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

Building Science

Roofs

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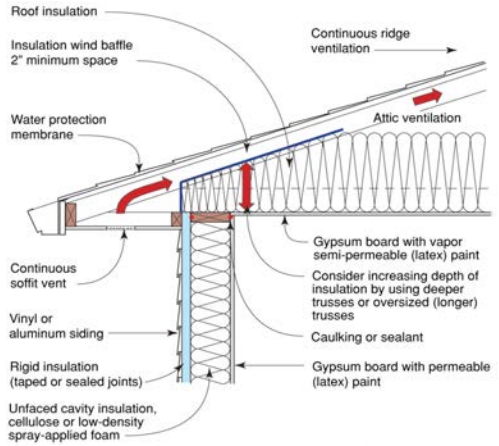
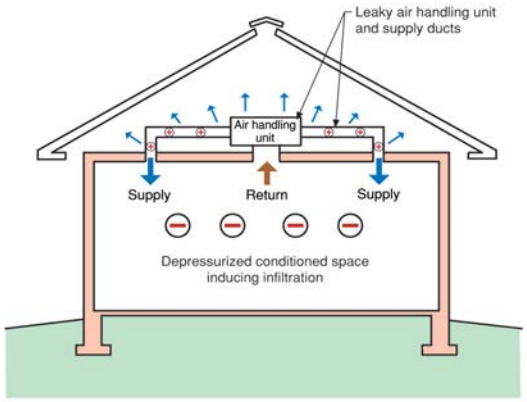


Building Science Corporation Joseph Lstiburek 2

Building Science Corporation Joseph Lstiburek 3



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

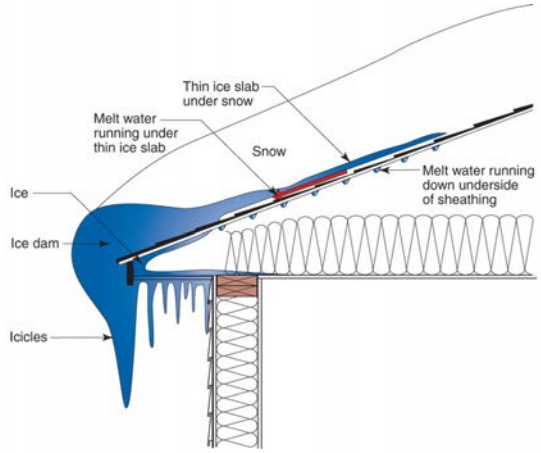
Building Science Corporation Joseph Lstiburek 4

Building Science Corporation Joseph Lstiburek 5

Building Science Corporation Joseph Lstiburek 6

Building Science Corporation Joseph Lstiburek 7

Building Science Corporation Joseph Lstiburek 8



Building Science Corporation
Joseph Lstiburek 9

Building Science Corporation
Joseph Lstiburek 10

Building Science Corporation
Joseph Lstiburek 11

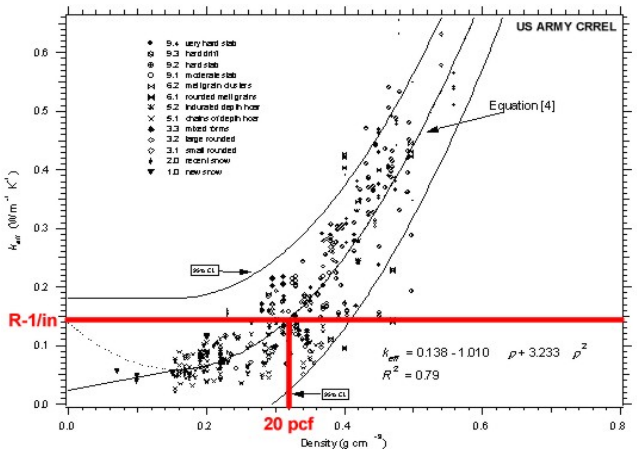
Building Science Corporation
Joseph Lstiburek 12

Building Science Corporation Joseph Lstiburek 13

Building Science Corporation Joseph Lstiburek 14

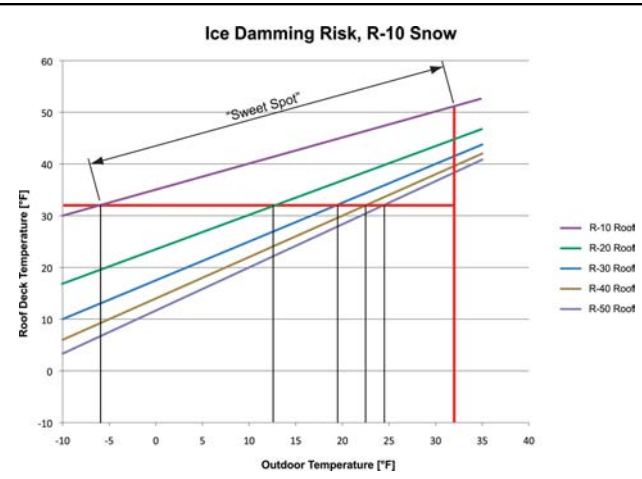
Building Science Corporation Joseph Lstiburek 15

