



The Complicated
Role of a

Water Resistive Barrier

Choose the right product and install it well,
because if you're not keeping water out,
nothing else matters

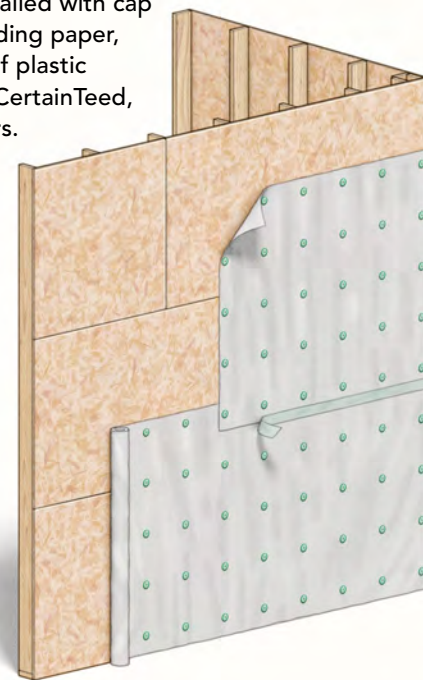
BY BRIAN PONTOLILLO

SIX WAYS TO

STANDARD HOUSEWRAPS

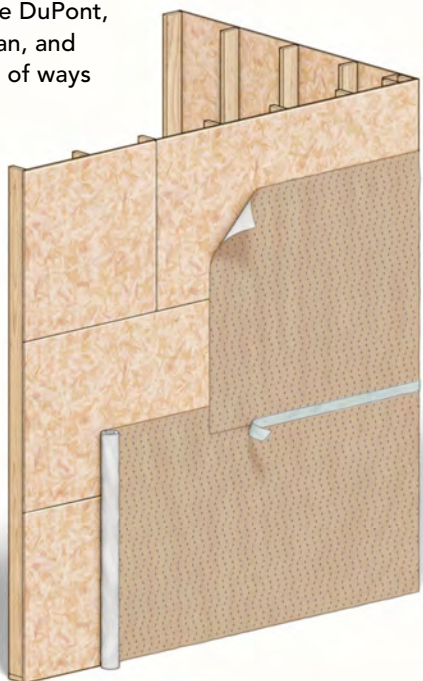
Water-resistant barriers that come in rolls and are generally installed with cap fasteners include felt, building paper, and numerous variations of plastic housewrap from DuPont, CertainTeed, Barricade, and many others.

Though installation is similar, with courses lapped over each other from the bottom to the top of the wall and flashings integrated for drainage, this category of products varies widely in performance, quality, and price. Even with the seams taped, most of these products tend not to be great air barriers, despite manufacturers' marketing claims.



DRAINABLE HOUSEWRAPS

As soon as building scientists spread the word that you don't need much of a gap behind your siding for water to drain, manufacturers like DuPont, Benjamin Obdyke, Kingspan, and Tamlyn invented a number of ways to integrate a drainage plane with their housewraps. There are products with wrinkles, grooves, dimples, and spacers, all designed to keep siding from trapping water. Most of these products install like housewrap, though they are generally a step up in cost. If you are not planning to install your siding on furring strips to create a more robust air and ventilation space, a drainable product is the next best option.



As a teenager, I worked for a small general contracting company. In between a lot of grunt work and coffee runs, I learned to do some carpentry. On two jobs, I helped install siding. When we installed cedar shakes, the carpenters taught me to offset each seam as much as possible to keep water from getting behind the siding. When installing clapboards, we backed up all of the butt joints with flashing, which has long been best practice.

Fast forward 20 years: I'm working at *Fine Homebuilding*, visiting the job site of a high-performance home that was designed by a well-respected architect and is being built by a high-performance builder. On the coast, where wind-driven rain is a regular event, the crew had just finished installing the "open-gap," or "rainscreen," siding—that is, siding installed over furring strips with an intentional space left between the boards.

How did we get from laying a healthy bead of caulk where siding meets trim to leaving a wide open space between each course? When did we stop relying on siding to keep water out, and start installing it to let water out? Perhaps it was the mold explosion in homes at the turn of the century and the work of architects, building scientists, and educators like Steve Baczek who showed us that even the best siding installation is no match for water, and that every house needs a dedicated and effective water-resistant barrier, or WRB. "Mother nature has a perfect record," says Baczek, "Water is the number one killer of buildings."

