Finishing Basement Walls

Q. *To finish an existing basement, I will be installing 2x4 walls around the perimeter. Should I install some type of waterproofing to the concrete walls? Can the 2x4 walls touch the concrete, or should I leave an air space?*

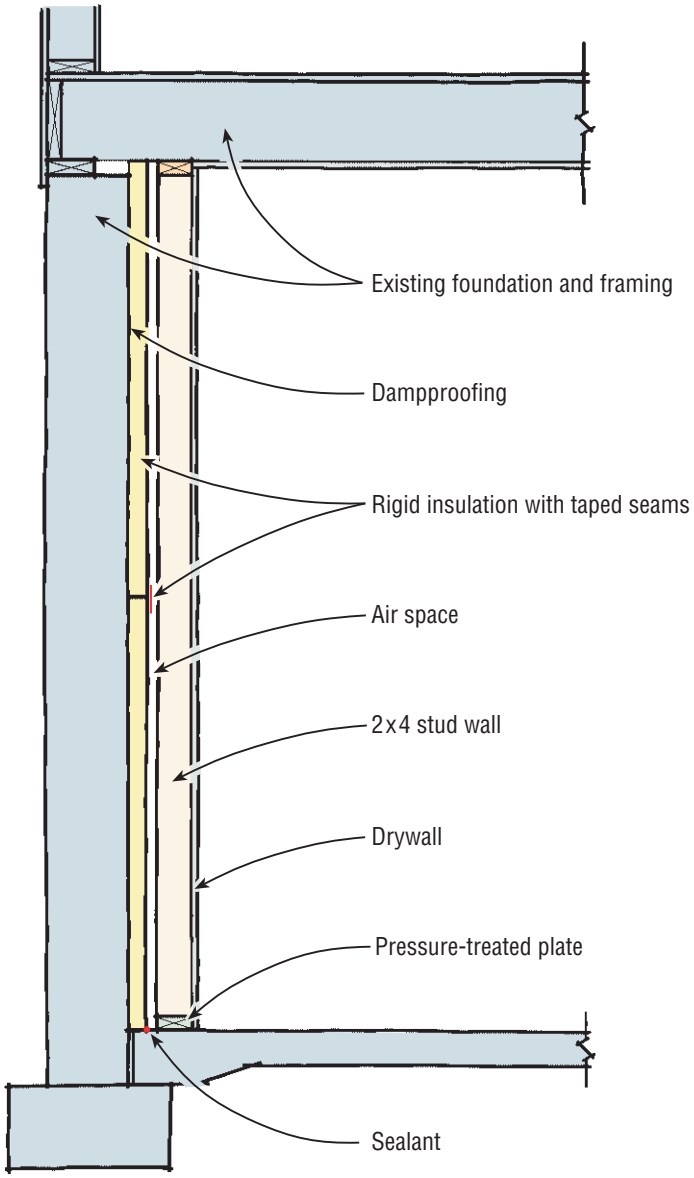
A. *Corresponding editor Paul Fisette responds:* Before finishing the interior of a basement, you must verify that the basement doesn't leak, and that the exterior of the foundation is protected by dampproofing, good drainage, and controlled surface runoff.

I believe that applying an additional layer of dampproofing on the interior surface of the foundation wall makes sense, if only as relatively cheap insurance. I have had good luck using Sto Watertight Coat (Sto Corp., 800/221-2397; www.stocorp.com), a two-component, trowelable, cementitious compound that has a low perm rating.

Your 2x4 walls should have pressure-treated bottom plates and should be spaced away from the foundation. Most foundation walls are not perfectly plumb and straight, so it is easier to keep your wall surface true if you space the frame away from the concrete wall. Also, building codes prevent you from placing nontreated wood in contact with the foundation.

After insulating between the studs, install your vapor barrier and finished wall surface. Since air leakage can result in condensation on the foundation wall, you should make an effort to carefully air-seal the interior finish materials.

