

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

Building Science

Roofs

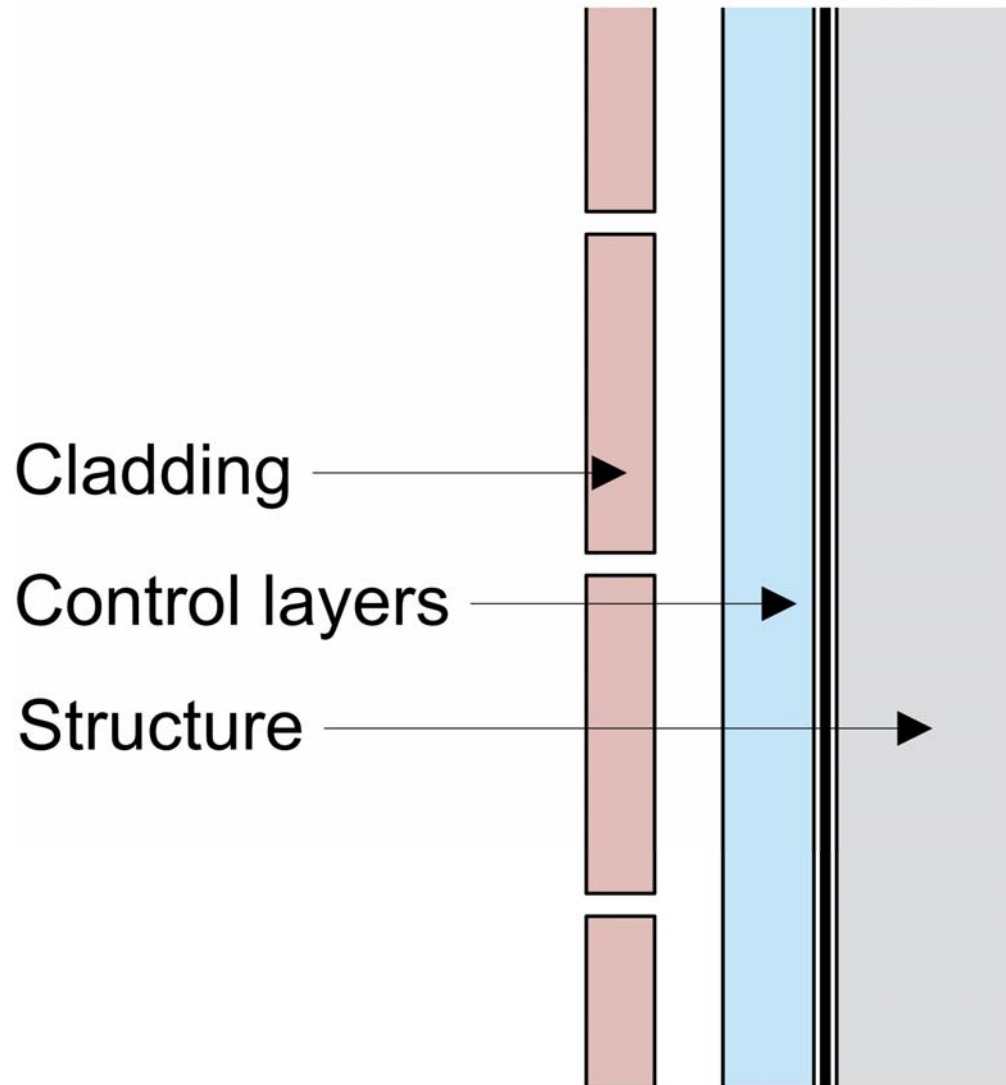
presented by www.buildingscience.com

Water Control Layer

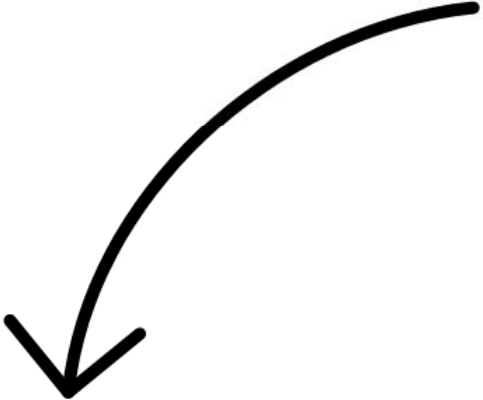
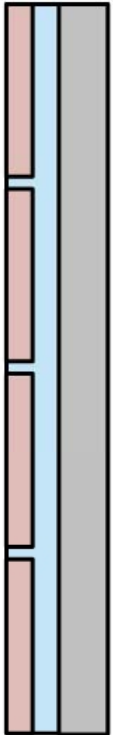
Air Control Layer

Vapor Control Layer

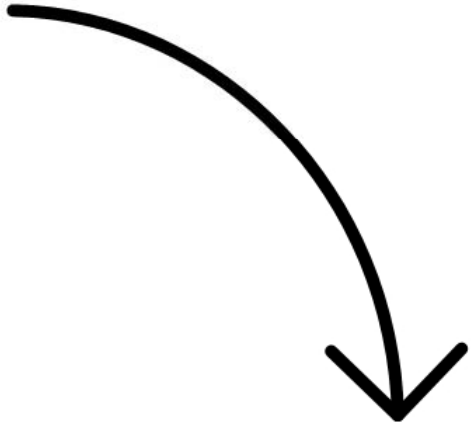
Thermal Control Layer



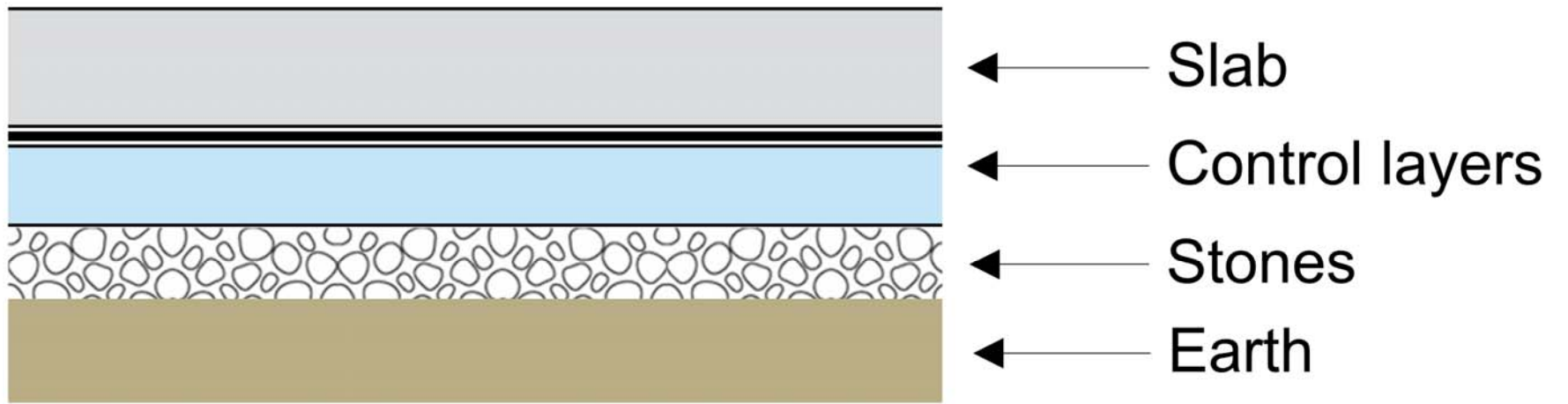
Wall

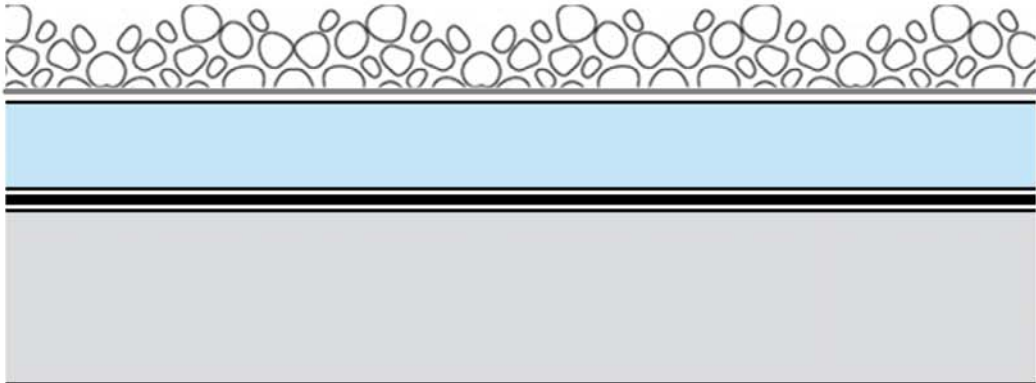


Slab

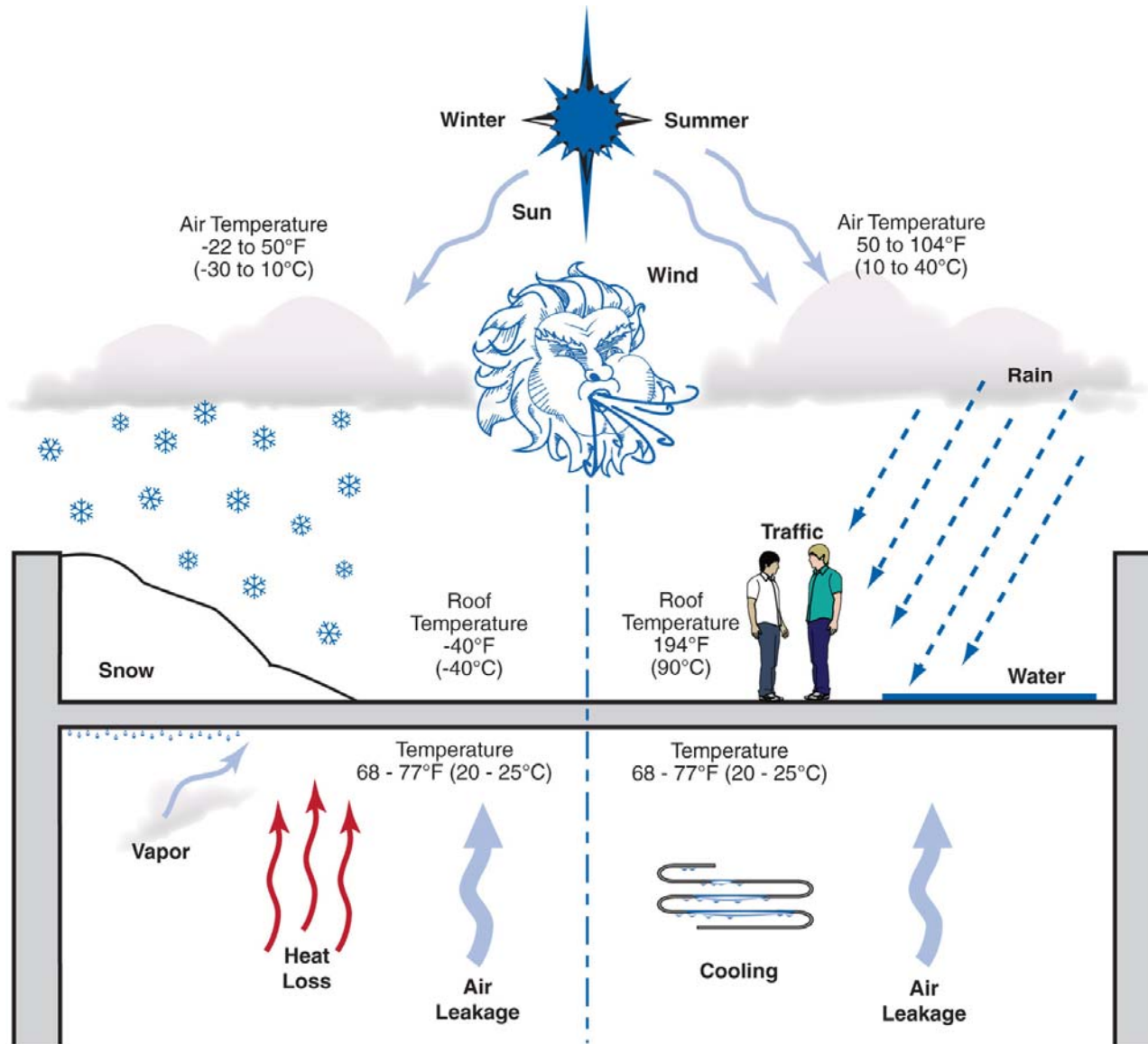


Roof

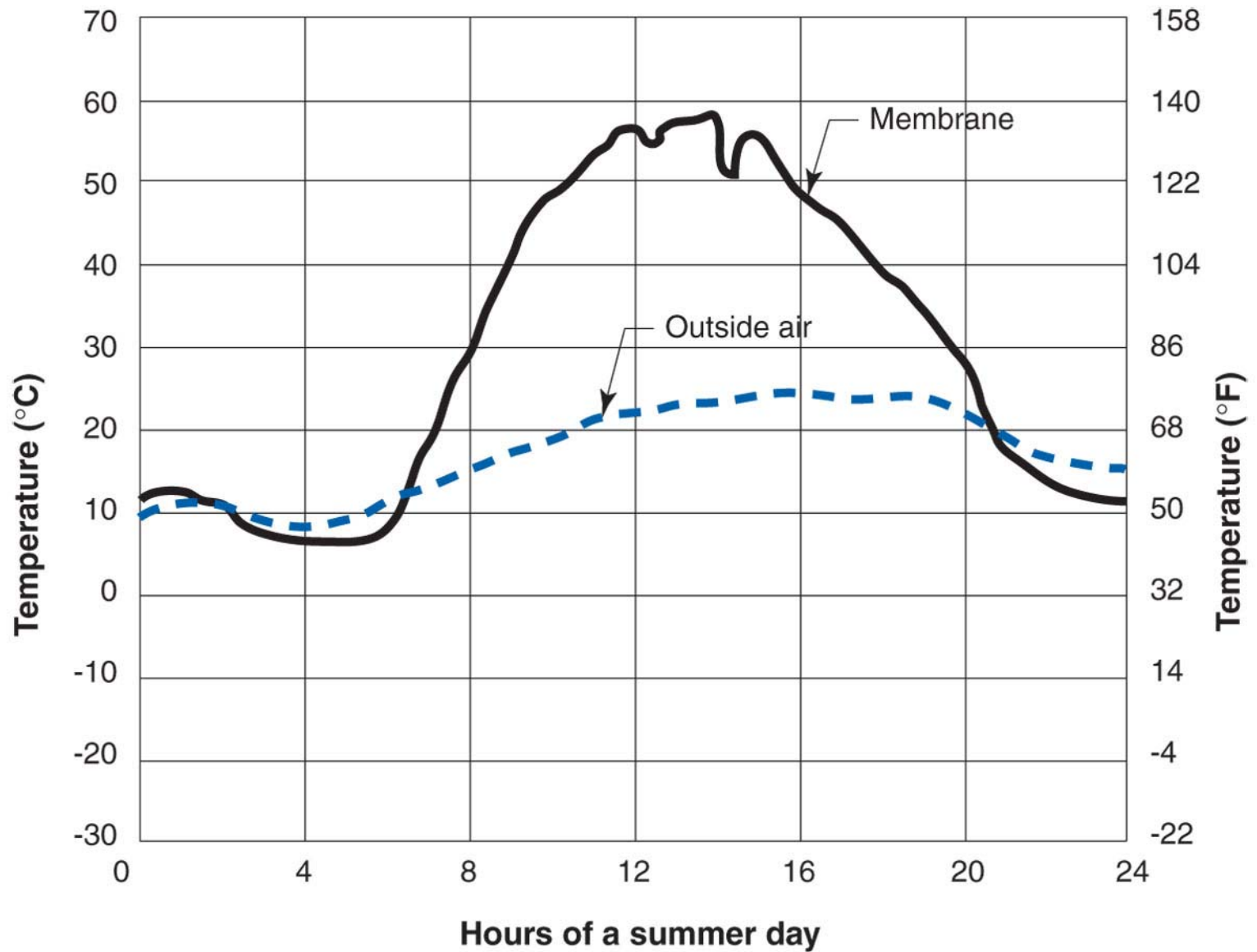




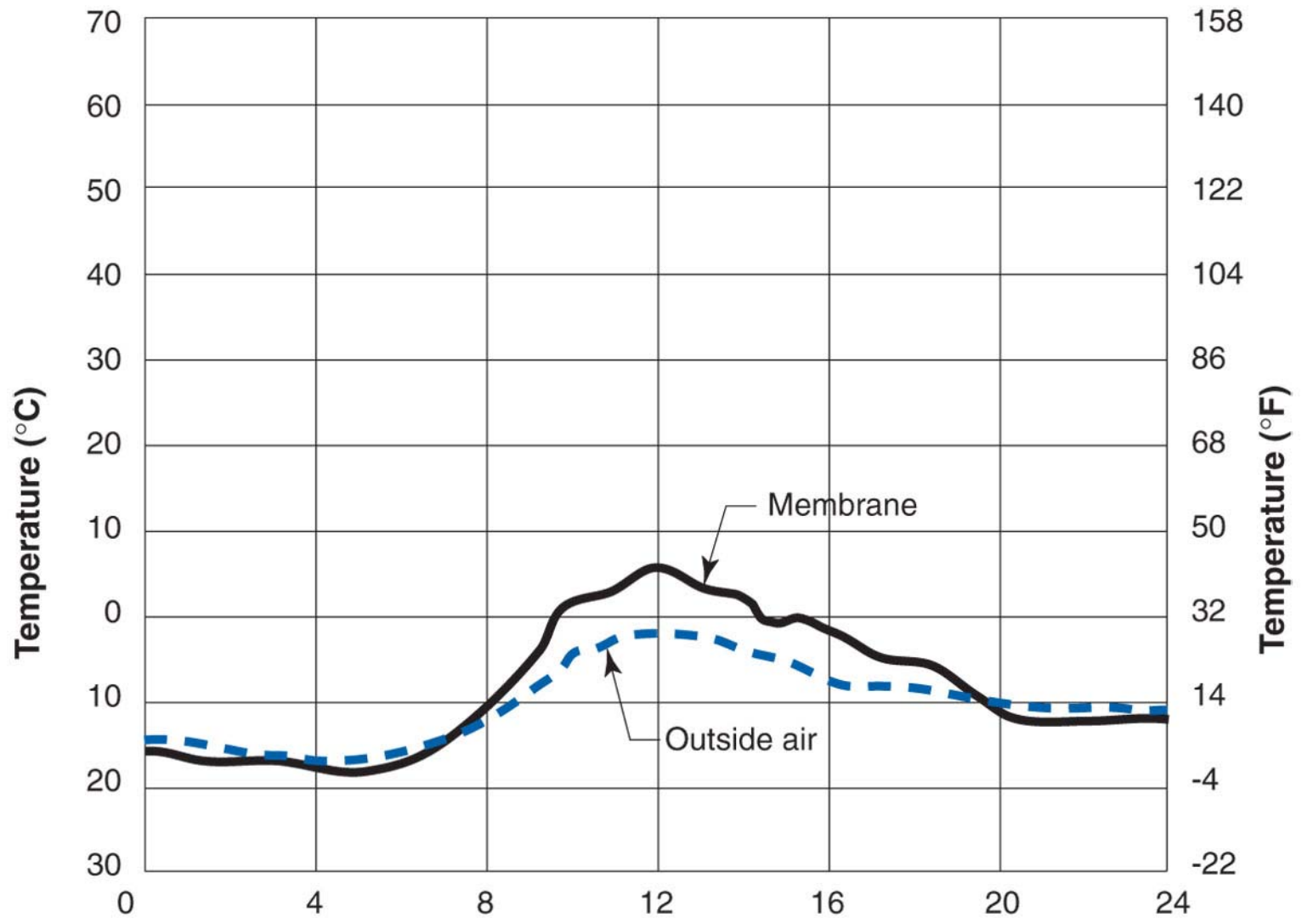
- ← Ballast
- ← Filter fabric
- ← Control layers
- ← Roof structure



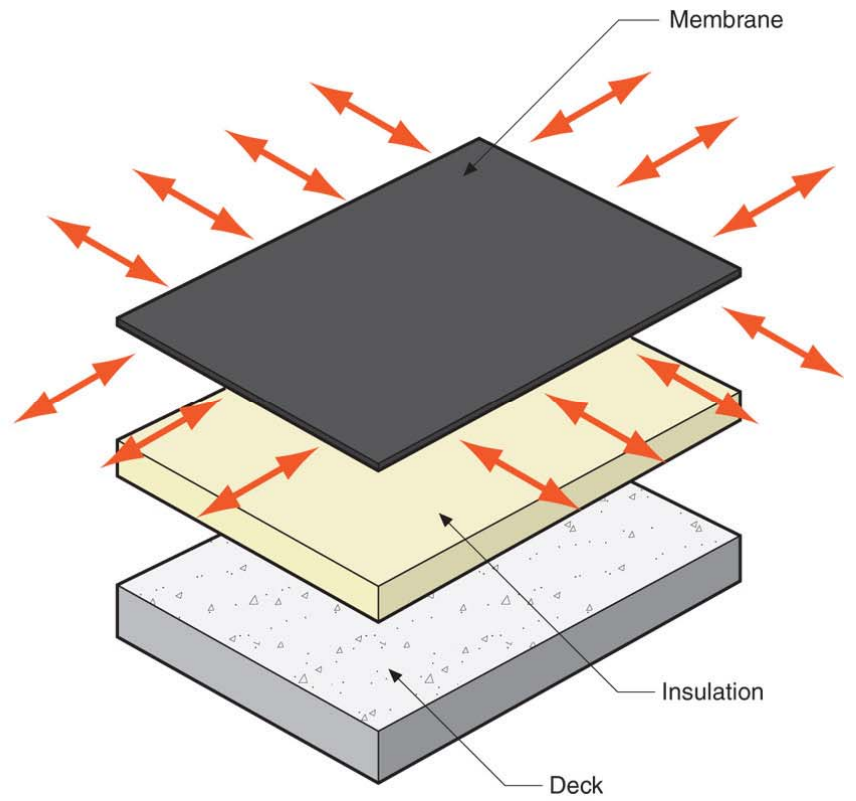
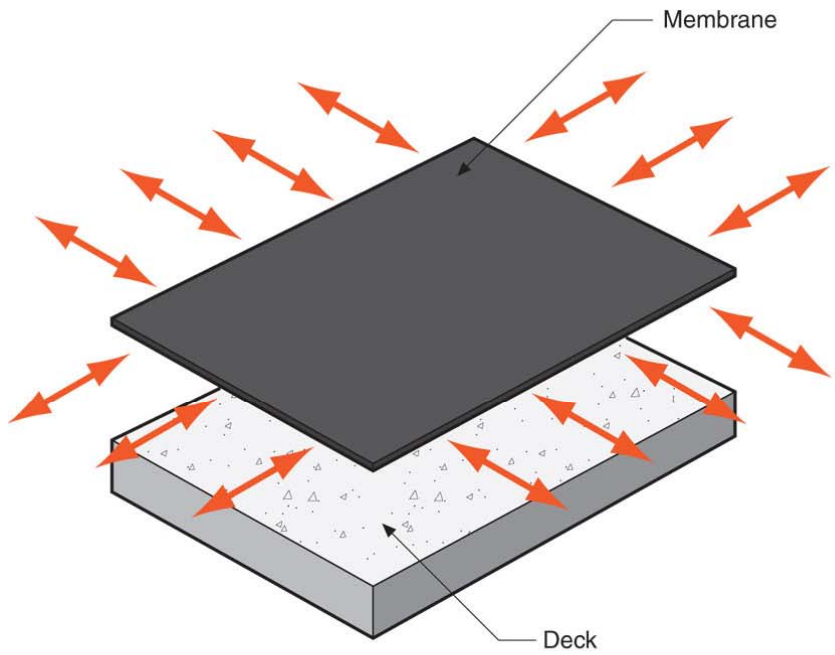
Adapted from Baker, M.; Roofs, 1980;
 Courtesy National Research Council of Canada



