STYROFOAM

Brick and Block Cavity Walls

"Should I Use STYROFOAM* or Foil-Faced Polyiso?"

Which Insulation?

The above question is often asked by architects and specification writers. With all the widely varying claims by manufacturers regarding R-value, moisture resistance, reflective surfaces, etc., there doesn't seem to be a good way to make an "apples to apples" comparison between the two products. One has a higher literature R-value and can be used with a reflective airspace, but the other has better moisture resistance and a higher compressive strength. When considering a cavity insulation, which property is the most important?

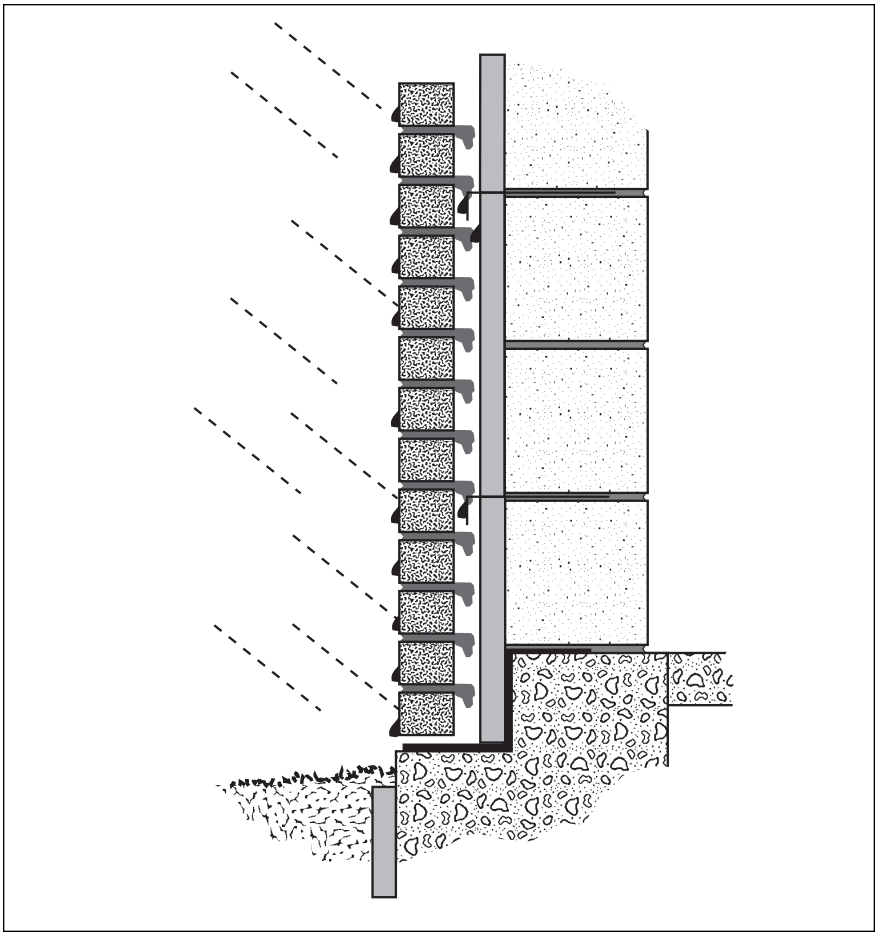
Insulation Must Be Moisture Resistant.

Without a doubt, the most important property of an insulation in a brick/block wall cavity is **moisture resistance**. Why? If the insulation gets wet, it loses R-value and can no longer provide insulating value to the wall. It doesn't matter what its literature or initial R-value is, if it can't resist moisture, it won't maintain its R-value.

Wall Cavity Is a Wet Environment.

Will there be moisture present in the wall cavity? Well, consider the fact that the basic design premise of a brick veneer wall cavity is not to prevent moisture from entering the wall cavity, but rather to accommodate the moisture once it has entered the cavity. As one publication states, these walls are designed so that,

> *"rain water penetrating the facing wythe [brick veneer] of the wall drains into a cavity and can be conducted back to the exterior by suitable flashings and openings."*[1]



Given the fact that moisture will enter the wall cavity, the importance of properly designed flashings and weepholes is well understood. However, equally important is that the materials used in the construction of the wall must be resistant to moisture and corrosion. Bricks must be freeze/thaw resistant, and the flashing materials and brick ties must be corrosion resistant. With all the consideration given to moisture in the design of the cavity wall, **shouldn't equal consideration be given to the moisture resistance of the insulation?** It doesn't make much sense to use an insulation with less that superior moisture resistance, since if it fails, it can't be easily replaced.

