PENNSYLVANIA HOUSING RESEARCH CENTER

RAINSCREEN GAPS IN EXTERIOR WALLS

June 2016 | Brian Wolfgang

BASICS OF MOISTURE MANAGEMENT

Since the publication of the 2006 International Residential Code (IRC), residential structures have been constructed with a code-mandated water-resistive barrier (IRC R703.2) as one layer within exterior wall assemblies. This water-resistive barrier is the primary layer that provides a dedicated drainage plane for shedding bulk water that penetrates the exterior cladding. In addition to the water-resistive barrier (WRB), there are numerous options for providing above-code alternatives related to moisture management, such as rainscreens. These options commonly include modifications that focus on enhanced drainage of the overall wall assembly and increased drying potential of the system once it becomes wet. Certain cladding systems, such as exterior plaster and brick veneer, may warrant these more robust options for bulk moisture management.

WHAT IS A RAINSCREEN?

The main concept behind a rainscreen system is the designed inclusion of a gap behind exterior cladding, whether that cladding is brick veneer, fiber cement siding, or any number of other common products (see Figure 1). Rainscreens provide the following benefits:

1. A capillary break between the cladding and the WRB,
2. Redistribution of moisture stored in wall assembly components through evaporation and diffusion,
3. An enhanced and clear drainage plane behind the exterior cladding, and
4. Drying of the assembly through convection if ventilation openings are present.

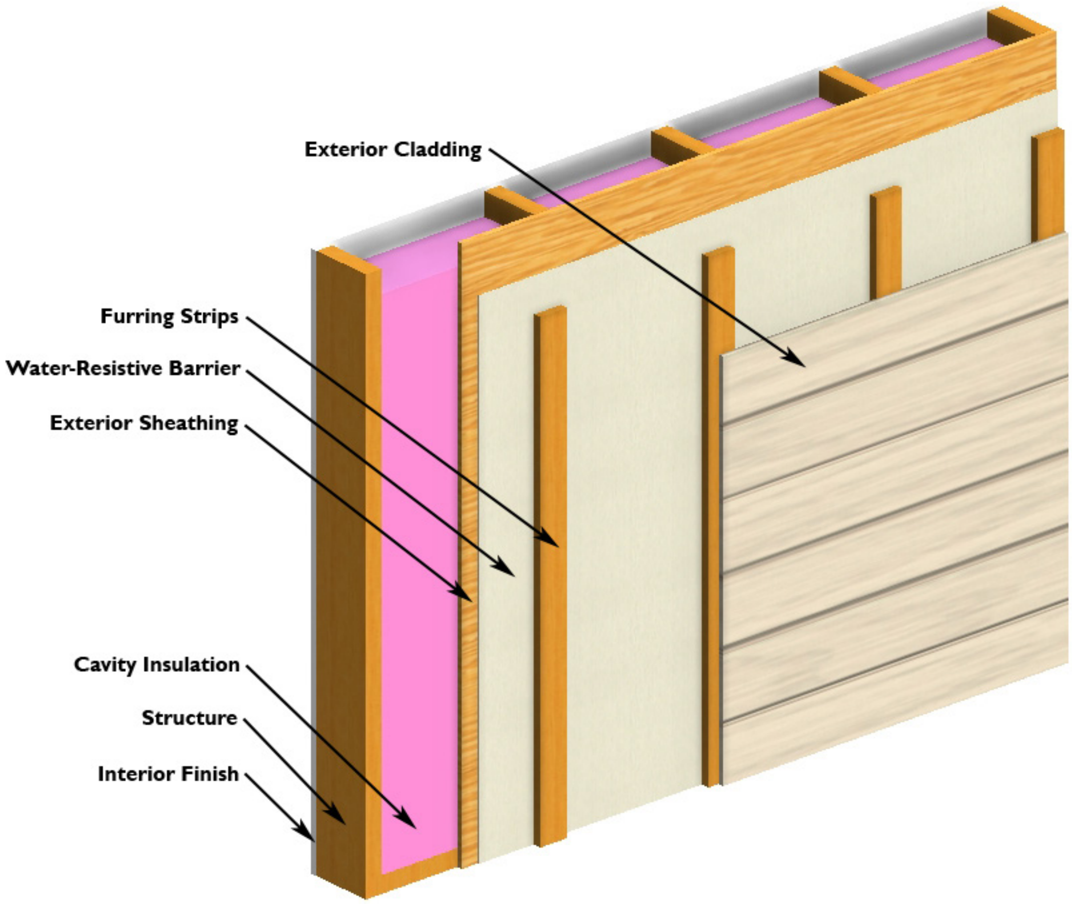

Figure 1: Rainscreen gap incorporated into exterior wall assembly using furring strips or strapping

RAINSCREEN DETAILS

Research and observation from outside industry stakeholders have shown that an effective rainscreen must employ a gap with a minimum depth of 1/4 inch. It is common, however, for rainscreen gaps to have dimensions of 1/4, 3/8, 1/2, or 3/4 inch. The depth of the gap will often depend on the material used to construct the gap. For example, plywood furring strips typically come in thicknesses of 1/2 or 3/4 inch, while some proprietary products are manufactured to depths of 1/4 inch.