Building Science Corporation Joseph Lstiburek 16

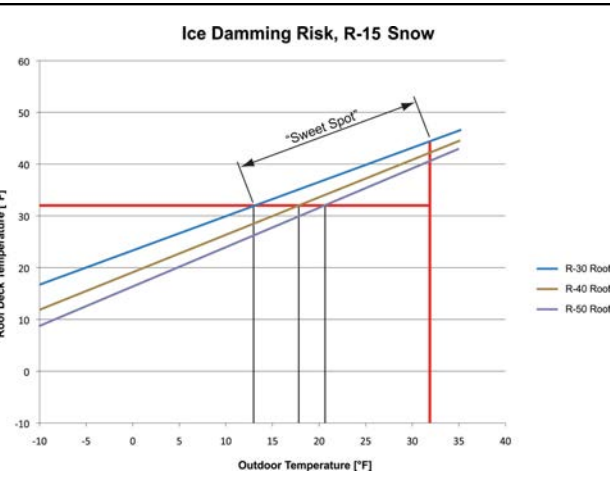


Building Science Corporation
Joseph Lstiburek 17

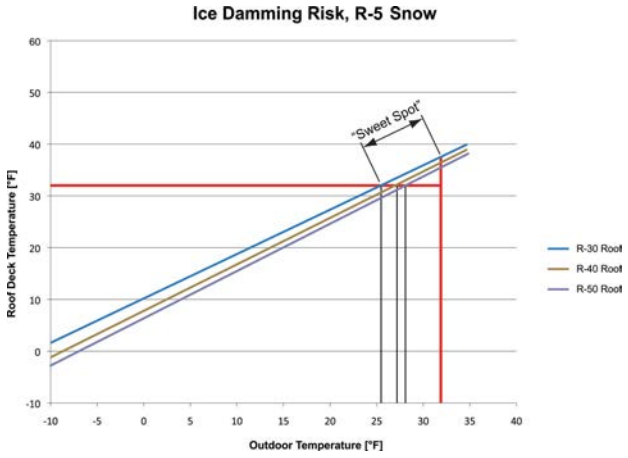
Building Science Corporation
Joseph Lstiburek 18



Building Science Corporation
Joseph Lstiburek 19

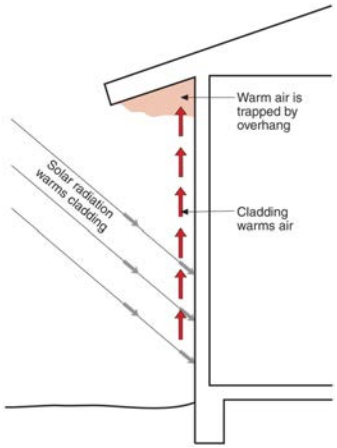


Building Science Corporation
Joseph Lstiburek 20



Building Science Corporation Joseph Lstiburek 21

Building Science Corporation Joseph Lstiburek 22



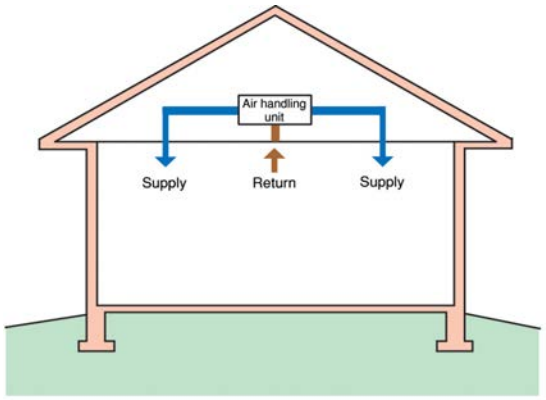
Building Science Corporation Joseph Lstiburek 23

Building Science Corporation Joseph Lstiburek 24

Building Science Corporation Joseph Lstiburek 25

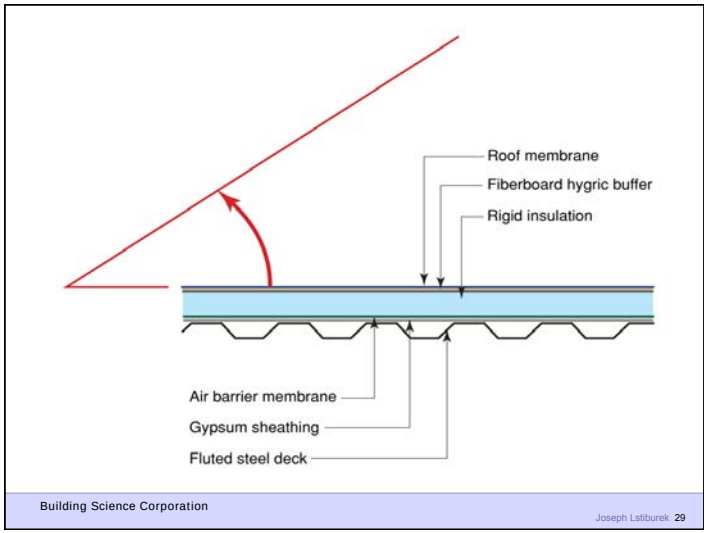
Building Science Corporation Joseph Lstiburek 26