STYROFOAM Is Moisture Resistant.

The moisture resistance of STYROFOAM brand insulation **far surpasses** all other types of insulation, including foil-faced polyisocyanurates. STYROFOAM is recommended for severe moisture environments. The following lists a few severe moisture environments in which STYROFOAM has demonstrated a long, successful history:

- Flotation billets for boat docks and swim rafts
- Roof insulation for above membrane use in protected membrane roof systems and plaza decks

*Trademark of The Dow Chemical Company

- Soil insulation for beneath roadways and airport runways
- Pipe insulation for underground water lines
- Foundation insulation for the below grade perimeter of buildings
- Floating pond covers for warm, anerobic waste treatment ponds

In each of these applications, STYROFOAM* is constantly exposed to moisture and freeze/thaw action. Even under these severe conditions, STYROFOAM continues to show excellent long-term performance. In fact, most designers would not consider using foil-faced polyisocyanurates in these applications.

STYROFOAM Approved for Severe Moisture Environments.

The U.S. Army Corps of Engineers Cold Regions Research & Engineering Lab (CRREL) has conducted testing of insulation in protected membrane roofs. It has concluded that due to the severe moisture conditions on these roofs, the only acceptable insulation is extruded polystyrene, such as STYROFOAM brand insulation.[2]

The State of Alaska investigated the use of STYROFOAM brand insulation and polyurethane/ polyisocyanurate foams as insulation beneath roadways and airfields in Alaska. Based on its findings, STYROFOAM has been approved by the Alaskan Department of Transportation for use beneath roadways and airfields. However, due to the "high moisture absorption" of polyurethane/polyisocyanurate foams, these products "are not presently accepted by the Alaska Department of Transportation for use beneath roads or airfields.[3]

Polyiso's Require Protection from Moisture.

Foil-faced polyisocyanurates do not have nearly the moisture resistance of STYROFOAM. Most polyisocyanurate manufacturers require that their products be stored on pallets elevated above the floor or ground and standing water. If the product is stored outside, it should be covered by a waterproof tarpaulin. How can the foam be protected from moisture in a wall cavity?

Another polyisocyanurate manufacturer claims that its product can be used below grade on a foundation wall because the foil facer provides superior protection from water vapor. However, the manufacturer still requires that the bottom edge of the foam be taped as well as all the board joints. Then a protection course, such as fiberboard, is required to prevent damage to the foil during backfilling. Are these same precautions taken in a wall cavity? The American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc. (ASHRAE) also states that deterioration of the foil facer can occur due to contact with wet cement mortar.

Reflective R-Values Virtually Impossible to Achieve.

Another claim made by polyisocyanurate manufacturers is that an additional 2.77 Rs can be achieved by the reflective foil facer in a cavity airspace. The basis for this claim is the 1993 ASHRAE Fundamentals Handbook. ASHRAE does allow an R-value of 2.77 for an airspace with a bright foil facer on one side. An airspace with no foil facer only has an R-value of 0.94 Rs. Therefore, the foil-faced polyisocyanurate has an advantage of 1.83 Rs, right?

Wrong! Have you ever noticed that these airspace R-values are always called "design" R-values. The reason is that reflective R-values are difficult, if not impossible to achieve in real world installations. The following statement regarding reflective airspaces is from the ASHRAE Handbook.

> *"Values apply for ideal conditions, i.e., airspaces of uniform thickness bounded by plane, smooth, parallel surfaces with no air leakage to or from the space. When accurate values are required, use over U-factors determined through calibrated hot box (ASTM C 976) or guarded hot box (ASTM C 236) testing."*[4]

If you've ever looked at the back side of a brick wall, you know it is anything but perfectly uniform and smooth because the mortar pushes out of the backside of the joint (see picture on the front page). We actually measured the R-value of a wall cavity with a foil-faced insulation using a guarded hot box (ASTM C 236). The results showed that the difference between a foil-faced insulation and a nonfoil-faced product was only 0.2 Rs, and we purposely kept the foil clean and bright. We also closed off the weepholes to prevent air leakage into the cavity. In a normal installation, with mortar smears on the foil and air moving in through the weepholes, it's questionable whether any R-value difference would have been measured.[5]

NCRA Recommends a 5.6 R-Value for Polyisos.

