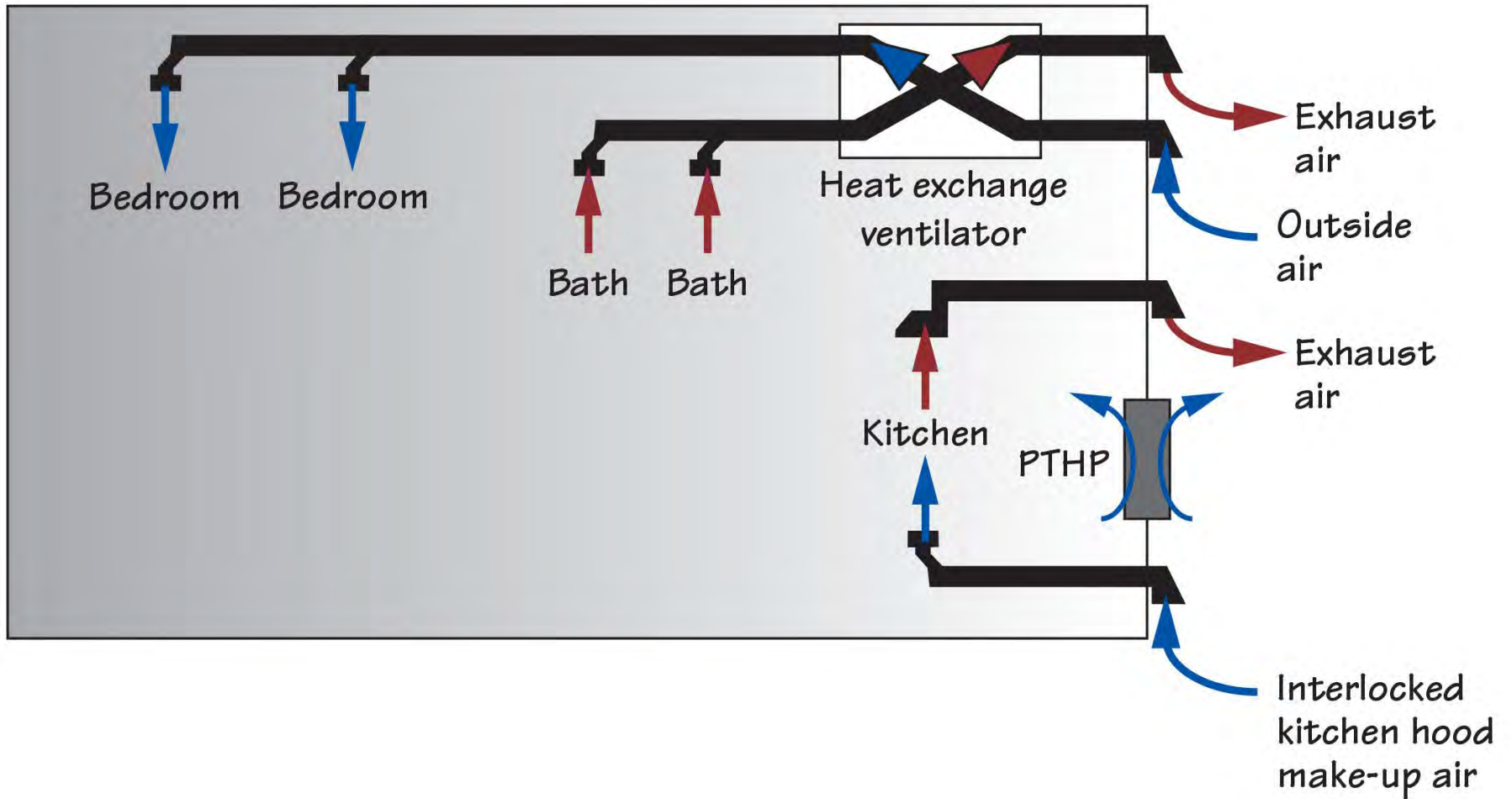


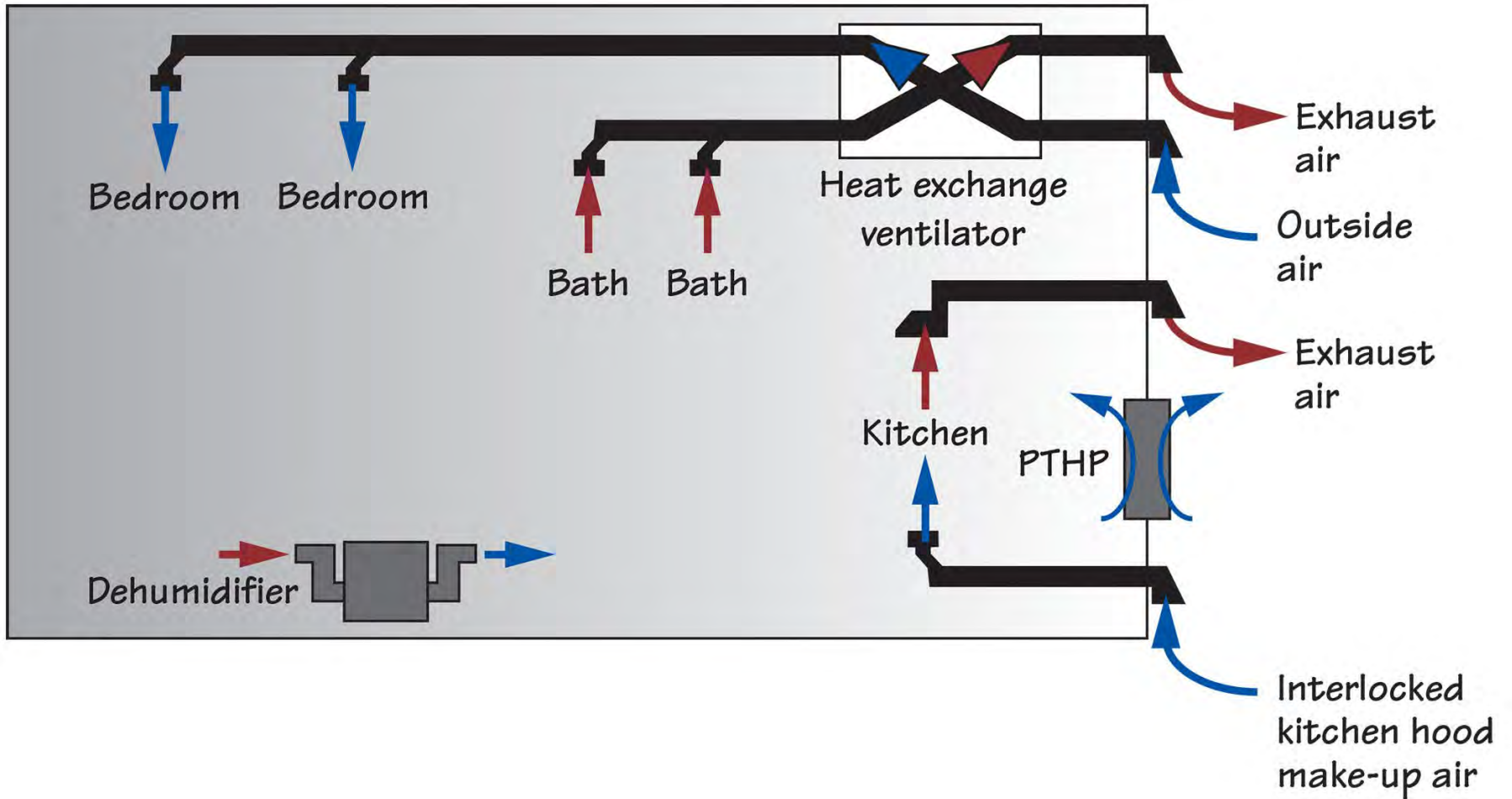


