

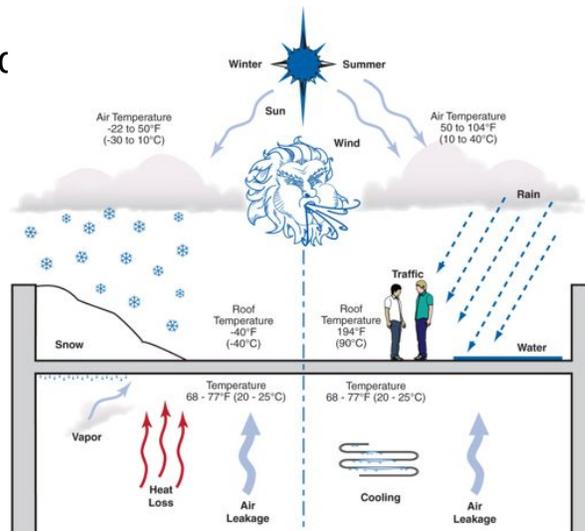
# Fixing the Lid

Dr John Straube  
 Building Science Corporation  
 University of Waterloo



## Roofs

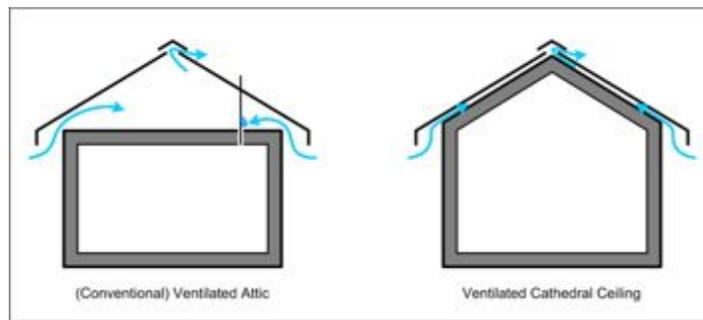
- Rain, sun, wind
- Stop rain
- Stop air
- Stop heat



Adapted from Baker, M., *Roofs*, 1990.  
 Courtesy National Research Council of Canada

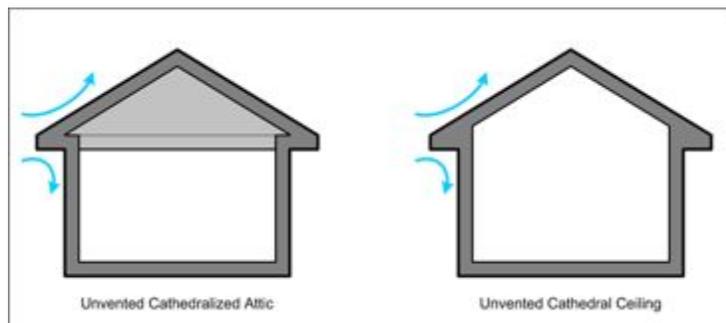
## Vented, Sloped Roof Types

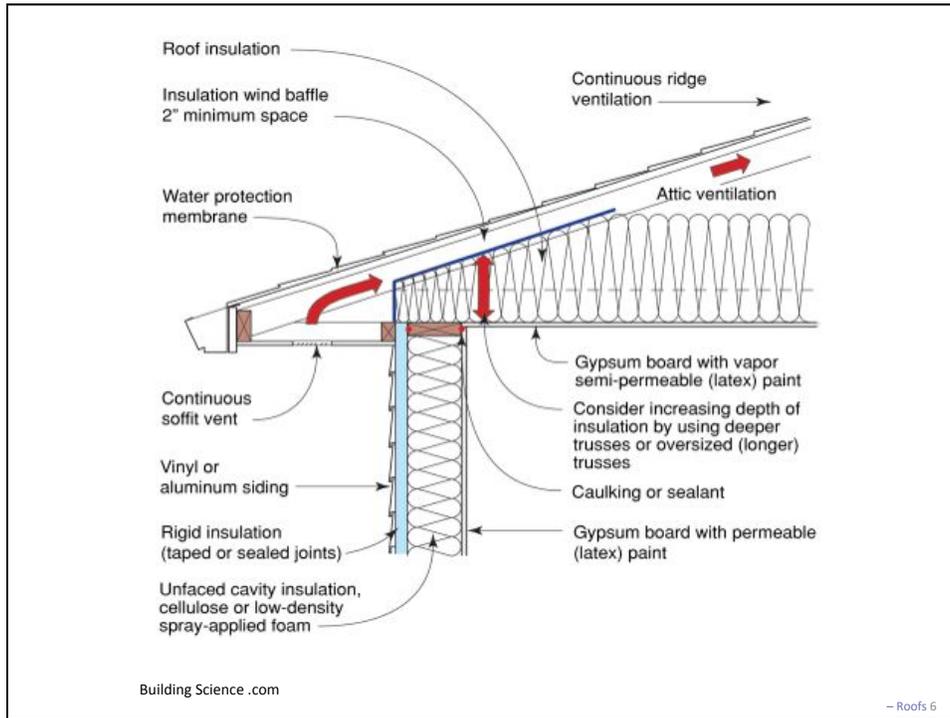
- Vented Attic
  - Insulation/air barrier at ceiling plane
- Cathedral Ceiling
  - Insulation/air barrier at roof plane

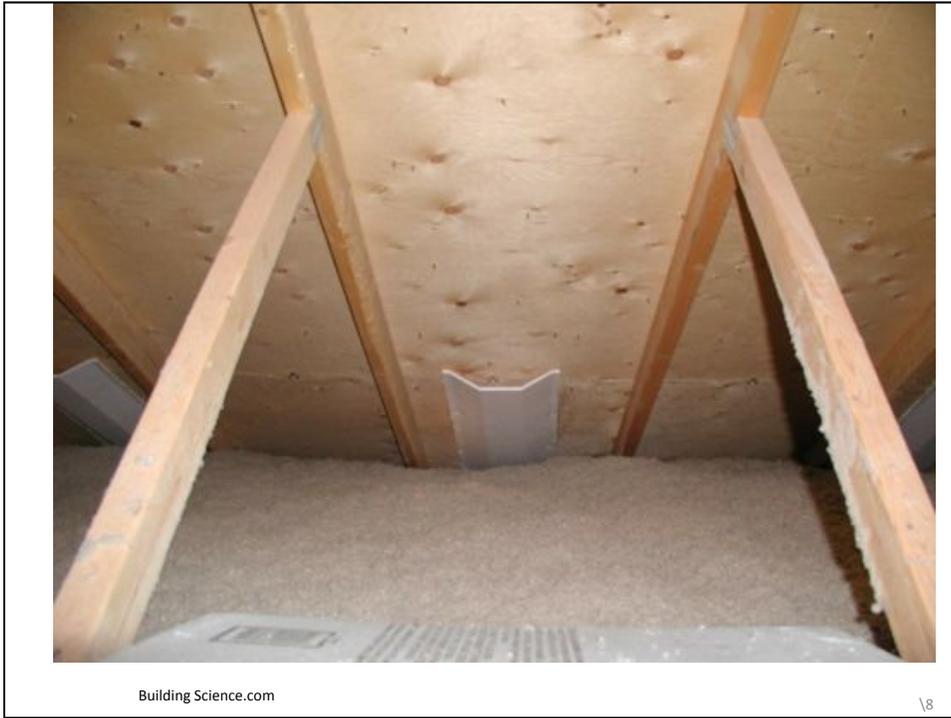


## Unvented, Sloped Roof Types

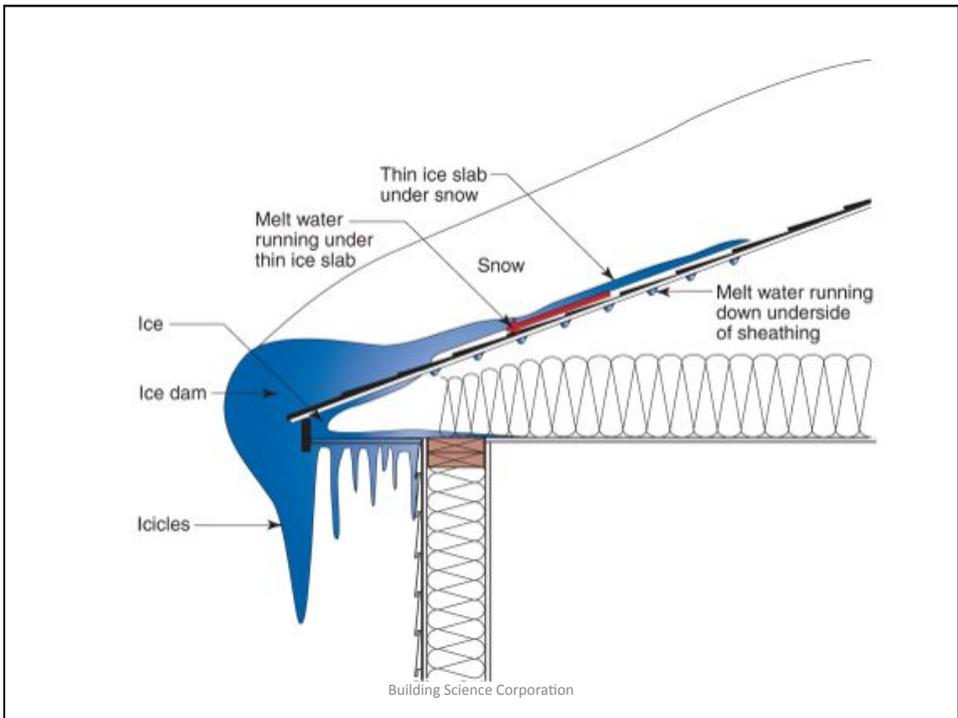
- Unvented Cathedralized Attic
  - As cathedral but no venting above insulation
- Unvented Cathedral













