Use of DuPont™ Tyvek® Weather Resistive Barriers with Exterior Insulation Wall Design

BUILDING SCIENCE BULLETIN

Vapor permeable membranes like DuPont™ Tyvek® CommercialWrap® and DuPont™ Tyvek® StuccoWrap® will perform the air and water barrier functions in exterior insulation wall design.

DuPont™ Building Innovations provides design professionals with 30 years of applied research on proven air and moisture management in wall assemblies. Used in commercial construction under all cladding types, DuPont™ Tyvek® weather resistive barriers are engineered to provide air and moisture management for a more durable, energy efficient building envelope by offering the best balance of properties:

- High air infiltration resistance to stop unwanted airflow into the building envelope (e.g. wind)
- Excellent water resistance to prevent bulk-water penetration (e.g. rain)
- Optimum water vapor permeability for drying (by water vapor diffusion) to help prevent the growth of mold and mildew and costly moisture-related damage.

DuPont™ Tyvek® CommercialWrap® is engineered to provide excellent performance as an air barrier and secondary weather barrier membrane. It offers UV resistance for 9 months in addition to the added strength and durability needed in commercial construction.

DuPont™ Tyvek® StuccoWrap® offers a specially engineered surface texture designed to meet the critical demands of both traditional and synthetic stucco applications in commercial construction. It improves stucco curing, helps reduce susceptibility to cracking, adds dimensional stability, channels water and moisture outside and provides extra drainage where needed.

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What is the exterior insulation wall design?

In framed wall construction (e.g. steel stud), the thermal insulation could be placed within the stud cavity (traditional design, Figure 1), or outside the cavity (new trend, Figure 2). The exterior insulation is also commonly used with masonry back-up walls.

Figure 1. Steel stud cavity wall with fiberglass batt insulation in the stud cavity

1 Exterior cladding
2 Air space (optional; recommended for water management)
3 Exterior sheathing
4 Cavity insulation
5 Interior sheathing

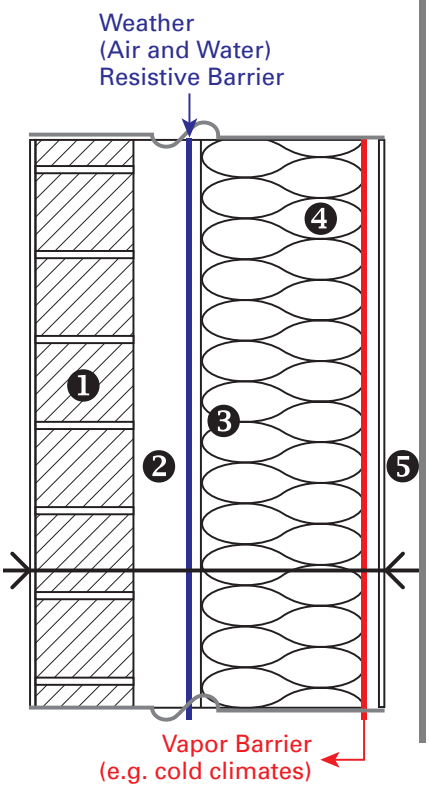
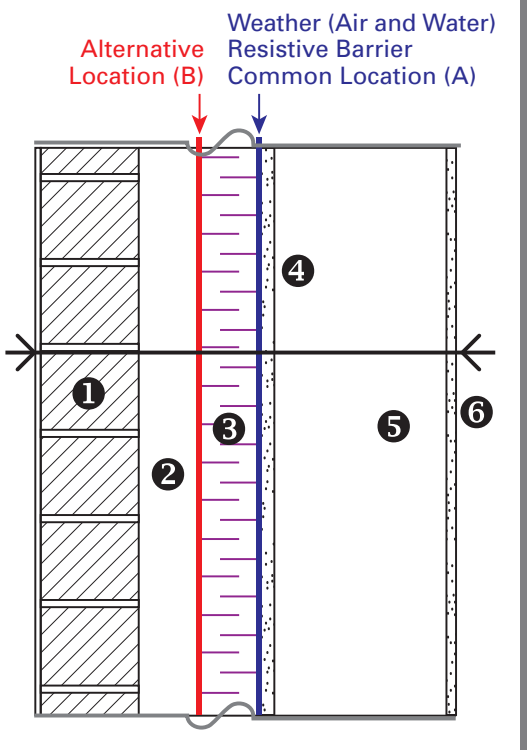


Figure 2. Steel stud cavity wall with rigid exterior insulation and un-insulated stud cavity

1 Exterior cladding
2 Air space (optional; recommended for water management)
3 Rigid insulation
4 Exterior sheathing
5 Stud cavity (conditioned space)
6 Interior sheathing



Advantages of Exterior Insulation Wall Design

The main advantage of exterior insulation wall design is *increased* thermal performance and *decreased* sensitivity to condensation because the dew point is moved outside the wall cavity. Metal framed construction benefits most from the exterior insulation by reducing *thermal bridging*. *Thermal bridging* occurs when the highly conductive steel studs break the continuity of the cavity insulation. Heat will choose the most conductive path, the path of least resistance, to bypass the insulation.