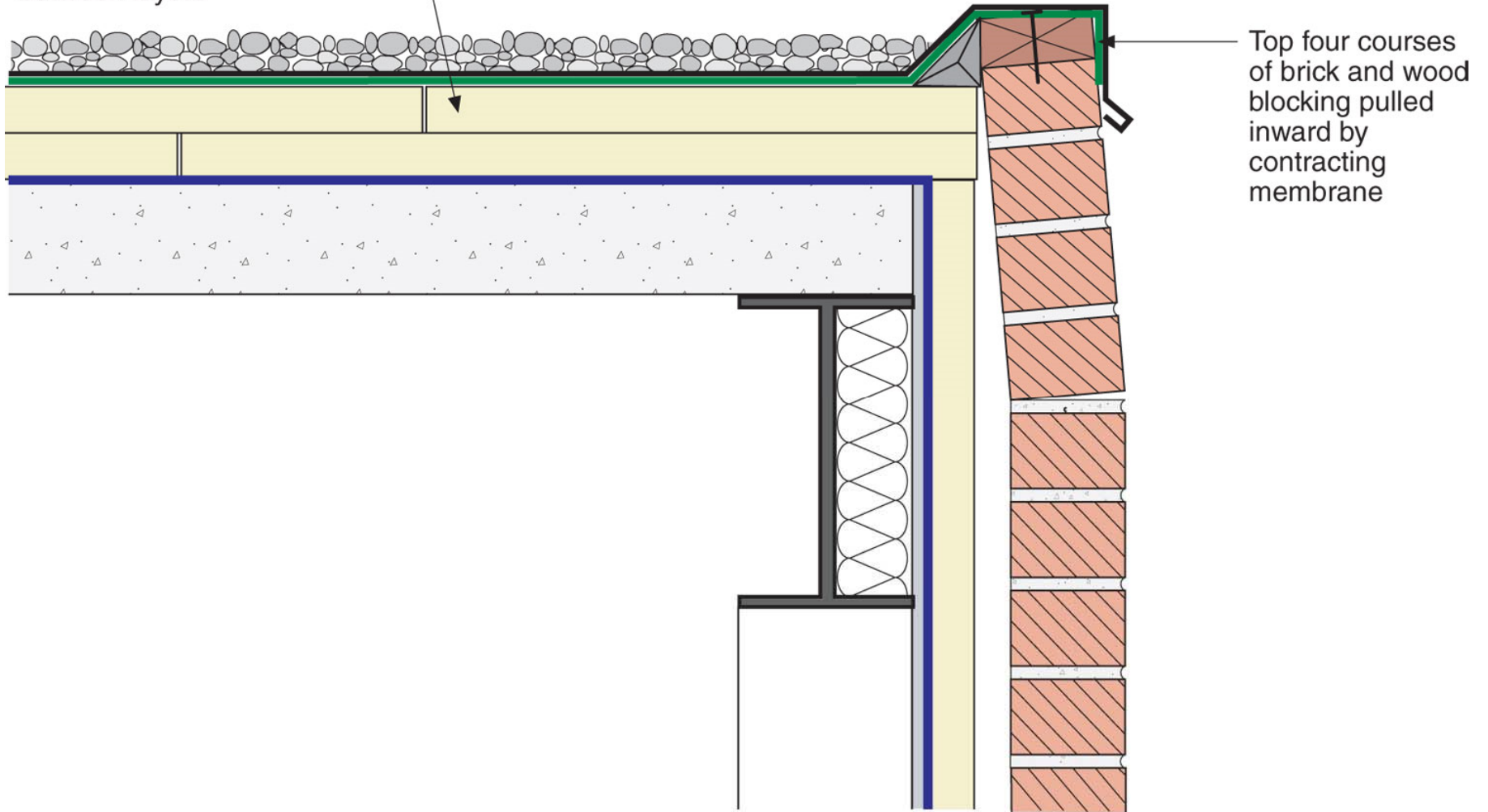
From Baker, M.; *Roofs*, 1980



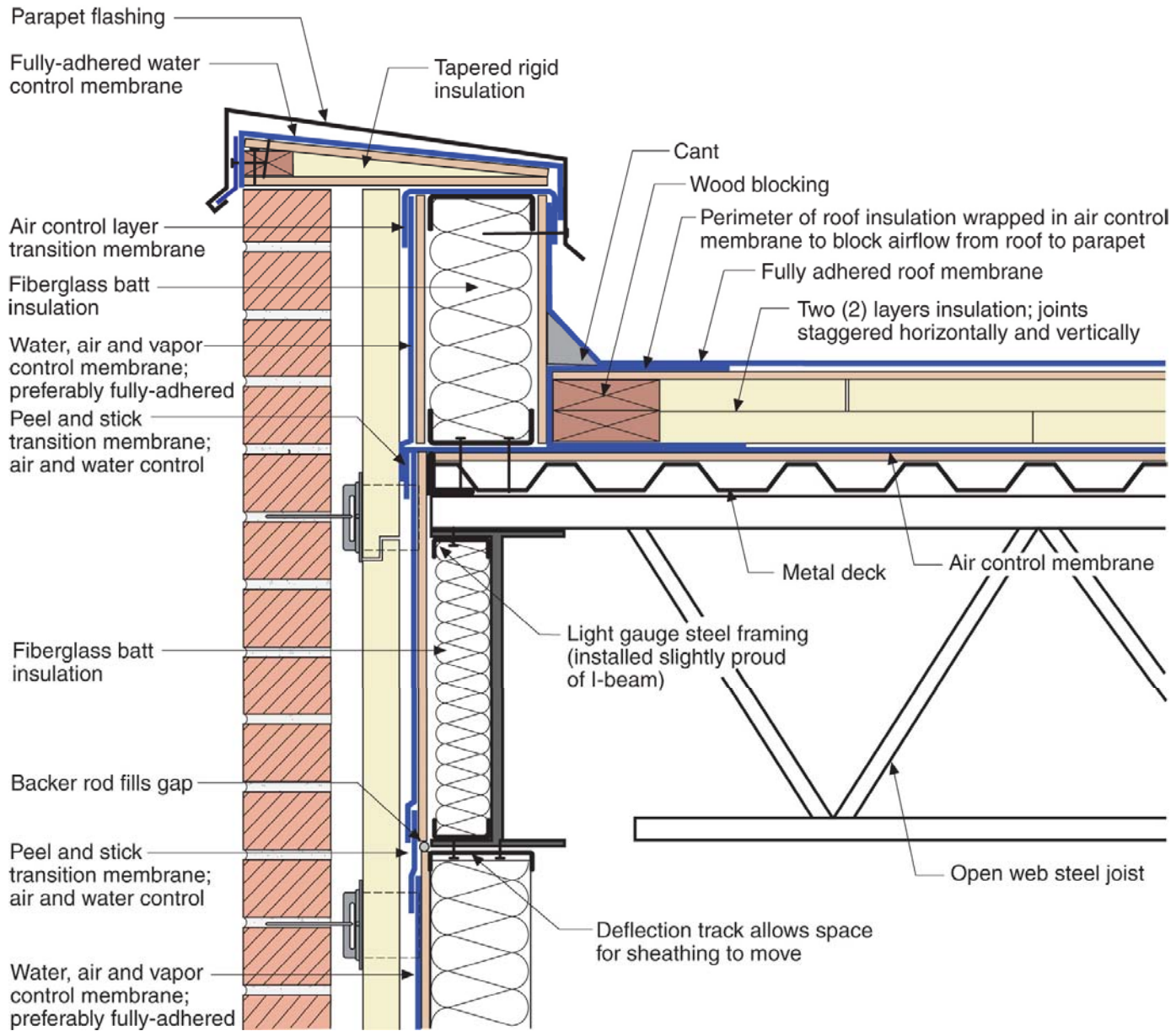
Hours of a winter day
From Baker, M.; Roofs, 1980

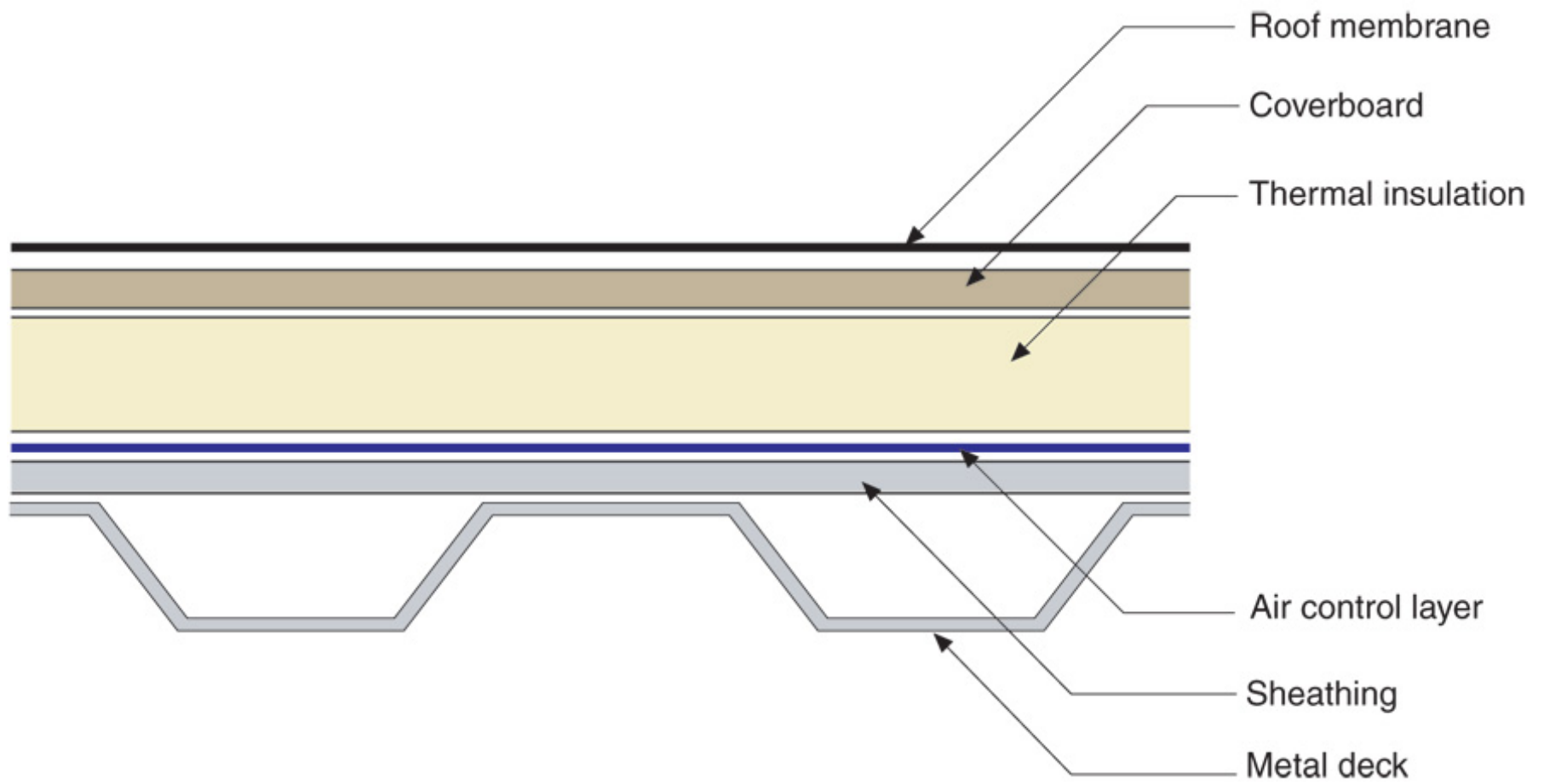


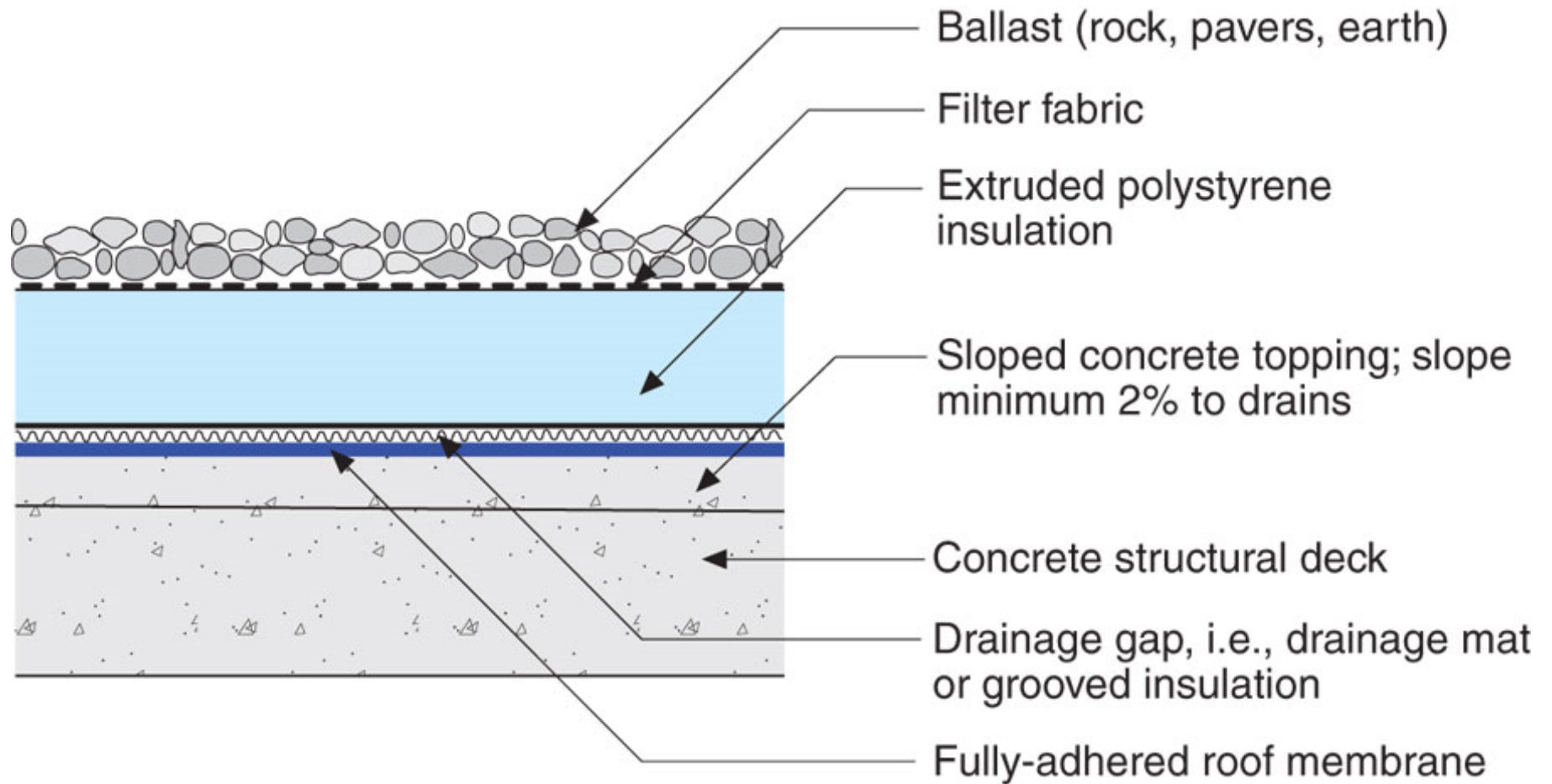
Insulation moved because of poor adhesion to deck and between layers



Adapted from Baker, M.; *Roofs*, 1980;
Courtesy National Research Council of Canada



