# PREPARING FOR CERAMIC TILE

**Figure 1.** *On a tub enclosure, the author coats the water-resistant drywall with cold-patch asphalt, then with tar paper. Next goes metal lath, a mortar bed, and finally – the tile.*

## Follow published industry specs, but adjust for cold-climate conditions

by Michael Byrne

Okay, you're a contractor and you have just broken your leg. You want it fixed, so you call two or three doctors, find the lowest price (don't bother checking credentials), and then arrange a time for the leg to be slapped together. Sure, there may be problems later on. But so what?

Of course, no one treats his body this way. But is it any way to select a tilesetter or other skilled tradesman?

If your answer is no, this article might change the way you handle the ceramic tile portion of your building projects, reduce your liability, and increase the level of customer satisfaction.

### Choosing a Tilesetter

Finding a suitable tilesetter is not unlike locating a good doctor. Of course with doctors, you can always ask for accreditation or a diploma. With tilesetters, accreditation comes in the form of references or completion of a certified training program. Here is where your problems begin.

First of all, outside of a union-funded four-year apprenticeship conducted in the Los Angeles area, I know of no comprehensive training programs that produce competent setters. There are short programs elsewhere, but overall, entry-level setters learn by trial and error. The demise of apprenticeships nationwide began after the end of World War II with the development of easy-to-use mastics and so-called "water-resistant" drywall. Manufacturers of tile welcomed these new products in the hope that they would make ceramic tile more competitive with resilient squares and sheet flooring.

Indeed, that is what happened. But along the way, the skills needed to create tile installations that would last for generations were lost. Now the entire tile industry is grappling with the problem of training. Harvey Powell, president of the Materials and Methods Standards Association (MMSA), a trade organization that promotes the proper use of tilesetting materials and methods, says, "The number one problem in the industry is the training of new setters and supplementing the knowledge of those already in the business."

Most manufacturers of tile products hold training seminars at the distributor level and many have technical staffs who field questions over Watts lines. But there is still a need for a nationally organized system of installation training.

It's no wonder that many contractors are turning to plastic modular showers and sheet goods with the "look of tile." But the situation is not hopeless and there are a number of ways a builder can beef up his tile program.

### Sources of Installation Information

The primary source for installation specifications is the "blue book," the *American National Standard Specifications for the Installation of Ceramic Tile.* It is available for $3 from the Tile Council of America, P.O. Box 326, Princeton, NJ, 08542. The blue book is considered the bible of the industry and is used extensively for developing contracts, nailing down specifications, and settling disputes.

Although written for tile contractors, it can be very helpful to architects and general contractors in that it spells out, in rather technical terms, not only tilesetting specs, but also work normally covered (in separate contracts) by other trades such as carpenters, plumbers, electricians, and waterproofers.

If you use the specs in this book, contracts will become black and white and more realistic to both you and your subcontractor. If your sub is unfamiliar with the ANSI book, it will be in your best interest to find another tilesetter.

Another excellent source of information with a more practical emphasis is the *Handbook for Ceramic Tile Installation 1988,* published by the Tile Council of America. With a few exceptions, the handbook is fully compatible with the ANSI book. The major difference is that the TCA book has cross-sectional illustrations of practically every conceivable installation and arranges them by floor, wall, or countertop installation. In addition, there are sections covering expansion and cold joints, wet installations, swimming pools, steam rooms, renovations, and even fire- and sound-rated installations.

With the TCA Handbook, a builder can make sure the prep work for tile is done correctly. He can also save money by using carpenters or drywallers to install underlayment or cement backer board rather than having the tilesetter do it.

By following both books, you will benefit from the experience and research of thousands of tile experts.

### Read the Label

Tile materials have gone through dramatic changes in the past 20 years. Prior to World War II, the standard materials were a few ready-to-use mastics that were expensive and unreliable, a smaller number of thin-set mortar adhesives, and an even smaller number of plain white grouts.

# High Marks for Epoxy Grout

When craftsmen installed tile a couple of thousand years ago, grout was not a separate and distinct product. Tiles were positioned over a thick bed of mortar and then tapped down into the bed. This caused the mortar to ooze up into the joints between tiles. The mortar was allowed to stiffen and was then struck with a tool to shape the joint. This type of grouting is still done on a limited basis, but it requires very thick mortar beds and massive underbases to keep the installation rigid.

Competitive construction practices have all but eliminated "thick" in favor of "thin," and grout manufacturers have worked hard to develop grouts that are hard and wear-resistant and, at the same time, flexible. In addition, they must be reasonably easy to apply, easy to maintain, and stain-resistant.

This last feature is particularly important to the consumer. Over the past ten years or so, the number of grout colors has increased from a handful to over 300 different shades. For the most part, these colored grouts have all been made acceptable through the use of latex or acrylic additives. But they have not been without their problems, most notably: chalking (or crumbling) of the grout material, color spotting caused by excessive water used during cleanup, and staining.

