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Drainage Planes and Air Spaces

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Abstract:

Every exterior cladding system needs an air space and drainage plane for performance and durability. This article presents the right materials and spaces for most exterior claddings—brick, stucco, and wood, metal and vinyl lap siding.

Drainage Planes and Air Spaces

All wood frame wall assemblies require a drainage plane coupled with a drainage space - where it rains. "Where it rains" is defined as locations in North America that receive more than 20 inches of rain annually. Traditionally, drainage planes consisted of tar paper installed shingle fashion behind exterior claddings coupled with a flashing at the base of each wall to direct rainwater that penetrated the cladding systems to the exterior. It was important that some form of air space or drainage space was also provided between the cladding system and the drainage plane to allow drainage.

With wood siding, the drainage space is typically intermittent and depends largely on the profile of the siding. Ideally, wood siding should be installed over furring creating a drained (and vented) air space between the drainage plane and wood siding. With vinyl and aluminum siding, the drainage space is more pronounced and furring is not necessary.

With stucco claddings, the drainage space was traditionally provided by using two layers of asphalt impregnated felt paper. The water absorbed by the felt papers from the base coat of stucco caused the papers to swell and expand. When the assembly dried, the papers would shrink, wrinkle and de-bond providing a tortuous, but reasonably effective, drainage space. This drainage space was typically around 1/8-inch wide.

With brick veneers, the width of the drainage space has been based more on tradition rather than physics. A 1-inch airspace is more-or-less the width of a mason's fingers. It is important that this 1-inch airspace is coupled with a functional drainage plane.

The Masonry Institute recommendation of a 2-inch airspace behind a brick veneer is based more on politics rather than physics. The masonry industry likes to see brick veneers installed over masonry block back-up walls. The masonry industry does not like steel stud back-up walls covered with gypsum board and a drainage plane. The reason is obvious - the masonry industry would like to sell you blocks, not steel studs.

However, the masonry industry is faced with a problem. In order to be cost competitive, the masonry back-up wall needs to be constructed at the same time as the brick veneer. This precludes the possibility of installing a drainage plane on the exterior surface of the masonry back-up wall. If a drainage plane is not present, an airspace greater than 1-inch is necessary to control rain entry - and this airspace must be free from mortar droppings. Of course, the corollary of this is as follows: if a drainage plane is present, and airspace or drainage space of 3/8-inch thickness will work just fine, even if it is filled with mortar droppings. Think of a traditional stucco wall - isn't it really a wall with a drainage plane that has a tortuous drainage space filled with mortar droppings?

Physics shows that free drainage occurs whenever an airspace is greater than 3/8-inch. The surface tension of water will not allow water to span a gap

greater than 3/8-inch. On the suction side, capillary suction will not occur with gaps greater than 1/8-inch.

When constructing stone veneers, a 3/8-inch airspace coupled with a drainage plane is common. This is often done with Enka-drain (thick plastic brillo pad covered with a filter cloth) installed over a #30 felt. With water managed EIFS, grooved foam with grooves 3/8-inch wide are common as well as plastic mesh spacers providing an airspace of 3/8-inch or more. The grooves or spacers are installed over a drainage plane. The problem with the standard EIFS have been due to the lack of a drainage plane and an associated drainage space.

With brick veneer, a minimum 3/8-inch airspace coupled with a drainage plane is required to control rainwater. Both are necessary. The drainage plane must also be vapor semi-permeable or impermeable to prevent the entry of solar driven water vapor. When brick gets wet and then is exposed to the sun, the moisture is pushed inwards.

Moisture moves from warm to cold (due to a thermal gradient) as well as from more to less (due to a concentration gradient). A vapor permeable housewrap such as Tyvek, Typar or #15 felt is not recommended behind a brick veneer for this reason. A more robust felt paper such as a #30 felt or a semi-permeable extruded foam such as the Dow blueboard or the Owens-Corning pinkboard is desirable.

When using foam sheathings, a drainage plane and drainage spaces are both still required. The foam sheathing can be installed in such a manner as to act as a drainage plane on its own or a drainage plane can be installed under the foam sheathing to provide this function. It is not recommended that building papers be installed over foam sheathing - they should be always installed under foam sheathing. It is not possible to staple building papers into foam and have the building paper be able to resist any wind load.

Foam sheathing can act as an effective drainage plane if vertical joints are shiplapped or tongue-and-grooved and if horizontal joints are flashed. An additional building paper is unnecessary in such a case.

About the Author

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