The International Code Council agrees. Section R703.1.1 of the International Residential Code (IRC) calls for a water-resistant barrier behind siding and only allows exceptions for some masonry walls and wall assemblies that have been specifically tested to show resistance to wind-driven rain. Regardless of how we got here, the role of the material behind the siding has become of the utmost importance, and manufacturers have responded at warp speed. While you can find code-approved WRBs marketed for every wall assembly imaginable, there's a lot to know to make an educated decision on how best to keep your walls dry.

Performance data is elusive

According to Yamil Moya, an engineer at the International Code Council Evaluation Service (ICC-ES), the non-profit that evaluates building materials for the IRC, Type 1 asphalt-saturated felt meeting ASTM standard D226 is the only WRB prescribed in the code. All other products must be approved through criteria created by his organization. ICC-ES acceptance criteria 38, or AC38, is used to evaluate the durability, water resistance, vapor transmission, air leakage, and other qualities of most housewraps. Other product types have different criteria. Fluid-applied water-resistant barriers, for example, must meet ICC-ES AC212.

To meet these standards, manufacturers submit materials including product specs, test results for water resistance and permeability, and installation guidelines. All approved products have a report available online at icc-es.org. Unfortunately, the reports don't provide test results or evaluate the products,

MANAGE WATER

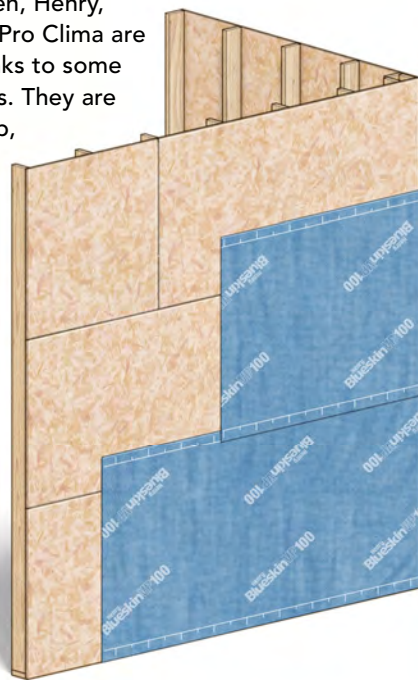
INTEGRATED PANELS

This style of WRB includes Huber's ZIP System, Georgia-Pacific's ForceField, and LP's WeatherLogic, which are all OSB with adhered water- and air-resistive materials. The benefit is that it takes fewer steps to sheath a house and detail the water and air barriers on the walls. Each company's panels and tapes work as a proprietary system, but install in a similar way. Critics point to the reliance on the tape—and some people are just not fans of OSB. These systems are slightly more expensive than wrapping standard OSB in most houswraps.



SELF-ADHERING BARRIERS

Peel-and-stick water-resistive barriers from companies like Dörken, Henry, VaproShield, Carlisle, and Pro Clima are growing in popularity thanks to some pretty exceptional benefits. They are rolled out like a housewrap, so the seams lap for drainage, and the adhesive creates a gasket around siding fasteners. Because they fully adhere to the sheathing, they share the air-sealing potential of a panel product. Expect to pay a premium and keep in mind that certain products, substrates, and weather conditions may require that you use a primer before installation.



FLUID-APPLIED BARRIERS

Sprayed or rolled on to the sheathing, fluid-applied water-resistive barriers have a long history in commercial construction and are slowly being adopted by home builders. Available from companies like StoGuard, Tremco, and Prosoco, they are among the more expensive options, but have some advantages. They efficiently seal the entire sheathed wall from water and air intrusion. Some products incorporate tape at sheathing seams and as flashings at rough openings; others rely on fluid-applied flashing products to complete the system. Some fluid-applied water-resistive barriers must be installed by certified contractors.



RIGID-FOAM INSULATION

There are a number of good reasons to insulate the outside of a house, and this thermal layer can sometimes be used as the water-resistive barrier. But there are some caveats. First, not all foam is approved. If you search on icc-es.org for AC71, the acceptance criteria for rigid-foam panels as a water-resistive barrier, you will find a relatively small number of approved polyiso, XPS, and EPS products. Another important detail is that you need to bring all of your waterproofing out to the face of the foam, which will likely mean furring out windows and doors and could require some tricky flashing details.



they simply describe the applications for which the products are approved, and give limitations. “Meeting these criteria only means that they comply with minimum requirements,” said Moya, who declined to comment on the quality of individual products.

