



Insulation Requirements for Vaulted Ceilings

This pamphlet is one in a series that describes residential energy conservation requirements of the Oregon Residential Specialty Code and Structural Specialty Code. Other pamphlets in this series may be downloaded from Oregon Department of Energy web site at <http://egov.oregon.gov/ENERGY/CONS/Codes/cdpub.shtm> or local building departments or from Oregon Building Codes Division.

Prescriptive requirements for vaulted ceiling insulation

Any ceiling is considered a vault when the ceiling slope is 2/12 or greater. Table N1101.1(1), Prescriptive Envelope Requirements, list required R-value for vaulted ceilings within standard wood frame construction. The Standard Base Case vaulted ceiling insulation R-value is R-38. The U-factor of 0.042 is representative of R-38 insulation installed within a standard scissors truss. A 10-inch deep wood rafter vaulted ceiling with R-30 insulation is U-0.033 and complies with this requirement and is classified as an R-30A (Advanced Framing). Other additional measure packages may require R-30A insulation.

Vaulted ceiling area is restricted. Vaulted ceiling area may not exceed 50 percent of total heated space floor area. If vaulted ceiling area exceeds 50 percent of the heated floor area, the area in excess of 50 percent must be insulated to U-0.031. Typically the entire vaulted ceiling would be insulated to R-38. Compliance could be demonstrated using Table 1104.1(1) thermal performance calculations. To determine vault area, multiply vault length by its width, measured along the slope to the ridge.

To provide design flexibility, footnote f to Table 1101.1(1) indicates ceilings that have attic/rafter depth such as dormers, bay windows, and similar architectural

features may have insulation reduced to R-21, as long as total area for all vaults in the residence does not exceed 150 square feet.

The code specifies required R-values, not products. Any insulation product or combination of insulation products that meets the installed R-value requirement at nominal thickness is acceptable.

Section drawings or written specifications that accompany the plans must identify vault insulation R-value.

R-30 vaulted ceiling insulation options

Faced batts or unfaced batts (incorporating a vapor retarder paint on the surface) are typically used to insulate single rafter vaults. Loose fill may be used in vaults with attic space above (scissors truss) where the roof pitch is 4/12 or greater and there is at least 44 inches of headroom at the ridge. Loose fill is not recommended when the slope of the interior ceiling exceeds 3/12 because loose fill tends to slip down the slope towards the eaves.

High density R-30 batts are available approximately 8-1/2 inches thick. They allow for R-30 insulation and ventilation in 2x10 framing. Standard density R-30 batts are 9-1/2 inches thick. They completely fill a 2x10 cavity. To get ventilation in the same cavity with a standard R-30 batt, 2x12 framing lumber is needed.

Most 10-1/4 inch thick foam core panels meet or exceed the U-0.42 vault requirement.

In conjunction with the appropriate roofing material, air impermeable spray-on insulation may be used in vaulted ceilings. A vapor retarder is still required unless the installed material has a perm rating of 1.0 or less at installed thickness.