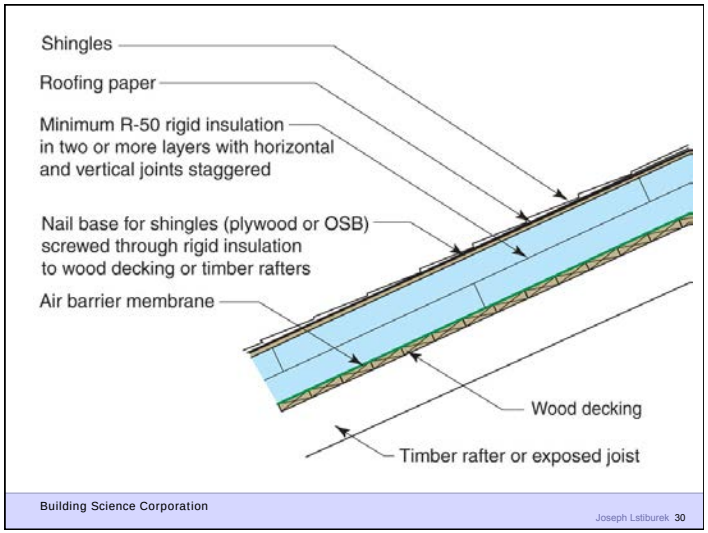
Building Science Corporation Joseph Lstiburek 27

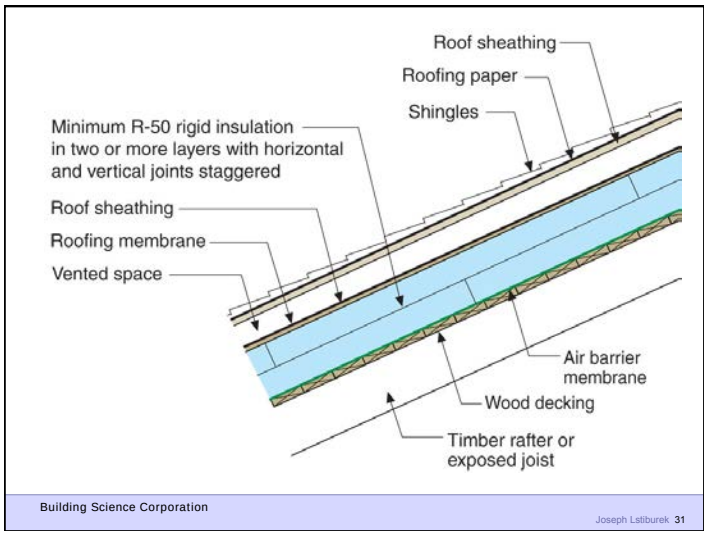


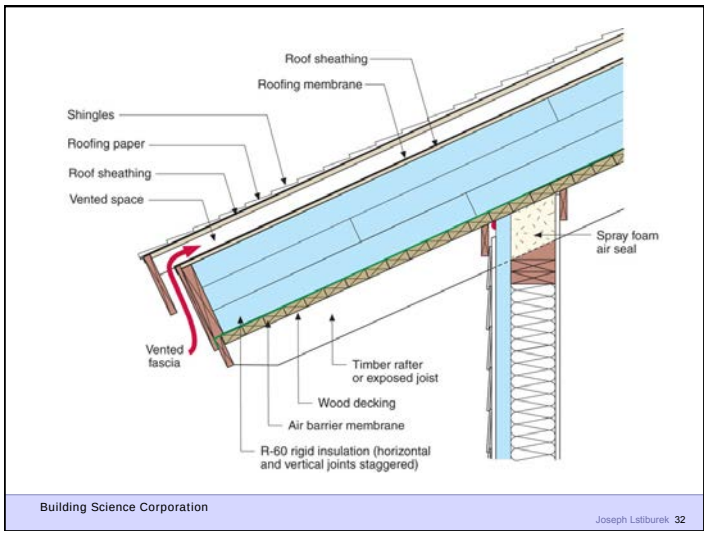
Note: Colored shading depicts the building's thermal barrier and pressure boundary. The thermal barrier and pressure boundary enclose the conditioned space.

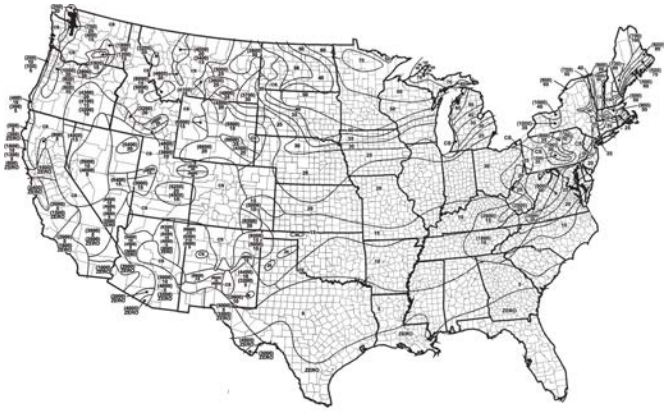
Building Science Corporation Joseph Lstiburek 28


Roof membrane
Fiberboard hygric buffer
Rigid insulation
Air barrier membrane
Gypsum sheathing
Fluted steel deck
Building Science Corporation
Joseph Lstiburek 29


Shingles
Roofing paper
Minimum R-50 rigid insulation
in two or more layers with horizontal
and vertical joints staggered
Nail base for shingles (plywood or OSB)
screwed through rigid insulation
to wood decking or timber rafters
Air barrier membrane
Wood decking
Timber rafter or exposed joist
Building Science Corporation
Joseph Lstiburek 30