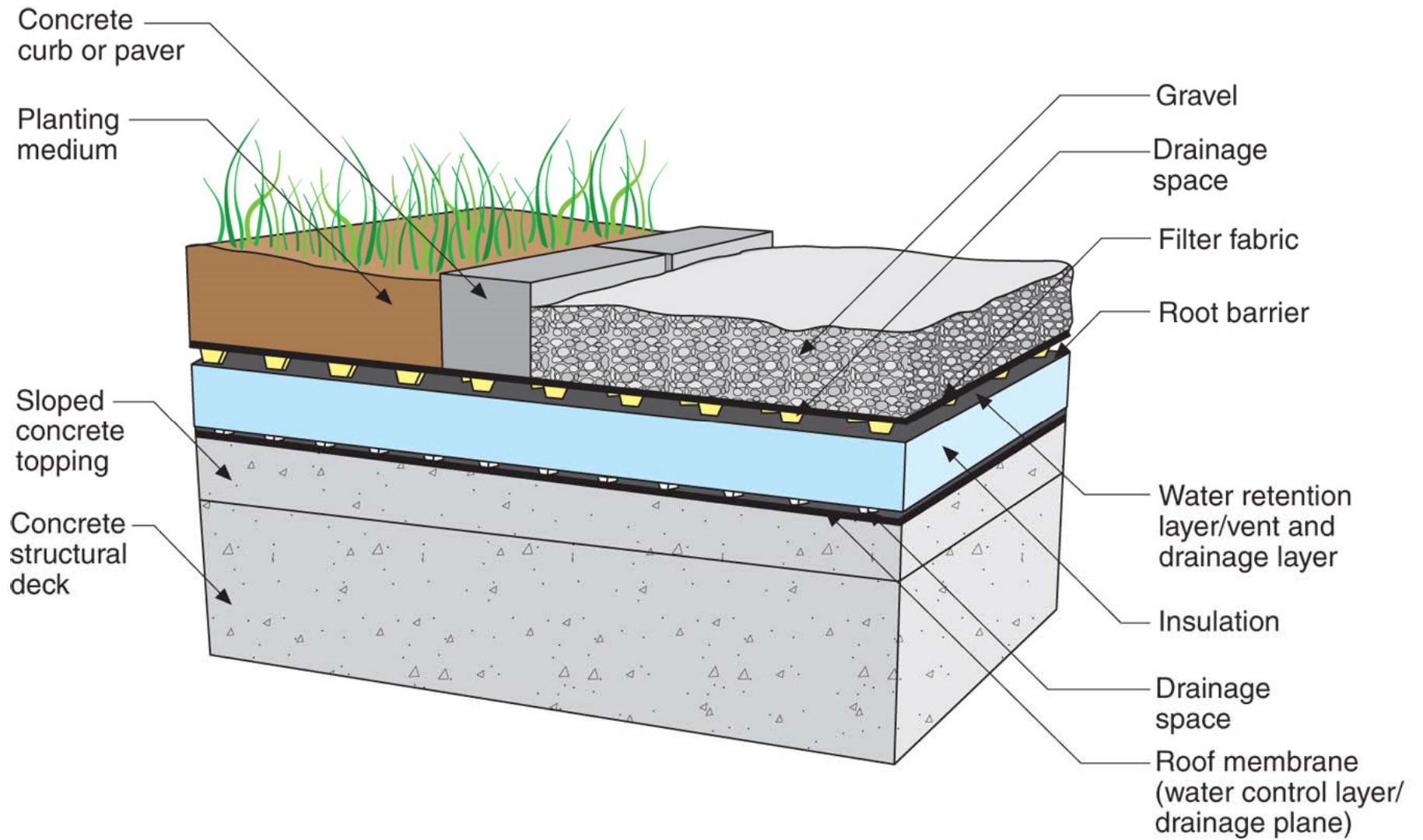






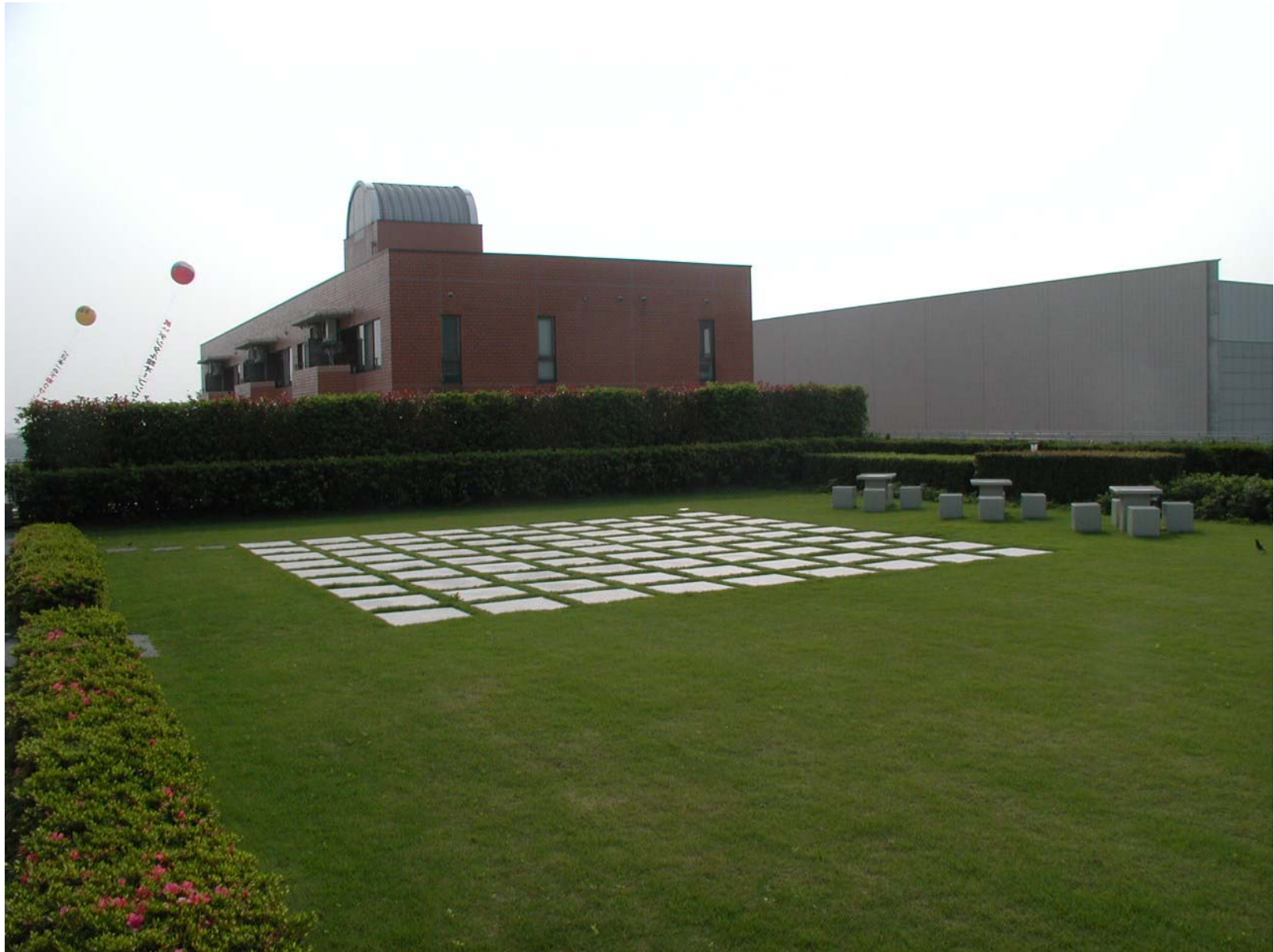
**Really Heavy
Pink Stuff**

**Liquid Waterproofing
over Concrete Deck**

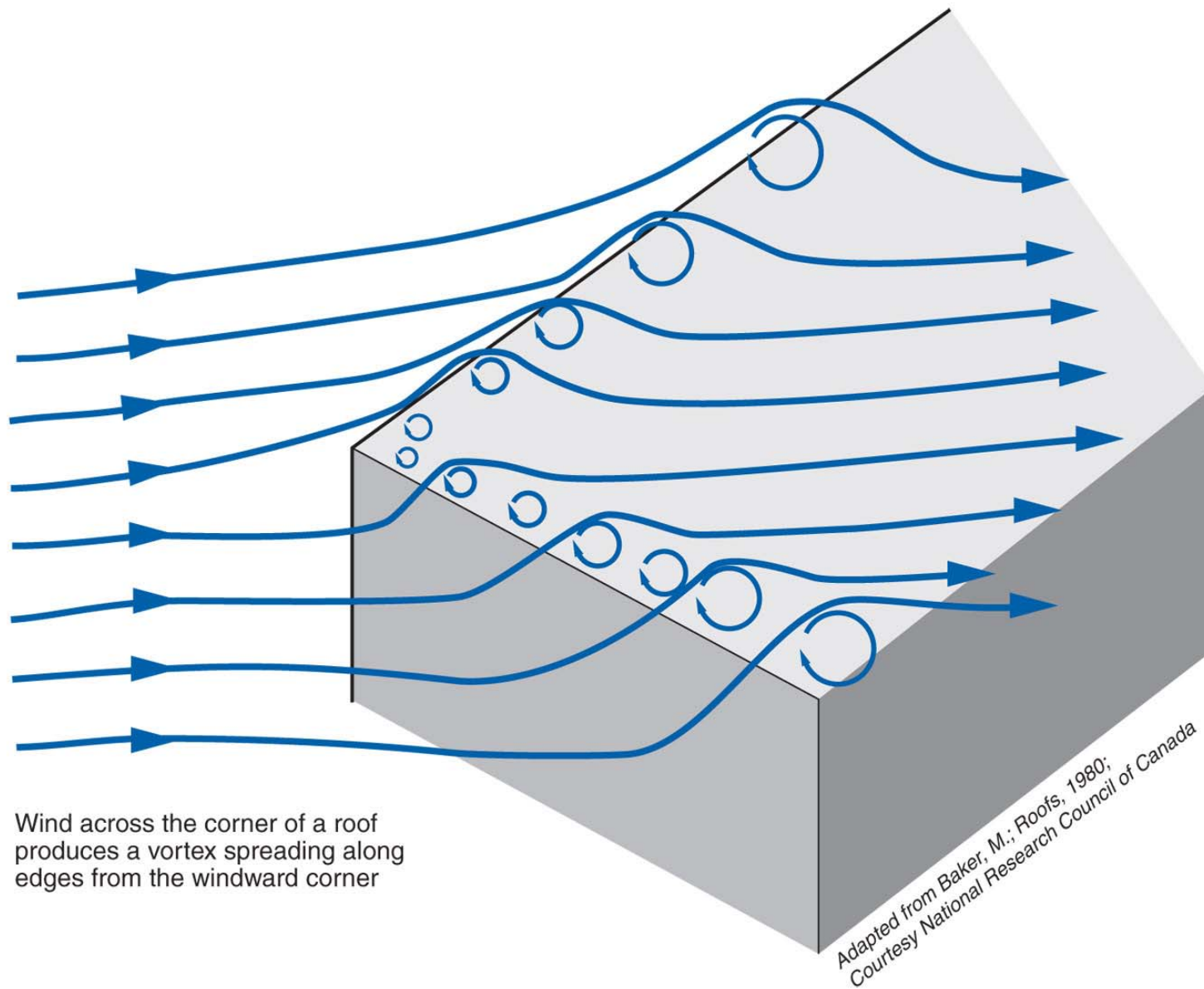


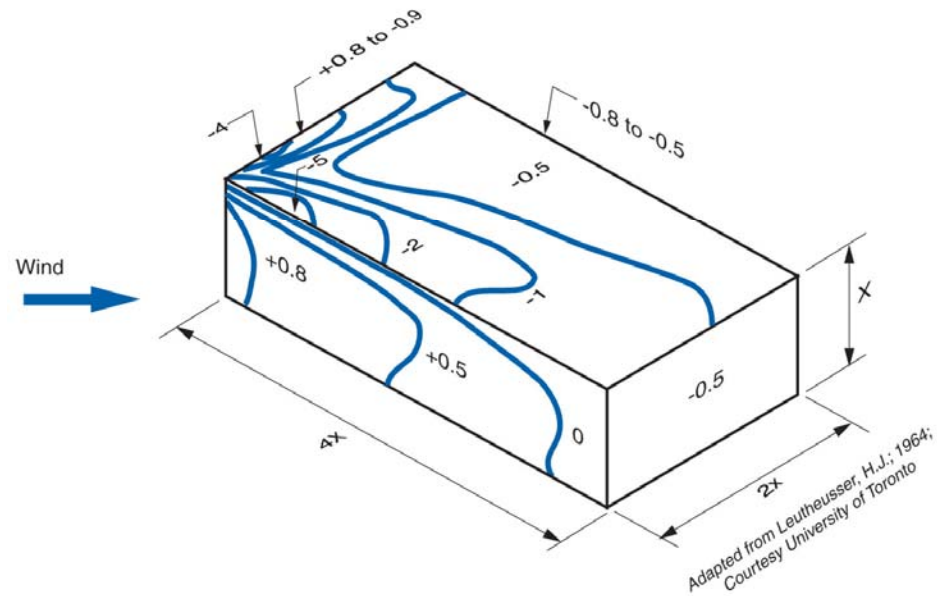
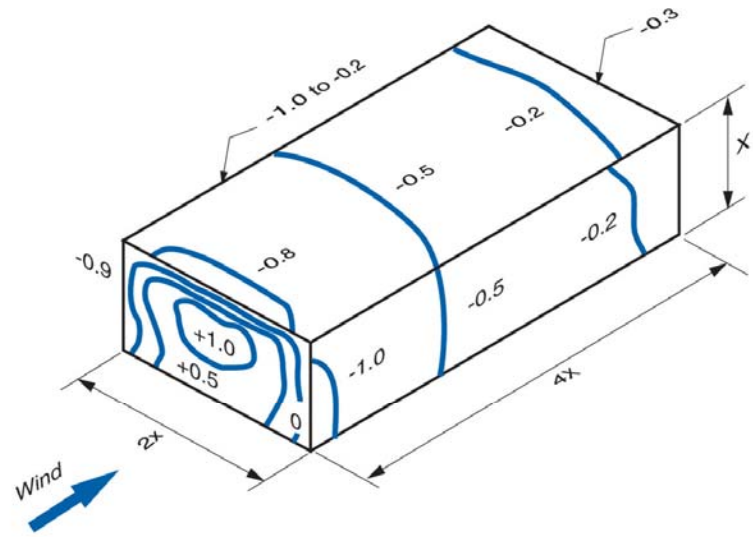


