U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Building America U.S. Department of Energy

Building America

New Code Options for Insulating, Sealing, and Controlling Moisture in Unvented Attics in Residential Buildings

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Pacific Northwest National Laboratory
Pam Cole

Building Science Corporation
Joe Lstiburek, Ph.D., P.Eng., ASHRAE Fellow

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Course Description

This webinar from the DOE Building America Program will provide an overview of the new unvented attic options in the 2018 IRC/IECC and the additional benefits.

The new code language would require installation of vapor diffusion ports/vents in unvented attics to allow moisture in the attic to be removed by diffusion rather than by air change. This allows the attic assembly to remain airtight while providing a path for moving the moisture to the outside via vapor diffusion. Airtight attics also provide an energy-efficiency benefit.

With the vapor diffusion ports, unvented attics can be insulated with lower-cost alternative insulation material, such as fiberglass batts, blown cellulose, and blown fiberglass, rather than polyurethane spray foam and rigid board insulation. This provides more material choices for designers, builders, and consumers who have issues with expense, the greenhouse gas potential of blowing agents, impacts of fire retardants, and off-gassing of some insulation products. In regions with high wildfire occurrence, elimination of eave vents and air sealing the upper attic vents at ridges significantly decreases entry paths for embers that could start a house fire. In hurricane zones, eliminating roof vents reduces the entry way for rainwater during storms.

Learning Objectives

1. Understand how moisture can be controlled in unvented attics.
2. Learn the proper roof ventilation measures for unvented attics.
3. Learn how to apply the new 2018 IECC/IRC code provisions for unvented attics and unvented enclosed rafter assemblies.
4. Apply best practices for installing vapor diffusion ports/vents, insulating, and air sealing unvented attic assemblies.

Code Change

R806.5 Unvented attic and unvented attic enclosed rafter assemblies.

- vapor diffusion port
- port area 1:600 of the ceiling area
- vapor permeance greater than 20 perms
- roof slope greater than 3:12
- air supply 50 cfm/1000 ft2 ceiling area
- insulation installed directly under the roof deck
- Climate Zones 1, 2 and 3

Vapor Diffusion Port: A passageway for conveying water vapor from and unvented attic to the atmosphere.

Technical Background to the Code Change

Arrhenius Equation

For Every 10 Degree K Rise

Activation Energy Doubles

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

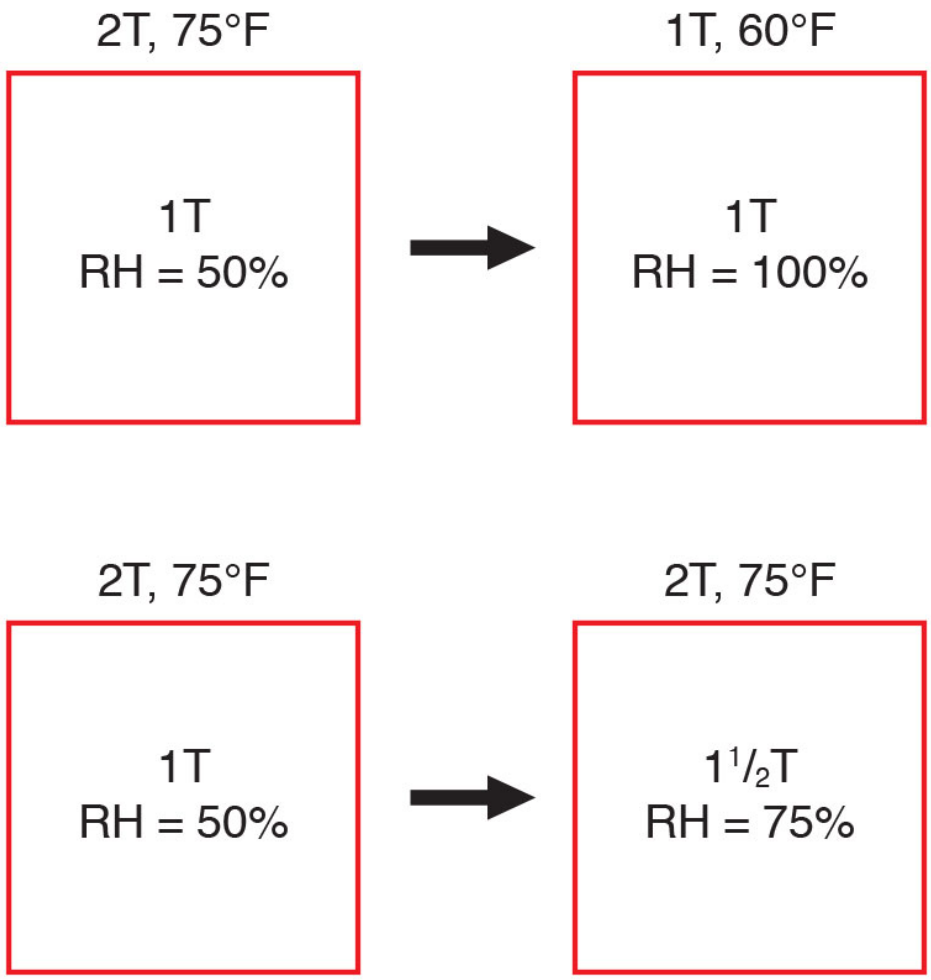
Damage Functions

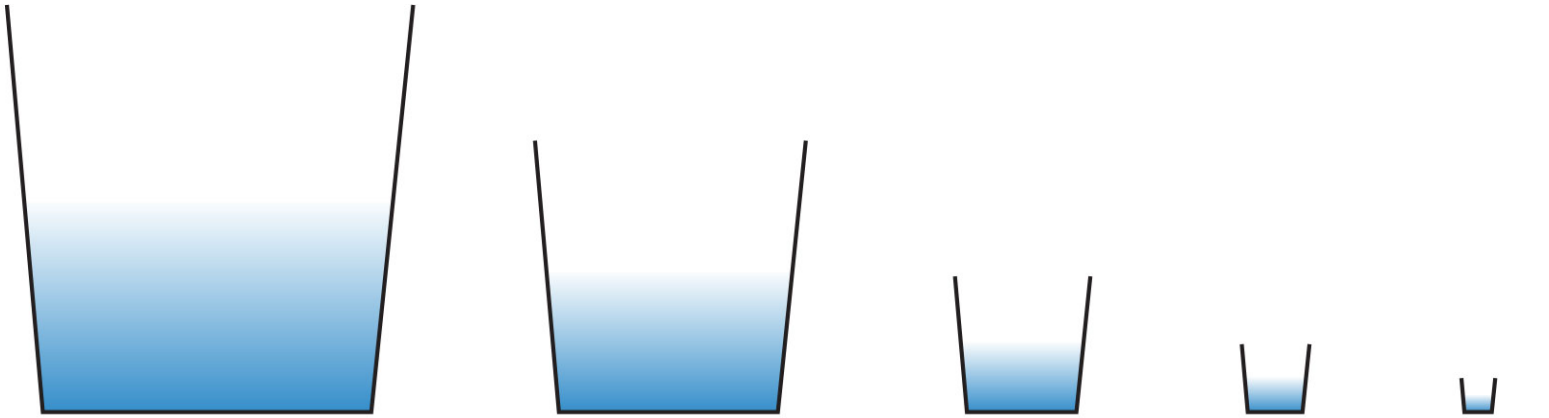
Water

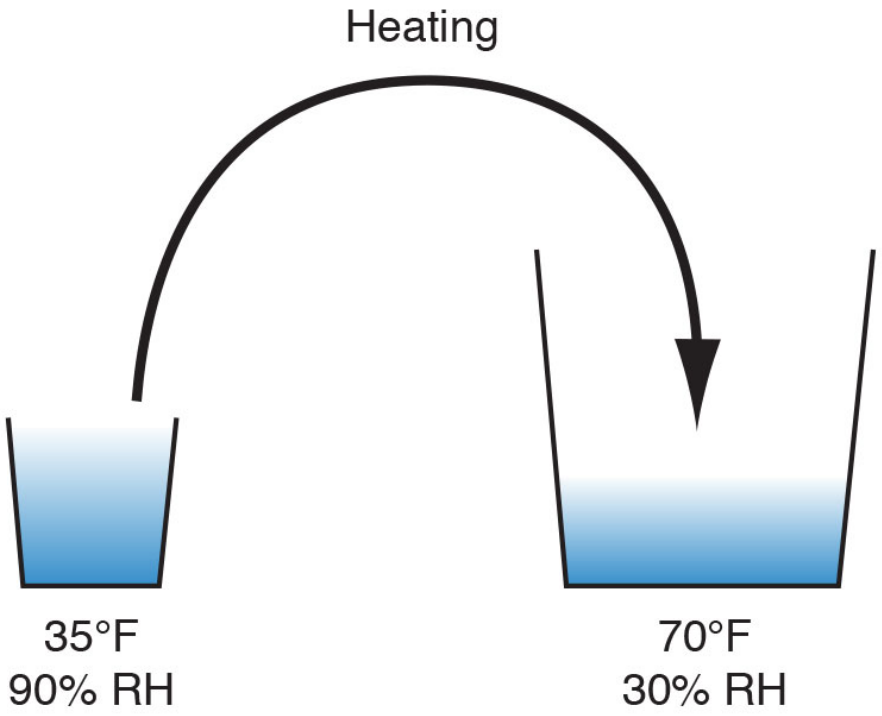
Heat

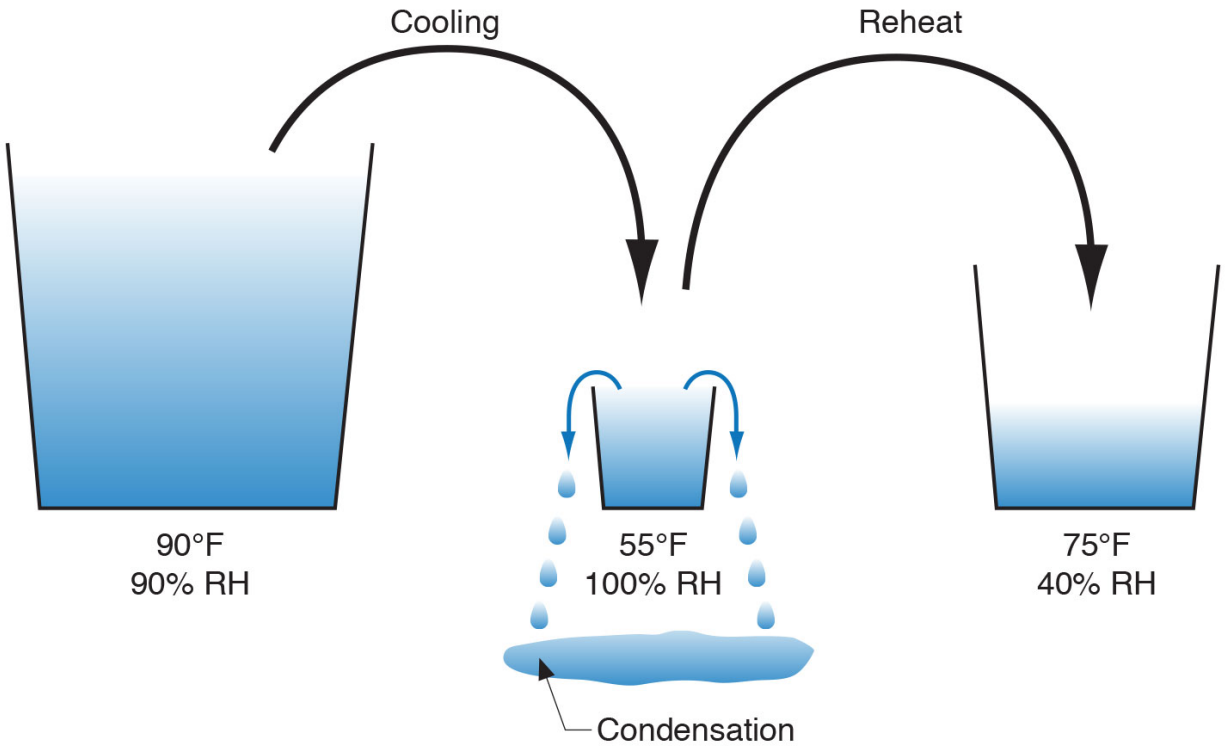
Ultra-violet Radiation

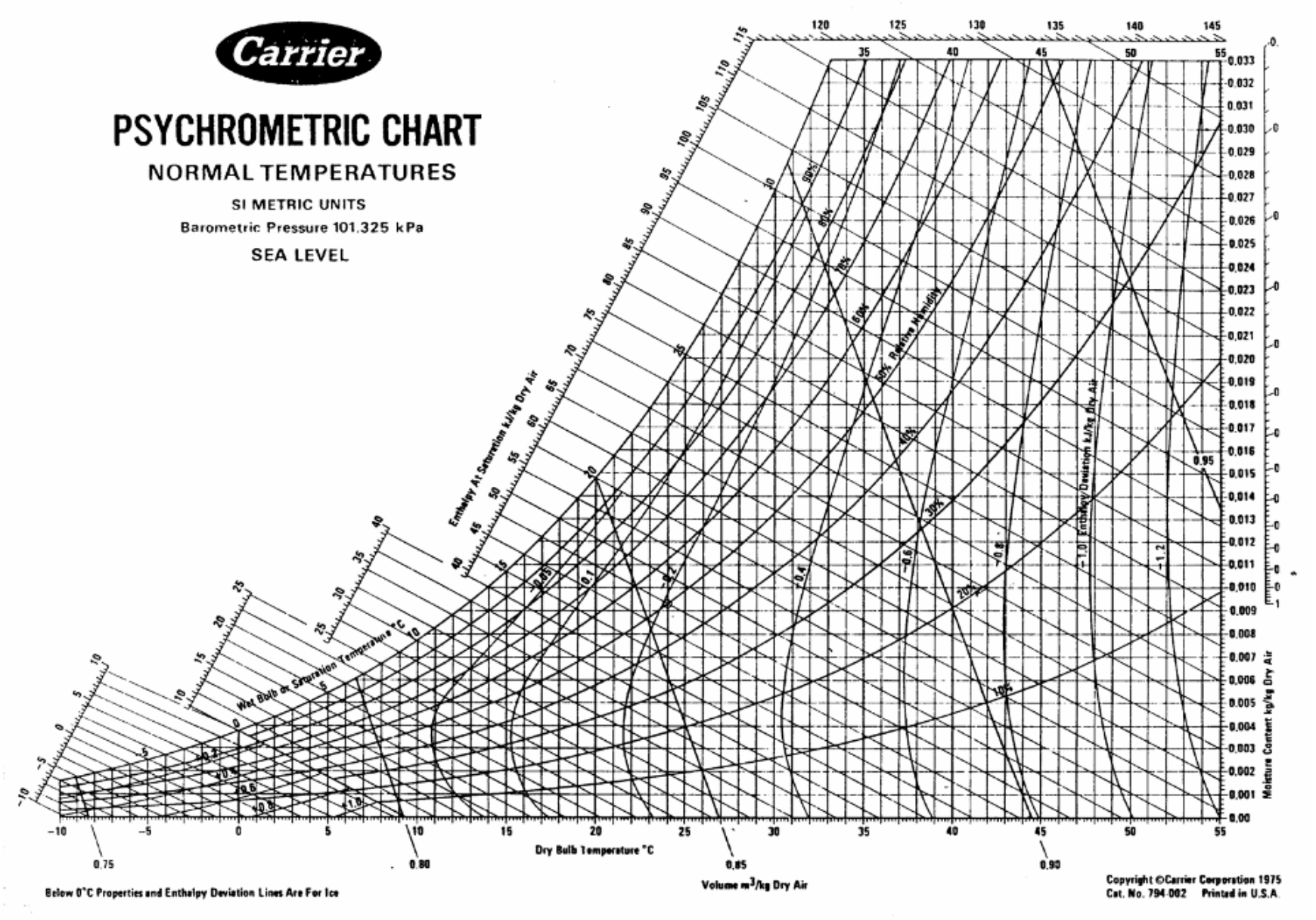
Vapor Pressure and Relative Humidity


2T, 75°F
1T
RH = 50%
1T, 60°F
1T
RH = 100%
2T, 75°F
1T
RH = 50%
2T, 75°F
1 1/2T
RH = 75%


90°F
50% RH
75°F
50% RH
60°F
50% RH
45°F
50% RH
30°F
50% RH


Heating
35°F
90% RH
70°F
30% RH


Cooling
Reheat
90°F
90% RH
55°F
100% RH
75°F
40% RH
Condensation


Carrier
PSYCHROMETRIC CHART
NORMAL TEMPERATURES
SI METRIC UNITS
Barometric Pressure 101.325 kPa
SEA LEVEL
Dry Bulb Temperature °C
Wet Bulb or Saturation Temperature °C
Enthalpy At Saturation kJ/kg Dry Air
Moisture Content kg/kg Dry Air
50% Relative Humidity
Below 0°C Properties and Enthalpy Deviation Lines Are For Ice
Volume m³/kg Dry Air
Copyright ©Carrier Corporation 1975
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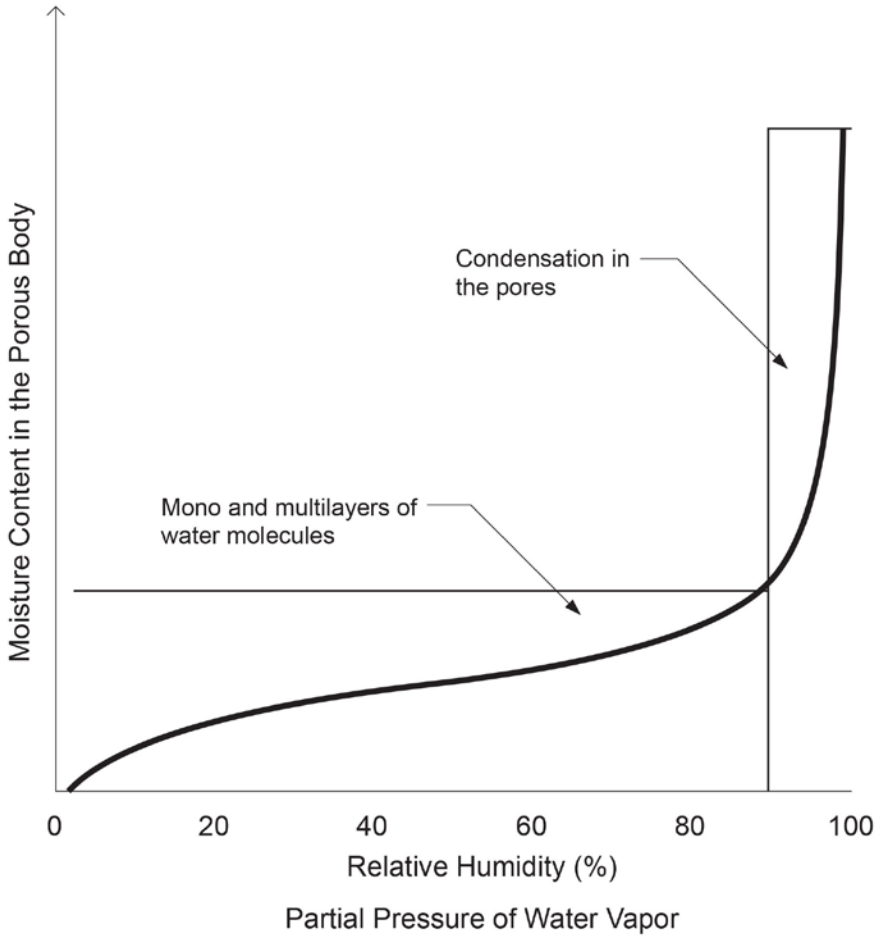
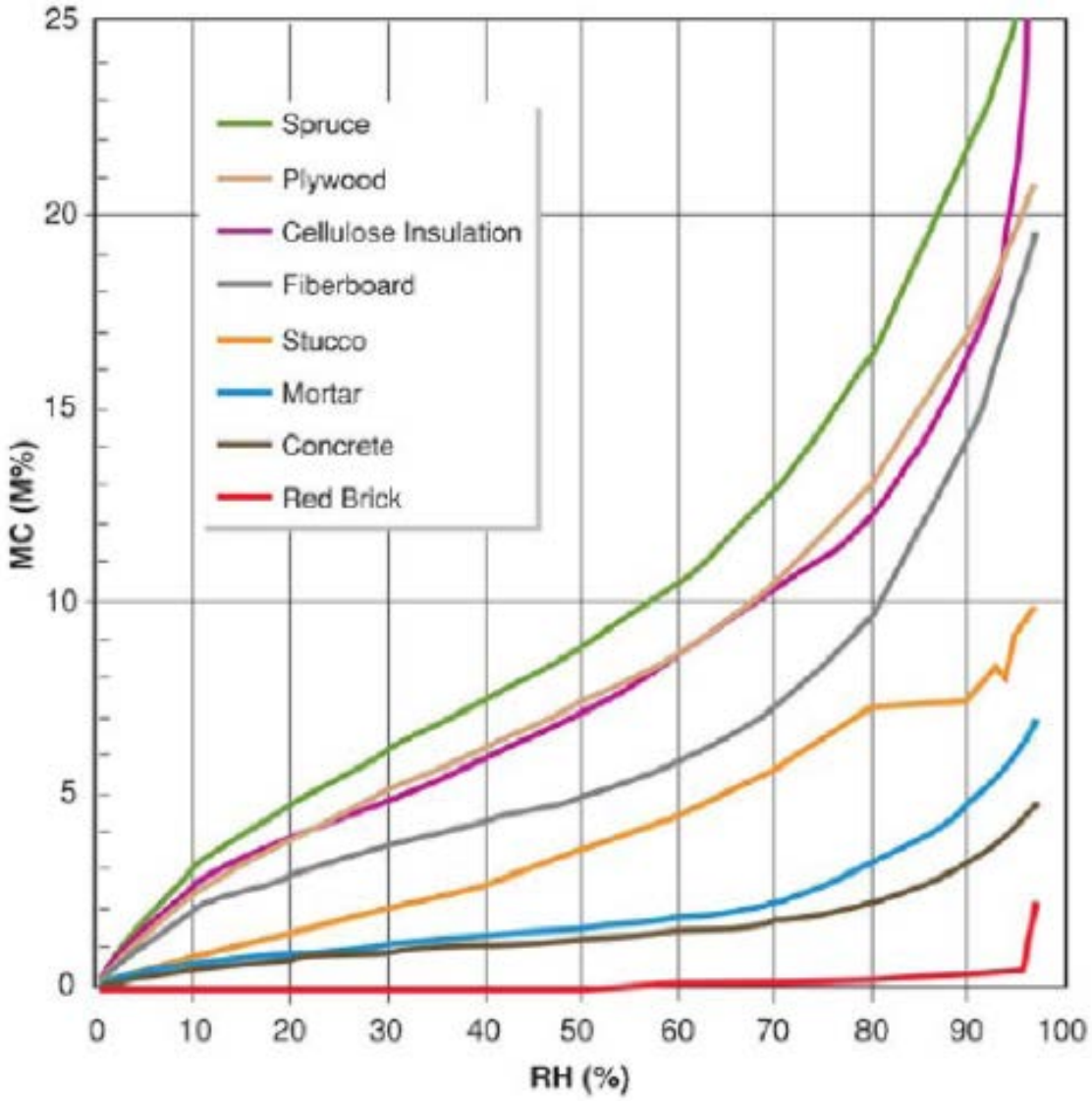
Sorption Isotherms

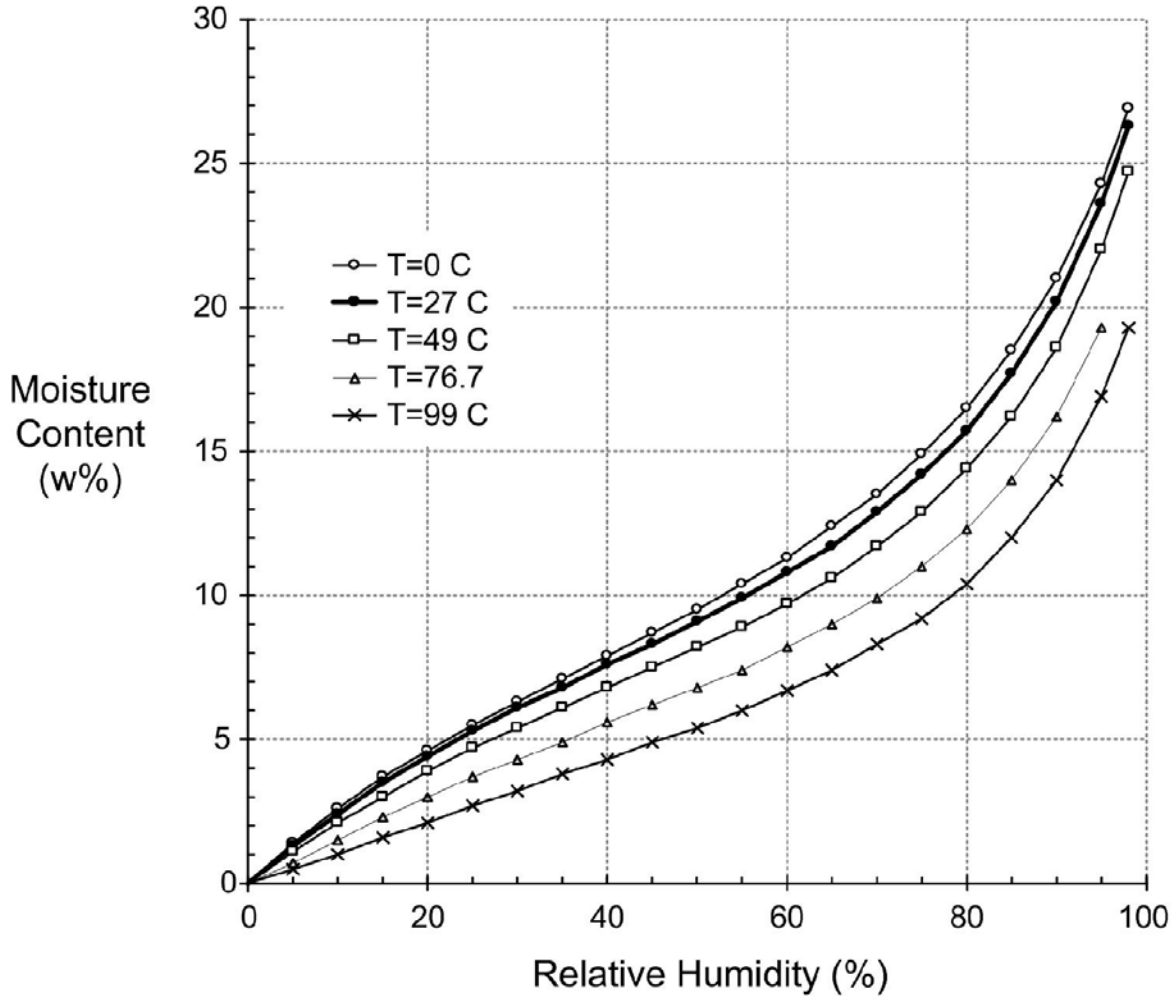


Change in the storage of moisture in a porous building material as the partial pressure of water vapor in the ambient air increases from zero to full saturation value at a given temperature.

