



# Wall Insulation

*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 wall insulation requirements

Wall performance requirement for the Standard Base Case in Table N1101.1(1), is U-0.060. This translates to R-21 insulation installed in a standard wood frame wall.

When code specifies required R-value it is for the insulation only. Any insulation product or combination of products that meets the installed R-value requirement is acceptable.

Minimum wall insulation that can be installed is R-15 (U-0.080). Residential thermal performance calculations are required to use less than R-21 (U-0.060) wall. This procedure is described in the pamphlet *How to Do Residential Thermal Performance Calculations Using Table N1104.1(1)*. 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 sometimes incorporating 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 structural, insulated, 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 wood framed R-21 wall assembly has a U-factor of 0.060. Any wall assembly with an overall 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(1)* 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, which complies with the U-factor requirement. An R-19 advanced frame wall is also considered equivalent to the R-21 requirement.

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.

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

Advanced framing can save resources (money) as well as energy and are considered a *best practice*. See the pamphlet *Advanced Framing for Walls and Ceilings* for more information.

Drawings that follow illustrate ways of meeting energy code requirements.



### U-0.047 (R-24) wall options

U-0.047 wood framed walls are commonly constructed using a combination of batts and rigid foam board insulation such as R-19 batt with one inch of continuous R-5 extruded polystyrene foam board insulation.

Other innovative wall construction methods such as certain Structural Insulated Panels (SIPs) and Insulated Concrete Forms (ICF) are construction methods to achieve U-0.047.

### Log walls

Log homes built to that case 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(1) Thermal Performance Calculations must also be compared to an R-21 wall standard. If conventional wood framed walls are incorporated into the log home, such as gable-end walls, they must be insulated to R-21 or an equivalent to U-0.060 for other types of construction.

### 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 wall, in so far as practical. Face stapling is not required but is preferred and considered a *best practice*. 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 and voids within insulated cavities.

