



## **Water Management Construction Details**

### **Introduction**

The underlying principle of water management is to layer materials from roof to foundation in such a way that water is always directed downward and outward from the building. Good water management practices require good drainage details. The typical building envelope is subject to water entry in numerous locations. Keeping water out of a building envelope is the primary line of defense against mold and a necessary condition for durability. Some of the most critical components are roofs, door and window openings, crawl spaces, and foundation drainage details. This fact sheet discusses water management issues for these building components and recommends best practices for water management construction details.

### **Discussion**

#### **Crawl spaces and Slabs-on-Grade**

With crawl spaces, make sure that the elevation of the grade in the crawl space is higher than the surrounding grade. For unvented crawl spaces, install a continuous 6-mil or heavier polyethylene vapor barrier across the crawlspace floor and to a point 6 inches above the outside grade. Overlap and tape all seams to prevent ground moisture from migrating into the crawlspace. For slab-on-grade foundations, the top of slab elevation should be about 8" or more above the surrounding grade.

#### **Basements**

Install dampproofing to the below-grade portion of the foundation wall to prevent it from absorbing ground water. Dampproofing should also be installed between the footing and the stem wall. Provide a positive drainage path to the foundation drain. The drainage path should consist of either a high quality drainage plane material or gravel with no fines placed against the foundation wall. The foundation drainage system at the bottom of the wall footing consists of perforated drainpipe located below the basement slab level, coarse gravel with no fines surrounding and above the drainpipe, and filter fabric containment

around the coarse gravel. Perforated drainpipe should be connected to a sump pump or outfall to daylight.

#### **Site Drainage**

With all types of foundations, site grading is critical. Slope the surrounding grade to direct the water away from the foundation on all sides of the home. This will drain away water and make sure that the ground next to the foundation does not get saturated. Most building codes require that the grade away from foundation walls shall fall a minimum of 6 inches within the first 10 feet. Install drainage swales if necessary to redirect stormwater around the building.

Install building gutters and downspouts so that they direct rainwater away from the building foundation. Terminate downspouts 8-10 feet away from the foundation to eliminate potential soil saturation problems. Also, ensure that underground irrigation systems are not installed adjacent to the foundation wall or crawl space. This will necessitate that no shrubs or flowers with high water requirements be planted adjacent to foundation walls as well.

#### **Roof and Deck Design**

Sloping roofs with wide overhangs are the best way of draining water away from the walls of a home. Flat roofs should never be truly flat. A slight slope is necessary to drain water off the roof. Install gutters and downspouts to further direct water away from the home (see site drainage). Deck floors should be installed slightly lower than the interior floor level they are adjacent to. Provide space in the deck flooring to allow for adequate drainage.

#### **Window Opening Details**

One of the biggest mistakes made in the construction industry is the assumption that doors and windows won't ever leak. Improper installation, poor quality or damaged products, and aging can all contribute to leaking problems. Proper sequence and installation of door and window flashings are of primary concern for a watertight assembly. Common off-the-shelf items such as pan flashings, self-adhesive liners, pre-fabricated sills, and formable flashings are available to flash door and window openings. Sealants, caulks, and gaskets should not be relied upon as the only defense against water entry. Construction details will vary depending on the wall system and type of window or door assembly, but the concept of layering

the assembly so water is always shed to the exterior as it flows down remains constant.

The sequence for installing a window with proper flashing in a wood frame wall is described below. The illustrations on the following page show the installation of window flashings step-by-step.

**Step 1:** The proper installation of a weather barrier over the exterior wall sheathing is the first step. Use of housewrap is recommended.

**Step 2:** Cut the housewrap flush across the head rough opening followed by two diagonal cuts extending upward and outward from the top of the rough opening corners equal to the width of the flashing being used. Next, a vertical cut is made about  $\frac{3}{4}$  of the way down the center of the rough opening followed by two diagonal cuts extending downward toward the bottom corners of the rough opening at the sill. These three cuts in the housewrap should look like an inverted Y in the opening.

**Step 3:** The side flaps of the housewrap are folded in through the jambs of the rough opening and fastened to the inside. The same is done at the sill. The top flap of the housewrap is folded up and temporarily secured so it can later be placed over the head flashing. Install a small backdam flush with the interior side of the sill opening.