A true rainscreen system also employs ventilation openings at the top and bottom terminations of the wall system. These ventilation openings, shown in Figure 2, enhance the drying process by allowing convective currents to travel through the rainscreen gap. Although these ventilation openings provide an optimal rainscreen assembly, a rainscreen assembly without ventilation openings still provides enhanced drainage and drying capability.

When employing a rainscreen system, an additional component, product, or series of products will be installed before the installation of the cladding. These rainscreen components can be categorized into two main installation strategies: furring strips and three-dimensional mesh or mat products.

Furring strips or strapping used as part of a rainscreen system are commonly made of wood-based materials or plastic products that are fastened into the main structure of the building as shown in Figure 1. Furring strips are most commonly installed vertically, although horizontal installation may be employed for those types of cladding that run vertically. Because rainscreen gaps are designed to remain dry between rain events, it is not a requirement that wood furring strips be treated for moisture resistance.

Three-dimensional mesh or mat products—proprietary systems installed beneath exterior claddings—can also provide a rainscreen gap in the wall assembly. These products are often manufactured in rolls and are installed in rows on the exterior of the building. Some mesh or mat systems are designed for specific cladding types, including hardcoat stucco and manufactured stone veneer.

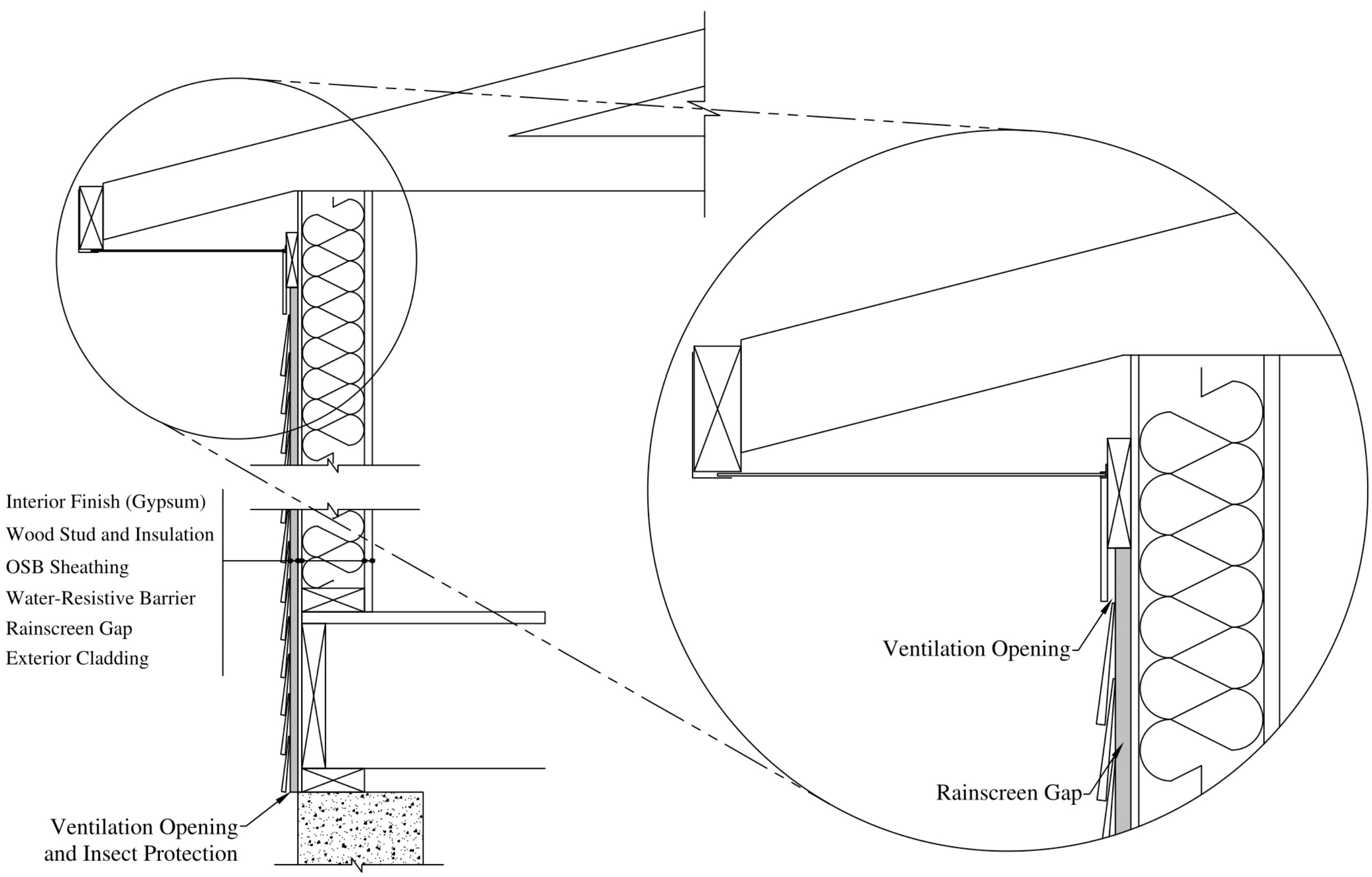

Figure 2: Exterior wall assembly cross section showing rainscreen system details at top and base of wall

RAINSCREEN GAP BEHIND LAP SIDING

