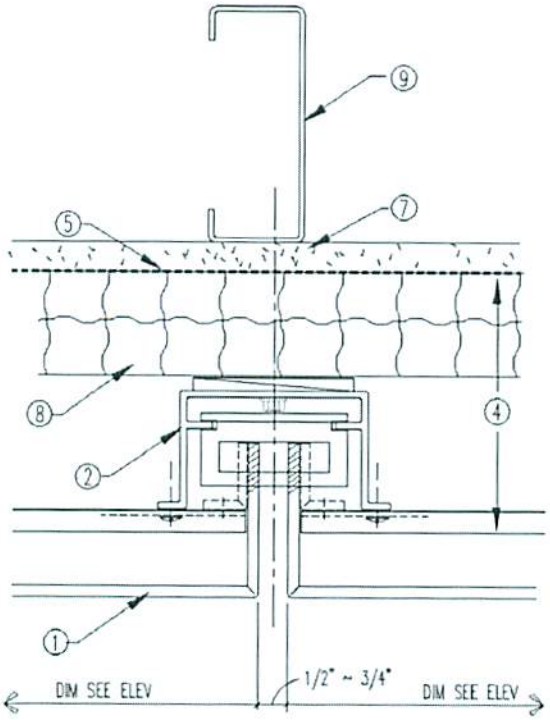

Figure 2: Typical Vertical joint detail for D/BV Rainscreen ('Hook & Pin') panel system.

Pressure-Equalized / Compartmented (PER)

Pressure-equalized Rainscreen walls are more design intensive. As such, they are also very sensitive to design variations and deviations from the PER design principles. The openings in the PER wall must be specifically designed to allow both static and dynamic pressure equalization to take place across the rainscreen. The essential defining attribute that differentiates PER from D/BV is the design and use of compartmentalization within the cavity. The reasoning for compartmenting is that pressure equalization can only occur within limited time periods if the internal volume of the cavity behind the Rainscreen is known and controlled. This compartmentalization is essential because wind pressures across a single face of a building are not uniform and are constantly changing. The number and geometry of the vent openings are calculated based upon the known cavity volume to allow sufficient air flow in and out of the internal compartmented space quickly enough to respond to ever-changing wind dynamics. This facilitates pressure differences across the plane of the rainscreen to be minimized vs. the internal compartment pressures thus equalizing the air-pressure on the external and internal sides of the exterior Rainscreen cladding element. If this condition exists, rain-driving forces are reduced, if not eliminated. The effective area of the vent holes depends upon 1) the air-tightness of the air barrier system on the inner leaf, 2) the stiffness of the rainscreen cladding and inner leaf and 3) the volume of the individual compartments that make up the internal air space. These compartments are an essential element of proper pressure-equalized design as they 1) control vertical and lateral air flow, 2) size the volume of the area that the vent openings must be designed to facilitate and 3) limit water infiltration and control water drainage at times of air-pressure disequilibrium. Non-compartmentalized cavities cannot be pressure-equalized.

A number of the system's construction elements are similar to the drained/back-ventilated rainscreen, but have several significant and important differences.

What is similar in both?

Refer to the D/BV outline above and Figures 1 and 2.

Elements (1), (3), (4), (5), (6) and (7) are common construction elements of the PER rainscreen.

However, item (4) the 'Ventilation Cavity' must be more specifically designed and controlled as to its size and volume in order to facilitate pressure-equalization. Item (5) the 'moisture barrier' must be an air/water barrier which can significantly deter air leakage into the building's interior thus cutting off air-pressure differentials that can bleed the ventilation cavity and reduce pressure equalization. . The design and installation of the air / water barrier must be a prime consideration in any rain screen system. The Air Barrier Association of America (abaa) has developed a master specification section 01410 "The Air Barrier System" that details the design considerations that must be addressed when specifying the air / water barrier to be installed. In order to insure a higher quality air barrier installation, but recognizing the likelihood of minor installation flaws, AMMA 508-05 details the minimum level of air leakage that the wall assembly must accommodate.

As noted in AAMA 508-05, at this point in time there is insufficient evidence to substantiate any reduction in the design load of the connection system and Rainscreen cladding elements for the PERS outer leaf system. If design load reductions are to be taken, it should be determined by the design professionals to what extent.

What is different?

Refer to Figures 3 and 4 below

The outer leaf cladding's (1) joinery design is altered to create extensions back to the face of the inner leaf (5) or insulation (7) creating 'pressure-controllable compartments' at both vertical and horizontal conditions. The size of the cladding and the compartmentation behind requires a series of special calculations that in reality must be proven-out by testing*. Each building has its own wind dynamics which must be taken into consideration so a "one-size-fits-all" approach is not recommended.

The vertical drainage channels (2) are typically interrupted by the bottom horizontal joinery of each compartmented unit. This is due to the fact that the principle design intent for a PER Rainscreen it to create isolated cladding units with internal cavities that self-drain any incidental water penetration.

The moisture barrier (5) must be a dual performing air and water barrier as discussed in "What is similar in both?"

Anderson and Gill note that for **Drained and back-ventilated rainscreens**:

> "The main point to note about the drained and back-ventilated approach is that claddings are allowed to leak, and no deliberate attempt is made to minimize the effects of wind by means

of pressure equalization. Instead, the cavity behind the cladding is drained and positive back-ventilation is used to promote the rapid evaporation of any rainwater deposited on the inner leaf. The same process is used to evacuate the water vapour which permeates through the inner leaf and its insulating layer."