Roof sheathing
Roofing paper
Shingles
Minimum R-50 rigid insulation
in two or more layers with horizontal
and vertical joints staggered
Roof sheathing
Roofing membrane
Vented space
Air barrier
membrane
Wood decking
Timber rafter or
exposed joist
Building Science Corporation
Joseph Lstiburek 31


Roof sheathing
Roofing membrane
Shingles
Roofing paper
Roof sheathing
Vented space
Spray foam
air seal
Vented
fascia
Timber rafter
or exposed joist
Wood decking
Air barrier membrane
R-60 rigid insulation (horizontal
and vertical joints staggered)
Building Science Corporation
Joseph Lstiburek 32



Building Science Corporation
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Building Science Corporation
Joseph Lstiburek 38

Building Science Corporation
Joseph Lstiburek 39

Building Science Corporation
Joseph Lstiburek 40

Building Science Corporation

Joseph Lstiburek 41

Building Science Corporation

Joseph Lstiburek 42

Building Science Corporation

Joseph Lstiburek 43

Building Science Corporation

Joseph Lstiburek 44

Building Science Corporation

Joseph Lstiburek 45

Building Science Corporation

Joseph Lstiburek 46

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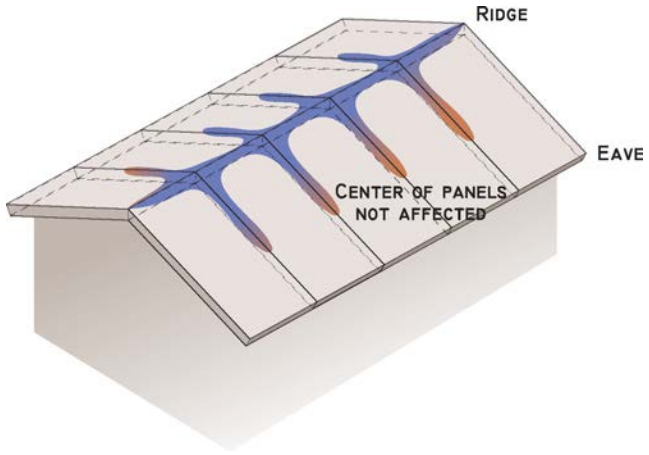
Joseph Lstiburek 47

Building Science Corporation

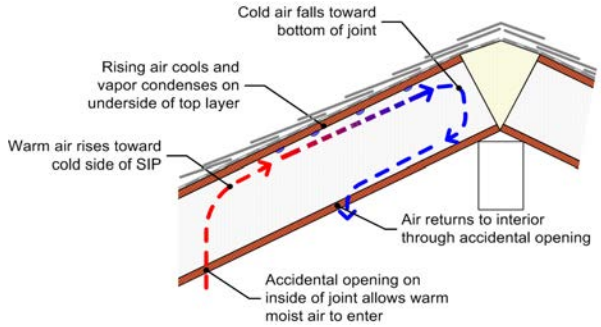
Joseph Lstiburek 48

Building Science Corporation Joseph Lstiburek 49

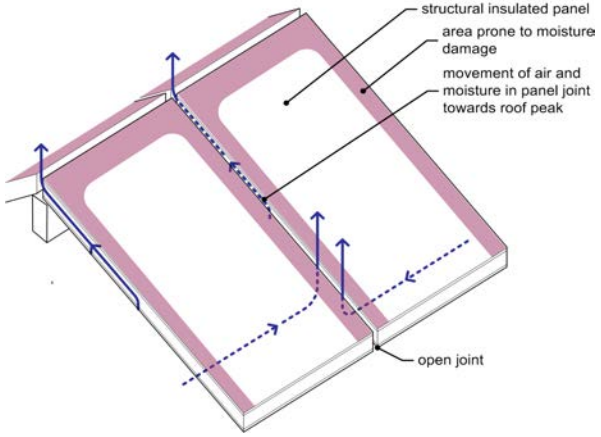


Building Science Corporation Joseph Lstiburek 50

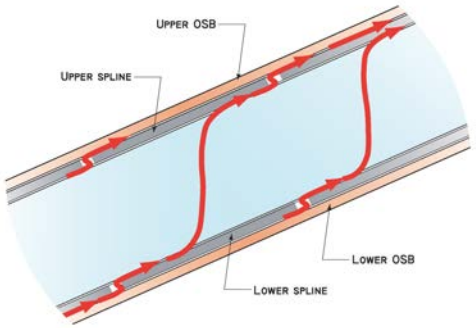
Building Science Corporation Joseph Lstiburek 51