To solve these problems, some manufacturers have begun to market 100-percent-solids epoxy grout. The "100-percent solids" means that the strength of this kind of grout comes exclusively from epoxy resins and not a combination of epoxy and cement. In fact, 100-percent-solids grout contains no cement at all. It is composed of a liquid epoxy resin and liquid hardener that are combined and mixed with a dry powder. So far, the product has been perfected only for floors.

Each manufacturer has specific use instructions that should be followed to the letter. Application is similar to regular grout but there are some significant differences.

Among the similarities between 100-percent-solids and plain, latex, or acrylic grouts are:

1. All types must be mixed thoroughly with no lumps.

2. All joints to be grouted must be fully packed with no voids.

3. All expansion joints must be free of grout (or other mortars).

4. The use of a Groutmaster grout trowel is recommended.

But there are also some major differences. As with other grouts, you must still pack the grout in and wash it off. But by following the approved methods of working with cementitious grouts, you will surely spell doom for 100-percent solids.

Here are some of the differences:

1. All the components coming into contact with 100-percent solids should be *bone-dry* (no misting or damp sponging).

2. Do not attempt to grout when the ambient temperature is lower than 60°F or higher than 90. The reason: 100-percent solids has the consistency of dry, sanded grout mixed with 120-weight open-gear lubricant. When mixing in cold conditions, more liquid is used to make the stuff less stiff. The added resin results in a spongy joint that can eventually tear.

Above 90 degrees, on the other hand, some setters will add excess powder to thicken the mix. However, the high temperatures accelerate the chemical reaction. And because the ratio of wet to dry ingredients is out of proportion, the grout very quickly turns to stone—literally right before your eyes. There is nothing you can do to stop it. (You can have the same problem if you warm a batch of grout to make it easier to work on a cold jobsite.)

3. 100-percent solids will continue to slump until it takes its initial "set." Any voids that open up should be back-filled quickly and before any water contacts the grout. As long as I am sure each title has been cleaned free of grout residue and the amount of grout in the joint is sufficient, I disregard minor surface flaws or nicks because in about twenty minutes or so (at 78°F), the joint will level itself out to become smoother than I could get it with a sponge.

4. When cleaning up 100-percent solids, use a Scotchbrite pad. Unlike with regular grout, use plenty of water to help lubricate the pad and loosen the grout residue on the tiles. The trick here is the Scotchbrite pad. It is porous and yet quite stiff, so it bridges from tile to tile without gouging out the joints. Once an area is cleaned with a pad, use a large, soft, rounded sponge to clean off the surface of the tiles. Water should be changed often.

5. After the floor is cleaned, there will remain some finishing work. This should take place within a day or two of grouting and involves nothing more than washing the tiles with TSP or some dishwashing detergent and water. Prior to this cleaning, the floor will be covered with a film highly effective at trapping sawdust and grabbing at sock fibers. These may be difficult to remove from the surface of the grout.

I find that 100-percent solids takes more time and scrupulous preparation. But in the end, the stuff doesn't crack, it doesn't shed powder or grit, it is easy to clean, and it is difficult to stain. In short, it's just about perfect. —*MB*

*For More Information:*

*AO 2000 epoxy grout*
American Olean Tile Company
Lansdale, PA 19446
215/855-1111

*SP 100 epoxy grout*
Laticrete International, Inc.
1 Laticrete Park North
Bethany, CT 06525
800/243-4788

*Groutmaster grout trowels*
(made by American Olean, and available at most tile stores).

*Scotchbrite pads*
(available at tile stores or cleaning supply stores – a Scotchbrite pad is included with each unit of SP 100)

Now the list would fill a book. There are thousands of different kinds of mastics, thin-set mortars, and grouts—not to mention latex, acrylic, or epoxy additives, and waterproofing and isolation membranes. Most of these products conform to accepted industry standards and many carry one or more seals of approval granted by the various industry groups.

The first step when using any new tile product is to read the instructions. If you cannot find answers in the brochures, call the maker's technical department and ask. According to Bob Cooper, a manufacturer's rep with Laticrete International, a manufacturer of latex and epoxy grouts and adhesives, "perhaps 25 to 30 percent of all setting material failures are caused by the setter not following the printed instructions." A few minutes of reading can often make the difference between a satisfied customer and an expensive repair.

### Learning from the Mistakes of Others

I was fortunate to begin my tile career working for a tile repairman. That experience gave me the opportunity to dissect thousands of faulty installations and see where they went sour. It gave me a solid foundation.

Later, after working for other companies, I started consulting on new construction and restoration work around the U.S. In doing so, I realized that materials and methods that worked in one location did not necessarily hold up elsewhere.

For example, in the San Francisco Bay area, I laid down hundreds of tile floors on an plywood underlayment using an epoxy-based thin-set adhesive. This was never a problem as long as I followed TCA specs. These floors were mostly dining-room, kitchen, or entry hall floors that occasionally would get wet, but could be considered a dry area. Now that I live in Vermont, I know that this type of floor cannot take the structural movement caused by the New England climate. I don't mean to imply that the TCA specs are no good in the Northeast but rather that the jobsite environment should determine how the specifications are read.

For example, I would treat the job described above (a kitchen/dining-room floor), as a dry installation in the Sunbelt, while in Vermont I would consider it a wet installation and follow the appropriate TCA spec. The main difference called for in a wet installation is the addition of an isolation membrane.