### 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.

Figure 1  
R-21 Wall insulation examples

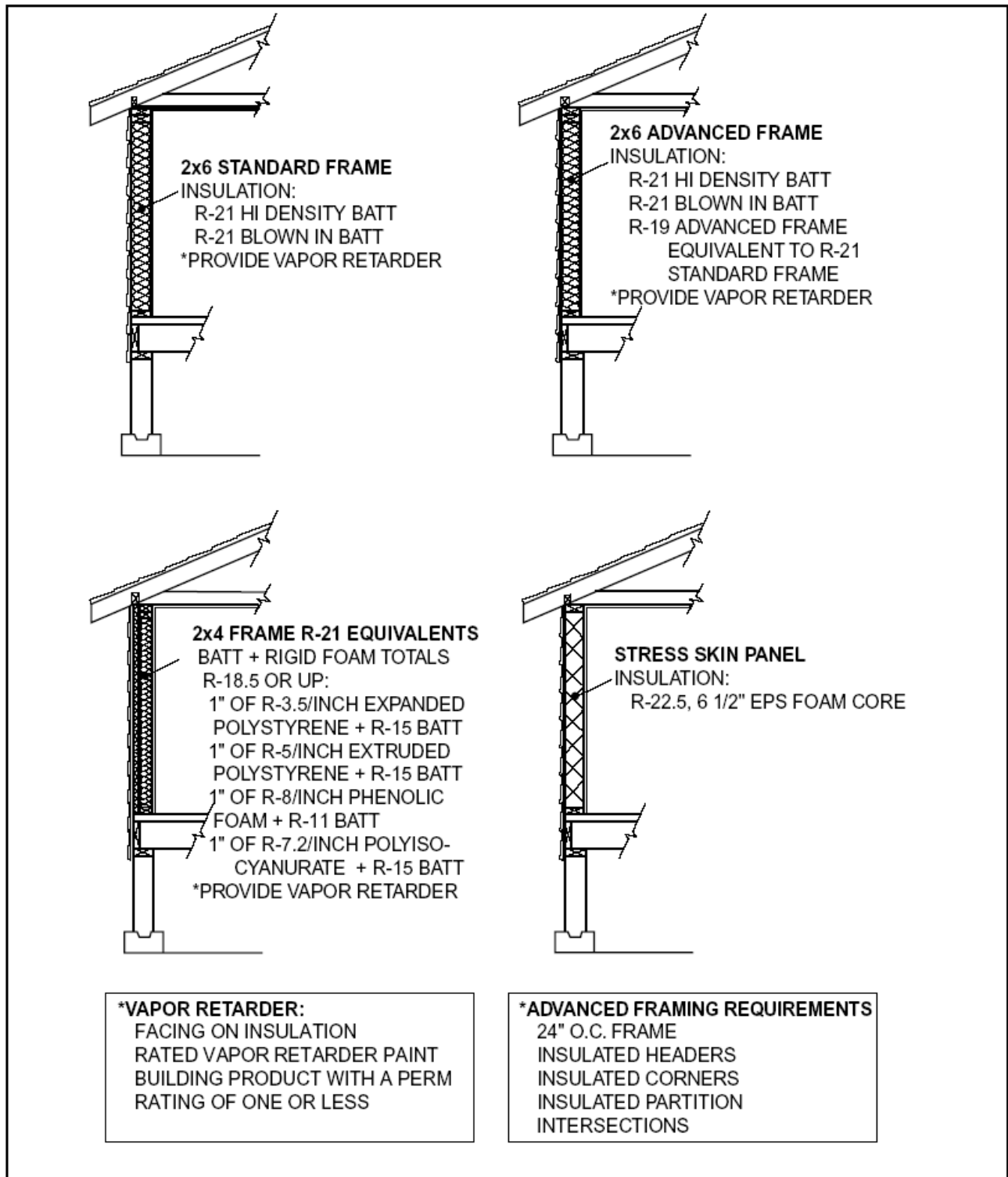
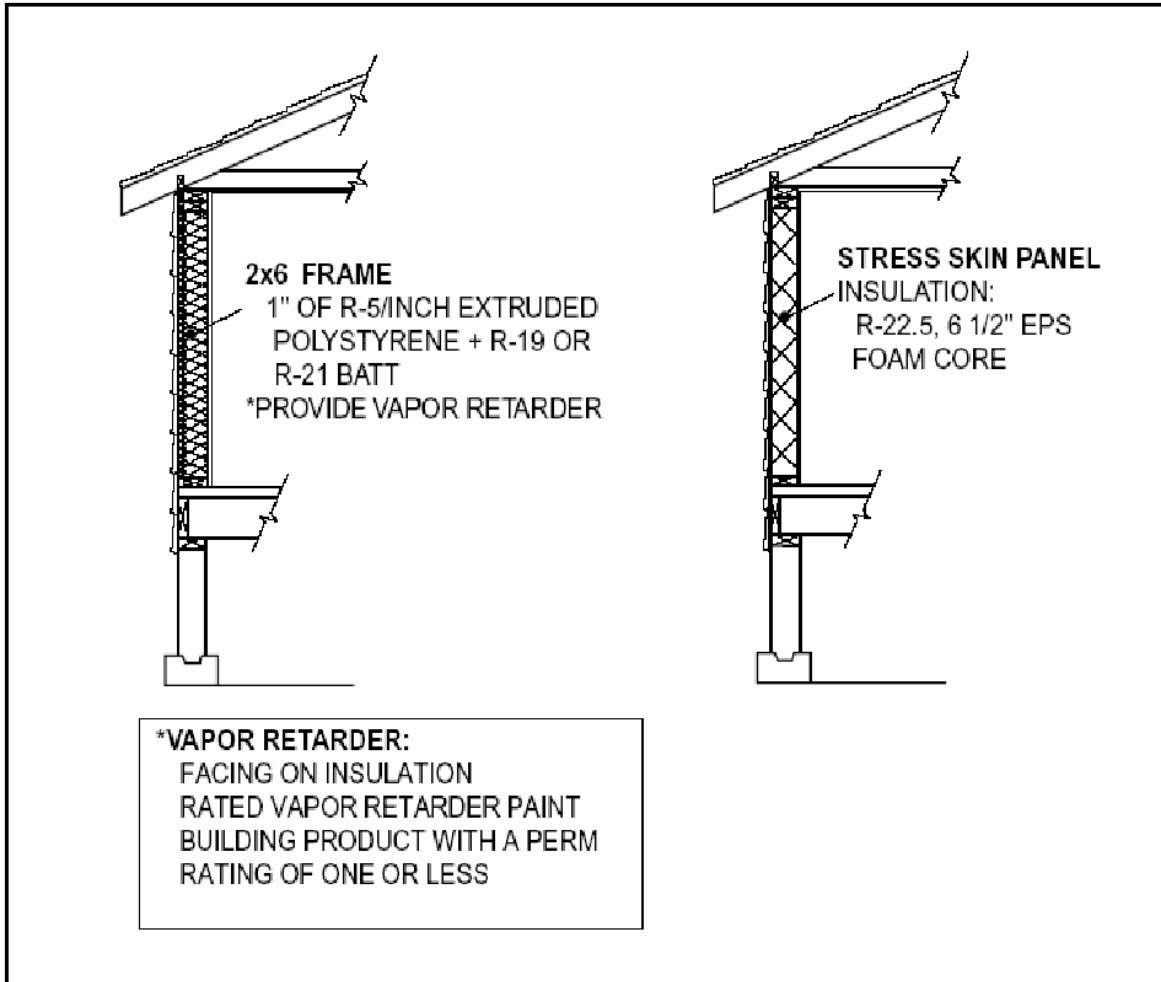


Figure 2  
U-0.047 Wall insulation examples



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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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