



# Wall Insulation

*This pamphlet is one in a series that describes residential energy conservation requirements of the Oregon Residential Specialty Code and the Structural Specialty Code for Group R buildings three stories and less in height. Other pamphlets in this series may be obtained from Oregon Dept of Energy at [www.oregon.gov/energy/](http://www.oregon.gov/energy/) or local building departments or from Oregon Building Codes Division.*

## Prescriptive wall insulation requirements

Wall insulation for Prescriptive Path 1 in Table N1104.1(1), is R-21. Wall insulation options in other prescriptive paths range from R-15 to R-24.

In some Table N1104.1(1) prescriptive paths, required wall insulation R-values are followed by an "A." The "A" indicates that advanced wall framing is required. Otherwise, standard wall framing is allowed. Consult pamphlet *Advanced Framing for Walls and Ceilings* for advanced framing definitions and requirements.

The energy code specifies required R-values, not products. Any insulation product or combination of products that meets the installed R-value requirement is acceptable. If a prescriptive path is used for code compliance, only R- and U-factors in that prescriptive path may be used. R- and U-factors in one path may not be mixed with R- and U-factors in other paths. R- and U-factor standards may be exceeded.

Minimum wall insulation is R-15. R-11 no longer meets code minimum component requirements. Section drawings or written specifications that accompany the plans must identify wall insulation R-value.

## R-21 Wall Options

R-21 high-density batts are 5-1/2 inches thick. They fit into a 2x6 frame without being compressed. Standard density R-19 batts are 6-1/4 inch thick. They must be compressed into 2x6 framing. Compression reduces insulation R-value. R-21 is available in faced and unfaced batts. See the pamphlet *R-Value Codes for Unfaced Batt Insulation* for help identifying R-values of unfaced products.

R-21 can also be achieved by other means. Blown-in batt systems can achieve R-21 in a 2x6 frame. Blown-in batt systems combine loose fill insulation and an adhesive. Insulation is retained by netting that is stretched and stapled over the face of the wall studs. The adhesive sets up and prevents loose fill from sagging over time. 6-1/2 inch foam core panels also meet or exceed the R-21 standard.

Combinations of batts and foam board panels can achieve R-21 or better. A conventional R-21 wall assembly has a U-factor of 0.060. Any wall assembly with a U-factor of 0.060 or less is acceptable. Consult the default U-factor table in the pamphlet *How to Do Residential Thermal Performance Calculations Using Table N1104.1(2)* for approved U-factors. For example, an R-13 conventional frame wall with an R-5 insulation sheathing has a U-factor of 0.058. An R-19 advanced frame wall is also considered equivalent to the R-21 standard.

Foam board systems achieve their equivalent efficiency by providing a thermal break to heat loss through the building frame. Advanced framing reduces heat loss through the frame by eliminating all but structural lumber and by insulating headers, corners, and partition intersections.

R-11 batts plus one inch of polyisocyanurate foam (R-7.2 per inch); R-13 batts plus one inch of extruded polystyrene (R-5 per inch); R-15 batts plus one-half inch of polyisocyanurate foam (R-7.2 per inch); or R-19 batts plus one inch of expanded polystyrene foam (3.5 per inch) all meet, exceed, or are considered equivalent to the R-21 standard.

Because of compression, two R-11 batts (full loft equals 7 inches) in a 2x6 cavity (5-1/2 inches) do not meet the required R-21 standard.

Some R-21 walls must have advanced framing. See the pamphlet *Advanced Framing for Walls and Ceilings* for more information.

Drawings that follow illustrate ways of meeting energy code requirements.

### **R-15 wall options**

The R-15 requirement is most easily met by using a high-density R-15 fiberglass batt. The high-density R-15 batt fits in a 2x4 wall cavity without being compressed. All major insulation manufacturers make this product and distribute it in Oregon. The product comes faced or unfaced. The pamphlet *R-Value Codes for Unfaced Batt Insulation* explains how to determine R-values for unfaced products.

Combinations of batts and rigid foam boards could also be used to achieve R-15. A 2x4, R-11 wall with one-half inch of polyisocyanurate (R-7.2 per inch) foam board meets this requirement. A 2x6 frame with R-19 insulation meets (actually exceeds) the R-15 requirement. A 5-1/2 inch blown-in-batt in a 2x6 wall meets or exceeds the R-15 requirement. Foam core panels commonly meet or exceed R-15.

Some R-15 walls must be advanced framed. See the pamphlet *Advanced Framing for Walls and Ceilings* for details.

### **R-24A wall options**

R-24A walls are most commonly constructed using a combination of batts and rigid foam board insulation. An R-21 batt with one inch of R-5 extruded polystyrene foam board insulation meets this requirement. An R-19 batt with one inch of polyisocyanurate foam (R-7.2 per inch) meets or exceeds this requirement.

