
FOUNDATION WATERPROOFING OPTIONS

When the plans call for dry basement living space, a membrane or liquid coating can do the job — if it's installed right



A two-person team can make good time with a self-adhering sheet membrane. One man smooths the sheet into place while the other peels away the paper.

by Al Bredenberg

“Do it right the first time” — it’s almost a cliché. But when it comes to waterproofing, not doing it right the first time can have truly disastrous results. A leaky foundation in a residential building can damage finishes and furnishings, even the structure itself. In a commercial building, water can ruin expensive equipment and disrupt vital work. It all adds up to lost money, wasted time, upset customers — and sometimes litigation.

Waterproofing isn’t pretty, and since it’s going to get buried anyway, it’s easy to skimp and go for damp-proofing instead — that cold black stuff in a bucket that you paint on. But dampproofing will only retard moisture; it can’t stop a head of water pressing against the foundation.

Nearly all waterproofing products can be applied to concrete block as well as poured concrete walls, and most of the same concerns and practical tips are relevant.

Choosing a Product

There are many below-grade waterproofing products on the market. Most manufacturers require you to become a certified applicator before they will guarantee an installation. If you’re just going to do occasional waterproofing, I suggest you choose one product, get certified by the manufacturer, and learn all about that one product. Eventually you’ll get good at applying it and be able to work quickly and safely. Different products can have very different characteristics, so



Figure 1. Liquid membranes are inexpensive and quick to apply, but it takes a skilled applicator to get the correct minimum coverage.

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only specialty waterproofing contractors should try working with multiple products.

Because there are so many materials on the market, any waterproofing job should begin with a careful review of the manufacturer's literature, maybe a phone call to a technical service representative, and possibly even a site visit by a field representative.

Waterproofing Options

Here's a rundown on the major types of waterproofing systems, along with some advantages and disadvantages of each type.

Liquid membranes. You apply a liquid membrane by spray, roller, or trowel (see Figure 1). The liquid cures into a rubbery coating on the wall. Koch Materials' Tuff-N-Dri is a spray-applied liquid membrane composed of polymer-modified asphalt; Tremco's Tremproof 60 and Pecora's Duramem 500 are polyurethane liquid membranes that come in different grades for trowel, roller, or spray application.

Watch application procedures carefully. The manufacturer probably has a special procedure for treating voids, form tie holes, and joints. At the wall-footing joint, you may be required to use cement or other trowel-grade material to form a "fillet"

(radius or cove) before applying the overall coating.

Liquid coatings have the advantages of quick application and low in-place cost. One of the chief disadvantages is the possible inconsistency in coverage. The products listed above all require a 60-mil thickness, but it takes a careful applicator to be sure of always achieving that minimum coverage.

Sheet membranes. The best-known sheet membranes are self-adhering rubberized asphalt membranes, such as W.R. Grace's Bituthene, Pecora's Duramem 700-SM, and W.R. Meadows's Sealtight and Mel-Rol. Meadows makes other membranes composed of multiple layers of bitumen and reinforcing materials. I've also seen PVC membranes and rubber or butyl sheet membranes similar to EPDM roofing. I'm going to focus on the self-adhering rubberized asphalt sheets, though, because these are by far the most commonly specified sheet materials. These membranes are composed of rubberized asphalt laminated onto a 4-mil film of polyethylene plastic (Figure 2). The asphalt side is incredibly sticky but is covered by a release paper, which you remove during application.

The first time you work with this material, it'll drive you crazy because it sticks to everything. But you'll be

surprised how fast you can move with it once you develop a rhythm. It takes two people, one on top to smooth it out and stick it down, the other on the bottom to pull off the paper (photo). You'll have many details to learn — surface preparation, priming, patching, joint treatment, terminations, lap joints, penetrations, and corners.

Because they're so sticky, these membranes can be pretty unforgiving. Once a piece is down, you won't get it back up again — at least not in reusable condition. However, the system allows easy repairs of holes, "fish-mouths," puckers, and wrinkles. You simply cover holes or damaged areas with a piece of membrane patched right over the first layer. With a fish-mouth or wrinkle, all you do is slit the raised area, press it down flat, and cover it with a patch.