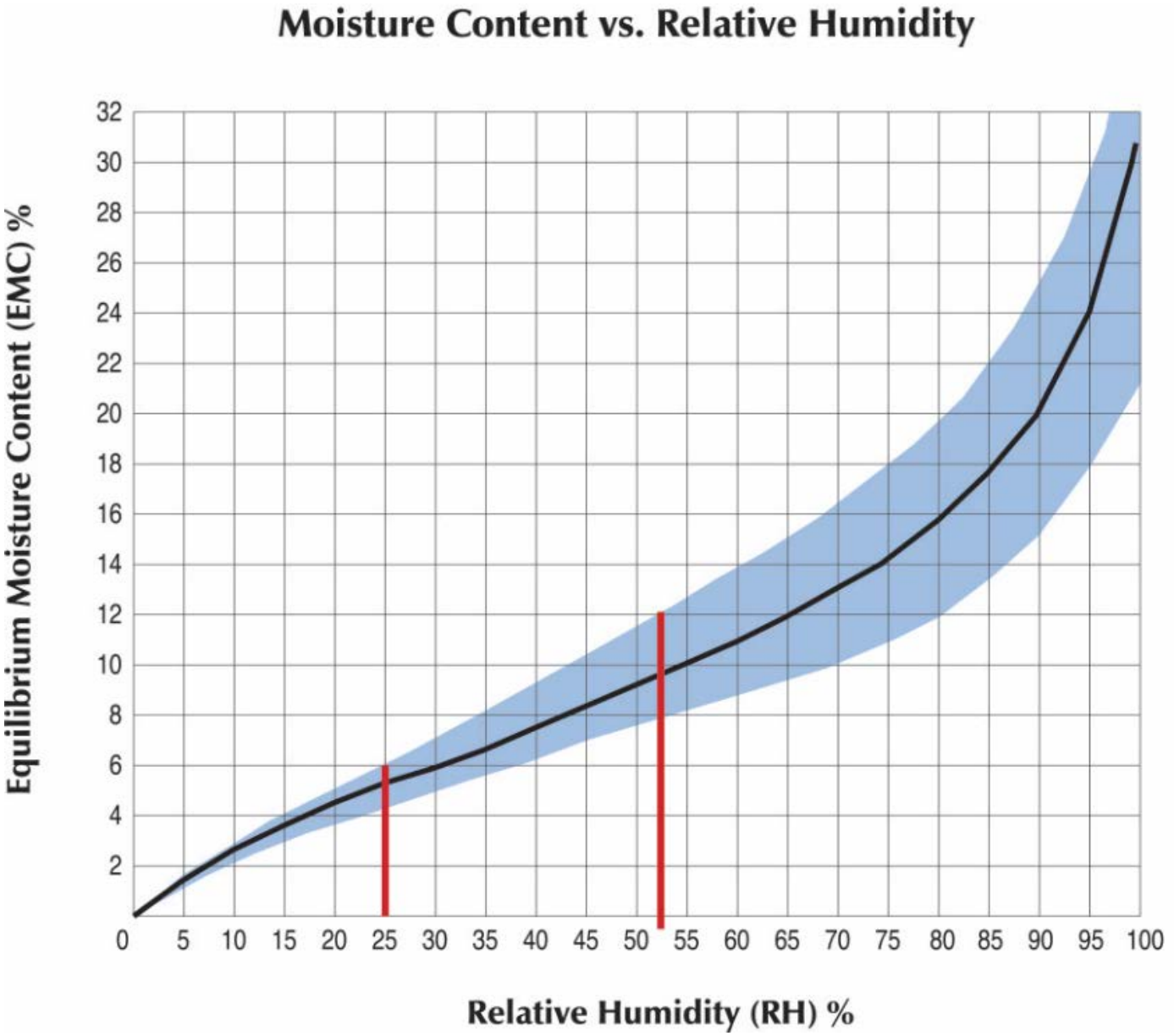
Sorption Curve

From M.K. Kumaran, ASTM MNL 18-2nd Edition, Moisture Control in Buildings, 2009


Spruce
Plywood
Cellulose Insulation
Fiberboard
Stucco
Mortar
Concrete
Red Brick
MC (M%)
RH (%)
0
5
10
15
20
25
0
10
20
30
40
50
60
70
80
90
100



Average sorption isotherm for wood as a function of temperature
From Straube & Burnett, 2005


Moisture Content vs. Relative Humidity
Equilibrium Moisture Content (EMC) %
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Relative Humidity (RH) %

2nd Law of Thermodynamics

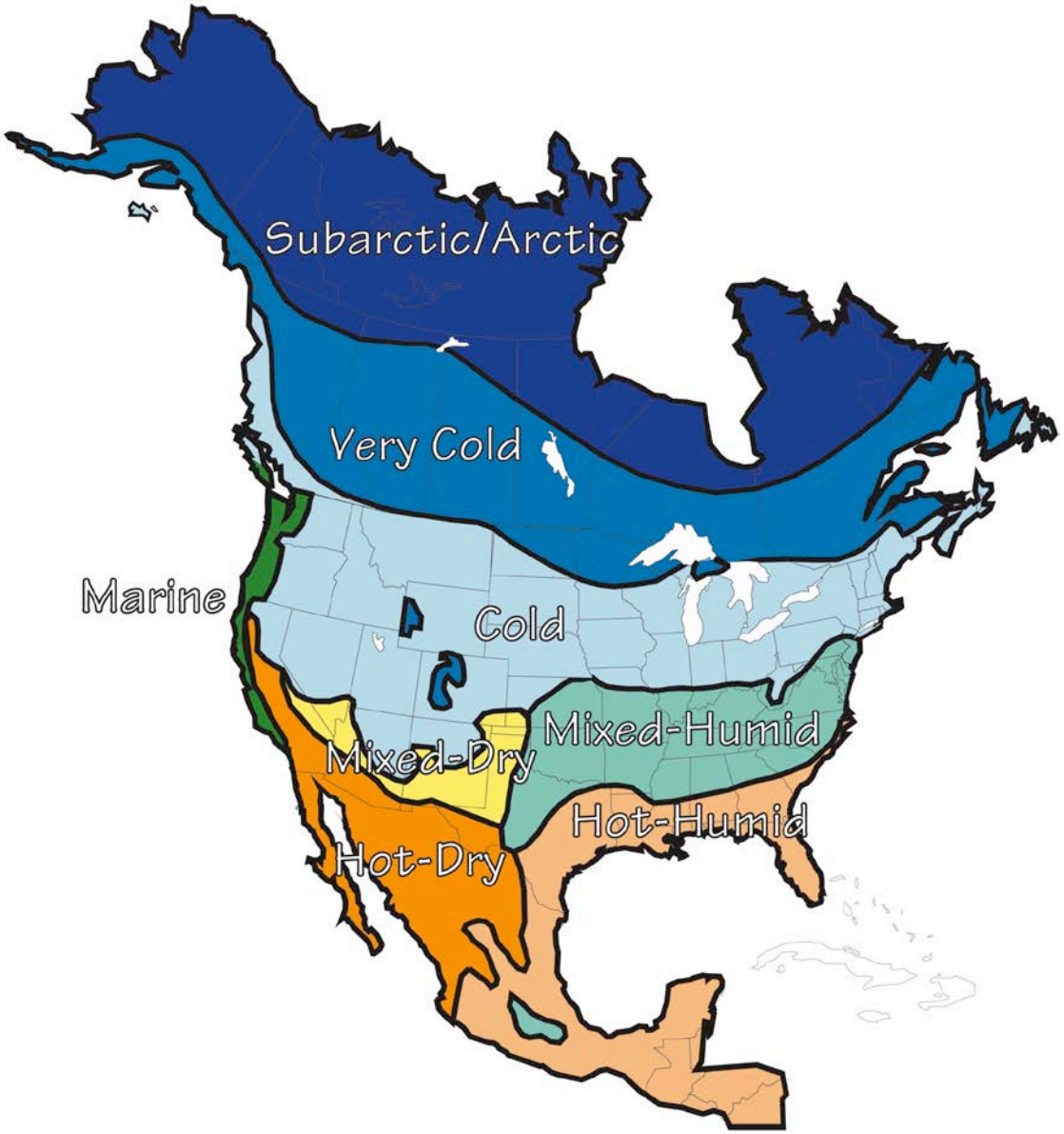
Heat Flow Is From Warm To Cold

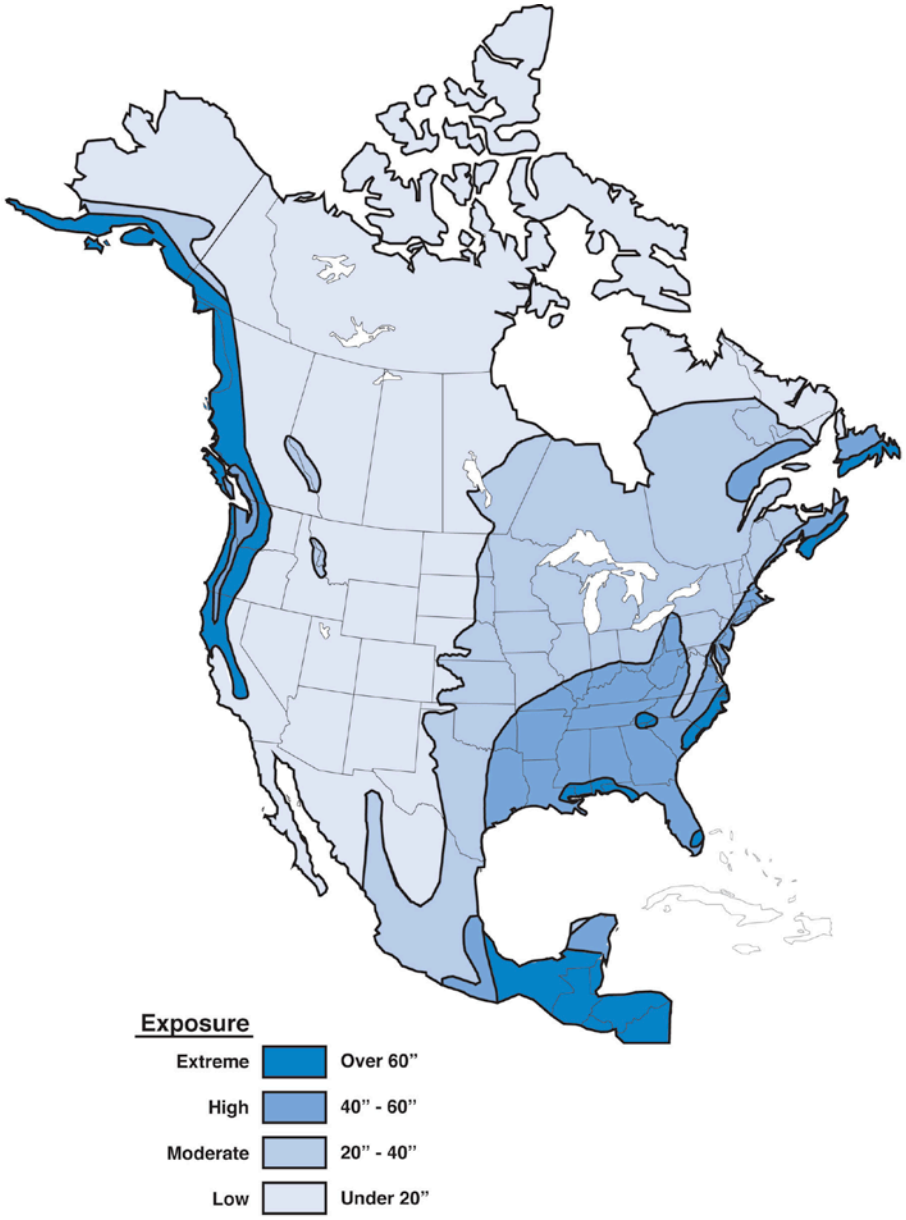
Moisture Flow Is From Warm To Cold

Moisture Flow Is From More To Less

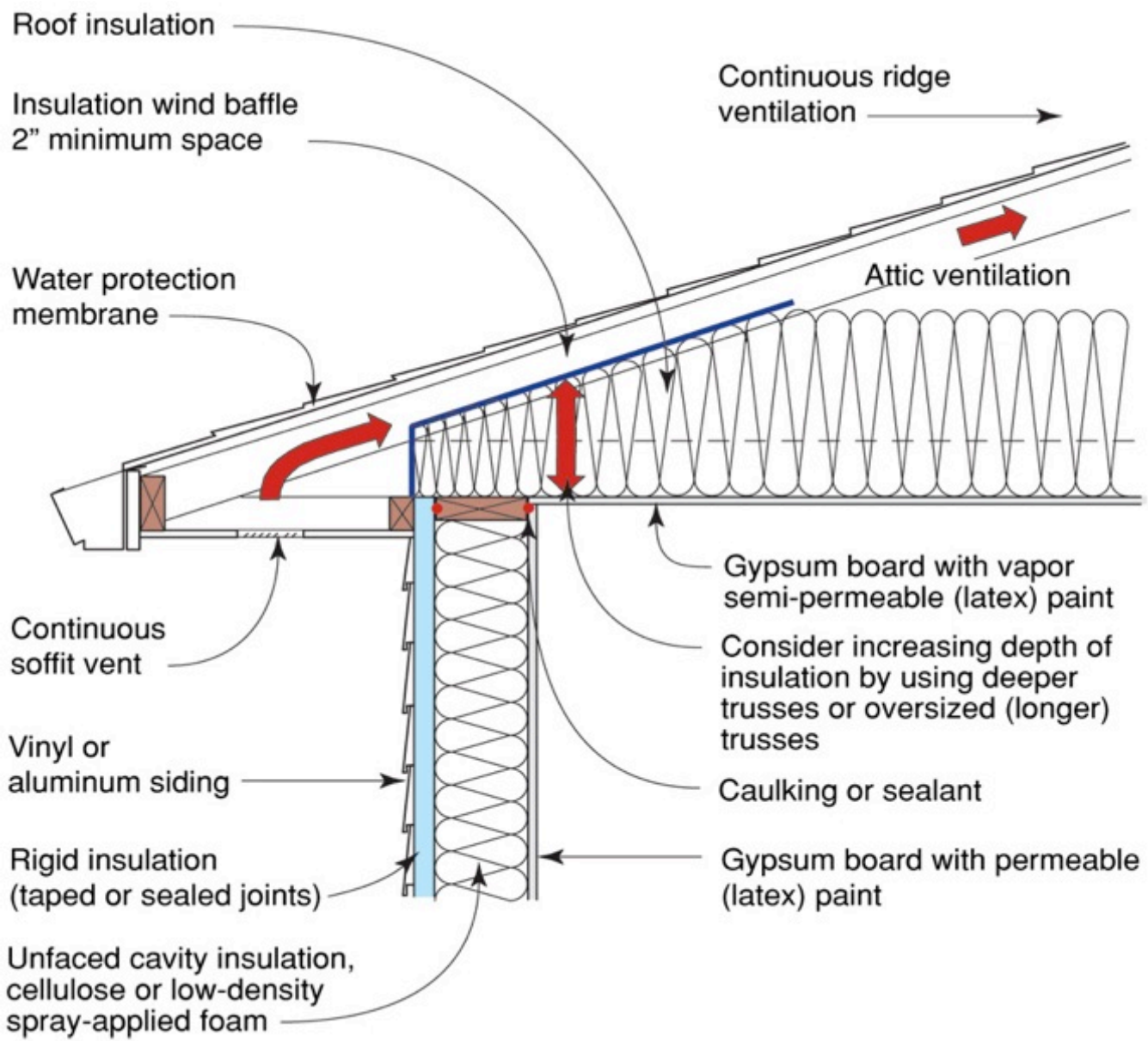
Air Flow Is From A Higher Pressure to a Lower Pressure

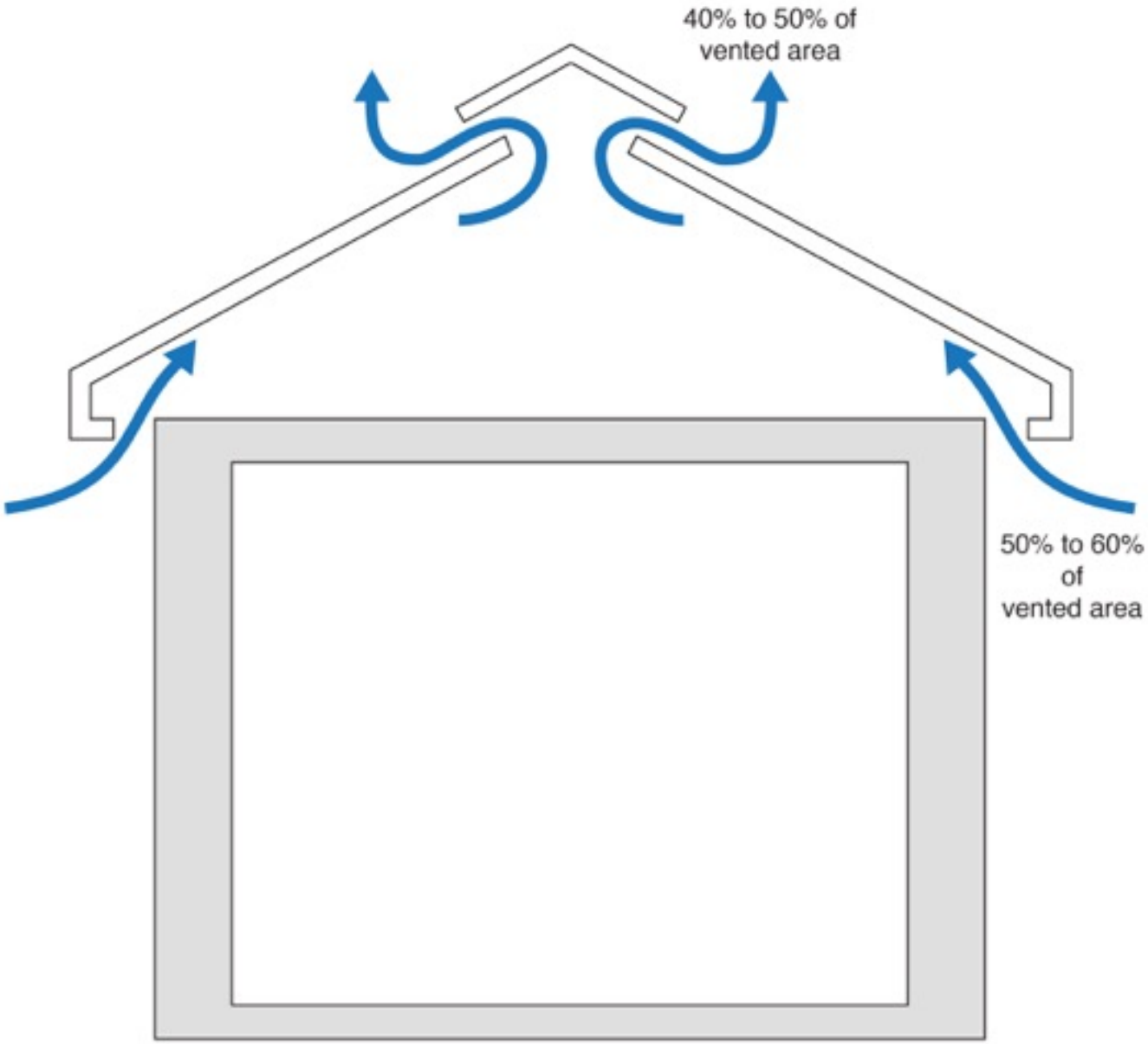
Gravity Acts Down

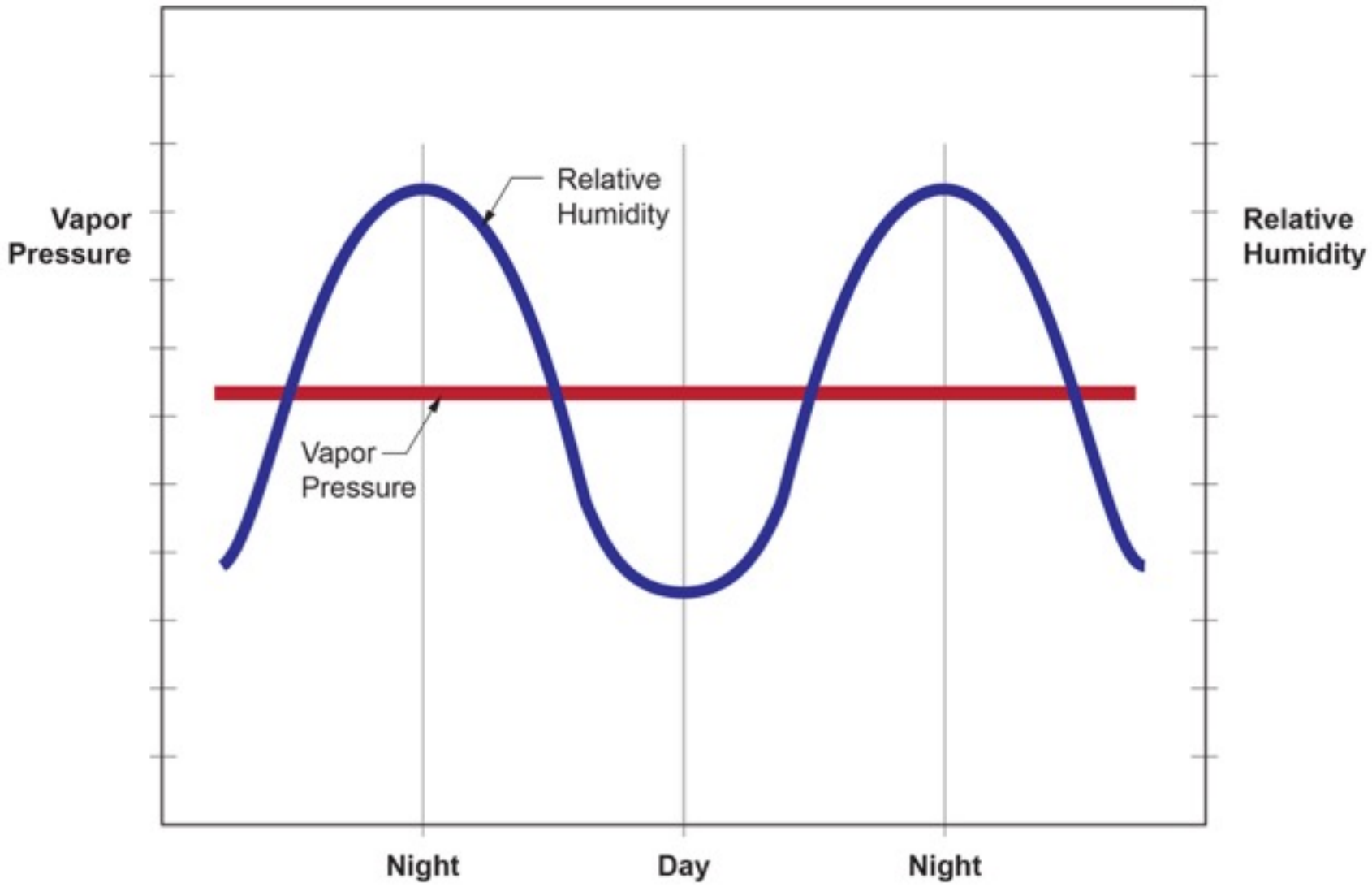

Subarctic/Arctic
Very Cold
Marine
Cold
Mixed-Humid
Mixed-Dry
Hot-Humid
Hot-Dry


Exposure
Extreme
Over 60”
High
40” - 60”
Moderate
20” - 40”
Low
Under 20”

Vented Attics Are Climate Dependant


Roof insulation
Insulation wind baffle
2" minimum space
Continuous ridge
ventilation
Water protection
membrane
Attic ventilation
Gypsum board with vapor
semi-permeable (latex) paint
Continuous
soffit vent
Consider increasing depth of
insulation by using deeper
trusses or oversized (longer)
trusses
Vinyl or
aluminum siding
Caulking or sealant
Rigid insulation
(taped or sealed joints)
Gypsum board with permeable
(latex) paint
Unfaced cavity insulation,
cellulose or low-density
spray-applied foam

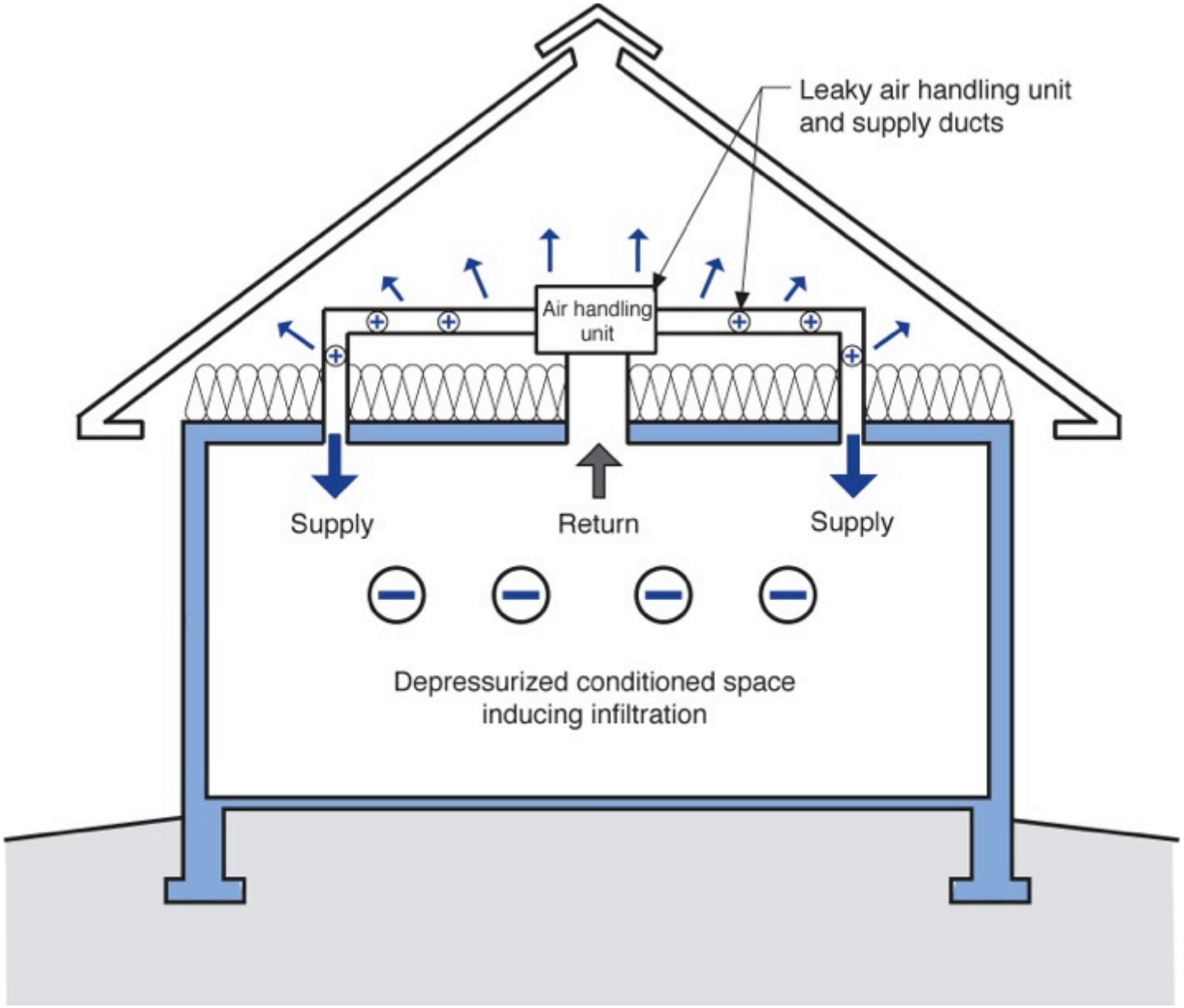

40% to 50% of
vented area
50% to 60%
of
vented area

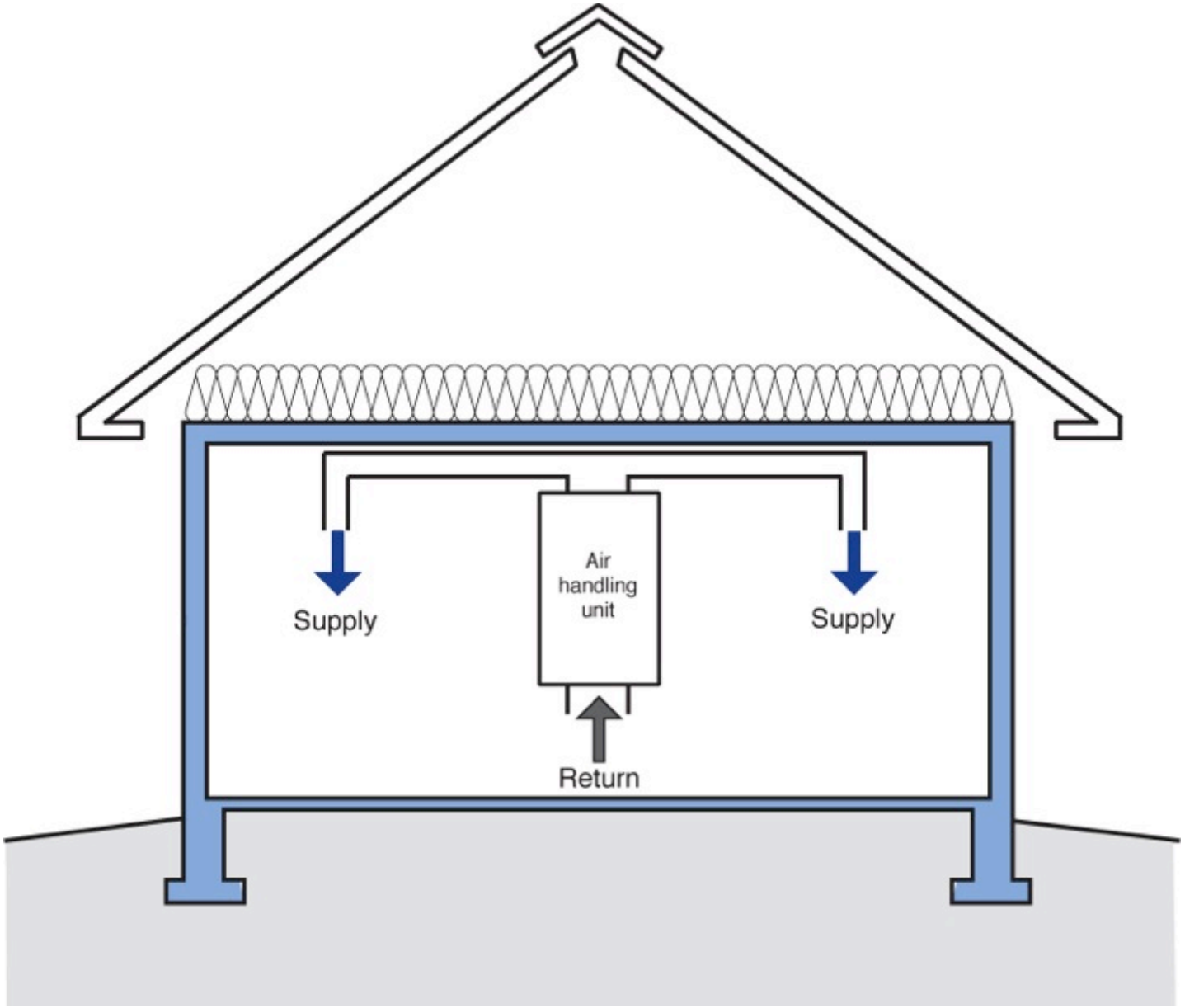

Vapor Pressure
Relative Humidity
Relative Humidity
Vapor Pressure
Night
Day
Night