### **Log walls**

Log homes built to Prescriptive Path 9 are required to have solid log or timber walls at least 3-1/2 inches thick. Log homes complying with energy code using Table N1104.1(2) Thermal Performance Calculations must also be compared to an R-21 wall standard. If conventional wood framed walls are incorporated, they must be insulated to R-21.

### **Walls separating heated from unheated spaces**

When people think wall insulation, they usually focus on walls at the building perimeter. However, walls away from the perimeter may also divide heated from unheated space and thus require insulation.

A common example is the wall between the heated house and unheated garage. Rooms with vaulted ceilings may have high walls that divide heated space from unheated attics. Sidewalls in skylight wells divide heated from unheated space. Pony walls may divide rooms from unheated attics or crawl spaces. Tri-level homes may have walls that divide heated spaces from attics or crawl spaces. Stairwell walls may divide a heated stair from an unheated garage or basement.

All walls that separate heated from unheated space must meet exterior wall R-value requirements.

### **Insulation installation**

Code requires insulation to be installed flush to the inside (warm) surface of the wall, in so far as practical. Face stapling is not required but is preferred. The intent of code is to avoid unnecessary compression during installation. When insulation achieves full loft in the stud cavity, it blocks air paths around the batt that could reduce its effectiveness. Voids, short cuts, crammed-in long cuts and gaps in the insulation job also reduce effective R-value. Splitting batts around wiring and plumbing and cutting in batts around outlet boxes reduce compression within insulated cavities.