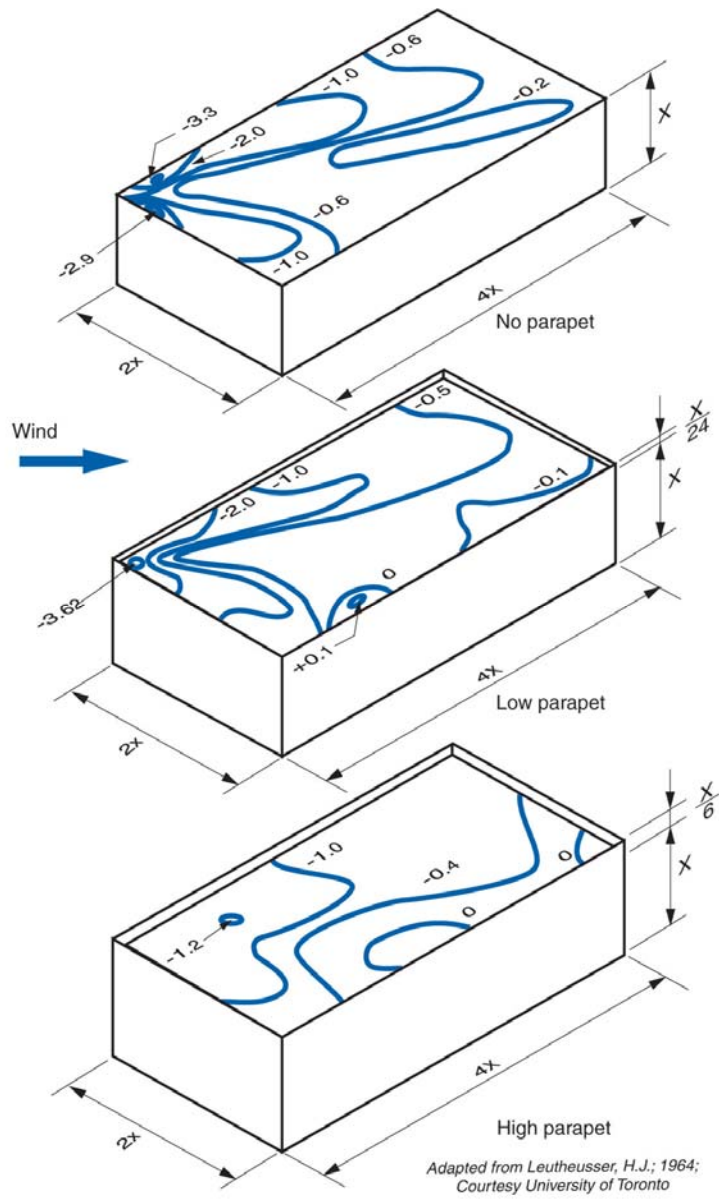


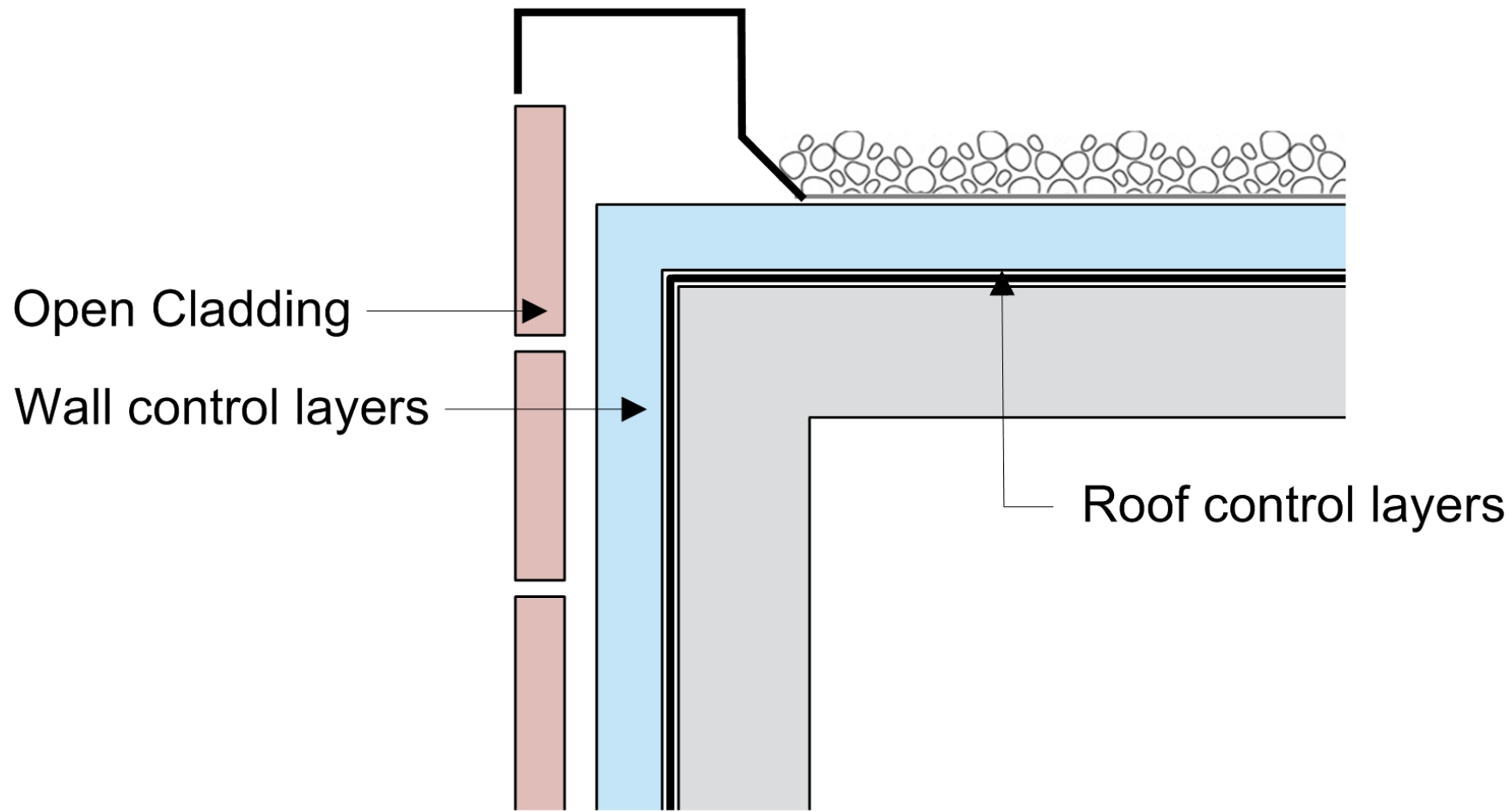


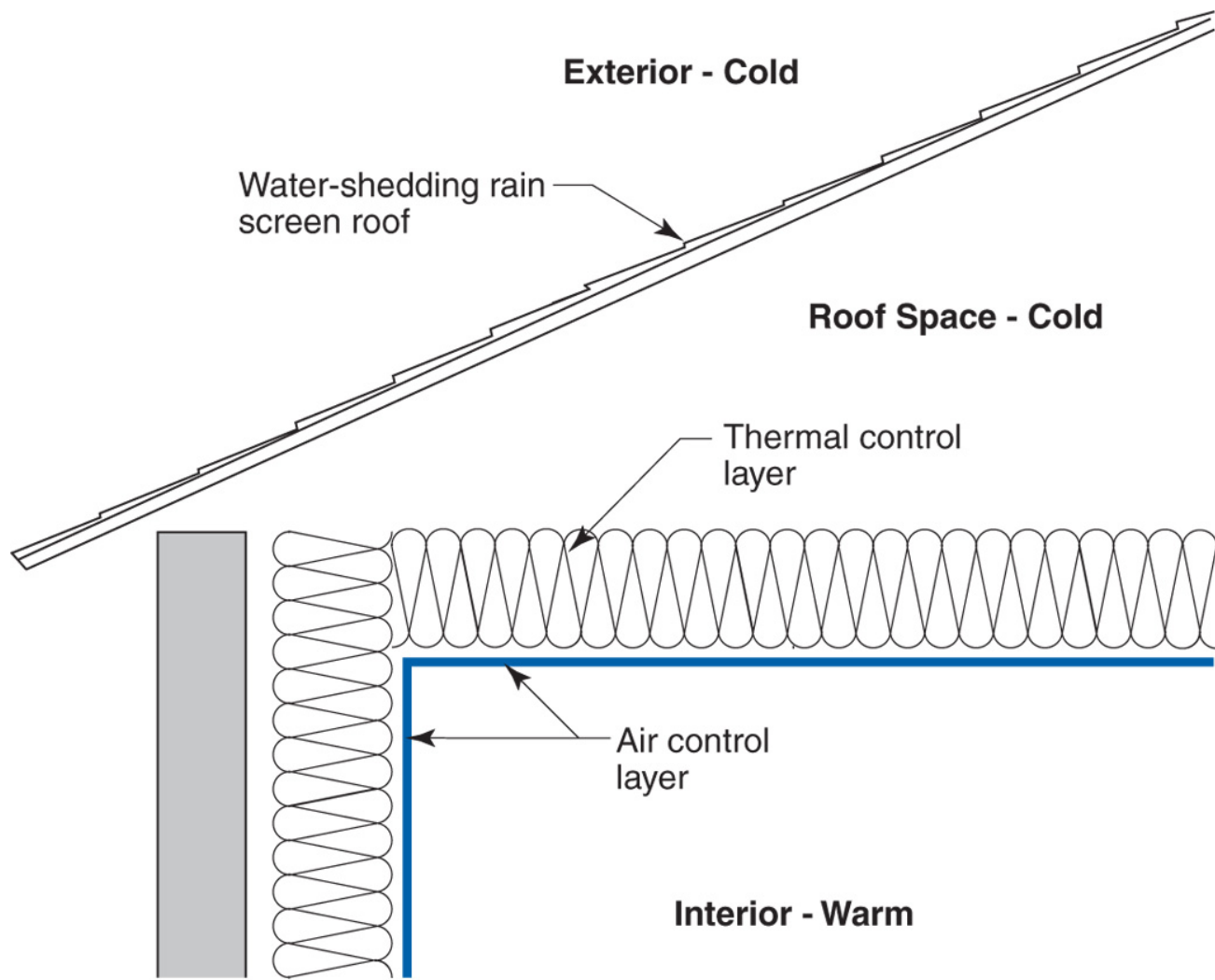




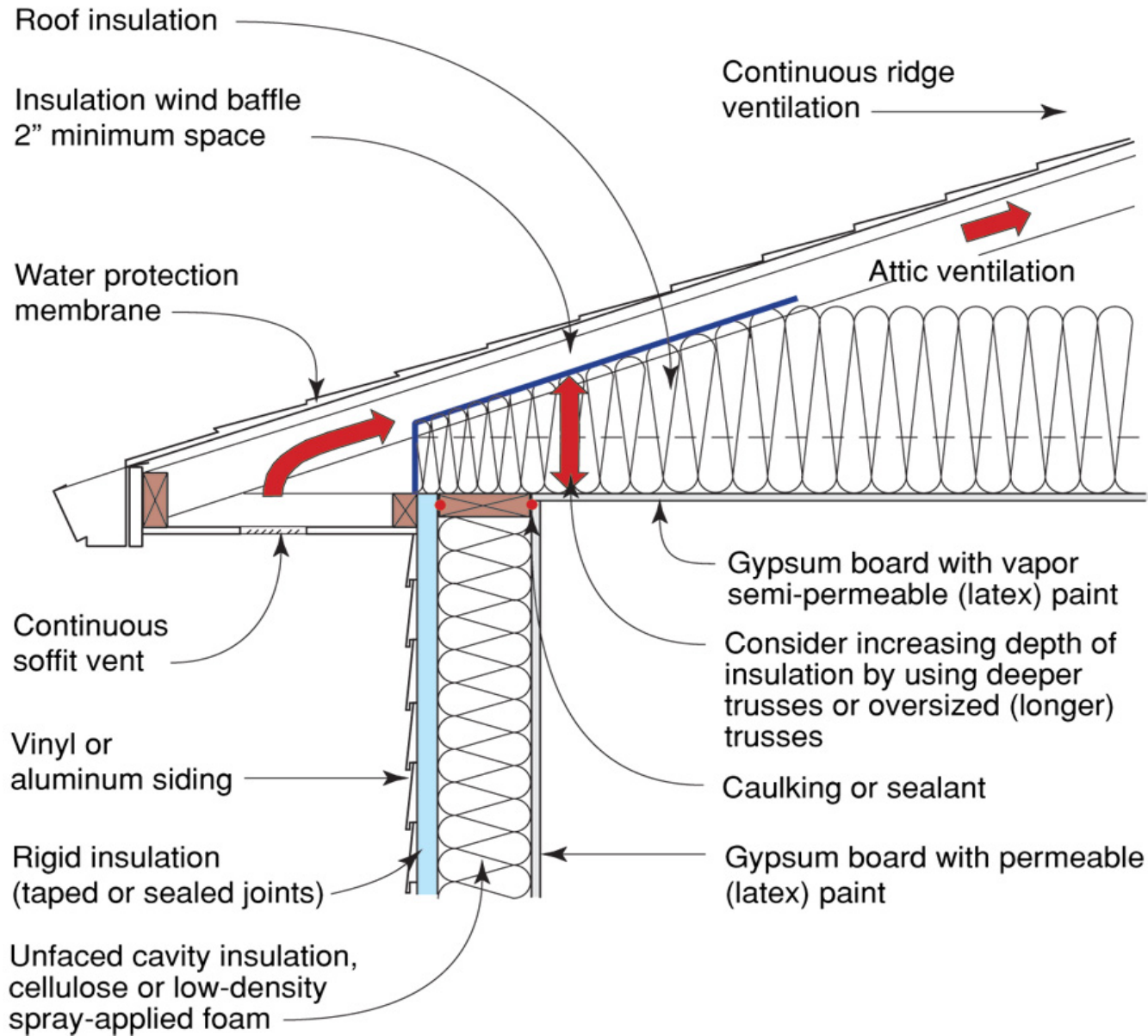




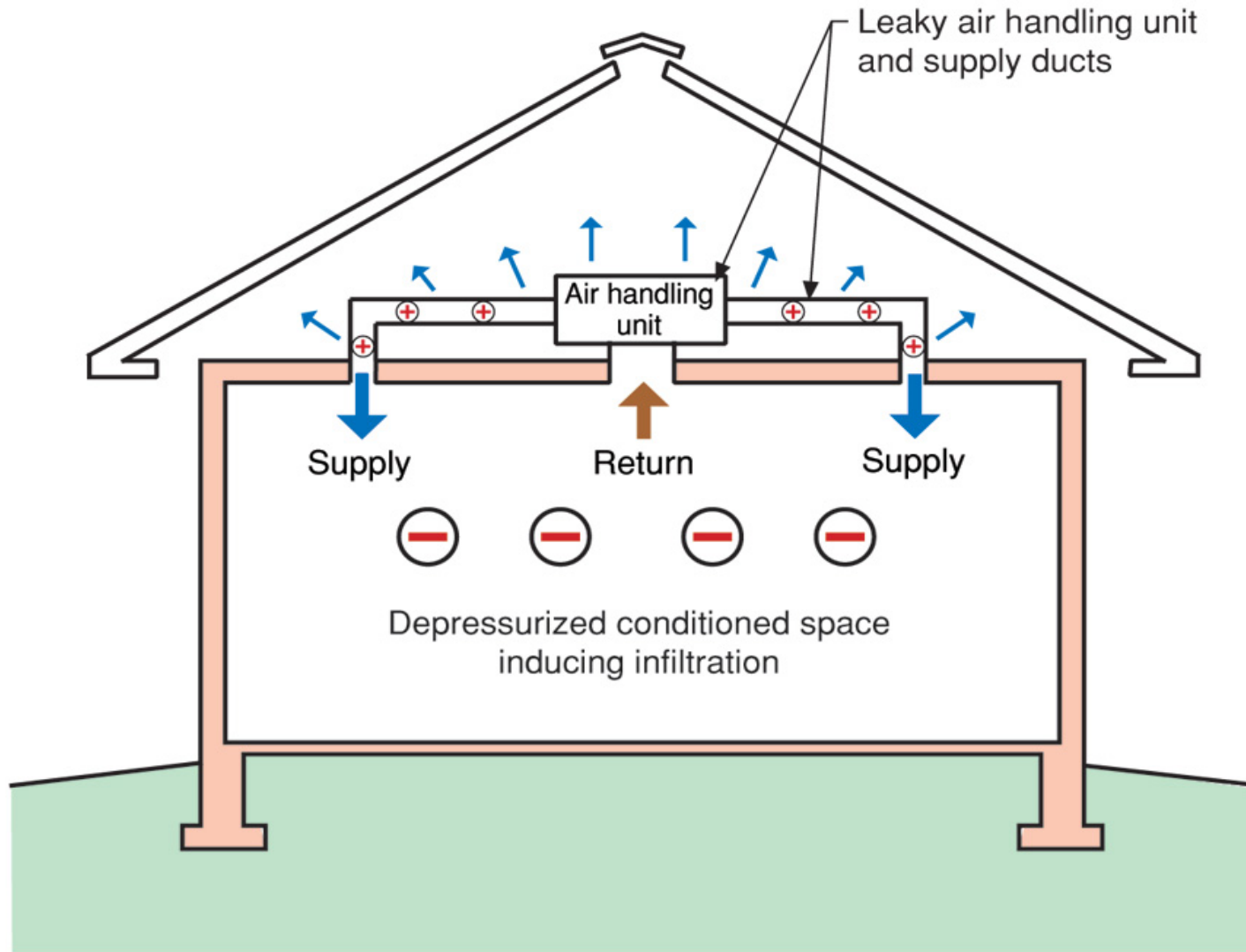




From Baker, M.; Roofs, 1980







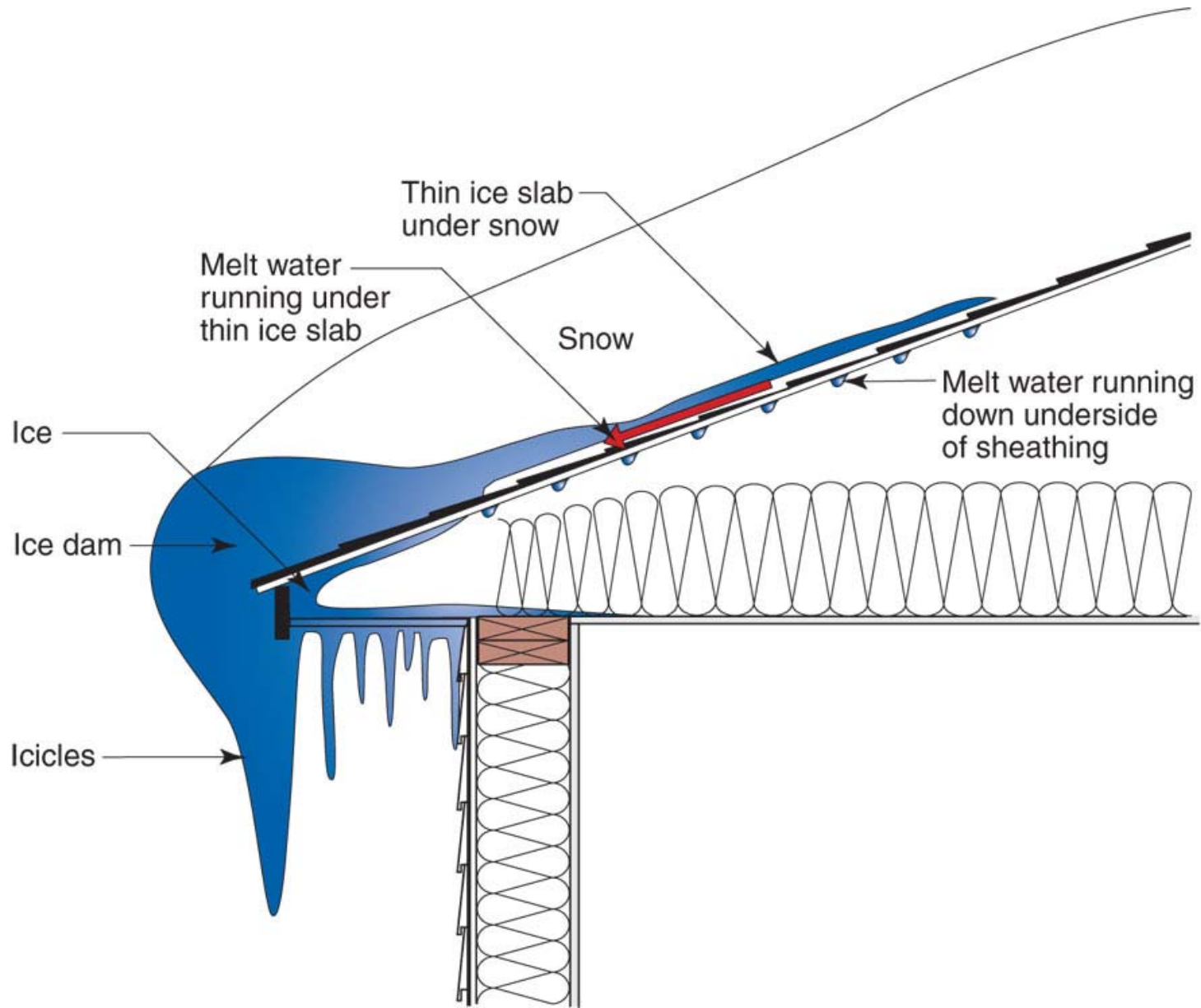
Note: Colored shading depicts the building's thermal barrier and pressure boundary. The thermal barrier and pressure boundary enclose the conditioned space.