Although this system will work, air-sealing a wall can be difficult, so I prefer a different approach. After installing interior dampproofing, install rigid foam insulation directly to the inside surface of the foundation walls, using construction adhesive. Caulk and/or tape the seams of the rigid foam to make it airtight, so that warm interior air can't reach the cold foundation. Then build an uninsulated wood-frame wall that is spaced away from the foundation. This way, it's easier to run plumbing and wiring, and the wall should remain above dew point temperature, reducing the likelihood that condensation will form in the wall.



240-Volt Lighting

Q. *I am planning to install new lighting in a warehouse. Are there any advantages, either in installation costs or in operating costs, to installing 240-volt lighting fixtures instead of 120-volt?*

A. *Master electrician Sean Kenney responds:* Since you can install twice as many lights on a 20-amp 240-volt circuit as on a 20-amp 120-volt circuit, installation costs for 240-volt lighting

should be lower. If your building is large, the savings in labor and materials could be substantial. Another benefit to 240-volt lighting is that the load is automatically balanced; there is no need to balance each 120-volt leg, as there is with 120-volt lighting.

One drawback to using 240-volt equipment is the limited availability of replacement ballasts. If you plan to use HID (high-intensity discharge) lighting, this is not a concern, since most HID lights have multi-tap ballasts. But 240-volt fluorescent ballasts are not widely available and would have to be obtained at an electrical supply house.

Fuel Cost Comparison

Q. *A customer asked me how to compare the cost of different heating fuels (natural gas, propane, oil, and electricity). Can you provide a chart with this information?*

A. *Energy and sustainable design consultant Andy Shapiro responds*: The tables at right are based on seasonal delivered efficiency. Because it accounts for equipment, pipe, duct, and other losses, seasonal heating efficiency is lower (by about 5% to 15%) than the listed efficiency of the equipment (the AFUE, or annual fuel utilization efficiency) or the steady-state tested efficiency.

Sonotube Reinforcement

Q. *To support a beam for a residential deck, does a Sonotube pier need any rebar?*

A. *Jay Meunier, contracting specialist at S.T. Griswold and Co., a ready-mixed concrete supplier in Williston, Vt., responds:* First, check with your local building authorities to find out what local codes apply.

I have never seen architectural or structural drawings that did not indicate some amount of reinforcing for concrete piers. We usually recommend that a minimum of two pieces of #4 rebar be placed vertically in an 8-inch-diameter concrete pier supporting a structure. A larger-diameter pier should have four or more pieces of vertical rebar. The rebar provides the tensile strength needed to resist lateral stresses that can be applied to a concrete pier by ground movement, freeze cycles, and wind loads.

Sealing Garage Floors

Q. *Is a concrete sealer effective at protecting a garage floor from road salt damage? If so, what is the best product to use — a floor paint or a clear waterproofing sealer?*

A. *Jay Meunier responds:* Either paint or sealer will slow or prevent road salt damage to a concrete slab. Sealers are typically easier to apply, because they require less surface preparation before application. We have had great success in harsh environments with a tung-oil concrete sealer called Waterlox Cement Stain 2000 (800/321-0377; www.waterlox.com). After preparing the concrete with an acid wash, one or two coats of stain are applied. We have used this product in auto body shops, and it

Oil

	Cost per million Btus, delivered		
Cost per gallon	50% efficiency	70% efficiency	85% efficiency
$0.80	$11.76	$8.40	$6.92
$1.00	$14.71	$10.50	$8.65
$1.25	$18.38	$13.13	$10.81
$1.50	$22.06	$15.76	$12.98

Efficiencies for oil equipment range from 50% for lower-efficiency water heaters to 85% for the best oil furnaces and boilers. Older boilers typically have seasonal efficiencies around 70%.