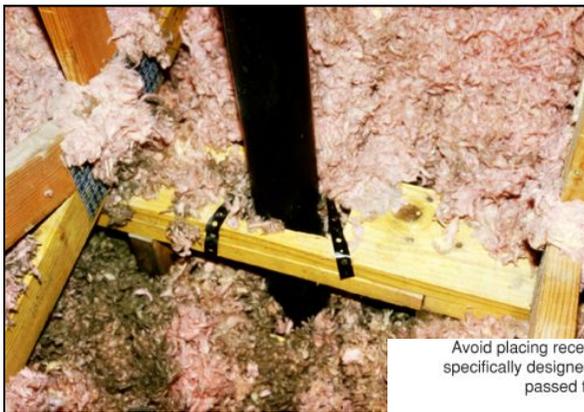
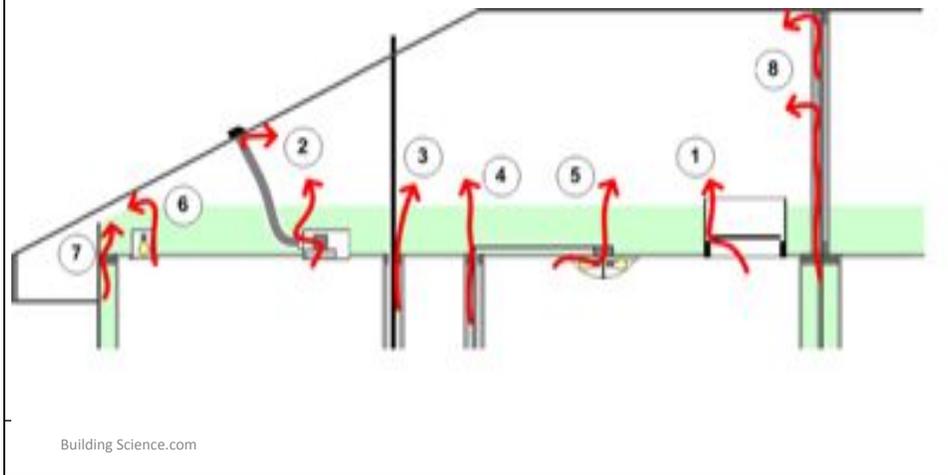
## Vented Attics

- Air leakage thru ceiling is a problem in colder climates
  - Ducts are a disaster
- Condensation and heat gain on ducts in warm climates
- Modern roofs often hard to vent

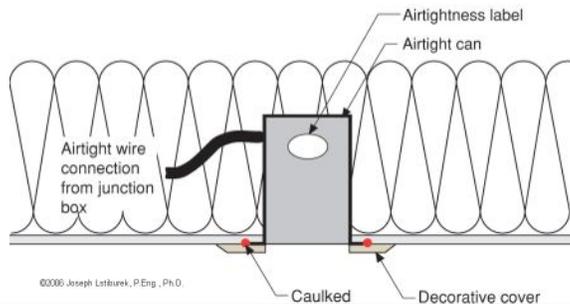
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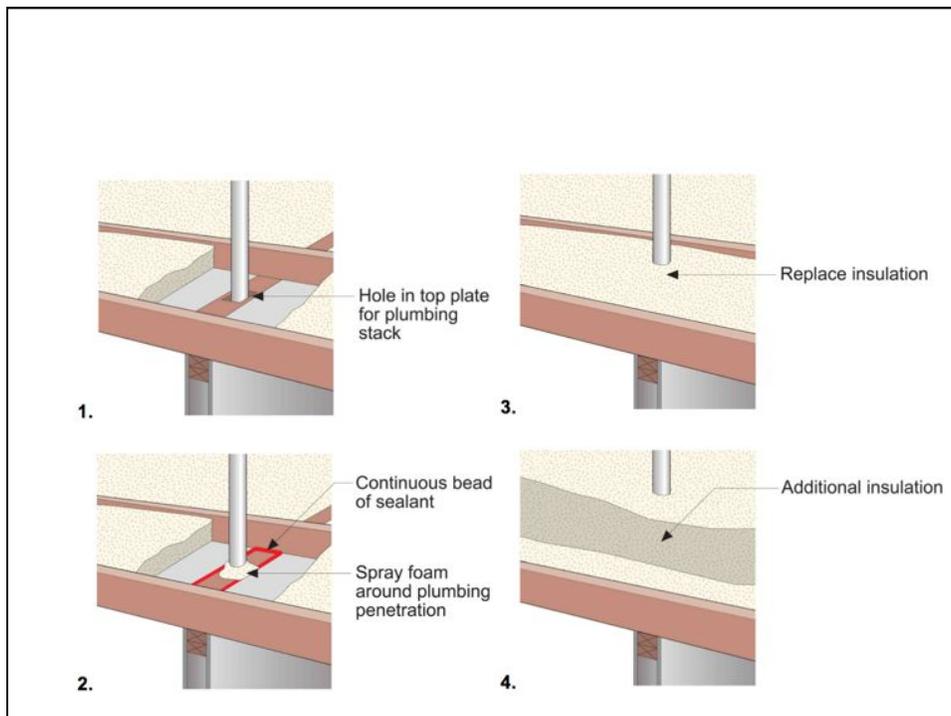
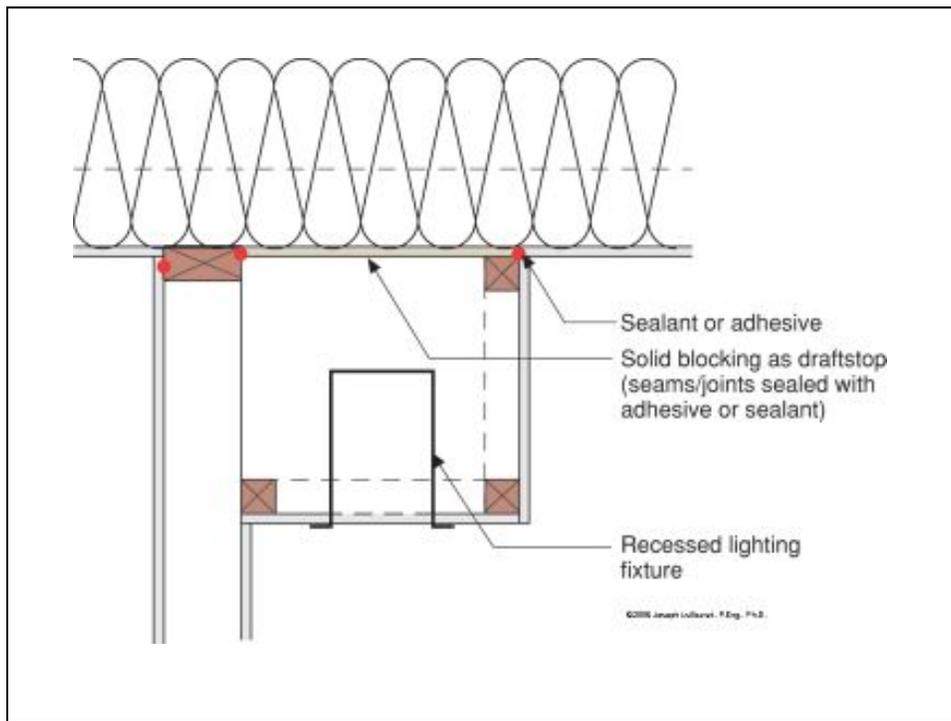
# How do I leak?