Many experts agree that the tests ICC-ES accepts for water resistance don’t necessarily represent installed conditions. In one test for housewraps, the products are shaped into boats and floated on water to see how long it takes for them to leak. Another exposes the material to a specific column of water for a certain amount of time. According to Peter Yost, a high-performance-building consultant, failure is often the result of water being trapped between the siding and the WRB, a phenomenon called “water held in tension.” Since products are not tested for this real-world situation, Yost says our best option is to install siding in a way that won’t allow it to occur.

More than a product

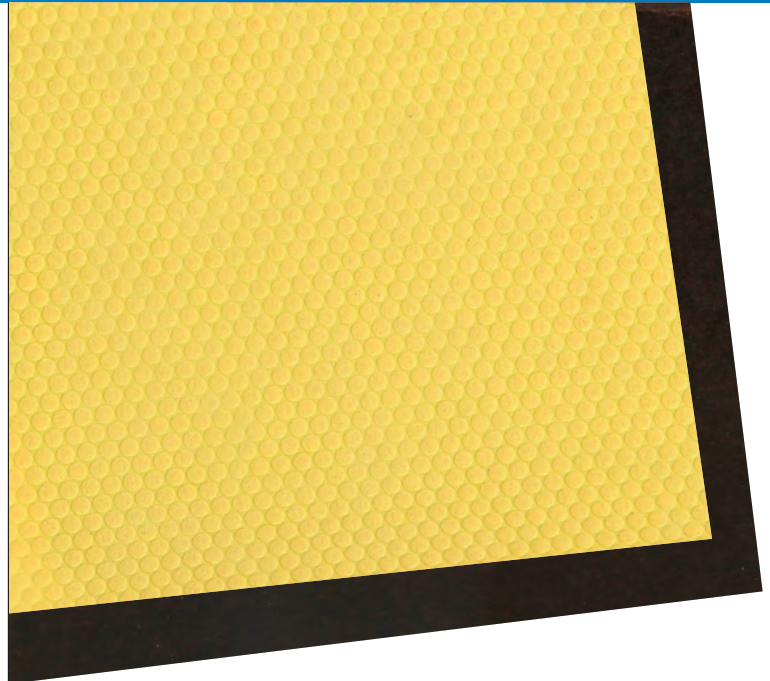
A WRB’s primary duty is to keep water from getting into the walls. The product you choose is part of the equation. But as Baczek likes to say, we can set any product up for success or failure with the way we design the rest of the house. He uses roof overhangs as an example: The greater the length of the overhang, the further away we keep rain and snow melt from the walls.

Baczek, Yost, and most other experts agree that the best thing you can do to give your WRB a chance to succeed is to ventilate your siding. In rainscreen siding installations, the WRB is also sometimes referred to as the drainage plane—the surface that water can run down to eventually escape to the ground. Any type of WRB can be used in this application. However, builders who don’t use furring strips to create an air space may prefer a drainable housewrap—a product with an integral drainage gap.

It is because we hope the water that gets behind the siding will drain that felt, building paper, and housewraps are installed shingle-style with overlapping seams. To effectively keep water out, there’s much more to know about installing a WRB, including how to integrate your chosen product with window and door flashing, how to integrate existing and new products when remodeling, and even how to make repairs when the WRB is accidentally damaged during construction. In other words, even the best products are only as good as the installation.

Air-sealing is possible

The order of the conditions that a wall assembly needs to control is important. Water comes first because everything else is irrelevant if your building starts to rot. Air is second on the list. A tight house is more comfortable and more efficient. And when we control air, we control moisture, because a lot