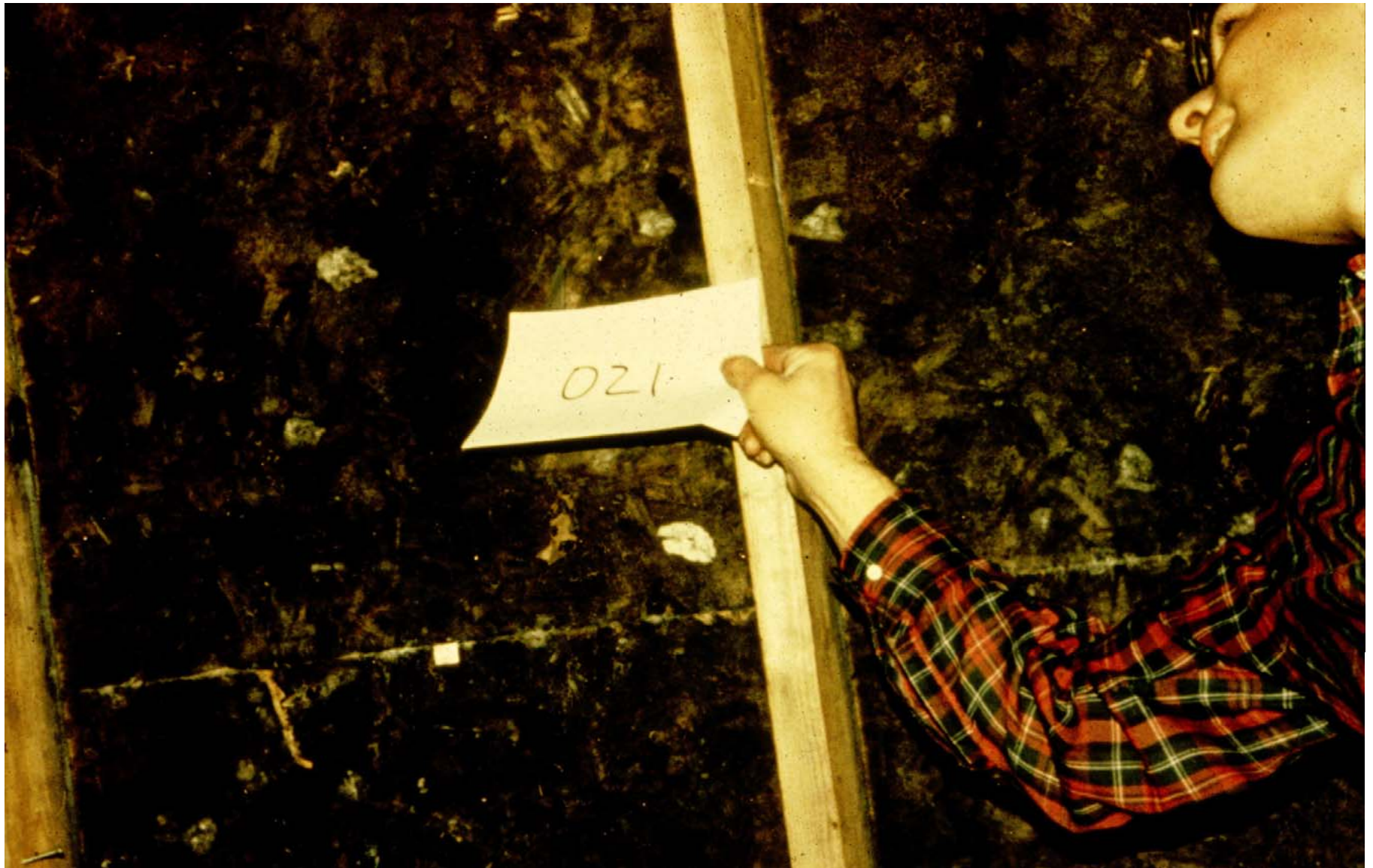












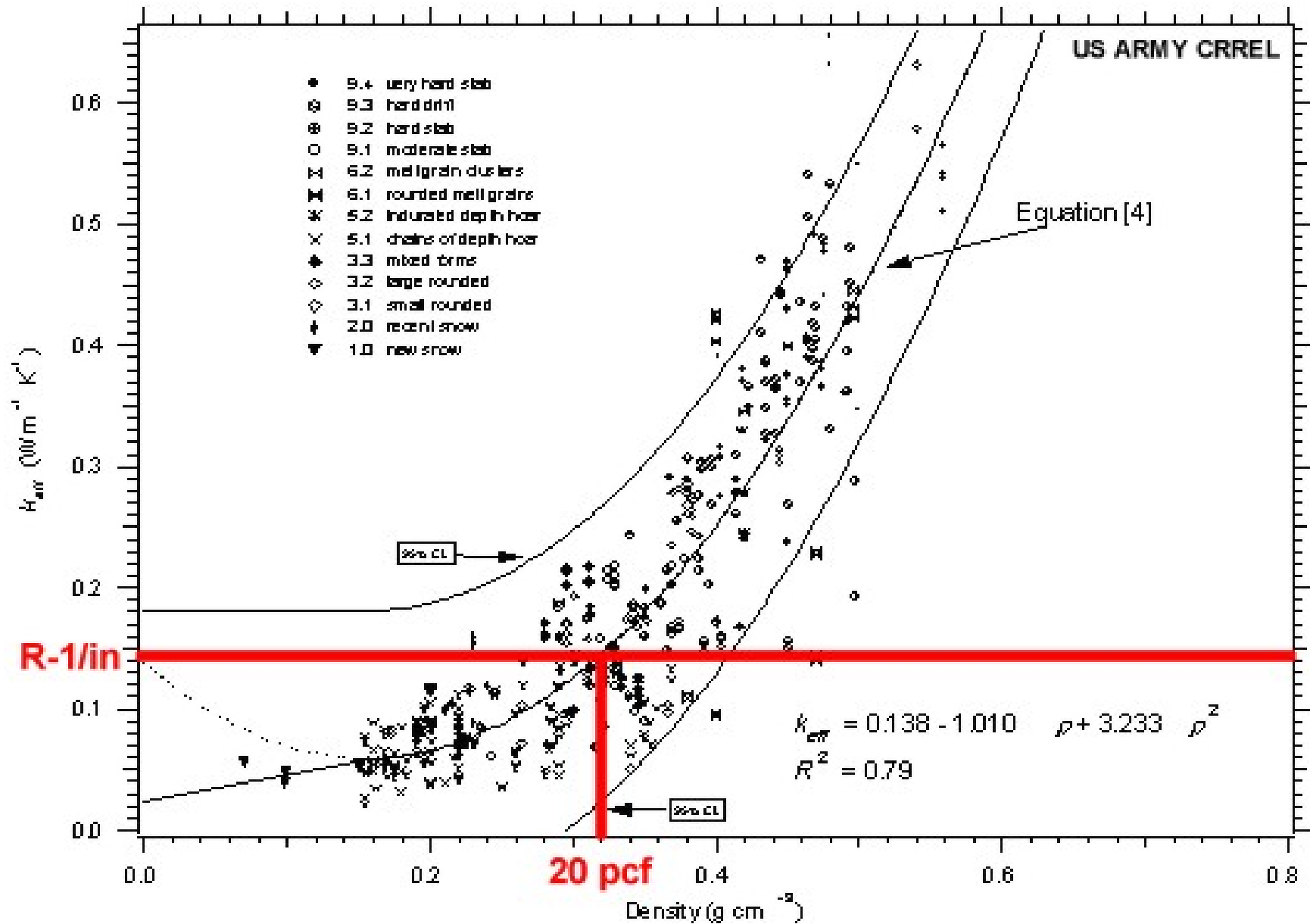






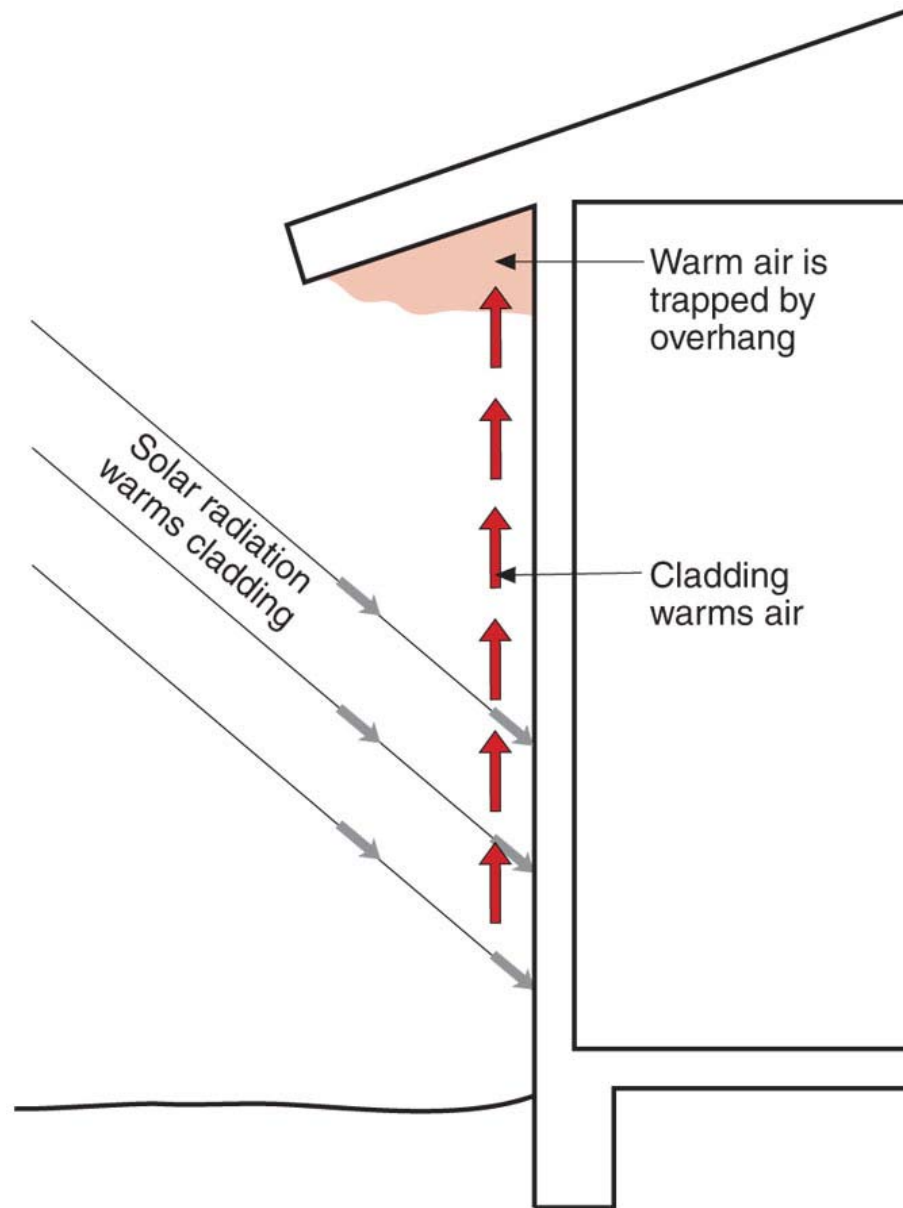










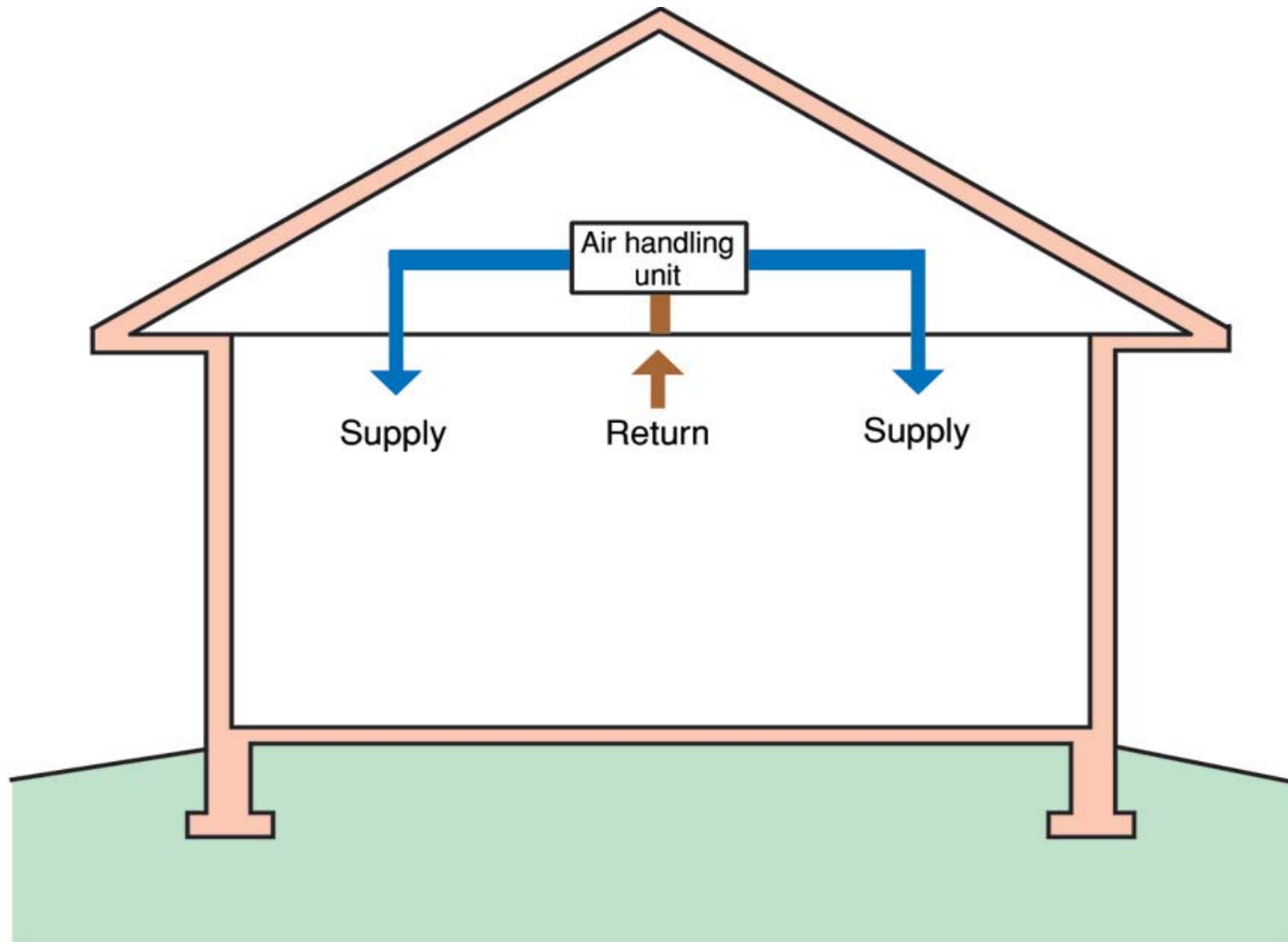




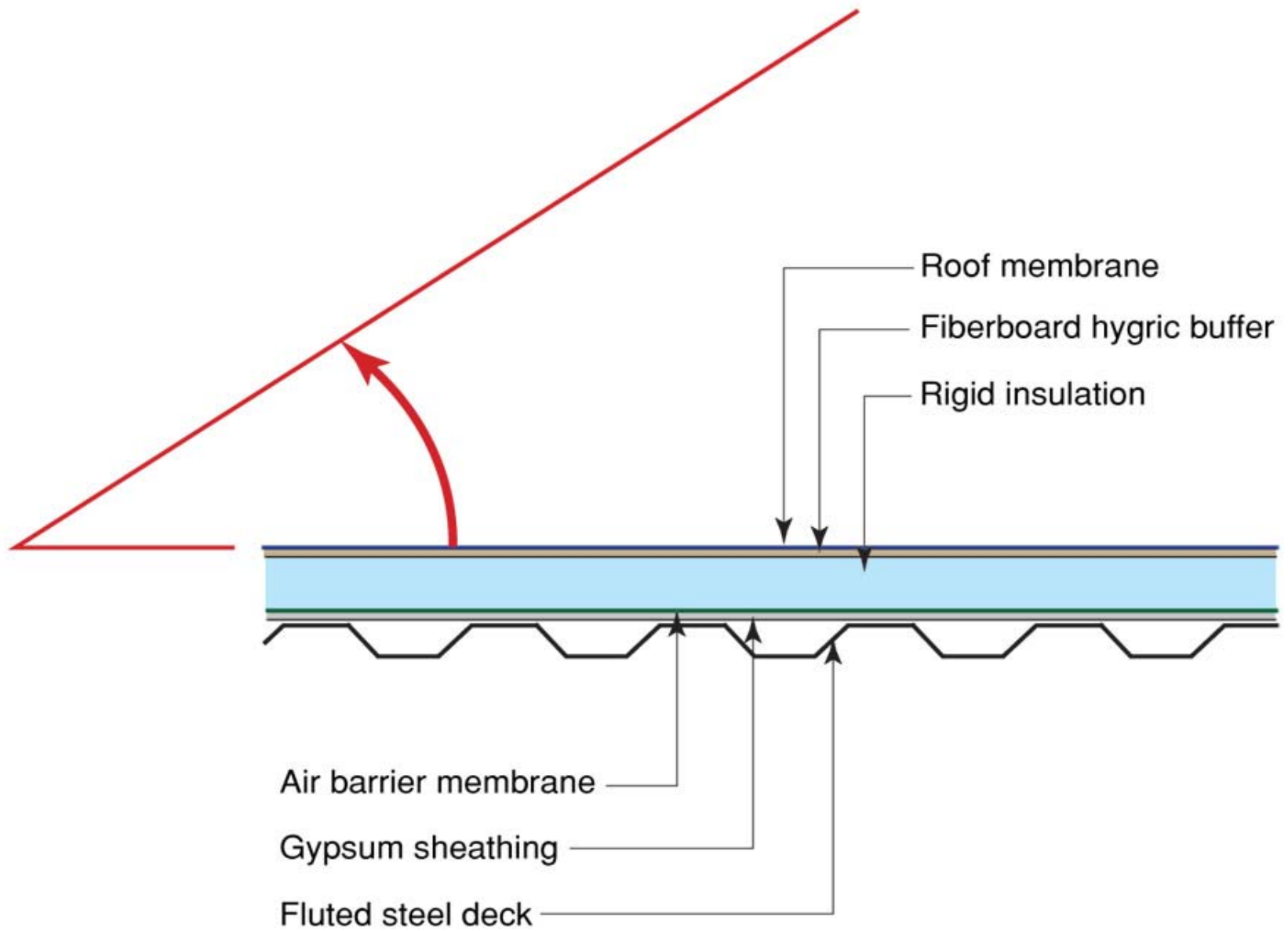


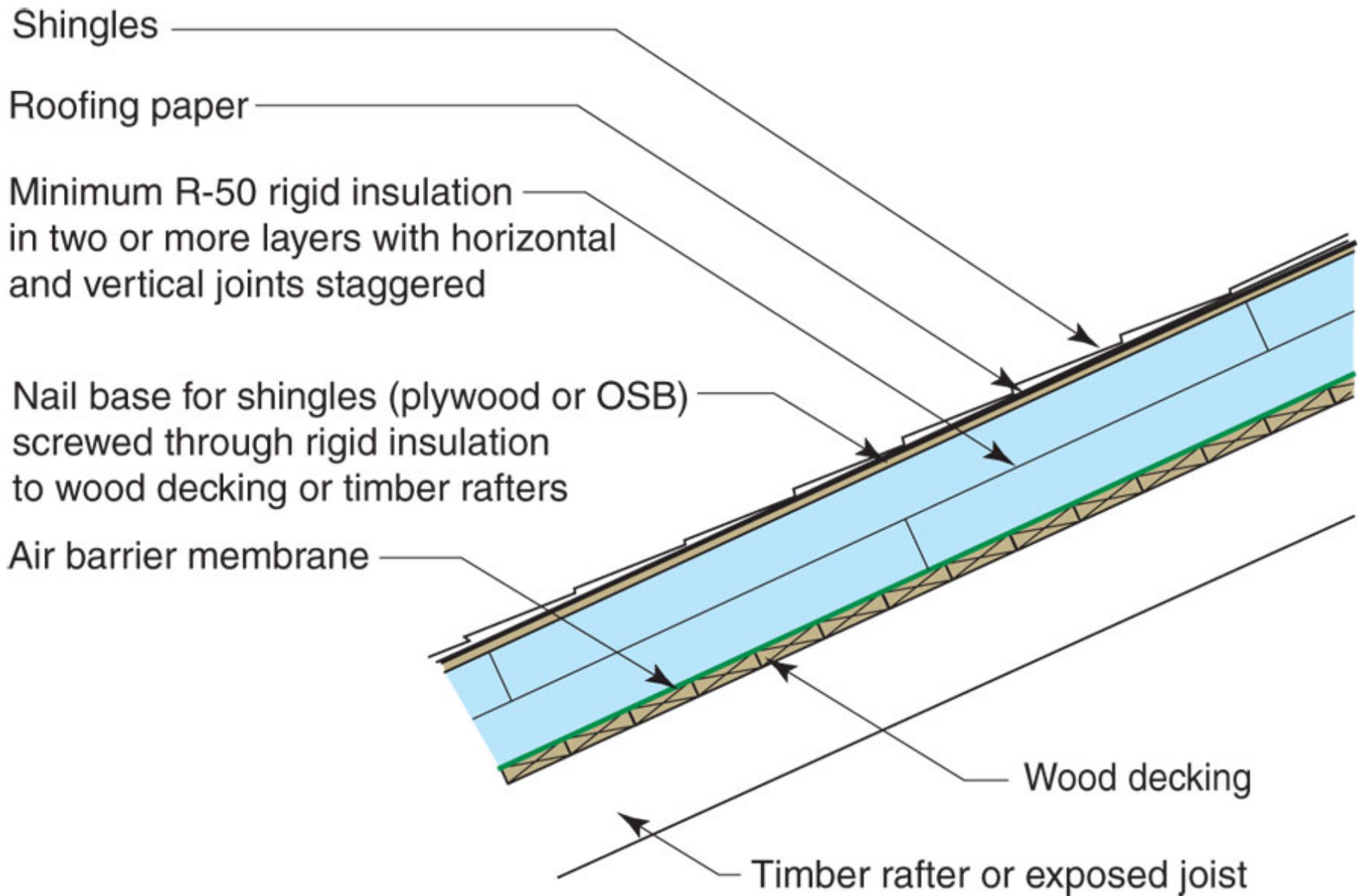


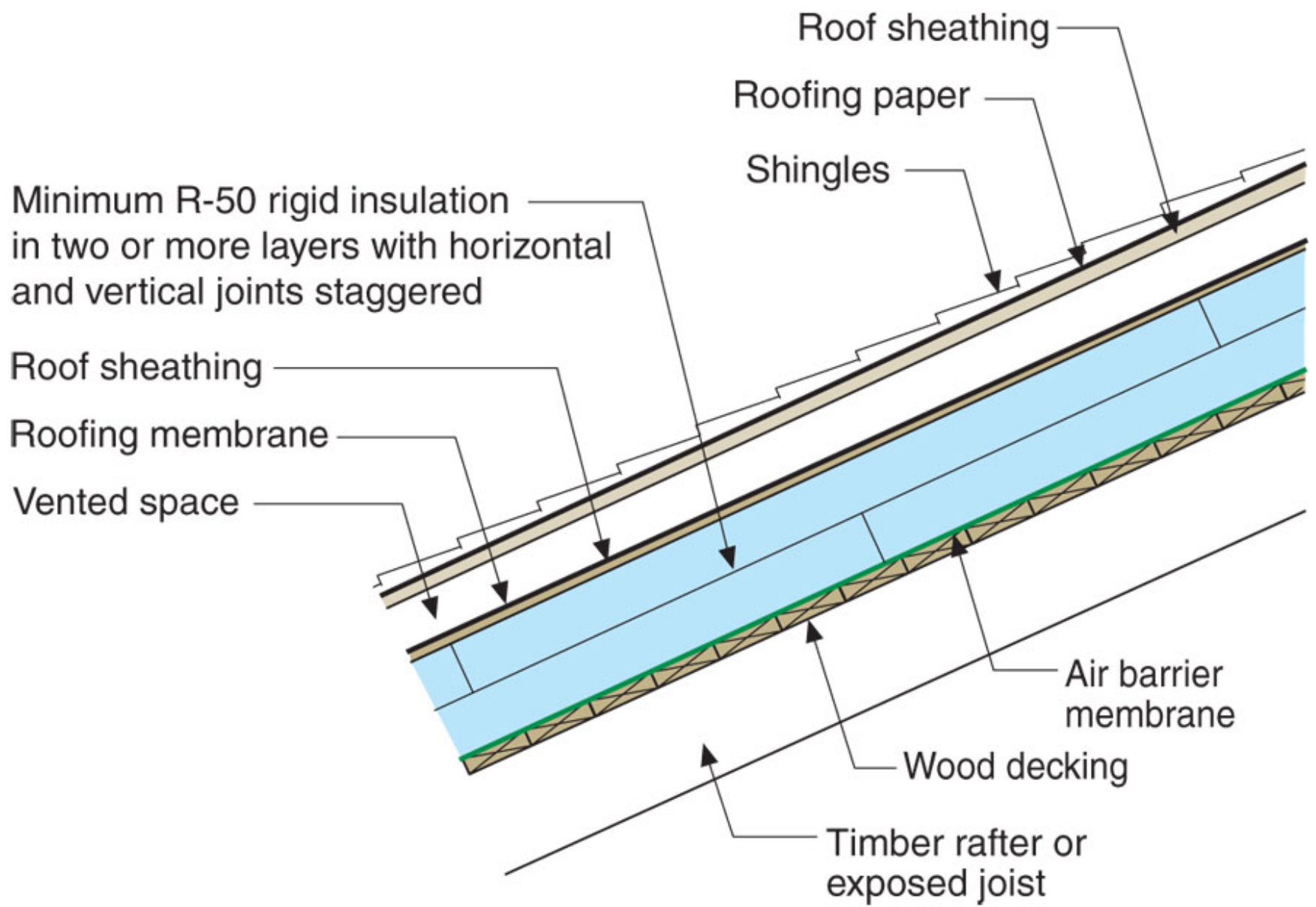


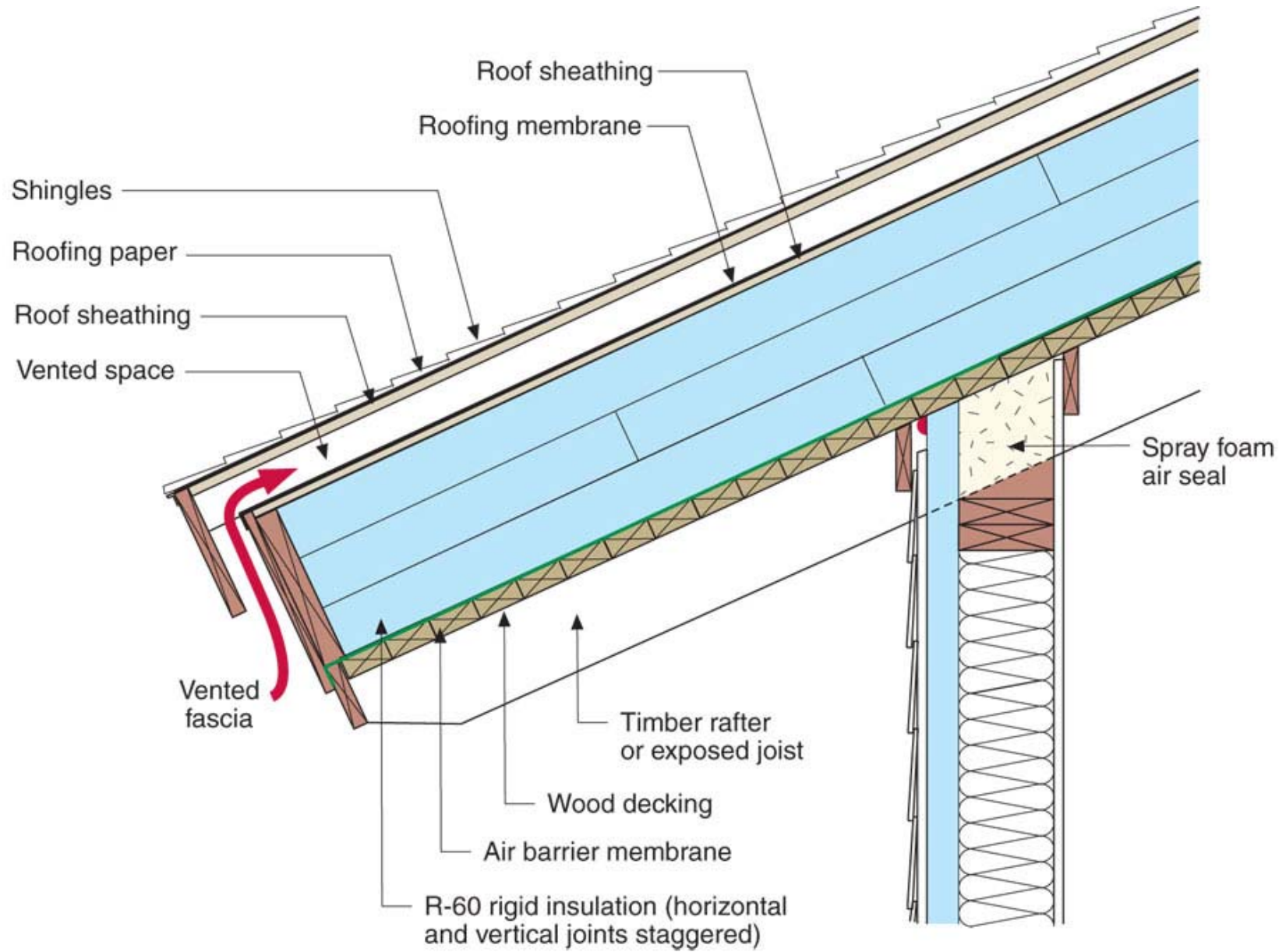


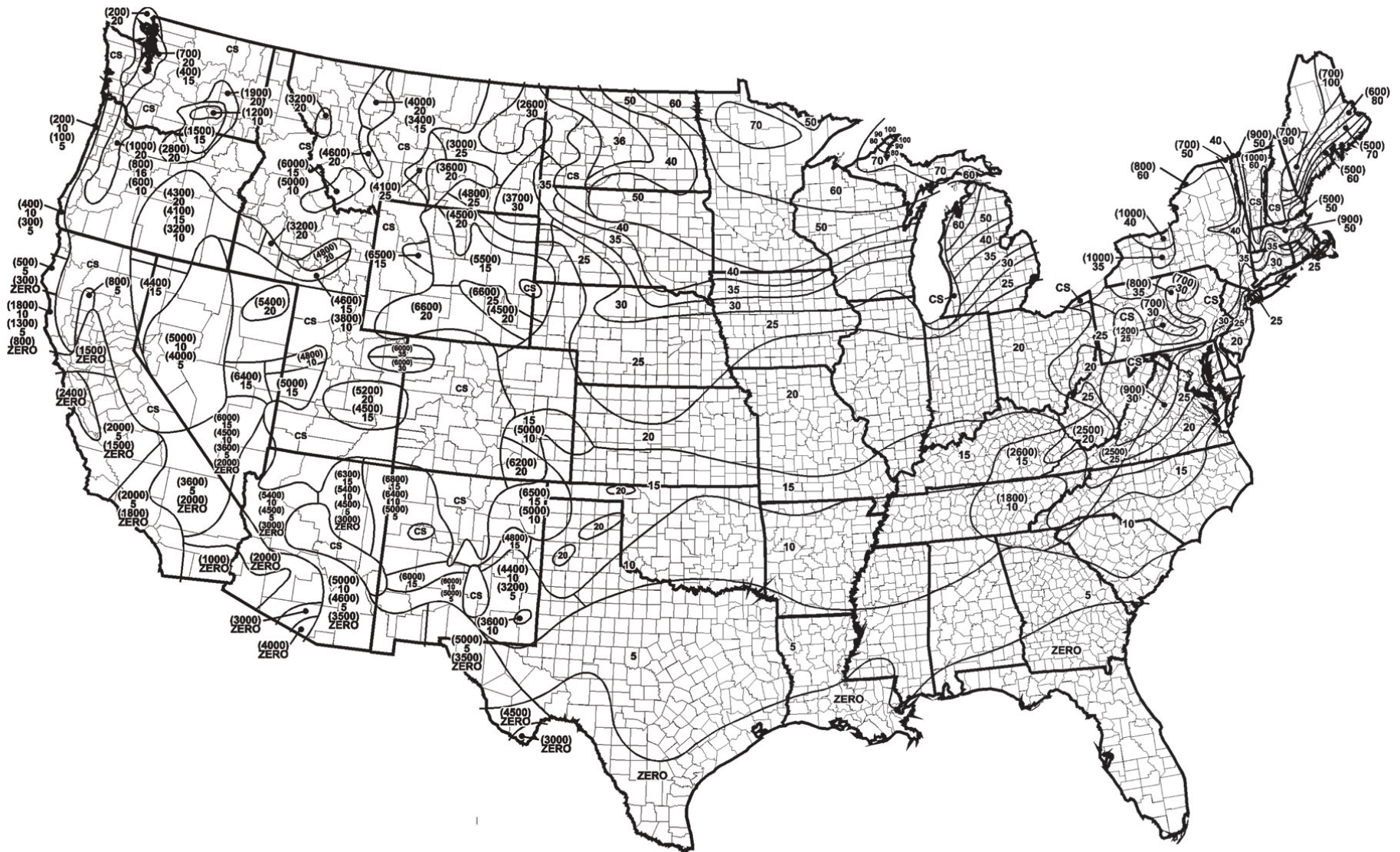
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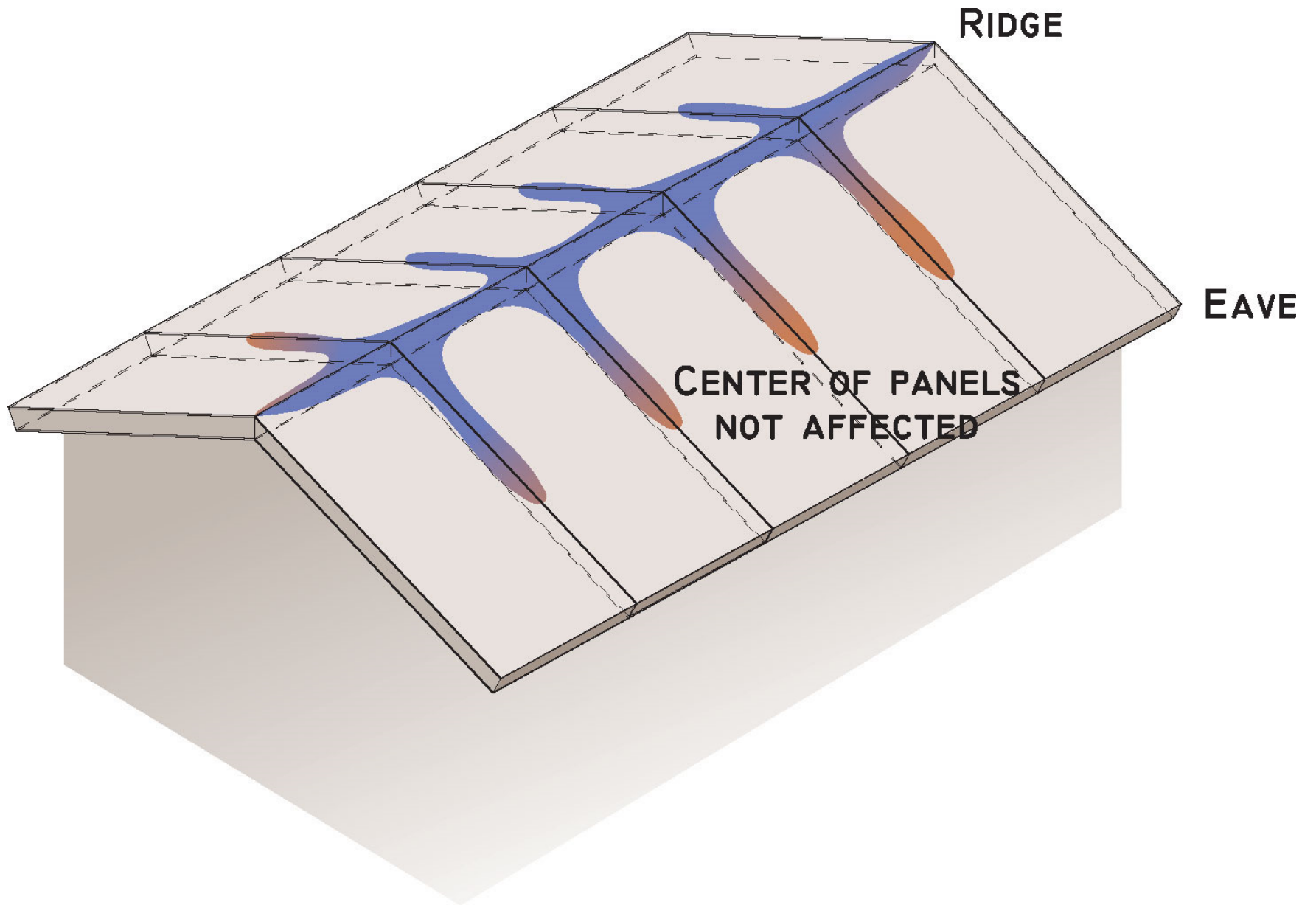




