Siding Installation in High-Wind Regions

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HURRICANE IKE RECOVERY ADVISORY

Purpose: To provide basic design and installation tips for various types of siding that will enhance wind resistance in high-wind regions (i.e., greater than 90-mph gust design wind speed).

Key Issues

- Siding is frequently blown off walls of residential and non-residential buildings during hurricanes. Also, wind-driven rain is frequently blown into wall cavities (even when the siding itself is not blown off). Guidance for achieving successful wind performance is presented below.
- To avoid wind-driven rain penetration into wall cavities, an effective moisture barrier (housewrap or building paper) is needed. For further information on moisture barriers, see Technical Fact Sheet No. 9 in FEMA 499, *Home Builder's Guide to Coastal Construction*, Technical Fact Sheet Series (available online at: http://www.fema.gov/library/viewRecord.do?id=1570). For further information on housewrap, see Technical Fact Sheet No. 23.
- Always follow manufacturer's installation instructions and local building code requirements.
- Use products that are suitable for a coastal environment. Many manufacturers do not rate their products in a way that makes it easy to determine whether the product will be adequate for the coastal environment. Use only siding products where the supplier can provide specific information on product performance in coastal or high-wind environments.
- For buildings located within 3,000' of the ocean line, stainless steel fasteners are recommended.
- Avoid using dissimilar metals together.
- The installation details for starting the first (lowest) course of lap siding can be critical. Loss of siding often begins at the lowest course and proceeds up the wall (Figures 4 and 12). This is particularly important for elevated buildings, where the wind blows under the building as well as against the sides.
- When applying new siding over existing siding, use shims or install a solid backing to create a uniform, flat surface on which to apply the siding, and avoid creating gaps or projections that could catch the wind.
- Coastal buildings require more maintenance than inland buildings. This maintenance requirement needs to be considered in both the selection and installation of siding.

Moisture barrier (also known as a water-resistive barrier): In the context of residential walls, the moisture barrier is either housewrap or building paper (felt). The moisture barrier occurs between the wall sheathing and the siding. It is a dual-purpose layer that sheds water that gets through the siding and limits air flow through the wall. When properly sealed, housewrap is considered an air barrier. Although building paper provides some resistance to air flow, it is not considered an air barrier. Moisture barriers shed water, but they allow water vapor to pass through them.

For further guidance on principles, materials, and procedures for the design and construction of walls to make them resistant to water intrusion, see American Society for Testing and Materials (ASTM) E 2266, *Standard Guide for Design and Construction of Low-Rise Frame Building Wall Systems to Resist Water Intrusion.*

Vinyl Siding

Vinyl siding can be used successfully in a coastal environment if properly designed and installed.

- Windload resistance:

- Vinyl siding is required by the International Building Code® (IBC®) and the International Residential Code® (IRC®) to comply with ASTM D 3679, *Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Siding*, which requires the siding to withstand wind pressures equivalent to 110 mph on a building up to 30' in height in Exposure B. Most vinyl siding has also been tested for higher wind pressures, and can be used in locations with a higher basic wind speed, greater building height, more open exposure, or some combination of those. The design wind pressure or wind speed for which these products are rated is available from product literature, installation instructions, or listings of agencies such as the International Code Council® (ICC®) Evaluation Service.

Definition of Wind Exposure Zones

Exposure B: Urban, suburban, wooded areas.

Exposure C: Open terrain, flat open country, grasslands, all water surfaces in hurricane-prone regions.

- For design wind speeds greater than 110 mph, or building heights greater than 30', or Exposure C, choose a model of siding rated for those conditions or higher. The manufacturer's product literature or installation instructions should specify the fastener type, size and spacing, and any other installation details needed to achieve this rating.

- Products that have been rated for high winds typically have an enhanced nailing hem and are sometimes made from thicker vinyl (Figure 1). Thick, rigid panels provide greater wind resistance, withstand dents, and lie flatter and straighter against the wall. Optimum panel thickness should be 0.040 to 0.048", depending on style and design. Thinner gauge vinyl works well for stable climates; thicker gauge vinyl is recommended for areas with high winds and high temperature changes.