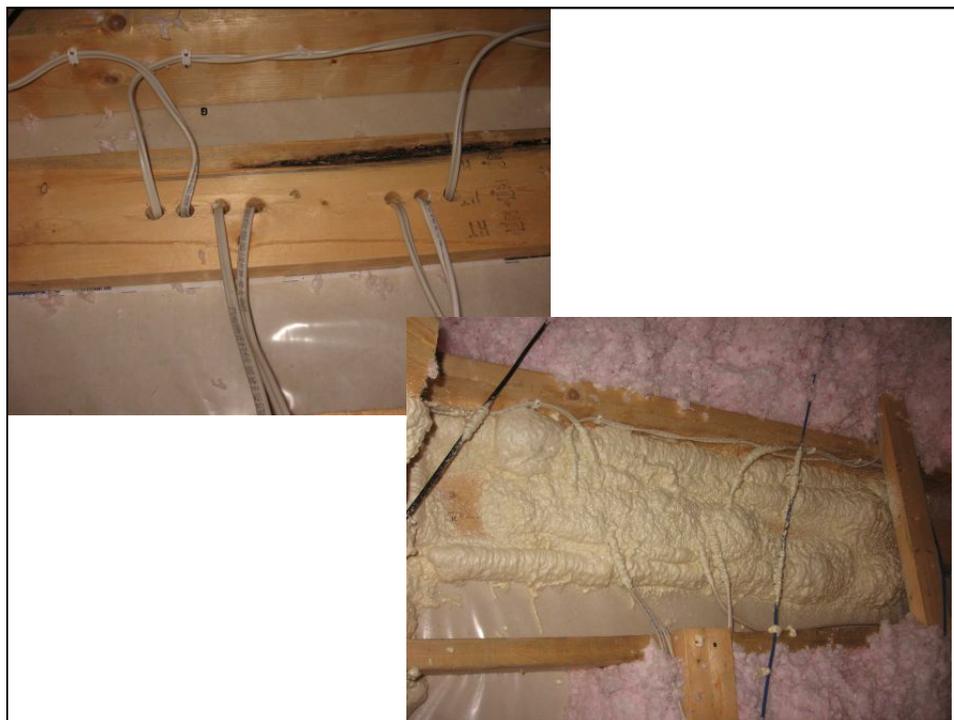
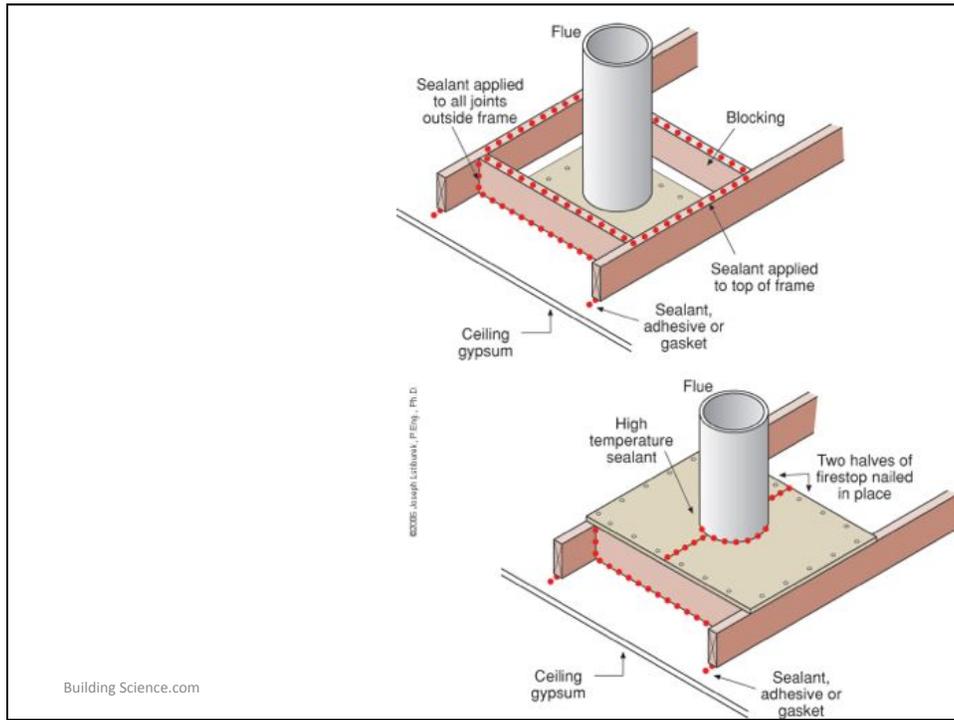
- Let me count the ways ...



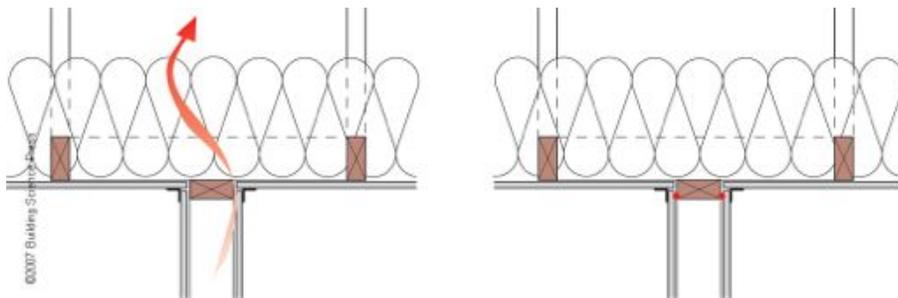
Avoid placing recessed lights in insulated ceilings unless they are specifically designed to be airtight. Install IC-rated fixtures that have passed the ASTM E-283 test for air leakage.



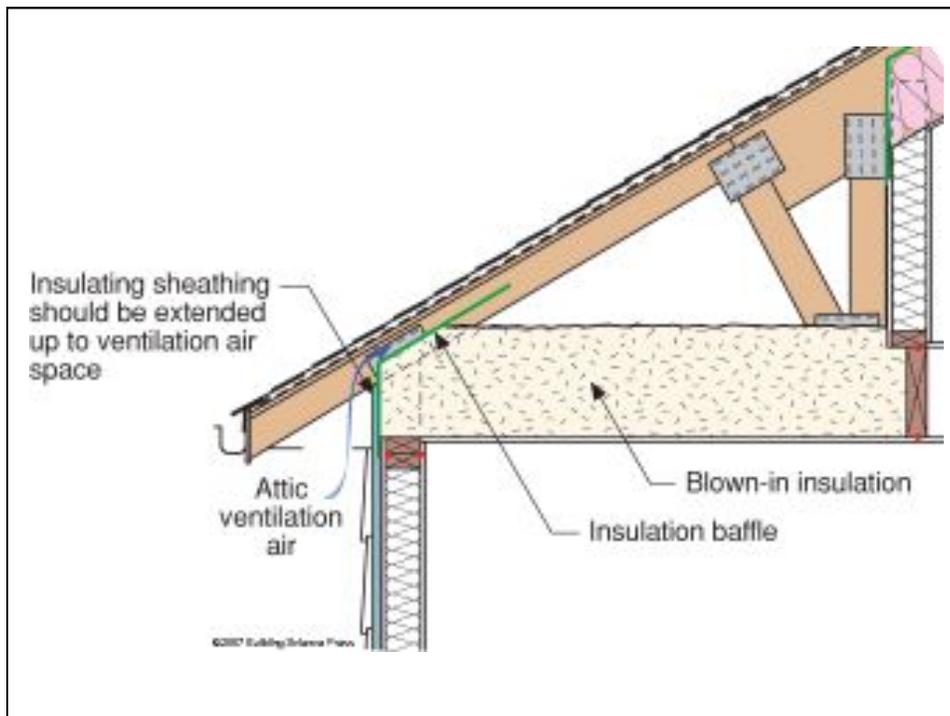




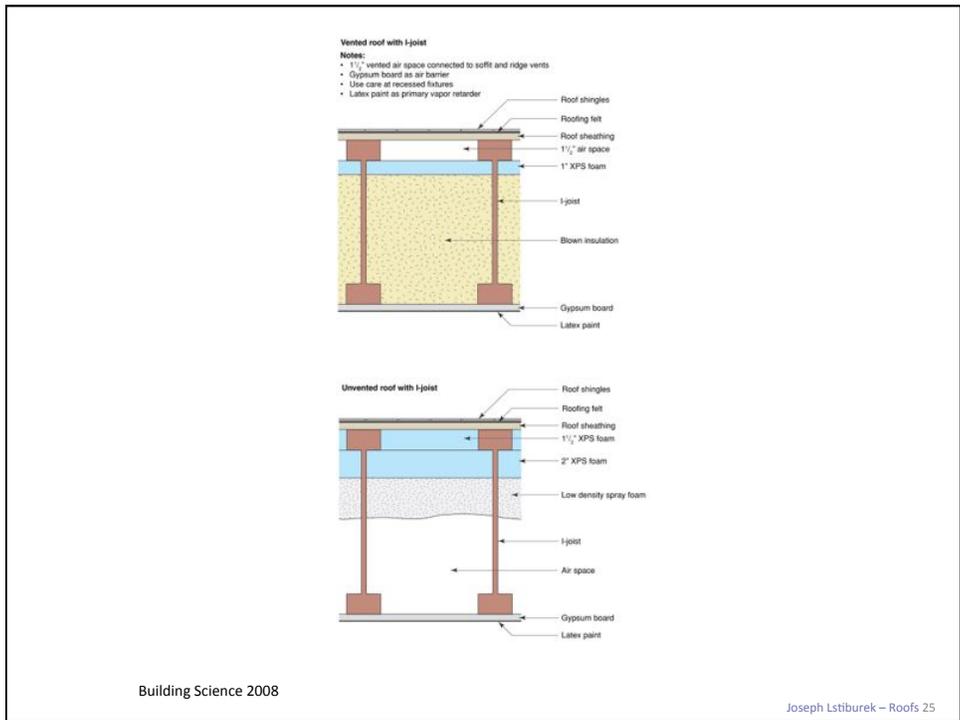
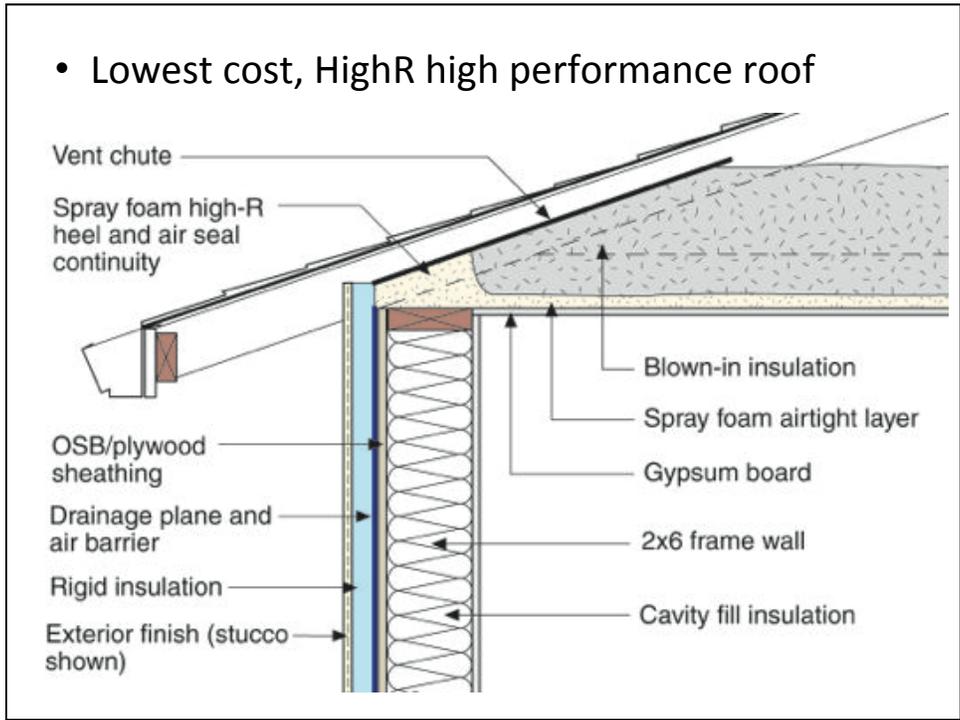
## Parition leaks (1/8" x 100 ft)