One chief advantage of sheet membranes is their consistent thickness. Because they're manufactured to exacting tolerances, you can be sure of the 60-mil coverage.

A higher in-place cost is one of the main disadvantages of the sheets. The cost of the material itself is likely to be greater on a square-foot basis than the liquid membranes. Labor cost is also higher, because of all the cutting, handling, reinforcing, and detailing you have to go through during installation.

Not everyone agrees, however, that sheet membranes lessen the quality control risk. A rubberized liquid forms a continuous, seamless coating, whereas a sheet membrane results in many seams, with the potential for a poor seal. If you're applying these materials, make sure your lap joints are tight and properly detailed. Make correct use of the manufacturer's mastic or other accessories. For example, with Bituthene, W.R. Grace requires you to apply a bead of mastic to every lap joint within 12 inches of a corner.

Cementitious waterproofing. Cementitious products, such as Thoroseal from Thoro System Products, are probably the easiest to use. They're readily available from lumberyards and masonry suppliers. They're easy to mix and apply. Most builders feel comfortable with cement, having worked around concrete and masonry. If you're going to apply much



Figure 2. Sheet membranes give consistent coverage to both walls and footings (far left). Some manufacturers require you to smooth all inside corners with a troweled mastic before installing the membrane (middle). Membrane edges must also be sealed with mastic (above).

of this material, a long-handled brush, such as Thoro's Thorobrush, will make your life easier. Also, spend the extra money to buy acrylic additive (a white, milky liquid) to mix in with the cement product. You'll get better bonding and a more solid, durable coating.

The chief disadvantage — a major one in my mind — is that cementitious products have no give to them. Bituthene's specs say it tests out at 300% elongation; Tremproof 60's specs cite 700%. Yet Thoroseal's specs don't even give an elongation figure — probably because cement just doesn't stretch to any degree worth mentioning. So it will tolerate almost no joint or crack movement, although otherwise it will stand up fine to a head of water.

Built-up systems. When I first went into the waterproofing business, I did a number of jobs with a hot-mopped asphalt-and-felt built-up system, which requires a piece of equipment called an "asphalt kettle." With these systems, you first apply a concrete primer. You then mop on a coating of hot tar with a roller-mop, followed immediately with a sheet of perforated felt, extending the system right out onto the footing. You keep staggering the felt sheets until you have three layers of felt with a final coating of tar. (The building code may let you get by with only two plies.)

It's a good system with a lot of strength, but probably not much elon-

gation ability. You can perform a similar built-up waterproofing procedure using cold, trowel-grade dampproofing and reinforcing fabric. Again, this is a system with some strength but little elasticity.

Bentonite. Sodium bentonite, a clay material, has enjoyed a steady upsurge in popularity over the past several years. It's had a bad reputation among waterproofers, possibly because it was associated with a wet-basement repair scheme that involved pumping bentonite into the ground around the house to stop leaks — a dubious solution in the eyes of most waterproofers I know. However, in panel form, such as the Volclay panels made by Colloid Environmental Technologies, bentonite has become the darling of a growing number of architects and builders. Bentonite works because it can absorb a tremendous amount of water. As it takes in water, the clay swells to 15 times its original volume and pushes itself into cracks and voids. When it reaches its maximum volume, it stays there permanently and seals against water. Volclay panels are 4x4-foot corrugated cardboard with clay particles held within the flutes of the cardboard. The panels can be nailed, fastened with a powder-actuated tool, or simply laid in place for horizontal applications.

Some waterproofers are still nervous about bentonite panels. With other products, you can inspect the finished waterproofing application and confirm

the integrity of the seal before backfilling. With bentonite panels, the seal doesn't form until everything's back-filled and water reaches the panel. Suppose something goes wrong? It's a nagging question for "traditional" waterproofers.