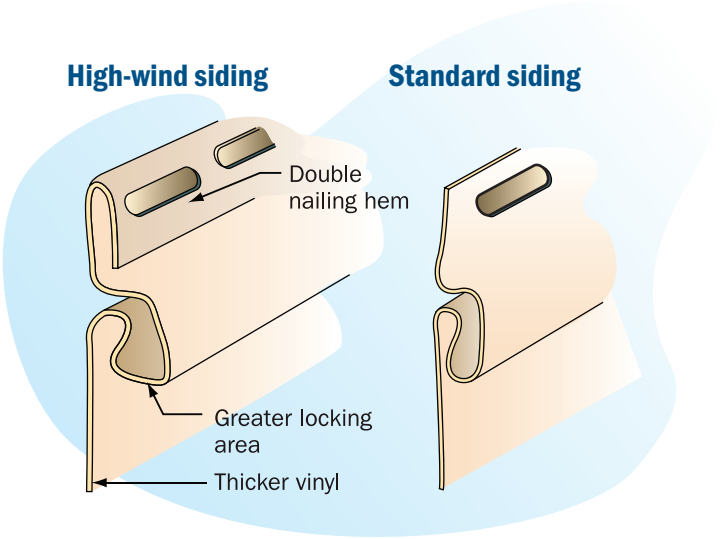

Figure 1. Features of typical high-wind siding and standard siding.

- Position nails in the center of the nailing slot (Figure 2).
- To allow for thermal movement of the siding, do not drive the head of the nail tight against the nail hem (unless the hem has been specifically designed for this). Allow approximately 1/32" (which is about the thickness of a dime) clearance between the fastener head and the siding panel (Figure 3).
- Drive nails straight and level to prevent distortion and buckling in the panel.
- Do not caulk the panels where they meet the receiver of inside corners, outside corners, or J-trim. Do not caulk the overlap joints.
- Do not face-nail or staple through the siding.
- Use aluminum, galvanized steel, or other corrosion-resistant nails when installing vinyl siding. Aluminum trim pieces require aluminum or stainless steel fasteners.

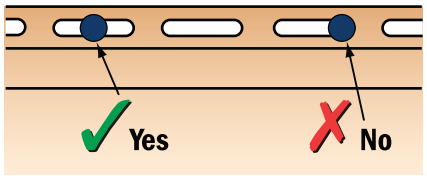

Figure 2. Proper and improper fastener locations.

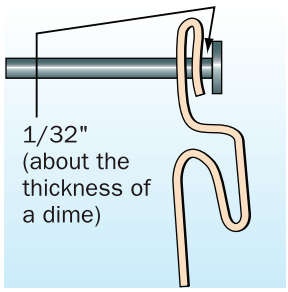

Figure 3. Allow 1/32" clearance between the fastener head and the siding panel.

- Nail heads should be 5/16" minimum in diameter. Shank should be 1/8" in diameter.
- Use the manufacturer-specified starter strip to lock in the first course; do not substitute other accessories such as a J-channel or utility trim (Figure 4) unless specified by the manufacturer. If the manufacturer specifies a particular strip for high-wind applications, use it. Make sure that the starter strip is designed to positively lock the panel, rather than just hooking over a bulge in the strip; field test the interlock before proceeding with the installation.

- Make sure that every course of siding is positively locked into the previous course (Figure 5). Push the panel up into the lock from the bottom before nailing rather than pulling from the top. Do not attempt to align siding courses with adjacent walls by installing some courses loosely.
- Make sure that adjacent panels overlap properly, about half the length of the notch at the end of the panel, or approximately 1". Make sure the overlap is not cupped or gapped, which is caused by pulling up or pushing down on the siding while nailing. Reinstall any panels that have this problem.
- Use utility trim under windows or anywhere the top nail hem needs to be cut from siding to fit around an obstacle. Be sure to punch snap-locks into the siding to lock into the utility trim. Do not overlap siding panels directly beneath a window (Figure 6).

Figure 4. Utility trim was substituted for the starter strip and the bottom lock was cut off the siding. Siding was able to pull loose under wind pressure.