Figure 1  
R-21 Wall insulation examples

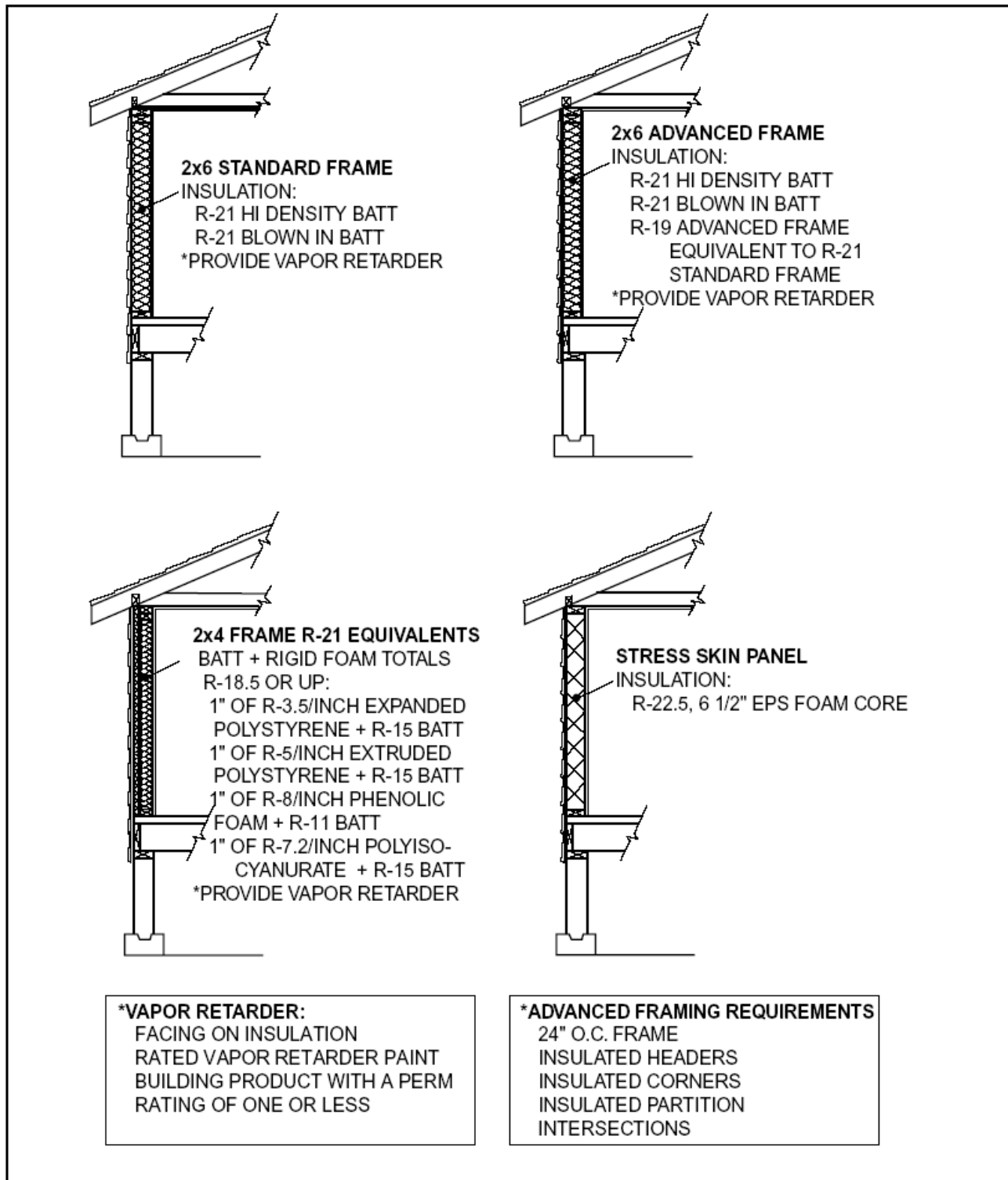


Figure 2  
R-15 Wall insulation examples

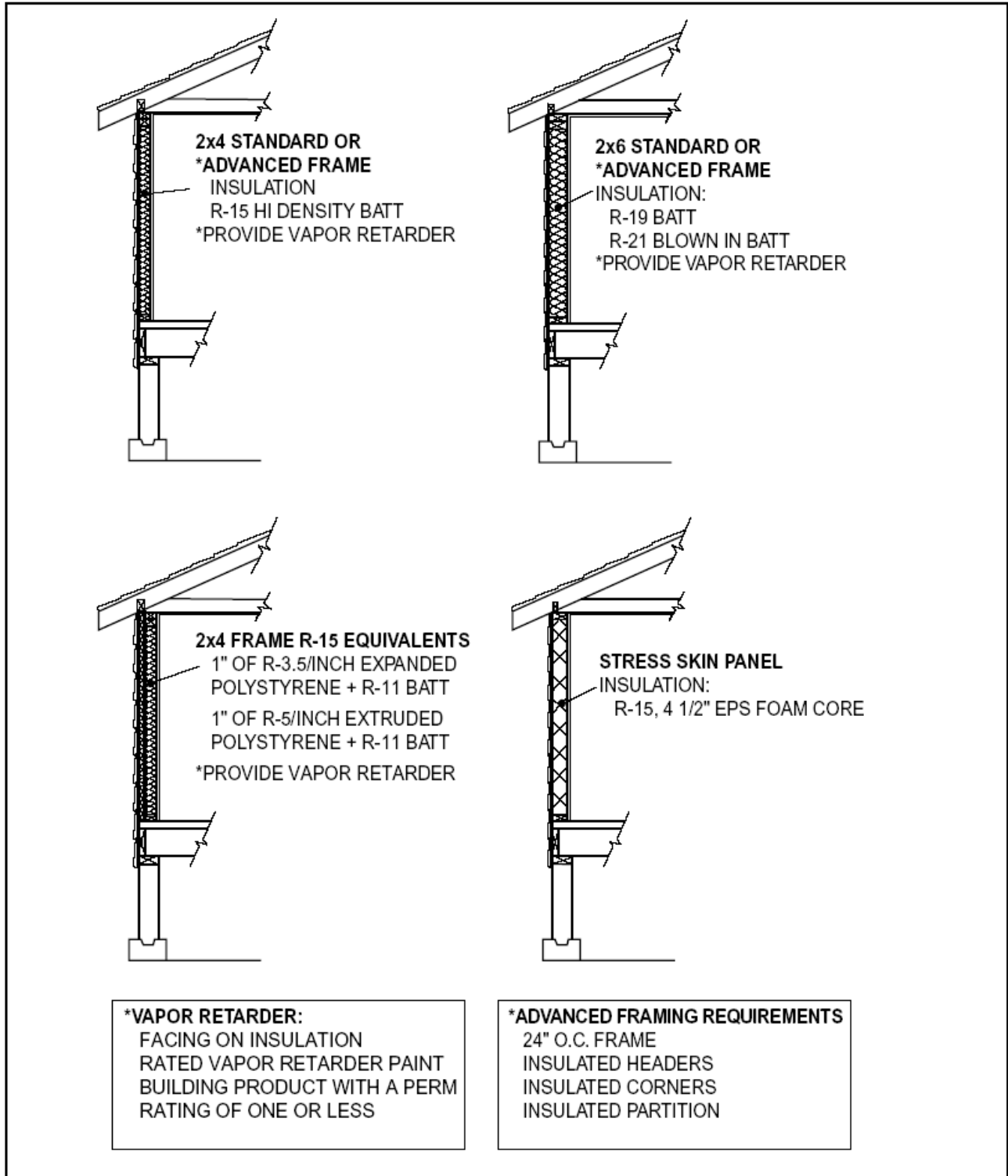
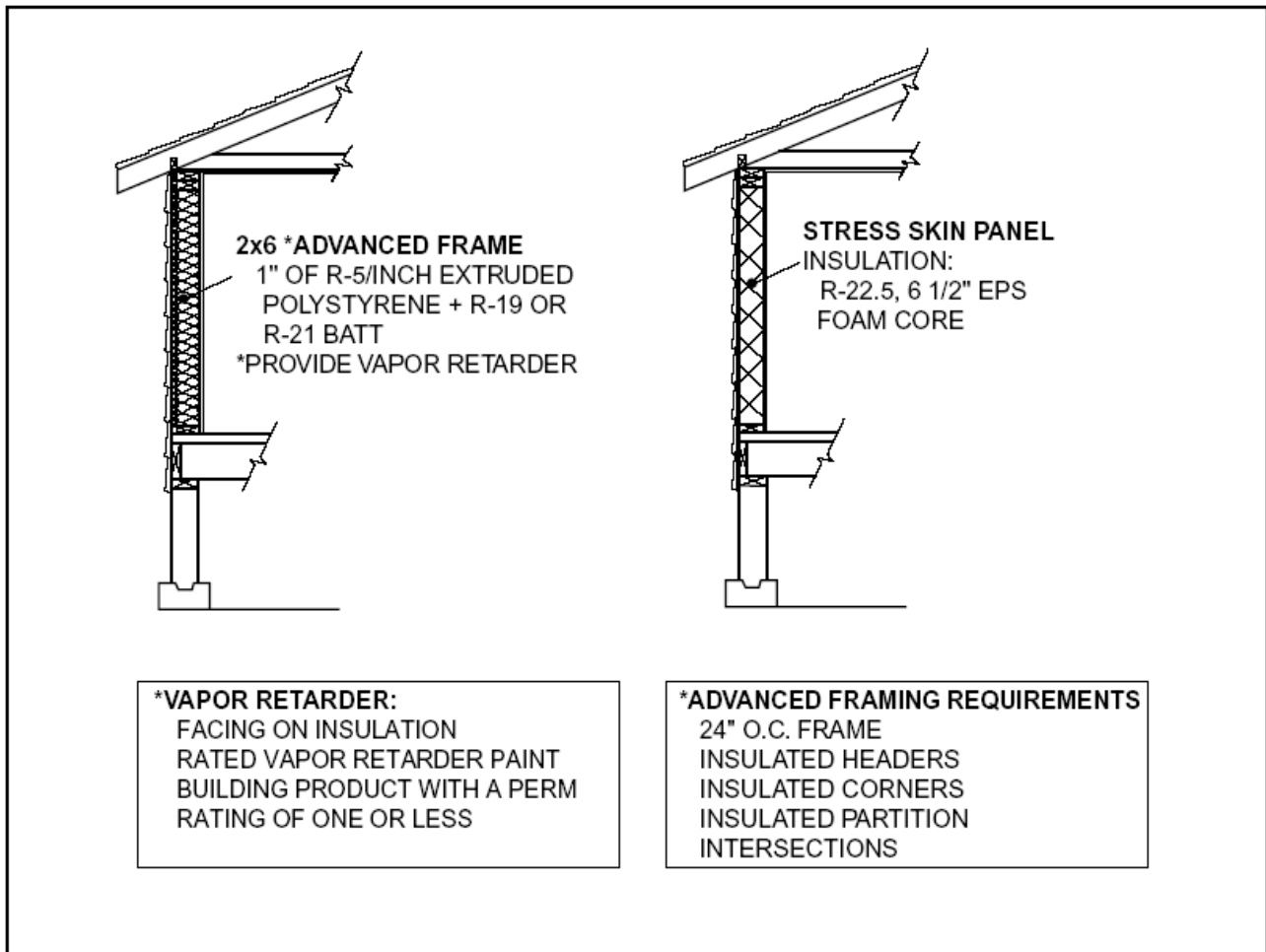


Figure 3

**R-24A Wall insulation examples**



**Wall vapor retarders**

To protect insulation from interior moisture, a one perm (or less) vapor retarder must be installed on the warm side of insulation. Facing on faced batts meets this requirement. When unfaced or blown-in-batts are used, an independent vapor retarder must be installed. Rated wall coverings such as vapor retarder paint/primer may be used to finish drywall and provide the vapor retarder.

See the pamphlet *Moisture Control Measures in the Oregon Residential Energy Code* for a list of perm ratings for common building materials.

Specify the type of wall vapor retarder on the blueprint section drawing or in written specifications attached to plans.

Information presented in this publication supports the Oregon Residential Specialty Code, or Chapter 13 of the Oregon Structural 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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