There are two main types of horizontal lap siding as it relates to rainscreen gaps. Vinyl and aluminum siding are examples of a cladding system that incorporates a rainscreen gap as a result of its shape (see Figure 3). These types of cladding are referred to as vented claddings. The gap behind vented cladding may not have a uniform thickness; however, the enhanced drainage and drying behind vinyl and aluminum siding provide similar benefits to a traditional rainscreen.

Other types of lap siding, including fiber cement and wood horizontal siding, may benefit from the installation of a rainscreen system. Fiber cement siding is installed tight to the WRB behind the cladding, thus reducing the ability of the WRB to shed bulk moisture. Including a gap behind this siding would enhance the ability of that WRB to shed moisture. Additionally, wood siding is quite moisture sensitive. Rainscreen gaps behind wood siding not only provide enhanced drainage of bulk moisture, they also allow the wood cladding to dry out and remain durable over a longer period of time.

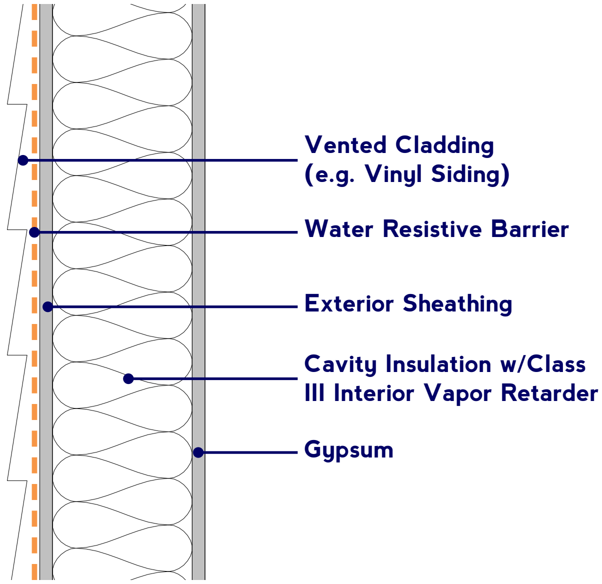

Figure 3: Insulated wall assembly w/vented cladding
Vented cladding systems, including vinyl and aluminum siding, include an air space behind the exterior face of the cladding simply by the material's shape. This air space allows for similar benefits to a traditional rainscreen system that is constructed with either furring strips or 3-D mesh products.

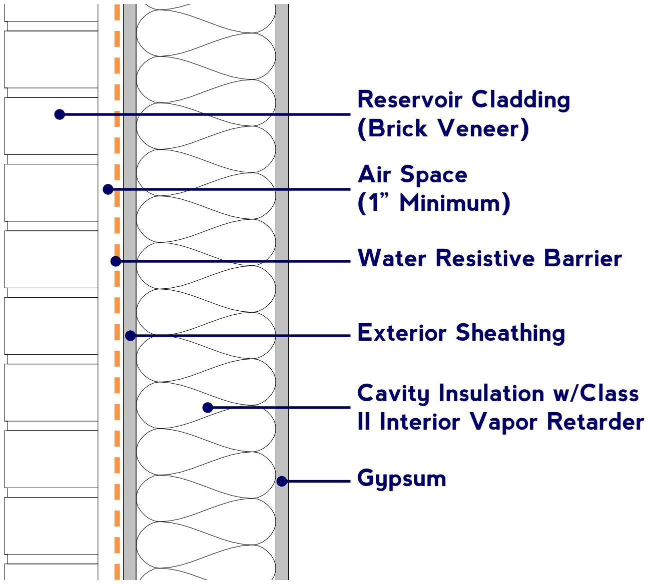

Figure 4: Insulated wall assembly w/brick veneer
Reservoir cladding systems, such as brick veneer, often warrant a more robust drainage component in the exterior wall assembly. This is often code-mandated to be at least 1 inch in thickness. This gap is formed by using brick ties to stand off the brick veneer from the WRB and exterior sheathing.