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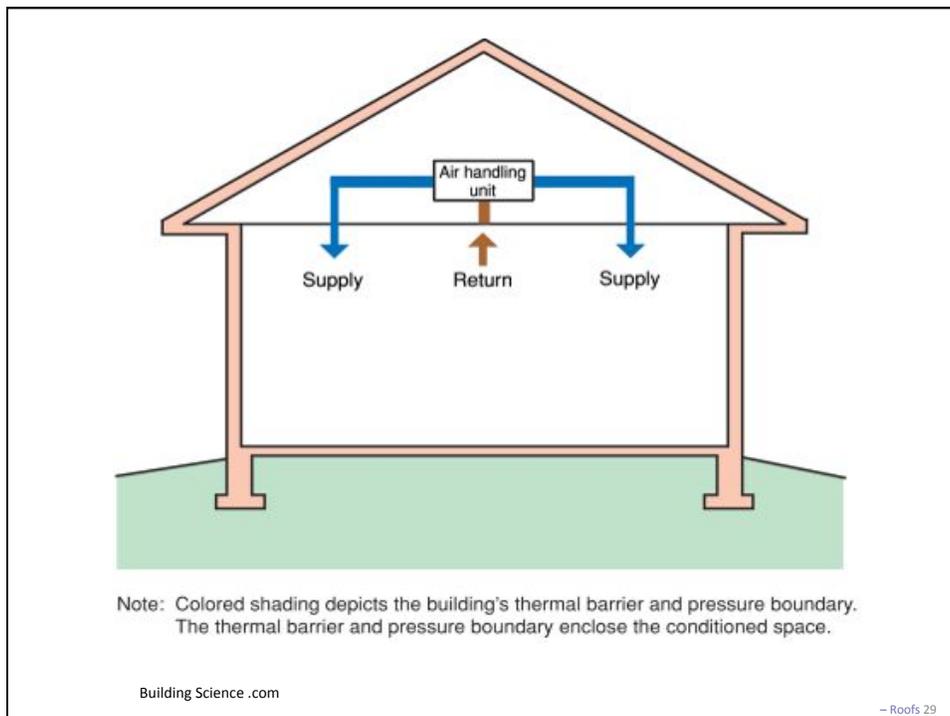
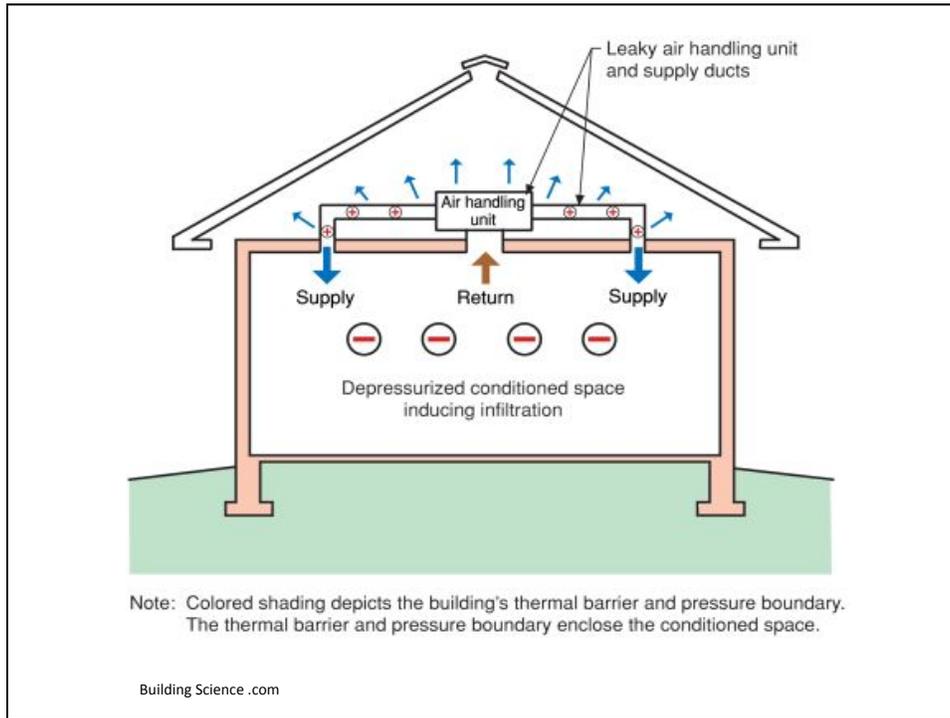
- Lowest cost, HighR high performance roof



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Joseph Lstiburek – Roofs 25





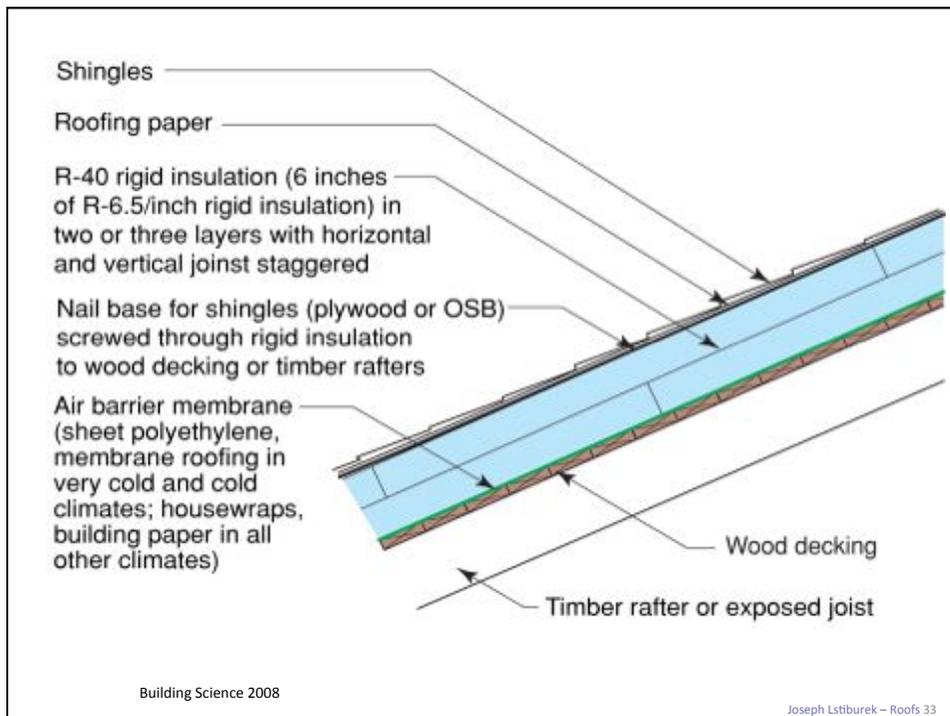
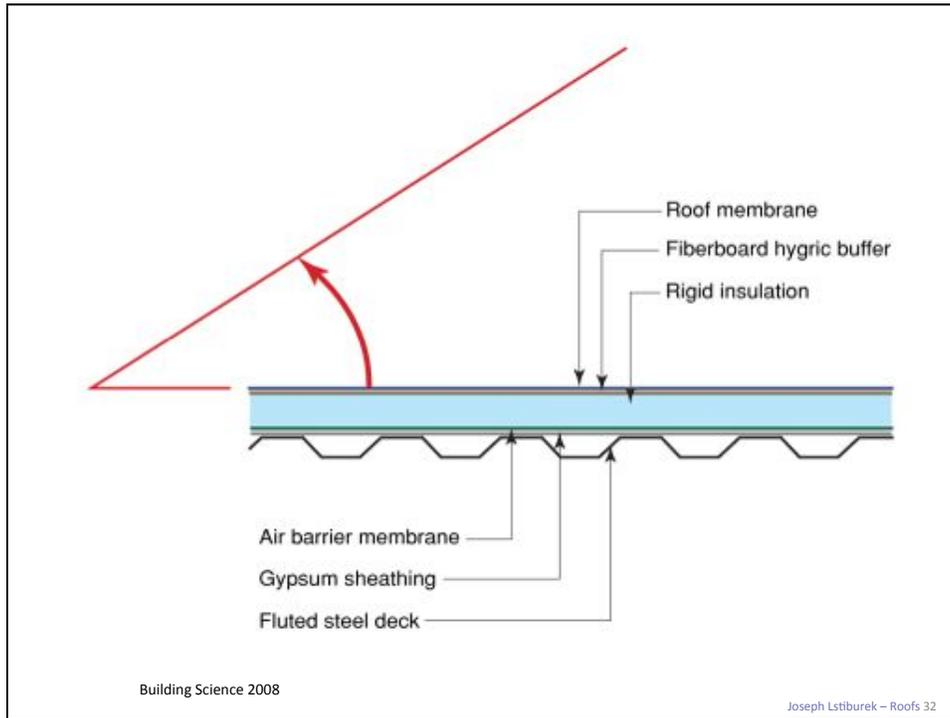
## Hard to Vent