Building Science Corporation Joseph Lstiburek 52



Building Science Corporation Joseph Lstiburek 53



Building Science Corporation Joseph Lstiburek 54

Building Science Corporation Joseph Lstiburek 55

Building Science Corporation Joseph Lstiburek 56

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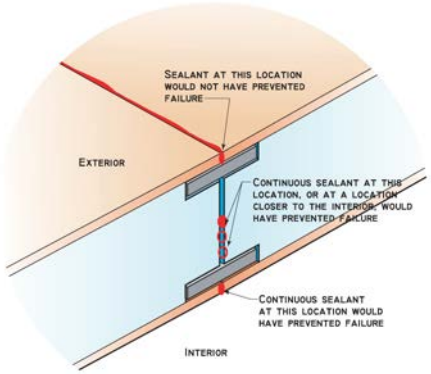
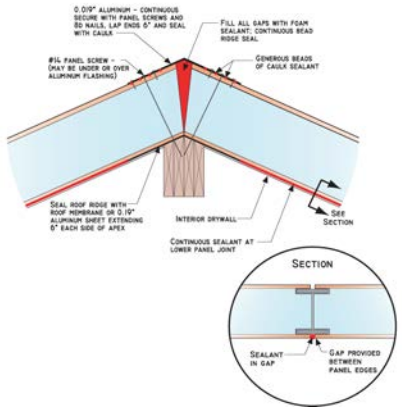
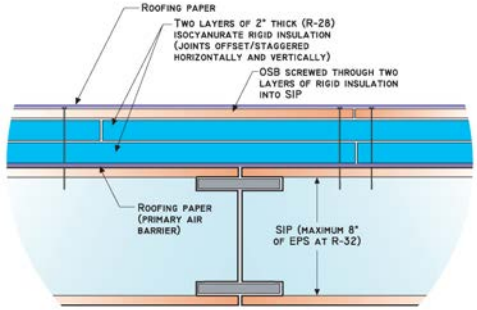
Joseph Lstiburek 62

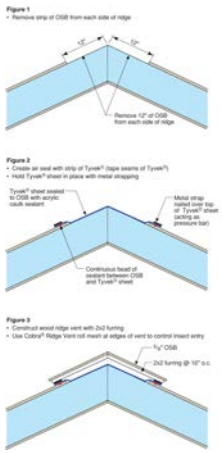
Building Science Corporation
Joseph Lstiburek 63



Building Science Corporation
Joseph Lstiburek 64


0.019" ALUMINUM - CONTINUOUS SECURE WITH PANEL SCREWS AND 8D NAILS, LAP ENDS 6" AND SEAL WITH CAULK
FILL ALL GAPS WITH FOAM SEALANT; CONTINUOUS BEAD RIDGE SEAL
#14 PANEL SCREW - (MAY BE UNDER OR OVER ALUMINUM FLASHING)
GENEROUS BEADS OF CAULK SEALANT
SEAL ROOF RIDGE WITH ROOF MEMBRANE OR 0.19" ALUMINUM SHEET EXTENDING 6" EACH SIDE OF APEX
INTERIOR DRYWALL
SEE SECTION
CONTINUOUS SEALANT AT LOWER PANEL JOINT
SECTION
SEALANT IN GAP
GAP PROVIDED BETWEEN PANEL EDGES


ROOFING PAPER
TWO LAYERS OF 2" THICK (R-28) ISOCYANURATE RIGID INSULATION (JOINTS OFFSET/STAGGERED HORIZONTALLY AND VERTICALLY)
OSB SCREWED THROUGH TWO LAYERS OF RIGID INSULATION INTO SIP
ROOFING PAPER (PRIMARY AIR BARRIER)
SIP (MAXIMUM 8" OF EPS AT R-32)



Building Science Corporation
Joseph Lstiburek 69

Building Science Corporation
Joseph Lstiburek 70

Building Science Corporation
Joseph Lstiburek 71

Building Science Corporation
Joseph Lstiburek 72

Building Science Corporation
Joseph Lstiburek 73

Building Science Corporation
Joseph Lstiburek 74

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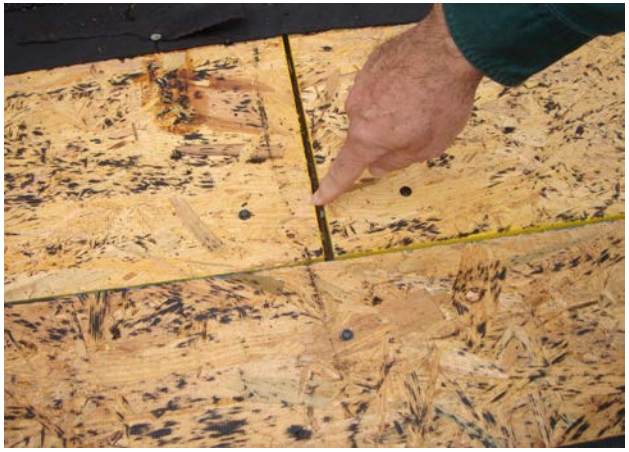
Building Science Corporation Joseph Lstiburek 77

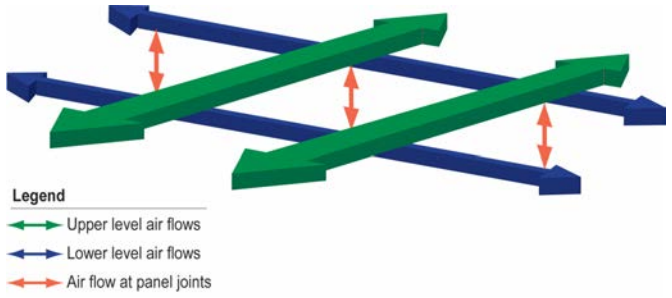
Building Science Corporation Joseph Lstiburek 78