Anderson & Gill further offer the following main point for **Pressure equalized rainscreens**:

"The main point to note about the pressure-equalized rainscreen approach is that without relying on the use of sealants or gaskets, every effort is made to minimize or eliminate leakage through the joints in the cladding assembly...There may, however, be some minor leakage into the cavity and a precautionary drainage mechanism is therefore necessary. Positive back ventilation is also used to promote the rapid evaporation of residual rainwater and to evaporate the water vapour which permeated through the inner leaf."

Key elements for **Figures 3** and **4**:

1) The 'outer leaf' cladding system (or the 'Rainscreen')
2) Vertical drainage channel
3) Penetration flashing
4) Ventilation cavity/compartment
5) Moisture barrier (commercial air/vapor barrier)
6) Approved 'Moisture Barrier' compatible flashing at all penetrations
7) The 'Inner leaf' or face of building structural wall
8) Optional moisture resistant insulation
9) Ventilation path for pressure equalization and drainage
10) Horizontal air dam used to create compartmentalization
11) The building structural wall

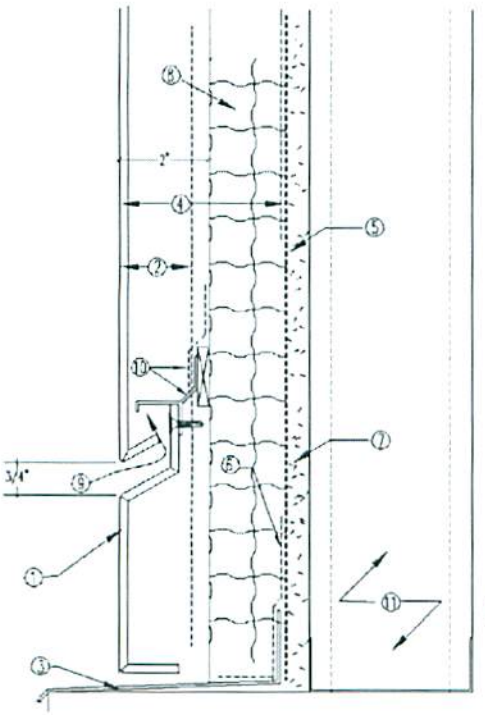

Figure 3: Typical horizontal joint detail for Rainscreen PE/C panel system.

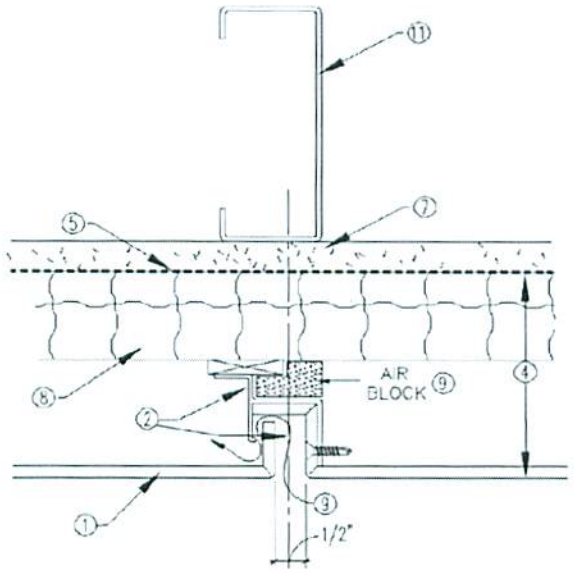

Figure 4: Typical vertical joint detail for Rainscreen PE/C panel system.

* One of the key elements of substantiating the existence of pressure equalization within a system is testing. While critical design calculations are a must for proper design, testing will prove the validity of these calculations. Up until recently, there has been no industry recognized testing protocol for proving-out pressure equalization. Some organizations create their own testing protocol while others side-step the issue due to lack of industry standards. AAMA has just released a test method which incorporates both cyclic and dynamic testing using air barriers with a defined level of imperfections. The AAMA 508-05 'Voluntary Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems' © 2005, dated December 2005 is the first recognized domestic testing protocol to be adopted specifically addressing Rainscreen performance. Copies of the testing procedures can be obtained (for a small fee) at www.AAMAnet.org (enter in search: '508')

Conclusion

There should be no confusion between the rainscreen types, yet confusion seems to be widespread in the industry. Too often we are faced with specifications that commingle the elements of both Rainscreen types and even introduce elements of other cladding designs. It must be incumbent upon us as professional representatives to educate the design market and to clear-up these misunderstandings.

As aptly stated by JM Anderson and JR Gill in their highly recognized technical article, ***Rainscreen Cladding: A Guide to Design Principles and Practice:*** "Successful application in design, however, particularly as regards detailing, demands clear understanding of the scientific principles underlying the main approaches to rainscreen cladding ...Successful rainscreen design depends on proper understanding of both of the design principles and of the way in which the technology originated and developed ... confusion may lead to the development of hybrid versions, which may or may not achieve the design objectives."

In summation, there are two basic types of 'Rainscreen' systems—The Drained/Back-ventilated and the Pressure-equalized. Both systems employ open joinery and allow a certain amount of water into the cavity area between the outer and inner leafs. Drained/Back-ventilated systems rely on the ventilation cavity to both drain and dry-out the residual water. Pressure-equalized systems employ drainable compartmentalization to limit water penetration during periods of pressure disequilibrium and to facilitate rapid pressure equalization.