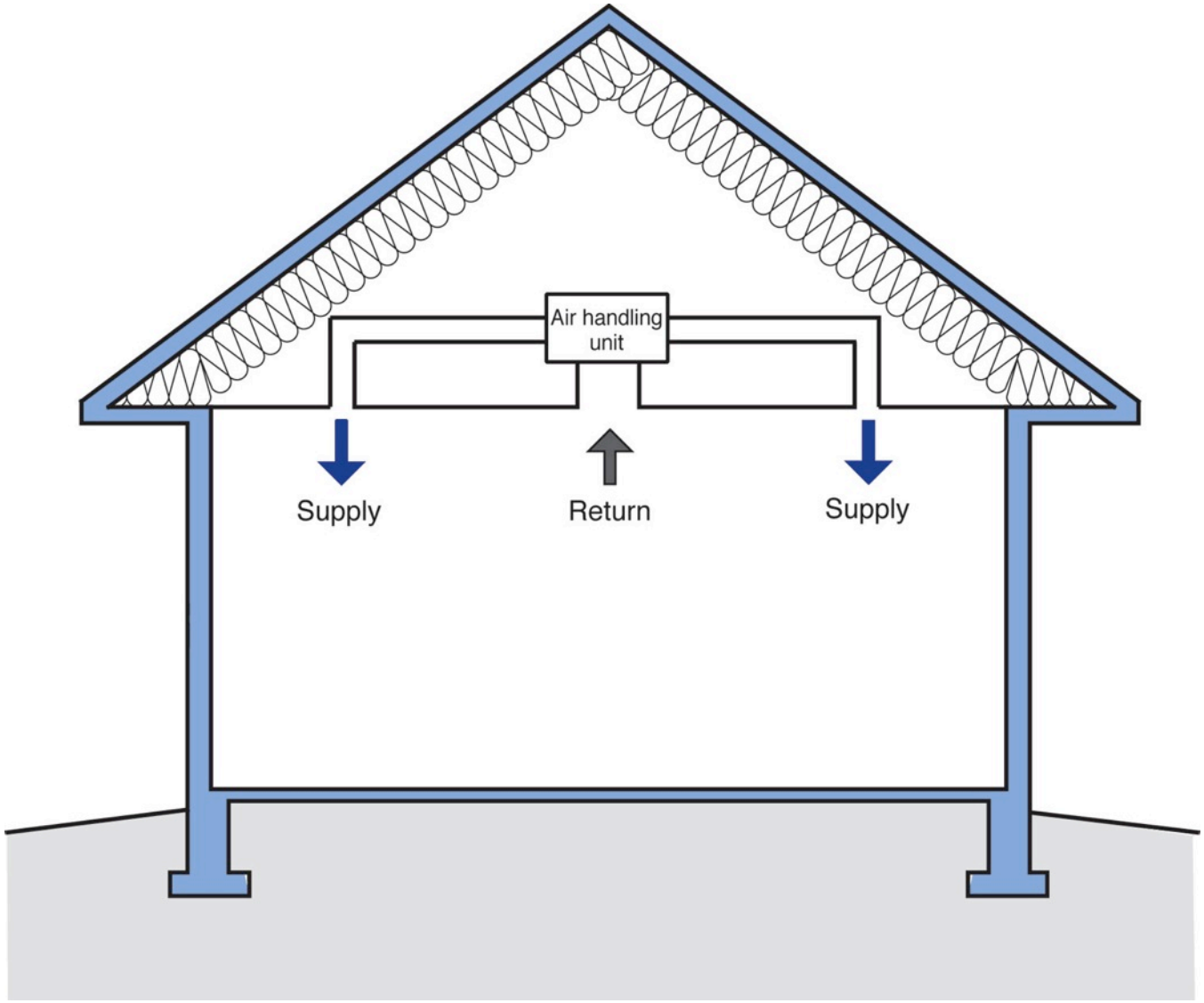
Houses With Vented Attics Suck

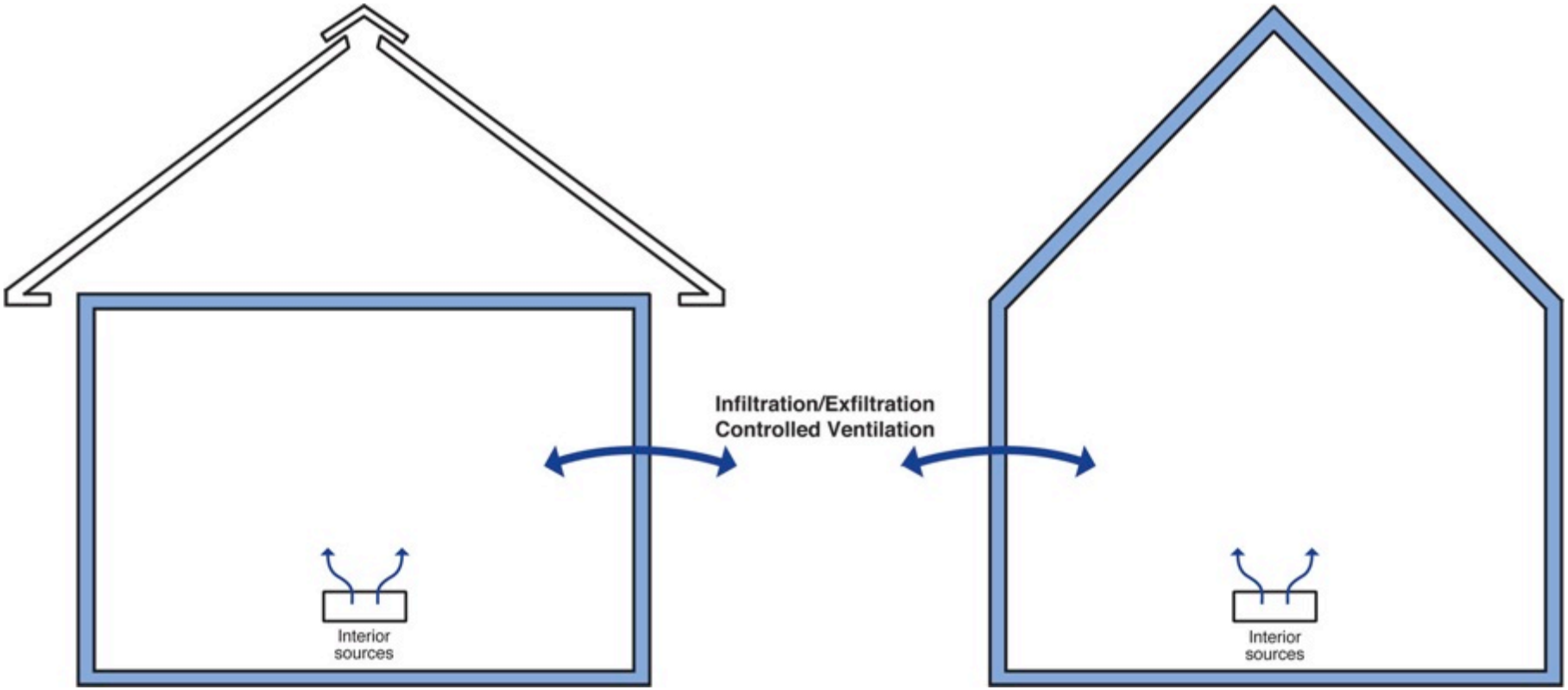
Houses With Vented Attics Suck

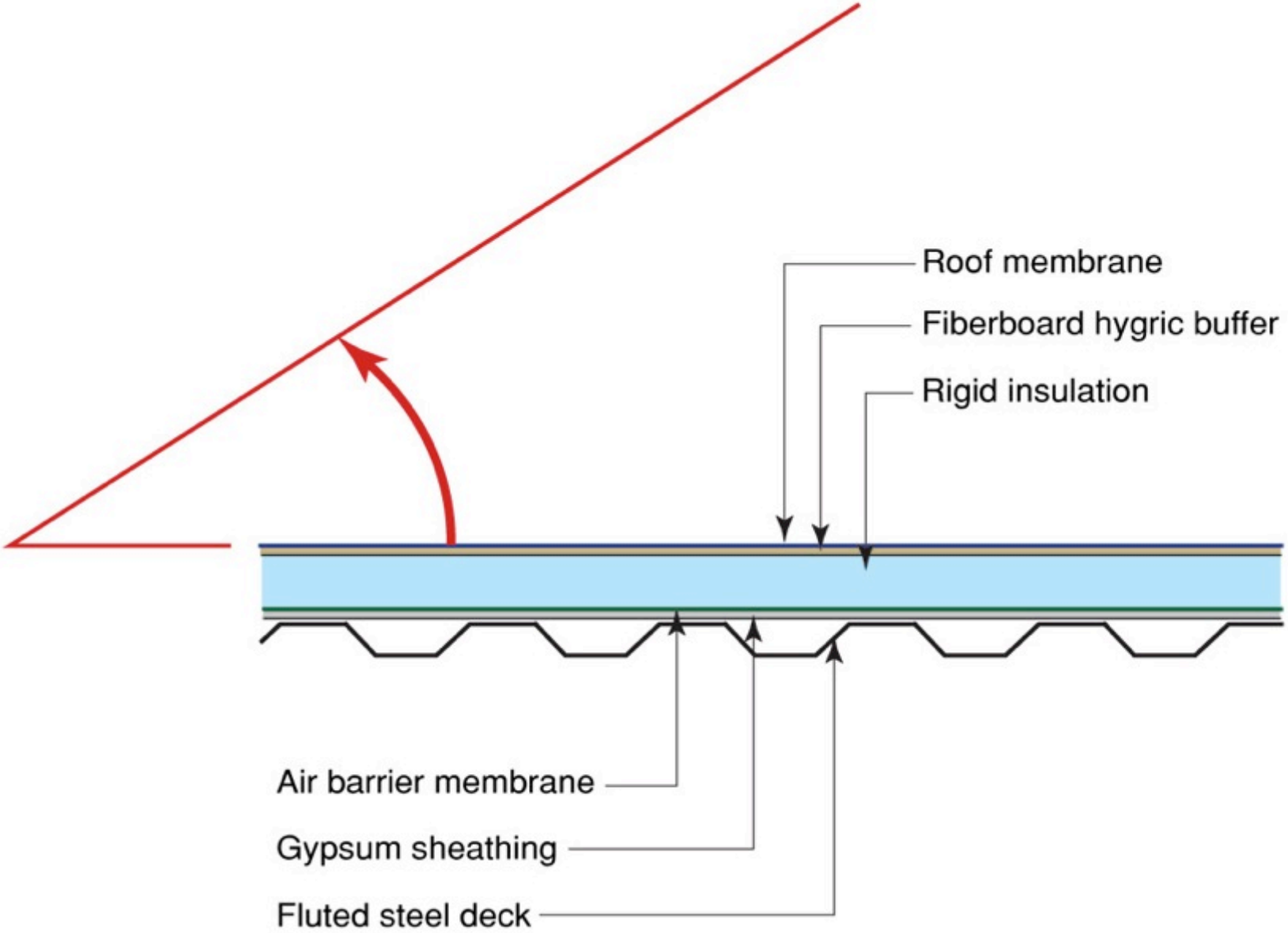
Not all the Time…..but.....

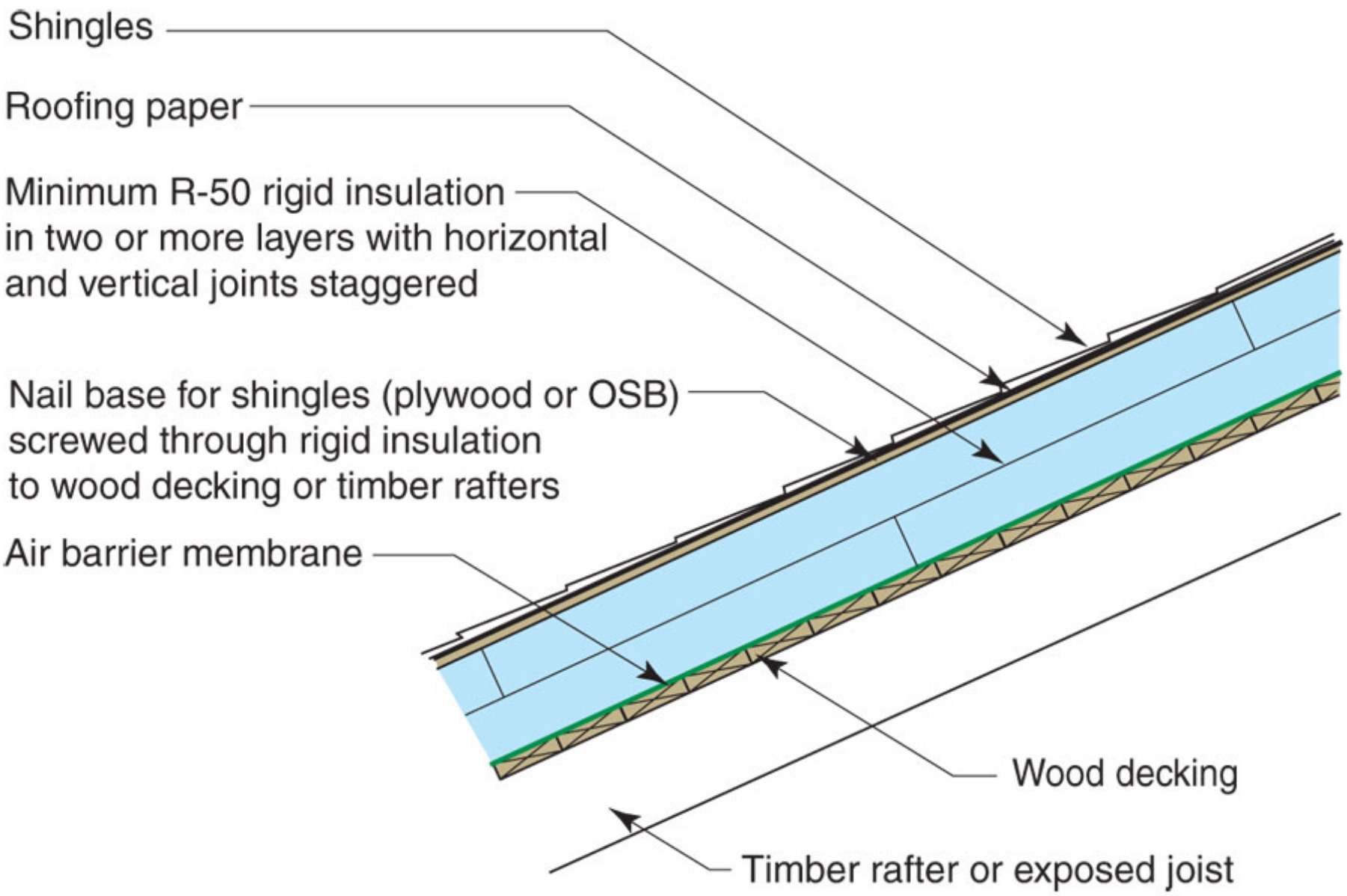

Leaky air handling unit
and supply ducts
Air handling
unit
Supply
Return
Supply
Depressurized conditioned space
inducing infiltration

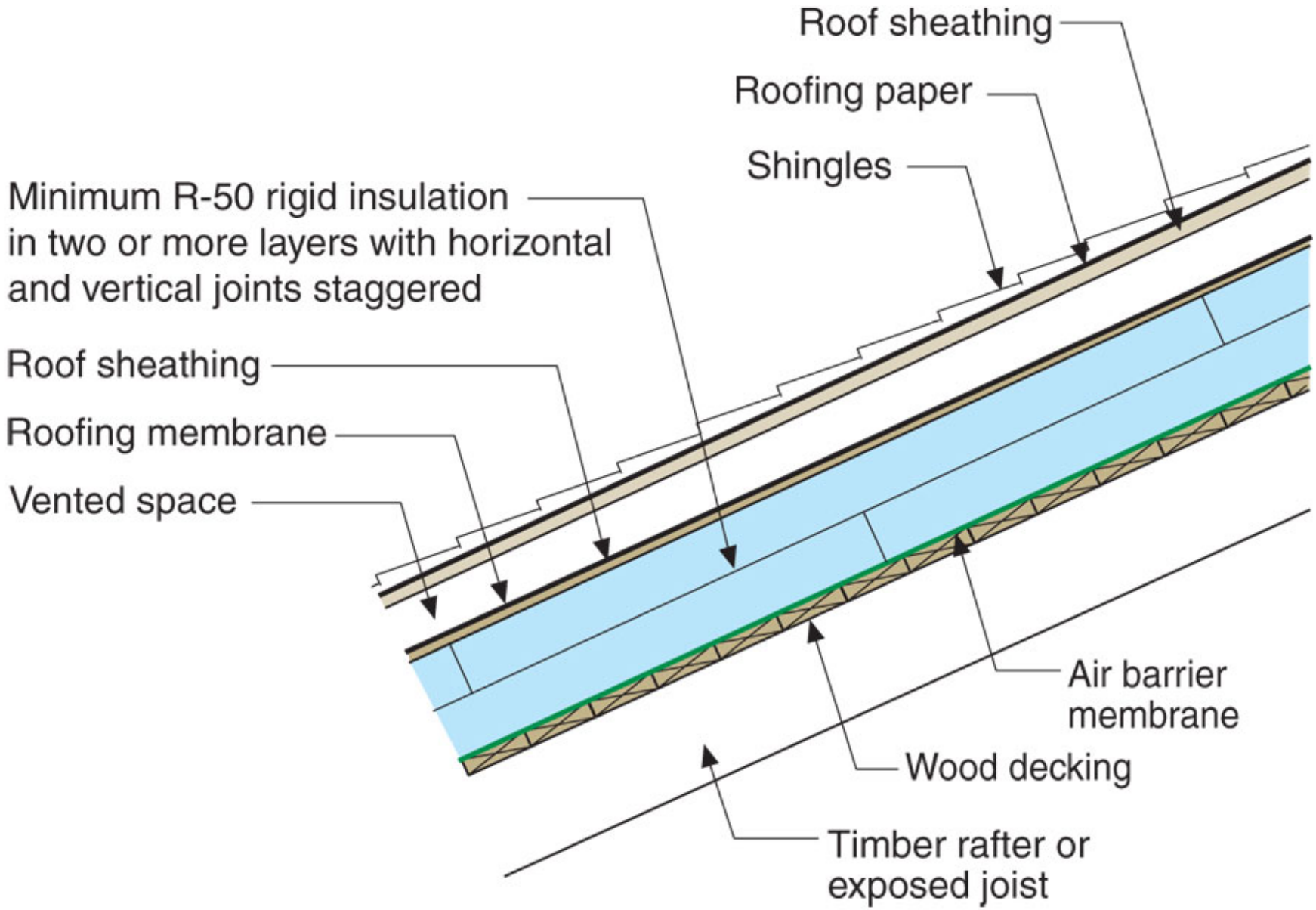

Supply
Air handling unit
Supply
Return

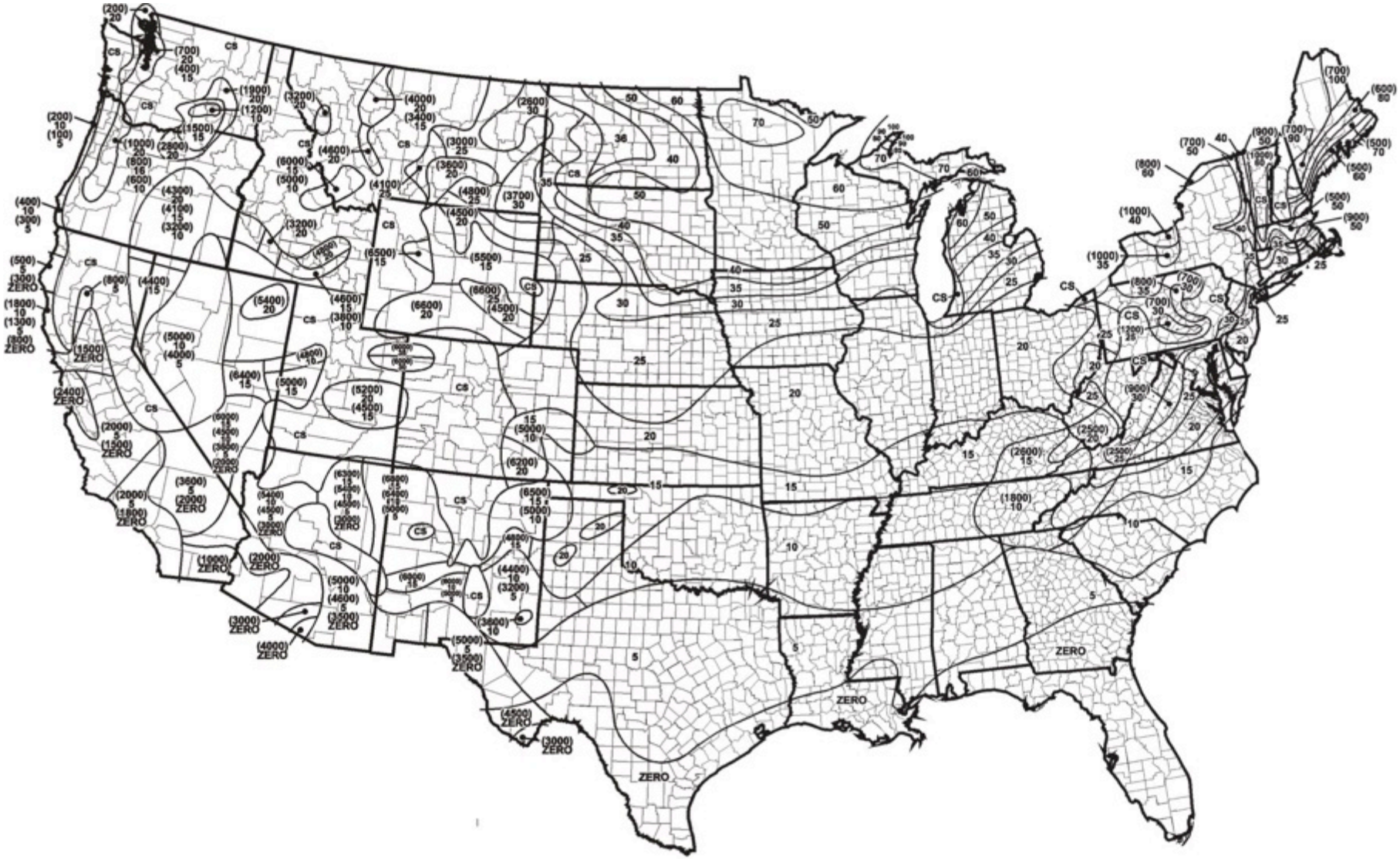

Air handling unit
Supply
Return
Supply

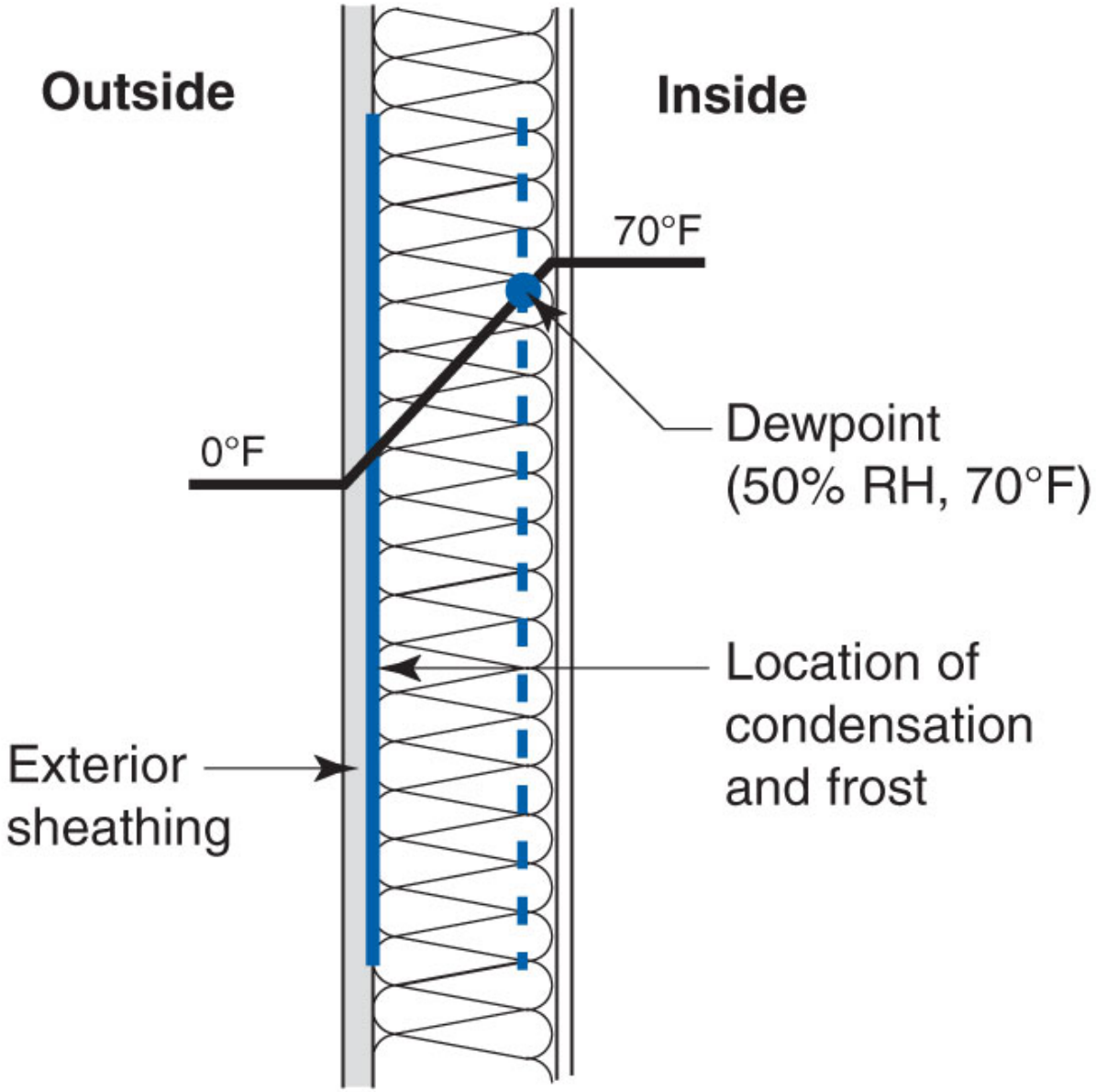

Infiltration/Exfiltration
Controlled Ventilation
Interior
sources
Interior
sources

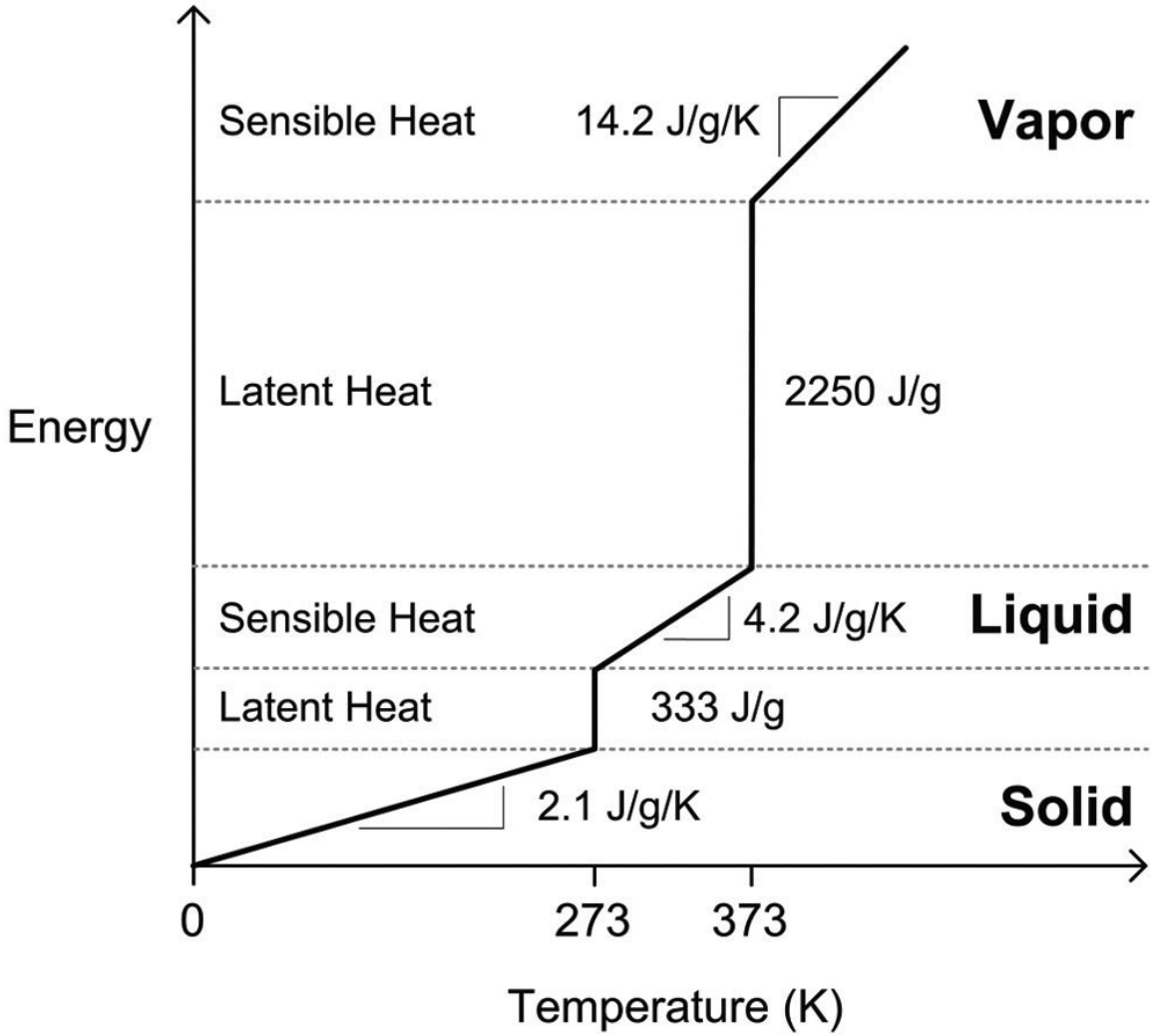

Roof membrane
Fiberboard hygric buffer
Rigid insulation
Air barrier membrane
Gypsum sheathing
Fluted steel deck


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

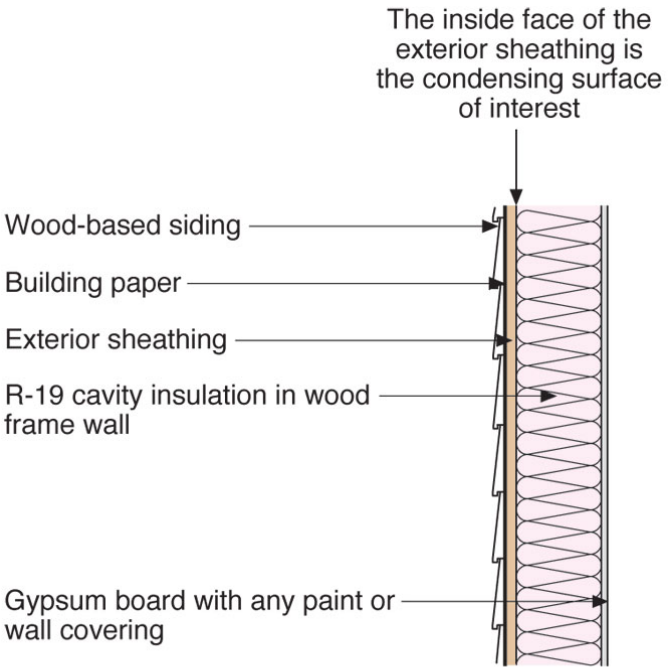

Roof sheathing
Roofing paper
Shingles
Minimum R-50 rigid insulation
in two or more layers with horizontal
and vertical joints staggered
Roof sheathing
Roofing membrane
Vented space
Air barrier
membrane
Wood decking
Timber rafter or
exposed joist

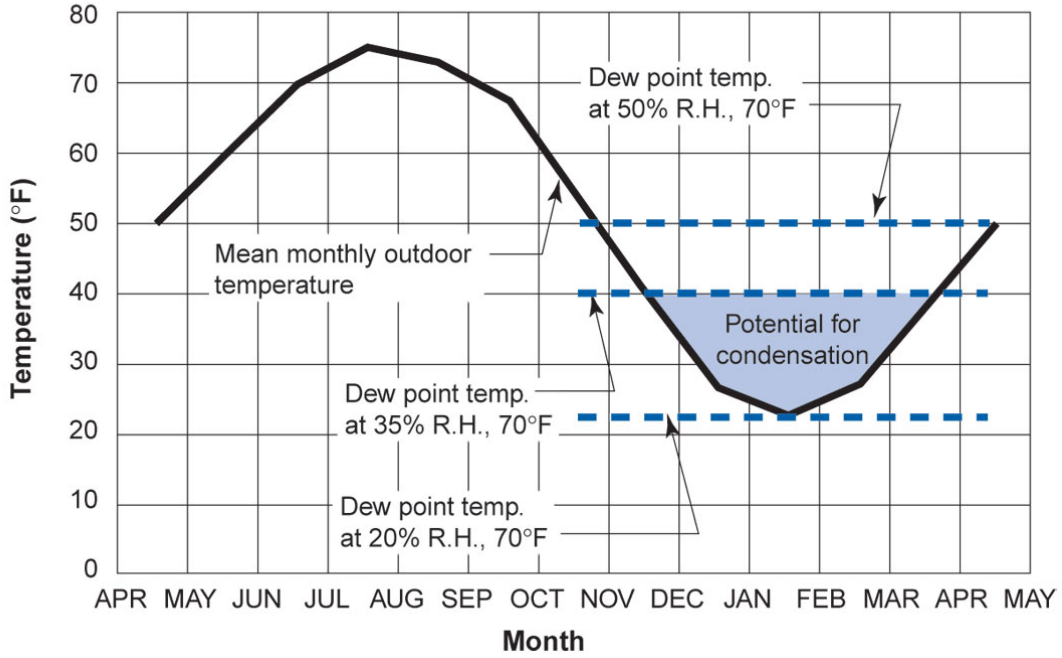


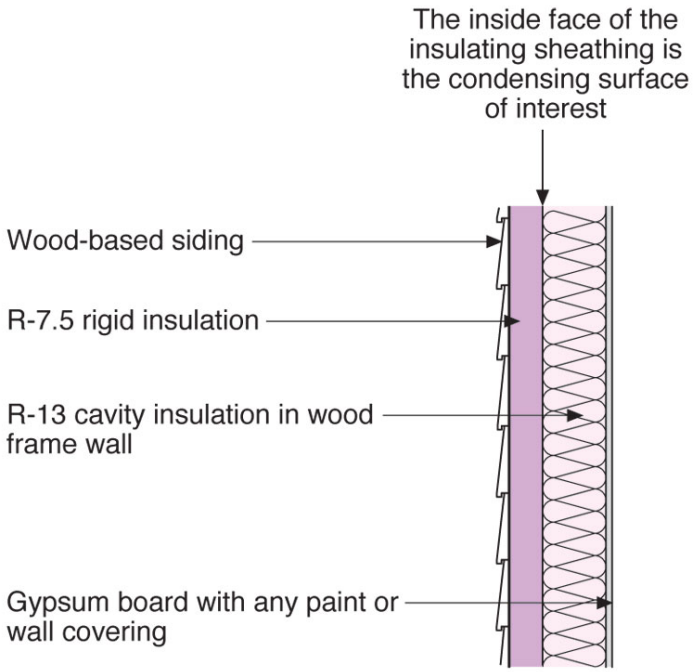

Outside
Inside
70°F
0°F
Dewpoint
(50% RH, 70°F)
Location of
condensation
and frost
Exterior
sheathing