**Step 4:** Properly flashing the sill is next. Formable or self-adhesive sill flashing should be applied to entirely cover the top of the sill plate, be long enough to extend up the jambs 3-4", and wide enough to overlap by 3-4" the outside of the housewrap. The flashing should be tight to the backdam and rough opening corners.

**Step 5:** Apply sealant or caulk around the exterior face of the rough opening at the jambs and head. For windows with nailing flanges, sealant can be applied to the back side of the flange.

**Step 6:** Install the window unit in the prepared opening.

**Step 7:** Install jamb flashing strips over the window's side nailing flanges. Next, install the head flashing strip flush with the rough opening, over the top window nailing flange, and long enough to extend over and beyond the jamb flashing strips by 2-3" on each side. All self-adhesive flashing should be pressed firmly in place to ensure a good bond with the weather barrier.

**Step 8:** Fold down the top flap of the housewrap over the head flashing strip. Apply sheathing tape over the diagonal cuts in the housewrap.

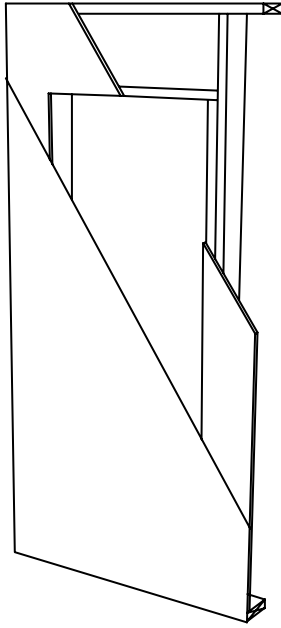
## For more information

- *Water Management Guide*, Joseph W. Lstiburek, Ph.D., P.E.; EEBA, 2004.  
<http://www.eeba.org/mall/water.asp>
- Technology Fact Sheets from Energy Efficiency and Renewable Energy Clearinghouse, U.S. Department of Energy:  
<http://www.eere.energy.gov/buildings/info/publications.html>
- *Best Practice for Non-vented Crawlspace Foundation*. Energy Efficiency and Renewable Energy Clearinghouse, U.S. Department of Energy  
[http://www.eere.energy.gov/buildings/building\\_america/pdfs/db/35379.pdf](http://www.eere.energy.gov/buildings/building_america/pdfs/db/35379.pdf)
- *Best Practice for Basement Moisture Control* Energy Efficiency and Renewable Energy Clearinghouse, U.S. Department of Energy  
[http://www.eere.energy.gov/buildings/building\\_america/pdfs/db/35398.pdf](http://www.eere.energy.gov/buildings/building_america/pdfs/db/35398.pdf)
- For more information about the Coalition, visit our website at [www.greenaffordablehousing.org](http://www.greenaffordablehousing.org) or call Bruce Mast at 510-271-4785.

## Disclaimer

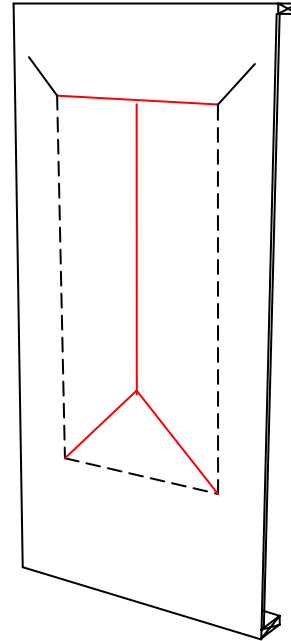
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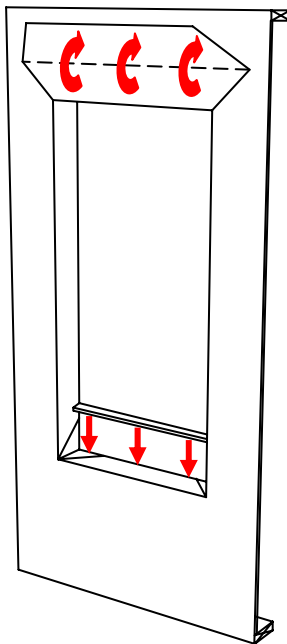
**Step 1**