Building Science Corporation Joseph Lstiburek 79

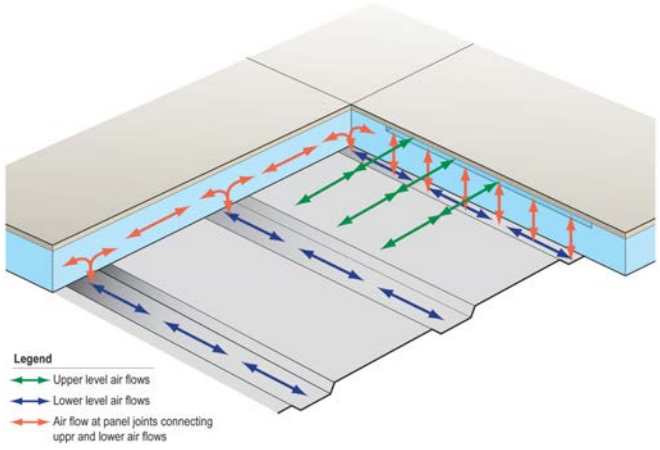


Building Science Corporation Joseph Lstiburek 80

Building Science Corporation Joseph Lstiburek 81



Building Science Corporation Joseph Lstiburek 82



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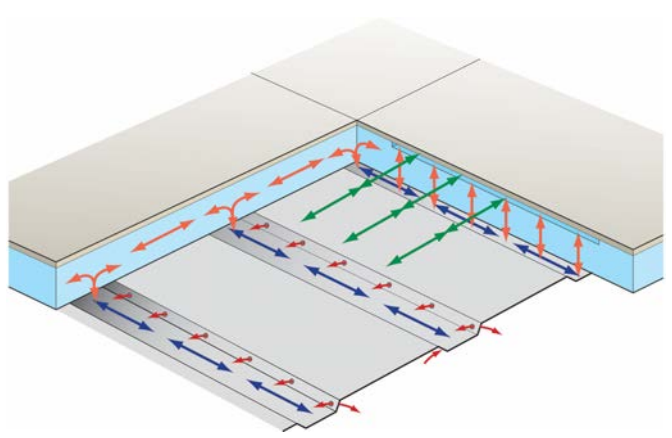
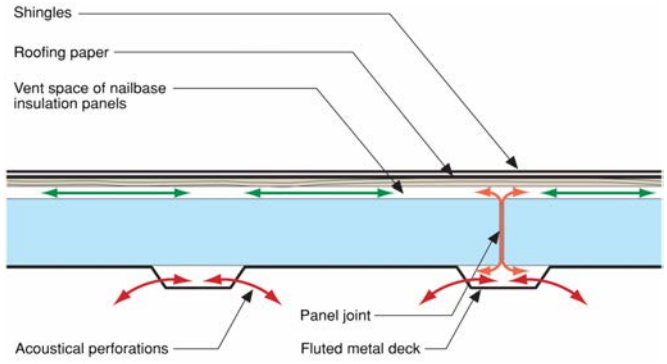
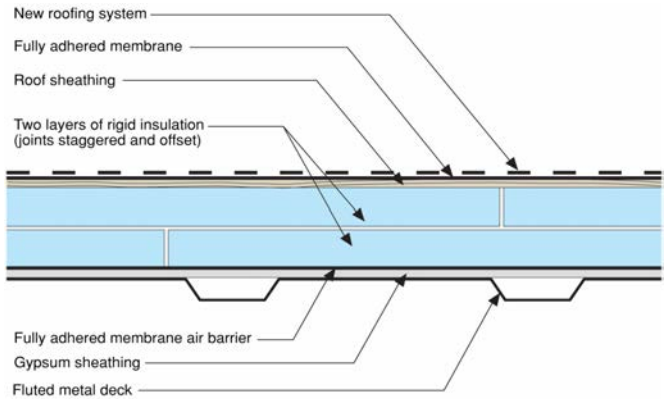


Building Science Corporation Joseph Lstiburek 84

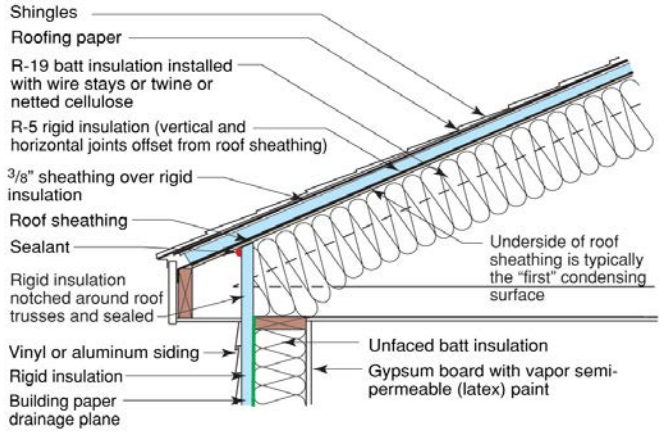
Building Science Corporation
Joseph Lstiburek 85



Building Science Corporation
Joseph Lstiburek 86



Building Science Corporation
Joseph Lstiburek 87



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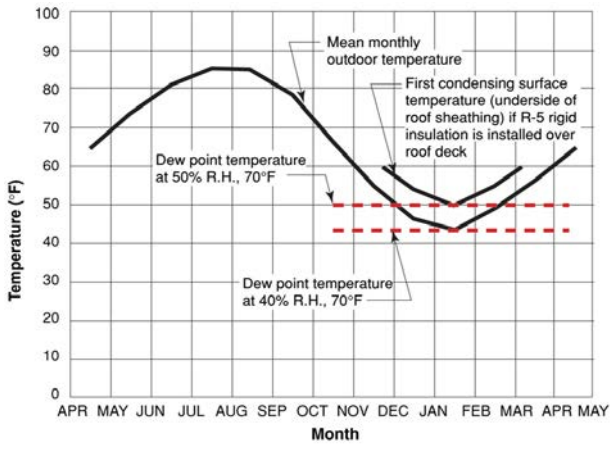
Joseph Lstiburek 88