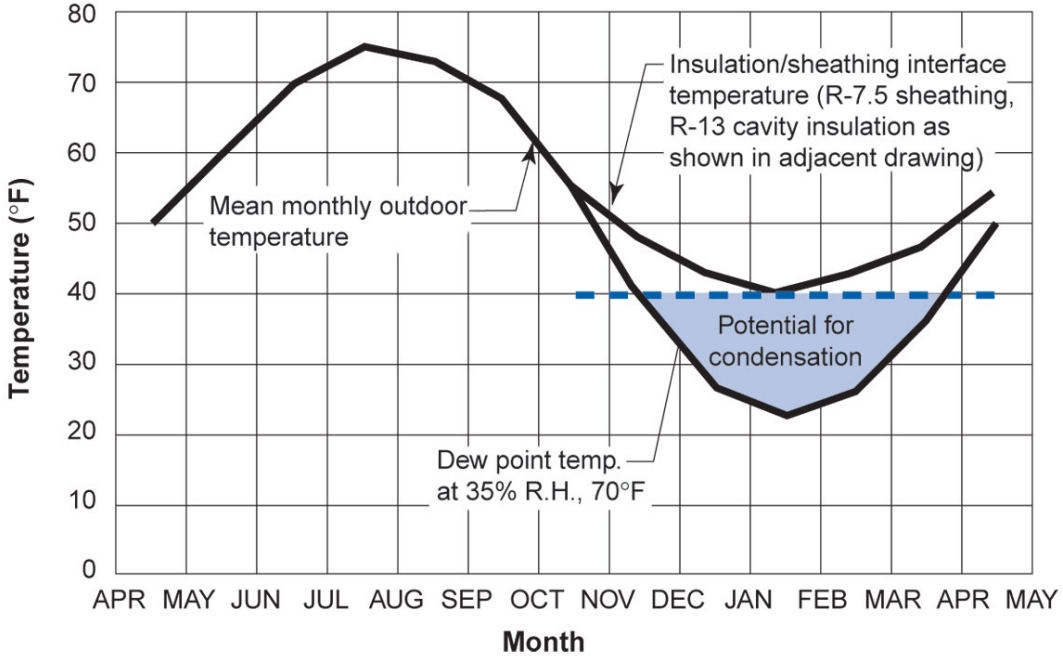


Simple linearized energy-temperature relation for water
From Straube & Burnett, 2005


The inside face of the exterior sheathing is the condensing surface of interest
Wood-based siding
Building paper
Exterior sheathing
R-19 cavity insulation in wood frame wall
Gypsum board with any paint or wall covering


Temperature (°F)
80
70
60
50
40
30
20
10
0
Dew point temp. at 50% R.H., 70°F
Mean monthly outdoor temperature
Potential for condensation
Dew point temp. at 35% R.H., 70°F
Dew point temp. at 20% R.H., 70°F
APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY
Month


The inside face of the insulating sheathing is the condensing surface of interest
Wood-based siding
R-7.5 rigid insulation
R-13 cavity insulation in wood frame wall
Gypsum board with any paint or wall covering


Temperature (°F)
80
70
60
50
40
30
20
10
0
APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY
Month
Insulation/sheathing interface temperature (R-7.5 sheathing, R-13 cavity insulation as shown in adjacent drawing)
Mean monthly outdoor temperature
Potential for condensation
Dew point temp. at 35% R.H., 70°F

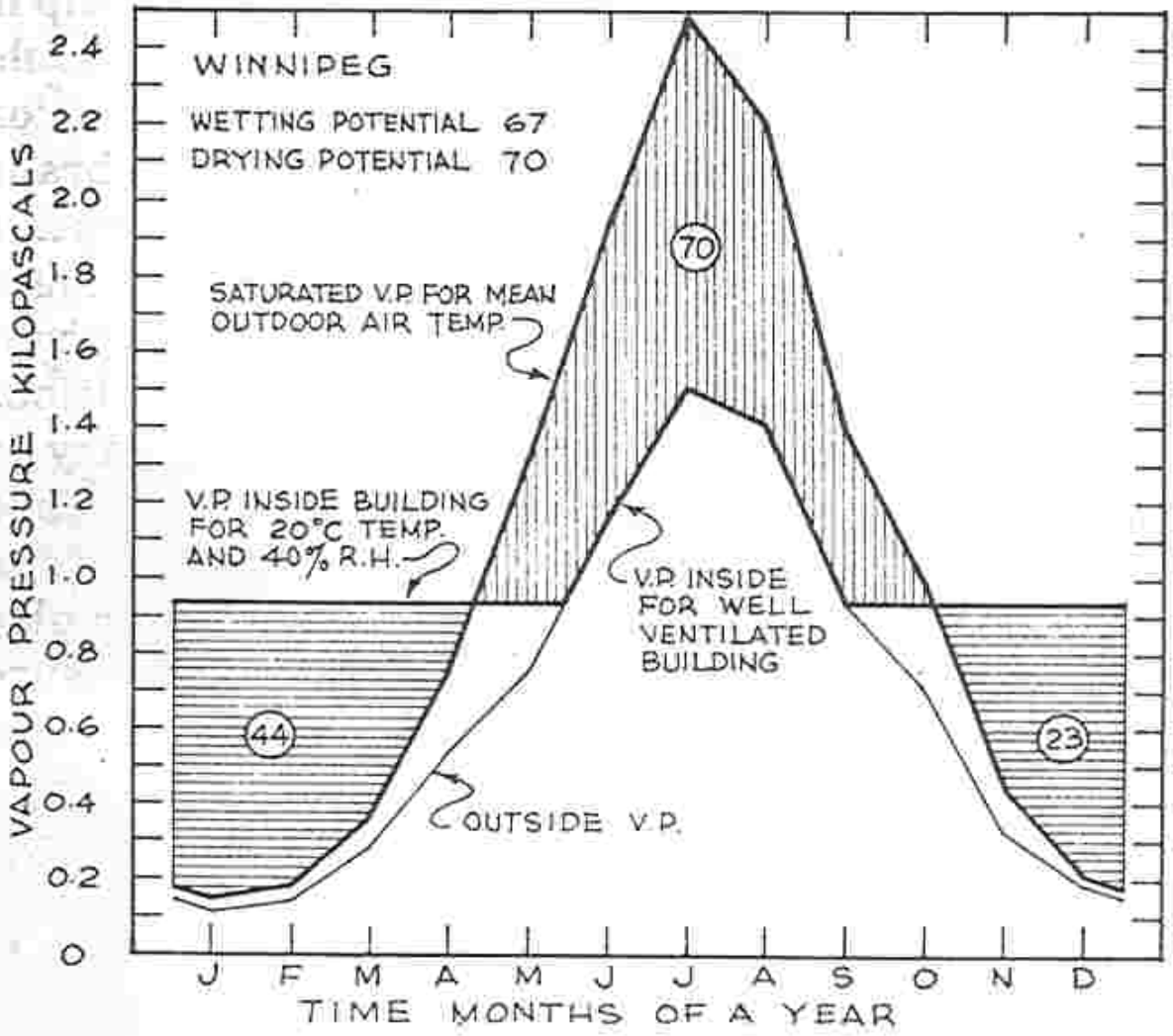
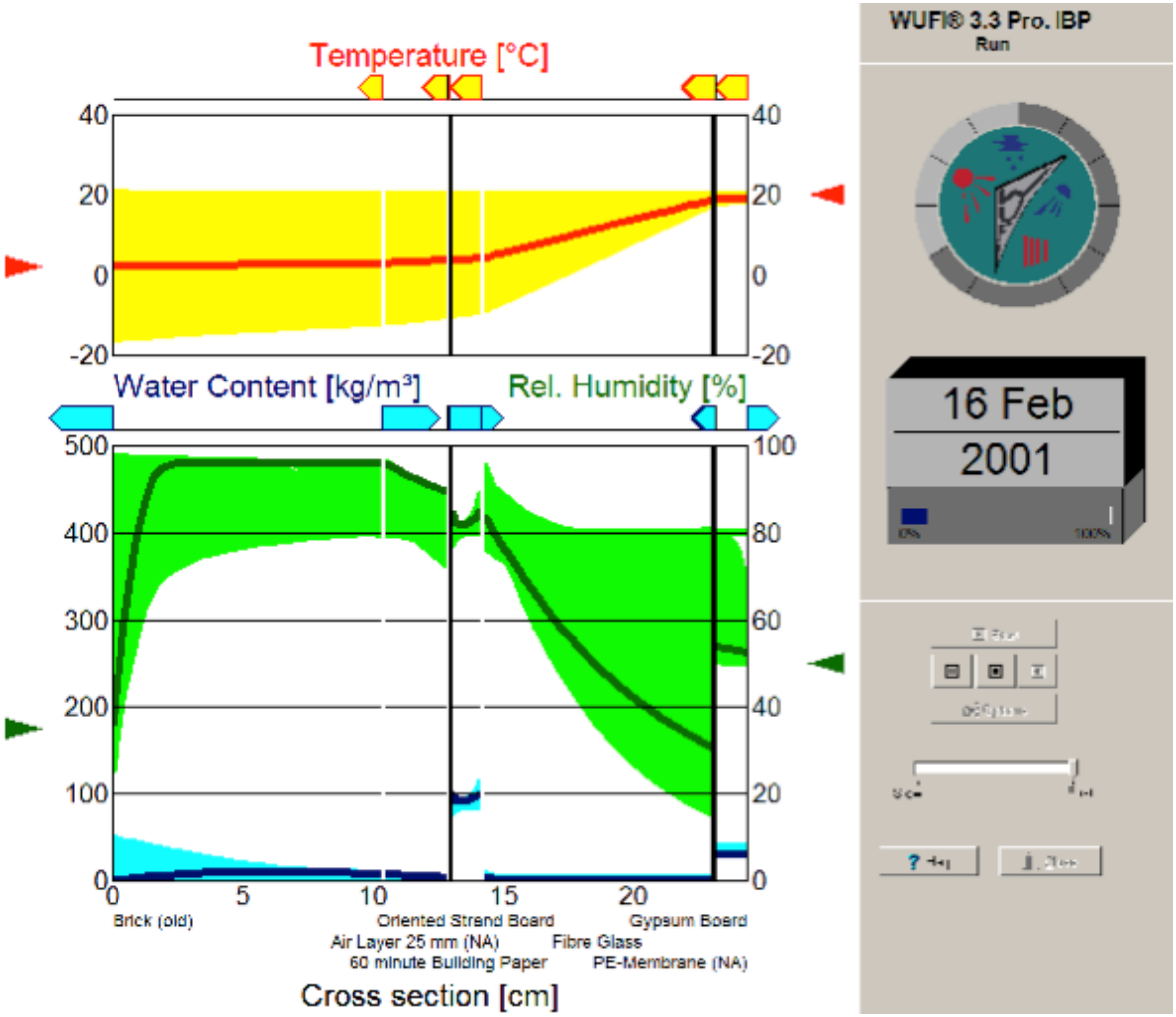
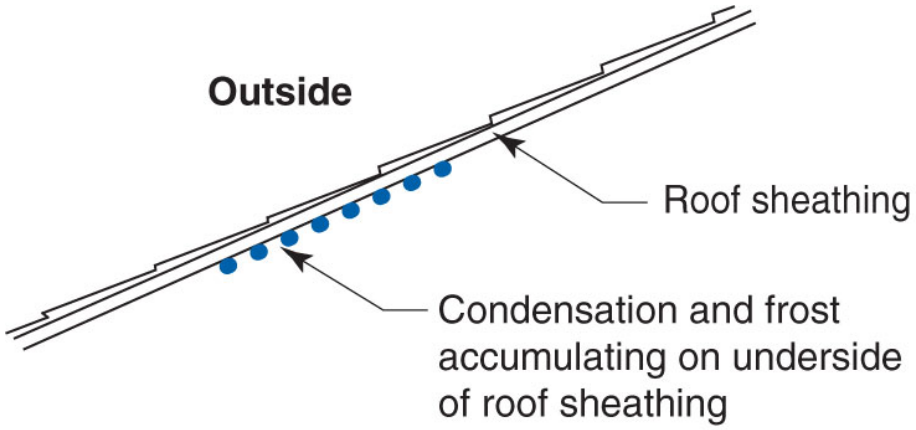
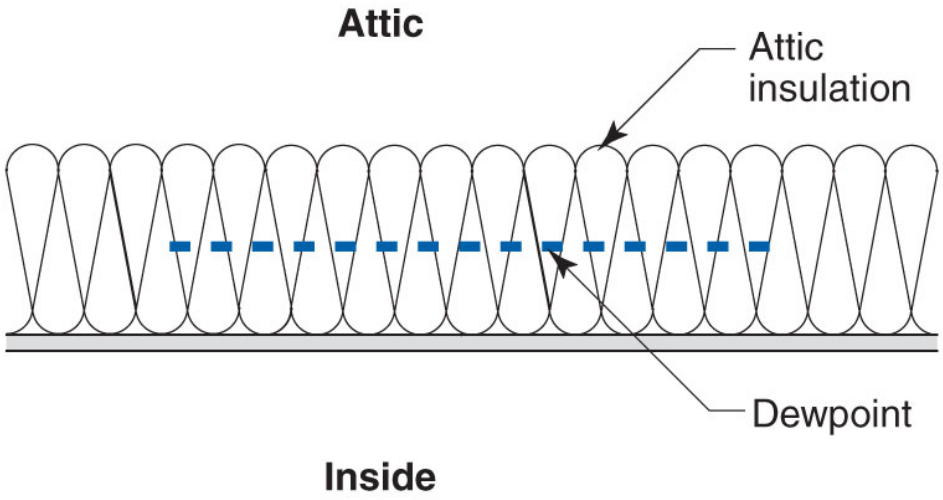
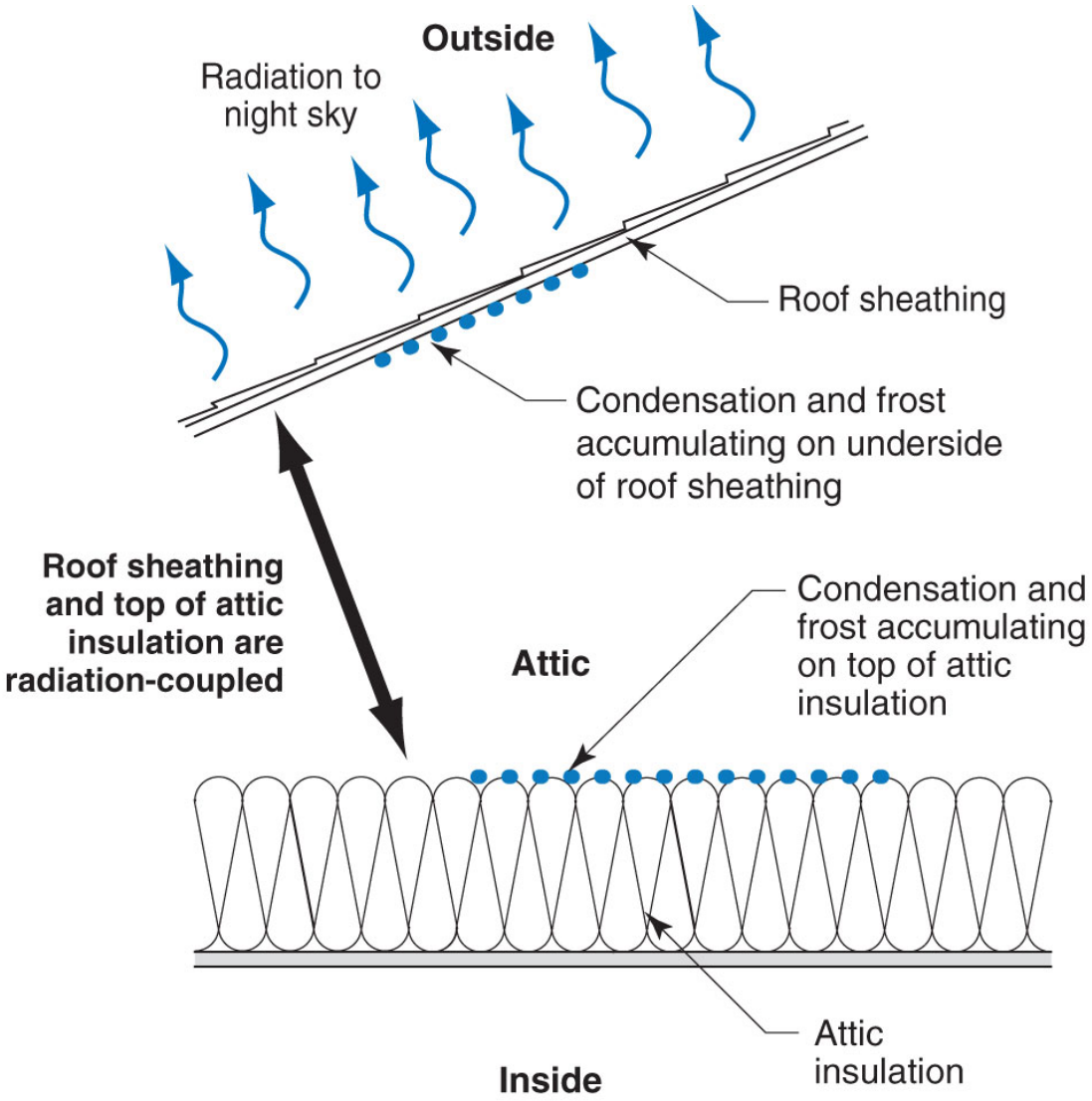


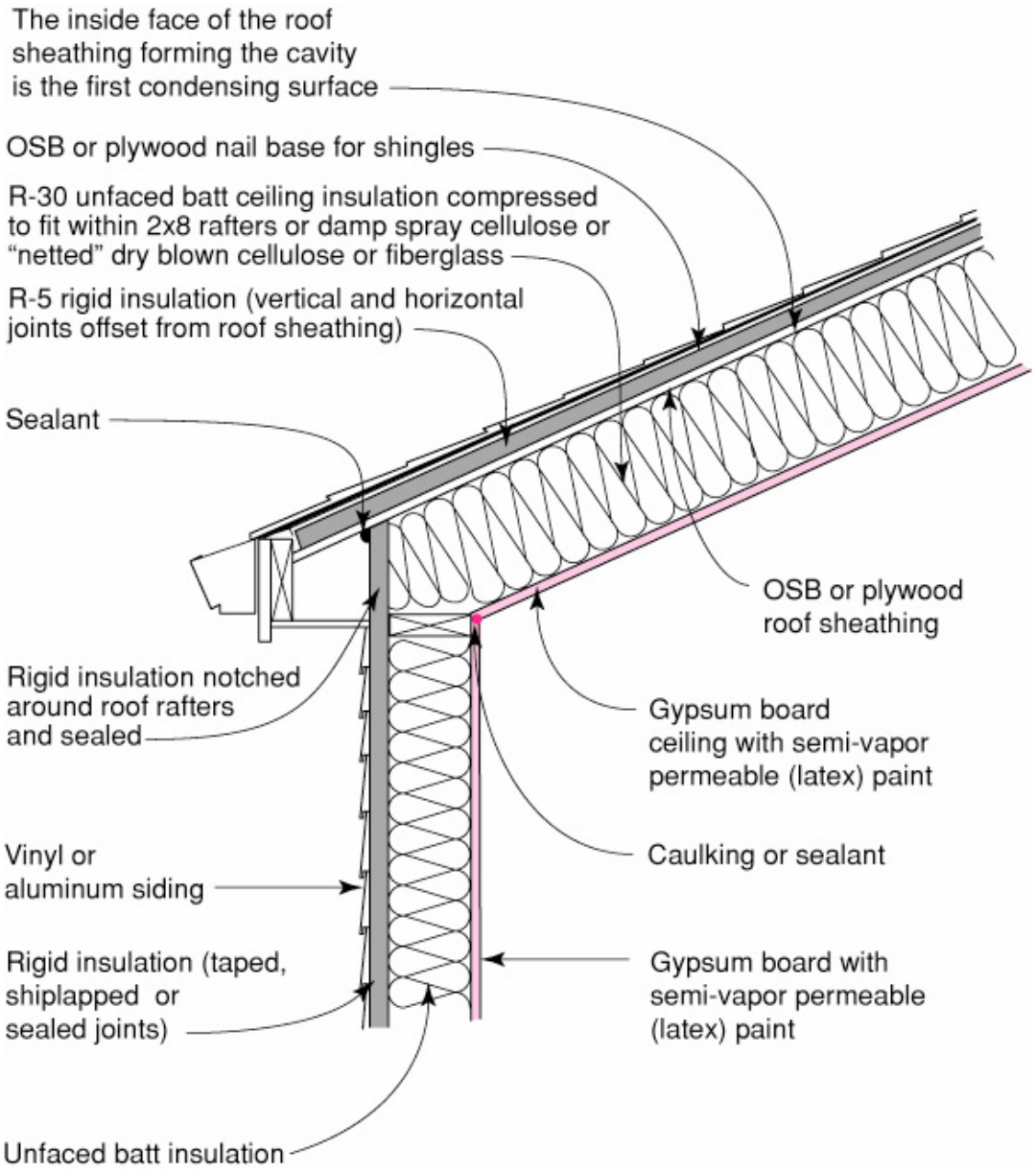
Figure 8-7. Outside vapour pressure, saturated vapour pressure and inside vapour pressure for Winnipeg.

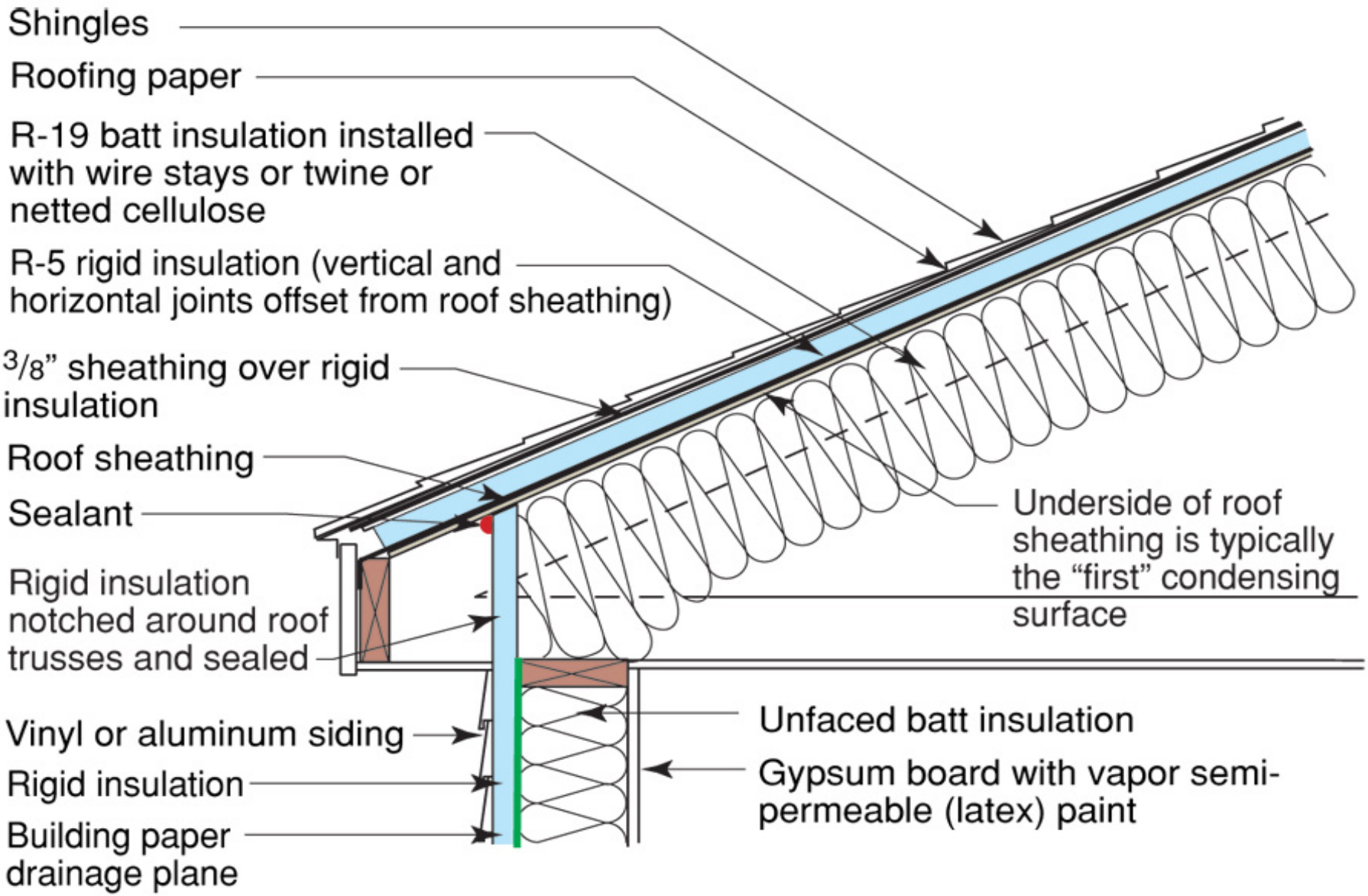

Temperature [°C]
40
20
0
-20
Water Content [kg/m³]
Rel. Humidity [%]
500
400
300
200
100
0
100
80
60
40
20
0
0
5
10
15
20
Brick (old)
Oriented Strand Board
Air Layer 25 mm (NA)
60 minute Building Paper
Fibre Glass
PE-Membrane (NA)
Gypsum Board
Cross section [cm]
WUFI® 3.3 Pro. IBP
Run
16 Feb
2001

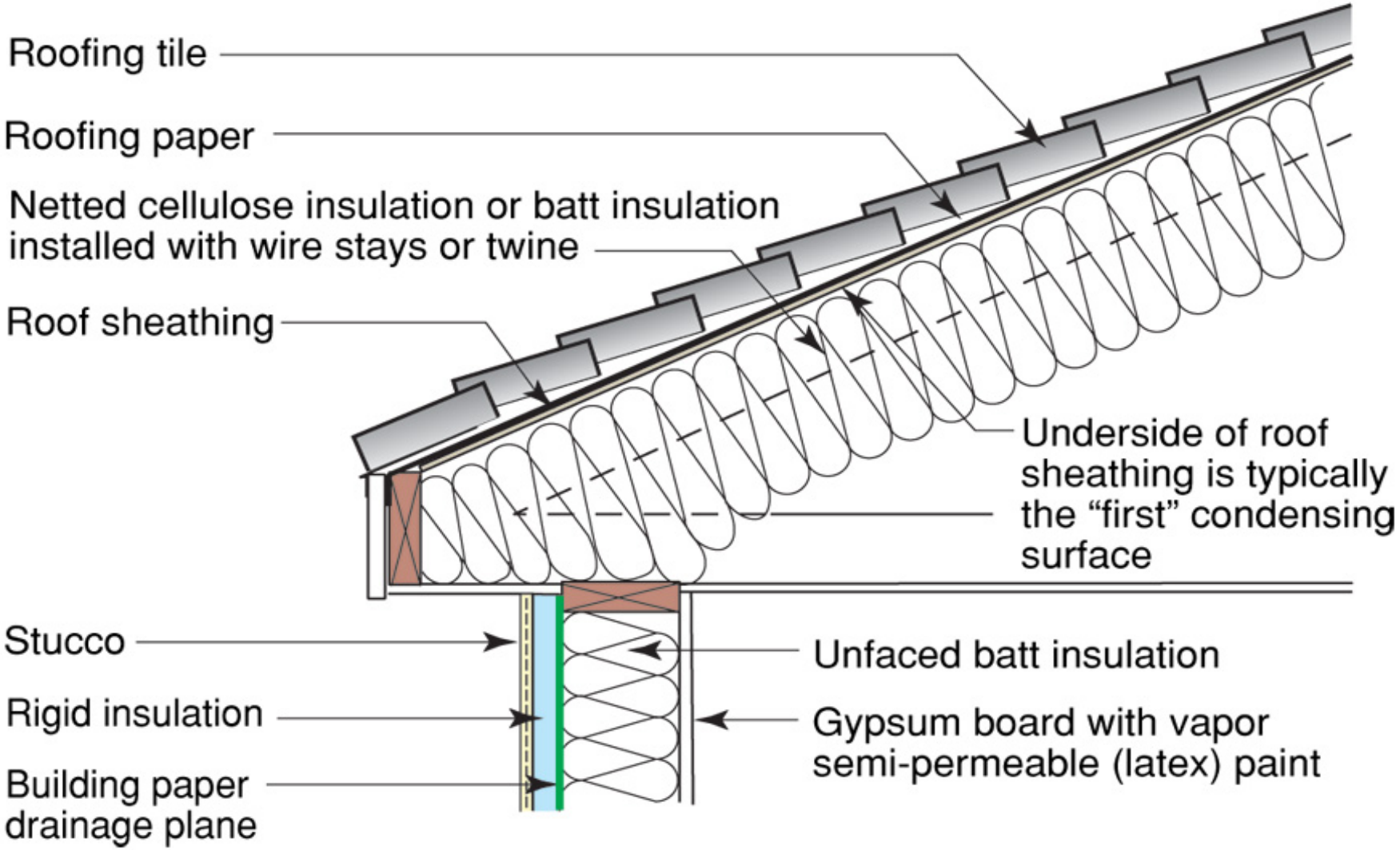

Outside
Roof sheathing
Condensation and frost
accumulating on underside
of roof sheathing

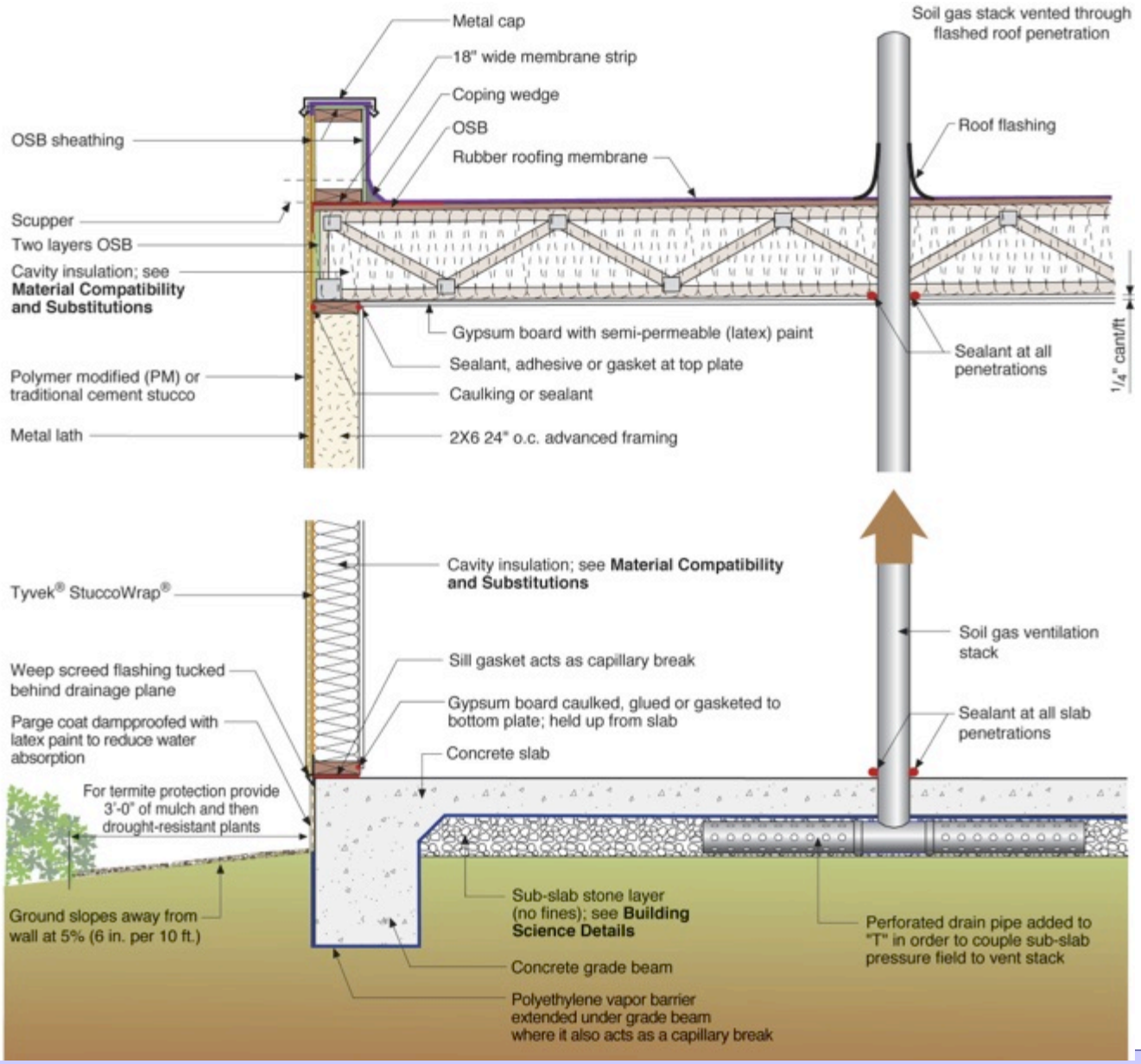

Attic
Attic
insulation
Dewpoint
Inside


Outside
Radiation to night sky
Roof sheathing
Condensation and frost accumulating on underside of roof sheathing
Roof sheathing and top of attic insulation are radiation-coupled
Attic
Condensation and frost accumulating on top of attic insulation
Attic insulation
Inside