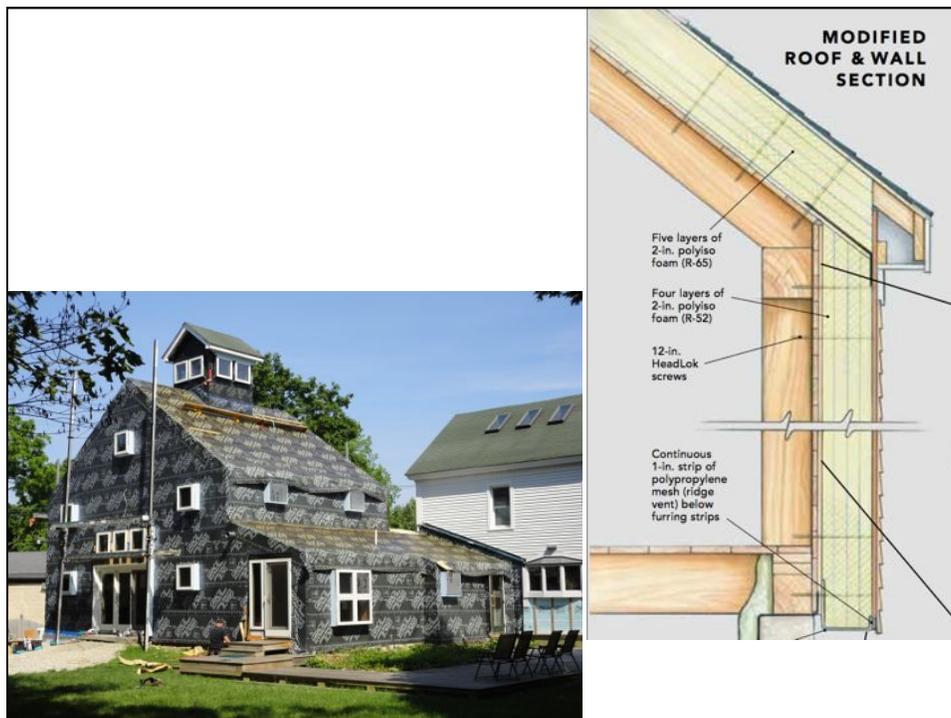
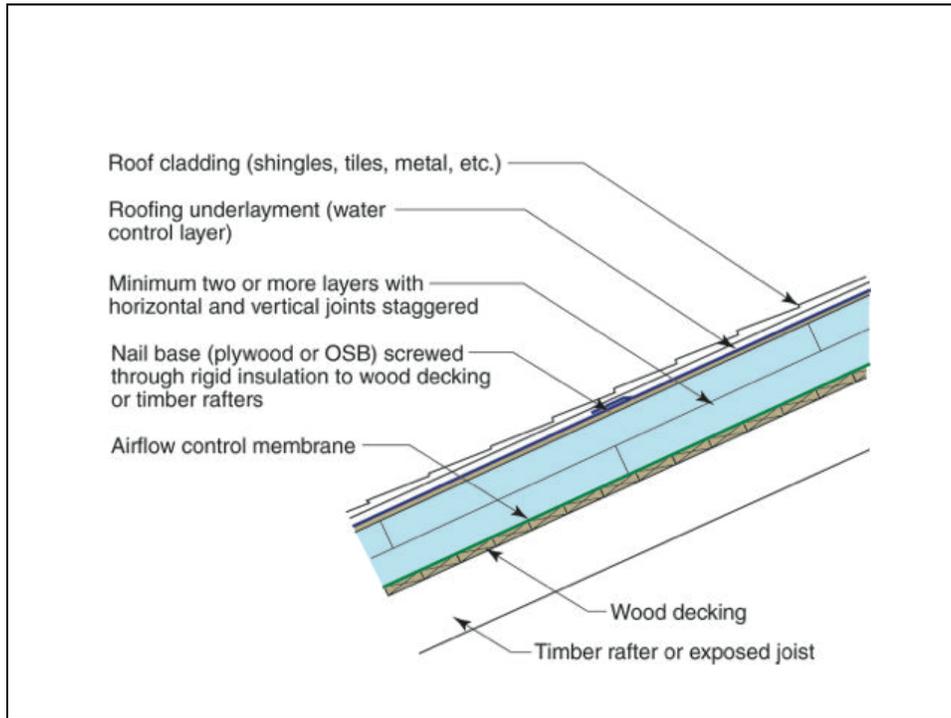


## Unvented Cathedralized Attics

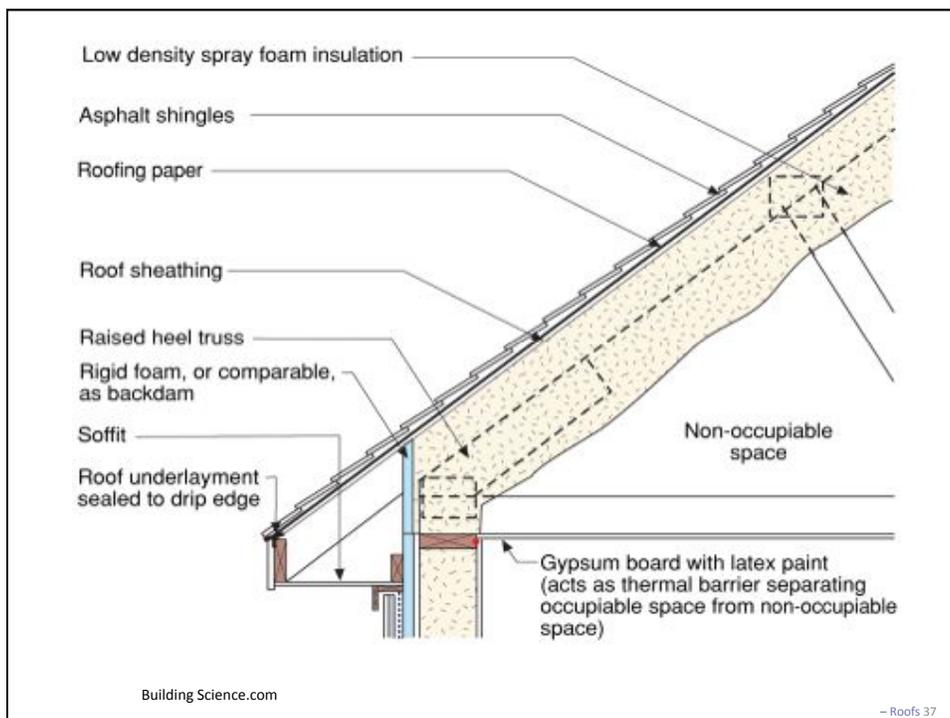
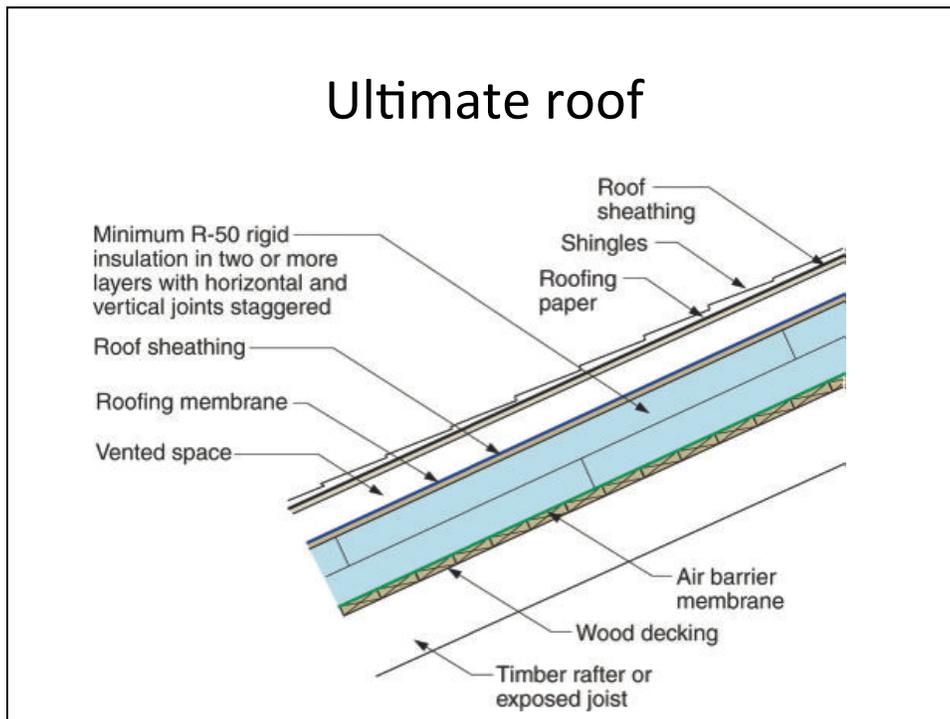
- Move air and insulation control from ceiling plane to roof plane
- Allows attic space to be used
- Or HVAC into conditioned space
  - Saves lots of energy, reduce problems with comfort, extends life of equipment
- Avoids wind blown rain, snow, and burning wildfire embers