Propane

	Cost per million Btus, delivered		
Cost per gallon	50% efficiency	75% efficiency	90% efficiency
$1.00	$21.39	$14.26	$11.88
$1.25	$26.74	$17.83	$14.85
$1.50	$32.09	$21.39	$17.83
$2.00	$42.78	$28.52	$23.77
$3.00	$64.18	$42.78	$35.66

Natural gas

	Cost per million Btus, delivered		
Cost per ccf or therm	50% efficiency	75% efficiency	90% efficiency
$0.70	$14.00	$9.33	$7.78
$0.85	$17.00	$11.33	$9.44
$1.00	$20.00	$13.33	$11.11

Efficiencies for propane and natural gas equipment range from 50% for lower-efficiency water heaters, to 80-85% for typical new furnaces and boilers, and 90% for condensing furnaces and boilers.

Electricity

	Cost per million Btus, delivered			
Cost/kWh	90% efficiency	100% efficiency	200% efficiency	300% efficiency
$0.05	$16.28	$14.65	$7.32	$4.88
$0.08	$26.04	$23.44	$11.72	$7.81
$0.11	$35.81	$32.23	$16.11	$10.74
$0.15	$48.83	$43.95	$21.97	$14.65

Efficiencies for electric equipment range from 90% for older water heaters and 95% for new water heaters to 100% for resistance heating, 200% for typical heat pumps, and 300% for the highest-efficiency ground-source heat pumps, depending on particular equipment and climate.

holds up well. The sealer is highly resistant to salts, acids, chemicals, and oils. A less expensive sealer like Thompson's Water Seal will work but will require reapplication much more frequently.

Bending Metal Roofing to a Curve

Q. *Can regular sheets of metal panel roofing be installed on a curved roof with a radius of 28 feet?*

A. *Daniel C. Jandzio, wood frame product manager at Fabral, a metal roofing manufacturer, responds:* Regular metal roofing panels can often be installed in a curved application, depending upon the panel profile chosen and the radius of the curved roof. The minimum radius is 24 feet for through-fastened steel panels and 18 feet for through-fastened aluminum panels. Standing-seam panels usually require a much larger radius — between 100 and 200 feet — for successful installation without pre-curving.

In general, panels with a shallower rib height and continuous corrugation pattern are easier to curve than panels with distinct high ribs and flat areas. Panel ribs will tend to flatten out as they are bent over a curve, and care must be used to maintain equal width at both ends of the sheets.

Many curved roofs are actually arches, not uniform circular segments, and the calculated radius may not be accurate. If in doubt, try bending a scrap panel over the tightest radius section of the arch to see if it will work.

Finally, curved applications typically require additional fasteners to resist the forces induced by curving the panels. Increase the number of fasteners in the field panels to the fastening pattern recommended by the manufacturer for eaves and endlaps. It may also be necessary to install stitch screws (short screws that join metal to metal without penetrating the substrate) in the side-lap where separation is apparent.

Preventing Storm Water Backup

Q. *The municipal storm drainage system in our city shares pipes with the sewer system. During heavy rainstorms, water backs up from the municipal drain line into a customer's basement floor drain. Is there any type of check valve that can be installed in the drain line to prevent this?*

A. *Master plumber Rex Cauldwell responds:* First of all, be sure that the local water department and building authorities are aware of the problem and see if they can propose a solution.

If the local municipality is unable to help, you have two choices. In either case, you'll need to cut open the floor slab. If all you want to do is stop stormwater (or worse) from coming into the basement via the floor drain, you can install a backwater valve in the drain line. Backwater valves are available for about $40 to $60 from Canplas Inc. (888/461-5307) and Oatey (800/321-9532; www.oatey.com). Most backwater valves are available with sleeves and access panels so that they can be installed under concrete and still be accessible for maintenance.

If you want the basement to drain even during a heavy rainstorm, you'll need to remove the floor drain and install a sump pump. Remove the existing drain, but leave the trap. Dig a hole for a plastic bucket or sump kit, and then install a submersible sump pump. Connect the sump pump's two-inch discharge connection to the existing drainpipe under your slab, using watertight threaded or glued fittings. Since the sump pump includes a check valve in its discharge fitting, stormwater will no longer be able to back into the basement from that location. The sump pump will be able to pump out under pressure any liquid that flows into the sump, even when the utility drains are full.