The inside face of the roof sheathing forming the cavity is the first condensing surface
OSB or plywood nail base for shingles
R-30 unfaced batt ceiling insulation compressed to fit within 2x8 rafters or damp spray cellulose or "netted" dry blown cellulose or fiberglass
R-5 rigid insulation (vertical and horizontal joints offset from roof sheathing)
Sealant
OSB or plywood roof sheathing
Rigid insulation notched around roof rafters and sealed
Gypsum board ceiling with semi-vapor permeable (latex) paint
Caulking or sealant
Vinyl or aluminum siding
Rigid insulation (taped, shiplapped or sealed joints)
Gypsum board with semi-vapor permeable (latex) paint
Unfaced batt insulation

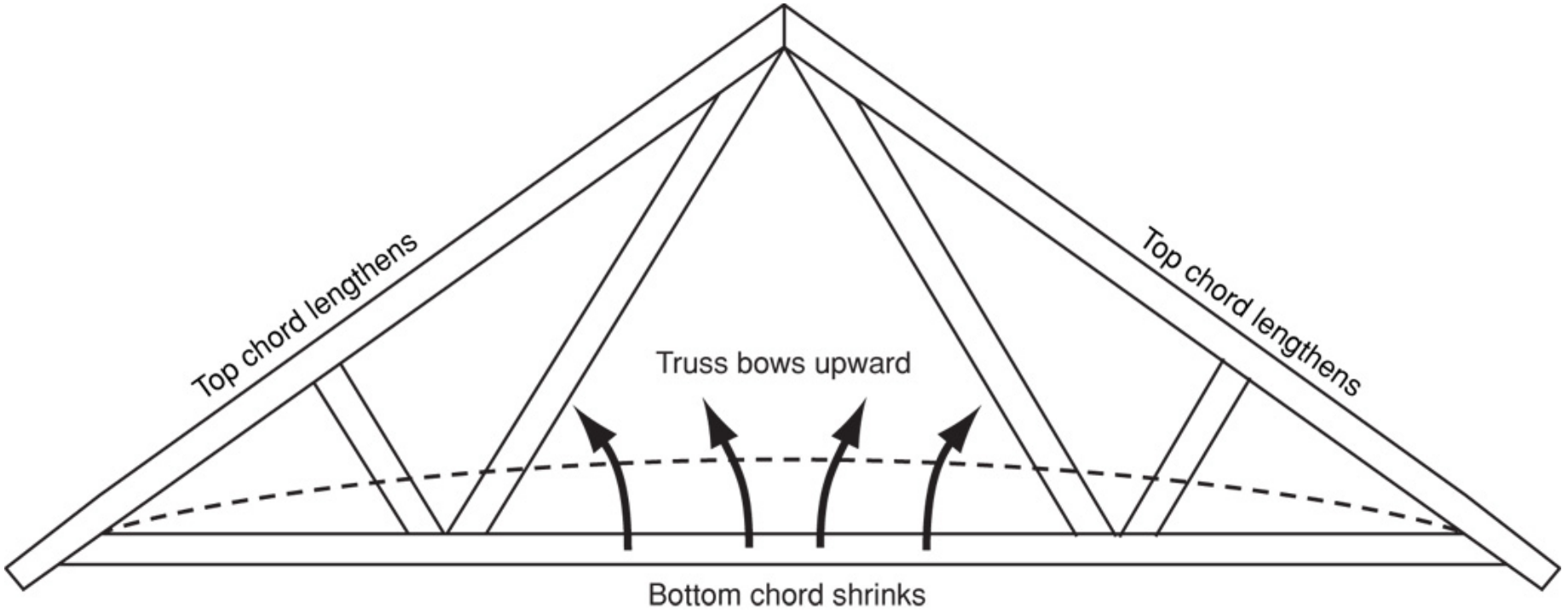

Shingles
Roofing paper
R-19 batt insulation installed with wire stays or twine or netted cellulose
R-5 rigid insulation (vertical and horizontal joints offset from roof sheathing)
3/8" sheathing over rigid insulation
Roof sheathing
Sealant
Rigid insulation notched around roof trusses and sealed
Vinyl or aluminum siding
Rigid insulation
Building paper drainage plane
Underside of roof sheathing is typically the "first" condensing surface
Unfaced batt insulation
Gypsum board with vapor semi-permeable (latex) paint

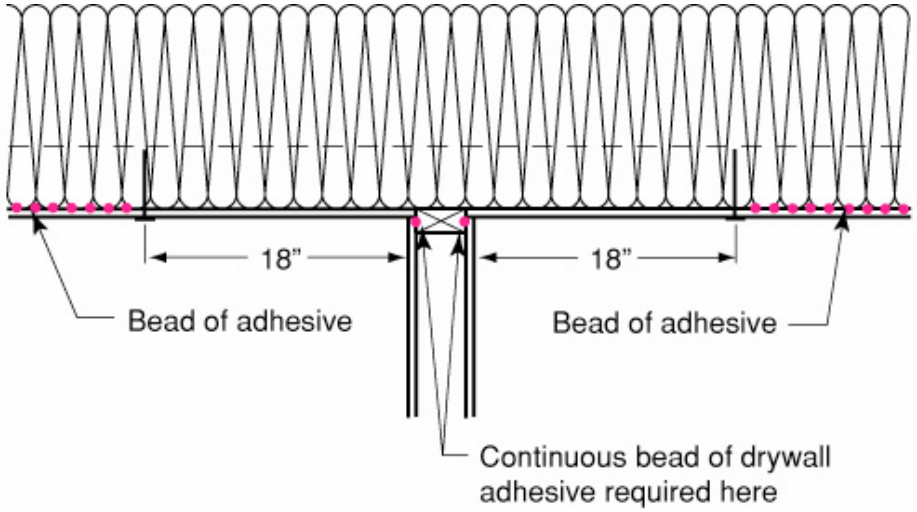

Roofing tile
Roofing paper
Netted cellulose insulation or batt insulation installed with wire stays or twine
Roof sheathing
Underside of roof sheathing is typically the “first” condensing surface
Stucco
Rigid insulation
Building paper drainage plane
Unfaced batt insulation
Gypsum board with vapor semi-permeable (latex) paint

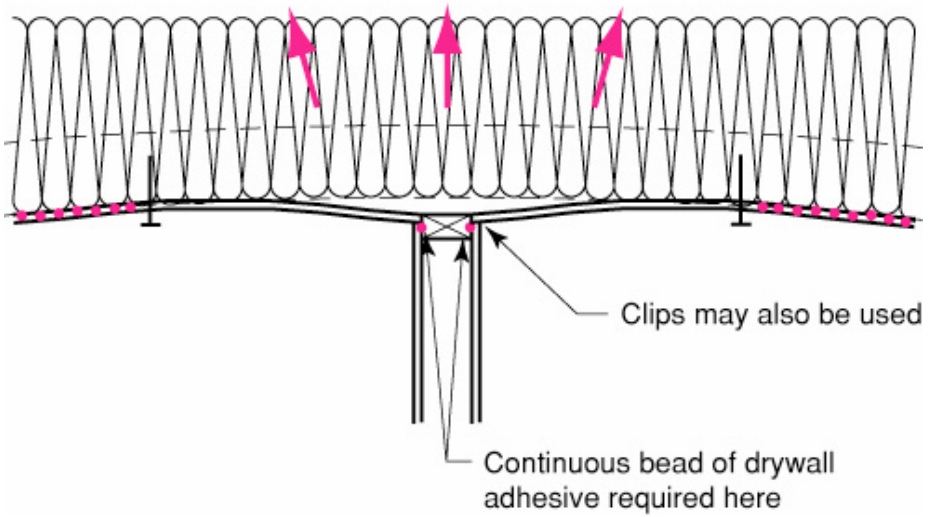

Metal cap
18" wide membrane strip
Coping wedge
OSB
Rubber roofing membrane
Soil gas stack vented through flashed roof penetration
Roof flashing
OSB sheathing
Scupper
Two layers OSB
Cavity insulation; see Material Compatibility and Substitutions
Gypsum board with semi-permeable (latex) paint
Sealant, adhesive or gasket at top plate
Caulking or sealant
2X6 24" o.c. advanced framing
Sealant at all penetrations
1/4" cant/ft
Polymer modified (PM) or traditional cement stucco
Metal lath
Cavity insulation; see Material Compatibility and Substitutions
Tyvek® StuccoWrap®
Soil gas ventilation stack
Weep screed flashing tucked behind drainage plane
Sill gasket acts as capillary break
Gypsum board caulked, glued or gasketed to bottom plate; held up from slab
Sealant at all slab penetrations
Parge coat dampproofed with latex paint to reduce water absorption
Concrete slab
For termite protection provide 3'-0" of mulch and then drought-resistant plants
Sub-slab stone layer (no fines); see Building Science Details
Perforated drain pipe added to "T" in order to couple sub-slab pressure field to vent stack
Ground slopes away from wall at 5% (6 in. per 10 ft.)
Concrete grade beam
Polyethylene vapor barrier extended under grade beam where it also acts as a capillary break

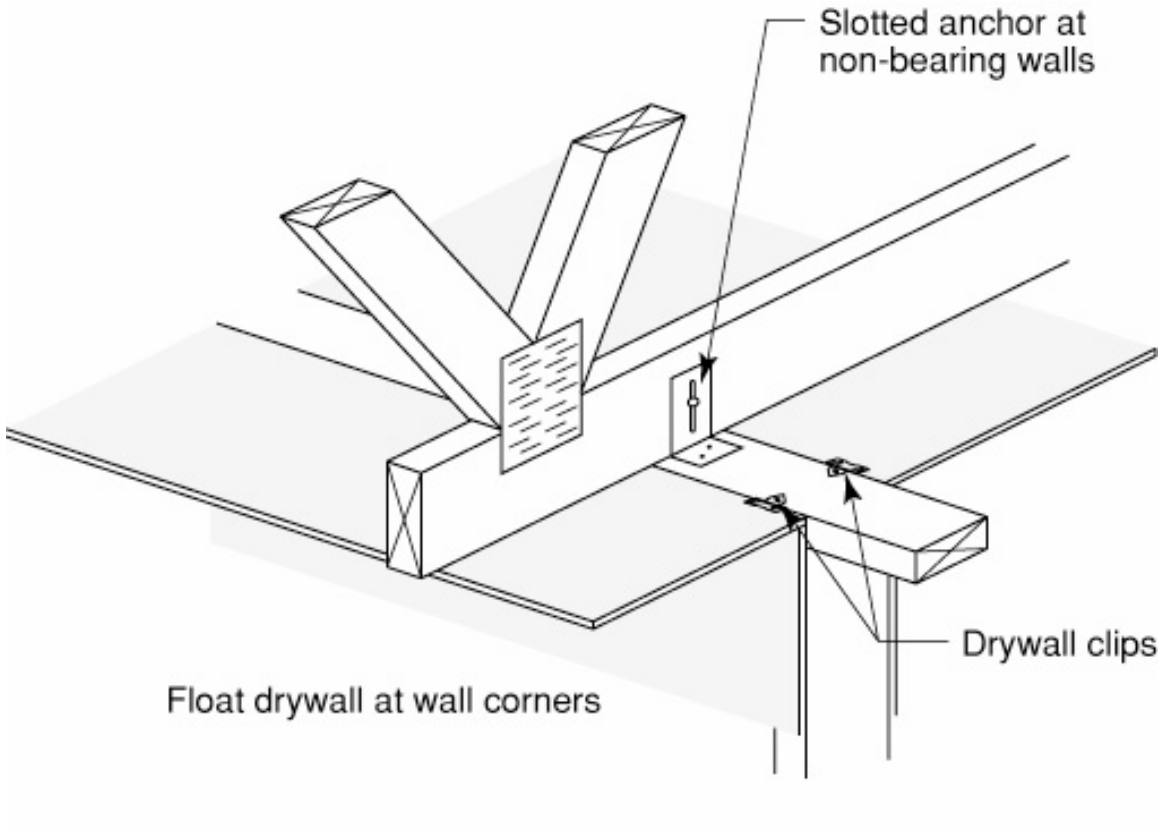
Truss Uplift


6537

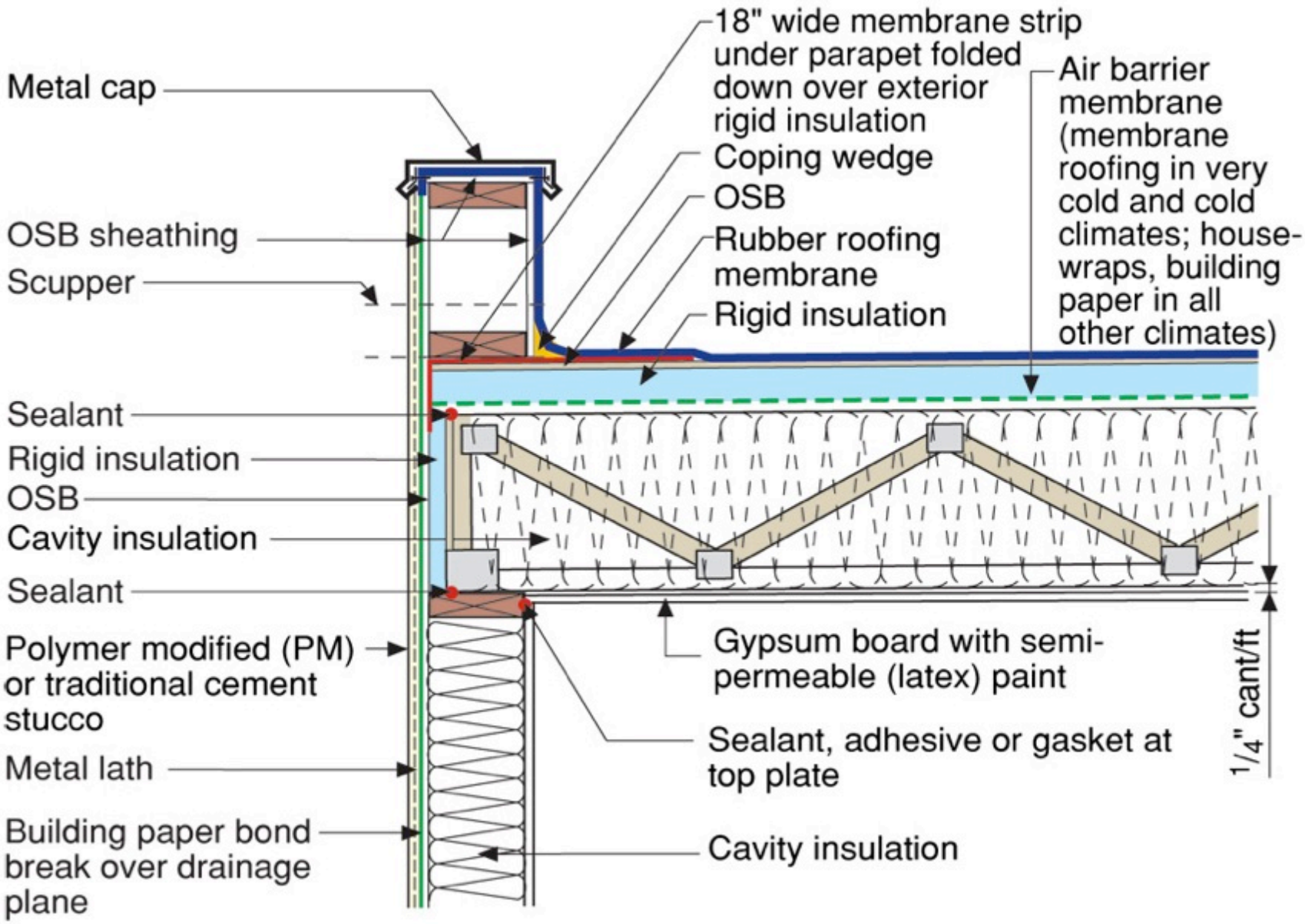

Top chord lengthens
Truss bows upward
Top chord lengthens
Bottom chord shrinks

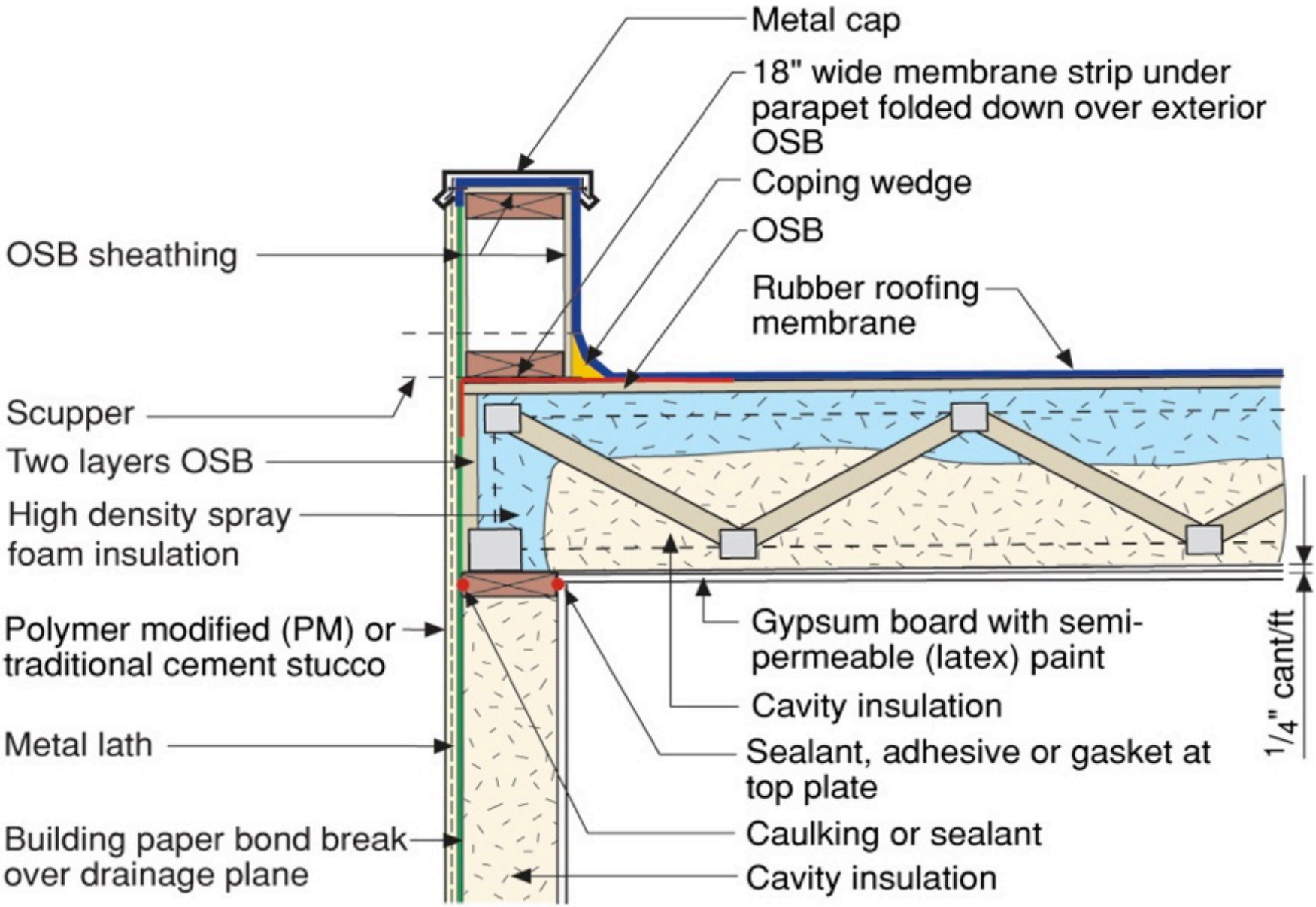

18”
18”
Bead of adhesive
Bead of adhesive
Continuous bead of drywall adhesive required here

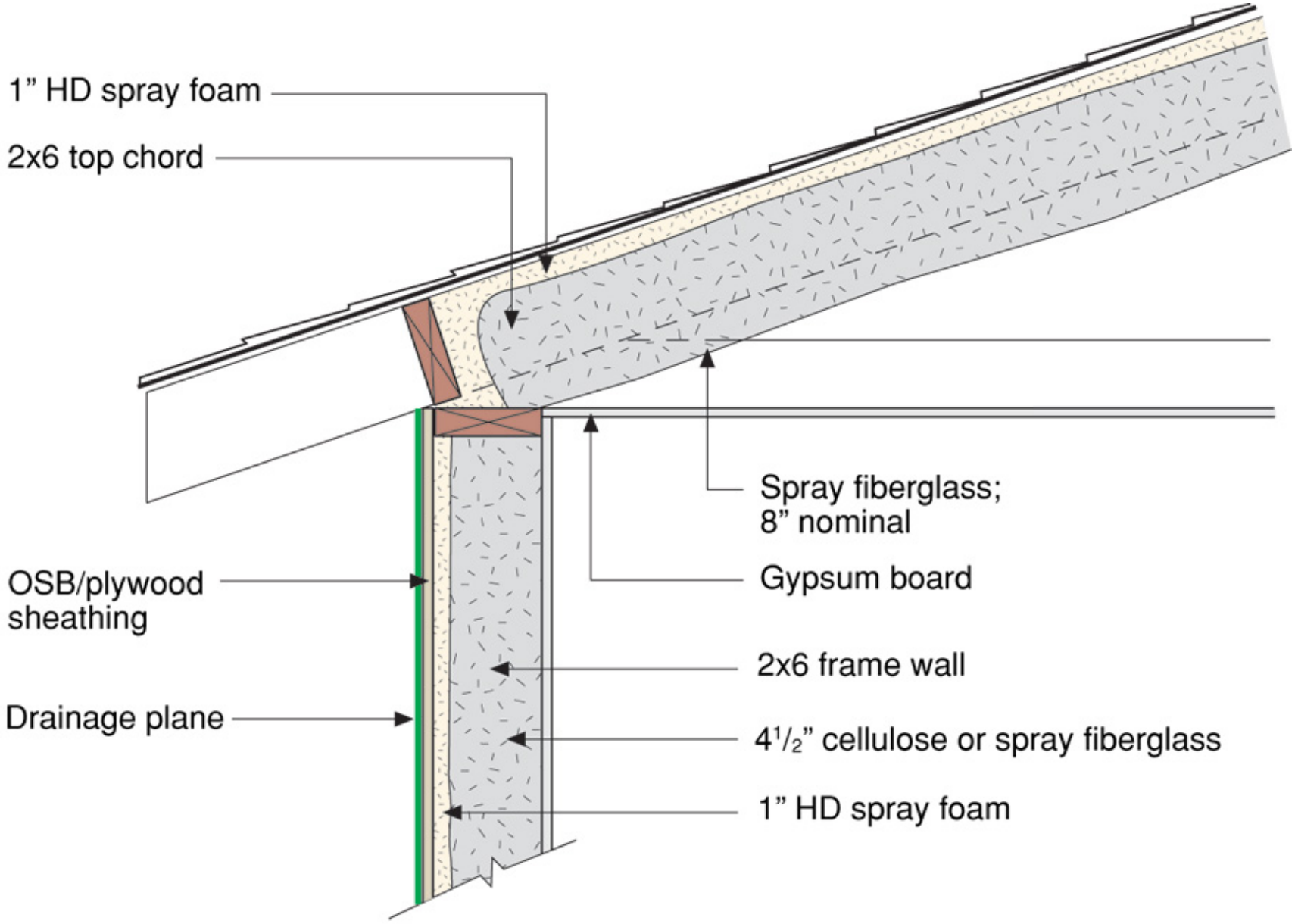

Clips may also be used
Continuous bead of drywall adhesive required here

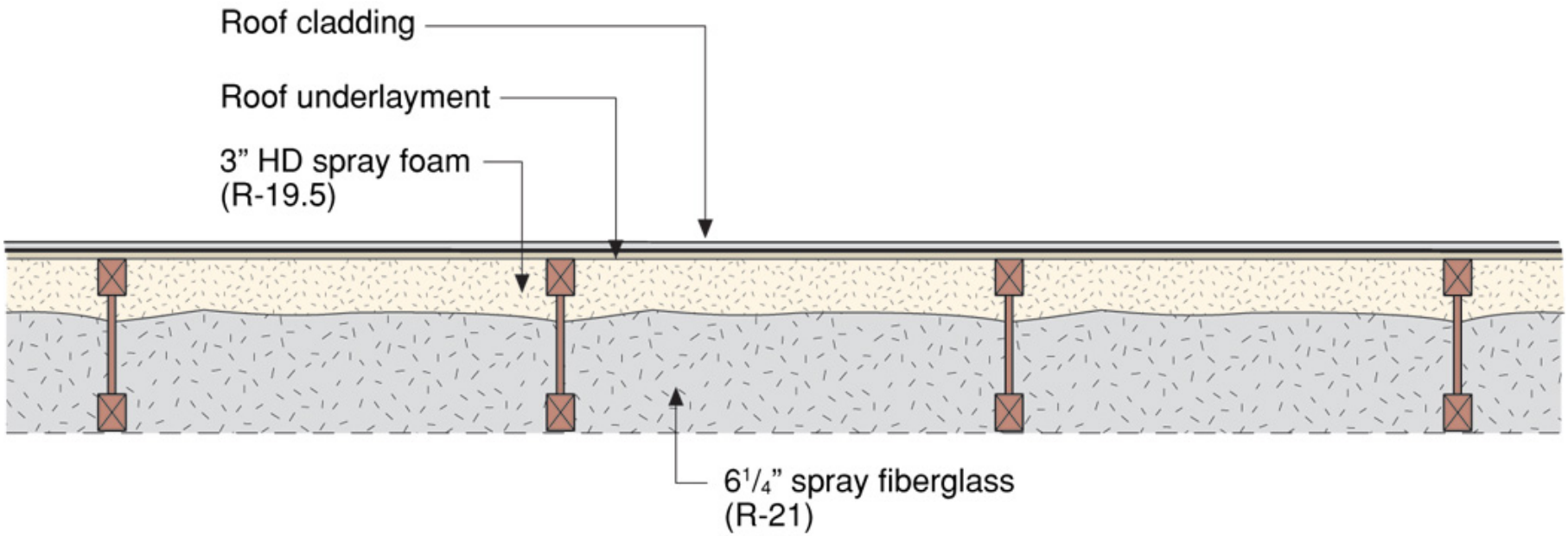

Slotted anchor at
non-bearing walls
Drywall clips
Float drywall at wall corners

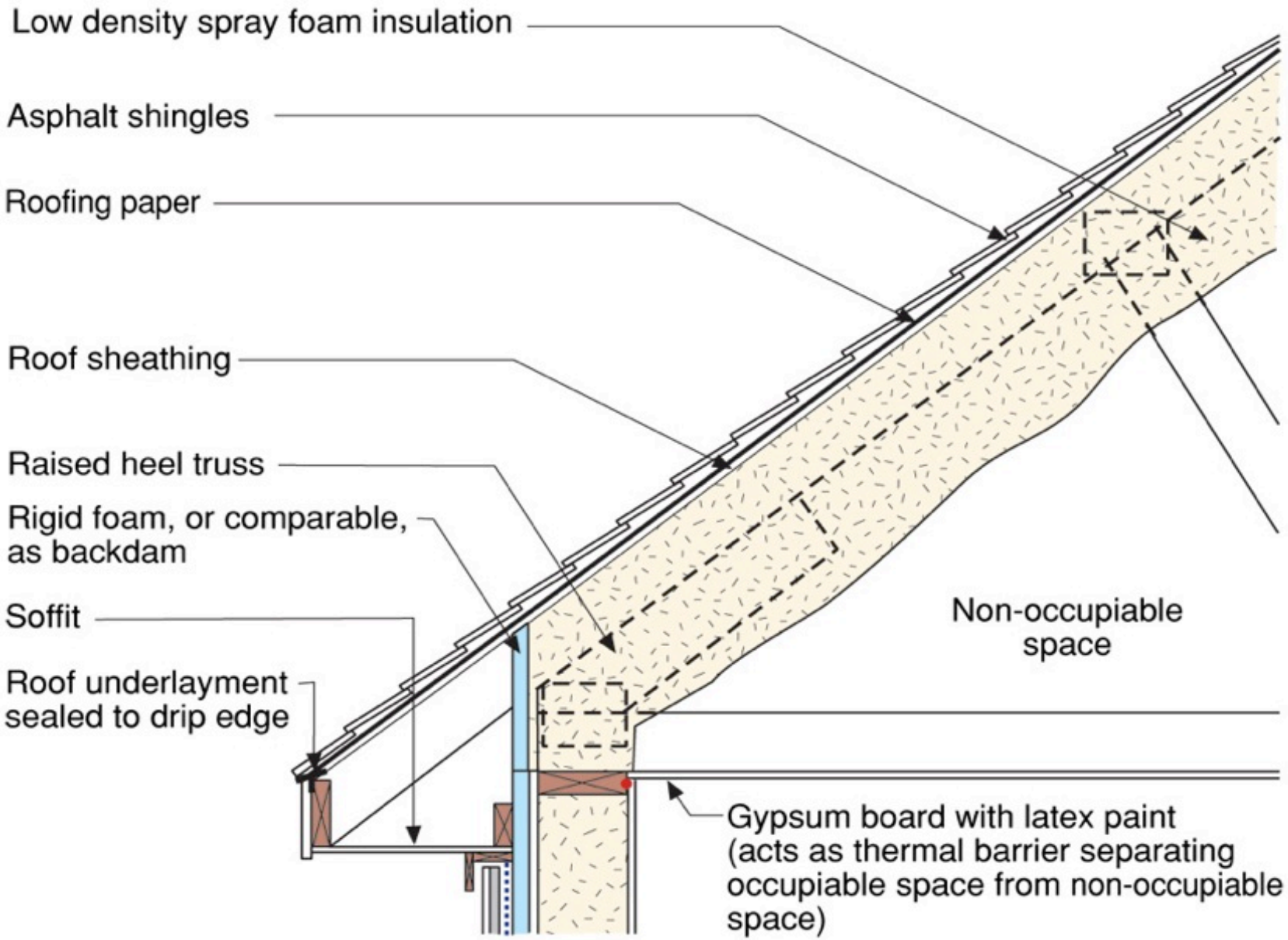

10-4-8
ermo-ply
STRUCTURAL GRADE
INSULATIVE SHEATHING
FOR ADDED ENERGY
PERFORMANCE
ermo
STRUCTURAL GRADE
INSULATIVE SHEAT
FOR ADDED ENE


