...T LOSS AND INSULATION VALUE OF WALL

...rsity of Alaska USDA and SEA Grant Cooperating.

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A considerable amount of heat is lost through the wall section of frame buildings where studs are located. In the past, in temperate climates, the effect of the studs was neglected in calculating heat loss and only the insulated portion of the wall was considered. But depending on the size of the wall (2 X 4', 2' X 6', etc.) and the spacing of the studs, the heat loss through framing can vary from 33 percent to 49 percent of the total. Some of these calculated values are shown in Table 1. These calculations are based on a typical section of wall, 8' X 8' in area, to provide a comparison of the effects the studs have on the heat loss through a wall. The comparison of different stud spacing for a 2'x 4' stud wall is given in Table 1. along with the percentage of total heat loss to the studs. The effect is quite significant, From this example calculation in Table 1., the reader can observe that as much as 44 percent of a wall's heat loss can be through the studs. This results in some common problems with buildings in cold climate areas.

Condensation is a very common problem in cold climate areas. It often occurs on windows, at cold corners or at the top or bottom of a wall, and on sheet rock nail heads. This is because the nail shank penetrates the framing members and cools more rapidly than the adjacent sheet rock. The tip of the shank is exposed to lower temperature (and greater temperature difference) within the stud. With an outside temperature of minus 40 F and an indoor temperature of 70 F it is estimated that a 1 1/2 inch nail would have a temperature of 54.8 F., while the surface of the sheet rock would be 58.7 F. Condensation on the nail head would occur at relative humilities greater than 50 percent.

Condensation of soot often becomes visible as painted surfaces darken over framing members because the framing members are cooler than adjacent insulated surfaces. The insulated portion of the wall between the studs (R = 13.1) would have an interior surface temperature of 64 F. The sheet rock directly over the framing members (R = 6.6) would have a surface temperature of 58.7 F., such that condensation would occur at around 66 percent relative humidity.

In order to minimize the staining of nail heads and soiling of painted surfaces due to temperature differentials, it is suggested that exposed walls be framed (in new construction) with either 2' X 4" (or better 2" X 6") studs, 24 inches on center.

In addition, the wall should be insulated with fiberglass batts and a 11/2 or two inch foil-faced phenol insulating sheet should be placed on the inside of the wall. This has several advantages 1.) It utilizes the vapor barrier properties of the foil-faced insulation on the warm side of the wall. 2.) It will completely cover the studs and shield them from direct contact to the inside of the wall, adding a rated value of R-16 (commercial rating information) to the all insulation. In the case of a 2" X 4" wall with 3 1/2 inches of fiberglass and studs 16 inches on center, this would result in a wall an R- value of 25.35 instead of and average R-value of 9.35.

The installation of 4' X 8" sheets of insulation are followed by a 6-mi vapor barrier and cross-hatch of 2" X 3" (or 2" X4" nailer onto which the sheet rock is screwed. The nailers are screwed directly through the insulation with long screws. (See Figure 1.)

It is suggested that all electrical runs be made in the nailer space to prevent perforating the vapor barrier. The nailer should not be set over the plates.

Wall types with 2' X6" stud base yields a finished wall R-value of approximately 36. While this type wall may have some disadvantages- mainly the slight decrease in interior space and the nailing difficulties- at present it is a top contender for the most efficient home wall both thermally and economically.

SS THROUGH A STUD WALL

Stud Spacing	AT LOSS THROUGH STUDS BTU-HR- F	Percent of total	THROUGH INSULATED SECTIONS BTU-HR- F	Percent of total	TOTALS BTU-HR- F	Average R-value
(2)	---	---	4.89	100%	4.89	13.1
24 inch o.c.	2.03	32%	4.37	68%	6.40	10.0
16 inches o.c.	2.61	38%	4.23	62%	6.83	9.35
12 inches o.c.	3.17	44%	4.08	56%	7.25	8.82

1. The example section is a 2' X 4" stud wall, with 3 1/2 inches of fiber glass insulation (R11), 1/2 inch gypsum dry wall and 5/8 inch plywood sheathing on the exterior , 64 square feet in area.

*2 This is an example showing the wall heat loss if studs are not present.