Stacy Byrd, technical marketing manager for Colloid Environmental Technologies, claims that rigorous testing proves the effectiveness of bentonite. And, indeed, bentonite is now being used on some very large jobs, including a huge I-90 tunnel in Boston. Bentonite has its advantages: It's not hazardous to work with, it's nonpolluting, it's easy and quick to apply, and can go on even at low temperatures. Colloid Environmental Technologies also makes a self-adhering sheet membrane that uses a compound of bentonite and butyl rubber for its "sticky layer."

Surface Preparation

Don't skimp on surface preparation. You must get the foundation wall and footing clean, free of loose material, and fairly smooth (see "Surface Prep Pays"). Do as much as you can ahead of time: Once you start waterproofing, rhythm is crucial, and you don't want to have to stop to scrape loose concrete from the footing or break off a form tie.

Waterproofing materials aren't designed to cover large voids or honeycombs. You'll need to fill these, preferably with nonshrink grout or a

Surface Prep Pays

Waterproofing likes a clean wall. Here's what I recommend for a surface preparation procedure:

Survey the entire surface to be waterproofed. Identify special problems — water on a footing, concrete forms not removed, footings not dug out, pipe penetrations not prepared, and so on. Have someone work on these right away, especially if these areas are the responsibility of someone not under your control — the superintendent or another trade.

Dry off all footings. A big propane torch with a 20-pound tank is good

for this. For puddles, sweep the standing water off with a broom, then hit the damp spot with the torch.

Remove concrete form ties. If there's an odd form tie that wasn't aligned properly and won't break off flush, cut it off with a cutting torch or reciprocating saw. Break form ties off on the inside of the foundation, too. Another waterproofer once told me that on one of his jobs the GC sent in a laborer, after the waterproofing was done, to break off form ties on the inside of a foundation. The laborer decided it would be easier to just pound the ties back into the

wall. Every one of them punched through the waterproofing membrane on the other side — which was already backfilled.

Scrape off excess and loose material from walls and footings. A long-handled ice breaker is good for this. Some waterproofing manufacturers will require you to machine-grind any ridges or protrusions. It's good to have a brick hammer on hand, too. Pay special attention to the footing. Quite often, puddles of congealed slurry form on the footing when the wall is poured. This material doesn't have the full strength of concrete, is not bonded to the footing, and should scrape off easily.



Sealing form-tie penetrations is required for some waterproofing systems. Use a grout or mastic recommended by the manufacturer.



Some self-adhering membranes require a painted primer coat.

Sweep off the walls and especially the footings. They don't have to be clean enough to eat off of, but don't leave a film of dust or mud. Waterproofing materials won't stick to a dirty surface. Keep other trades and workers out of the area. Besides the safety hazards, other workers tend to be oblivious to what the waterproofers are trying to accomplish. I don't know how many times I've cleaned a footing, only to see a muddy-booted laborer stride right down its length, leaving tracks the whole way.

Take care of any patching or filling. Grout around penetrations and follow any other instructions from the manufacturer that apply at this point.

— A.B.

good patching cement. For form-tie holes or smaller voids, you may be able to patch with trowel-grade mastic. Check the manufacturer's instructions to make sure that whatever material you use for patching is compatible with the waterproofing product.

Scheduling and Planning

Allow considerable "float time" for waterproofing. Rain will delay waterproofing work. If you're using a waterproofing subcontractor, recognize that

good waterproofers can be in high demand during the busy season. Coordinate the schedule closely and communicate often with your sub.

Plan the layout of waterproofing well ahead of time. The plan elevations will likely show the finish grade line on the foundation walls, but these lines should be confirmed with the architect, if necessary. You don't want black, gooey waterproofing showing above grade. Watch for changes in the level of grade. A line of waterproofing

descending at a diagonal from one level to another won't work if the architect has decided to handle the change with a retaining wall.