Metal cap
OSB sheathing
Scupper
Sealant
Rigid insulation
OSB
Cavity insulation
Sealant
Polymer modified (PM) or traditional cement stucco
Metal lath
Building paper bond break over drainage plane
18" wide membrane strip under parapet folded down over exterior rigid insulation
Coping wedge
OSB
Rubber roofing membrane
Rigid insulation
Air barrier membrane (membrane roofing in very cold and cold climates; house-wraps, building paper in all other climates)
Gypsum board with semi-permeable (latex) paint
Sealant, adhesive or gasket at top plate
Cavity insulation
1/4" cant/ft

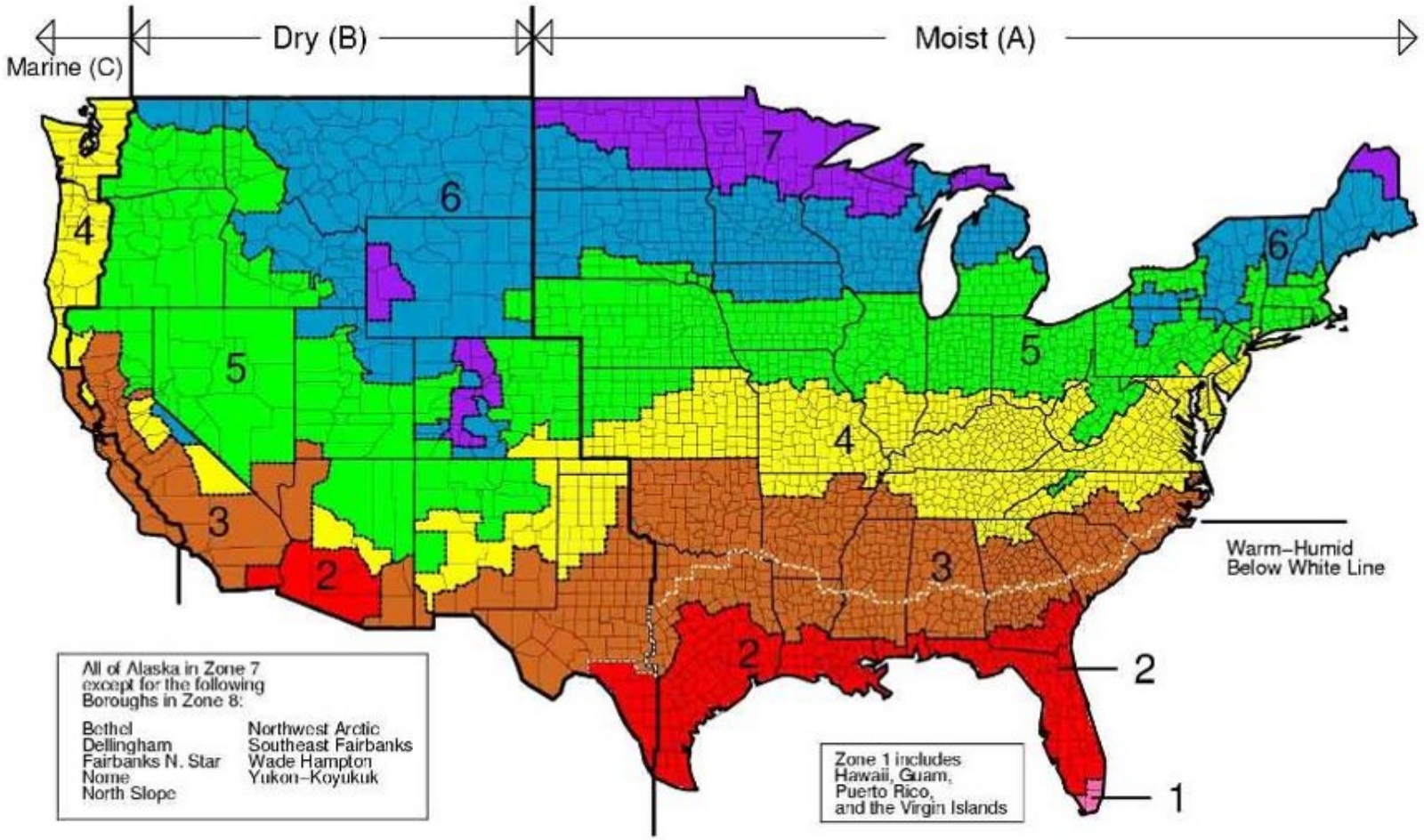

Metal cap
18" wide membrane strip under parapet folded down over exterior OSB
Coping wedge
OSB
OSB sheathing
Rubber roofing membrane
Scupper
Two layers OSB
High density spray foam insulation
Polymer modified (PM) or traditional cement stucco
Metal lath
Building paper bond break over drainage plane
Gypsum board with semi-permeable (latex) paint
Cavity insulation
Sealant, adhesive or gasket at top plate
Caulking or sealant
Cavity insulation
1/4" cant/ft


1” HD spray foam
2x6 top chord
Spray fiberglass;
8” nominal
Gypsum board
OSB/plywood
sheathing
2x6 frame wall
Drainage plane
4 1/2” cellulose or spray fiberglass
1” HD spray foam


Roof cladding
Roof underlayment
3” HD spray foam
(R-19.5)
6¼” spray fiberglass
(R-21)


Low density spray foam insulation
Asphalt shingles
Roofing paper
Roof sheathing
Raised heel truss
Rigid foam, or comparable, as backdam
Soffit
Roof underlayment sealed to drip edge
Non-occupiable space
Gypsum board with latex paint (acts as thermal barrier separating occupiable space from non-occupiable space)

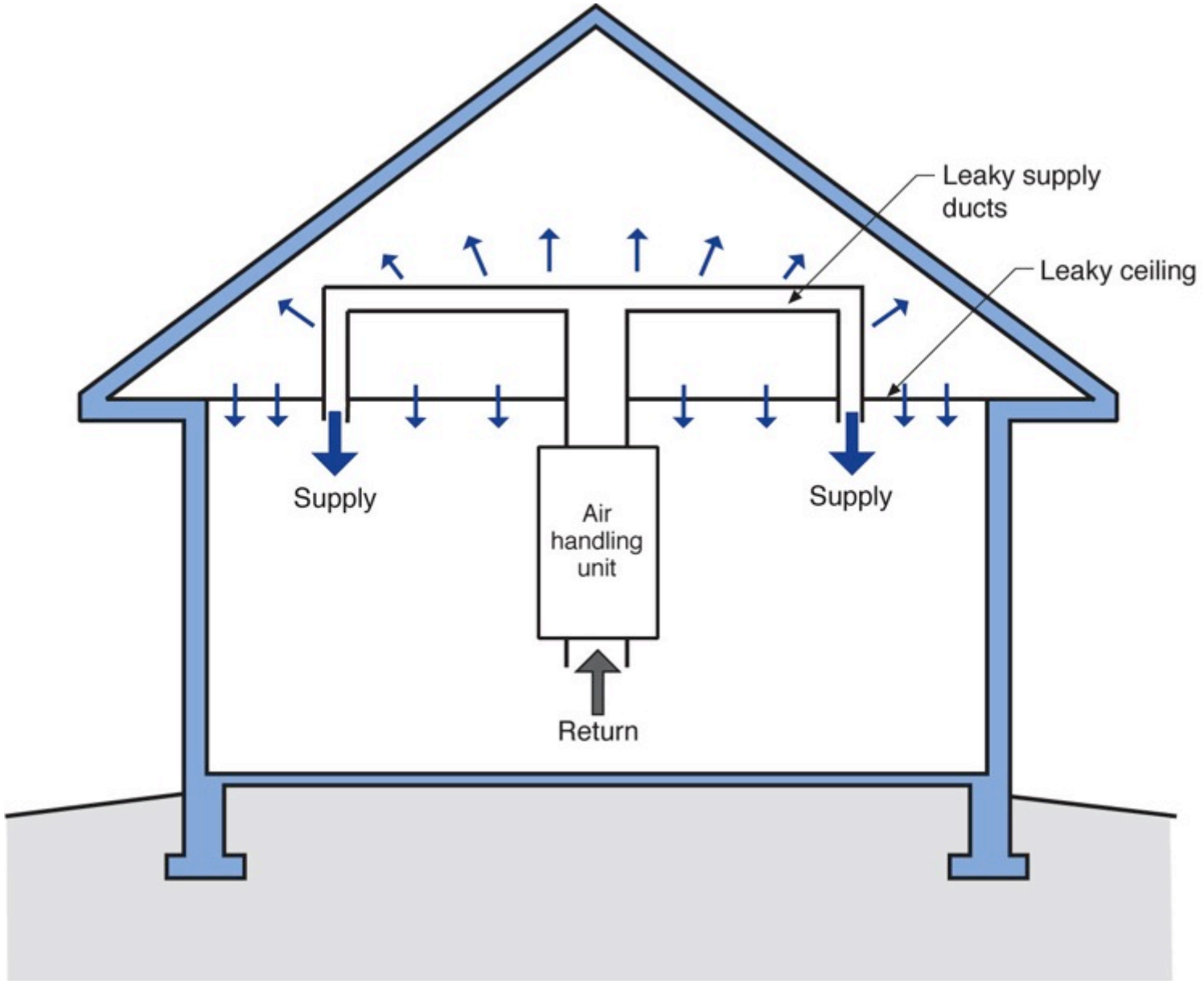

FOAMULAR
OWENS CORNING


Marine (C)
Dry (B)
Moist (A)
Warm–Humid
Below White Line
All of Alaska in Zone 7
except for the following
Boroughs in Zone 8:
Bethel
Dellingham
Fairbanks N. Star
Nome
North Slope
Northwest Arctic
Southeast Fairbanks
Wade Hampton
Yukon–Koyukuk
Zone 1 includes
Hawaii, Guam,
Puerto Rico,
and the Virgin Islands


GRACE
Ice & Water Shield
TRI-FLEX 30
APR 20 2004


APR 20 2004

Conditioned Attics Not Unvented Attics


Leaky supply ducts
Leaky ceiling
Supply
Supply
Air handling unit
Return

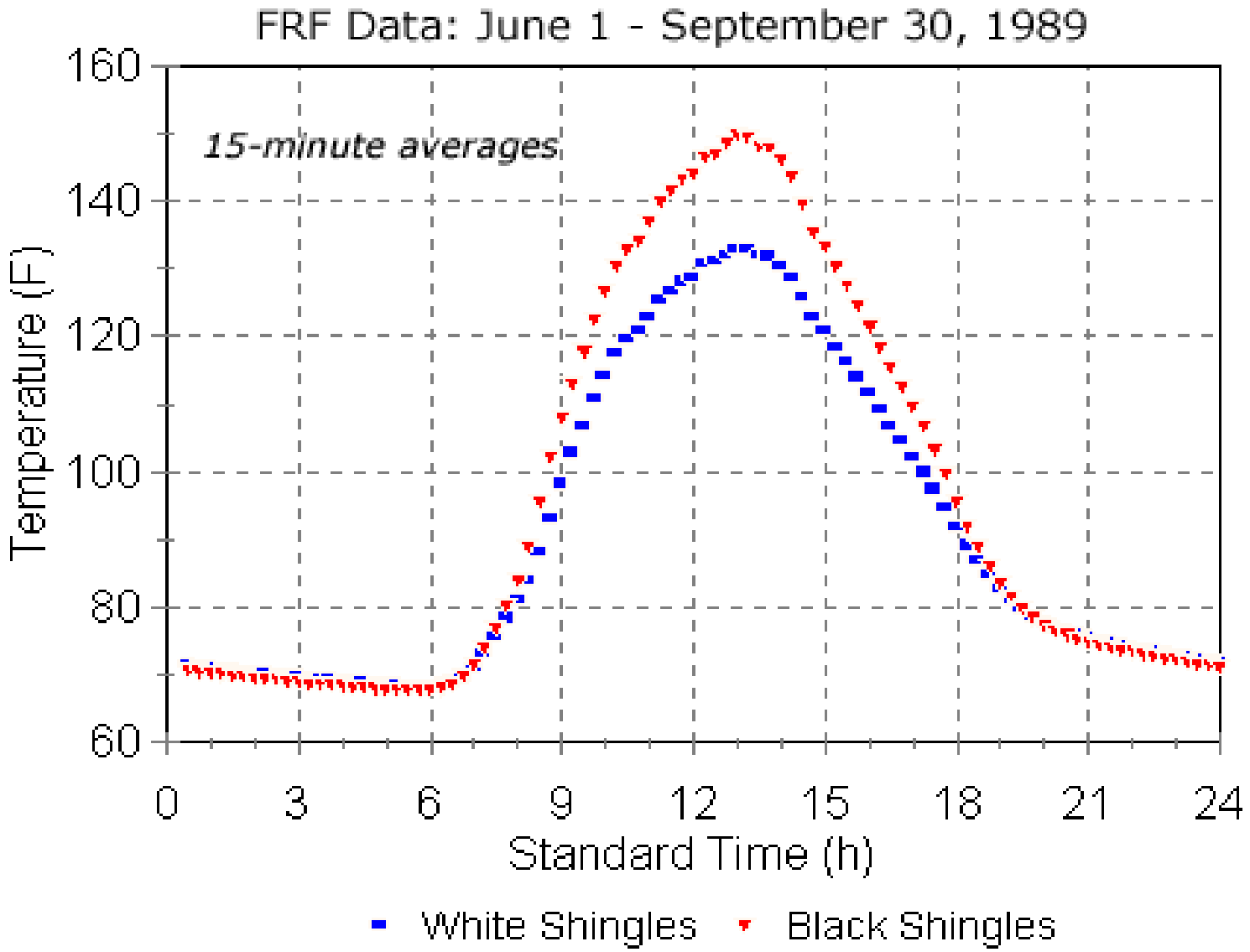
Conditioned Attics Not Unvented Attics

Need Supply Air

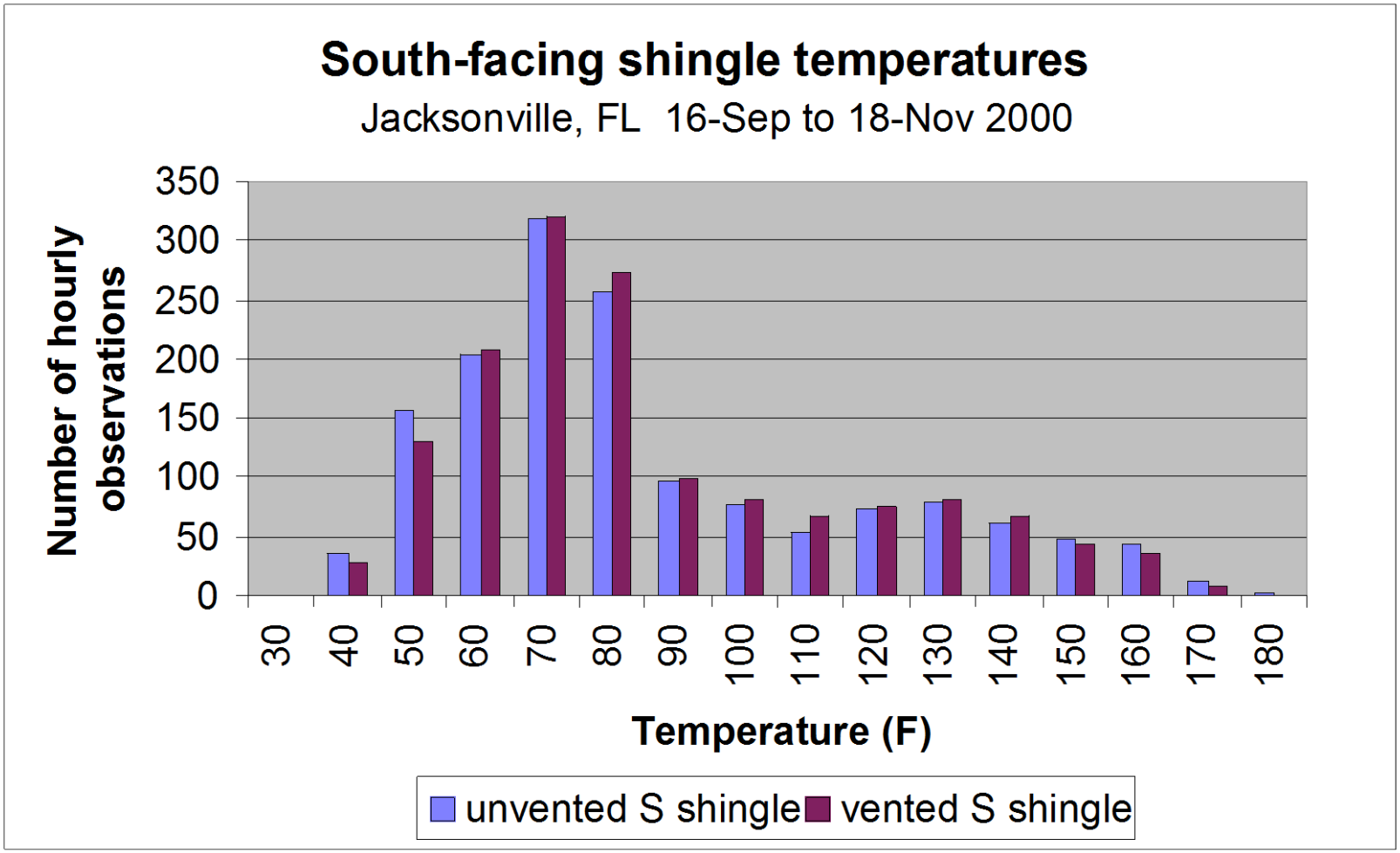
Conditioned Attics Not Unvented Attics

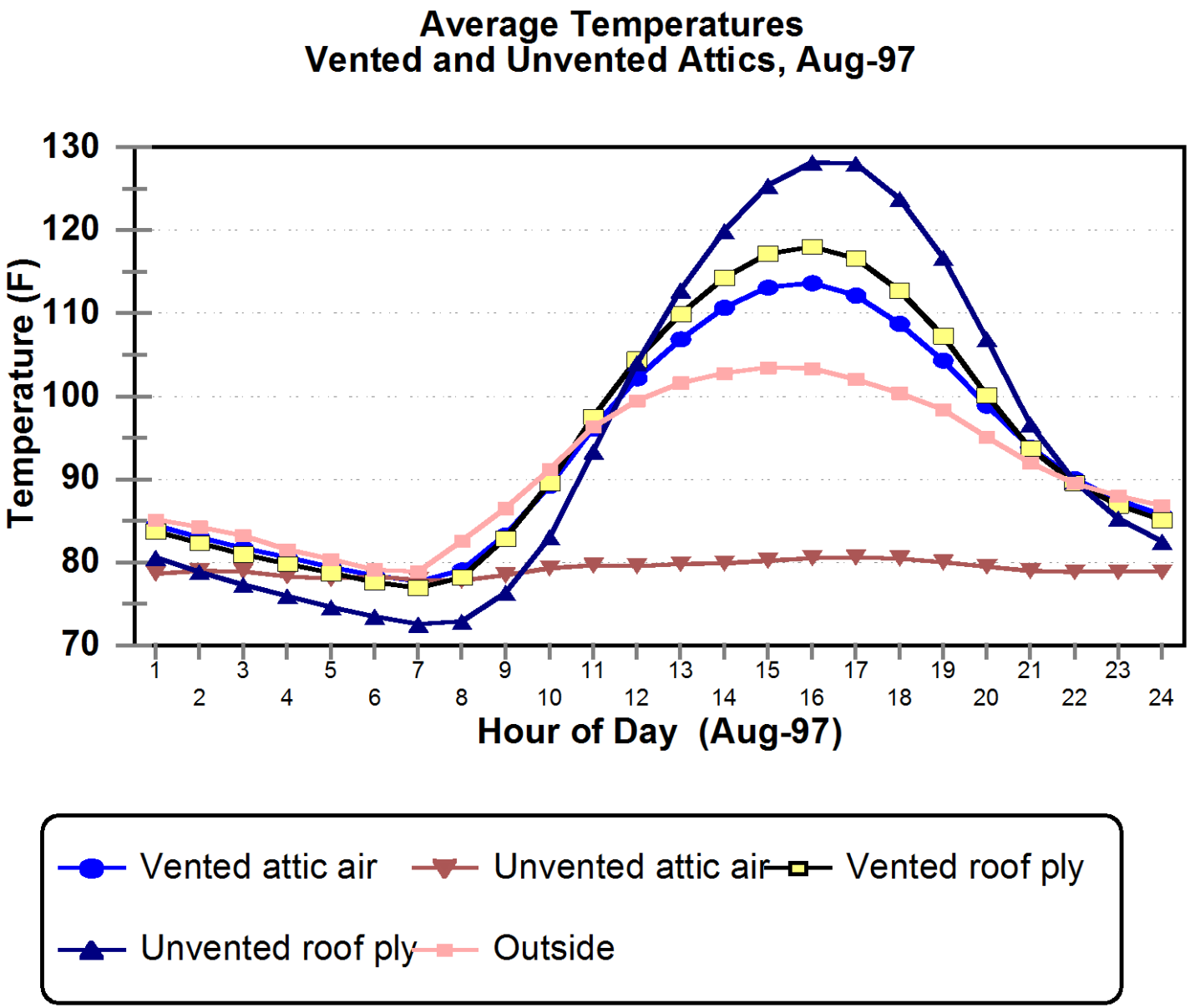
Need Supply Air

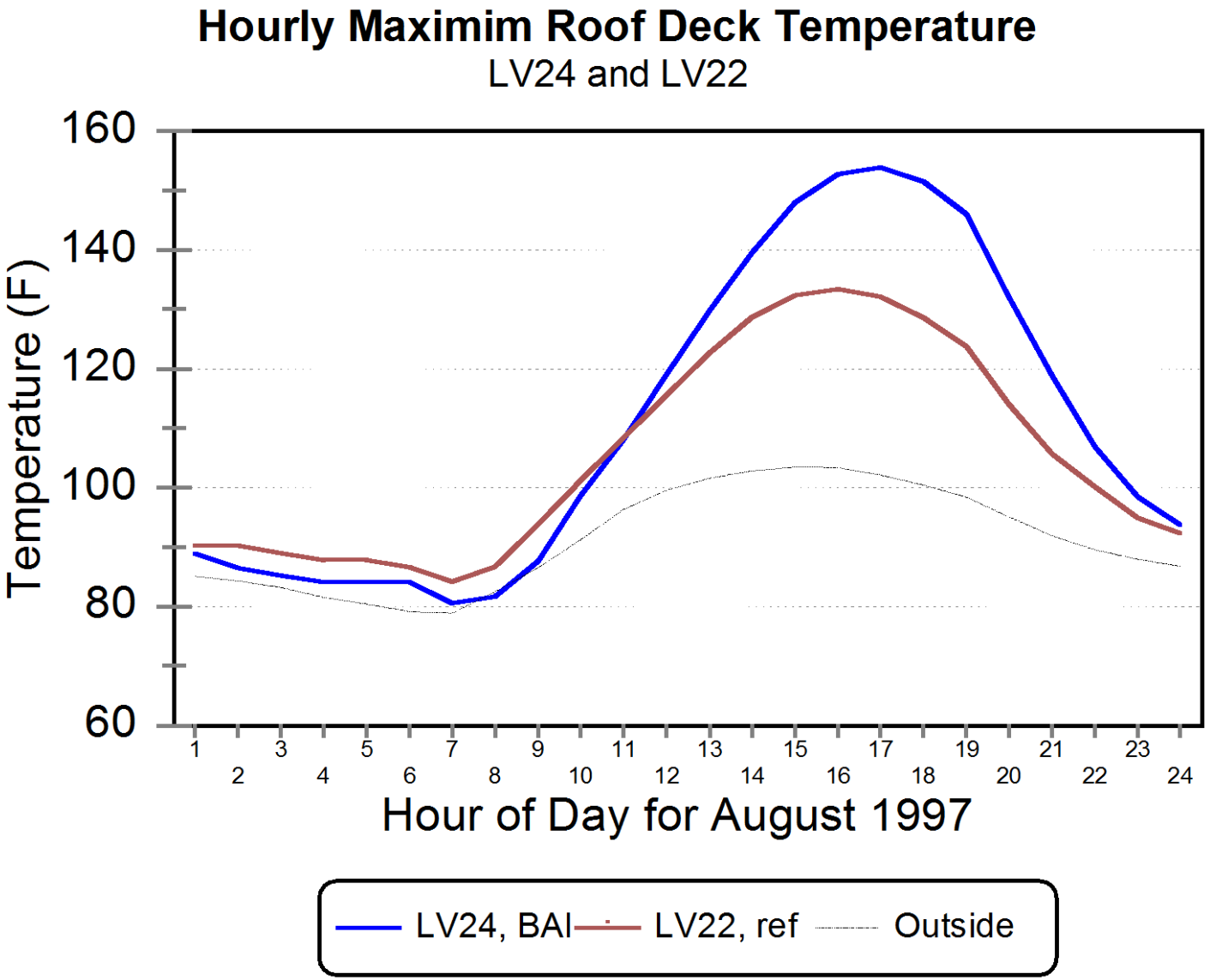
50 cfm/1000 ft2 of Attic

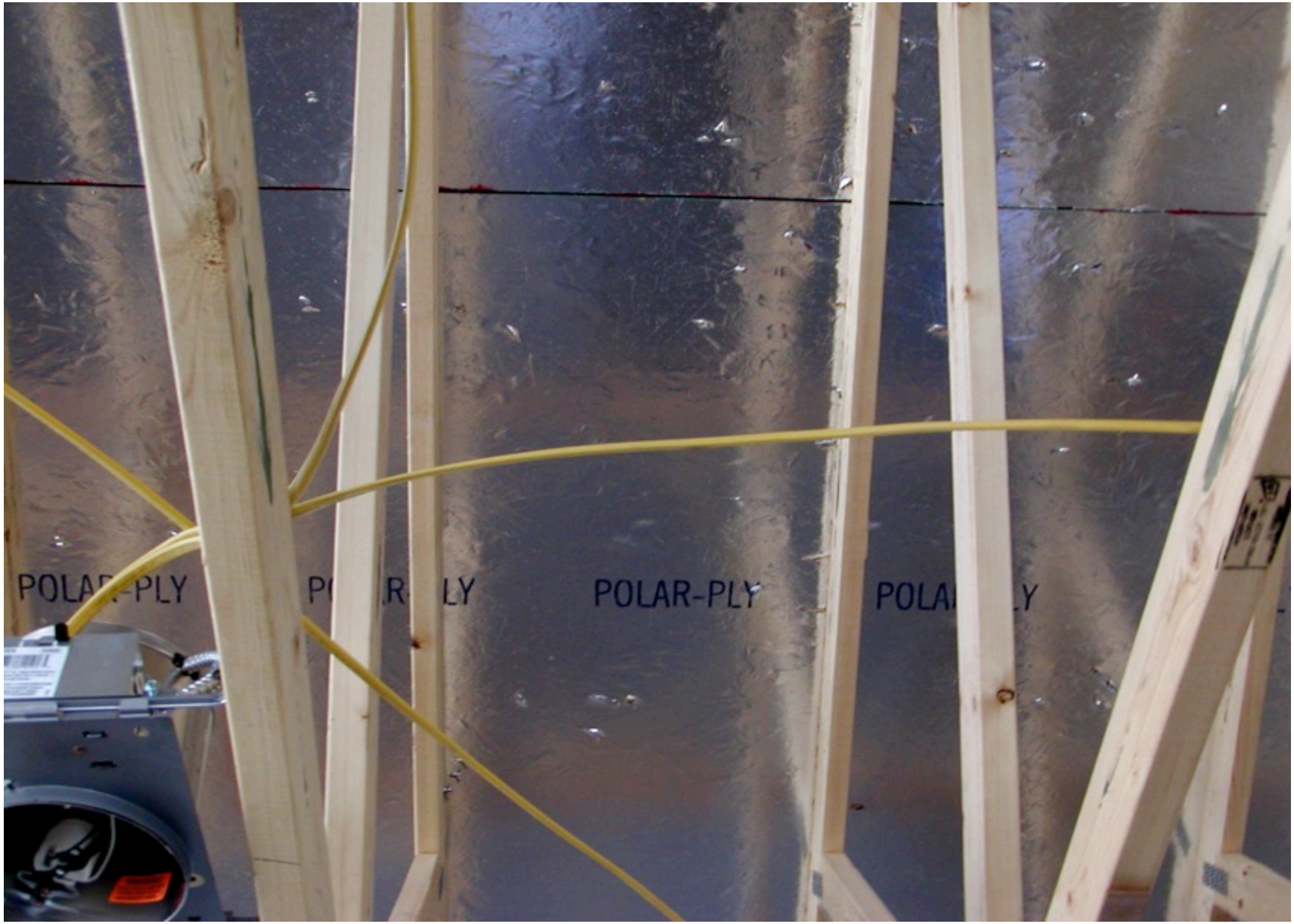

FRF Data: June 1 - September 30, 1989
15-minute averages
Temperature (F)
160
140
120
100
80
60
0
3
6
9
12
15
18
21
24
Standard Time (h)
White Shingles
Black Shingles

Vented vs. unvented shingle temperatures

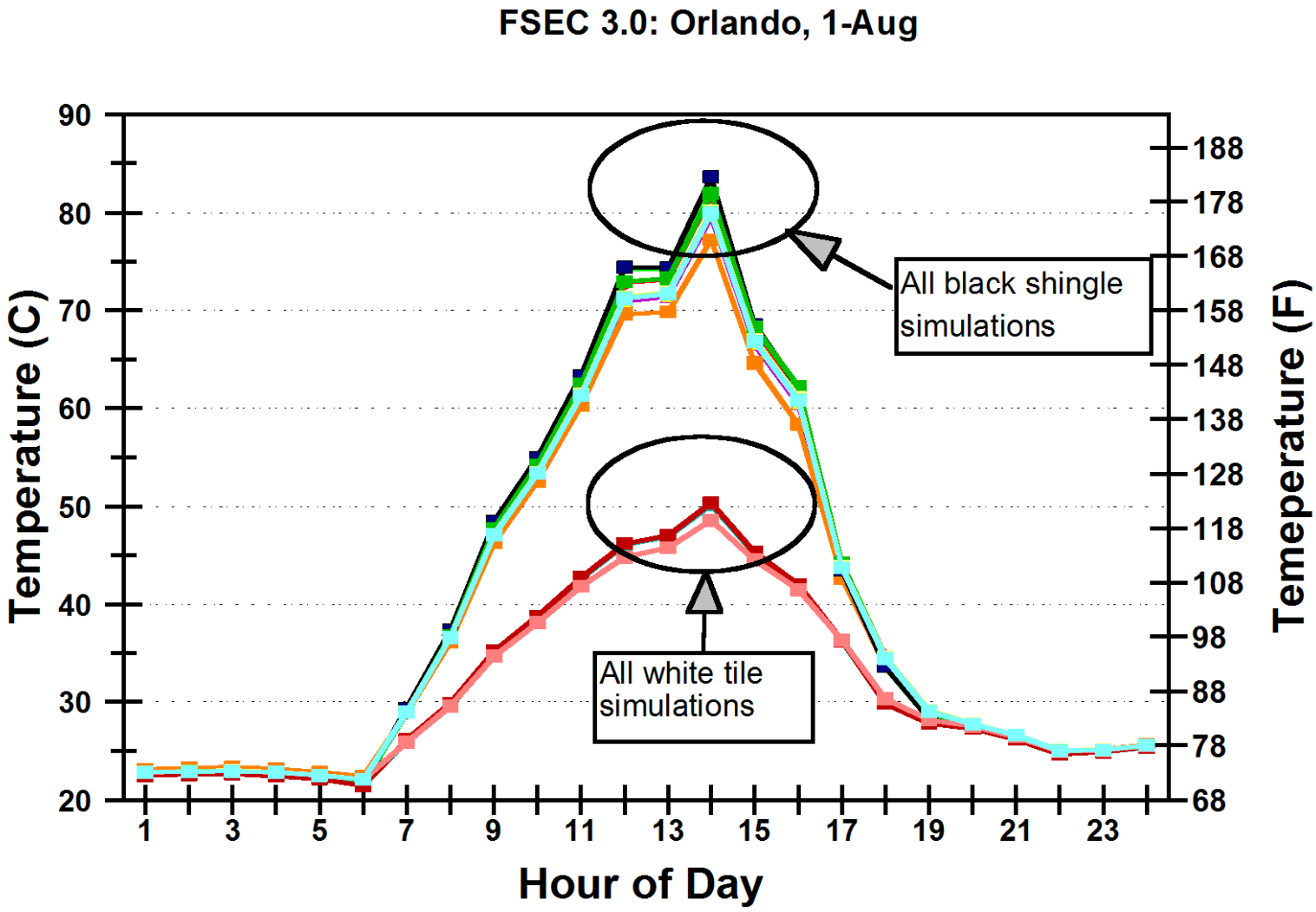



Average Temperatures
Vented and Unvented Attics, Aug-97
Temperature (F)
130
120
110
100
90
80
70
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Hour of Day (Aug-97)
Vented attic air
Unvented attic air
Vented roof ply
Unvented roof ply
Outside