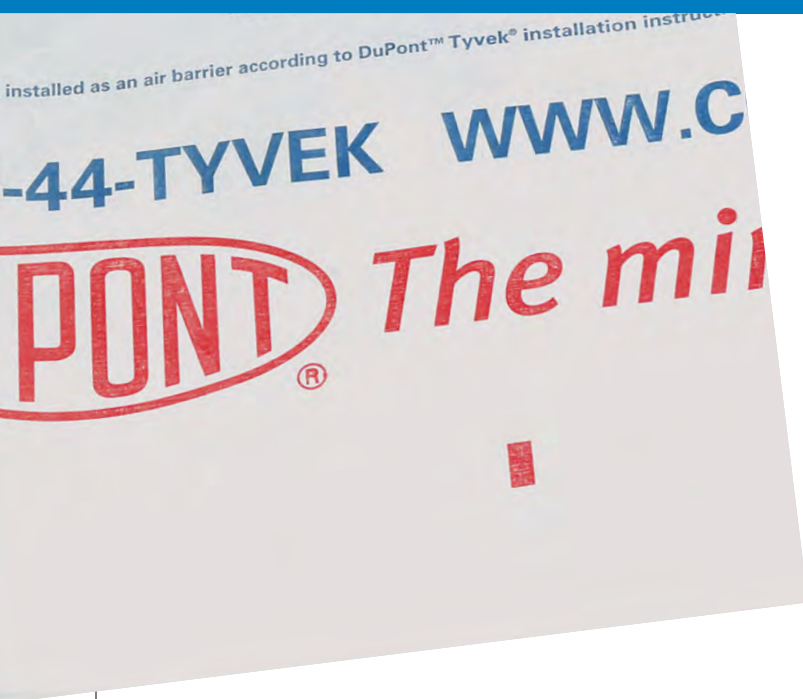
HENRY JUMBO TEX

In our time of high-tech materials, it seems odd that the only product the IRC lists as a water-resistive barrier for walls—Type 1, #15 asphalt felt—is actually made for roofs. More curious is that today’s “felt” is mostly asphalt-impregnated, recycled paper. If you like the qualities that felt has to offer, but want a product designed for walls, you might consider Henry’s Jumbo Tex. Made from virgin organic material, Jumbo Tex is asphalt-saturated kraft paper. It meets the IRC’s criteria for a WRB, can be used behind any type of siding, and has a higher perm rating than roofing felt. Jumbo Tex is available in 20-minute and 60-minute water-resistive options, as well as two-ply products (shown here). Like other felt and paper products, Jumbo Tex needs to be covered quickly as it is not UV stable. Though prices vary regionally, a 40-in. roll of basic Jumbo Tex that will cover 324 sq. ft. typically costs less than \$20.

WRB FAQS

I interviewed a number of manufacturers’ marketing folks and product managers for this article. One thing that I asked all of them was, “What are the most common question you get about your products?” Here are some of the most applicable responses.

AT WATER-RESISTIVE BARRIERS



DUPONT TYVEK HOMEWRAP

For a while it seemed that the brand name “Tyvek” was used synonymously with “housewrap.” This is because it was the first synthetic product to hit the market, long before a water-resistive barrier was required by the IRC. Tyvek HomeWrap is nonwoven, nonperforated, high-density polyethylene. It has a perm rating of 56, one of the highest available, and is UV resistant for 120 days. DuPont also offers Tyvek DrainWrap, a slightly less permeable product with vertical grooves that create a drainage plane behind siding; Tyvek ThermaWrap, an insulating water-resistive barrier; and Tyvek StuccoWrap, a water-resistive barrier specifically designed for stucco and EIFS. A 9 ft. by 150 ft. roll of Tyvek HomeWrap costs \$150 at the big box stores (you’ll also need fasteners, and maybe tape).



HUBER ZIP SYSTEM SHEATHING

Huber Engineered Woods introduced ZIP System sheathing around the same time Apple introduced the iPhone. Both were revolutionary. Huber’s goal was to lessen the number of steps it takes a builder to sheath a house, install the WRB, and create an airtight envelope. ZIP panels are OSB with a phenolic-resin-impregnated covering. Seam-sealing and flashing are done with ZIP System tapes and fluid flashing products. The panel coating has a perm rating between 12 and 16 and can be exposed for up to 180 days before siding is installed. Huber has since launched ZIP System R-sheathing, which includes thermal control. The cost of ZIP System panels varies regionally and fluctuates with the price of OSB. At the time of writing, a 4-ft. by 8-ft. sheet of 7/16-in. Zip System sheathing costs \$16 in Texas and \$30 in Connecticut (a roll of tape, enough for eight sheets, is \$27 in Texas and \$33 in Connecticut).

Why should I spend money on an expensive housewrap when the siding is keeping most of the water out?