**Wood frame wall with OSB and Housewrap**



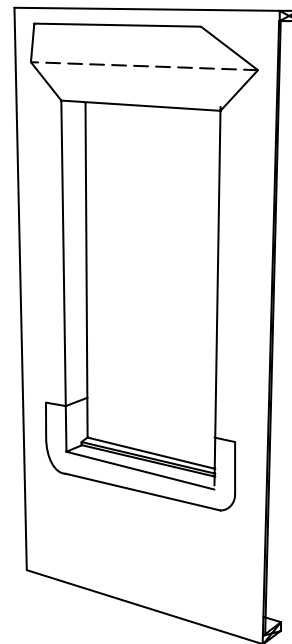
**Step 2**

**Modified "T" cut in Housewrap**



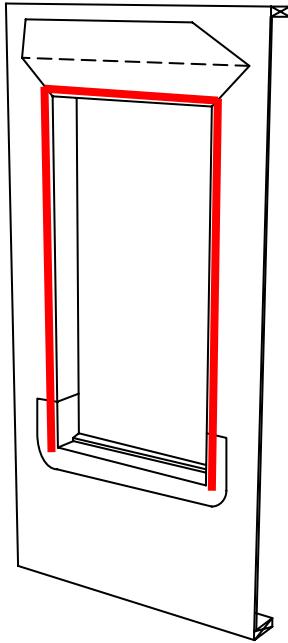
**Step 3**

**Fold Housewrap in at jambs and sill; Housewrap at head temporarily folded up or, alternatively, tucked under; install backdam**



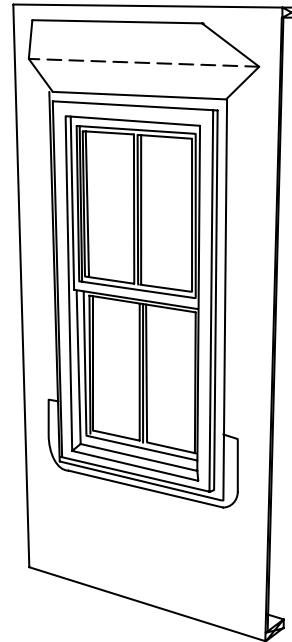
**Step 4**

**Install formable flashing at sill per manufacturer's instructions; use care in forming around backdam and corners**



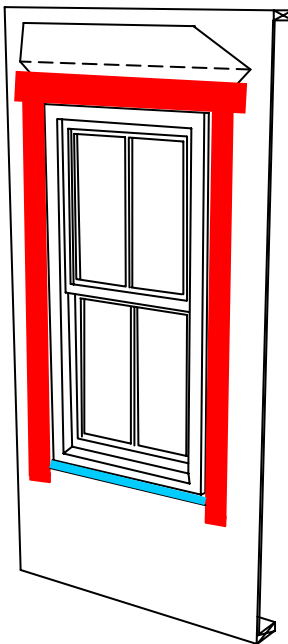
**Step 5**

Apply sealant at jambs and head; alternatively, sealant can be applied to the back side of the nailing flange (back-caulked); sealants, housewraps and flashings must be chemically compatible



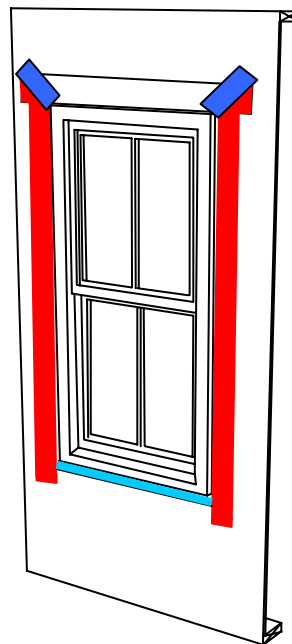
**Step 6**

Install window plumb, level and square per manufacturer's instructions



**Step 7**

Install jamb flashing; install a drip cap (if applicable); install head flashing



**Step 8**

Fold housewrap down at head; tape head flashing; air seal window around entire perimeters on the interior with sealant or non-expanding foam