Figure 1.

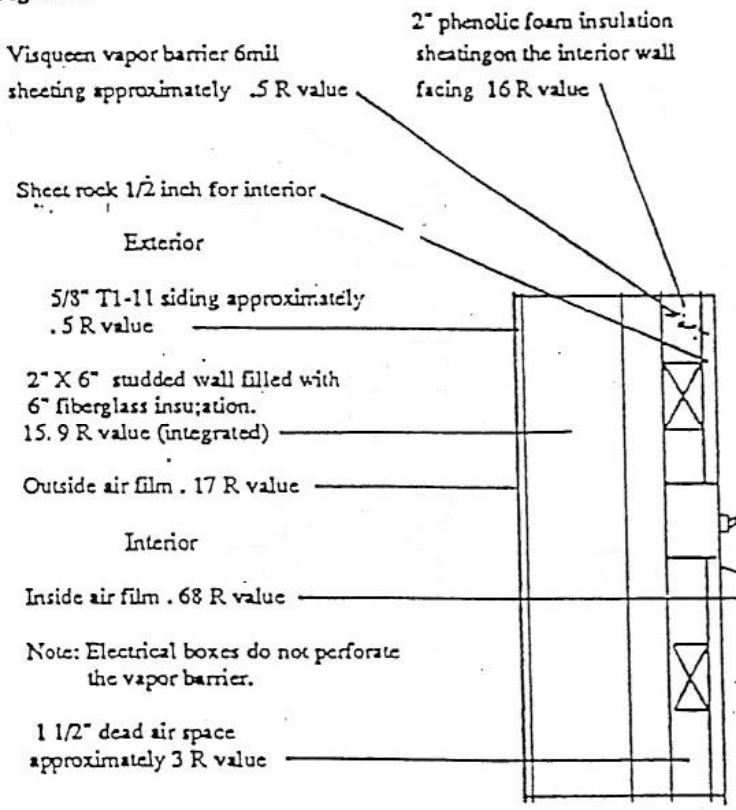
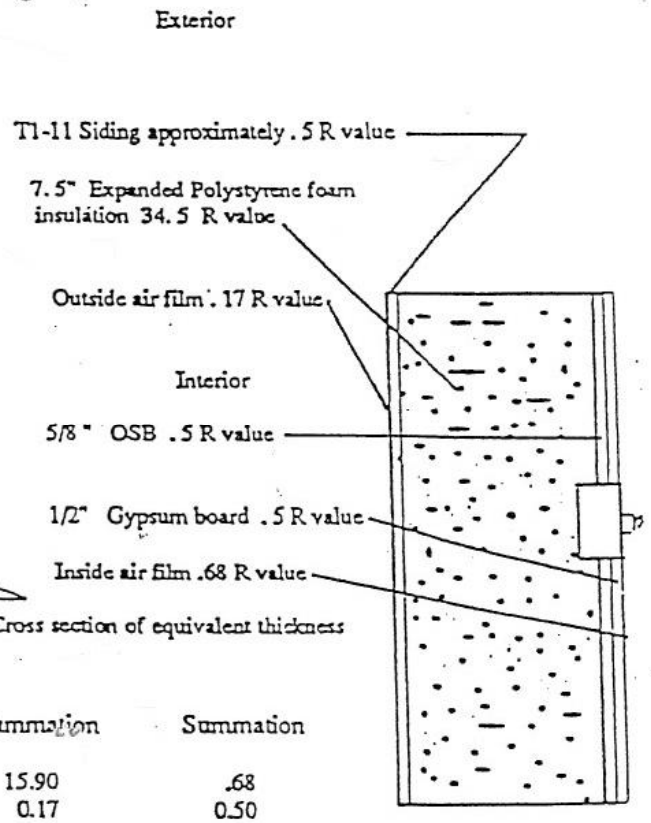


Figure 2.



Summation	Summation
15.90	.68
0.17	0.50
0.50	.57
3.00	34.50
16.00	.17
.68	.50
36.25	36.92

ThermaSAVE

The ThermaSAVE wall system creates in "one step " the same R value as compared to the labor in intensive 5 step 2" X 6" stud wall