RAINSCREEN GAP BEHIND BRICK VENEER

Brick veneer is commonly referred to as a reservoir cladding. This type of cladding is known to take up and store large amounts of moisture from precipitation. Because of this storage capability, existing building codes typically require the inclusion of an air space behind brick veneer (see Figure 4). This air space provides a capillary break and reduces the impact of the stored moisture in the brick veneer. It also reduces the impact of solar vapor drive by providing a ventilation gap between the veneer at the WRB.

It is common for the rainscreen gap to be provided through the installation of appropriately sized brick ties. The size of the air space behind brick veneer is often required to be a minimum of 1 inch. While this gap is larger than some rainscreen systems, it is still critical to keep this air space clear and free from debris, specifically mortar droppings from the installation of the brick itself. Additionally, weep holes at the base of the assembly are crucial in providing an exit for bulk moisture and to provide appropriate ventilation openings.

RAINSCREEN GAP BEHIND EXTERIOR PLASTER

Exterior plaster, including traditional hardcoat stucco and manufactured stone veneer, is another example of a reservoir cladding. These systems are capable of absorbing and storing large amounts of moisture, but are often installed without rainscreen gaps because they are not required by most building codes. The susceptibility of these assemblies to moisture damage and the recent history of stucco tearoffs warrant additional consideration of a rainscreen system.

Rainscreen gaps behind exterior plaster are formed using either furring strips or 3-D mesh systems (see Figure 5). When using furring strips, it is common for the lath to be fastened to wood furring strips prior to the installation of the scratch coat. For proprietary 3-D mesh systems, a filter fabric is commonly included on the outer face of the mesh in order to prevent the scratch coat from penetrating the mesh and reducing its ability to function properly.

Regardless of the type of rainscreen gap, it is critical for the installation of a rainscreen system to comply with current enforceable codes and ASTM standards. With exterior plaster, attention to detail when flashing around penetrations and installing casing beads is critical to the durability of the system.

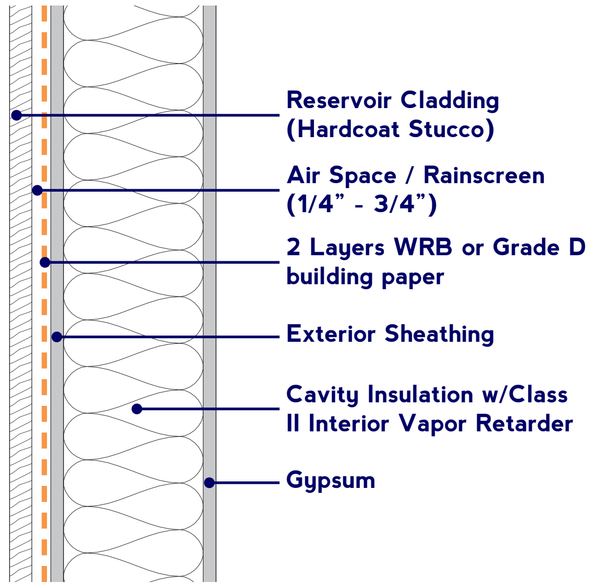

Figure 5: Insulated wall assembly w/exterior plaster
Reservoir cladding systems, such as exterior plaster, often warrant a more robust drainage component to the exterior wall assembly. This is not usually mandated by code (as with brick veneer) and requires a comparison of acceptable risk vs. construction costs.

Rainscreen systems have clear benefits, including enhanced drainage and increased drying potential. However, these systems typically add up-front cost to the construction of the exterior wall assembly. In some cases, the additional costs may be outweighed by the risk mitigation associated with this above-code option.

CONCLUSION

Moisture management is a critical function of all building enclosure systems. This is accomplished in a variety of ways, including building shape and orientation, cladding specification, WRB selection, and flashing details, among others. The selection of a WRB system and the decision to include a rainscreen gap should be based on the type of cladding installed and the risk associated with that cladding type.

REFERENCES

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