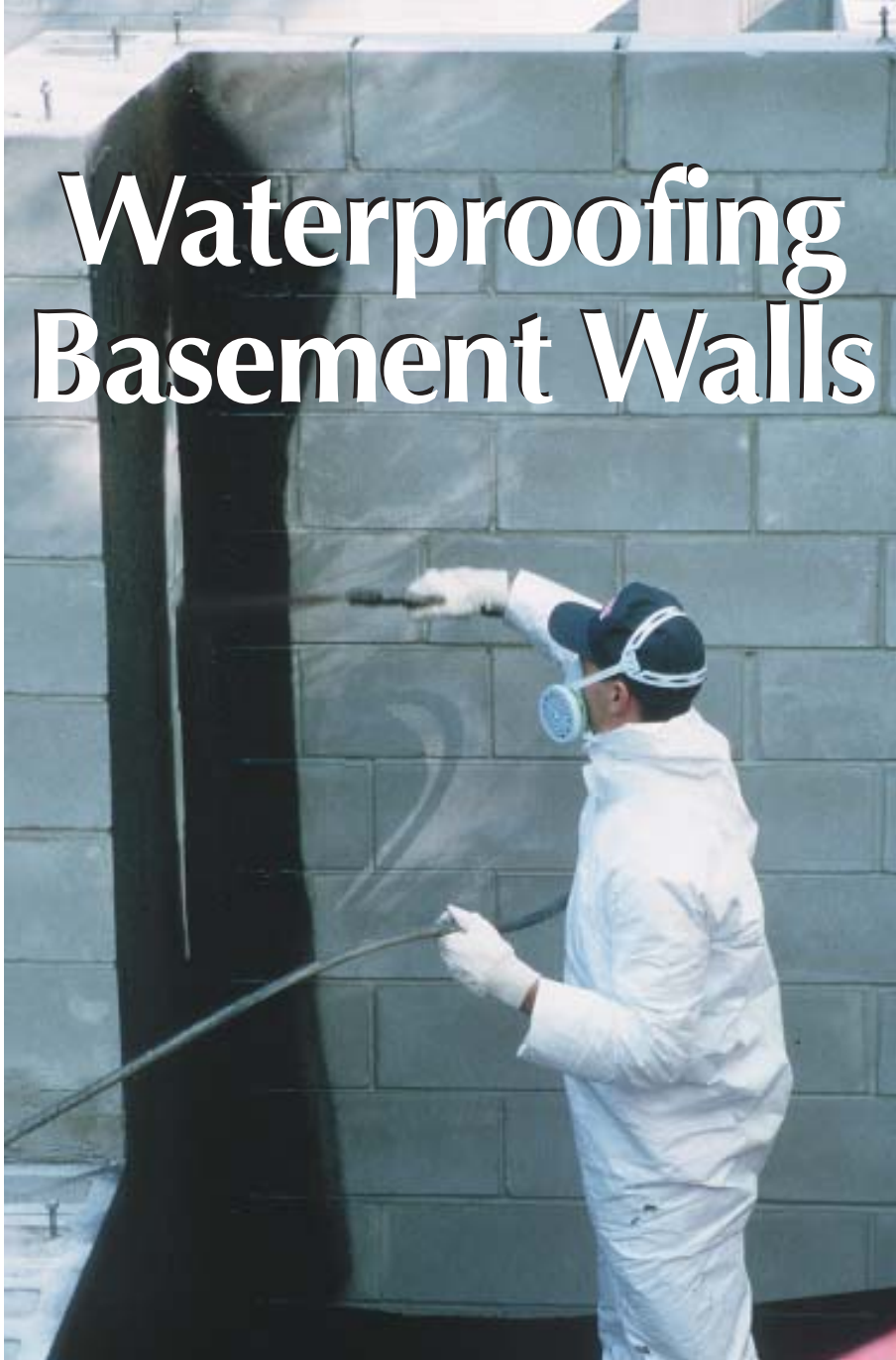


Waterproofing Basement Walls



Take your pick of spray-on, brush-on, or sheet membrane products, but don't forget the foundation drain

As one manufacturer of waterproofing systems put it, most builders paint the foundation black and move on. He

by David Frane

was referring to builders who do the minimum required by code, which is dampproofing the walls. However, dampproofing a foundation won't necessarily keep the water out. Residential codes don't require dampproofing to meet any performance standards. The only requirement is that it be some kind of bituminous (asphalt) coating.