- At gable end walls, it is recommended that vinyl siding be installed over wood sheathing rather than over plastic foam sheathing, as was done at the house shown in Figure 7.
- Install vinyl siding in accordance with manufacturer's installation instructions and local building code requirements.
- It is recommended that vinyl siding installers be certified under the VSI Certified Installer Program sponsored by the Vinyl Siding Institute. For more information, go to http://www.vinylsiding.org/aboutsiding/installation/certinstaller.

Figure 5. The siding panel was not properly locked into the panel below.

Figure 6. Proper detailing around windows and other obstacles is important. Use utility trim, punch snap-locks into siding, and don't overlap directly beneath a window.

Figure 7. The vinyl siding at this gable was installed over plastic foam insulation. Without wood sheathing, the wind pressures on the vinyl are increased. Also, if the siding blows away, the foam insulation is very vulnerable to blow-off. With loss of the foam insulation, wind-driven rain can freely enter the attic, saturate the ceiling insulation, and cause collapse of the ceiling.

Wood Siding

- Use decay-resistant wood such as redwood, cedar, or cypress. See the Sustainable Design section regarding certified wood.
- To improve longevity of paint, back-prime wood siding before installation.
- Carefully follow manufacturer's detailing instructions to prevent excessive water intrusion behind the siding.
- For attachment recommendations, see *Natural Wood Siding: Selection, Installation and Finishing*, published by the Western Wood Products Association (http://www.wwpa.org).

  This publication recommends an air gap between the moisture barrier and the backside of the siding to promote drainage and ventilation. Such a wall configuration is referred to as a rain screen wall. See the text box on page 5.
- Follow the installation details shown in Figure 8. (Note: Although these details do not show a rain screen, inclusion of vertical furring strips to create a rain screen is recommended.)