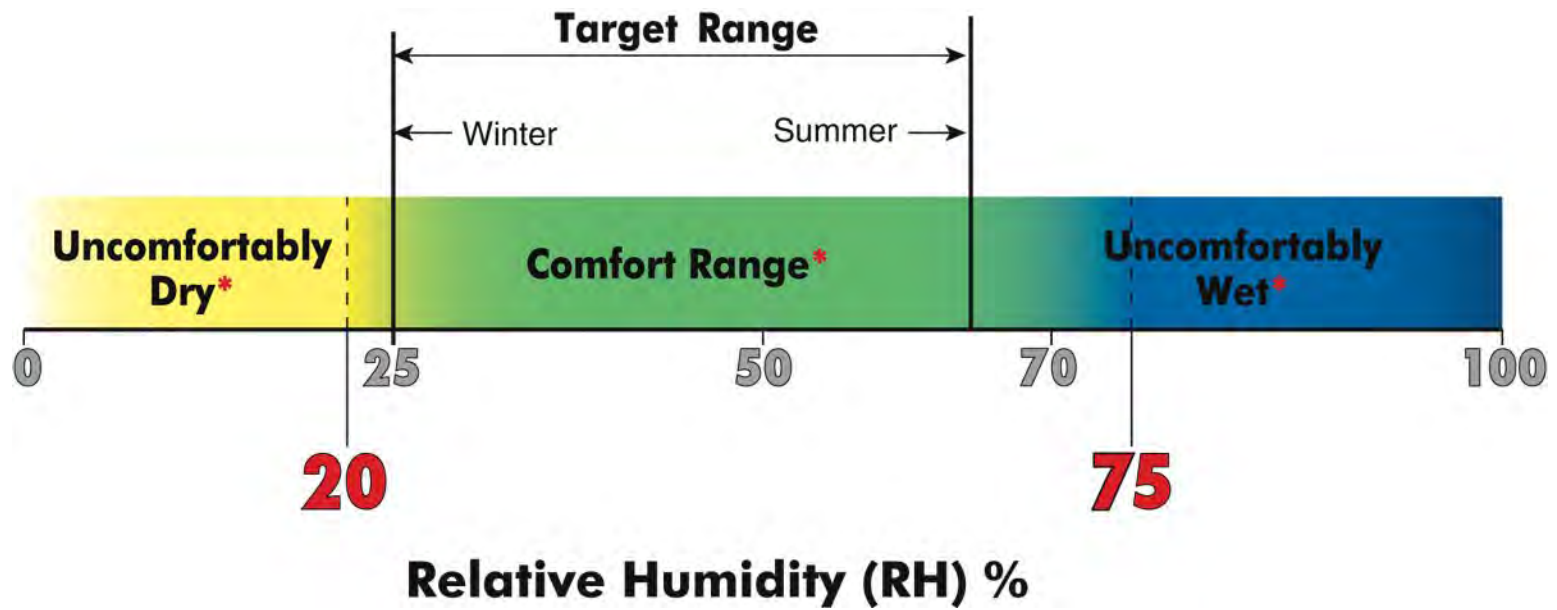