Waterproofing vs. Dampproofing

Dampproofing can stop water vapor but won't bridge cracks or resist water pressure. Waterproof membranes are designed to be flexible, so they can span small cracks and resist static pressure. Most waterproofing systems are intended for use on block and poured concrete walls, but some also work on foundations made from pressure-treated wood or insulated concrete forms (ICFs).

It's cheaper to dampproof a basement than to waterproof it. The typical installed cost for dampproofing the walls of a 30x40-foot foundation is

about \$300. But it would cost around \$1,200, or \$1.25 per square foot of wall, to waterproof the same basement.

It's hard to fault a spec builder for going with a cheaper product when there's no guarantee a customer will pay more to get something better. On the other hand, cheap products aren't so cheap if they lead to callbacks. And the recent wave of lawsuits over toxic mold has given builders an added incentive to do whatever it takes to avoid moisture problems. According to one manufacturer, about 25% of new houses with basements now get waterproofing.

A waterproof membrane is part of a bigger system. Foundation coatings are designed to work in conjunction with footing drains and proper grading. The idea is to keep water away from the foundation. Any water that does reach it should be prevented from entering until it can drain away (see Figure 1).

Drains should be covered with gravel and filter fabric and slope to daylight.

Figure 1. All the waterproofing products featured in this article are intended for use with a properly installed foundation perimeter drain.



Figure 2. Water-based asphalt emulsion coatings are far less toxic than solvent-based formulations but must be protected from freezing during application.



KOCH WATERPROOFING SOLUTIONS

Soil should slope away from the wall, and swales should be used to direct runoff away from the building. Rather than tying them into the foundation drain, gutter downspouts should be extended away from the foundation in separate pipes.

Liquid Membranes

Most waterproofing systems rely on

liquid coatings that dry to form seamless membranes. Materials come in different grades for different application methods. Most waterproofing is sprayed on, but you can use a roller, brush, or trowel. Liquid membranes are popular because they go on quickly and easily.

None of these products works if it isn't installed properly. Every manufacturer has specific requirements for filling rod holes and cracks, and for precoating or creating fillets at inside corners. Each coating must be applied to a specified thickness, usually 40 to 60 mils. (By way of comparison, a dime is about 40 mils thick; dampproof coatings are typically about 10 mils thick.) The actual thickness of the membrane depends on the skill of the applicator and the number of coats applied. Unskilled applicators apply material unevenly, which leaves thin spots in the membrane.

Most contractors sub out this work to companies that specialize in waterproofing. Some products require specialized application equipment, and most aren't covered by warranty unless the work is done by a certified applicator.

Modified Asphalt Coatings

Dampproofing is made from unmodified asphalt, which is not elastic enough to bridge the hairline cracks that develop in foundations as they dry. Also, pure asphalt tends to dry out and get brittle with age.

Asphalt-based waterproofing, on the other hand, contains rubber or rubber-like additives that increase initial elasticity and prevent it from drying out over time.

Modified asphalt formulations typically contain solvents such as xylene, toluene, or mineral spirits. This allows them to be applied over a wide range of temperatures, even well below freezing. But it also means they produce fumes and tend to be flammable and toxic until they dry. Modified asphalt should not be used on green concrete, and you can't use it on ICFs because the solvents will dissolve the foam.

