

Finishing Basements

Issues related to health, comfort and energy efficiency

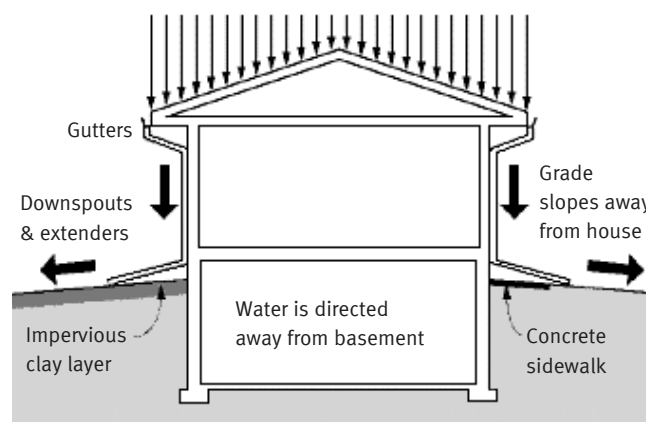
Use this fact sheet if you are remodeling an existing basement into living space and the exterior foundation walls and basement floors of your home are not insulated or waterproofed.

Finishing your basement is generally one of the least expensive ways to create more living space. But there are many things to consider before you get started. Recent studies have found that common finishing techniques can contribute to moisture buildup and mold growth. Mold is a special concern because it can cause health problems. Moisture dynamics should be considered very carefully when insulating the interior of a below-grade space. This is especially true in a cold climate because moisture flows will vary depending on the season. In winter, there is vapor pressure to force moisture from inside to outside and in summer, from outside to inside. With moisture flowing both ways, good design is critical. “Materials used to insulate a basement wall must be selected based on their ability to control the flow of moisture and air as well as heat. Selecting the wrong type of insulation or placing it in the wrong wall assembly often leads to moisture accumulation with subsequent material deterioration and growth of mold.”¹

Here are some basic guidelines to get you started:

1. Start with a dry basement. If the area to be finished leaks or is damp, **fix it before you start.** Failure to adhere to this first guideline can be very expensive, aggravating and unhealthy and could lead to deterioration of the finish materials.

Make sure you’ve done everything to keep water away from the foundation. This means functioning



gutters and downspouts are positioned with the exterior grade sloping away from the foundation. If that doesn’t fix the problem, here are some options to consider:

- a. If the wall is merely damp on occasion, an application of an interior basement waterproofing coating may help. (See “How to test for dampness of basement walls and floors” below.) If you know the cause of the dampness (e.g., heavy rain) and the waterproofed walls are not damp after a heavy rain, then you may be in the clear. Of course, there is always the possibility the problem will get worse and the waterproofing won’t hold and you won’t be aware of it because it is covered up with a finished wall.
- b. If the wall leaks at a particular crack or cracks every time it rains, a good interior solution to consider is polyurethane crack injection. Visible, nonstructural cracks can normally be fixed by injecting a hydrophobic polyurethane grout into the crack. Polyurethanes are flexible and will stand up to continued movement of the crack without breaking the repair. Epoxy, because of its rigidity, is used to seal structural cracks.

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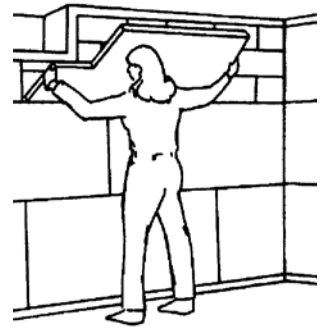
c. If the basement leaks up through the floor or where the wall meets the floor, then a drainage system should be considered. This can be installed on the interior or the exterior.

For the exterior method, you'll need to dig a trench to expose the foundation wall. After fixing the leak, install drain tiles at the footings to direct the water away from the foundation. Then waterproof and insulate the wall before backfilling. Exterior methods are usually the most expensive and disruptive to sidewalks, shrubs, bushes, etc.

With the interior method, the concrete floor is removed along the problem area and a trench dug to allow placement of a new drain tile. A waterproof membrane is placed on the wall and over the tile which allows the water to be directed to a sump pump or floor drain. The concrete floor is then replaced. Systems like this don't fix the leaks; they just redirect the water but are generally less expensive and disruptive than the exterior option.

Installing wall-to-wall carpeting on a concrete basement floor with no insulation underneath is generally not recommended. Concrete floors can be a source of moisture, mainly during the summer. If you plan to install carpeting anyway, see Guideline No. 4. A better option is to install vinyl or tile and use throw rugs for comfort.

2. In the vast majority of cases, a Class I vapor retarder or vapor barrier (see sidebar) should not be installed on the inside of a below grade wall, either directly against the foundation wall or within the added frame wall.



Rigid board is lightweight and easy to handle.

Below grade spaces should be designed to dry to the interior and a Class I vapor retarder will inhibit drying. Class II and III vapor retarders are more forgiving of moist conditions because they are semi-permeable. If the wall does get wet through a leak or condensation, Class II and III vapor retarders offer more drying potential. Once a material gets wet, mold can begin growing within 48 hours depending on temperature and humidity conditions.