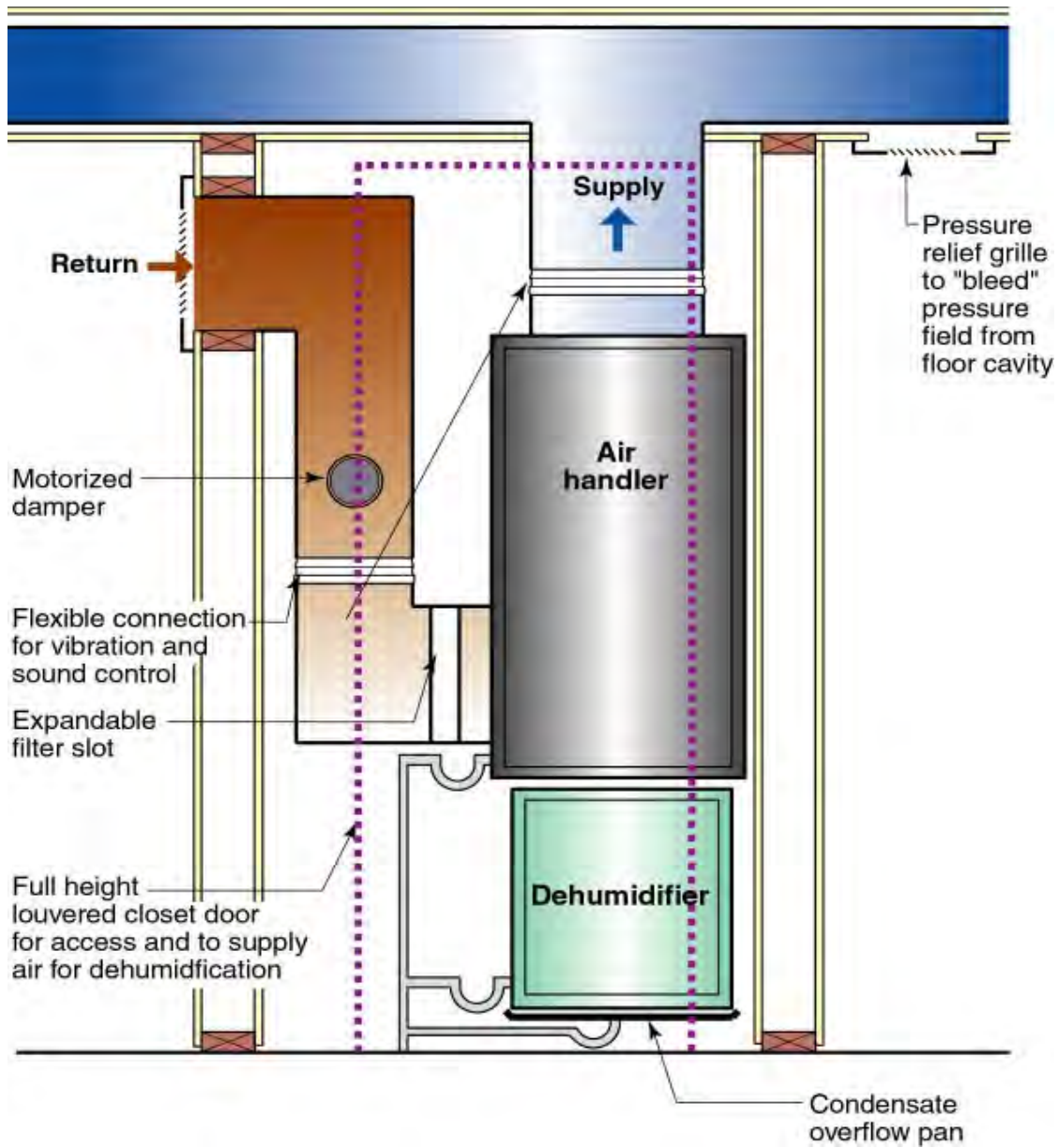




Recommended Range of Relative Humidity

