Understanding Rainscreen Design

The perfect wall design to defend against the elements of Mother Nature

By Tom Diamond, P.E.

Protecting your facility's assets begins with the building envelope; after all it is the first line of defense against the wrath of Mother Nature.

From the roof down to the foundation, and everything in between, nature's elements attempt to force their way into a structure, the largest part of which are the walls.

Incorporating a properly designed, high-performance wall system is not only critical to protecting your investment, but also allowing your facility to perform at optimum levels.

A rainscreen wall system is the ideal way to provide an attractive, long-lasting, high-performance wall system.

What is a Rainscreen?

Rainscreens are time tested wall systems that have been in use for over a century. The rainscreen design is generally defined by the separation of cladding from a structural wall in an effort to manage moisture and energy transfer through a wall assembly.

Advances in technology over the past few decades have optimized the design from a simple two stage weather-tightening system to the inclusion of a ventilated airspace and high-performance products that make up the entire assembly.

A rainscreen typically consists of the following components:

- Exterior cladding (with or without open joints)
- Ventilation and drainage cavity
- Insulation
- Air barrier
- Structure of building

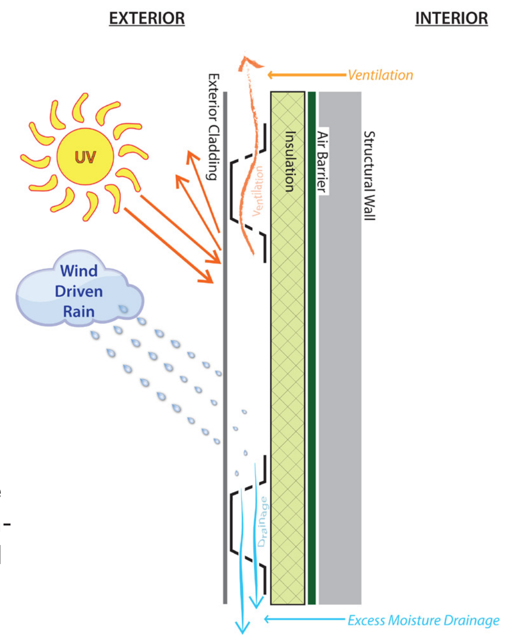
The Elements

The key to a properly designed rain screen wall system is to control and manage nature's elements, which are:

- Water infiltration
- Ultra-violet radiation
- Negative wind pressures
- Heat transfer into and out of the building
- Air infiltration
- Vapor transmission

It is almost inevitable that, at some point, moisture will bypass the exterior cladding of a wall assembly.

A rainscreen system is designed to allow the remaining components of the wall assembly to effectively manage this moisture, along with the other elements, to provide a long-lasting, energy efficient, high-performance wall system.



*The components of a Rainscreen system must be designed to **control and manage** the elements of nature that act upon a wall assembly.*

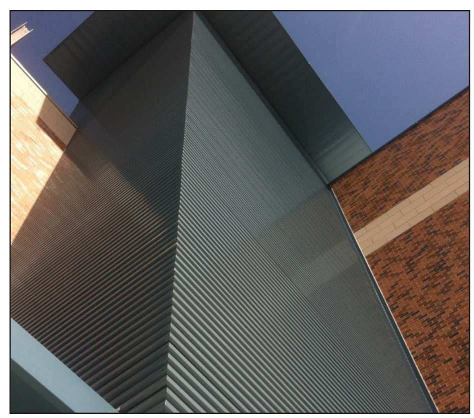
System Components

Metal Cladding – With today's technology, there are many different options available that allow designers to provide a unique and aesthetically pleasing appearance for a building.

As the first line of defense, a high-quality wall panel cladding system is essential for a number of reasons in a rainscreen assembly. In addition to protecting the wall assembly against the majority of rain, it also protects against negative wind pressures and ultra-violet radiation.