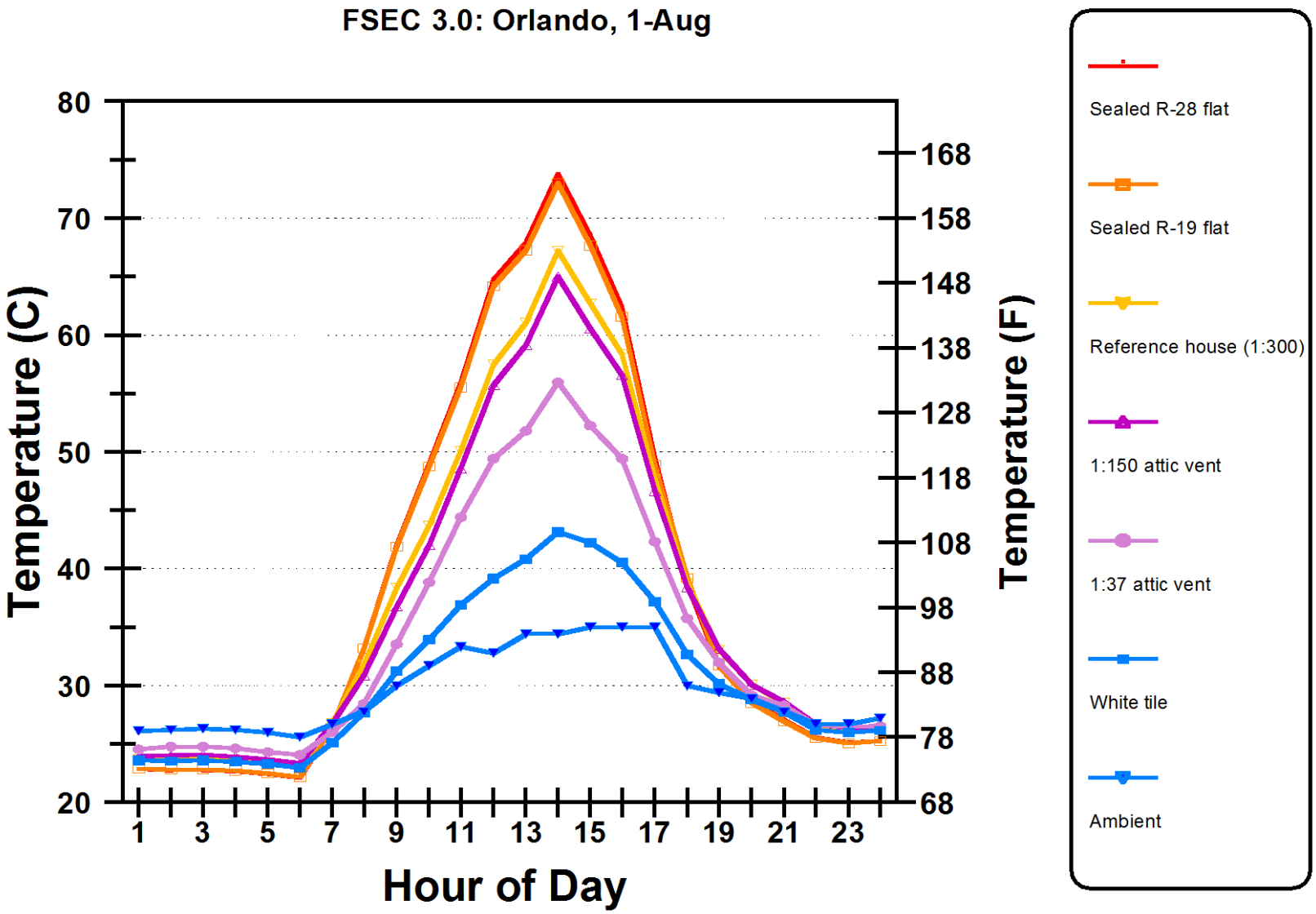

Hourly Maximim Roof Deck Temperature
LV24 and LV22
Temperature (F)
160
140
120
100
80
60
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Hour of Day for August 1997
LV24, BAI
LV22, ref
Outside

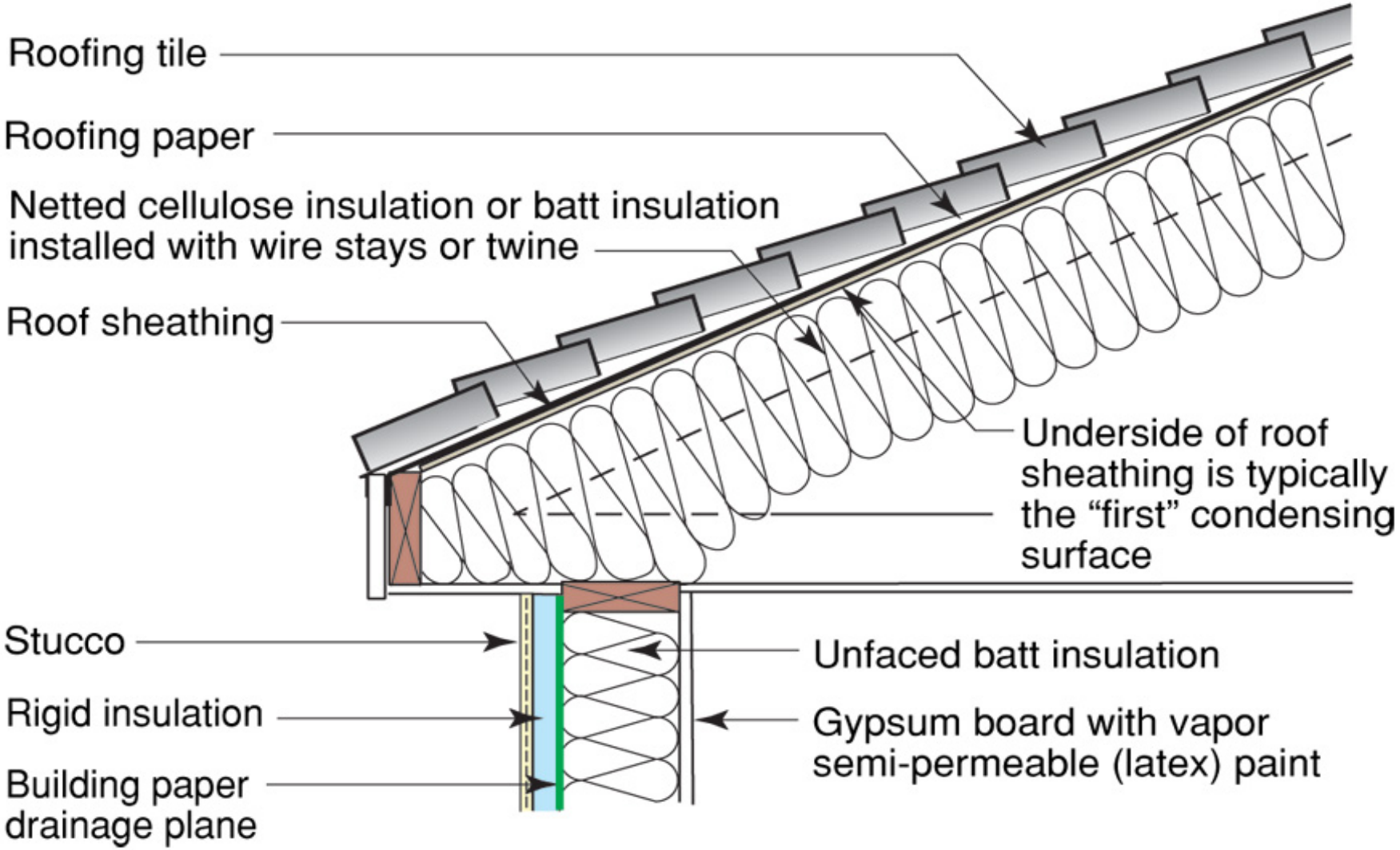

POLAR-PLY
POLAR-PLY

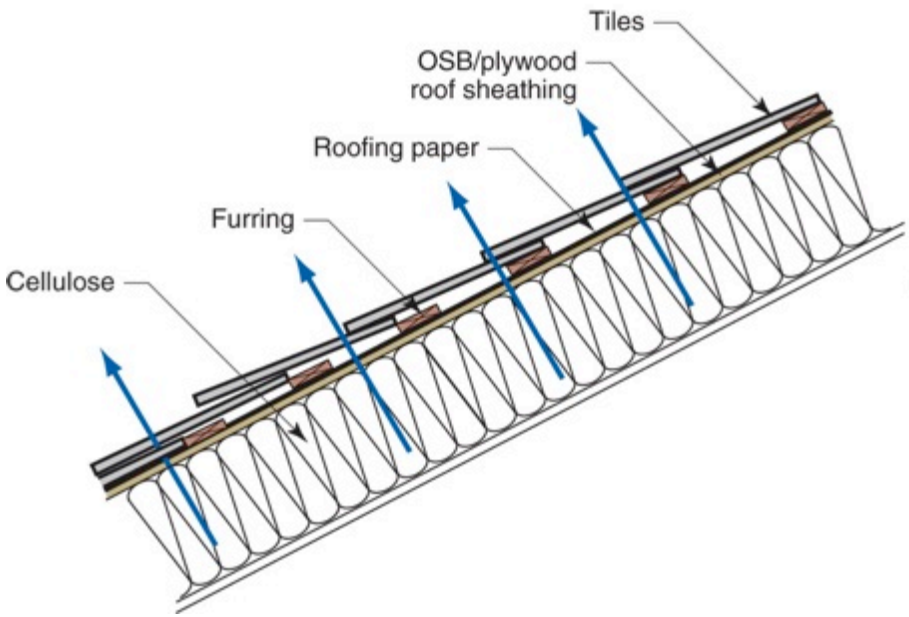
Roof Shingle Temperature

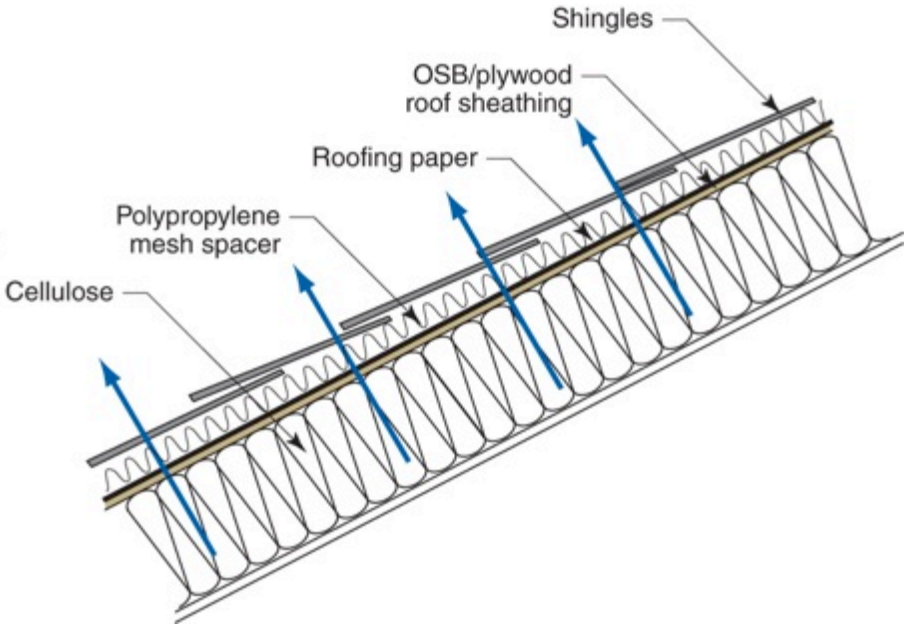


Bottom of Roof Plywood Temperature

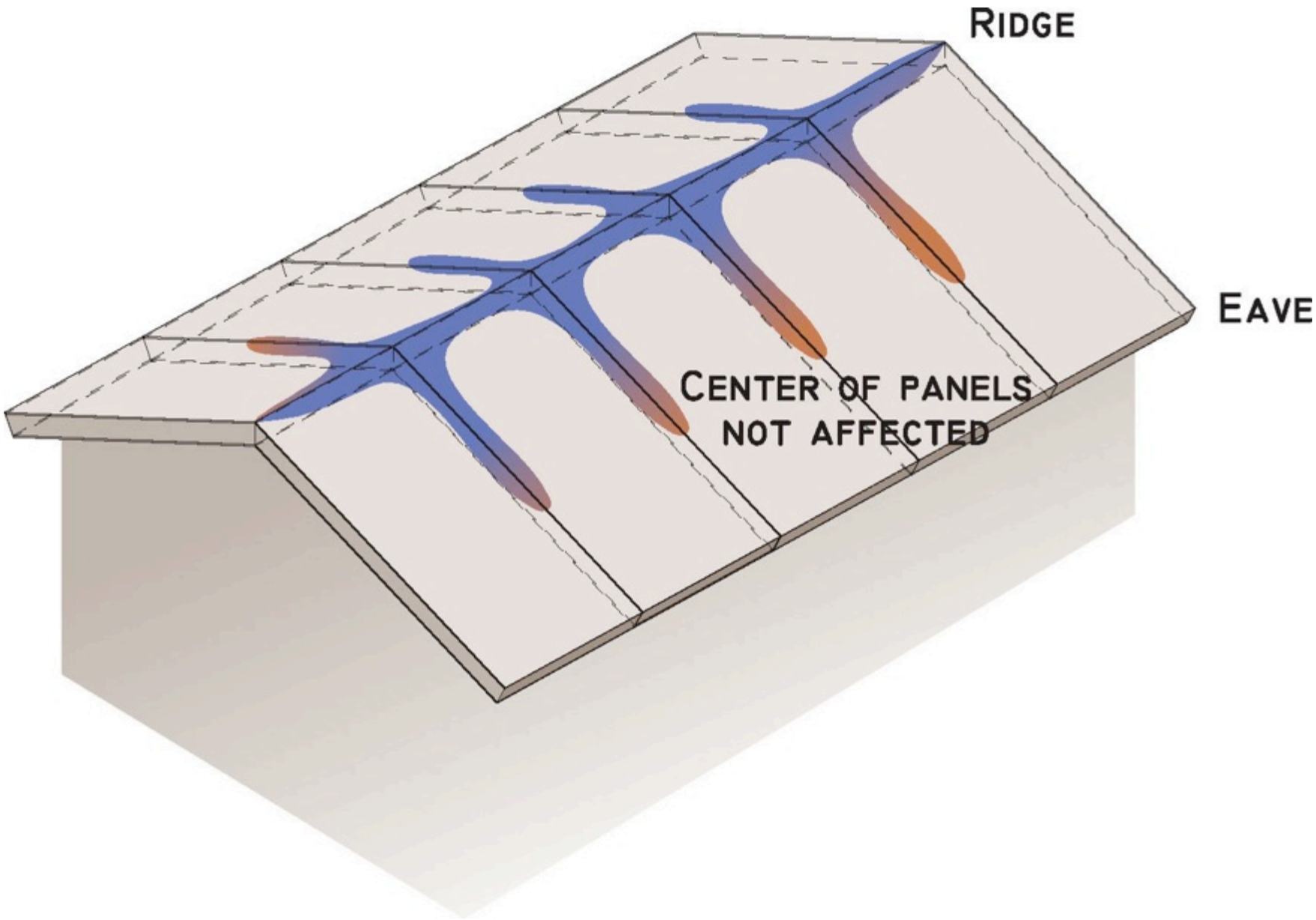



Roofing tile
Roofing paper
Netted cellulose insulation or batt insulation installed with wire stays or twine
Roof sheathing
Underside of roof sheathing is typically the “first” condensing surface
Stucco
Rigid insulation
Building paper drainage plane
Unfaced batt insulation
Gypsum board with vapor semi-permeable (latex) paint

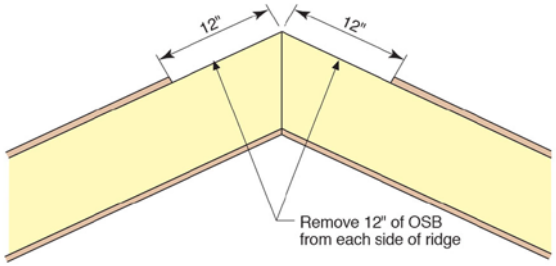

Tiles
OSB/plywood
roof sheathing
Roofing paper
Furring
Cellulose


Shingles
OSB/plywood
roof sheathing
Roofing paper
Polypropylene
mesh spacer
Cellulose

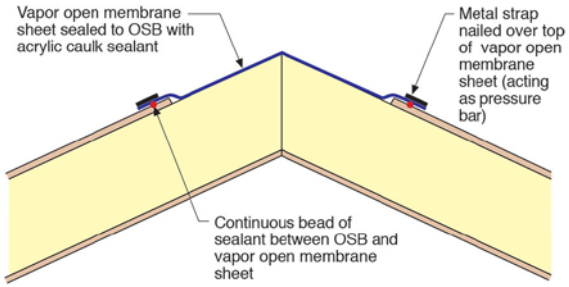

8/22/01 09:32


RIDGE
EAVE
CENTER OF PANELS
NOT AFFECTED

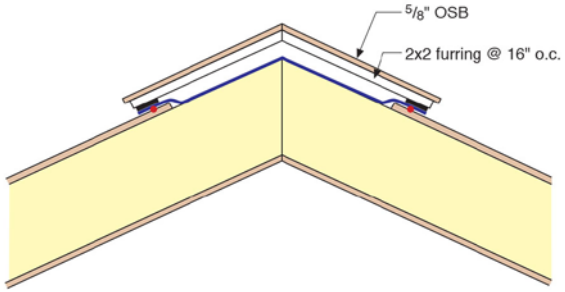
Step 1
- Remove strip of OSB from each side of ridge



Step 2
- Create air seal with strip of vapor open membrane (tape seams)
- Vapor open membrane sheet sealed to OSB with acrylic caulk sealant
- Hold vapor open membrane sheet in place with metal strapping



Step 3
- Construct wood ridge vent with 2x2 furring

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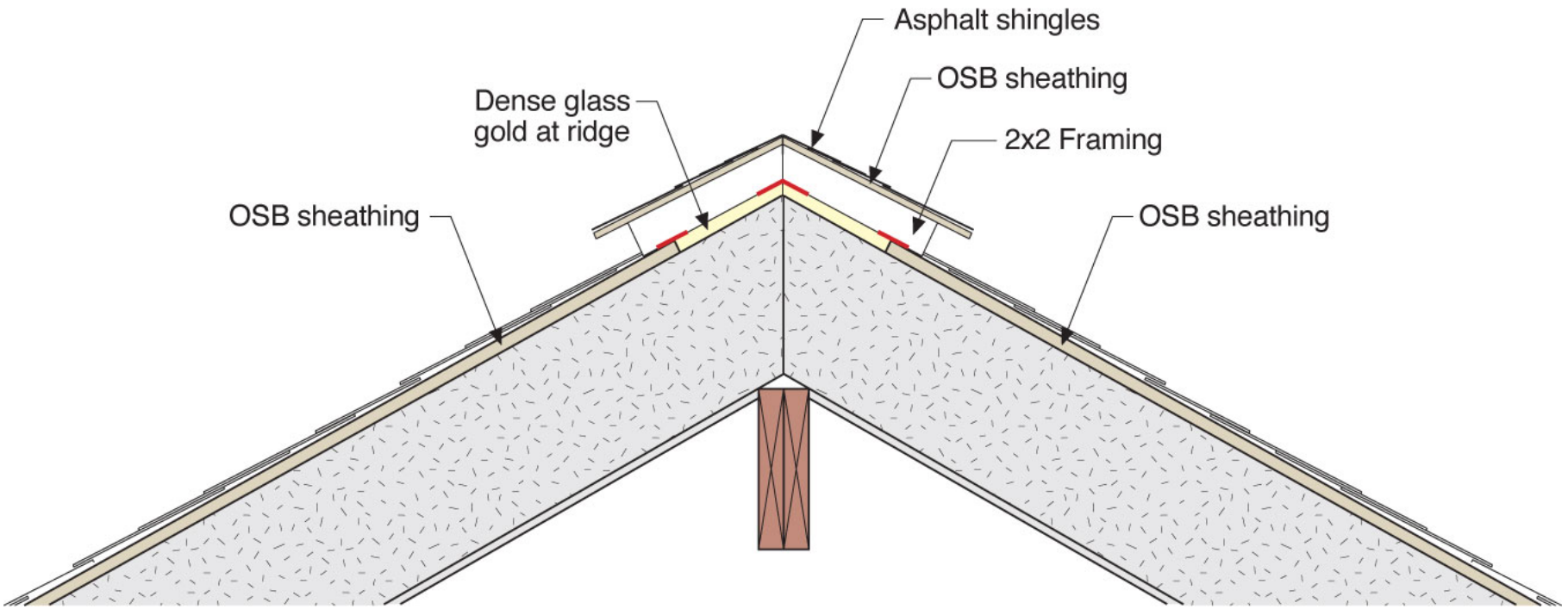
Tyvek
Attic Wrap
DuPont