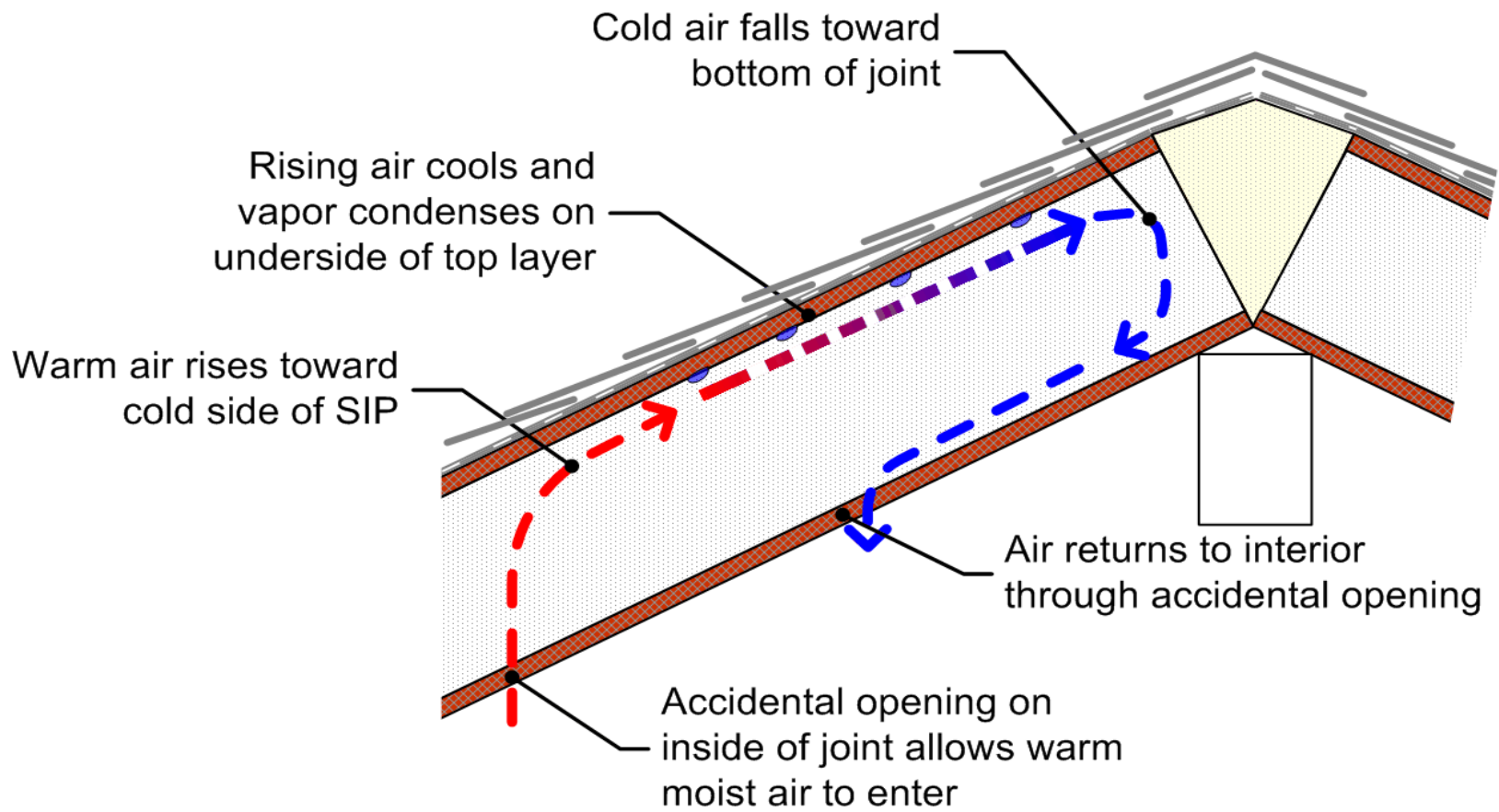


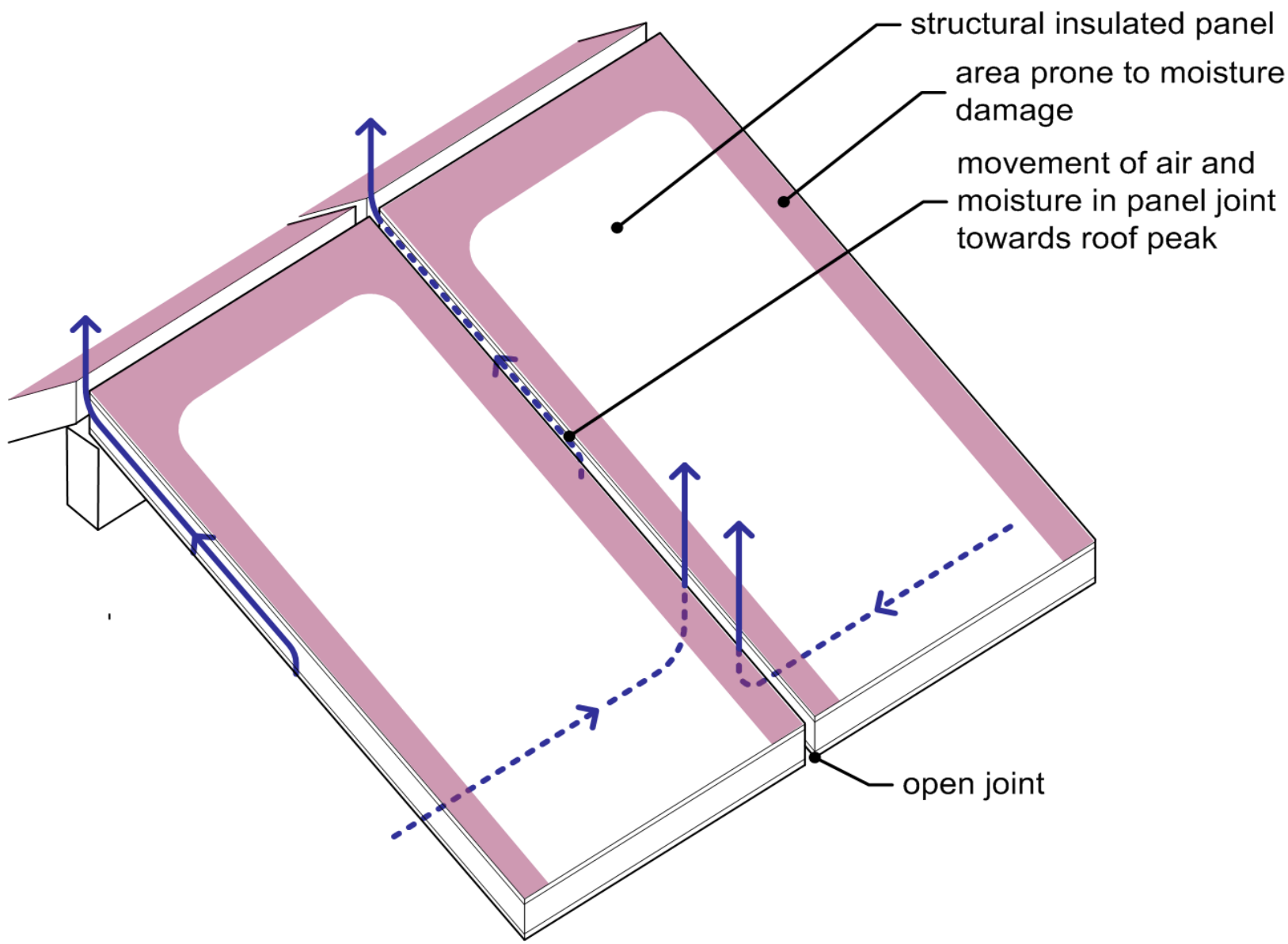


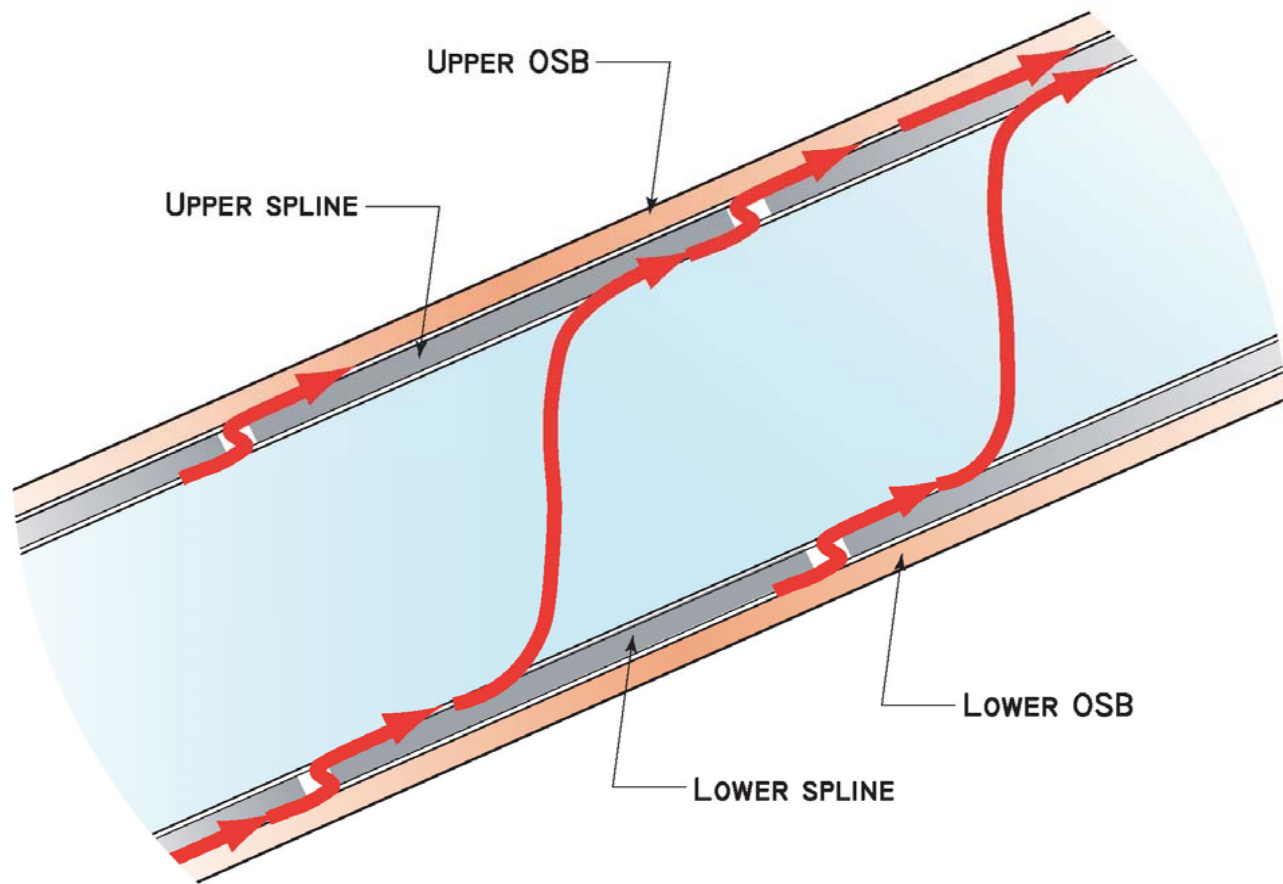




















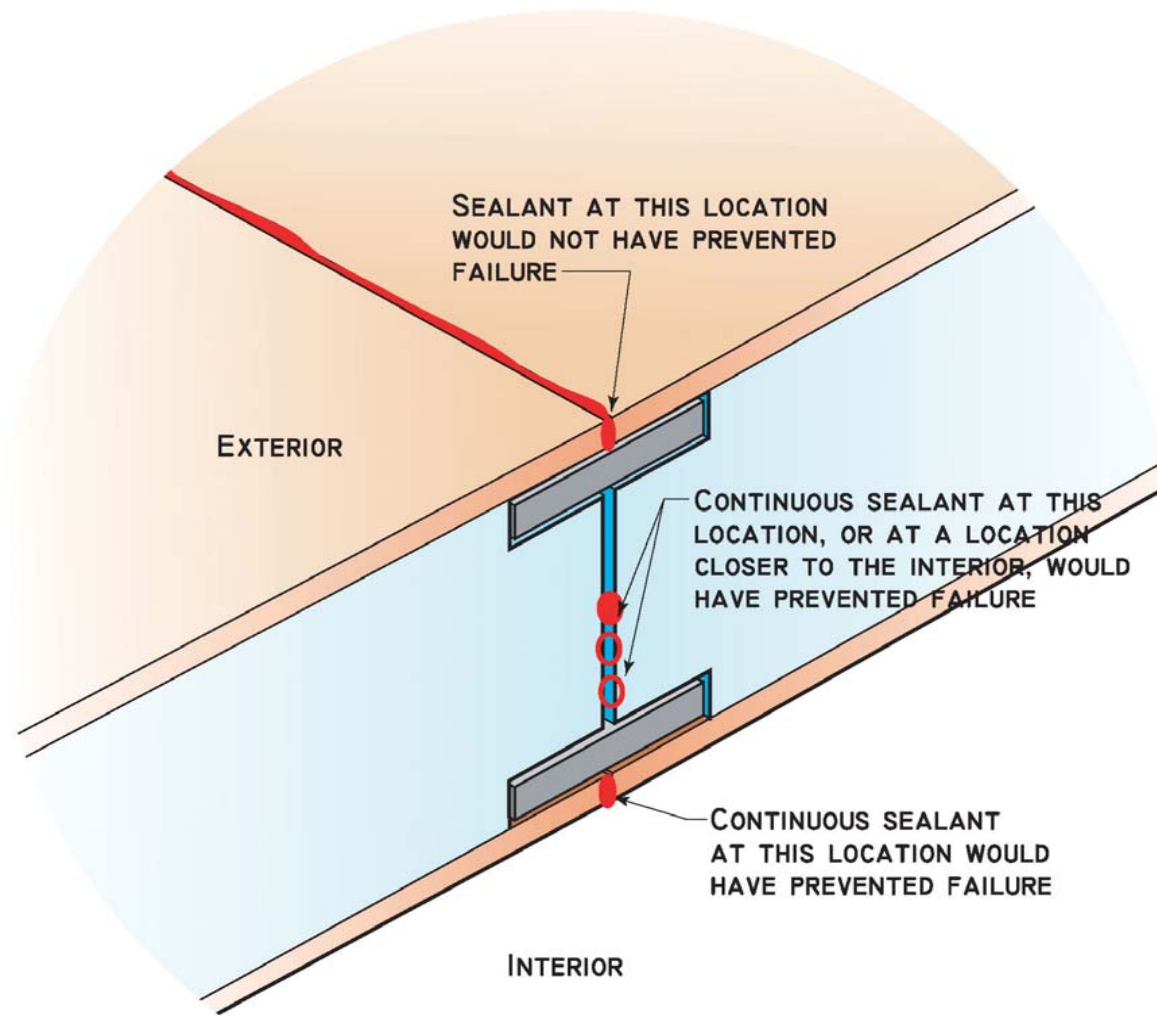


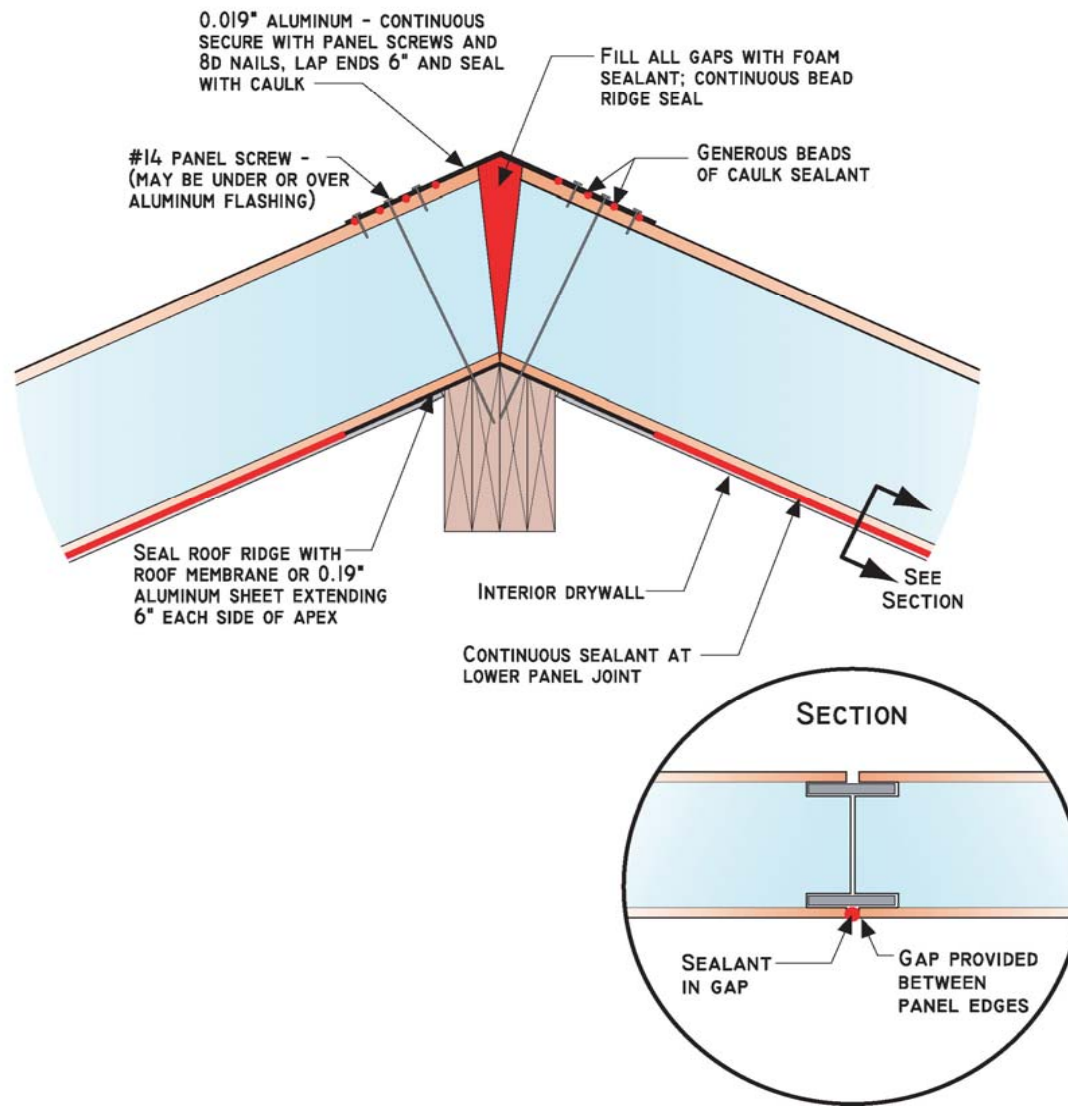










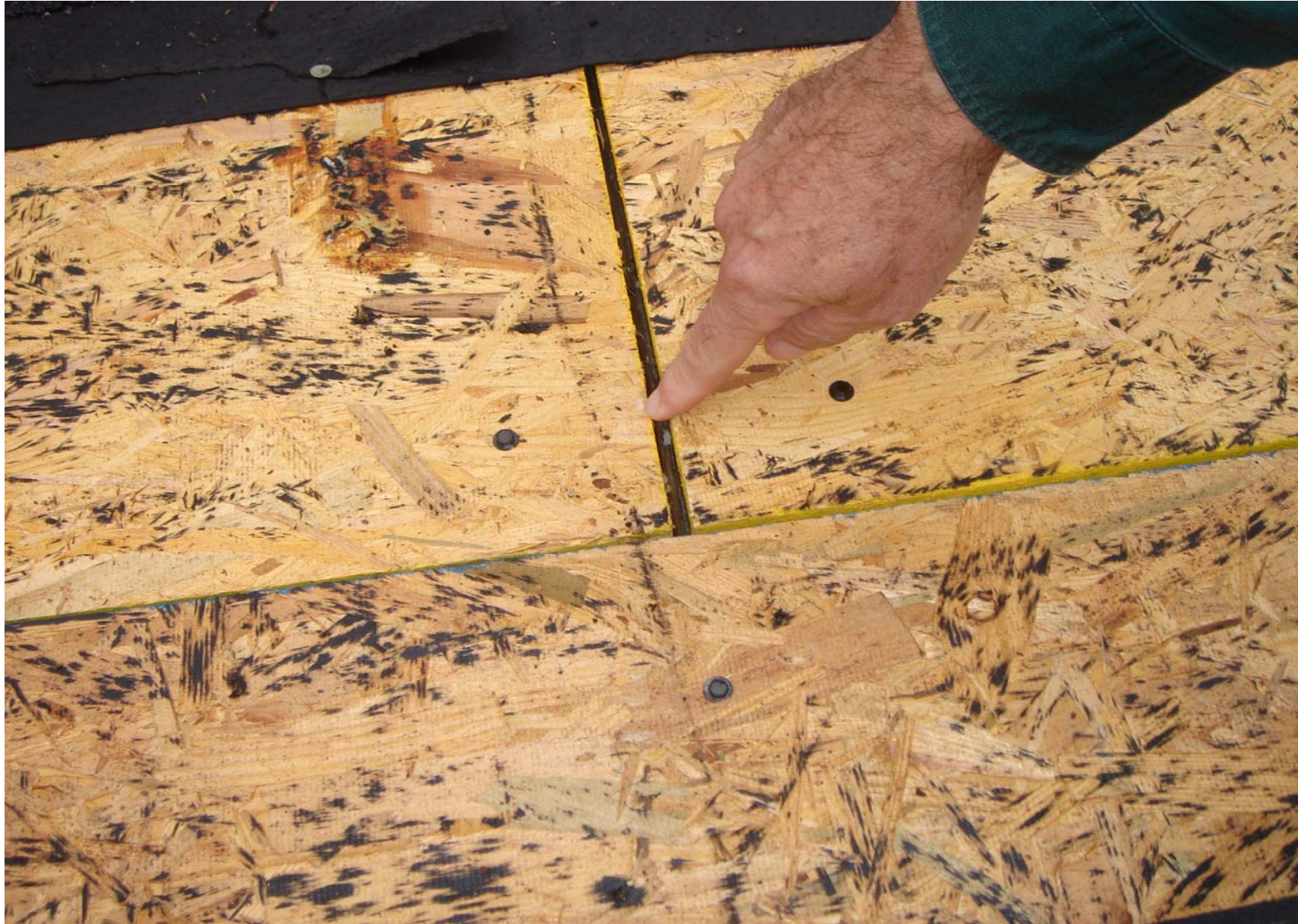