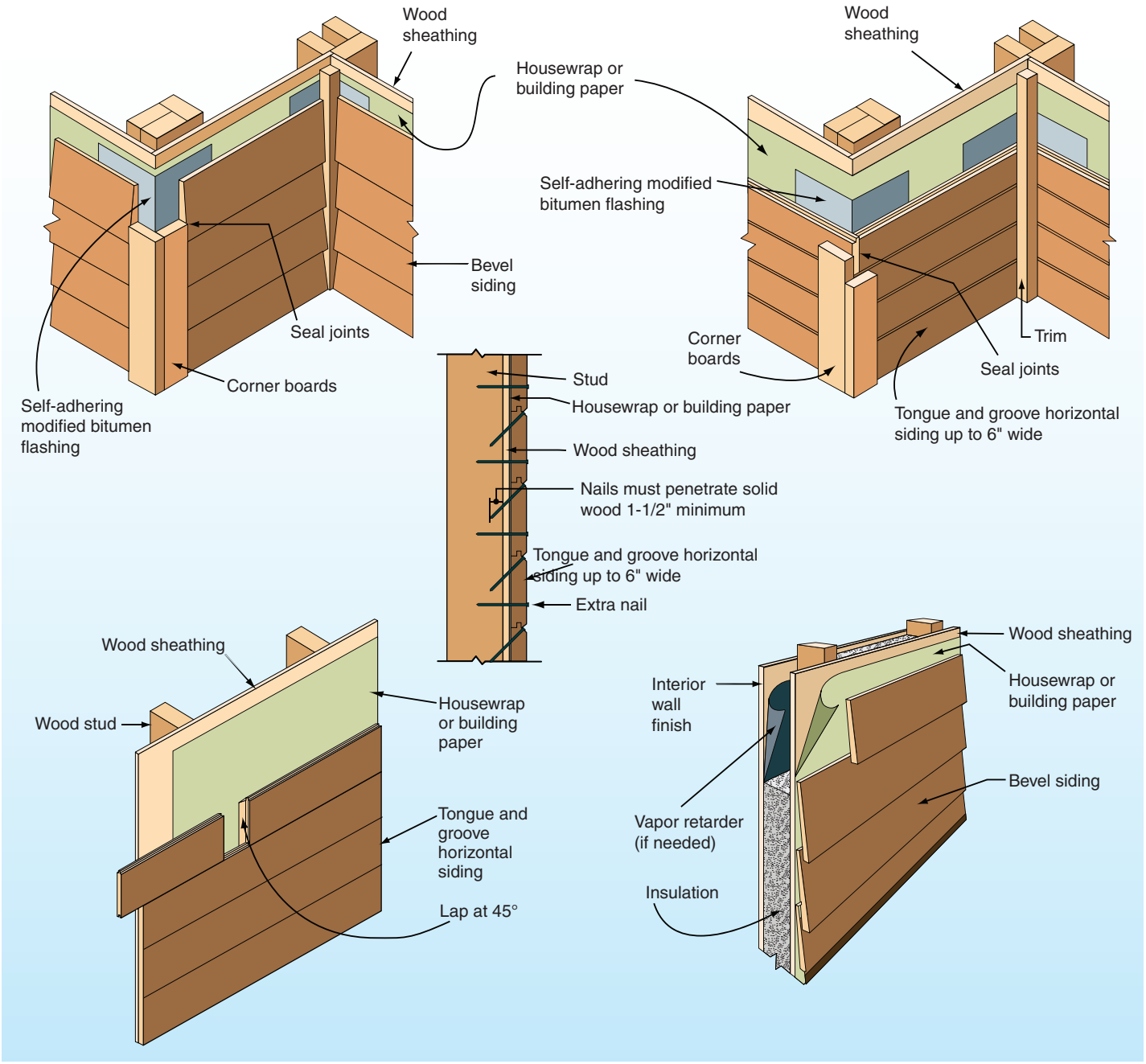

Figure 8. Wood siding installation details.

Pressure-equalized rain screen wall system

In areas that experience frequent wind-driven rain and areas susceptible to high winds, it is recommended that a rain screen design be considered when specifying wood or fiber cement siding. (Typical vinyl siding products inherently provide air cavities behind the siding that facilitate drainage. Therefore, incorporation of vertical furring strips is normally not applicable to this type of wall covering.) A rain screen design is accomplished by installing suitable vertical furring strips between the moisture barrier and siding material (see Figure 9). The cavity facilitates drainage of water from the space between the moisture barrier and backside of the siding and it facilitates drying of the siding and moisture barrier.

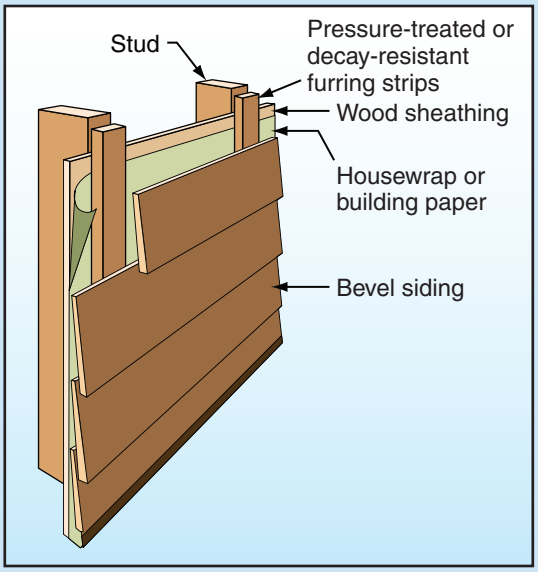

Figure 9. Pressure-equalized rain screen system.

Furring strip attachment: For 1" x 2" furring strips, tack strips in place and use siding nails that are ¾" longer than would be required if there were no strips (thereby maintaining the minimally required siding nail penetration into the studs). For thicker furring strips, an engineered attachment is recommended.

At the bottom of the wall, the cavity should be open to allow water drainage. However, the opening should be screened to avoid insect entry.

At the wall/soffit juncture, the top of the cavity can open into the attic space to provide inlet air ventilation, thereby eliminating soffit vents and their susceptibility to wind-driven rain entry. If the rain screen cavity vent path is used in lieu of soffit vents, the depth of the cavity needs to be engineered to ensure that it provides sufficient air flow to ventilate the attic.

Fiber Cement Siding

Installation procedures are similar to those for wood siding, but require specialized cutting blades and safety precautions because of the dust produced during cutting with power tools. Manufacturer's installation recommendations should be strictly adhered to, and particular attention paid to the painting and finishing recommendations for a high-quality installation.