Siding does keep a lot of water away from your wall assemblies, but experts agree that even the best siding installations leak. And there are other ways that water can get behind your siding and into your walls. Brian Kirn at CertainTeed says that the upgrade from CertaWrap—their woven, perforated, more budget-oriented housewrap—to CertaWrap Premium—their nonwoven, non-perforated high-performance product—will only add a few hundred dollars to the cost of a project. Kirn says that you can get away with CertaWrap in drier areas with less intense weather. Everywhere else, the upgrade to CertaWrap Premium is money well spent.

If I overdrive nails when installing ZIP System sheathing, do I create a weak link in my water-resistive barrier?

Chris Clark, the director of technical services at Huber, says this is the number one question he’s asked. The answer is: It depends. While a slightly overdriven nail won’t affect the performance of the water-resistive barrier or the product warranty, any nail driven more than halfway through the panel should be addressed. From a water-management perspective, this simply means covering the fastener with a small piece of ZIP tape or their fluid flashing product. However, overdriven fasteners can be a structural weak point, so another nail should be added to satisfy your building inspector and allow you to sleep well at night.

of water vapor rides on air. A leaky home will have much more water vapor traveling through the walls than a tight home. According to Baczek, vapor diffusion through an airtight assembly is an insignificant problem in comparison to air intrusion in a leaky home. “If I solve for water and I solve for air,” he said, “vapor and thermal are easy.”

For this reason, many architects and builders are turning to WRBs that are also effective and easy-to-detail air barriers. Panel products, self-adhering WRBs, and fluid-applied WRBs can be part of a home’s air-barrier system. While certain products can make water- and air-management a one-step process, be careful as you consider what WRB is right for your project.

Many plastic housewraps are made of airtight materials and are marketed as such, but it’s widely known that they are tricky, although not impossible, to install as effective air barriers. If you plan to go with this type of product, and want your air barrier on the exterior of the wall, a more straightforward option is to tape the sheathing joints and use a combination of tape and polyurethane spray foam to air-seal penetrations.

Walls can still get wet

All WRBs have a listed perm rating that describes how easily water vapor can move through the material. A product with a higher perm rating will allow water vapor to transfer through the material more readily than one with a lower perm rating. Code-approved felt has a perm rating around five when the material is dry, though the perm rating increases to as much as 60 when the felt gets wet. Most WRBs do not absorb water, but that doesn’t mean the perm rating is always consistent. Perm ratings are tested in specific weather conditions, namely under controlled temperature and humidity. When those conditions change around an installed material, so does its permeability.

Carl Fiocchi, a building scientist at the University of Massachusetts, looks for a combination of water resistance, durability, and high vapor-permeability when choosing a product. “For my money,” says Fiocchi, “the higher permeability I can get, the better.” Many experts take this route because even without leaks, walls can still get wet. For example, water vapor from the warm air inside a house can be driven outward during the winter and condense on cold sheathing. In this situation, a more permeable water-resistive barrier won’t trap the water inside the wall.

Michael Aoki-Kramer, managing principal at RDH Building Science, points out that it’s important to know the general thresholds when it comes to perm ratings. “At the upper end, perm rating doesn’t really matter. Above 20, there is no appreciable improvement in drying time. Below 10 perms, you start slowing down the rate of drying in ways that could be appreciable.” While a low perm rating may not