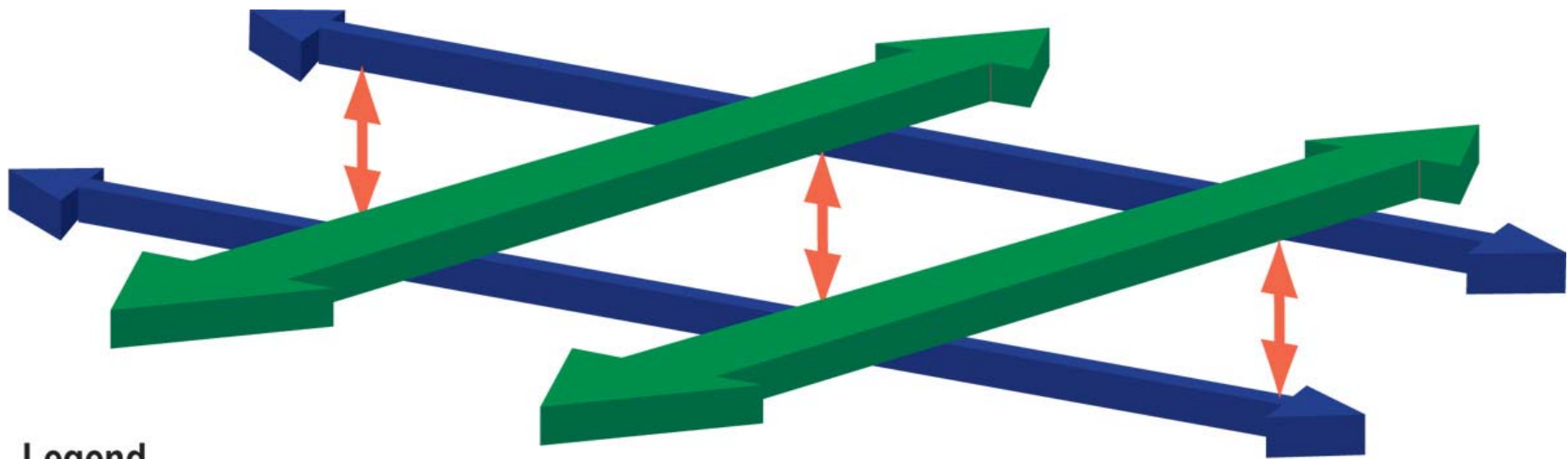









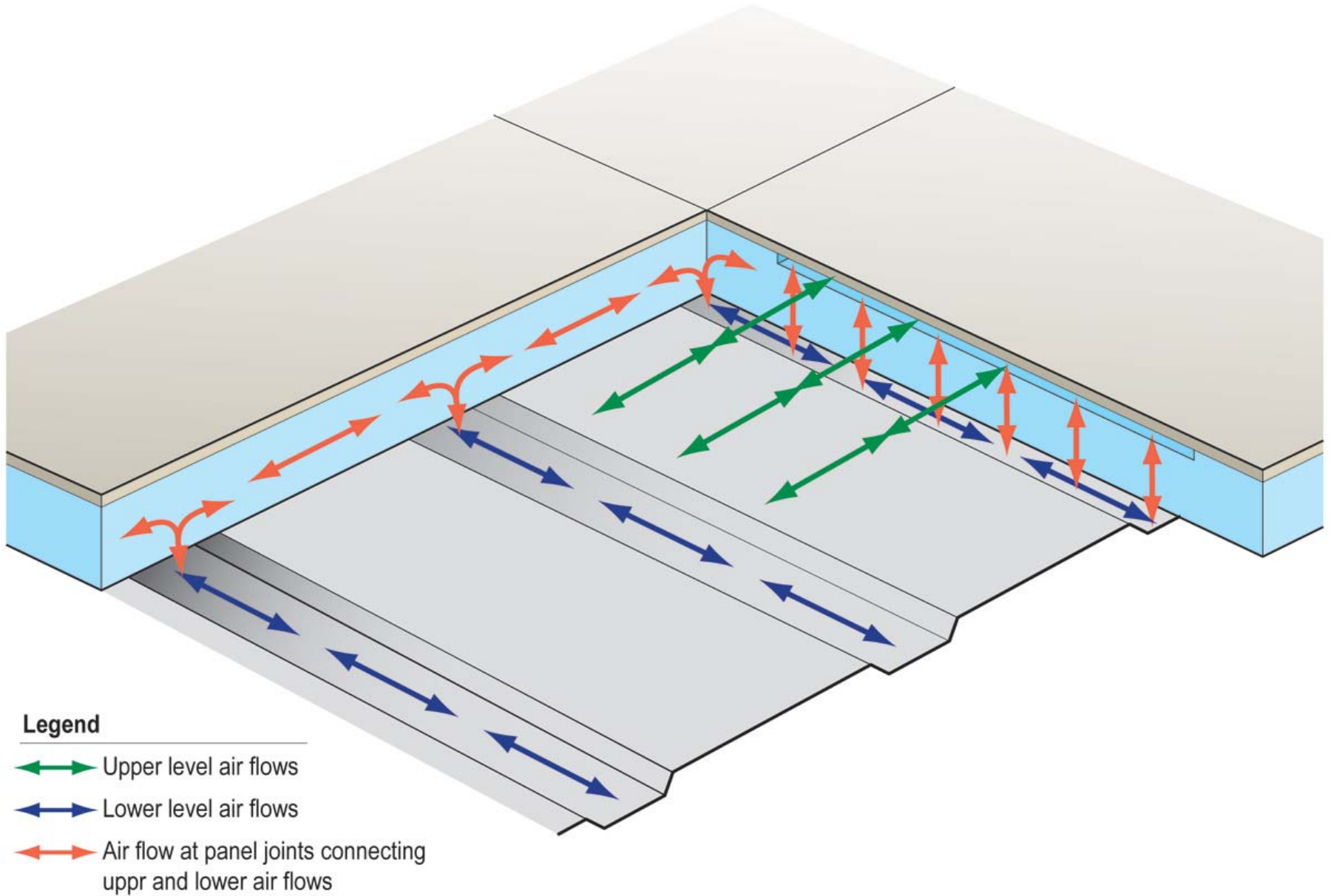


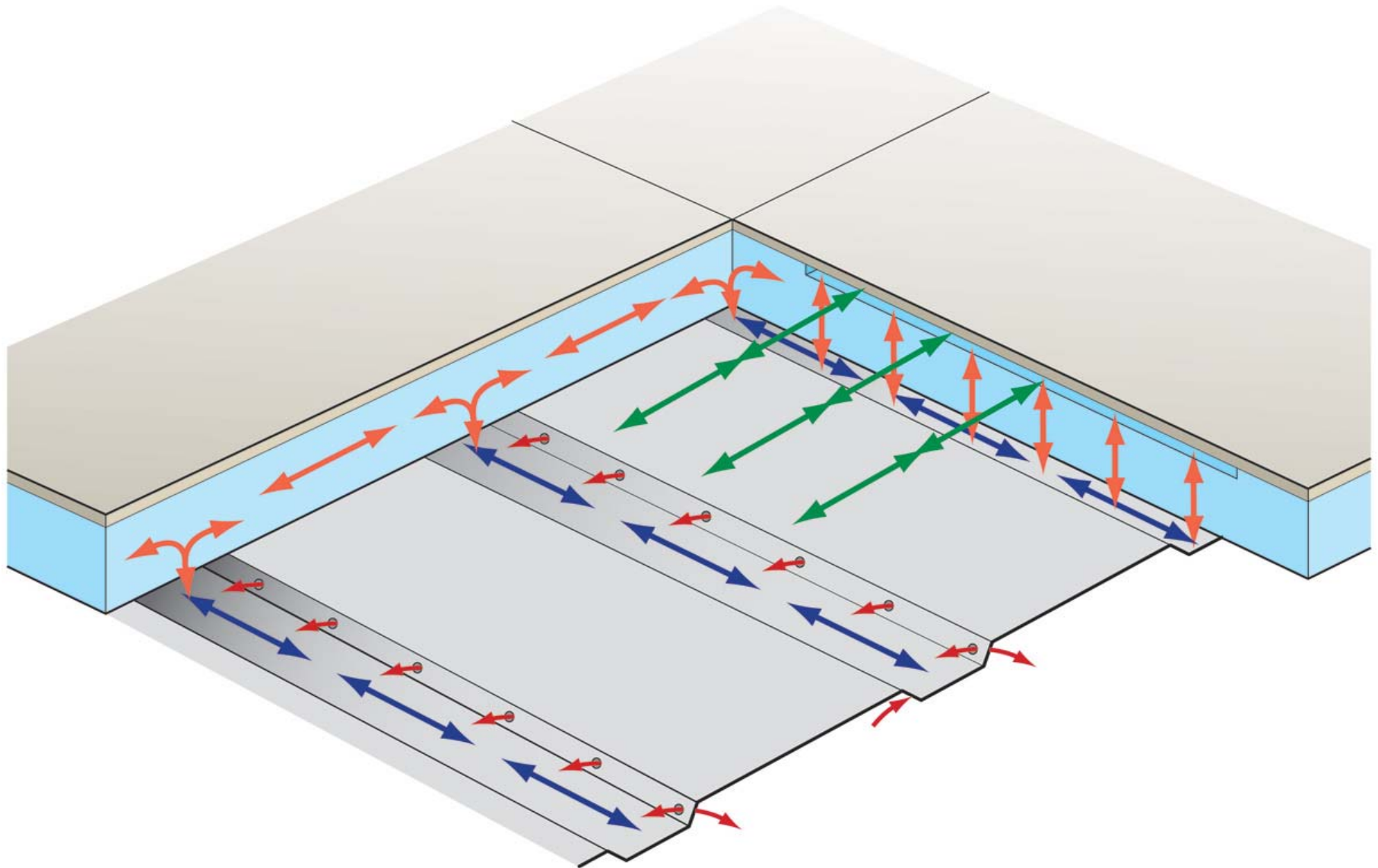




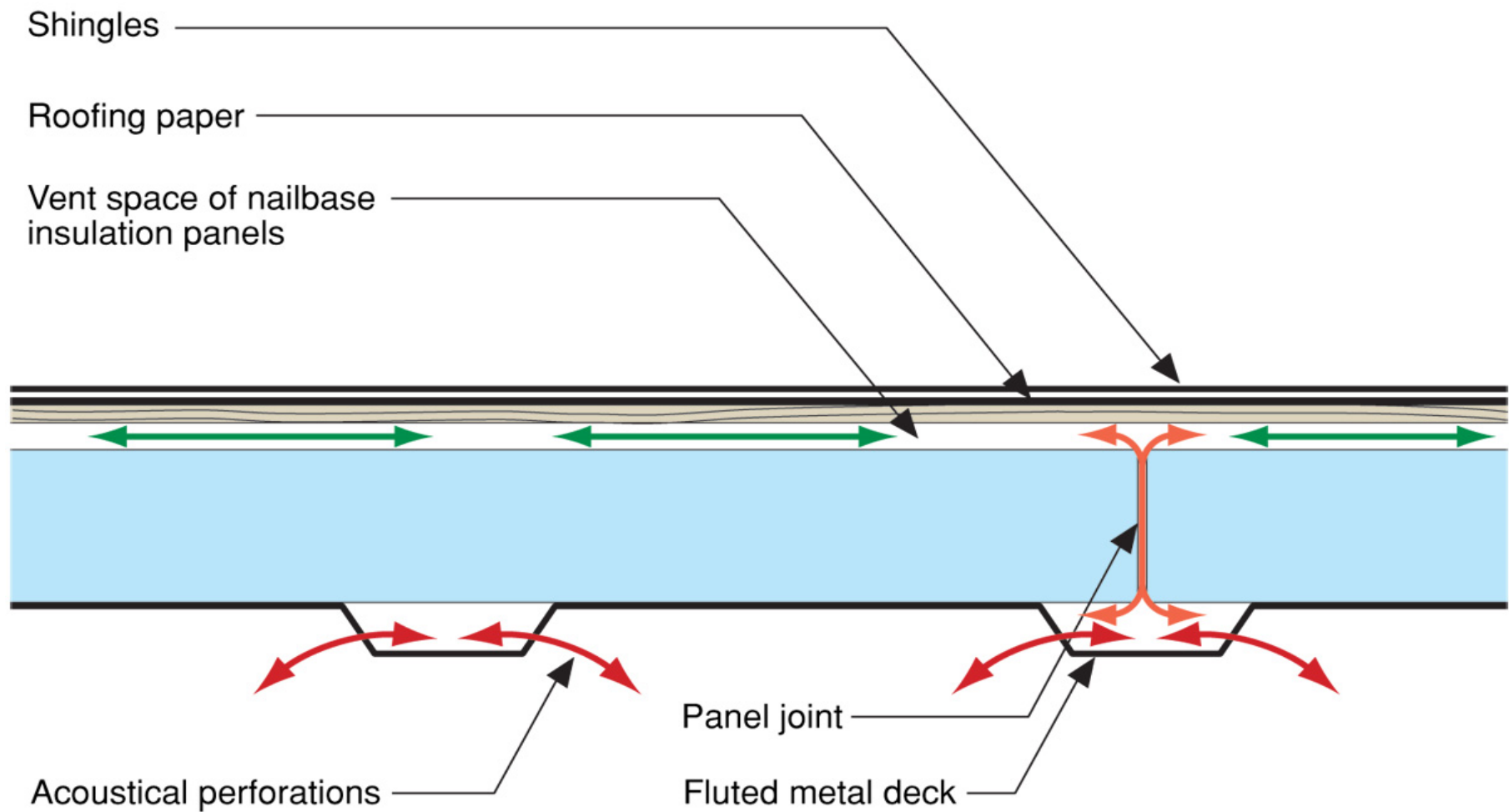
Legend

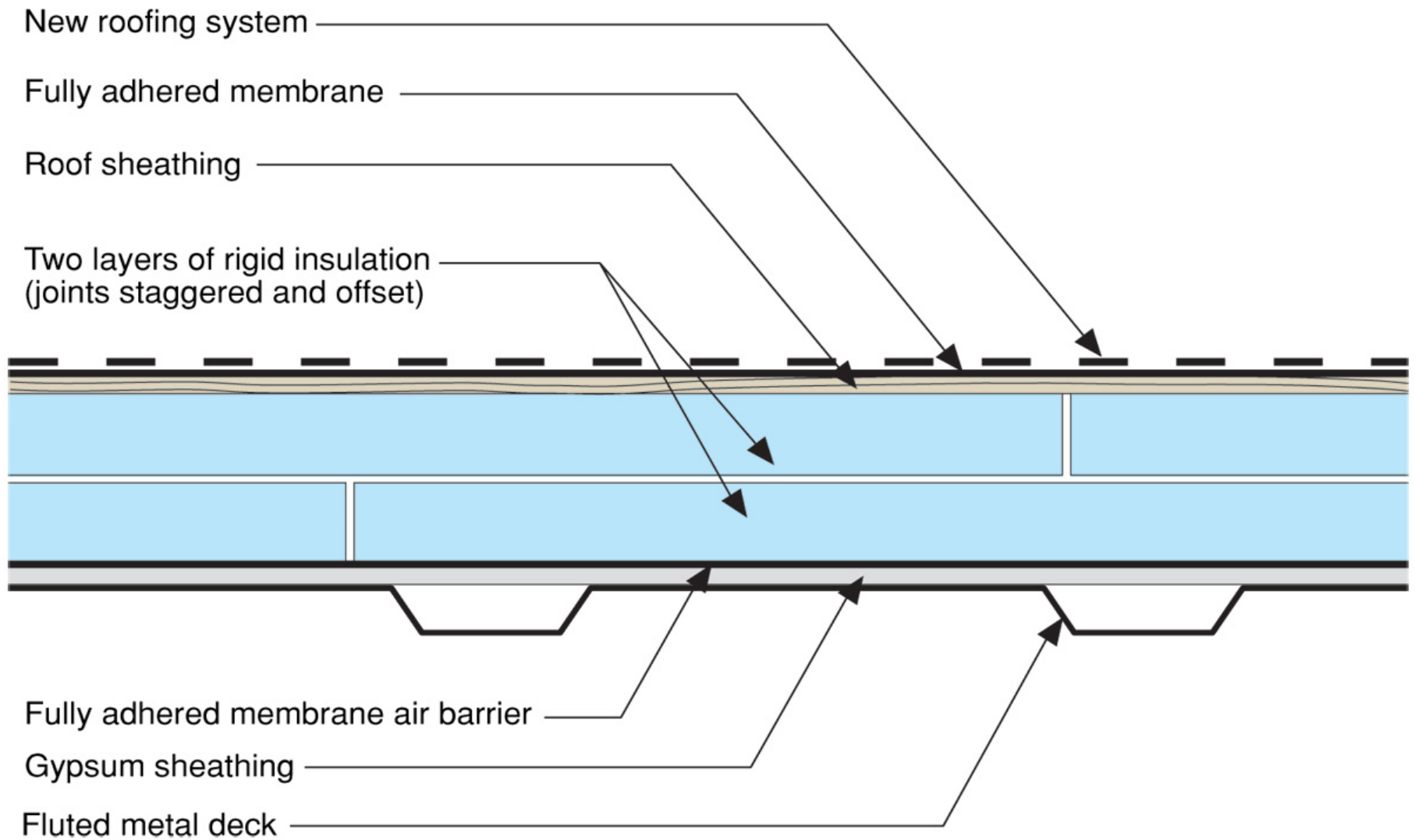
-  Upper level air flows
-  Lower level air flows
-  Air flow at panel joints