Mar-Flex Waterproofing Systems' Mar-Flex 5000 is a modified asphalt that has a 24-hour cure time and can be applied anywhere between 0 and 150 degrees. Karnak's #229 AR-Elastomeric is a single-component rubber-reinforced asphalt.

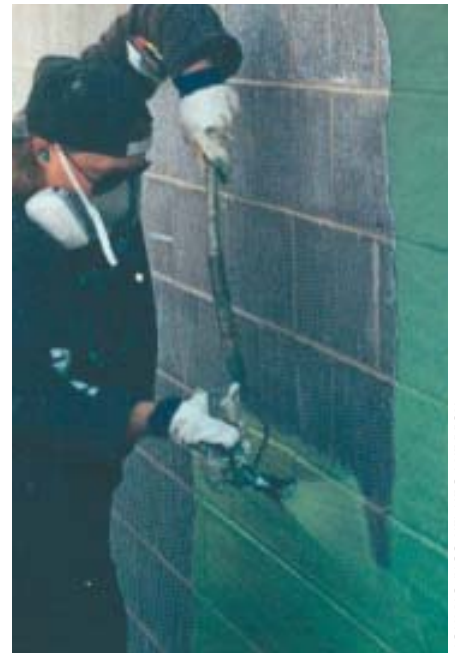
Asphalt emulsions. Asphalt emulsions are water-based versions of the more traditional modified asphalt coatings (Figure 2). Most asphalt emulsions can be applied to green or damp concrete, which makes it easier to schedule the job. These materials aren't flammable, produce little in the way of fumes, and can be cleaned up with water. They're usually compatible with ICF foundations because they don't contain the kind of solvents that dissolve foam insulation.

But asphalt emulsions aren't perfect. They take a long time to dry when it's cold and can get washed off the wall if it rains before the membrane has set. Water-based coatings should be protected from freezing before application and can't be applied at the same low temperatures as modified asphalt. Typically, you can't apply an emulsion below 20°F, or, in many cases, 40°F.

A large number of companies produce asphalt emulsion waterproofing material. Some of the better-known products are Koch's Tuff-N-Dri and Watchdog, W.R. Meadows' Meadow-Pruf, Epro's Ecobase, and HouseGuard's Tru-Dry.

Nonasphalt coatings. Some liquid waterproofing membranes contain little or no asphalt. Modified asphalt might be 20% rubber, but these nonasphalt coatings contain a much higher proportion of rubber or other polymers (Figure 3). It's hard to generalize about this category, because it covers a wide range of materials, but typically these coatings are described as urethane, polyurethane, or rubber. These materials produce some of the most flexible membranes you can get. But many of them break down in sunlight, so it's often recommended that you backfill within two or three weeks of application. In most cases, they should not be applied to green or wet concrete.

Among the better-known rubber coatings are Rubber Polymer Corporation's Rub-R-Wall and Graywall. Grace Construction makes Procor, a two-part synthetic rubber that can be applied to green concrete. Two of the better-known polyurethane products are



RUBBER POLYMER CORPORATION

Figure 3. Rubber membranes, like Rub-R-Wall, shown here, are extremely flexible, so they can better withstand shrinkage cracking in concrete than other types of membrane.



Figure 4. Sheet membranes, like Grace's Bituthene, shown here, apply like peel-and-stick eaves membranes. Inside corners are first coped with proprietary sealants (above left), then the membrane is pressed into place (above right). Most sheet membranes are around 60 mils thick, or about one and a half times as thick as a dime (right).

Tremco's Tremproof 60 and Pecora's Duramem 500.

Sheet Membranes

Sheet membrane — or peel-and-stick, as it's often called — is about 60 mils thick and comes in rolls about 3 feet wide (Figure 4, previous page). It's made by bonding a layer of rubberized asphalt to a cross-laminated sheet of polyethylene. Installing sheet membrane is kind of like hanging wallpaper. But instead of using paste, you peel off the release sheet and press the sticky inner face onto the foundation.