The final argument relates to the R-value claim of 5.0 per inch for STYROFOAM and 7.2 per inch for foil-faced polyisosyanurates. Studies have shown that foil-faced polyisocyanurates can lose 20-30% of their R-value when simply stored at room temperature for one year. A study by Dynatech R/D company found that the R-value of 1.5" foil-faced polyisocyanurate fell to 5.33 per inch, and the R-value of a 3.0" foil-faced polyisocyanurate fell to 5.63 per inch over a 360 day period. STYROFOAM aged for this same time period showed no R-value loss.[6] As a result of this and other studies, the National Roofing Contractors Association (NRCA) has recommended that designers use an R-value of 5.6 for estimating the long-term performance of polyisocyanurates.[7] The bottom line is that although the literature claimed R-values were significantly different, the R-values of STYROFOAM* and foil-faced polyisocyanurates were almost identical after one year. And this study didn't even consider the possibility of the insulation getting wet.

Summary

When considering which insulation to use in a cavity wall construction, remember the following points:

- While foil-faced polyisocyanurates do have higher initial R-values, studies have shown that the aged R-values of these products are similar to that of STYROFOAM.
- Dow backs up the R-value of STYROFOAM by providing a 15- or 30-year limited thermal warranty on most products.
- The reflective R-value claim of 2.77 is virtually impossible to achieve in a block and brick cavity wall.
- STYROFOAM is also CFC-free. It is manufactured with HCFC blowing agents, which have ozone depletion potentials over 90% less than standard CFC blowing agents.
- It is evident that block and brick wall cavities are designed to receive and to accommodate water entering due to wind driven rains; and while the cavity will not fill with water, there can be considerable moisture available to interact with the insulation.
- Designers ensure that moisture-resistant structural materials are used in wall cavities.
- STYROFOAM is vastly superior in moisture resistance to foil-faced polyisocyanurates.

While it may be tempting to use foil-faced polyisocyanurates in a block and brick wall cavity because of the promise of higher R-values, we think that when you consider all of the facts, the only real choice is clear that....

STYROFOAM brand insulation is the best long-term value for cavity walls.

Notes

[1] "Exterior Wall Construction in High-Rise Buildings - Masonry Cavity Walls and Veneers on Frame Buildings." J.W. Sawers, Canada Mortgage and Housing Corporations, NHA 5450 81/12, Ottawa, Ontario.

[2] "Wetting of Polystyrene and Urethane Roof Insulations in the Laboratory and on a Protected Membrane Roof." Wayne Tobiasson, et al. U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory. Paper presented at ASTM Committee C-16 Conference on Thermal Insulation, Materials and Systems. Dallas, TX. December 2-6, 1984.

[3] "Insulation Performance Beneath Roads and Airfields in Alaska." David Esch, Highway Research Manager. Alaska Dept. Of Transportation and Public Facilities. Paper presented at the proceedings of the fourth International Cold Regions Engineering Specialty Conference. Anchorage, AK, 1986.

[4] 1993 ASHRAE Handbook Fundamentals. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., Atlanta, GA.

[5] "Thermal Resistances of Insulated Brick Veneer Walls with Reflective and Non-reflective Air Spaces." A.G. Contreras and A.J. Palfey. Thermal Insulation, Materials and Systems for Energy Conservation in the 80's. ASTM STP 789. American Society for Testing and Materials, 1983, pp. 373-383.

[6] "Experimental Methods for Determining the Thermal Performance of Cellular Plastic Insulation Materials Used in Roofs." Desjarlais and Tye. Dynatech Scientific, Inc., 8th Conference on Roofing Technology, Gaithersburg, MD, April 16-17, 1987.

[7] "In-Service R-values (ISR) for Polyisocyanurate and Polyurethane Roof Insulation Boards." Joint Technical Bulletin. National Roofing Contractors Association and Midwest Roofing Contractors Association. November, 1987.

WARNING: STYROFOAM brand insulation products are combustible and may constitute a fire hazard if improperly used or installed. Consult Dow for further information. The material contains a flame retardant additive to inhibit accidental ignition from small fire sources. During shipping, storage, installation and use, these products should not be exposed to open flame or other ignition sources.

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For Technical Information:
1-800-441-4369

For Sales Information:
1-800-232-2436

The Dow Chemical Company
Construction Materials Group
2020 Dow Center
Midland, MI 48674

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