3. "All recommended basement interior insulation strategies involve placement of a layer of rigid foam insulation against the foundation wall.

The moisture sensitive interior wood framing and paper-faced gypsum board are no longer in contact with the major moisture source—the concrete or masonry foundation wall."¹ Any finishing or insulation materials that come in contact with below-grade

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What is the difference between a vapor retarder and a vapor barrier?

Vapor barrier is often used to refer to any material, typically a plastic or foil sheet, that resists diffusion of moisture through wall, ceiling and floor assemblies in buildings. Technically, many of these materials are only **vapor retarders** as they have varying degrees of permeability.

Permeability, which is the amount of moisture that can pass through a material, is measured in perms. The lower the number, the less permeable the material and the more moisture it will block. Contact the manufacturer to get the perm-rating information for the product you are thinking about using.

Classes of vapor retarders - Based on their perm rating, building products fall into one of three classes of vapor retarder.

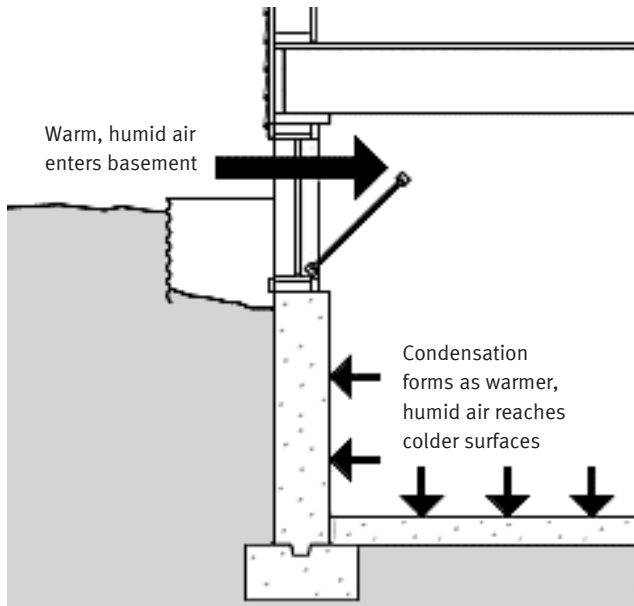
Class I has a permeance rating of 0.1 perm or less and is considered impermeable and is sometimes referred to as a vapor barrier (e.g., 6 mil polyethelene plastic or non-perforated foil).

Class II has a permeance rating of between 0.1 perm and 1.0 perm and is considered semi-permeable (e.g., 1" of extruded polystyrene foam board insulation or kraft faced insulation).

Class III has a permeance rating of between 1.0 perm and 10 perms and is considered semi-permeable (e.g., 1 coat of most latex paints, 30# building paper or 5/8" plywood).

masonry walls should not be a food source for mold. The Wisconsin Uniform Dwelling Code requires most foam to be covered with at least 1/2" drywall.

4. Once the basement is finished, try to keep the relative humidity to a comfortable level. This generally



means keeping the basement windows closed and running a dehumidifier or an air conditioner during the humid, summer months. If a musty odor is detected, the tendency is to open the windows to “air-out” the basement. This should only be done if the outside air is drier than the basement air. In Wisconsin during the summer, using outside air to “air-out” a basement will almost always make the problem worse. Most people are comfortable with basement humidity levels that range from 30% to 50% in winter and 50% to 60% in summer.

5. If you would like the temperature in the basement to be as comfortable as your first-floor living space, you will need some supplemental heat other than your current furnace. In winter, the basement is generally 10 degrees cooler than the upstairs because the thermostat controlling the furnace is on the first floor. An exception to this would be if you are able to add a heating zone to the basement from your current heating system and a thermostat could be installed in the basement.

How to test for dampness of basement walls and floors

Dry a portion of the damp area with a hair dryer and tape aluminum foil over the area. Wait two days, remove the tape and look for moisture on the foil. Moisture on the side facing the wall indicates moisture coming from outside the basement. Moisture on the side facing the room indicates condensation problems within the house. Moisture on both sides indicates problems are both internal and external. Remember, this test can give different results at different times of the year. Some basements only get wet once every decade or two but that can be enough to ruin finished walls and insulation and create a potentially hazardous mold problem.

MGE is committed to providing you with expert advice so our residential energy experts have put together a list of resources that discuss considerations when remodeling or finishing a basement.

Resources

The following publications can be downloaded from our Web site at <http://www.mge.com/basements>:

1Basement Insulation Systems

Building Science Press, 2006

Basement Insulation

Minnesota Department of Commerce Energy Information Center.

Basement Insulation (Technology Fact Sheet)

U.S. Department of Energy, 2002

Renovating Your Basement—Moisture Problems

Canada Mortgage and Housing Corp., 2000

The following two publications are only available by calling MGE’s Home Energy Line at 252-7117.

Dry Notes from the Underground, D. Fugler, Home Energy Magazine, pp. 18-22, March/April 2002.

Keeping Basements Free of Mold, Energy Design Update, pp. 9-12, February 2002.