Adjoining sheets overlap by about 2 inches. Running a roller over the joints seals the seams. Some brands have an additional strip of adhesive along the edge of the outer face to create extra adhesion at the laps. In order to ensure a continuous bond, masonry walls should be primed before the membrane is applied. That limits the amount of water that can enter through punctures by preventing it from migrating behind the sheet.

The big advantage of sheet membranes is that they'll stand up to an

enormous amount of static pressure. And unlike spray-applied materials, you can be certain there aren't any thin spots. On the other hand, it takes more time and skill to apply material a sheet at a time than to spray it on with a gun. As a result, the installed cost of sheet membranes is much higher than the cost of liquid membranes.

This type of waterproofing is more common on commercial projects. It's easier to justify an expensive waterproofing job when you're building a multistory building or one that goes 50 feet underground. House foundations rarely go that deep, and most residential builders avoid sites that have high water tables.

The best-known sheet membrane is Bituthene, which is made by Grace Construction Products. Comparable products include W.R. Meadows' Mel-Rol, Pecora's Duramem 700-SM, and MFM Building Products' Sub Seal.

Insulation, drainboard, and protection board. Waterproof membranes are frequently used in conjunction with drainboard, protection board, or rigid insulation (Figure 5). Sometimes the

board is added on to improve the performance of the membrane, but often the board is an integral part of the waterproofing system. Many liquid membranes are designed to remain tacky so insulation and protection boards will stick. Tougher versions of these products are often available for use without added board.

Foundations can be insulated by gluing rigid foam insulation to the outside of the wall. In addition to lowering energy costs, insulation prevents the membrane from being damaged by backfill.

Drainboard performs the same protective function as insulation board and also speeds the movement of water into footing drains. It comes in many shapes and sizes and is made from a variety of materials. Grace Construction's Hydroduct has an expanded polystyrene core that's bonded to a sheet of filter fabric. Water passes through the fabric and drains down through the hollow core. Colbond Geosynthetics makes a similar product called Enkadrain.

Owens Corning makes Warm-N-Dri, the rigid fiberglass board that's used in Koch's Full System Tuff-N-Dri. Installed over the membrane, it drains and insulates at the same time. Mar-Flex uses similar insulating drain panels in its Mar-Flex 5000 system.

TClear Corp.'s ThermoDry insulating drainage panels consist of a grooved Styrofoam core bonded to filter fabric. The foam insulates, and the fabric allows the water to pass into the grooves and fall into the drain.

Air-Gap Membranes

Air-gap membranes have been used in Europe for 30 years but are relatively new to the North American market (Figure 6, next page). Instead of coating the foundation with a waterproof membrane, you use a dimpled sheet of high-density polyethylene to create a small air space between the foundation and the backfill. Any water that gets into that space is supposed to fall to the footing drain before it has time to



Figure 5. Protective insulation and drainage boards are often incorporated into foundation waterproofing systems. Shown here are Koch's Tuff-N-Dri (above), which includes a foundation board from Owens Corning; and HouseGuard's Tru-Dry (right), which uses a Dow Styrofoam insulation and drainage board.



soak into the wall (see "Practical Foundation Waterproofing," 8/00).

Two companies sell these products in the U.S. Cosella Dörken makes Delta-MS, and Armtec makes System Platon. Both materials come in rolls and are installed in long continuous sheets. Delta-MS is nailed directly to the wall, and vertical seams are caulked with sealant. To keep dirt from getting in and clogging the air gap, the top edge of the sheet is covered with a nail-on molding strip. It takes fewer nails to fasten Platon because it's fastened to the building with metal clips. No caulk is used at the vertical laps, but the top edge is caulked to keep the dirt out.