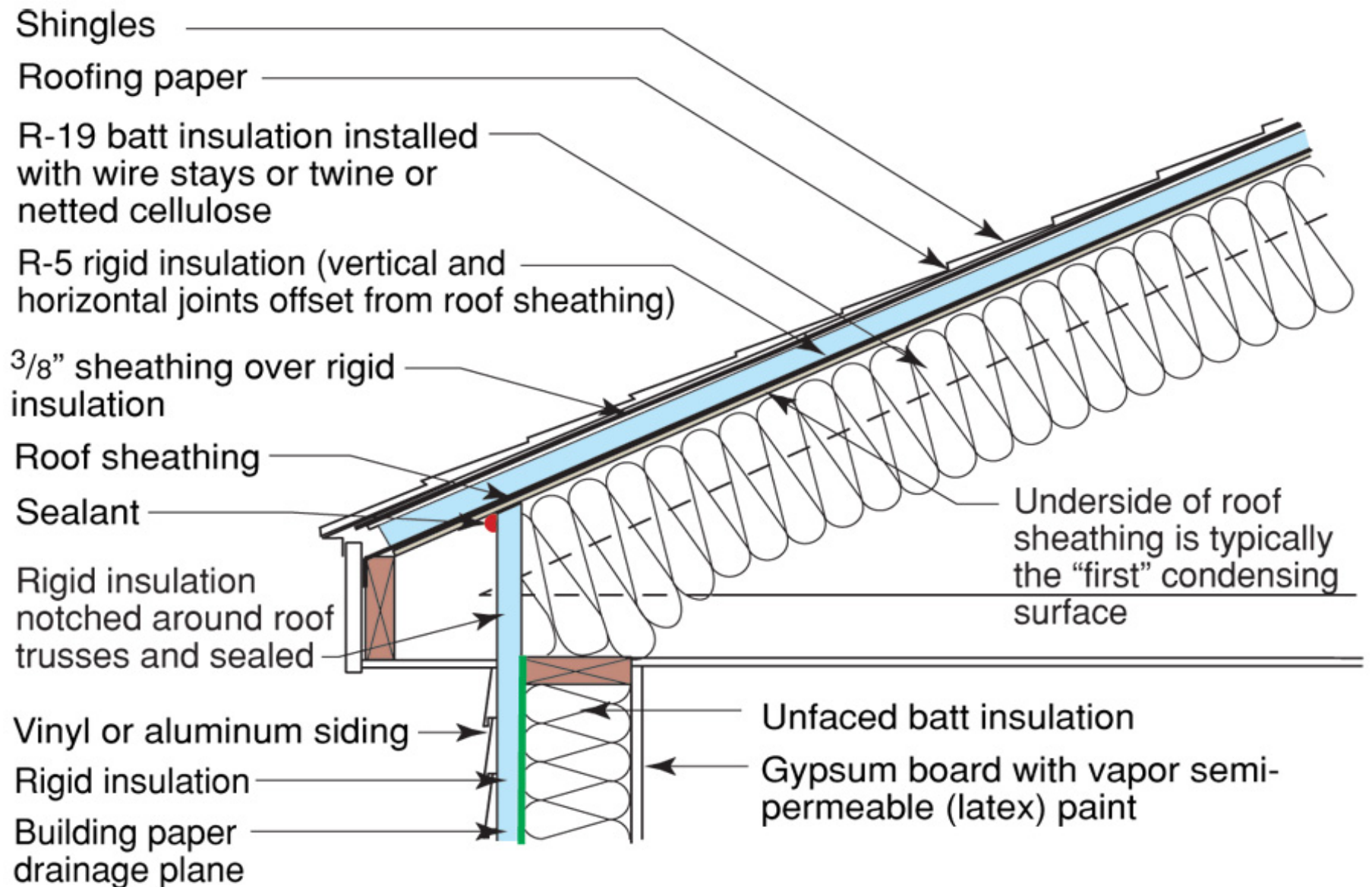


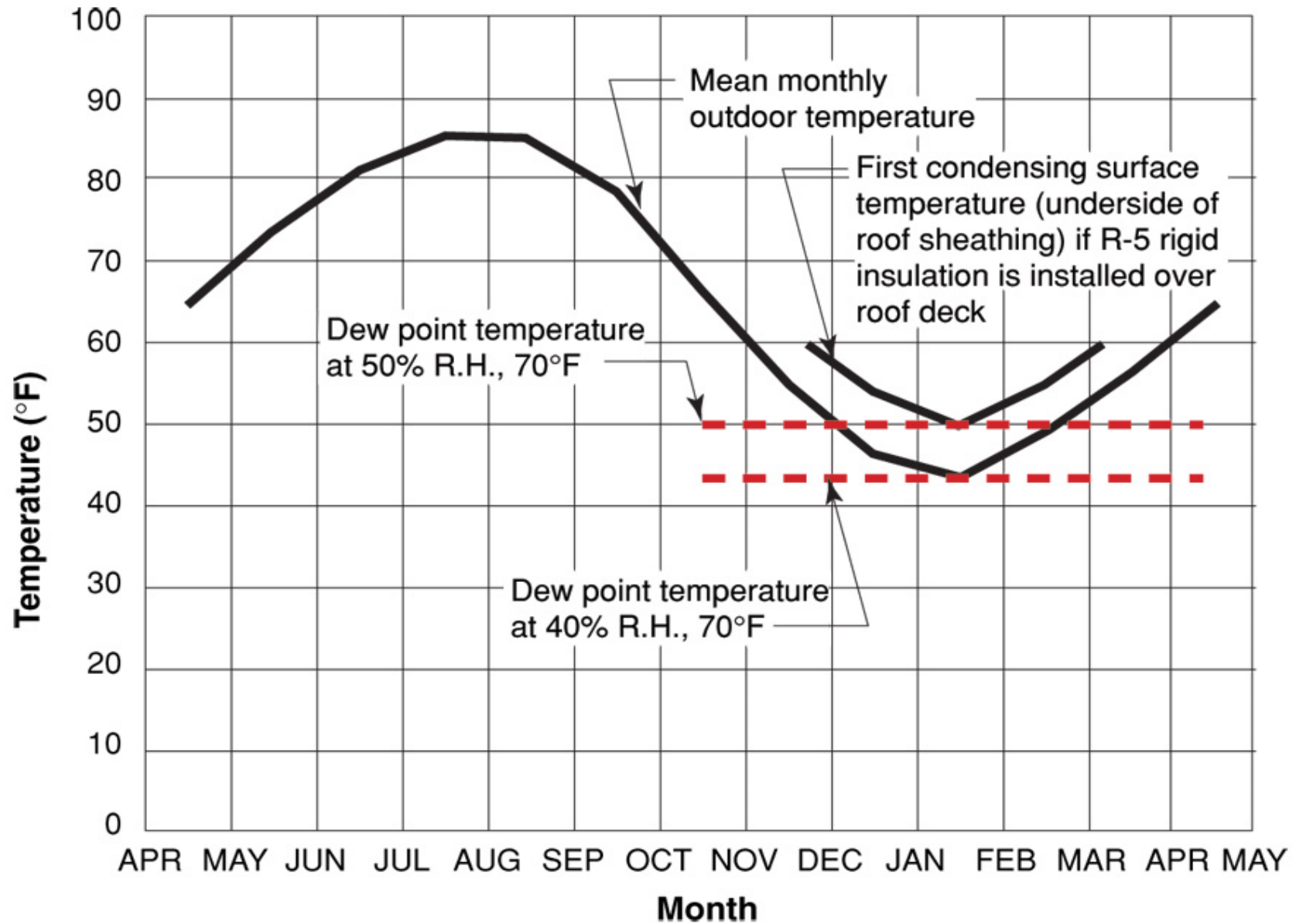


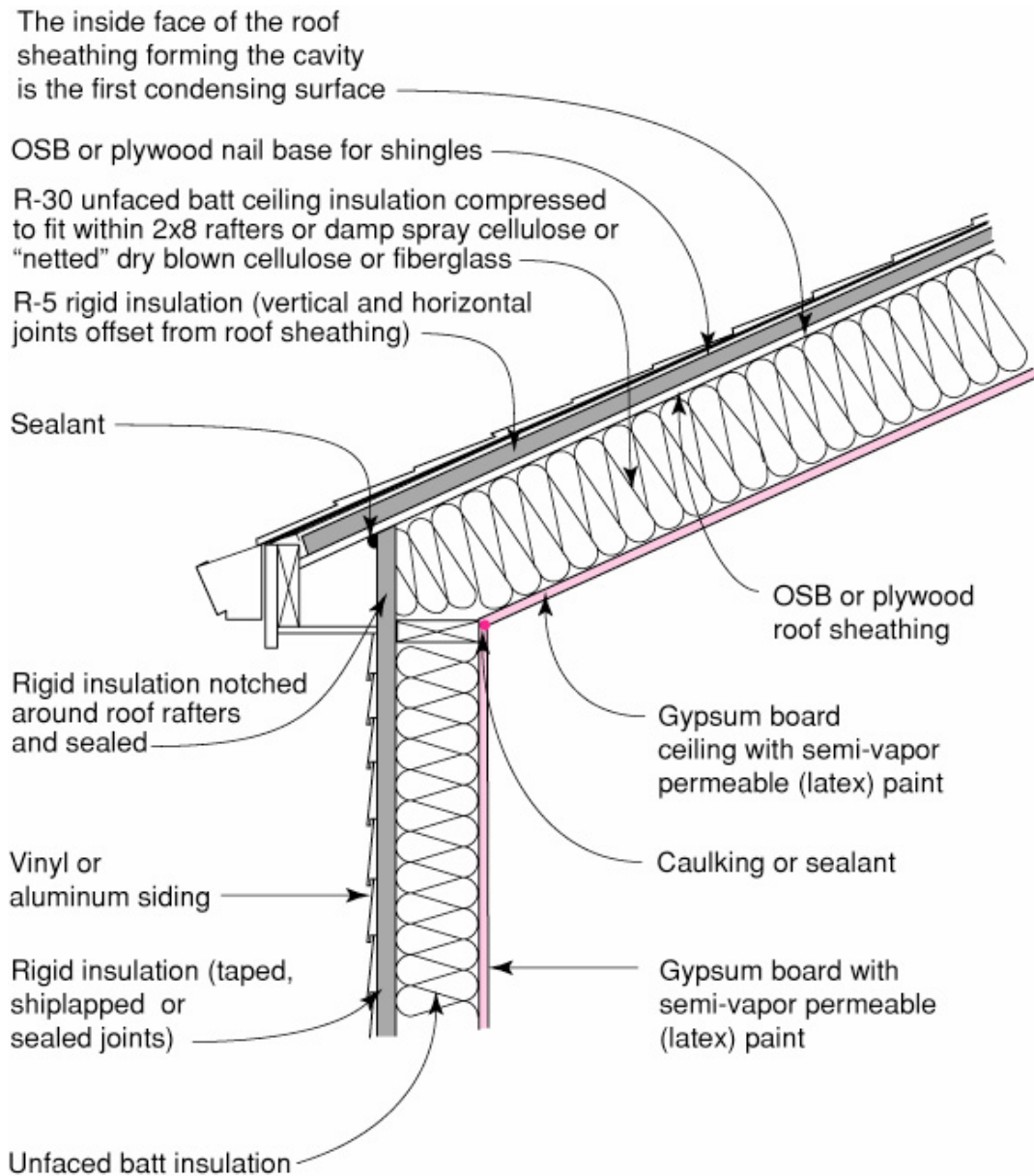


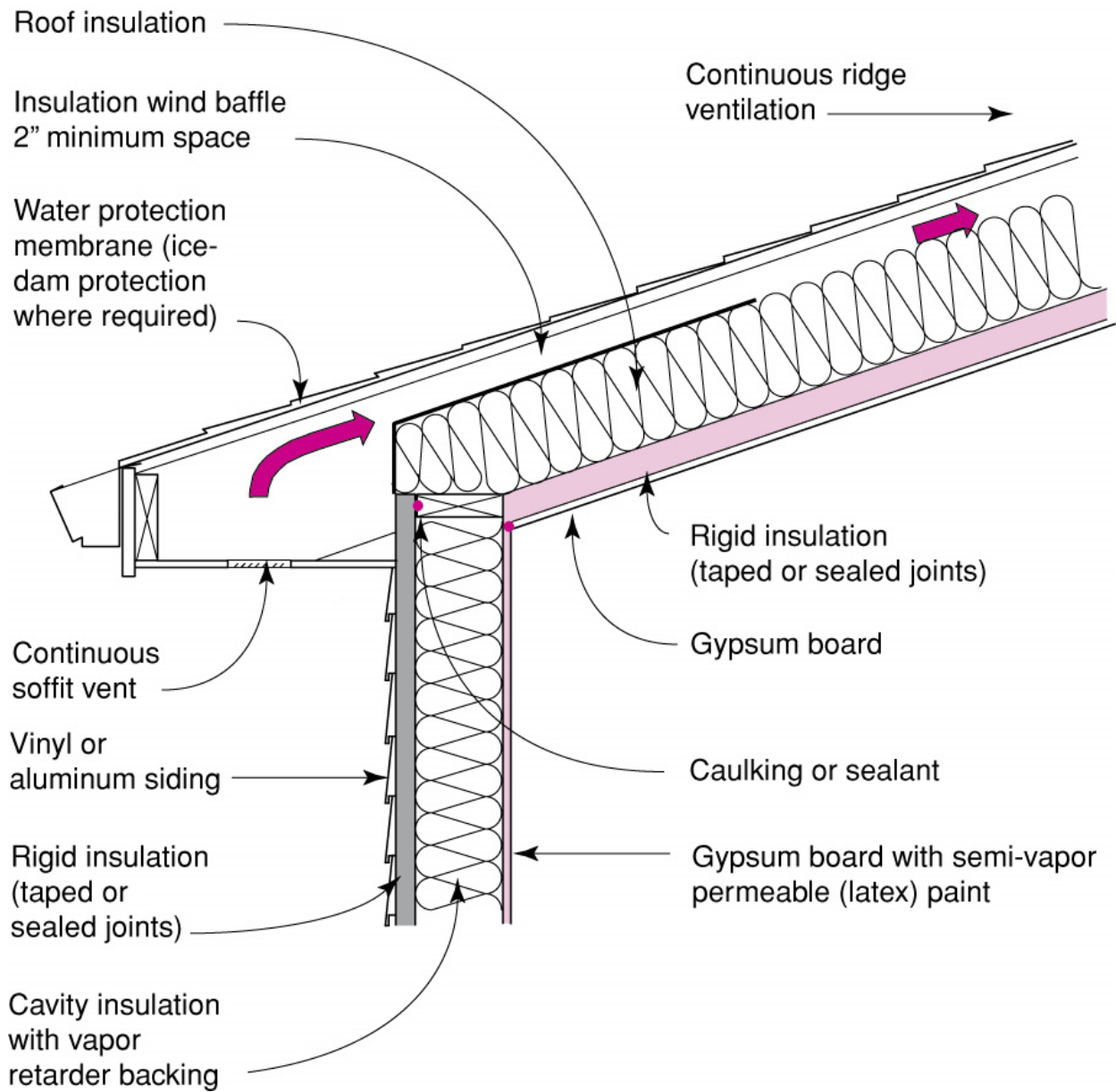


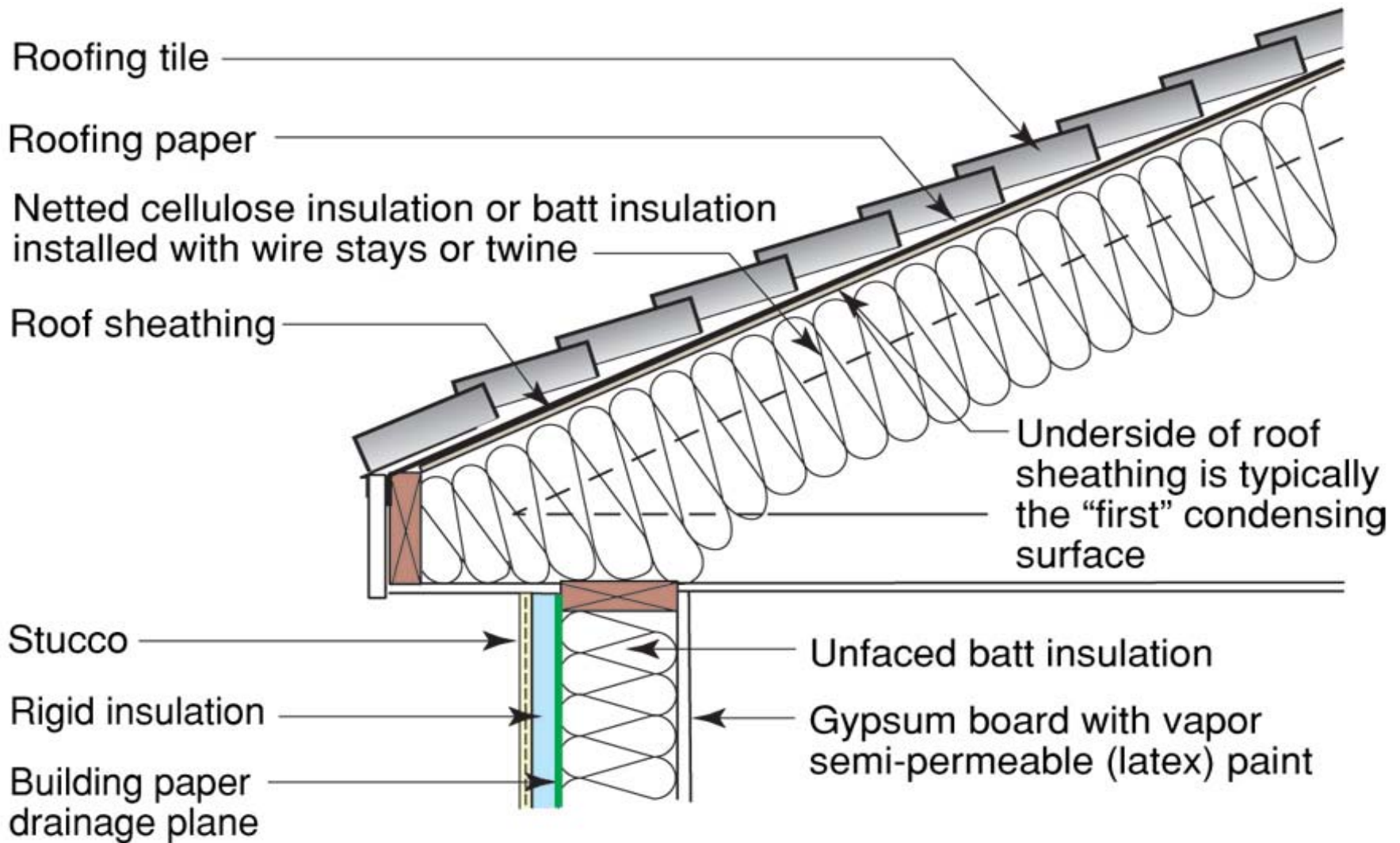








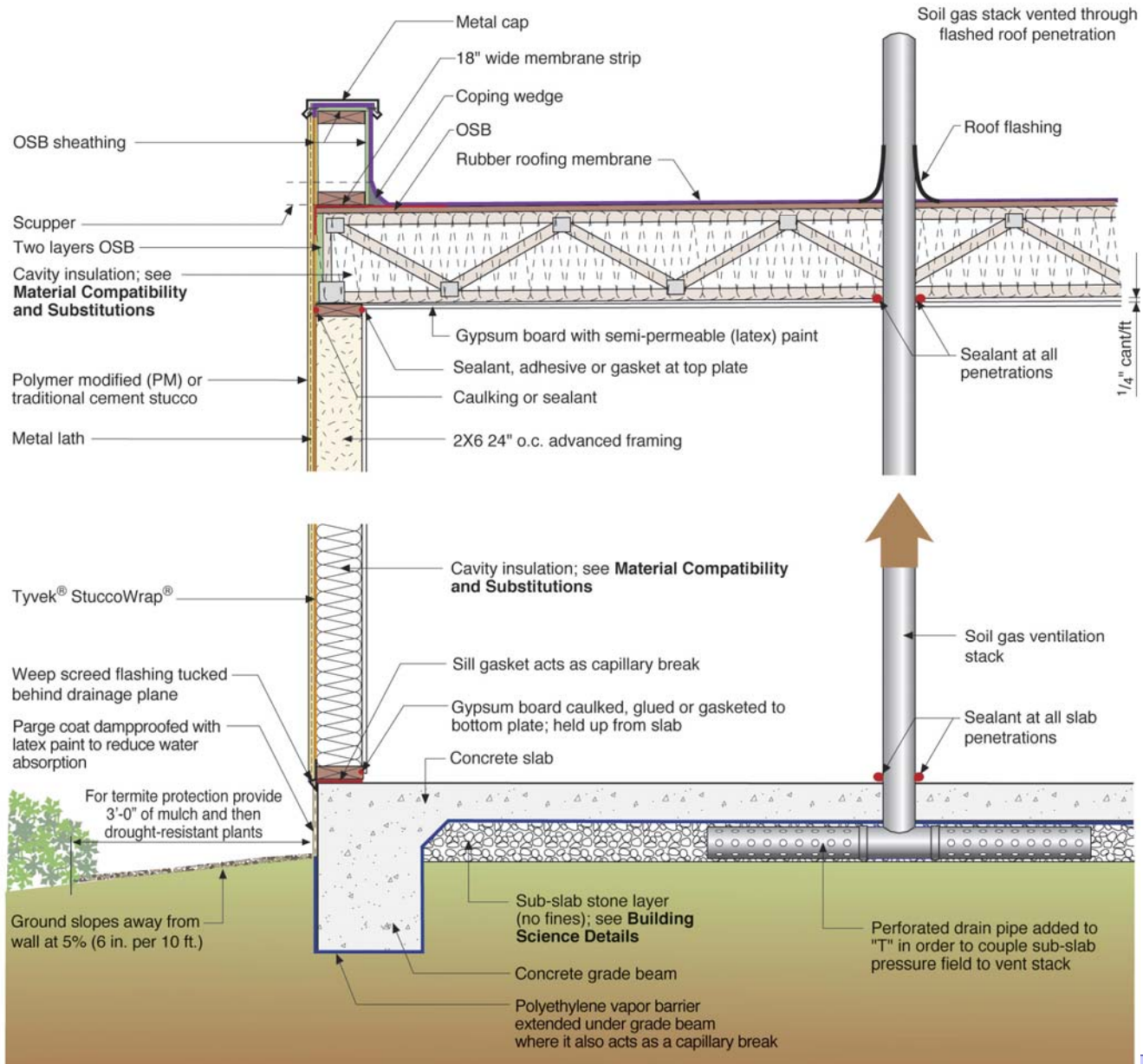


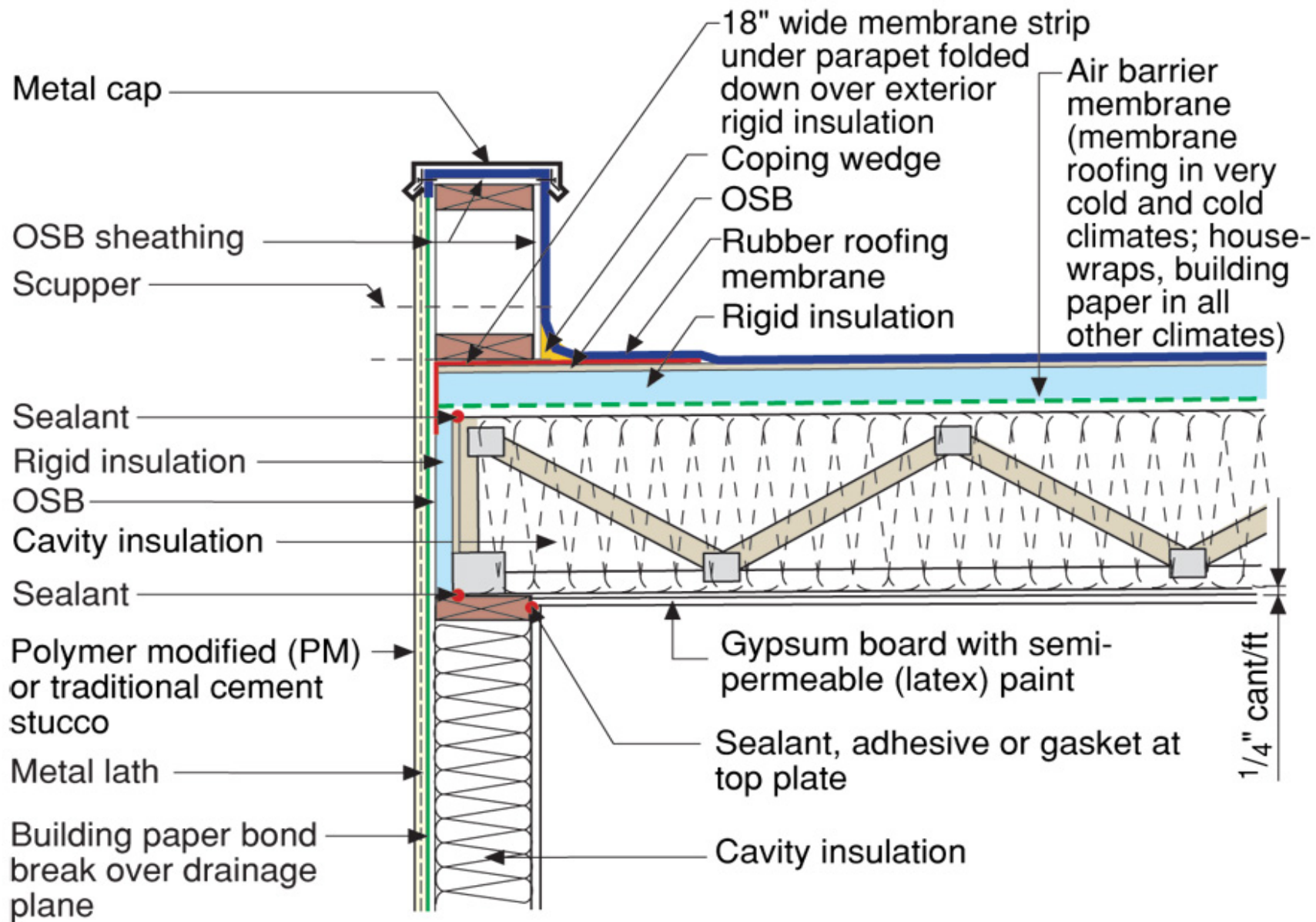


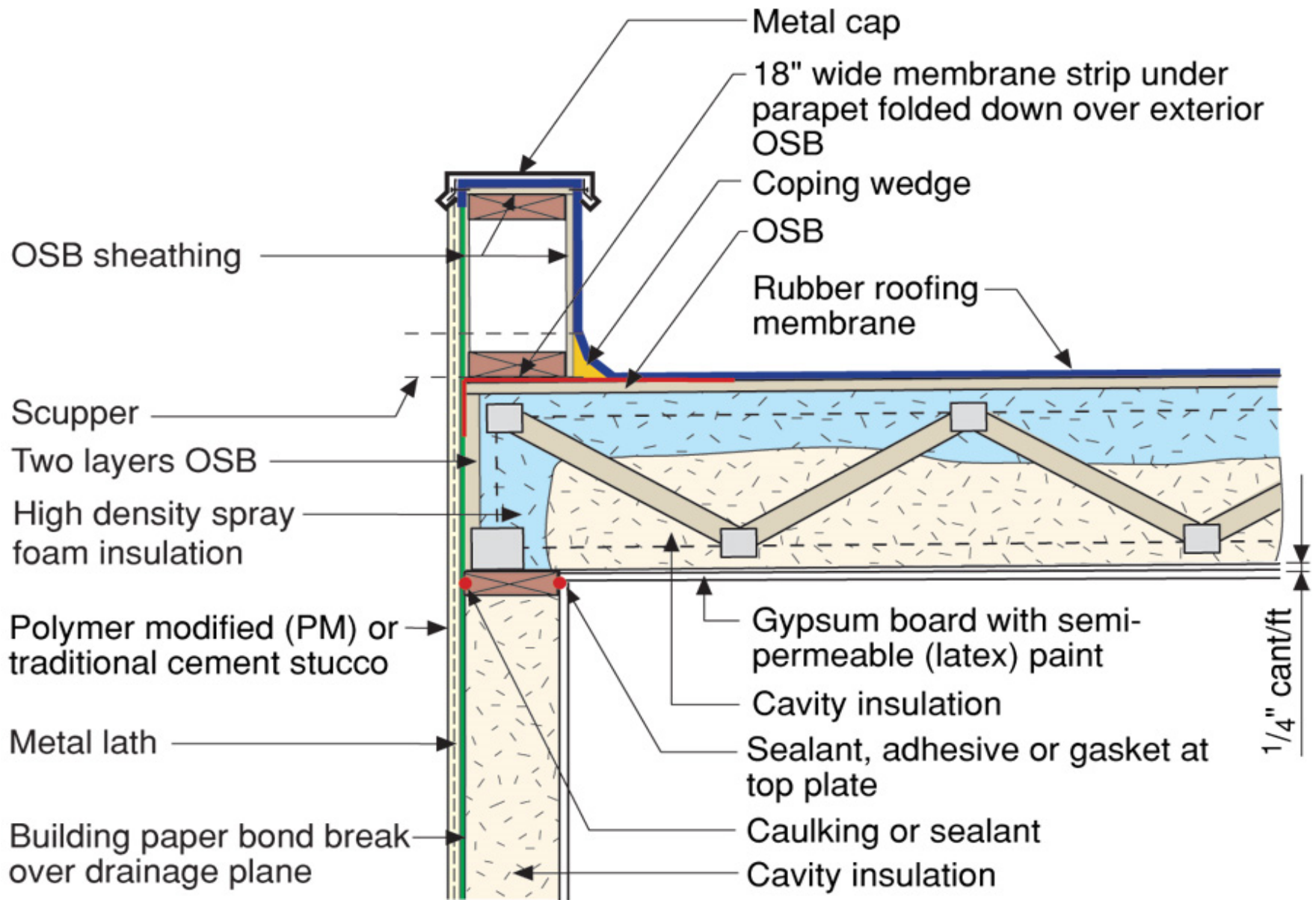




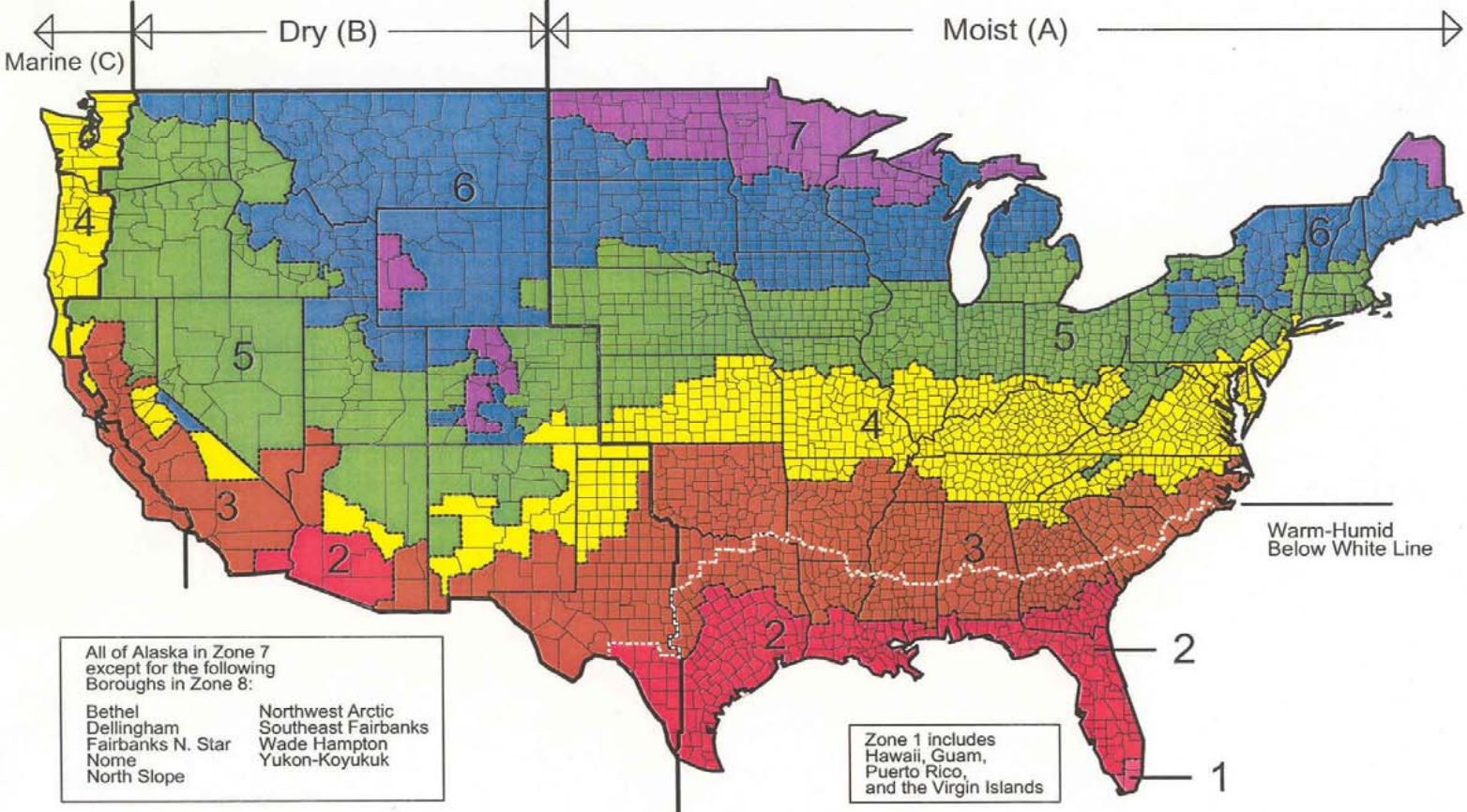








Map of DOE's Proposed Climate Zones



March 24, 2003