ASHRAE (American Society for Heating Refrigeration and Air Conditioning) requires that architects use a factor in calculating the effective thermal performance of fiberglass insulation in steel stud walls. For example, in a wall system with 2"x 6" steel studs 16" O.C., the factor could be as low as 40% (depending on climate); this means that the effective R value for R-19 fiberglass could be as low as R-7.6 or 19.0 x 0.40.

When using rigid exterior insulation ASHRAE gives full credit for the manufacturer's published R-value because there is less thermal bridging when insulating by this method.

Disadvantages of Exterior Insulation Wall Design

The main disadvantage of exterior insulation wall design is increased cost. When the cavity insulation is fully replaced by the exterior rigid insulation it adds 2-3 inches in wall thickness (depending on climate), reducing the useful floor space for the same overall dimensions. In addition, there may be higher structural requirements for mechanical fasteners used to support the exterior cladding. Despite these disadvantages, this wall design is gaining broader acceptance due to its enhanced thermal performance and moisture management capabilities.

Air and Moisture Management in Exterior Insulation Wall Design

As with other wall types, the exterior insulation wall must be protected against air infiltration and moisture intrusion into the wall cavity. A continuous air and water resistive barrier will protect against bulk water intrusion and air transported moisture vapor, the main moisture sources for above grade walls. For exterior insulation walls this membrane is generally sandwiched between the exterior sheathing and the rigid insulation, as shown in Figure 2A or installed outside the exterior insulation as shown in Figure 2B.

The Air and Water Resistive Barrier Membrane must meet the following requirements:

1. It **MUST** have **HIGH AIR RESISTANCE** - to resist the flow of moisture laden air though wall cavities, as well as prevent drafts and reduce energy bills.
2. It **MUST** have **HIGH WATER RESISTANCE** - to prevent bulk water intrusion into the interior wall cavity
3. It **MUST** be **CONTINUOUS** to prevent air leakage at the joints and penetrations
4. It **MUST** have **STRUCTURAL INTEGRITY** to resist the structural loads and safely transfer loads to the structure.
5. It **MUST** be **DURABLE** to withstand the rigors of the construction site and to continue to perform its function for the expected life of the structure

A common misconception is that the membrane in this application must also be a **VAPOR BARRIER** (vapor non-permeable membrane) such as Fluid Applied or Self-Adhered Air and Vapor Barrier. Contrary to this misconception, a vapor barrier is not required in this application for the following reasons:

A. The function of a vapor barrier membrane would be to prevent interior moisture *diffusion* into the wall cavity. However, in the exterior insulation wall design the wall cavity is part of the interior conditioned space therefore the moisture loads in the cavity are *controlled by HVAC and not by vapor diffusion.*

B. The dew point (which is the onset of condensation) is moved outside of the wall cavity (e.g. the cavity is on the "warm side" of the wall in winter).

C. In addition, the exterior rigid insulation is typically extruded polystyrene (XPS). XPS is a **VAPOR BARRIER** with vapor permeability <1 Perm/inch, therefore a second vapor barrier next to XPS is redundant and unnecessary.

Consequently, either vapor permeable (e.g. DuPont™ Tyvek®) or vapor non-permeable membranes (e.g. fluid applied or self-adhered) will perform the air and water barrier functions in this application, if the five performance requirements are met. An example of DuPont™ Tyvek® StuccoWrap® installed behind XPS polystyrene rigid insulation is shown in Figure 3.

DuPont™ Tyvek® CommercialWrap® and DuPont™ Tyvek® StuccoWrap® are the most cost effective air and water barriers, when compared to fluid applied or self-adhered membranes.

Figure 3. DuPont™ Tyvek® StuccoWrap® air and water barrier behind exterior polystyrene rigid insulation

Our Specialist Network

A DuPont™ Tyvek® Specialist is assigned to your local area specifically to support participating Dealer locations and assist with product installations. The DuPont™ Tyvek® Specialist is a member of a national group of over 170 highly-trained field representatives educated in construction and building science.

From the latest updates on building codes to on-site consulting and training, your local DuPont™ Tyvek® Specialist will help make sure the job gets done right.

For more information about DuPont™ Tyvek® Weatherization Systems please call 1-800-44-TYVEK or visit us on the web at www.Construction.Tyvek.com

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