Air-gap membranes can be installed over liquid membranes, but the manufacturers claim that you get a drier basement if you skip the coating. A poured foundation takes about three years to dry out, and the moisture has to go somewhere. Makers claim that with a traditional membrane, moisture goes into the building. If an air-gap membrane is used, the moisture is said to move outward until it hits the back of the dimpled sheet membrane, condenses, and falls to the drain.

The materials for an air-gap membrane cost about \$.40 per square foot; installed price is about \$.80 per square foot. These membranes can be installed over green or wet concrete and will bridge any nonstructural crack. The only down side to an air-gap system is that it's absolutely dependent on a properly functioning footing drain. That said, remember that every waterproofing system is designed to work with a drain.

Bentonite

Bentonite is a clay-based waterproofing material that's used as the basic ingredient in cat litter. For waterproofing purposes, it's formed into thin sheets by sandwiching it between layers of kraft paper, filter fabric, or polyethylene. You install the material by nailing or gluing it to the wall.

Bentonite doesn't do much of any-

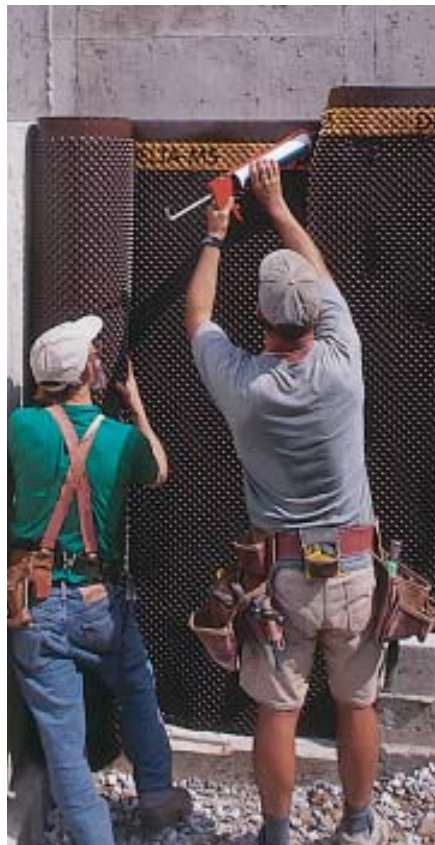


Figure 6. Air-gap membranes, like Cosella Dörken's Delta-MS (left) and System Platon (above), have raised dimples that allow any water that gets past the membrane to fall to the footing drain.

thing till it gets wet, at which point it swells to 15 times its dry volume and fills nearby cracks and voids. Once the material reaches maximum volume, it remains that size and forms a permanent barrier to water. Such membranes are self-healing and can be installed at any temperature.

But bentonite is expensive and can be ruined if it gets wet before the foundation is backfilled. Architects sometimes specify it for residential projects, but it's more common in commercial construction.

Cementitious Waterproofing

These Portland cement-based materials are mixed in the field and applied by brush. In the past, you mixed the dry material with water, but these days many take acrylic additives. One of the best things about cementitious waterproofing is that you can buy it anywhere. It also sticks well and is easy to apply.

The problem with cementitious coatings is that they don't stretch

much. The specs for most membranes contain a rating for elongation, which is a measurement of how much they will stretch before they fail. Most liquid waterproofings have elongations between 500% and 1800%. Sheet membranes spec out between 300% and 500%. Cementitious coatings are not nearly as flexible. For example, Master Builder's Masterseal 550i has an elongation of 20%, and the specs for Thoro's Thoroseal Foundation Coating don't even list elongation.

Waterproofing Warranties

Warranty periods for waterproofing run between five years and the lifetime of the building. A longer warranty may sound better, but it's worth reading the fine print to check the ifs, ands, and buts. For example, a number of manufacturers mentioned that leaks and dampness can lead to toxic mold, but every warranty I looked at specifically excludes coverage for damage caused by that problem.