Ideally, you should mark layout lines with a crayon or chalk line, especially on a complex foundation with varying grade. On a simple foundation, it might be safe to just instruct the waterproofer to keep his work so many inches from the top of the foundation. I like to see waterproofing as close to finish grade as possible, but no lower

than 6 inches in any case. Don't leave any form-tie holes below grade unprotected. Work out ahead of time what you're going to do at cellar windows and bulkheads, porch foundations, and intersecting walls that don't have to be waterproofed.

The basic rule for what gets waterproofed is: Waterproof any foundation wall that has earth on one side and usable space on the other, including crawlspaces. Extend waterproofing at least 12 inches onto intersecting walls that don't have to be waterproofed. You might want to continue the waterproofing on other walls if it's a very wet site. Under extreme conditions, water has been known to travel through the keyway along the footing and into occupied space. Consult with the architect if you have any doubts.

Check the manufacturer's literature for temperature limitations. I've been able to waterproof on cold days. I've even had to chip off ice and sweep off snow. You're probably okay on a cold day if you're working with a solvent-based material. But watch out if your material is water-based. The lower limit for some products is 40°F.

Likewise, check the manufacturer's requirements for concrete curing time. Every sheet membrane I know of requires the concrete to be cured a minimum of seven days, some even longer. This is because the concrete will continue to dry long after it's poured. The water vapor escaping from the concrete can prevent the waterproofing material from bonding. Concrete curing times for liquid membranes also vary considerably. Some require 14 days, others longer. Still others can be applied as soon as the forms are removed.

Protecting the Work in Place

Most waterproofing systems need protection during backfilling. Some manufacturers have their own protection board — such as Tremco's Tremboard or Meadows's Sealtight Protection Course. A drainage mat can double as a protection course — Grace's Hydroduct mat works this way. Insulation can also function as protection board, but it has to go all the way to the footing. An inexpensive 1-inch EPS foam board works fine as a protection course. Owens-Corning's Warm-N-Dri functions as insulation,

Waterproofing Safety

Waterproofing below grade can be dangerous. Because of the hazards, it's usually not a good idea for anyone to waterproof alone. If you're using a waterproofing subcontractor, make sure they have a written safety program and that they comply with hazard communication requirements. Keep other trades and workers well away from the waterproofer's work area.

Once you learn how to work with waterproofing materials, you can make good time without sacrificing safety. When I went out on my first job with Rodney Carrington, the man who taught me the trade, he saw me looking down nervously at a bucket of hot, smoking asphalt on the ground. "You don't have to be afraid of that stuff," he told me. "You just have to respect it."

Here are some primary safety concerns that go along with waterproofing:

Flammable materials. Many waterproofing products are solvent-based. Keep fire, smoking materials, welding operations, cutting torches, and other sources of ignition well away from the area.

Respiration hazards. Use the manufacturer-recommended respirator, especially with solvent-based materials. In a close area, you might need an air-fed respirator. Don't be complacent about this. Solvent fumes are deadly, and a large surface area of newly-applied material can put out a lot of vapor. The fumes are usually heavier than air, so they tend to build up in a sunken area like a foundation excavation.

Skin injuries. Waterproofing materials can contain all sorts of exotic chemicals. It's best to keep them off your skin. As needed, wear protective clothing and gloves. When cleaning tools in solvent, wear chemical-resistant gloves.

Injection hazards. Take precautions when working with or around spray equipment. A high-pressure airless sprayer can inject toxic chemicals directly into your bloodstream.

Eye injuries. Wear protective glasses or goggles as needed, especially when working with liquids.

— A.B.



This Tuff-N-Dri installer is protected from head to toe — the high-pressure spray gun can inject chemicals directly through the skin into the blood.

