



Control Air Leakage Through Frame Walls

STYROFOAM* brand insulation in frame wall sheathing applications

Proven Air Retarder Performance in Residential Construction

When considering residential wall systems, it's obvious that not all walls are created equal. For example, when evaluating thermal performance, insulating sheathings reduce and uniformly control heat loss through a wall better than noninsulating wood-based sheathings, such as plywod, OSB, or fiberboard. Why? Insulating sheathings cover the entire opaque wall and significantly reduce heat loss through areas which have little insulation value. This includes the framing area which typically represents 25% of the total wall area! Wood-based sheathings do little to stop heat loss through these areas. In addition, insulating sheathings help keep the wall warmer than wood sheathings, which reduces the potential for moisture condensing within the wall assembly.



using STYROFOAM brand sheathings than with housewrapped assemblies. This information reinforces previous in-field comparisons which demonstrated that homes with STYROFOAM brand sheathing had less air leakage than comparably constructed homes covered with wood-based sheathings.

But is that all?

No. STYROFOAM* brand sheathings can help limit air leakage through the wall assembly. Laboratory tests performed at ORTECH International demonstrate that typical wood framed wall assemblies sheathed with nontaped/unsealed 4' x 8' STYROFOAM brand Insulation can outperform other wall assemblies which are generally accepted as good air retarding systems. This includes walls featuring housewraps. The test results in the accompanying table clearly show that there is less air leakage in the walls

Why is this important?

Air leakage through the envelope of a typical home results from a variety of normal exposure conditions, such as: wind, air distribution systems, and temperature differences within the home. Controlling air leakage in and out of the structure is important in keeping the home comfortable because it helps eliminate drafts. Also, it is important in managing the overall energy usage of the home required for heating and cooling. Some air movement into the house is desired to maintain acceptable air quality.



But a large volume of air exchanging with the living area (infiltration and exfiltration) will result in significant energy costs to heat or cool the air. Air retarding wall assemblies, such as walls with STYROFOAM brand sheathings, can help control the costs of heating and cooling the exchanged air and keep the home feeling comfortable.

What about wood sheathings?

Wood-based sheathings do not significantly help control the air leakage through a wall assembly. Fiberboard sheathings are relatively permeable to air. Plywood and OSB/waferboard are less permeable through an individual sheet. However, when they are installed on framing according to industry instructions to allow for expansion of the panels (an 1/8" gap at all ends and edges) and because the sheathing will not fit tightly to an irregular surface due to the stiffness, they do not provide an effective exterior air retarder. Because of the poor performance of wood sheathings in controlling air leakage, housewraps are popular as one method to control air leakage with the wood sheathed walls, even though they add considerable cost. Obviously, the housewraps and the wood sheathings do little to improve the thermal resistance through the wall.

TABLE AIR LEAKAGE TEST RESULTS	
Test Assembly Description of sheathings/Coverings	Air Leakage Results at 75 Pascals Pressure (a) (ft. ³ of air/min. · ft. ² of area)
1/2" (nominal) STYROFOAM brand Residential Sheathing (b)	.015
1" (nominal) STYROFOAM brand Tongue and Groove sheathing with tongue and groove edges (b)	.010
7/16" OSB/waferboard sheathing covered on the exterior with housewrap product (b)	.042
7/16" asphalt impregnated fiberboard covered on the exterior with housewrap product (c)	.096

What does this mean?

Investing in STYROFOAM brand sheathings can provide multiple benefits, such as:

- uniformly help control heat loss and heat gain through the entire wall which includes the wood framing area,
- reduce the potential for condensation within the wall assembly, and
- provide an effective method to control the air leakage through the wall.

Result: Walls sheathed with STYROFOAM brand sheathing allowed less air to pass through the walls!

(a) 75 Pascals (0.3 inches of H₂O) is equivalent to pressure resulting from a wind load of approximately 25 mph. Tests on STYROFOAM brand sheathings were run

to over 500 Pascals of pressure and retested at 75 Pascals which showed little impact on leakage results. **A proposed ASTM standard on air retarders currently recommends a maximum air leakage of .06 ft.³/min. · ft.² at 75 Pascals.**

(b) Results from positive and negative pressure tests conducted in accordance with ASTM E283 at ORTECH International. Tests were made on 8' x 8' wood frame test wall with studs 16" o.c. with wall-board on the interior of the frame. An electrical box opening was made through the wallboard and holes were drilled through studs to allow pressure differential across entire sheathing

surface. Four by eight foot sheathing was installed with long dimension vertical with joints between boards over studs. Joints were not taped. Attachment of STYROFOAM brand sheathing was as described in a section on recommended construction practice. Wood sheathing was attached according to building codes recommendations (6" o.c. around edge and 12" o.c. in the field of the board). Waferboard/housewrap result shown in table is for typical fabric installation, with top and bottom horizontal edges unsealed. With top and bottom edges sealed to test assembly, results were .026 ft.³/min. · ft.². Walls were tested without siding/cladding materials which would provide additional attachment support.

(c) Test results are from Canada Mortgage and Housing Corporation, Report No. 5505.1, June 1988. Materials were attached to an 8' x 8' wood frame test wall.

Recommended wall construction practice for controlling air leakage with STYROFOAM brand sheathings

The 4' wide STYROFOAM brand sheathing should be installed with the long dimension vertical and with the vertical edges of the boards securely abutted over the studs. Nails (recommend ring-shank or similar) with 1" diameter washers should be long enough to develop adequate pull-out strength from the wood frame (1" minimum penetration is recommended). With nominal 1" STYROFOAM brand Tongue and Groove sheathing, space the nails at

16" o.c. within the field of the board, 12" o.c. along the top and bottom edge, and 12" o.c. along the vertical edge (offsetting the nails 6" from nails holding the adjacent board edge appears to provide best performance). With nominal 1/2" STYROFOAM brand R-3 Residential Sheathing, space the nails 16" o.c. within the field of the board, 6" o.c. along top and bottom edge, and 6" o.c. along the vertical edge. Install gypsum wallboard on the wood frame interior according to manufacturer's recommendations.

This construction will help control air movement through the opaque wall area. Joints with adjacent materials or building components (such as: window frames, door frames, foundations, ceilings, etc.) must be adequately sealed to limit air leakage through other areas of the building.

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