- Always seal field-cut ends according to the manufacturer's instructions. Properly gap the intersection between siding edges and other building components and fill the gap with sealant.
- Always consult and follow the manufacturer's installation requirements for the needed wind speed rating or design pressure (refer to the manufacturer's building code compliance evaluation report). Observe the manufacturer's fastener specifications, including fastener type and size, spacing, and penetration requirements. Do not over drive or under drive.
- At gable end walls, it is recommended that fiber cement siding be installed over wood sheathing rather than over plastic foam sheathing.
- Keep blind nails between ¾ and 1" from the top edge of the panel (Figure 10). Be sure to drive nails at least 3/8" from butt ends, or use manufacturer-specified joiners.
- Face nailing (Figure 11) instead of blind nailing is recommended where the basic (design) wind speed is 100 miles per hour or greater. If the local building code or manufacturer specifies face nailing at a lower wind speed, install accordingly.
- Do not leave the underside of the first course exposed or extending beyond the underlying material (Figure 12). Consider the use of a trim board to close off the underside of the first course.

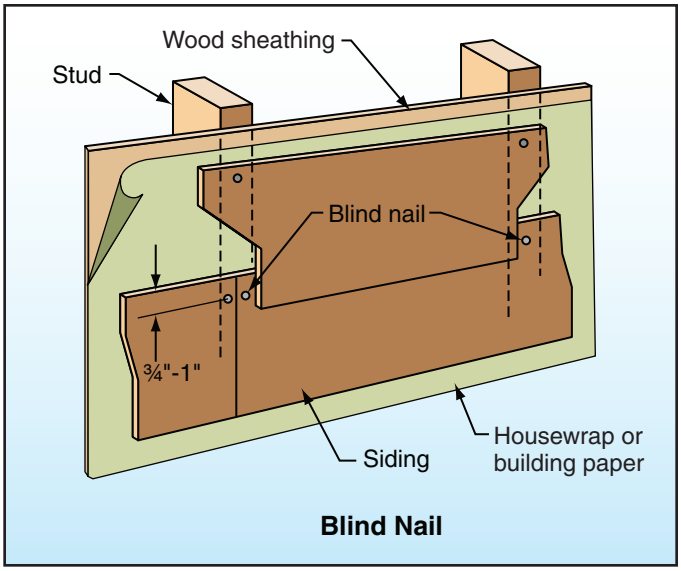

Figure 10. Blind nailing.

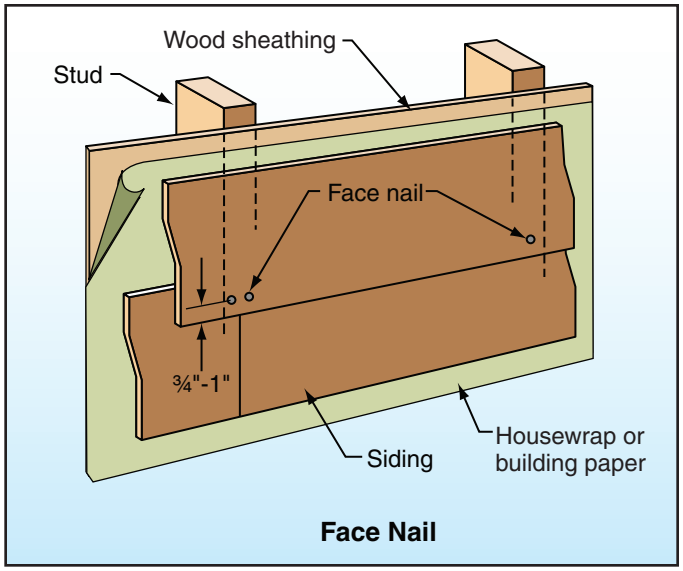

Figure 11. Face nailing.

Sustainable Design

Material selection for sustainable sources and durability

For wood products, select a Forest Stewardship Council (FSC) certified product. The FSC seeks to ensure that wood is harvested in a more responsible fashion, including protecting forest ecosystems, and avoids the use of chemicals and genetic engineering. While redwood, cedar, and cypress are decay-resistant and recommended for durability, they are generally cut from old growth timber. You can determine if the manufacturer is FSC certified by going to http://www.fsc-info.org.

For other siding products, consider long-term life spans for coastal environments, recycled content, and post-consumer use.