Installing New Stucco Over Old

Q. *The owner of a house with existing exterior cement stucco is unhappy with the finish. How difficult is it to install a new coat of stucco over the existing stucco?*

A. *Ron Webber, owner of Prime Plastering in Irvine, Calif., responds:* Applying new stucco over old stucco (often called re-stuccoing) is a fairly simple process. If the existing wall is in good condition, this job can be straightforward. But if the existing surface has imperfections, the problems that caused the flaws must be repaired, or else the problems will recur. Before re-stuccoing, thoroughly examine the existing surface and ask the following questions:

Is there any loose, spalling stucco? Rub and tap the wall, listening for hollow sounds. Any loose stucco will need to be removed by scraping or sandblasting. To patch the stucco, combine sand and cement with calcium aluminate, an accelerator, or use a good non-shrinking stucco patching material or a rapid-set mortar mix.

If the house has been painted, is the paint in good condition? Loose or chipping paint can reduce the bonding power of a new coat of stucco, so it should be removed by sandblasting. If the painted surface is in very good condition, you can apply stucco directly over it, as long as you use a bonder.

Is there efflorescence? Efflorescence is a white powder or film on a surface, composed of salt crystals left behind when salt-laden water evaporates. Efflorescence reduces the bonding power of the new coat of stucco. To neutralize efflorescence, spray on a mild acid such as vinegar. Let the vinegar sit for half an hour, and then flush the wall with water. This will bring the pH level down to an acceptable level.

Is the wall dirty? Dirt, like loose paint or efflorescence, will interfere with the bond of the new stucco. Any dirt should be washed off.

Does the wall have any cracks or leaks? Leaks near doors and windows, as well as cracks, should be repaired before re-stuccoing (see "Patching Stucco," 9/97).

Is the flashing in good condition? Inspect the metal flashing and weep screed for rust or separation at the joints, and repair or replace it as necessary.

Is the existing stucco surface rough and uneven? If so, scrape down the high points and fill in the low areas before proceeding.

Once all problems in the existing stucco have been corrected (including,

if necessary, adding a leveling coat to even out the low areas), apply a new finish coat with the texture and integral color of your choice. To ensure a good bond, use a bonder between the existing stucco and the new material.

Vinyl Trim for Bay Windows

Q. *What is the best vinyl trim detail to use on the wide angles of bay windows? The house in question does not have enough room at the corners to use a vinyl outside corner piece, which would be too wide. Is it acceptable to use a piece of inside corner trim, bent backwards, or is there a better trim product available?*

A. *Doug Price, vice president of marketing at Norandex-Reynolds, a vinyl siding manufacturer, responds:* An inside corner piece bent backwards may look unattractive. Depending on the trim configuration, it may also lack pockets deep enough to accommodate the expansion of the siding. The best solution is to use a 45-degree bay corner post, a type of trim piece available from some siding manufacturers.

Unfortunately, 45-degree corner posts are usually available in a limited number of colors. If you can't locate the right type of vinyl trim, you can always install a piece of wood trim and wrap it with aluminum trim coil in a color that matches the siding or trim.

Weight Limits for Ladders

Q. *Do the listed weight limits for ladders and scaffold planks include a safety factor? If so, how much weight can be added beyond the listed weight until failure occurs?*

A. *Alan Kline, president of Lynn Ladder and Scaffolding Co., Lynn, Mass., responds:* As a general rule of thumb, OSHA requires ladders and scaffold planks to be designed with a 4-to-1 safety factor. That means that under test conditions, they must be able to support four times their weight rating without failing.

As to when any particular model might fail, that depends on many factors. Overloading any ladder or scaffold plank is a violation of OSHA regulations.