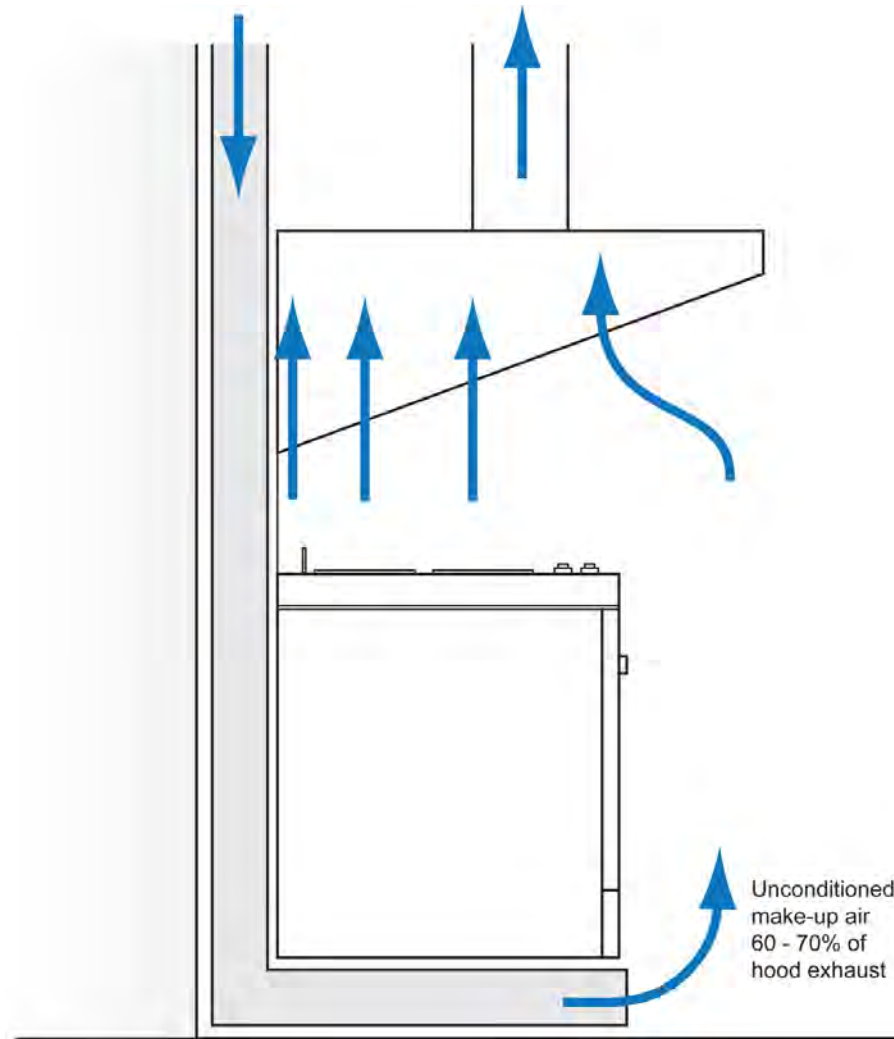
Above 25 percent during winter