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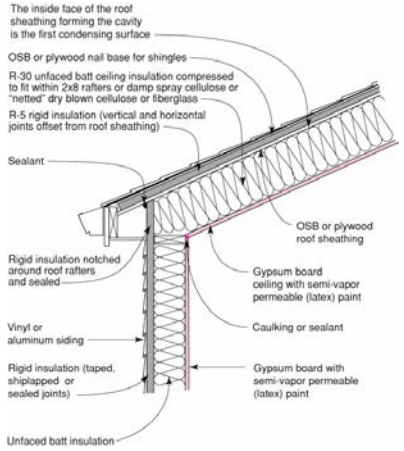

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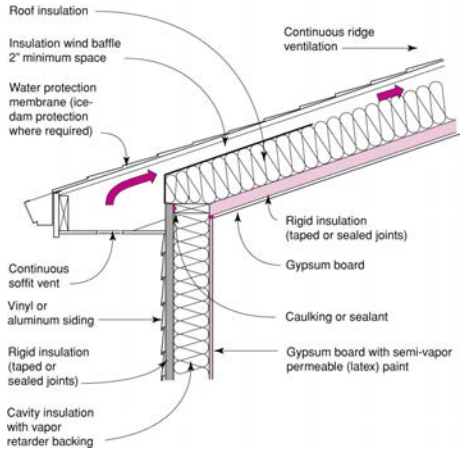

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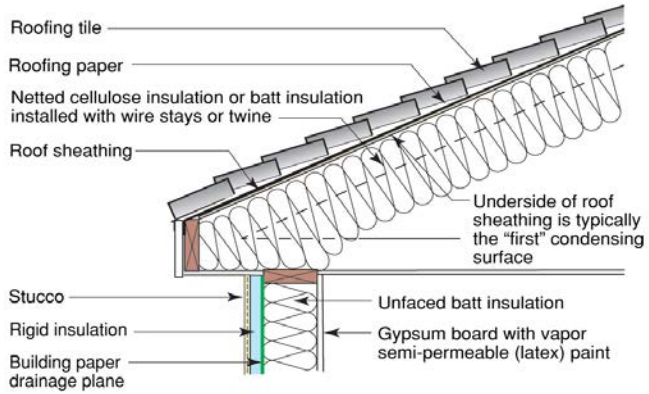
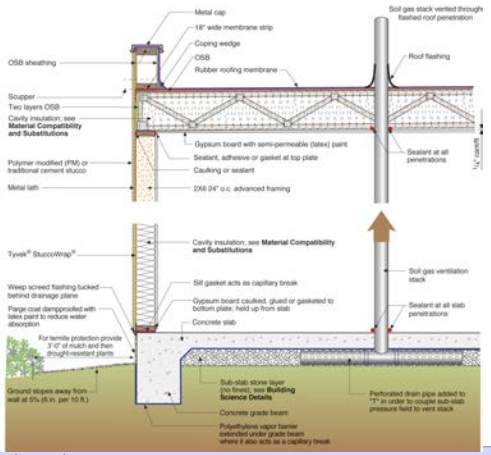


Building Science Corporation Joseph Lstiburek 92

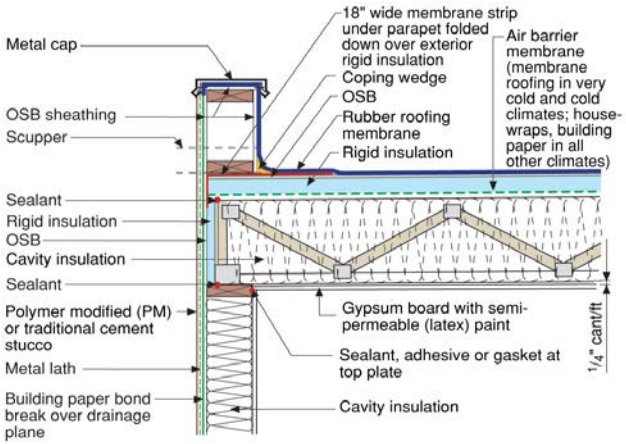
Building Science Corporation
Joseph Lstiburek 93

Building Science Corporation
Joseph Lstiburek 94

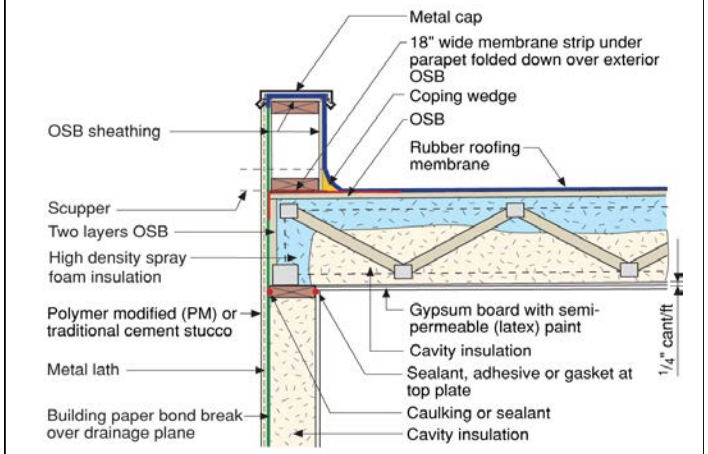
Building Science Corporation
Joseph Lstiburek 95