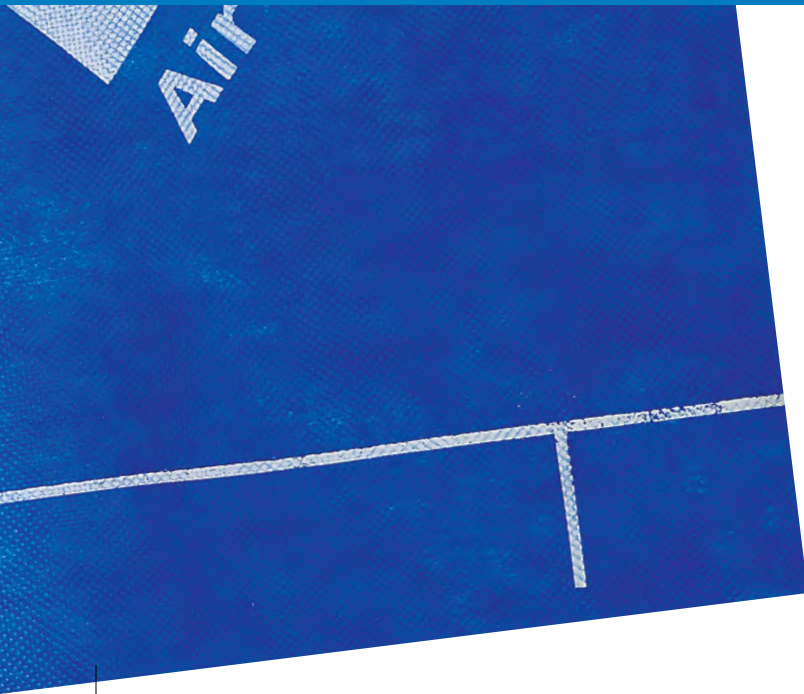
BENJAMIN OBDYKE HYDROGAP

The folks at Benjamin Obdyke pride themselves on using the latest building science to develop their products. When they began to develop their first drainable housewrap, they turned to the research of Building Science Corp. to determine the optimal space. The results of their research and development is HydroGap Drainable Housewrap. Launched in 2011, HydroGap is a laminated product with a waterproof film sandwiched between nonwoven polypropylene layers that provide strength and UV resistance. On the outer surface, HydroGap has rigid 1-mm spacers that create a drainage plane behind the siding. The product is rated at 16 perms and can be exposed for 120 days. You can buy HydroGap direct from Benjamin Obdyke’s website. A 5-ft. by 100-ft. roll sells for about \$140.

be desirable in a wall assembly that you are expecting to dry outward, Aoki-Kramer points out that there are situations where you may want a WRB to resist inward vapor drive. He says that homes with reservoir sidings like brick and stucco that can hold a lot of water may be candidates for a WRB with a lower perm rating.

Finally, the perm rating on a product’s data sheet only tells some of the story. With panel products, the stated perm ratings apply to the water-resistive coatings, not the OSB it’s applied to, and OSB is a pretty effective vapor retarder. How the product achieves permeability matters, too. For example, a plastic housewrap may be perforated or nonperforated. Perforated materials are punched with tiny holes to create permeability while nonperforated materials allow water vapor

AT WRBs CONTINUED



HENRY BLUESKIN VP100

Henry has been making sticky stuff for a long time. The company produces a number of tapes, sealants, and adhesives. These products are generally not breathable, but Henry cracked this code with Blueskin VP100—a peel-and-stick water-resistive barrier with a perm rating of 33. Henry won't give away their "trade secrets" and just says that Blueskin has an engineered film with a patented, permeable adhesive. Some substrates and application in certain temperatures may require a primer, and you must use compatible Henry flashing products to maintain the warranty, so read the product literature carefully. Henry doesn't offer consistent regional pricing. At the time of writing, a 4-ft. by 100-ft. roll costs about \$250 in South Carolina.



LP WEATHERLOGIC

To create WeatherLogic, LP Building Solutions applied their SmartSide technology—a water-resistive paper overlay—to OSB panels. When taped and flashed properly, the structural sheathing provides a code-approved WRB. LP's acrylic tape comes in 3³/₄-in. and 6-in. widths for taping seams and flashing windows, doors, and penetrations. Each roll comes with a squeegee to smooth and bond the tape to the substrate. WeatherLogic is currently only available in 7/16-in. panels approved for walls, but LP plans to release roof sheathing, more panel sizes, and more helpful accessories. The product coating is rated at just over five perms and can be exposed for six months. WeatherLogic is so new that it may be difficult to source, but at the time of writing, a builder in Alabama can get 4-ft. by 8-ft. sheets for \$15, and a roll of the 3³/₄-in. seam tape for \$27.

WRB FAQs CONTINUED

Does siding installation compress drainable housewrap, reducing the gap and the ability of the assembly to drain?

It is hard to believe that the small wrinkles, grooves, and spacers in some drainable housewraps actually create an effective space for drainage. However, Chris Yount, senior vice president for residential products at Henry, and Tara Murray, director of marketing at Benjamin Obdyke, both explain that part of their drainable housewrap's design and testing was to make sure that the material will not be flattened or smoothed out when siding is installed. Benjamin Obdyke funded testing of ten drainable housewraps in a chamber mimicking a real-world wall assembly. The results are available on their website.