Below 70 percent during summer

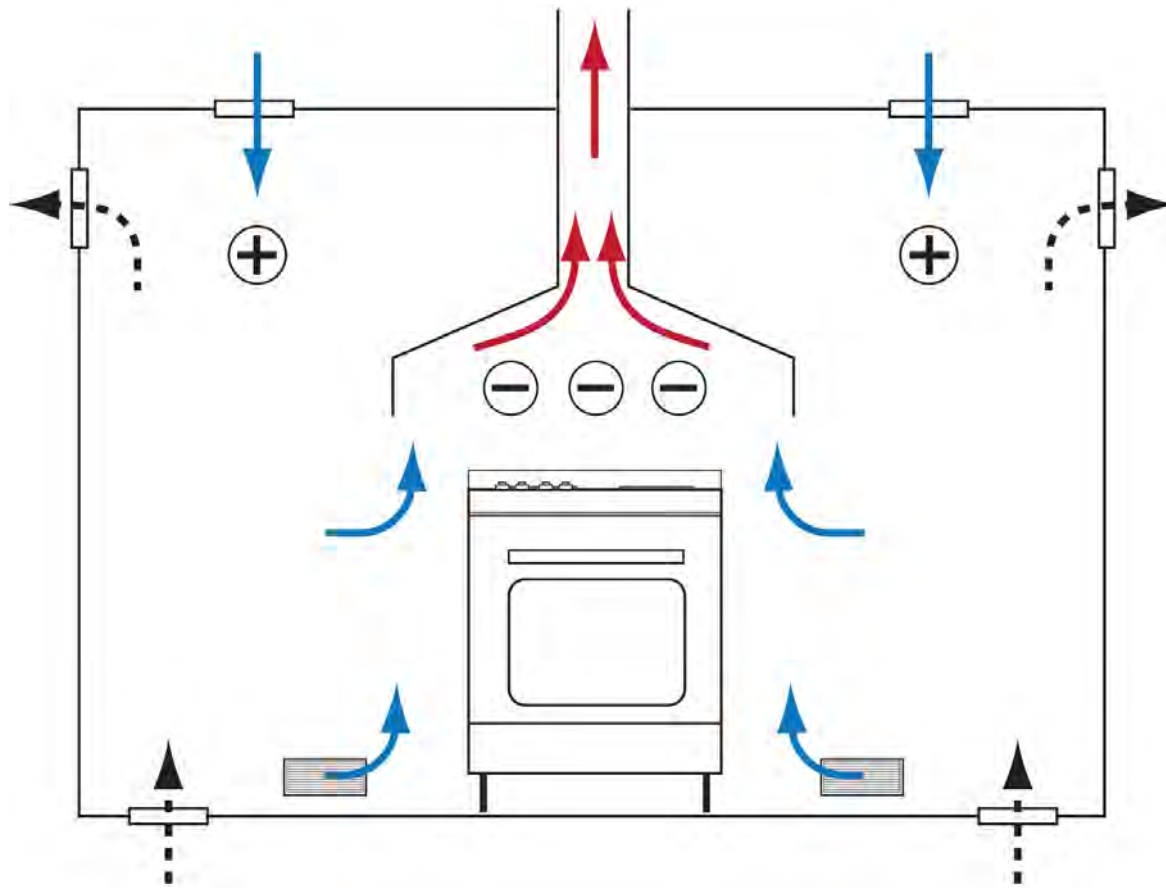