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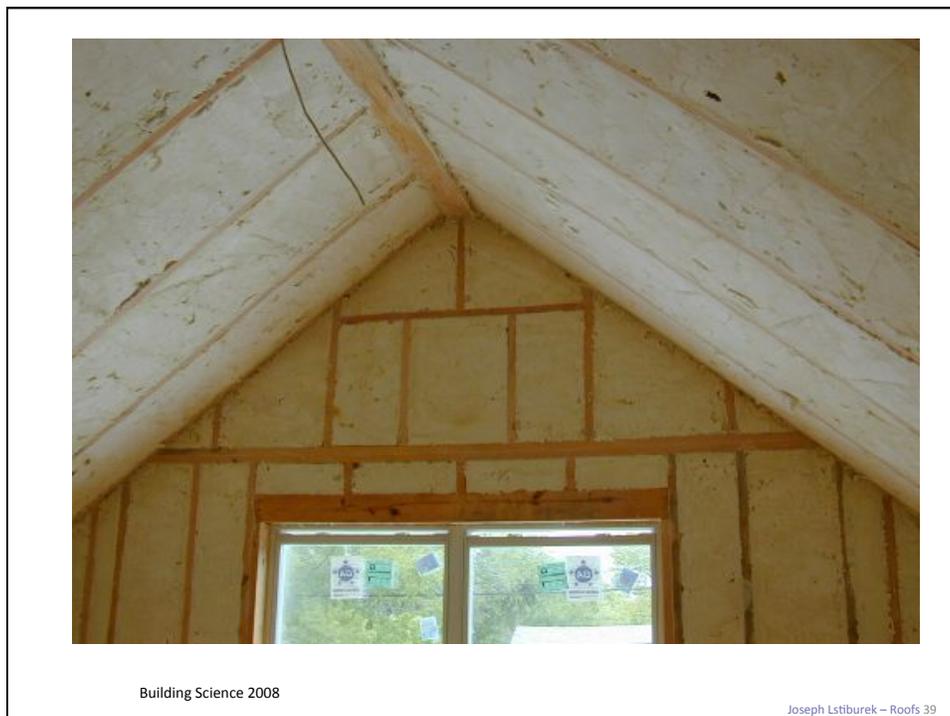
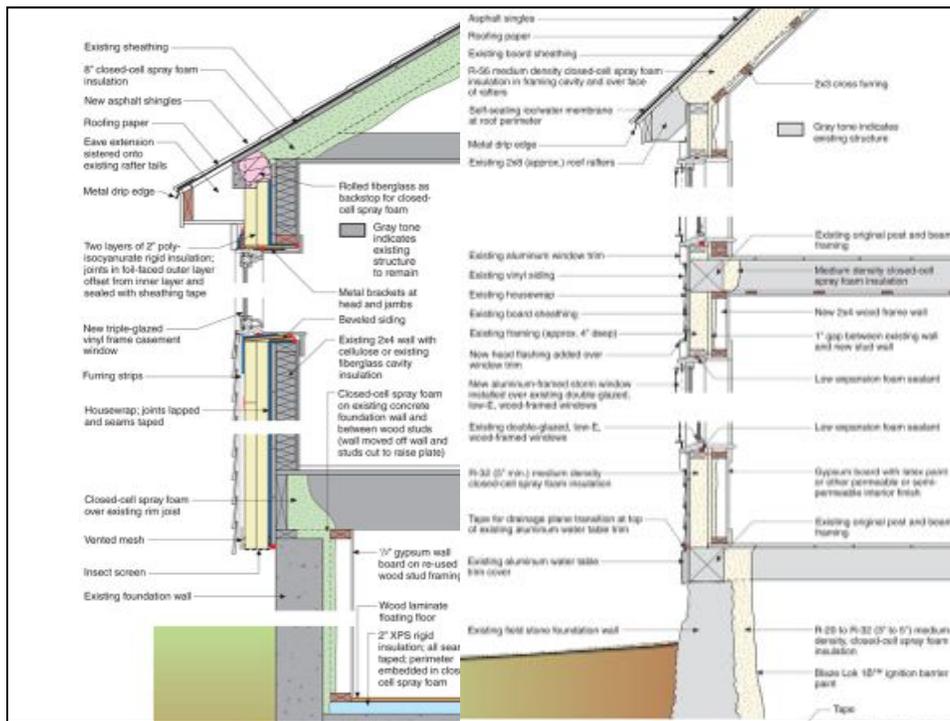