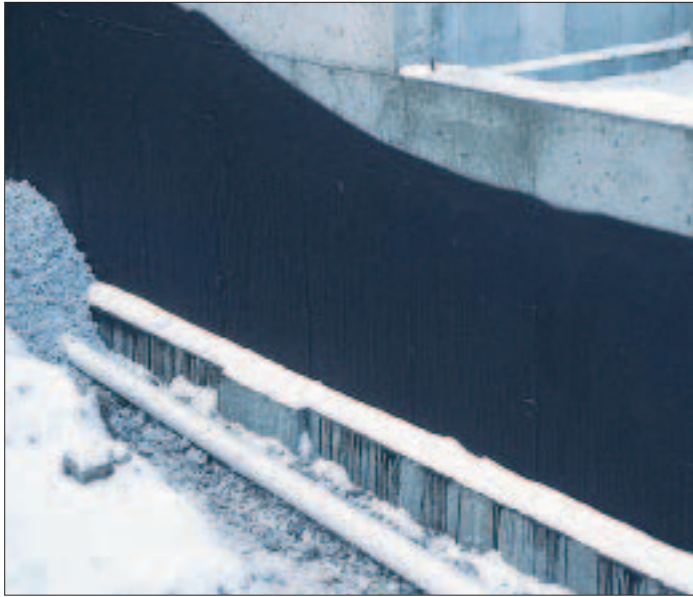


Figure 3. Proper drainage is an essential element of any foundation waterproofing scheme. Most manufacturers will not warrant their waterproofing products if drainage is inadequate.

waterproofed in Massachusetts, the excavating company had the contract to install drainage mat over our sheet waterproofing. On checking over the work, I discovered that they had nailed up the mat, driving the nails right through the waterproofing into the concrete! I had to talk to the superintendent repeatedly and write two letters to get them to stop.

Don't neglect drainage. No waterproofing system I know of is designed to work without proper drainage (Figure 3). Without relief, water can build up tremendous pressure underground. A waterproofing manufacturer won't warrant its product if drainage is missing or inadequate, or if the structure is built on a site where proper drainage is impossible.

The minimum drainage for any building is a perimeter footing drain. Depending on conditions, some buildings will require an underdrain system or a sump pit with an ejector pump. ■

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protection board, and drainage medium in one; it's available as part of Koch's Tuff-N-Dri system (applied only through licensed contractors).

Be careful what you use to adhere the protection board. Use an adhesive that's compatible with the waterproofing membrane. I've seen adhesives eat right through the waterproofing material.

Besides providing protection during backfilling, you should protect waterproofing work in place from damage by other workers and trades. Keep workers from tracking across exposed membrane on footings, decks, or other horizontal surfaces. Don't expect others to be as sensitive as you are to the importance of waterproofing. On a large resort project we

Sources of Supply: Below-Grade Waterproofing

Colloid Environmental
Technologies Co.
1350 Shure Dr.
Arlington Heights, IL 60004
708/392-4600
Volclay bentonite panels
Swelltite sheet membrane

Koch Materials Co.
Coatings and Sealants Division
4900 S. Mason Ave.
Chicago, IL 60638
800/562-1052
Tuff-N-Dri liquid membrane
*Warm-N-Dri insulation, drainage,
and protection board*

The Noble Co.
614 Monroe St.
Grand Haven, MI 49417
616/842-7844
*NobelSeal chlorinated polyethylene
sheet membrane*

Pecora Corporation
165 Wambold Rd.
Harleysville, PA 19438
800/523-6688
Duramem liquid and sheet membranes

Sonneborn Building Products
7711 Computer Ave.
Minneapolis, MN 55435
800/243-6739
Liquid membrane

Thoro System Products
7800 N.W. 38th St.
Miami, FL 33166
800/327-1570
Thoroseal cementitious waterproofing
Acryl 60 acrylic admixture

Tremco
3735 Green Rd.
Beachwood, OH 44122
800/321-7906
Tremproof liquid membrane
Tremboard protection board

U.S. Waterproofing Inc.
425 Stillson Rd.
Fairfield, CT 06430
203/336-7900
Five Star cementitious waterproofing

W.R. Grace & Co.
Construction Products Division
62 Whittemore Ave.
Cambridge, MA 02140
800/354-4656
Bituthene sheet membrane
Hydroduct drainage composite

W.R. Meadows
2100 Monroe St.
York, PA 17405
717/792-2627
Mel-Rol and Sealtight sheet membranes
Sealtight Protection Course