Kitchen Exhaust Hoods





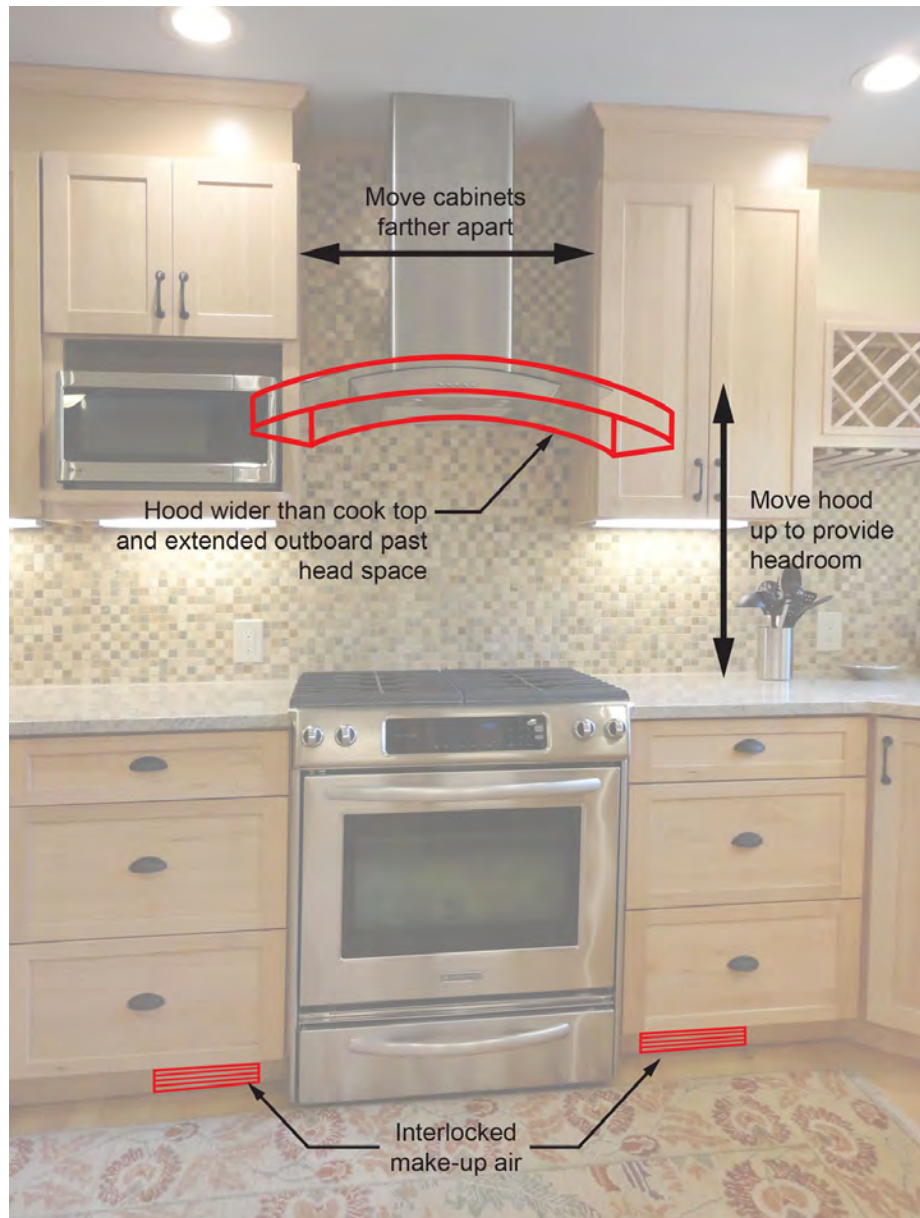