Do I really need to use a J-roller when installing flashing tape to seal a water-resistive barrier?

Yes. These tapes are generally pressure activated, and according to the folks at both Huber and Benjamin Obdyke, this is a critical installation detail. Run a J-roller over the tape and smooth out any bubbles or wrinkles for the best bond and a more waterproof assembly. If you choose a self-adhering water-resistive barrier like Henry Blueskin, the entire surface must be rolled.

to diffuse through the material itself. Though both types can pass the necessary testing for code approval, and both may be considered permeable materials, perforated materials have shown to be much less water resistant in independent testing. If you're building in an extremely wet area, this may be an important distinction. In a dry area, it may not.

Installation matters

In one simple paragraph, the IRC describes how felt must be installed to meet the requirement for a WRB—horizontally, upper course lapped over the course below by at least 2 in., vertical joints lapped at least 6 in., without “holes or breaks,” and continuous to the top of the wall. That's it. The IRC says that any other approved product should be “...installed in accordance with the water-resistive barrier manufacturer's installation instructions.”

The best housewrap manufacturers' instructions will include not only how much to overlap the horizontal courses and vertical seams, but also a fastening schedule and how to integrate flashings for many different penetrations. According to Mike Guertin, who has been educating the building industry about WRBs for two decades, reverse lapping is still a common mistake, and builders often integrate the flashing incorrectly too. If you mistakenly put step flashing over the WRB where a wall meets a roof, for example, then any water that gets behind the flashing gets to the sheathing.

When it comes to using air-sealing and flashing tapes with any type of water-resistive barrier, make sure they are compatible. If this information isn't listed in the installation instructions, it's worth a call to customer service to make sure you don't do anything that will fail or void the WRB's warranty. While panel-style products will first be installed as structural sheathing, it's the taping and flashing process that allows them to work as effective water-resistive barriers. The manufacturer's installation instructions specify which weather conditions are acceptable for taping, how much the tape must overlay each side of the seams, the order of taping seams, and methods for firmly seating the tape—a J-roller may be needed.

Self-adhering WRBs combine installation details for housewraps and panels. Though these products can sometimes be installed vertically, manufacturers encourage shingle-style installations—overlapping courses from the bottom of the wall to the top—and specify how much the courses should overlap. Because these products are essentially big rolls of tape, the right temperature and surface prep are necessary. Like tape, self-adhering water-resistive barriers should be rolled out to improve adhesion.

Though some manufacturers of fluid-applied WRBs require training to use their products, these types are among the simplest to install once you understand the process. On



DÖRKEN DELTA-VENT SA

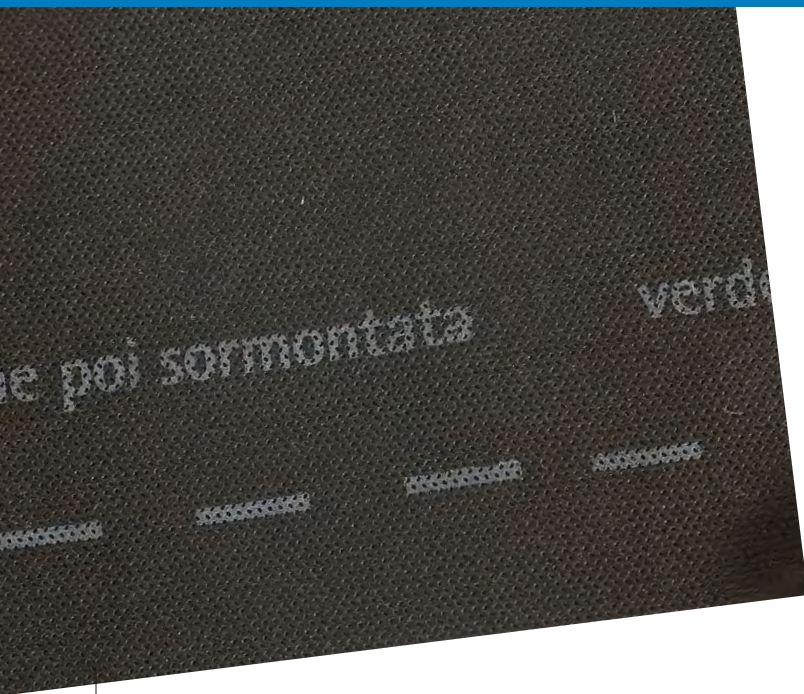
Dörken is a German company that proves how far ahead Europeans tend to be when it comes to innovative home-building practices. Dörken started making finishes in 1892, released their first synthetic roofing underlayment in the 1960s, and had a UV-resistant water-resistive barrier for open-joint siding in 1999. Today, their premium WRB is Delta-Vent SA. This layered product has protective spun-bonded polypropylene outer layers protecting a polymeric water-resistive barrier. It has a high perm rating of 50 and a one-of-a-kind lap-sealing system. Dörken's suggested retail price for Delta-Vent SA is around \$565 for a 4-ft. 11-in. by 115-ft. roll, but they also offer “special project pricing.” So, it may be worth a visit to their website to find the sales rep for your region before ordering.