When considering more economical options, the wall panel system should be comprised of a Galvalume® or G-90 galvanized coated steel, or high-quality aluminum with a fluorocarbon paint finish, such as Kynar®.

For a more premium design, corrosion resistant metal materials such as zinc, copper or stainless steel provide for a highly attractive, longer-lasting cladding system. With the rainscreen design, the metal wall panel system may contain open joints that are not as installer sensitive as some face-sealed wall panels, which drastically reduces maintenance throughout the life of the system.



Properly designed metal wall panels provide beauty along with rain and wind uplift protection.

Ventilation/Drainage Cavity and Framing System – The ventilation cavity is a crucial component of the rainscreen wall assembly. It must be incorporated into the system via the framing system of the metal wall cladding.

This framing system should be designed to not only support the wall panels, but also provide a means to promote ventilation behind the cladding.

This cavity promotes residual water drainage and air flow behind the wall panel, which helps to dry out any water that gets through the exterior cladding, as well as ventilates moisture-laden air that may be drawn into the cavity.

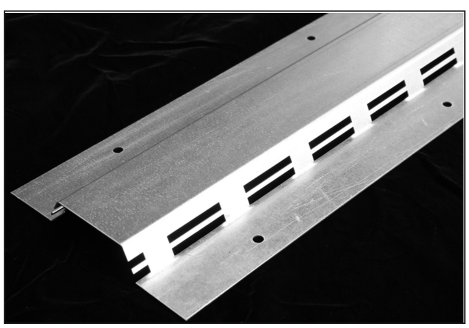
The ventilation cavity can be achieved a number of ways, such as a vented hat channel system, along with vented metal trim components at the bottom and top of the wall panel assembly.

The metal wall panel system anchors into the hat channel, which is fastened through the continuous layer of insulation and into the structural assembly of the wall.

These fasteners are the only metal components that penetrate through the entire wall assembly, which greatly reduces thermal bridging.

According to Building Science Corporation[1], failure to break thermal bridging of metal stud components through the insulation of a wall system can reduce their effective R-value by 50-80%.

The vented hat channel method eliminates this thermal bridge, allowing the effective R-value of the continuous layer of insulation to remain nearly unchanged.



Vented Hat channel provides anchorage of the metal wall cladding, while promoting air flow through the ventilation cavity.

Insulation – The insulation in a wall assembly reduces the heat flow into and out of the building. For the most effective and energy efficient design, insulation should be applied in a continuous layer on the exterior side of the air barrier.

In fact, Table C402.2 of the 2012 International Energy Conservation Code requires continuous layers of insulation to be installed on both mass walls and metal framed walls.

The insulation used in a rainscreen should be comprised of a material that can handle small amounts of moisture and has the ability to dry without degrading the insulation material or reducing its effective R-value.

The ideal types of insulation for rainscreen design include rock wool or extruded polystyrene.

However, if extruded polystyrene is used, it must meet the building code requirements of a fire-rated assembly using foam plastic insulation. Some manufacturers do have these fire-rated options available.

Air Barrier – The air barrier, which is actually the air and water barrier, is the most critical component of the rainscreen assembly. It is the last and most critical line of defense against water infiltration.

Any residual amounts of water that bypass the external cladding will ultimately be stopped by this air barrier. Any water that contacts this surface will either drain out of the bottom of the wall assembly, or will evaporate out of the wall.

The air barrier, by definition, stops the flow of air through a wall assembly. This air flow can come from pressure differentials between the exterior and interior climate caused by wind, mechanical and stack effect pressures.

Without the air barrier, moving air can also migrate large quantities of vapor through the wall. If this vapor comes in contact with a cool surface, it can condense within the wall assembly, potentially leading to more severe issues.

It is important to understand that air control and vapor control are two separate entities. While the movement of the air can be stopped by the air barrier, vapor transmission can either be stopped or allowed to pass through the air barrier, depending on the material used.

In some climates and building design, vapor transmission through the air barrier should be allowed to promote the drying of materials and, in other scenarios, the vapor should be stopped completely.