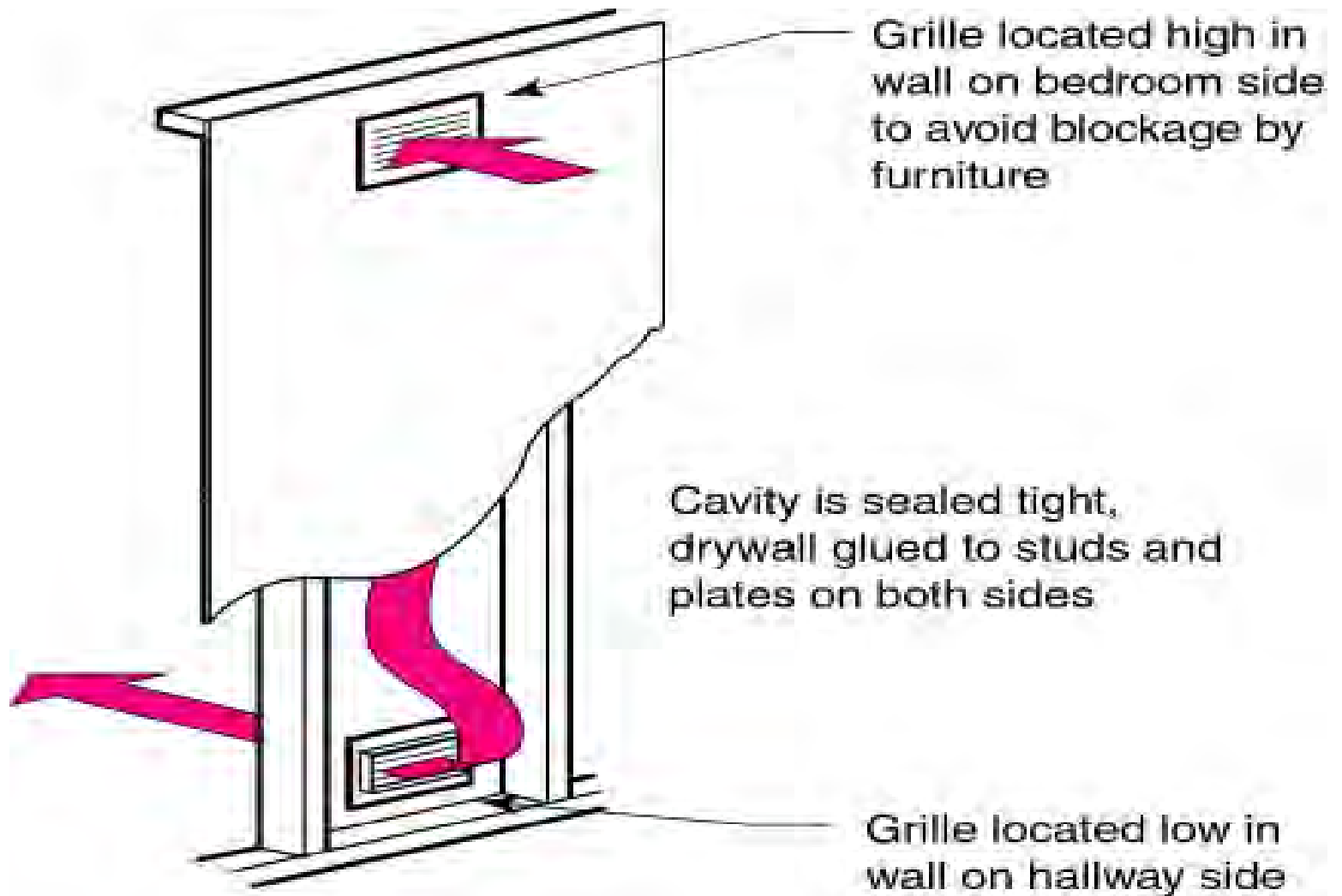