Wooden Shelf Around a Whirlpool Tub

Q. *I will be installing a whirlpool tub for a customer who wants me to surround the tub with a horizontal shelf of natural wood. The customer has rejected my suggestion to install tile. Is there any species of wood that would hold up in this environment? Or should I refuse to install a wood shelf?*

A. *Michael Poster, publisher of a website for woodworkers at www.woodweb.com, responds:* In such an application, no species of wood will hold up over time without changes in appearance. If you perform the installation, the customer should understand that the appearance of the wood will change, perhaps dramatically. Even if the customer accepts this, you must still decide whether you want to be associated with the work.

That said, people build boats out of wood all the time. Wood species that are most likely to hold up in a humid environment include teak, mahogany, redwood, and red cedar. Maintaining a finish on the wood will require frequent maintenance. Even with vigilant refinishing, the wood may discolor or develop dark stains, particularly if water is wicked up from the end grain.

Sizing an Insulating Air Space

Q. *How big does an air space need to be before it stops working as insulation and starts working as a convective loop?*

A. *Engineer Joe Lstiburek, a principal with Building Science Corporation in Westford, Mass., responds:* The answer is 1/2 inch. Still air is an insulator. The thicker the layer of still air, the greater the reduction in conductive heat transfer. However, the greater the gap, the easier it is for buoyancy forces (the stack effect) to overcome boundary layer friction effects and create fluid convection flow. If the width of an air space measures 1/2 inch or more, the heat transfer convective losses become greater than conductive heat transfer reductions.

The situation changes if the air is replaced with argon or krypton, since those gases have a much lower conductivity and a much higher density, making them less prone to convection. With argon and krypton, the bigger the space, the better. The only limitations are cost (argon and krypton are expensive) and the technical difficulties of making an effective seal.

Cutting Solid Surfacing

Q. *What type of saw blade should I use to remove about an inch from a solid-surface countertop?*

A. *Tony Pelcher, a solid-surface fabricator at the Top Shop in S. Burlington, Vt., responds:* Many manufacturers, including DeWalt, Everlast, and Forrest, make circular saw blades for cutting solid surfacing. The most efficient blade will have as close to a zero rake as possible.

But since every solid-surface cut should be trimmed with a router, saw blade choice is not too important, especially if you are making only an occasional cut. Once you've made your cut (about 1/8 inch beyond your final mark), clamp a straightedge to the solid surfacing and rout the edge using a straight bit with a template guide, or with a template bit with a bearing above the cutter.

Makeup Air for an Exhaust-Only Ventilation System

Q. *I'm building a tight house with above-average attention to air sealing, and I plan to ventilate with a Panasonic exhaust fan running continuously. Will the cracks around windows and doors admit adequate makeup air, or do I need to provide wall vents?*

A. *Bill Rock Smith, building consultant and former contractor, responds:* Studies have shown that even a tight home usually has enough openings in the building shell to provide makeup air for the base ventilation rate of most homes (45 to 90 cfm). Dedicated passive makeup air inlets have been shown to be ineffective, since the fans used for ventilation typically do not generate the high level of negative pressure (10 to 20 pascals) needed to draw outside air through the inlets.

The main concern for your proposed system is not whether the house has enough cracks for makeup air; it is

whether the makeup air will be drawn from the wrong locations. Potentially, an exhaust-only ventilation system can cause backdrafting of open combustion systems (fireplaces, water heaters, furnaces, or boilers), or the entry of soil gases into the home. If you plan to use exhaust-only ventilation, it's important to install a pre-radon mitigation system and to use only sealed-combustion appliances. Before using any open-combustion systems, a worst-case depressurization test of the house should be performed.

For more information on residential ventilation, see Judy Roberson's article "Choosing a Whole-House Ventilation System" (9/00).

GOT A QUESTION? Send it to On the House, *JLC*, 186 Allen Brook Ln., Williston, VT 05495; or e-mail to *jlc@bginet.com*.