Figure 1:
Vault insulation examples

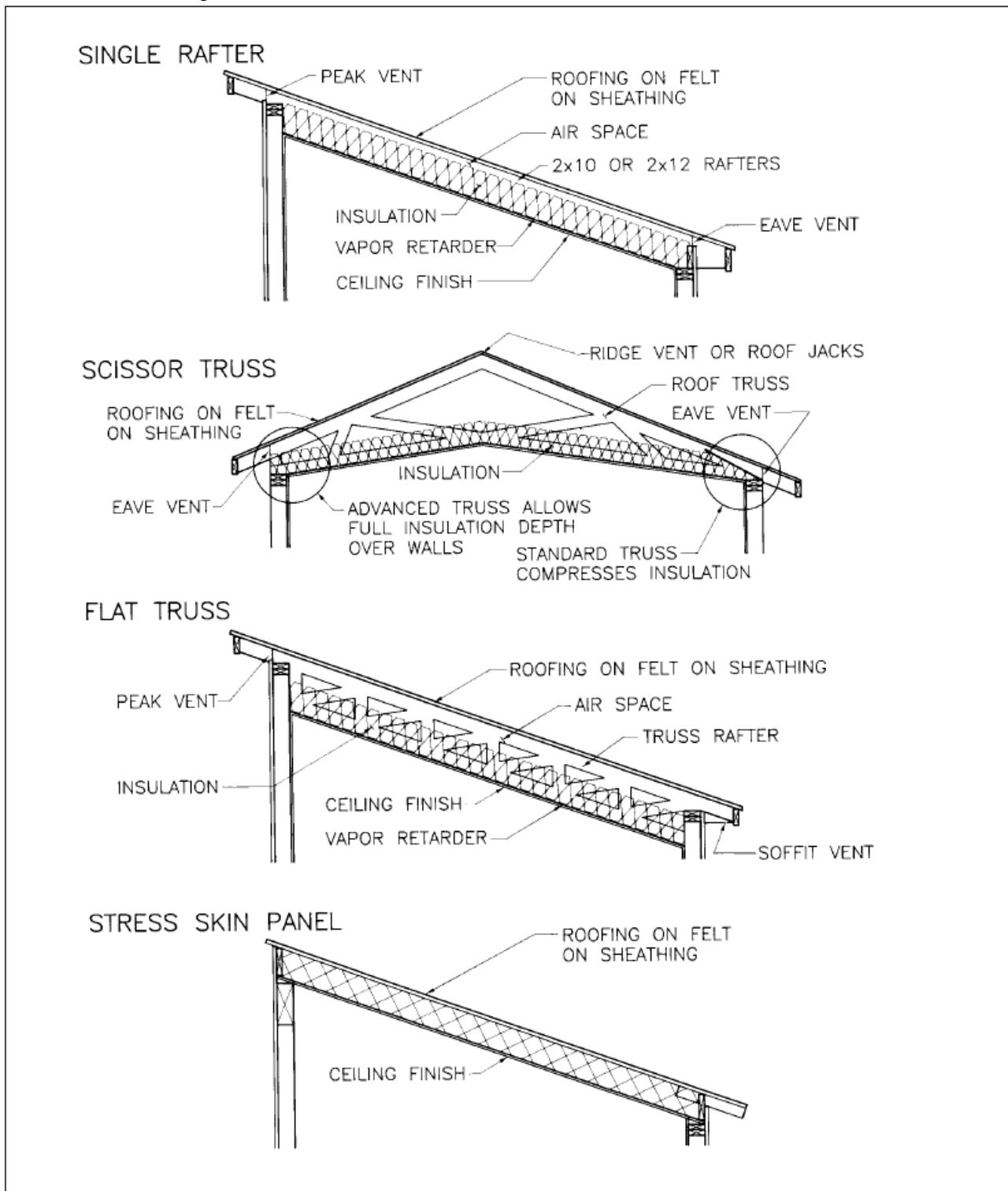


Figure 2:
Vault ventilation details

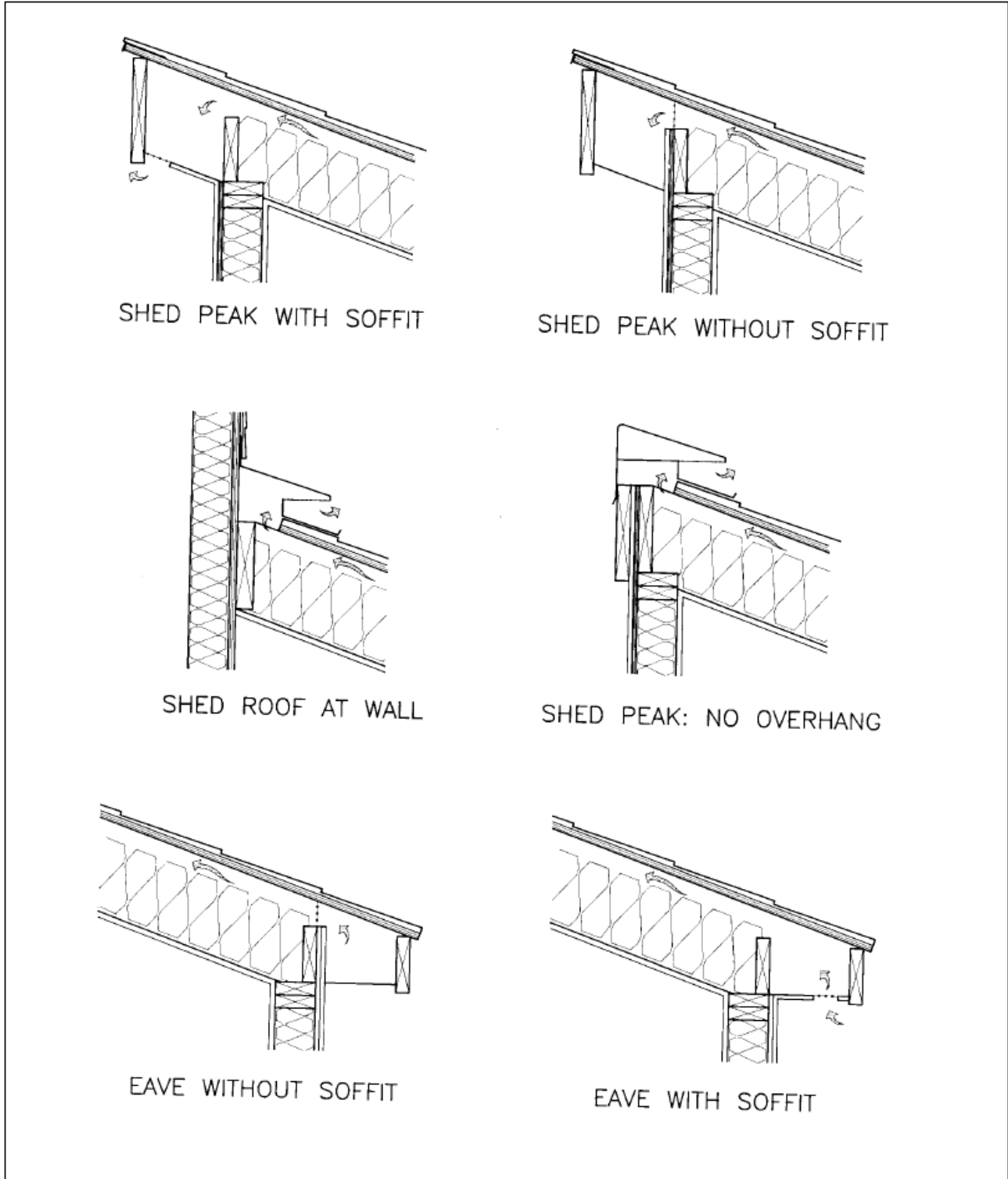
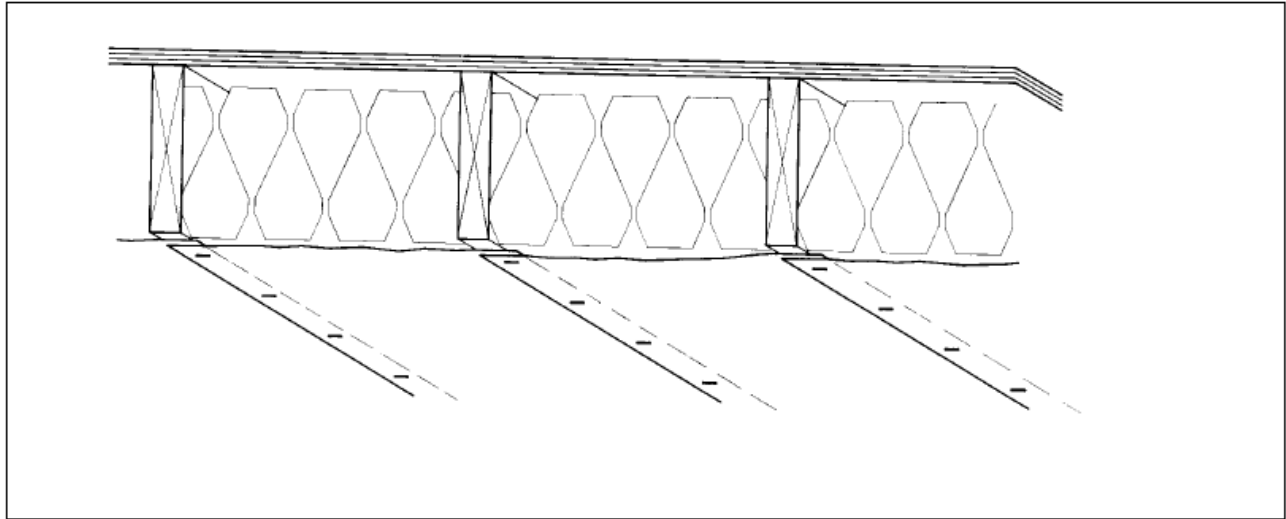