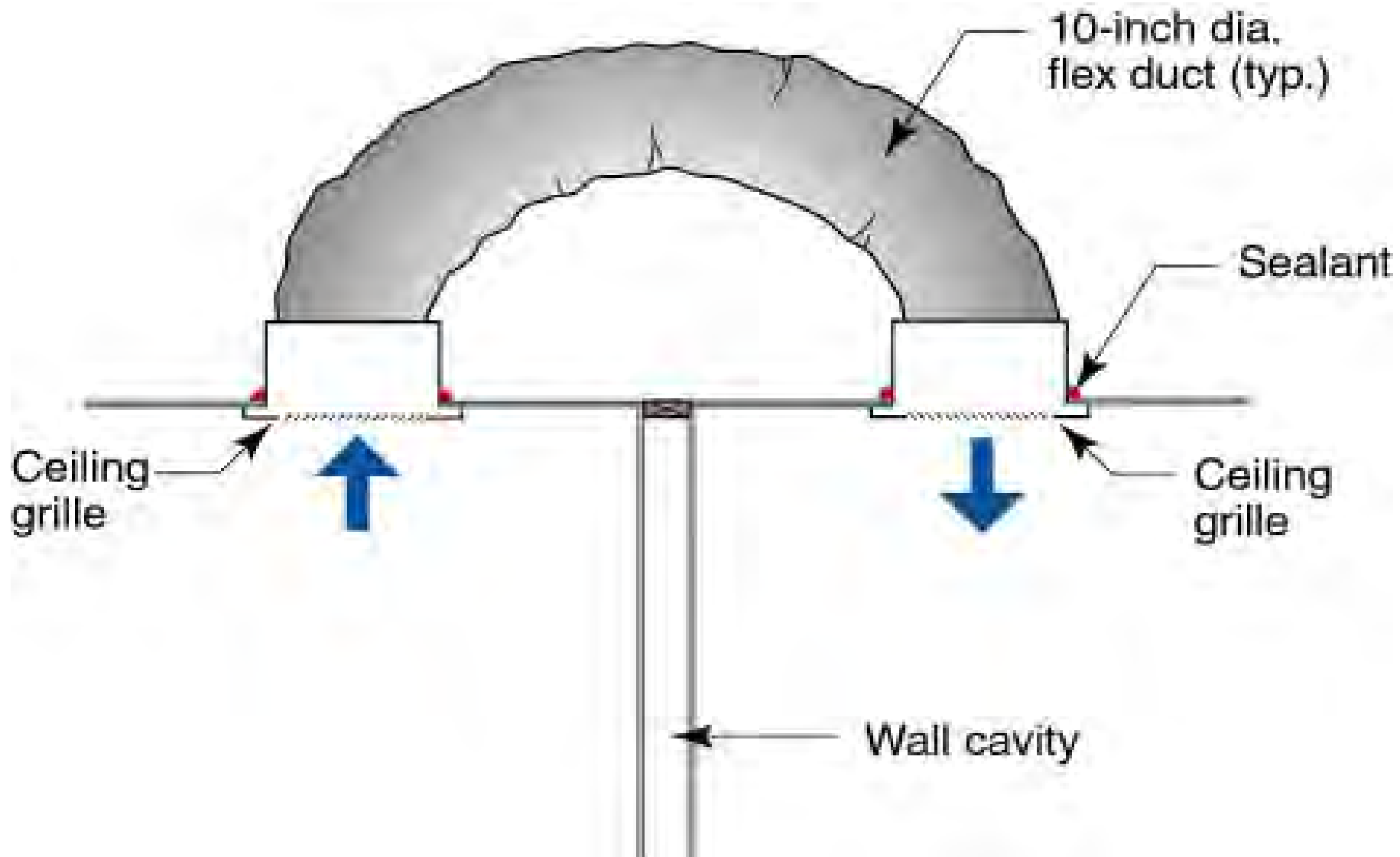


Equalizing Pressures









Clothes Dryers