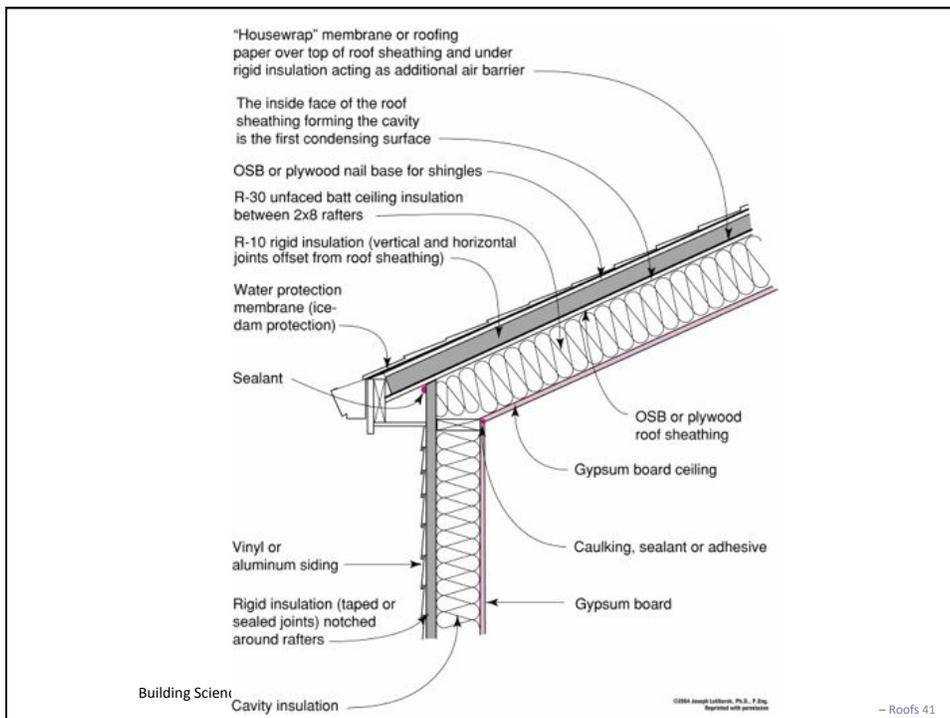
# Ultimate roof

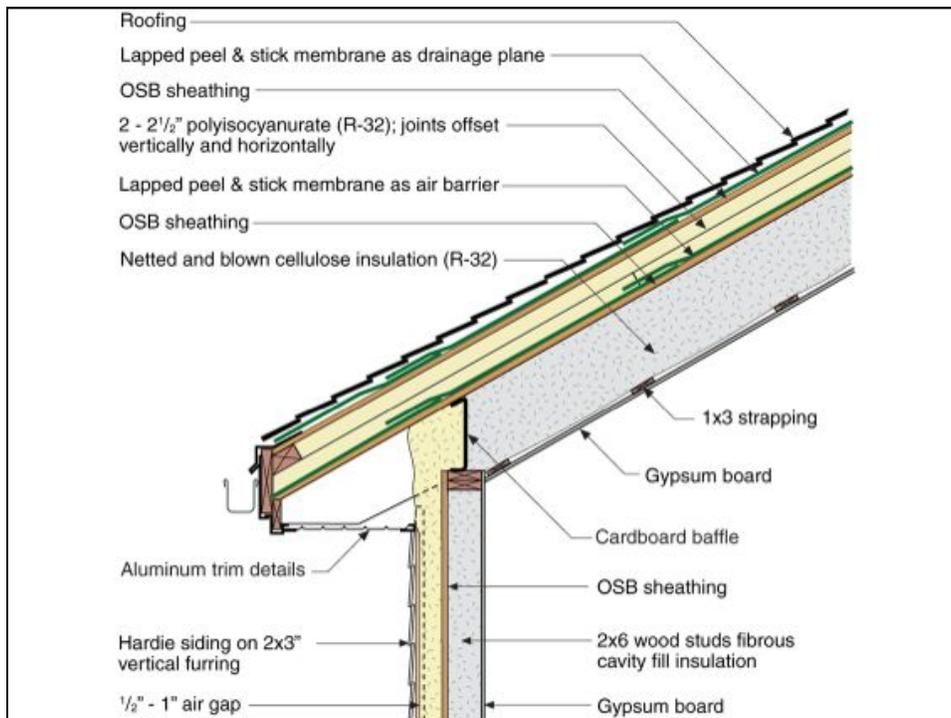
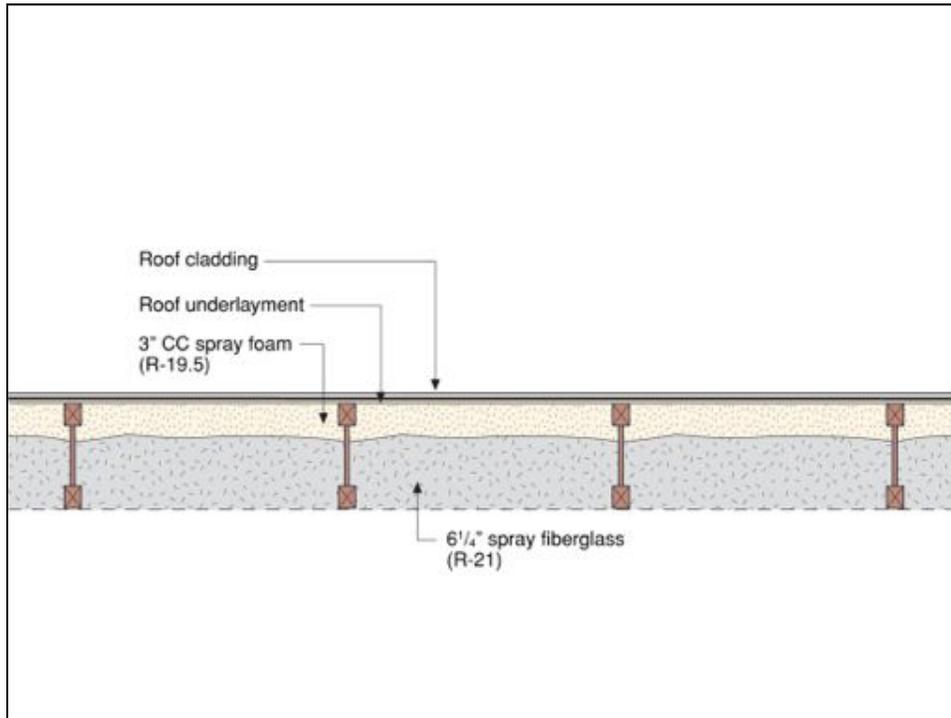


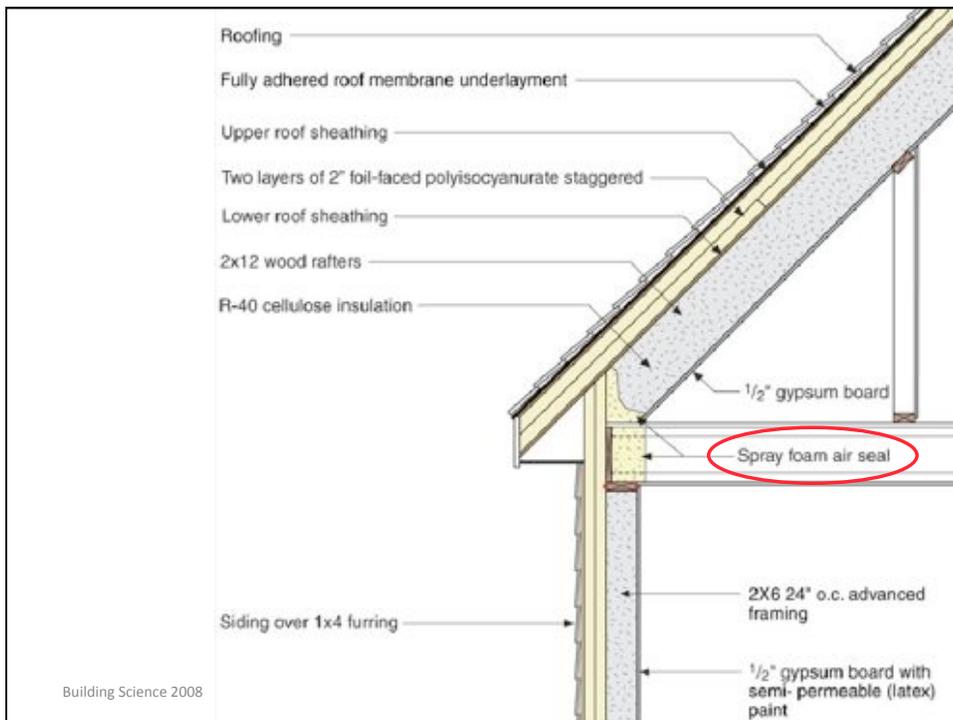
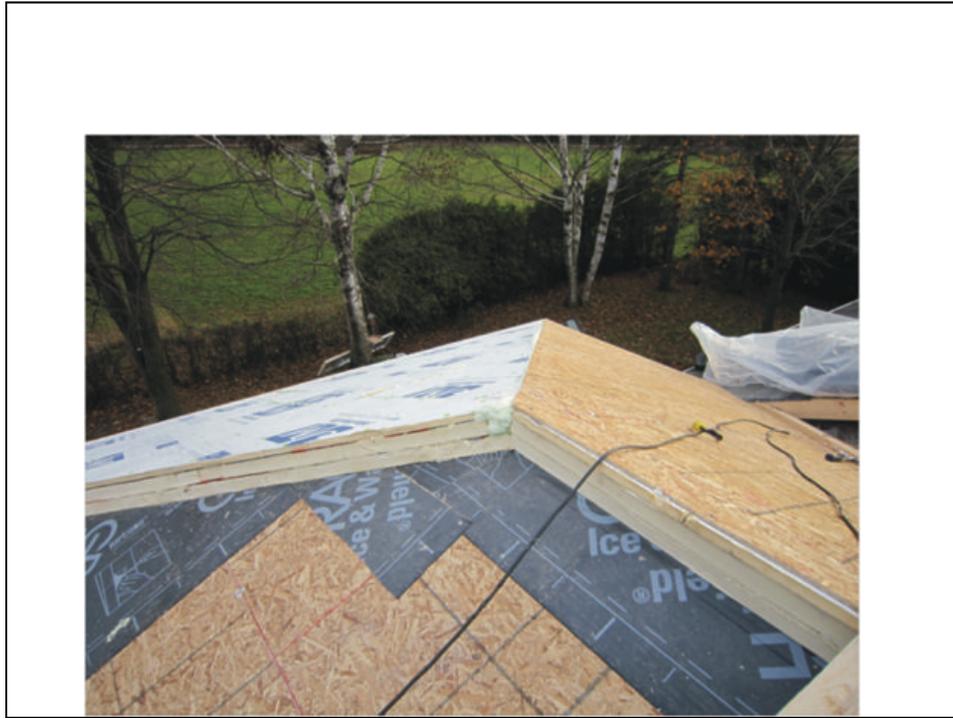
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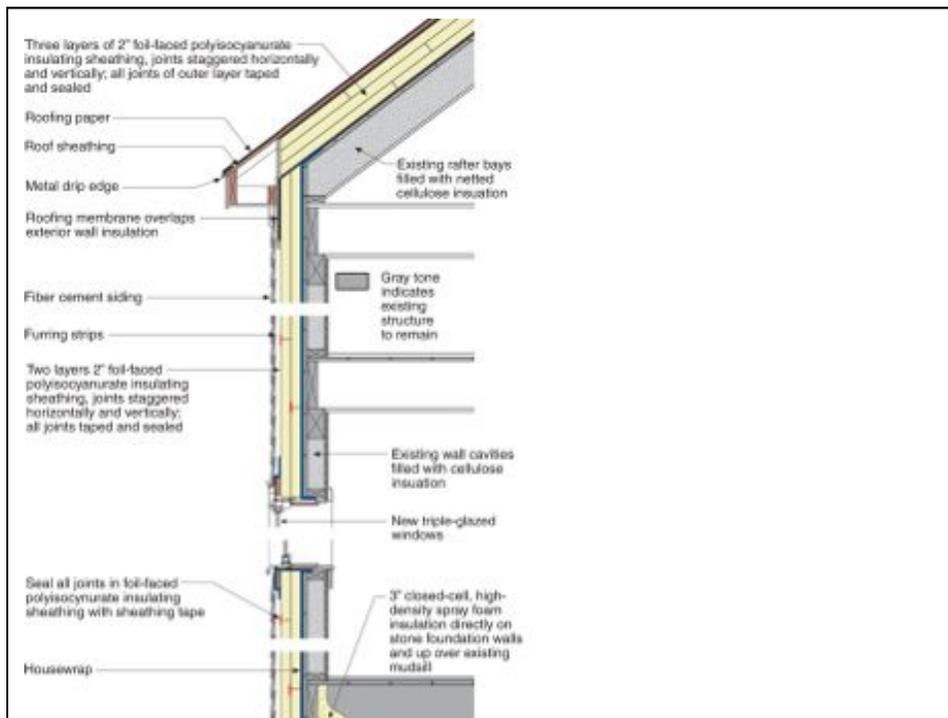
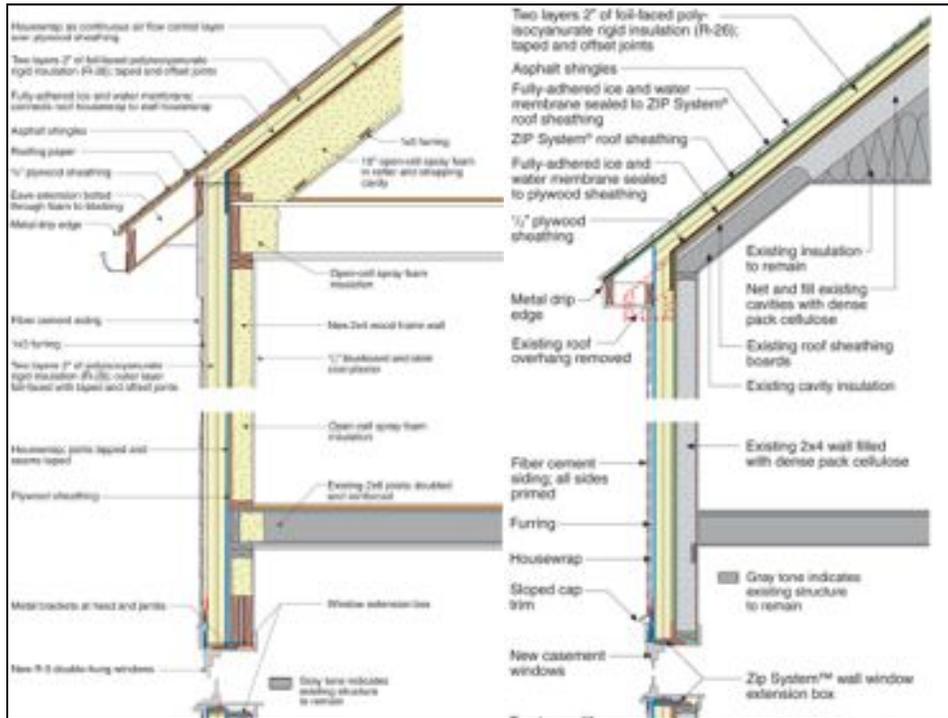
- Roofs 37