Figure 12. Blind nailed siding installed with exposed gap at bottom (red circle) is vulnerable to failure.

The following publications discuss sustainable aspects of vinyl siding:

A Dozen Things You Might Not Know That Make Vinyl Siding Green (available online at http://www.vinylsiding.org/aboutsiding/greenpaper/080919_VSI_Green_Paper_for_web.pdf).

Siding with the Environment (available online at http://www.vinylsiding.org/publications/final_Enviro_single_pg.pdf).

Energy Conservation and Air Barriers: Uncontrolled air leakage through the building envelope is often overlooked. The U.S. Department of Energy estimates that 40 percent of the cost of heating or cooling the average American home is lost to uncontrolled air leakage. In warmer climates, it is a lower percentage of loss. An air barrier system can reduce the heating, ventilation, and cooling (HVAC) system size, resulting in reduced energy use and demand.

Uncontrolled air leakage can also contribute to premature deterioration of building materials, mold and moisture problems, poor indoor air quality, and compromised occupant comfort. When uncontrolled air flows through the building envelope, water vapor moves with it. Controlling the movement of moisture by air infiltration requires controlling the air pathways and/or the driving force.

To effectively control air leakage through the building envelope, an effective air barrier is required. To be effective, it needs to be continuous; therefore, air barrier joints need to be sealed and the barrier needs to be sealed at penetrations through it. The Air Barrier Association of America recommends that materials used

as a component of a building envelope air barrier be tested to have an air infiltration rate of less than 0.004 cfm/square foot, assemblies of materials that form the air barrier be tested to have an air infiltration rate of less than 0.04 cubic feet per minute (cfm)/square foot, and the whole building exterior enclosure have an air infiltration rate of less than 0.4 cfm/square foot.

Air barrier systems installed behind siding:

Housewrap is the most common air barrier material for residential walls. To be effective, it is critical that the joints between sheets of housewrap be sealed as recommended by the manufacturer, and penetrations (other than fasteners) should also be sealed. At transitions between the housewrap and door and window frame, use of self-adhering modified bitumen flashing tape is recommended.

An air barrier should be installed over a rigid material, or it will not function properly. It also needs to be restrained from pulling off of the wall under negative wind pressures. For walls, wood sheathing serves as a suitable substrate, and the siding (or furring strips in a rain screen wall system) provide sufficient restraint for the air barrier.

At the base of the wall, the wall air barrier should be sealed to the foundation wall. If the house is elevated on piles, the wall barrier should be sealed to an air barrier installed at the plane of the floor.

If the building has a ventilated attic, at the top of the wall, the wall air barrier should be sealed to an air barrier that is installed at the plane of the ceiling.

If the building has an unventilated attic or no attic, at the top of the wall, the wall air barrier should be sealed to an air barrier that is installed at the plane of the roof (the roof air barrier may be the roof membrane itself, or a separate air barrier element).

Siding maintenance:

For all siding products, it is very important to periodically inspect and maintain the product especially in a coastal environment. This includes recoating on a scheduled maintenance plan that is necessary according to the manufacturer's instructions and a periodic check of the sealant to ensure its durability. Check the sealant for its proper resiliency and that it is still in place. Sealant should be replaced before it reaches the end of its service life.

Air barrier: A component installed to provide a continuous barrier to the movement of air through the building envelope. Housewrap is a common air barrier material for residential walls. Although very resistant to airflow, housewrap is very vapor permeable and therefore is not suitable for use as a vapor retarder.

Vapor retarder: A component installed to resist diffusion of water vapor and provide a continuous barrier to movement of air through the building envelope. Polyethylene is a common vapor retarder material for residential walls. To determine whether or not a vapor retarder is needed, refer to the Moisture Control section of the *NRCA Roofing and Waterproofing Manual*, published by the National Roofing Contractors Association (NRCA) (http://www.nrca.net).

ASTM E 1677, *Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls*: This specification covers the minimum performance and acceptance criteria for an air barrier material or system for framed walls of low-rise buildings with the service life of the building wall in mind. The provisions contained in this specification are intended to allow the user to design the wall performance criteria and increase air barrier specifications to accommodate a particular climate location, function, or design of the intended building.