Figure 3:
Face stapling at vaults



U-0.031 vaulted ceiling insulation

One way to obtain U-0.031 in vaults is to provide advance frame scissors truss (raise heel or cantilevered) framing. Advanced scissors trusses can generally meet the 44-inch headroom requirement and allow plenty of room for insulation and ventilation. When this framing is used with ceiling slopes of 3/12 or less, loose fill insulation is typically used.

High density R-38 batts approximately 10 inches thick may be installed in 2x12 vaults, leaving space for ventilation above the batt.

Most 10-1/4-inch thick foam core panels meet the U-0.031 requirement.

Ventilation of vaulted ceilings

When vaulted ceiling ventilation is required per Oregon Structural or Residential Specialty Codes ventilation for enclosed attics or rafters may be required. The 1/150 rule for flat ceilings also applies to vaults: 1 square foot of net free vent area is required for each 150 square feet of vaulted area. If half the vent area is located high, at the ridge, and half is located low, at the eaves, the

vent to ceiling ratio may be reduced to 1/300. Some jurisdictions only allow high/low venting in single rafter vaults.

Figure 2 shows vault ventilation details. Section drawings or written specifications that accompany the plans must show vault ventilation details.

Vapor retarders in vaulted ceilings

In ceilings with attic spaces above them, such as scissors truss ceilings, no vapor barrier is required. Attic spaces are defined as spaces with at least 44-inches of clear headroom at the roof ridge.

When vaults have no ventilated attic space above, a 1.0 perm vapor retarder is required. It helps protect the vault from moisture sources inside the home. A *best practice* for maintaining integrity of the vapor retarder is to lap and staple flanges of foil-faced insulation at the ceiling framing members. Section drawings or written specifications that accompany the plans must identify the 1.0 perm vapor retarder.

Recessed light restrictions in vaults

To avoid fire hazards and to minimize moisture penetration and heat loss into vaulted areas, only *AIRTIGHT* “IC-rated” (insulation cover) recessed lights are allowed in vaults. For more information, see the pamphlet *Recessed Lights and the Oregon Residential Energy Code*.

Information presented in this publication supports the Oregon Residential Specialty Code. This publication does not include all code requirements. Refer to the code and check with your code official for additional requirements. If information in this publication conflicts with code or your local officials, follow requirements of code and your local officials.

For more information about the residential energy code, call the Building Codes Division at (503) 378-4133 or the Oregon Dept of Energy (503) 378-4040 in Salem or toll-free, 1-800-221-8035.

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