the other hand, using rigid foam as a water-resistive barrier, which can be tempting if you are planning to use it for exterior installation, can be very tricky to detail well.

Finally, it's important to know how long your WRB can be left exposed. While some products offer up to 12 months, more commonly WRBs must be covered within two to four months. One UV-stable product is Benjamin Obdyke's InvisiWrap UV. Not only is this new water-resistive barrier rated for up to a year of exposure, it's black with no writing on it and meant to disappear behind open-joint siding. The 25-year warranty allows gaps in the siding of up to 2 in., which prompts the question: How long until we don't need siding at all? □

Brian Pontolilo is editor of greenbuildingadvisor.com.

AT WRBs CONTINUED



PRO CLIMA SOLITEX MENTO

Germans like to over-engineer everything from cars to, well, water-resistive barriers. Pro Clima is a German company distributed by 475 High Performance Building Supply. Their main line of WRBs includes Solitex Mento 1000, 3000 Connect, and 5000 Connect, all layered products with a polymer blend sandwiched between protective layers and a perm rating of 38. The product numbers represent increasing thicknesses and durability—the 1000 can be exposed for three months, the 3000 for four, and the 5000 for six. When installing a rainscreen assembly over these products, you can use Pro Clima's Tescon Naideck batten tape behind furring strips to create a WRB with no vulnerable fastener penetrations. A 59-in. by 164-ft. roll of Mento 1000 costs \$220; 3000 Connect is \$280; and 5000 Connect is \$350.



PROSOCO CAT 5

Prosoco claims to test their fluid-applied water and air barriers to failure in high-rise commercial construction, so they feel confident in the performance of their entire line. Their most durable product, Cat 5, is a silyl-terminated polyether that is rolled onto the substrate. Because it is moisture-activated and rated at 18 perms, Cat 5 can be applied to wet surfaces. It can be exposed for up to a year. Cat 5 works in tandem with Prosoco's fiber-reinforced Joint & Seam Filler and fluid-applied FastFlash. Many jobs will only require one coat of Cat 5, though two is recommended for OSB sheathing. In Denver, a 5-gal. bucket of CAT 5 costs \$560 and covers up to 500 sq. ft., depending on the substrate. A 20-oz. tube of Joint & Seam Filler costs \$35 and covers up to 60 linear ft. A 20-oz. tube of FastFlash costs \$25 and covers up to 17 sq. ft. Prices may vary regionally.

WRB FAQs CONTINUED

Do I need to tape the horizontal laps of my housewrap?

More than one manufacturer told me that this is a commonly asked question. However, their answers differed. From a water-management perspective, the folks at Benjamin Obdyke would rather you didn't tape horizontal seams. As long as your housewrap is lapped appropriately, water will drain. Tara Murray told me that any surface-mounted tape will only create a reverse lap and a place for water to potentially hang up. Brian Kirn at CertainTeed feels differently, and says that taping horizontal laps provides extra waterproofing protection. And of course, if you're trying to use your housewrap as an air barrier, you'll have to tape all of the seams.

Is it really a good idea to make my house airtight?

Johnny Rezvani, a certified Passive House consultant and the director of communications at 475 High Performance Building Supply, the North American distributor for Pro Clima, told me that this is still a very commonly asked question. The answer, of course, is yes—but you need to know what you are doing. He says that his company is always willing to help their customers design building assemblies that are airtight and vapor-open, and they are building a free library of details on their website to help. They also sell a number of ventilation appliances for tight homes.