Building Science Corporation
Joseph Lstiburek 96



Building Science Corporation Joseph Lstiburek 97



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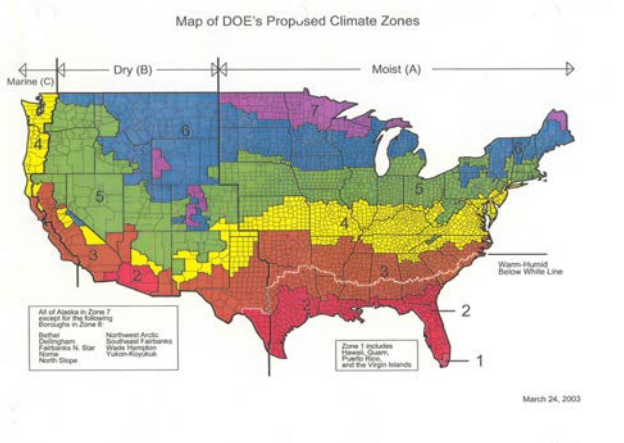

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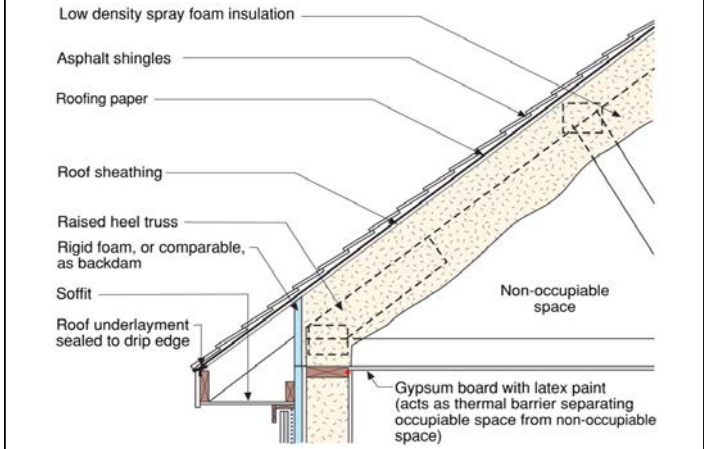


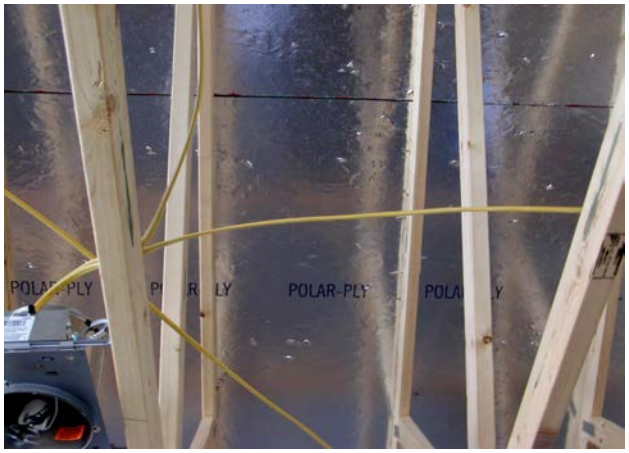
Building Science Corporation Joseph Lstiburek 100

Building Science Corporation Joseph Lstiburek 101

Building Science Corporation Joseph Lstiburek 102

Building Science Corporation Joseph Lstiburek 103

Building Science Corporation Joseph Lstiburek 104



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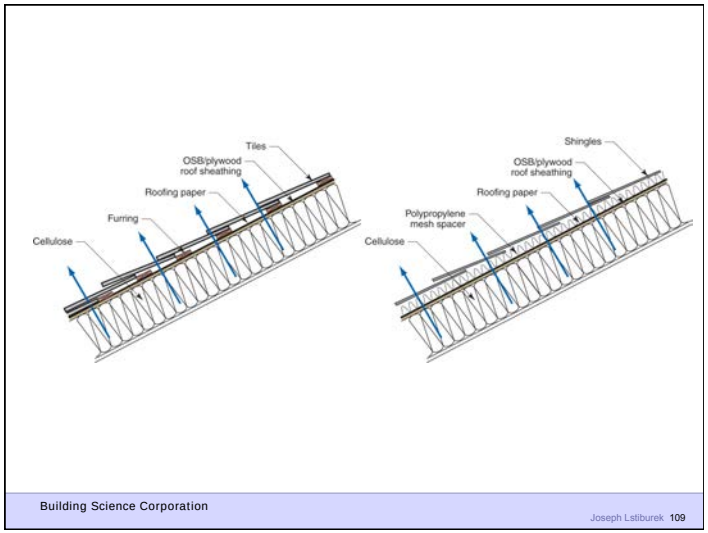
Building Science Corporation Joseph Lstiburek 106

Building Science Corporation Joseph Lstiburek 107

Building Science Corporation Joseph Lstiburek 108


Tiles
OSB/plywood roof sheathing
Roofing paper
Furring
Cellulose
Shingles
OSB/plywood roof sheathing
Roofing paper
Polypropylene mesh spacer
Cellulose
Building Science Corporation
Joseph Lstiburek 109