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Insulation Value of Log Versus Frame Wall

Insulation is very important in reducing heating costs and improving the comfort level of either a log or frame home. The theoretical insulation value of a 2×4 stud wall is based on the insulated portion between the studs, which has a theoretical R-value of 13.1, excluding framing members. Unfortunately, the theoretical insulation R-value selected for frame walls has resulted in the inadvertent misrepresentation of the insulation value of log walls. For instance, it has been advertised that it takes a 12-inch log to equal the insulation value of 3½ inches of fiberglass. This statement is partially true when comparing the 12-inch log with only the fiberglass. On the other hand, the statement is false when including the framing members, as a 2×4 stud wall insulated with 3½ inches of fiberglass may only have an average R-value of 10.2 or less, depending on the spacing of the studs. A 4×8-foot paneled wall may have a R-value of 9.6 or lower, depending on the spacing of the framing.

A 6-inch three-sided log wall has an R-value of 8.35, which is equivalent to a 2×4 stud wall insulated with 3½ inches of fiberglass with a close (4 inches or less) stud spacing, excluding window heat loss. An 8-inch milled log has an R-value of 9.2, which is equivalent to a 2×4 paneled stud wall insulated with 3½ inches of fiberglass at a 4-inch stud spacing. A 10-inch milled log has an R-value of 10.7 which is equivalent to a 2×4 stud wall with 3½ inches of fiberglass with an 8-inch stud spacing. Natural logs are tapered so the insulation value should be based on the average thickness. A 16-inch top diameter log would have a R-value in excess of 16.7, which is equivalent to a 2×6 stud wall insulated with 6 inches of fiberglass, if studs are about 10 inches on center.

People building log homes often select logs as a means of reducing construction costs. As a result, more judicious use of windows is made in an effort to reduce overall building and heating costs. Windows may account for 22 to 54 percent of the wall cost, depending on the number and sizes selected, especially in the case of log homes.

Window areas in homes vary widely. For instance, in a 24×32-foot log house, window areas as low as 60 square feet may be selected, which amounts to 7.9 percent of the floor area. In a typical low-cost frame house, 107 to 137 square feet of window area may be selected, amounting to 13.9 to 17.8 percent of the floor area. In a more expensive home, as much as 230 square feet of windows may be used which amounts to 29.9 percent of the floor area.

It becomes apparent in studying heat loss of walls that large window areas can nullify any advantages of the better insulation properties of larger diameter logs or thicker applications of fiberglass. For instance, an 16-inch log wall with 230 square feet of window would have a heat loss of 129 Btu/H/°F (British thermal units per hour per degree Fahrenheit) for an average R-value of 6.9. This is nearly as great as for a 6-inch three-sided log house with 60 square feet of windows, resulting in a total wall heat loss of 133 Btu/H/°F for an average R-value of 6.7. A log house with 8-inch milled logs and 60 square feet of windows would have a total heat loss of 118 Btu/H/°F for an average R-value of 7.6. A 10-inch diameter log wall with 107 square feet of windows would have a total heat loss of 122 Btu/H/°F for an average R-value of 8.2. A 16-inch diameter log with 230 square feet of windows would have a heat loss of 129 Btu/H/°F for an average R-value of 6.9.

An astute home builder or buyer should analyze the heat loss of all exposed floor, wall and ceiling areas. The heat loss through foundations and floors of the crawl space or basement may even exceed the heat loss through the walls and other exposed surfaces, which can easily nullify advantages of larger logs or placing thicker fiberglass insulation in the walls.

Related UAF Cooperative Extension Service Publications

"Windows," HCM-04458

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