Most companies say that if there's a

leak, they'll excavate the affected area and reapply the coating. Some agree to repair damage caused by the leak but limit the cost of repairs to \$2,500. A few will go as high as \$10,000. They all promise to backfill the trench when they finish patching the leak, but they won't replace lawn or landscaping that's damaged in the process. And all

bets are off if the leak was caused by improper backfilling, a nonfunctioning footing drain, or a crack that's more than $\frac{1}{16}$ inch across. 

David Frane is a finish carpenter and contributing editor to The Journal of Light Construction.

Sources of Supply

Armtec Limited

800/265-7622
www.systemplaton.com
System Platon (air-gap membrane)

Carlisle Coatings and Waterproofing

800/527-7092
www.carlisle-ccw.com
CCW-525 (polyurethane), CCW-701 (sheet membrane), CCW Claymat (bentonite), Sure-Drain (drain mat)

Colbond Geosynthetics

800/365-7391
www.colbond-usa.com
Enkadrain (drainboard)

Colloid Environmental Technologies Company (CETCO)

800/527-9948
www.cetco.com
Volclay (bentonite panels), Voltex (bentonite sheets)

Cosella Dörken

888/433-5824
www.deltams.com
Delta-MS basement wrap (air-gap membrane)

Epro Waterproofing Systems

800/882-1896
www.eproserv.com
Ecobase II waterproofing membrane (asphalt emulsion)

Five Star Products, Inc.

800/243-2206
www.fivestarproducts.com
Five Star Waterproofing (cementitious coating)

Grace Construction Products

866/333-3726
www.na.graceconstruction.com
Procor (liquid rubber), Bituthene (sheet membrane), Hydroduct (drainboard)

HouseGuard

800/560-5701
www.houseguard.com
Tru-Dry (asphalt emulsion), HouseGuard (Tru-Dry + Dow Styrofoam drainage board)

Karnak

800/526-4236
www.karnakcorp.com
#229 AR-Elastomeric (modified asphalt), One-Kote (liquid polyurethane)

Koch Waterproofing Solutions, Inc.

800/379-2768
www.guaranteeddrybasements.com
Tuff-N-Dri (asphalt emulsion), Watchdog Waterproofing (asphalt emulsion), Warm-N-Dri (insulation/drainage board), Full System (Tuff-N-Dri + Warm-N-Dri)

Mar-Flex Waterproofing Systems

800/498-1411
www.mar-flex.com
Mar-Flex 5000 Waterproofing (modified asphalt), Mar-Flex Drain and Dry (insulation/drainage), Mar-Flex Aqua (insulation/drainage), Sunflex Waterproofing System (liquid + insulation board)

MBT Protection and Repair

800/433-9517
www.chemrex.com
Masterseal 550i (cementitious coating)

MFM Building Products Corp.

800/882-7663
www.mfmbp.com
Sub Seal (sheet membrane)

Owens Corning

800/438-7465
www.owenscorning.com
Warm-N-Dri (insulation/drainage board)

Pecora Corporation

800/523-6688
www.pecora.com
Duramem 500 (polyurethane), Duramem 700-SM (sheet membrane)

Protecto Wrap Company

800/759-9727
www.protectowrap.com
Jiffy Seal Membrane (sheet membrane)

Rubber Polymer Corporation

800/527-0238
www.rpcinfo.com
Rub-R-Wall Waterproofing (liquid rubber), Rub-R-Wall Plus Waterproofing (liquid rubber), Graywall Waterproofing (liquid rubber)

TClear Corp.

800/544-7398
www.tclear.com
ThermaDry drainage panels (drainage/insulation)

Thoro System Products

800/433-9517
www.chemrex.com
Thorseal Foundation Coating (cementitious coating)

Tremco

800/321-7906
www.tremcosealants.com
Tremproof 60 (liquid-polyurethane), Paraseal (bentonite)

W.R. Meadows

800/342-5976
www.wrmeadows.com
Meadow-Pruf Seamless (asphalt emulsion), Mel-Rol (sheet membrane), Mel-Drain (drainage system)