Proper design and application of the air barrier system is essential. Attention to detail is absolutely critical to assure air barriers within a wall properly tie into roof system air barriers, windows, penetrations and foundations.

In summary, rainscreens provide an ideal wall that includes cladding, a ventilation cavity, insulation, an air barrier and a structural wall that are integrated in a manner to manage and control moisture and energy.

This design is ideal for new construction and retrofit applications alike. Depending on the building design, geographic location, and the use of the building, rainscreens can be designed to suit the needs of each and every facility.

The finished product will provide a beautiful, long-lasting, high-performance wall system, allowing a building owner to focus more on their business instead of the building that protects it.

See Figure 1.1 and Figure 1.2

Thomas G. Diamond, P.E., Project Engineer

Tom Diamond, P.E. is a Project Engineer for The Garland Company, Inc., a leading manufacturer and distributor of high performance roofing solutions for commercial and industrial applications. Tom graduated from The University of Akron in 2003 with a Bachelors of Science Degree in Mechanical Engineering. He obtained his Professional Engineering License in December of 2011. Tom's primary focus in the commercial and industrial roofing industry involves designing optimum performance roof and wall systems to assure that they are compliant with the Building Code at National, State and local levels. He frequently delivers seminars and AIA-accredited classes on installation techniques, building envelope design, and roofing and wall system technology.

[1] Building Science Corporation specializes in building technology consulting for all types of buildings. For more information visit www.buildingscience.com

Figure 1.1 - New Construction

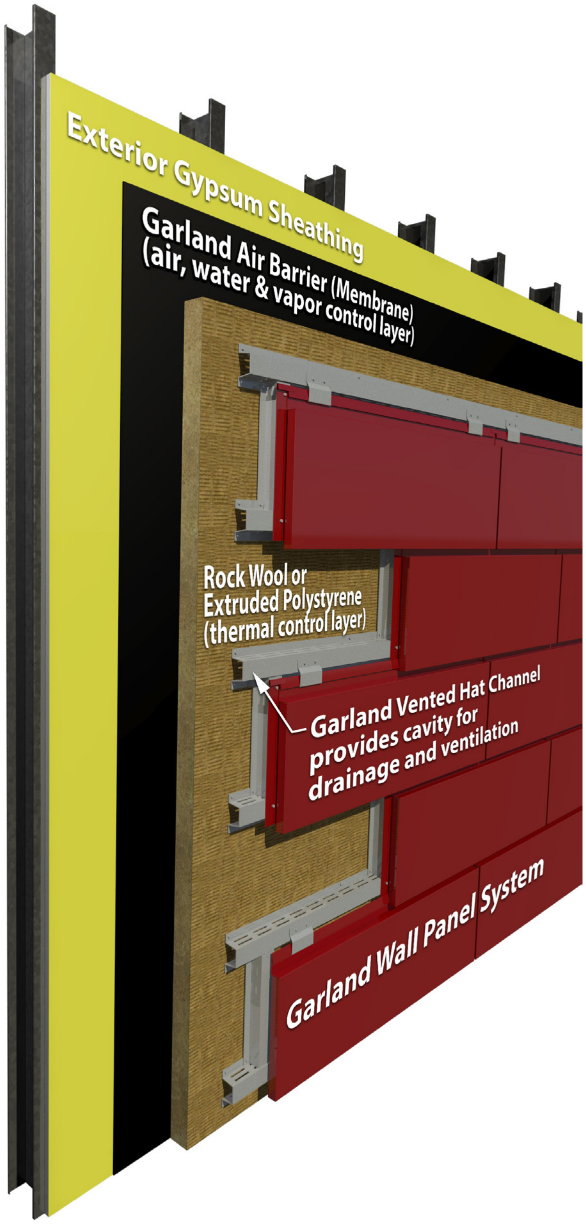


Figure 1.2 - Retrofit Construction