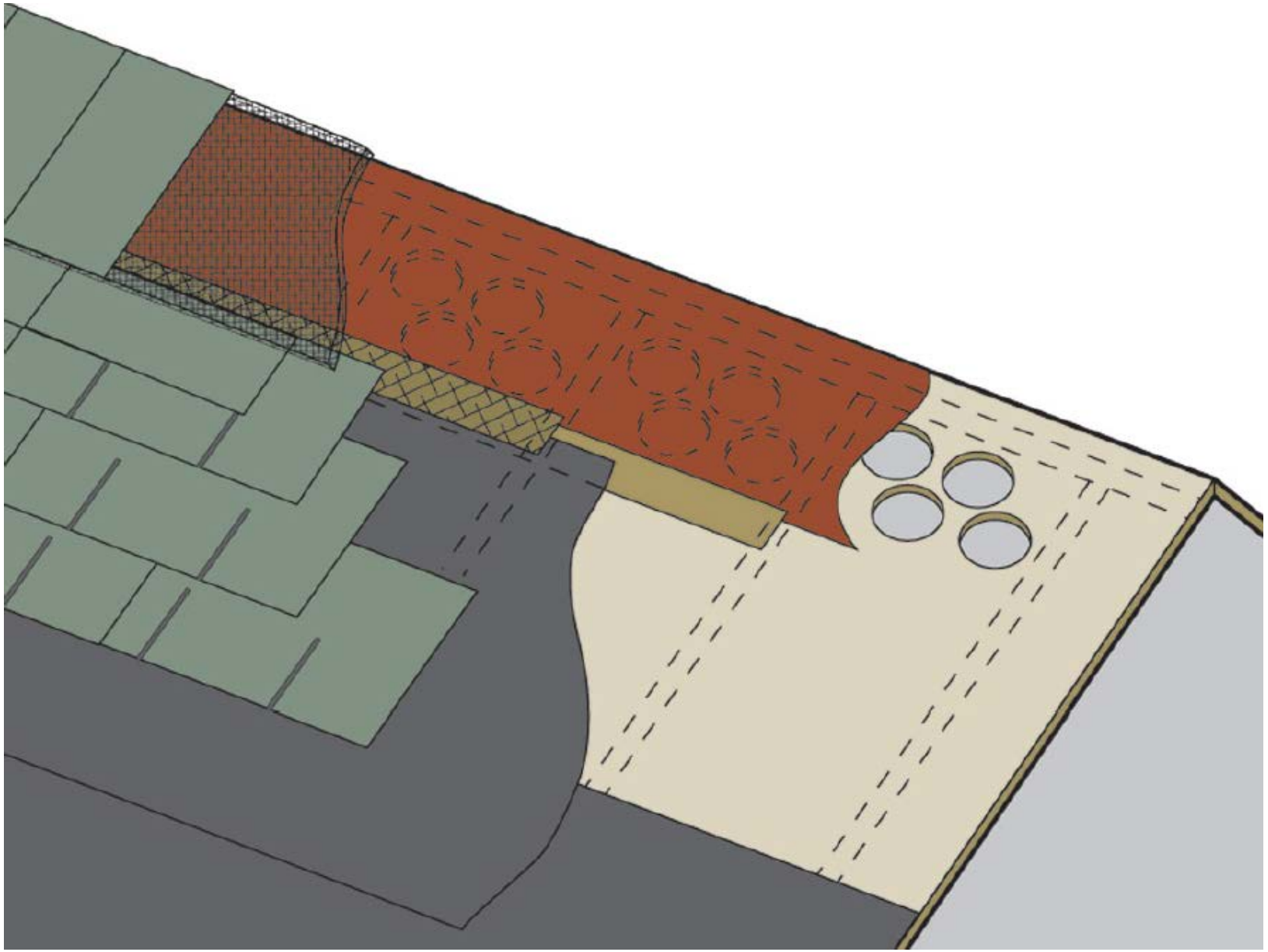

Tyvek
AtticWrap

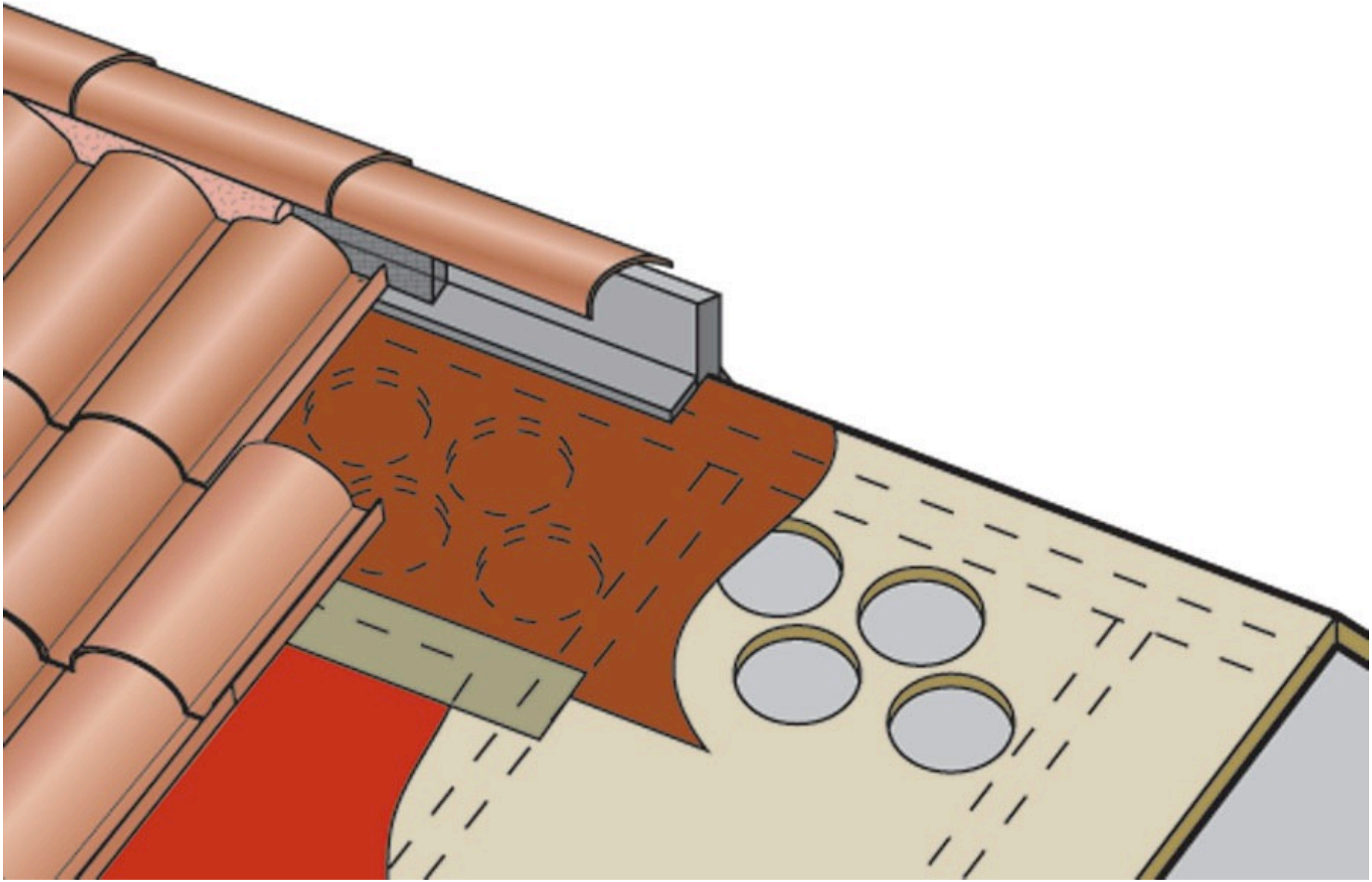

GAF
VELVETRAP

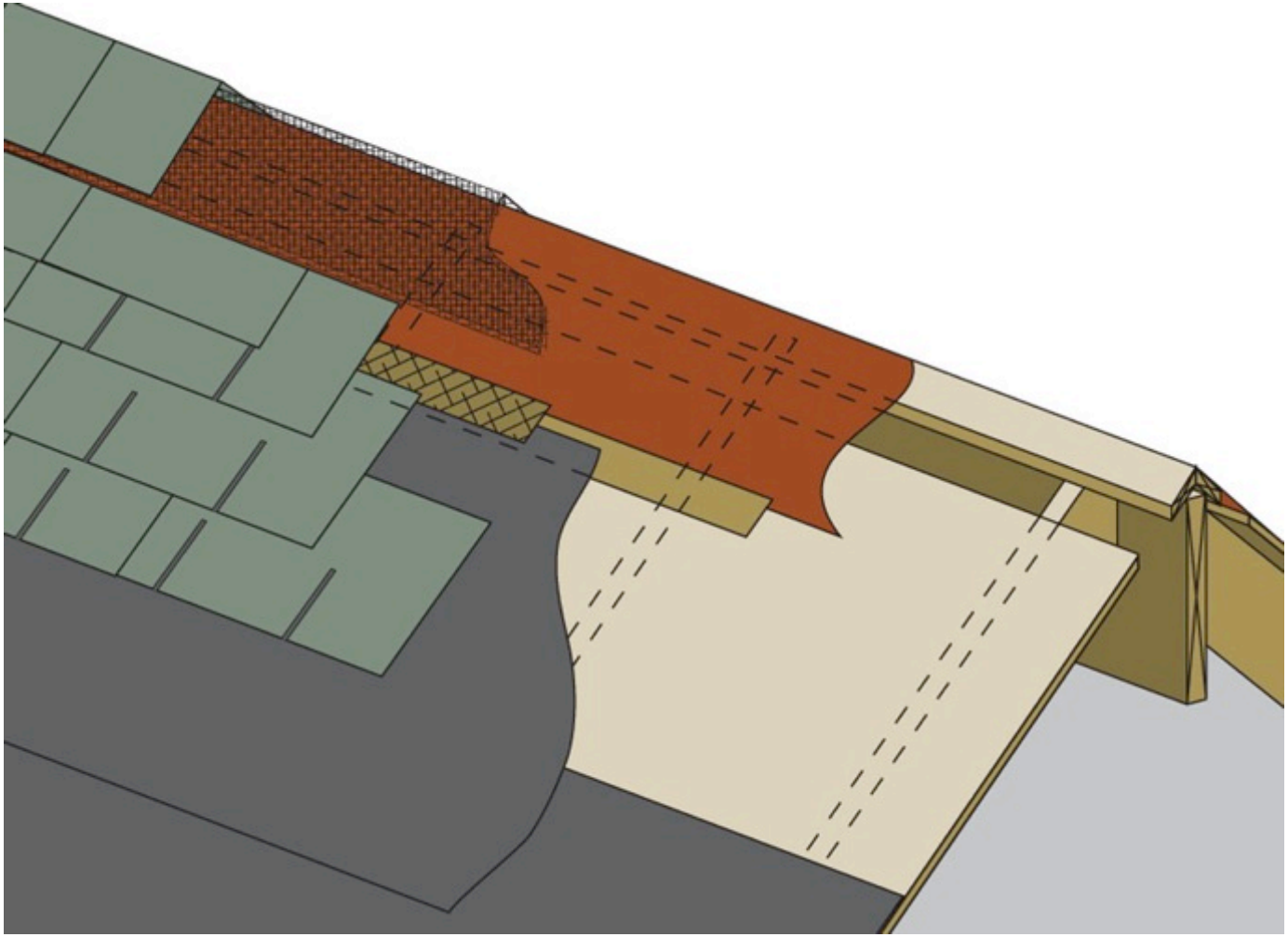

GRACE
Ice & Water Shield®

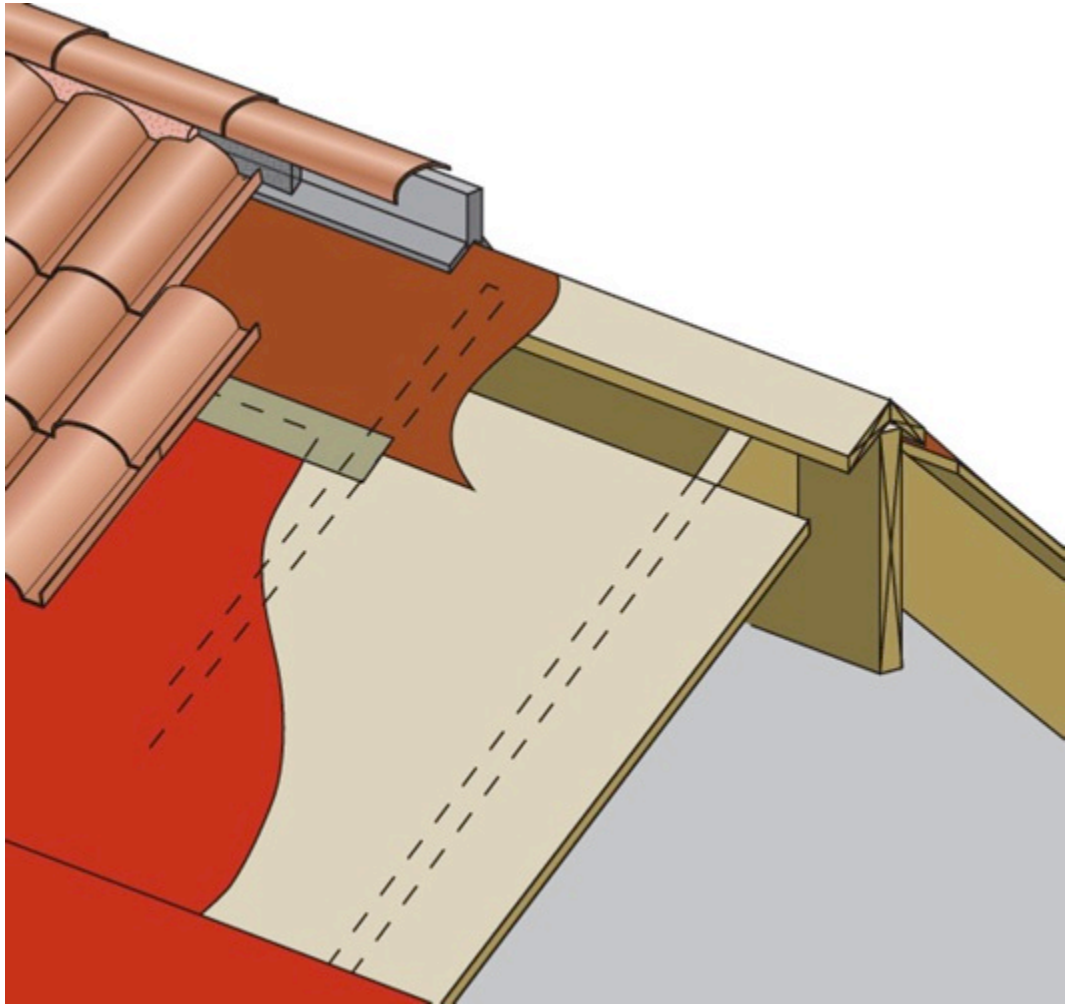

JUL 9 2006


Asphalt shingles
OSB sheathing
Dense glass
gold at ridge
2x2 Framing
OSB sheathing
OSB sheathing










3M
All Weather
Flashing Tape 8067


DELTA
DELTA
DELTA


PROPINK
High Performance
Attic System
OWENS CORNING
R-30

Sweating Ducts

Sweating Ducts

Light Colored Roofs

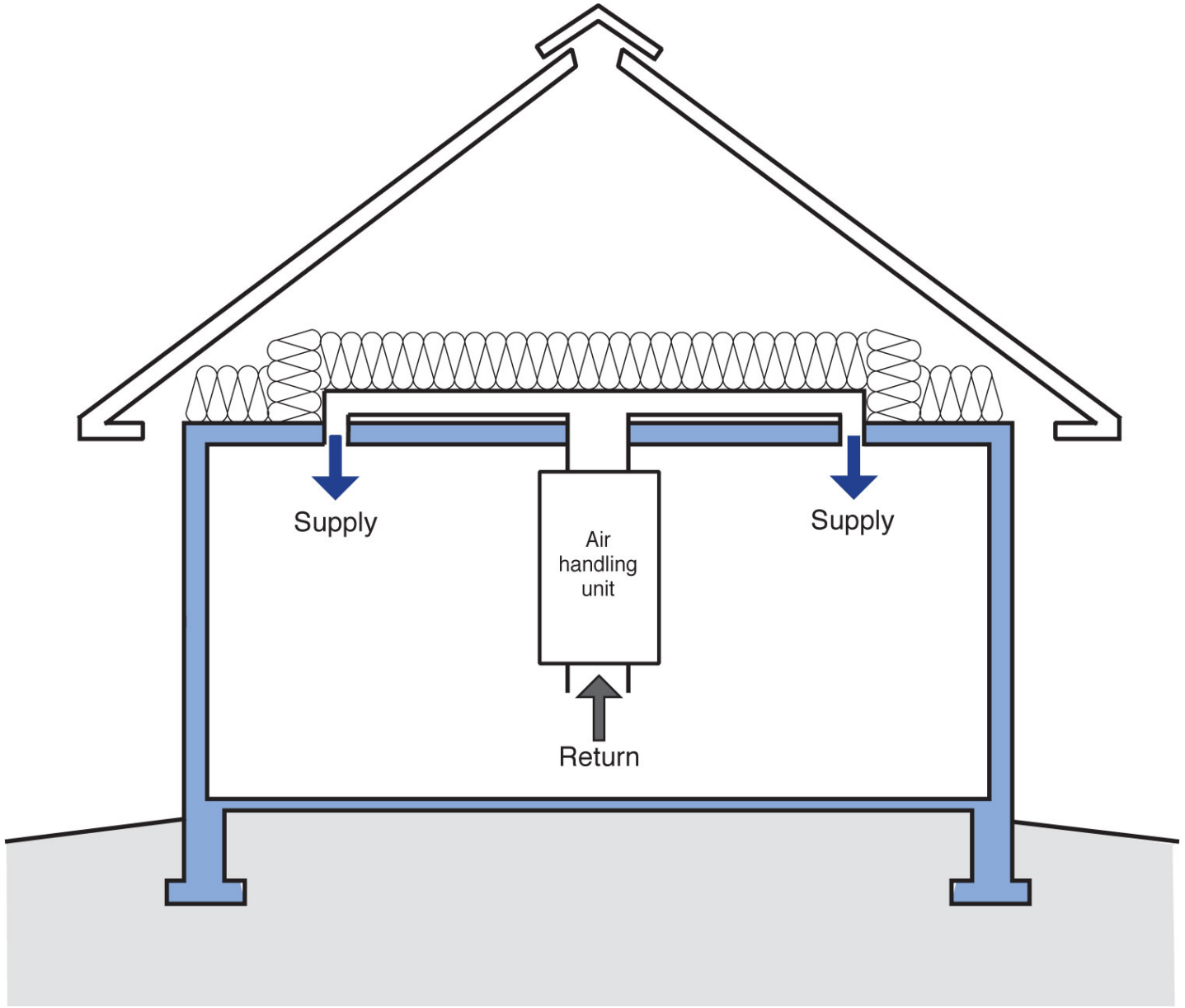
Cool Roofs

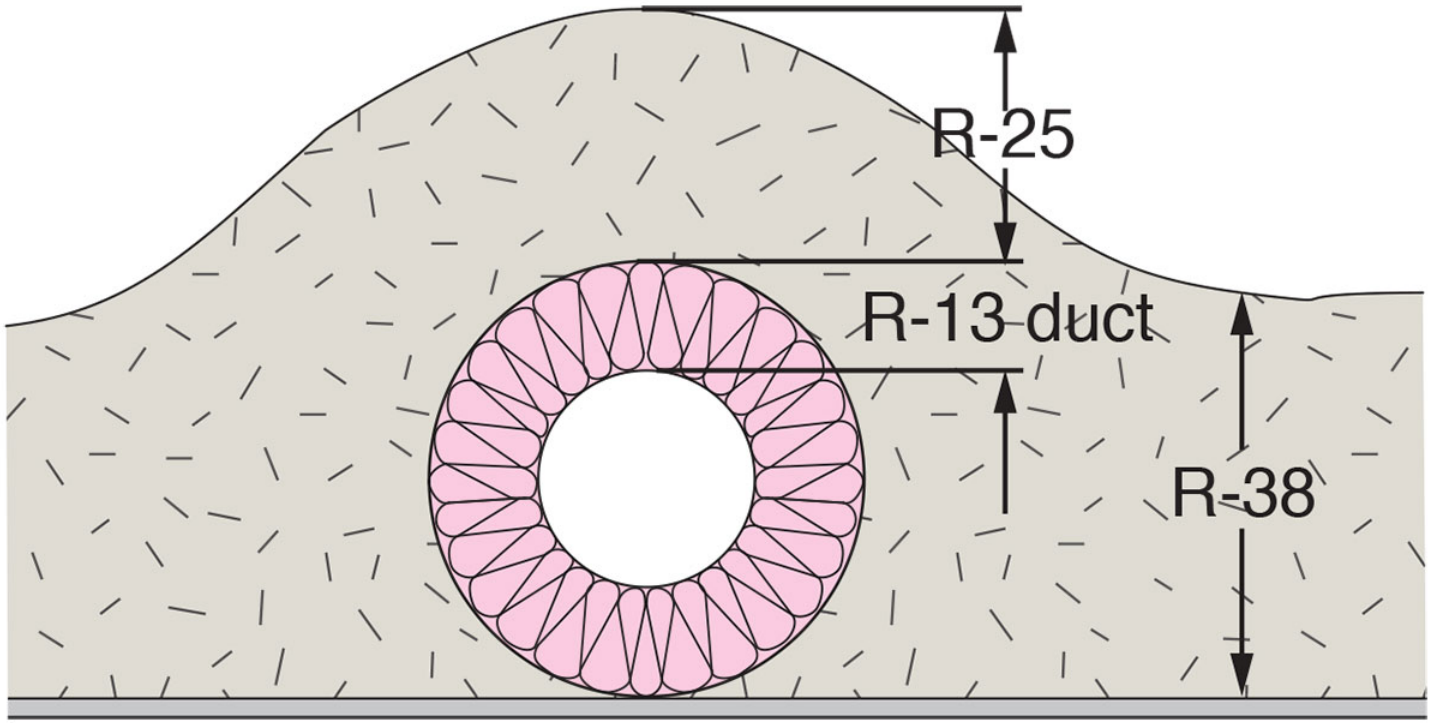
Radiant Barriers

ACCA Manual J, S and D

Ductwork Attic Dehumidification System

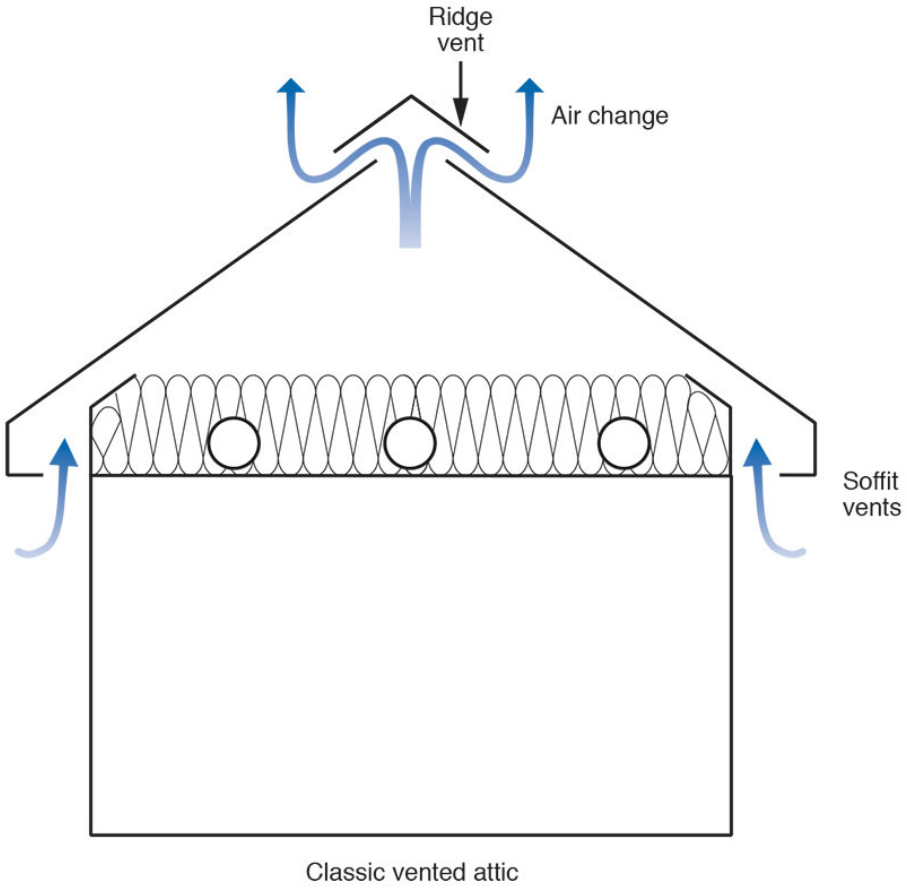
Burying Ducts


Supply
Air handling unit
Supply
Return

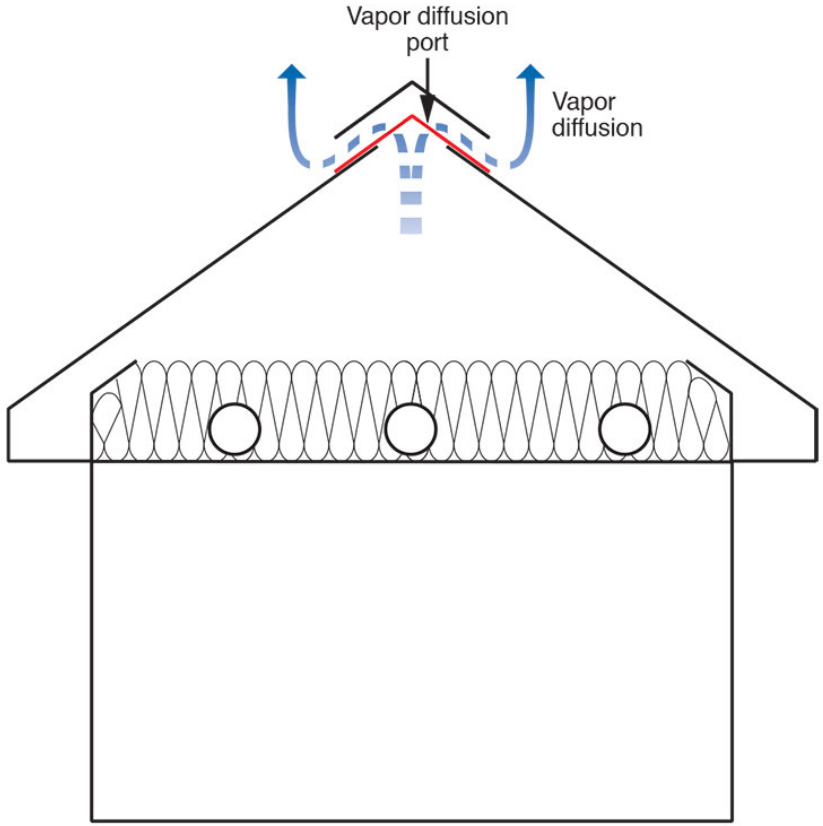

R-25
R-13 duct
R-38


FOAMULAR
FOAMULAR 150


R-5.0
1 inch thick
CERO
CAPA DE OZONO
OWENS CORNING
FOAMULAR 150



Classic vented attic



Unvented attic with vapor diffusion port

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Water Managed Existing Roof Penetrations
Last Updated: May 01, 2017
Transfer Grilles
Last Updated: April 26, 2017
Jump Ducts
Last Updated: April 24, 2017
More Guides

RECENTLY ADDED CONTENT

CAD image for roof pipe penetration water and air sealing details
CAD File Posted: May, 2017
A ducted central return brings air from central return registers back to the air handler through insulated, air-sealed ducts
Image Posted: April, 2017
Right – A transfer grille is installed high on a bedroom wall in a new-construction home
Image Posted: April, 2017

Building AMERICA U.S. Department of Energy

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Water Managed Existing Sill Beams and Sill Plates

Guide describing how to insulate the sill beam or sill plate on the exterior side in a way that allows drying to the exterior, as part of an exterior wall upgrade.

Water Managed Existing Wall Penetrations

Guide with information about how to install flashing integrated with air and water control layers around piping, vents, and other wall penetrations as part of an exterior wall retrofit.

Water Managed Roof – Re-roofing and Adding Insulation over a Flat Roof

Guide describing an approach to re-roofing an existing flat roof to improve thermal, water, and air control performance.

Water Managed Roof – Re-roofing – Sloped Roof

Guide describing how to re-roof an existing home with a sloped roof.

Water Managed Roof-Wall Intersections in Existing Homes

Guide describing how to install and properly integrate flashing at the intersection of an existing wall and an existing intersecting roof

Water Management of Existing Basement Floor

Guide describing how to retrofit an existing basement floor or slab to reduce moisture issues.

Water Management of Existing Crawlspace Floor

Guide providing information about treating bulk water drainage issues and moisture control measures in existing basements and crawl spaces.

Whole-Building Delivered Ventilation

This guide describes how to install a whole-building ventilation system to provide adequate dilution of indoor air contaminants.

Whole-House Dehumidification

Guide describing additional requirements for HVAC systems in warm-humid climates to operate in a dehumidification mode to maintain indoor relative humidity at or below 60 percent.

Wind Washing

Guide describing wind washing and how to prevent it.

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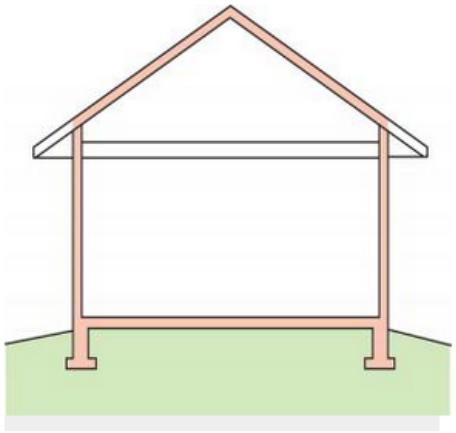
Scope



Install insulation along the underside of the roof deck of an unvented attic rather than on the ceiling deck of a vented attic for either of two reasons: to provide an unvented, conditioned space for locating HVAC equipment in the attic, and/or to provide a continuous thermal barrier for designs that have complex coffered ceiling planes and/or numerous penetrations for lights, speakers, vents, soffits, etc., which make it difficult to achieve an airtight ceiling plane.

Install insulation to levels that meet or exceed code or energy-efficiency program requirements.

The insulation components for an unvented attic assembly can be successfully designed and installed, based on recommendations from this Guide and the requirements of the 2012 International Residential Code (IRC) Section R806.5 "Unvented attic and unvented enclosed rafter assemblies." The intent of Section R806.5 is to require unvented attic assembly designs that keep the roof deck – the principle condensing surface in roof assemblies – sufficiently warm throughout the year, or to prevent interior moisture-laden air from accessing the roof deck. This is done by using what is referred to as "air-impermeable insulation" such as rigid foam board above the roof deck or spray foam on the underside of the roof deck.

DOE Zero Energy Ready Home Notes

The U.S. Department of Energy Zero Energy Ready Home National Program Requirements specify as a mandatory requirement (Exhibit 1, #2.2) that, for all labeled homes, whether prescriptive or performance path, ceiling, wall, floor, and slab insulation shall meet or exceed 2012 IECC levels. See the guide 2012 IECC Code Level Insulation – DOE Zero Energy Ready Home Requirements for more details.

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Unvented Attic Insulation

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Compliance

The Compliance tab contains both program and code information. Exact code language is copyrighted and may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our webmaster if you find broken links.

Code Compliance Brief

2009 and 2012 IRC

The 2009 and 2012 IRC Section R202 defines vapor retarders class information. A vapor retarder is defined as "a measure of the ability of a material or assembly to limit the amount of moisture that passes through that material or assembly." Vapor retarder classes are defined by the IRC using the desiccant method with Procedure A of ASTM E96. These classes are:

Class I: 0.1 perm or less
Class II: 0.1 perm to 1.0 perm
Class III: 1 perm to 10 perms

The IRC has had information on unvented attics for several editions. The 2012 IRC Section R806 contains the following requirements, with slight modifications from the 2009 edition, with the most notable addition being identification of vapor retarders by class in R806.5 items 2 and 4.

R806.5 Unvented attic and unvented enclosed rafter assemblies. Unvented attic assemblies and unvented enclosed rafter assemblies are permitted if all the following conditions are met:

1. The unvented attic space is completely contained within the building thermal envelope.

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The intent of Building America's Code Compliance Briefs are to provide code-related information about Building America's research, best practices, and new innovations to help ensure that the measures will be accepted as being in compliance with the code. Providing notes for code officials on how to plan review and conduct field inspections can help builders or remodelers with proposed designs and provide jurisdictional officials with information for acceptance. Providing the same information to all interested parties (e.g., code officials, builders, designers, etc.) is expected to result in increased compliance and fewer innovations being questioned at the time of plan review and/or field inspection.

Air Sealing and Insulating Attic Knee Walls - Code Compliance Brief

Air sealing and insulating attic knee walls to code.

Air Sealing and Insulating Common Walls (Party Walls) in Multi-Family Buildings - Code Compliance Brief

Publication Date: May, 2016

The intent of this brief is to provide code-specific information about air sealing and insulating common walls in multi-family buildings to help ensure that the measures will be accepted as being in compliance with the code. Providing the same information to all interested parties (e.g., code officials, builders, designers, etc.) is expected to result in increased compliance and fewer innovations being questioned at the time of plan review and/or field inspection.

Air Sealing and Insulating Garage Walls - Code Compliance Brief

This brief provides an overview of the 2009 through 2015 IRC/IECC code requirements related to air sealing and insulating attached garage walls.

Bathroom Fan Ratings - Code Compliance Brief

If the bathroom fan is part of the whole-house mechanical ventilation system (WHMV), there are code provisions that should be verified during plan review and field inspection depending upon codes enforced in your jurisdiction.

Buried Ducts in Vented Attics in Hot-humid and Mixed-humid Climate Zones - Code Compliance Brief

Publication Date: May, 2016

The intent of this brief is to provide code-related information about buried ducts in vented attics to

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Controlling Moisture in Unvented Attics - Code Compliance Brief

Overview:

The intent of this brief is to provide code-related information about controlling moisture in unvented attics by installing a vapor diffusion port/vent that would convey water vapor from an unvented attic to the outside when air-permeable insulation materials are installed and can be verified as being in compliance with the related codes and standards for residential construction. Providing consistent information to document compliance with codes and standards to all relevant parties responsible for verifying compliance (e.g., code officials, builders, contractors, designers, inspectors) is challenging and more uniform plan review and field inspection

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ventilation, and insulation issues in unvented attics with interior insulation. The c
diffusion port/vent that would convey water vapor from an unvented attic to the
Some of the main reasons for the new code changes are described below:

- The research supporting this code change is an outgrowth of the original resear
under the Department of Energy's Building America Program. The same technical team and the same technical rigor that supported the original code changes for unvented attics in the early 2000s is the basis for this proposed code change.

Plan Review:

This section, provides current code sections and details in the 2015 IRC and IECC, and the language (underscored, struck-through, and highlighted in red) from code change proposals that were approved for the 2018 IRC.

2015 IRC, Section R104 Duties and Powers of the Building Official

Section R104.1, General. The building official has authority to render interpretations of this code and to adopt policies and procedures in order to clarify the application of its provisions. Such interpretations, policies and procedures shall be in conformance with the intent and purpose of this code.

2015 IECC/IRC, Section R102.1/R104.11, Alternative Materials, Design and Method of Construction and Equipment. The provisions of this code are not intended to prevent the installation of any material or prohibit any design or method of construction not specifically prescribed in the 2015 IECC/IRC, provided that any such alternative has been approved. The building official is permitted to approve an alternative material, design, or method of construction where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and the material, method, or work offered is for the purpose intended, not less than the equivalent of that prescribed in the code. Compliance with specific performance-based provisions of the International Codes is an alternative to the specific requirements of this code.

2015 IRC, Section R104.11.1, Tests. Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the building official has authority to require tests as evidence of compliance to be made at no expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the building official shall approve the testing procedures. Tests shall be performed by an approved agency. Reports of such tests shall be retained by the building official for the period required for retention of public records.

Construction Documentation. Review the construction documents for details describing roof ventilation, attic insulation, installation, air sealing, and construction techniques. (Bullet items underscored are based on the 2018 ICC code proposals.)

2015 IECC/IRC, Section R103.3/R106.3, Examination of Documents, the code official/building official must examine or cause to be examined construction documents for code compliance.

2015 IECC/IRC, Section R103.2/N1101.5, Information on Construction Documents. Construction documents should be of sufficient clarity to indicate the location, nature, extent of the work proposed, and show of sufficient detail pertinent data features. (Bullet items below that are underscored and highlighted in red are based on the new provisions that will be published in the 2018 IRC. Construction documents should include:

- Roof assembly details.
- *Vapor diffusion port(s)*/vent(s) design and location.
- Moisture barrier material used for the *vapor diffusion port*(s)/vent(s).
- Insulation materials and their R-values.
- Details indicating how the insulation is to be applied.
- Where preformed insulation board is used as the *air-impermeable insulation* layer, confirm that the construction documents specify air sealing at the perimeter of each individual sheet interior surface to form a continuous layer.
- Air sealing details (joints, seams, penetrations).
- Confirm that the continuous air barrier is specified.
- Details of roof ventilation and moisture control.
- Design specifications of air supplied to the conditioned attic.

Field Inspection:

This section provides details for inspecting to the specific provisions for construction of unvented attics or enclosed unvented rafter assemblies, roof insulation, ventilation, and moisture controls where one or more specific types of inspection called for by the IECC or IRC [illegible] necessary to confirm compliance. Framing and rough-in would be the typical type of inspection performed. (Bullet items underscored and highlighted in red are based on the new provisions for the 2018 IRC.)

Per the ***2015 IECC, Section R104 Inspections***, construction or work for which a permit is required is subject to inspection. Construction or work is to remain accessible and exposed for inspection purposes until approved. Required inspections include footings and the foundation, framing and rough-in work, plumbing rough-in, mechanical rough-in, and final inspection.

Per the ***2015 IRC, Section R109 Inspections***, for onsite construction, from time to time the building official, upon notification from the permit holder or his agent, can make or cause to be made any necessary inspections. Further details are provided for inspections regarding the foundation, plumbing, mechanical, gas and electrical, floodplain, frame and masonry, and the final inspection. Any additional inspections are at the discretion of the building official.

Inspections should provide verification with the following items if specifed and approved on the contruction documents and per manufacturer specifications and installation:

- Verify that joints, seams, holes, and penetrations are caulked, gasketed, weather-stripped, or otherwise sealed (assemblies part of the *building thermal envelope*).
- Ensure that the appearance of the insulation, as appropriate, in the field matches what is on the approved construction documents.
- If the R-value or U-factor approach for compliance was used in the documentation, ensure that the insulation installed meets the minimum R-value(s) specified for the assembly per climate zone based upon the approved construction documents.
- Confirm that the continuous air barrier is properly installed.
- Where preformed insulation board is used as the *air-impermeable insulation* layer, confirm that it is sealed at the perimeter of each individual sheet interior surface to form a continuous layer.
- Confirm that the *vapor diffusion port*(s) are installed per the approved construction documents.
- Confirm that the moisture barrier material used for the *vapor diffusion port*(s) is the same material specified on the approved construction documents.
- Confirm that [illegible] applied to the conditioned attic meets the approved construction documents.

Technical Validation(s):

This section provides additional related information and references to materials that are applicable to the provision.

- *2015 [illegible] Energy Conservation Code*

  Author(s): ICC

  Organization(s): ICC

  Publication Date: May 2014

  This code establishes a baseline for energy efficiency by setting performance standards for the building envelope (defined as the boundary that separates heated/cooled air from unconditioned, outside air), mechanical systems, lighting systems, and service water heating systems in homes and commercial businesses.

- *2015 IRC—International Residential Code for One- and Two-Family Dwellings*

  Author(s): ICC

  Organization(s): ICC

  Publication Date: May 2014

  This code for residential buildings creates minimum regulations for one- and two-family dwellings of three stories or less. It brings together all building, plumbing, mechanical, fuel gas, energy, and electrical provisions for one- and two-family residences.

Additional Resources

Building America Website:

- Program information
- Top Innovations
- Climate-specific case studies
- *Building America Update* newsletter
- Building America Solution Center
- Publications Library
- Newsletter
  - Subscribe to notices about webinars and other news at: http://energy.gov/eere/buildings/subscribe-building-America-updates

www.buildingamerica.gov

PDF of the presentation of this webinar available at:
http://energy.gov/eere/buildings/building-america-meetings#current

Additional Resources

Building America Solution Center
https://basc.energy.gov

Code Compliance Brief
- Controlling Moisture in Unvented Attics

https://basc.pnnl.gov/code-compliance/controlling-moisture-unvented-attics-code-compliance-brief

Building Science Corporation
- Venting Vapor

https://buildingscience.com/documents/insights/bsi-088-venting-vapor