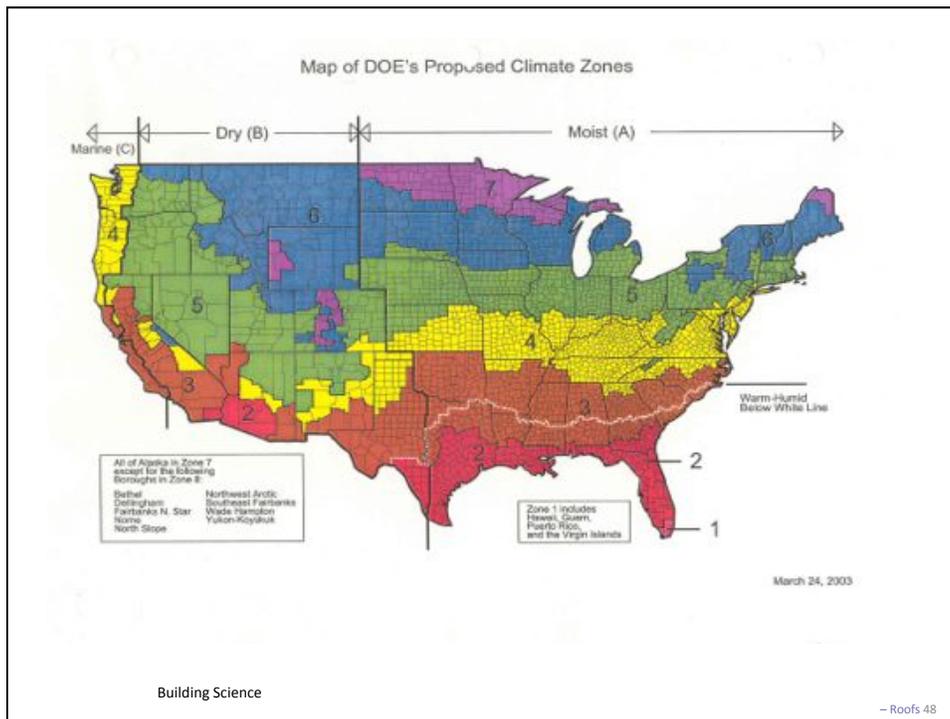












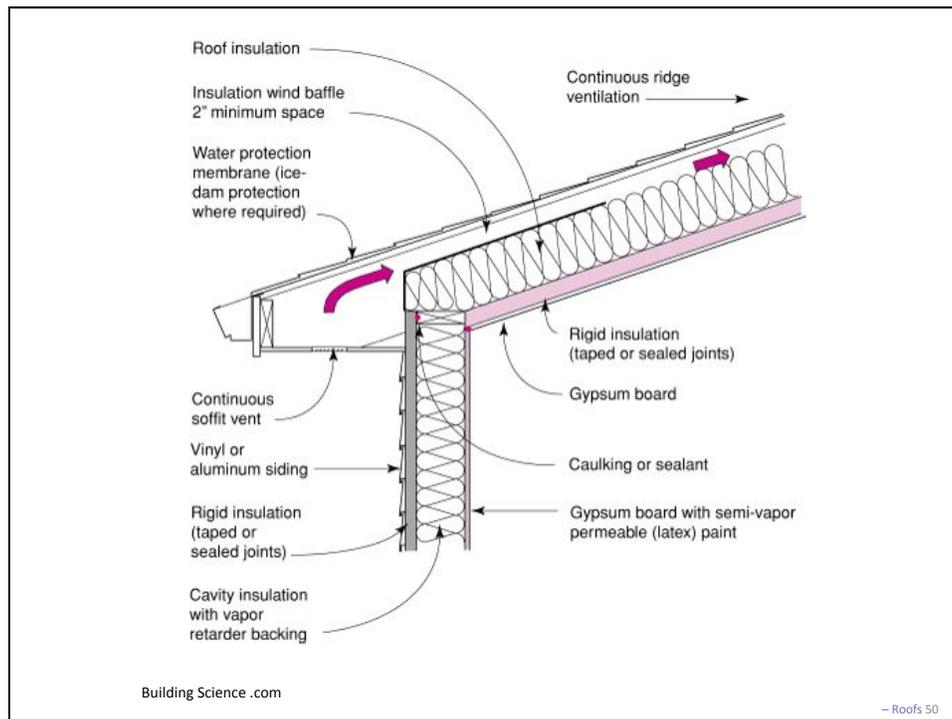
## IRC R806.4 2009

- “Cathedralized attics” explicitly allowed
  - Requires air impermeable insulation in contact
- No additional vapor control needed in Zones 1-4
- Zone 4 Marine, Zones 5 and higher need vapor retarder
  - ccSPF is a retarder

**TABLE R806.4**  
**INSULATION FOR CONDENSATION CONTROL**

CLIMATE ZONE	MINIMUM RIGID BOARD OR AIR-IMPERMEABLE INSULATION R-VALUE <sup>a</sup>	
2B and 3B tile roof only	0 (none required)	R-30
1, 2A, 2B, 3A, 3B, 3C	R-5	R-30
4C	R-10	R-38
4A, 4B	R-15	R-38
5	R-20	R-38
6	R-25	R-49
7	R-30	R-49
8	R-35	R-49

a. Contributes to but does not supersede Chapter 11 energy requirements.



## Conclusions

- Get the airtightness right
  - Yes, even small cracks can matter
- Remove ducts (or seal them perfectly, insulate)
- Insulate to control condensation
- Then add R-value