What's the solution? For me, the answer is easy. I float mortar beds for all my installations. With this method, I ensure that all setting surfaces are plumb, level, and flat. I use a latex additive in the mortar beds, adhesives, and grouts (when I don't use epoxy). I use a combination waterproofing/isolation membrane and I design expansion joints into the layout of the tiles.

**I would treat a kitchen or dining-room floor as a dry installation in the Sunbelt, while in Vermont I would consider it a wet installation and follow the appropriate TCA spec.**

This system is certainly more time-consuming and expensive than mastic over plywood, but it's economical in that it gives the customer good looks, easy maintenance, and generations of trouble-free service. That policy has served me well, but there are too few mud setters to service the existing tile market. On the other hand, there are products and methods available that will let the thin-bed tilesetter produce work just as durable and trouble-free as the mortar-bed setter. The "trick" is to plan the installation carefully, use the right materials, and avoid shortcuts.

If there was enough space in this article, I could make recommendations for every possible tile job you might encounter. But instead, I would like to walk you through some fairly typical situations, show you some of the most common job failures, and describe how those failures can be avoided. Let's begin with a standard shower.

### Tiling a Shower

Most showers found in today's market are built around a bathtub or a preformed shower pan with the tiles set over moisture-resistant drywall with a ready-to-use mastic (enough to make me choke). In tract housing, an experienced worker with a good helper can easily set and grout eight or more units in an 8-hour day. A quick-and-dirty job like this can cheaply satisfy the demand for tile but after a few months you'll find cracked corners, loose tiles, and a shoddy appearance—and that's in the guest bathroom that has not even been used! Imagine what the shower in the kid's bathroom looks like.

Figure 1 shows the beginnings of such an installation and how I handle it. Using a 1/8-inch notched trowel, I cover the area to be tiled with cold-patch asphalt and then cover this with a layer of 15- or 30-pound tar paper. Then I add metal lath, float the mortar bed and set the tiles, leaving an 1/8-inch gap between the tiles and the tub or preformed pan (called a receptor). Immediately after grouting, I'll rake the grout from this joint and the vertical corners and fill these joints with a silicone caulk.

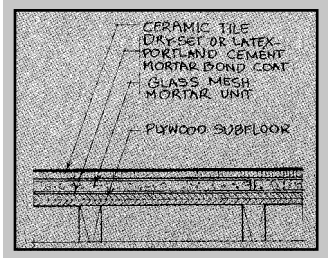
Another way to go, which would reduce the cost, would be to waterproof the drywall with a waterproofing/isolation membrane. The one I prefer is called Nobleseal T/S (The Noble Company, 614 Monroe St., P.O. Box 332, Grand Haven, MI 49417; 616/842-7844). This material is made of chlorinated polyethylene with layers of polyester fiber bonded to each side. It comes in 5-inch-wide rolls and is bonded to the substrate with a latex-modified thin-set. The same thin-set is then used to bond the tiles to the sheet and the tiles are then grouted and caulked as in the mortar-bed job. The membrane allows for considerable movement between the substructure and the tiles so that seasonal movement of the structure does not affect the tiles.

Two things you should keep in mind: All manufacturers of moisture-resistant drywall (so-called green or blue board) state that this kind of drywall should not be used as a setting bed for tiles. Only the addition of the membrane makes this configuration okay. The preferred base for thin-set installations (floors, walls, or countertops) is cement backer boards, designed specifically for the thin-bed method.

These boards are available at most tile dealers, go up like regular drywall, and are completely unaffected by water. The brand I favor is called Durock (United States Gypsum, 101 South Wacker Drive, Chicago, IL 60606;

# TCA Specifications

**Interior Floors with Glass-Mesh Mortar Units**
(Dry-set mortar or latex-portland cement)




**Recommended Uses:**

- Over structurally sound plywood where light-weight construction is a factor.
- Where water resistance is desired.
- Eliminates necessity of recessing subfloor to accommodate Portland cement mortar bed.

**Limitations:**

- Will provide bond for presanded dry-set mortar or latex-portland cement mortar only.
- Waterproof membrane shall be provided where a waterproof floor is required. Follow manufacturer's installation recommendations.

**Requirements:**

- Deflection shall not exceed l/360 of the span, including live and dead loads.
- Maximum spacing of floor joists is 16" o.c.
- 1/8"-wide spacing between units to be filled solid with dry-set or latex-portland cement mortar.
- All joints between unit ends to be aligned over floor joists.
- Laminate units to subfloor with latex-portland cement mortar.
- Sheets to be fastened through subfloor into joints with galvanized nails, screw-type nails, or other corrosion-resistant fasteners.
- Surface of units to be clean and free of dirt, dust, or oily film.

**Materials:**

- Underlayment glass-mesh mortar unit – certified by the manufacturer as suitable for intended use.
- Dry-set mortar – ANSI A118.1.
- Latex-portland cement mortar – ANSI A118.4.
- Grout – ANSI A118.6, specify type.

**Preparation by Other Trades:**

- Subfloor – 1/2" exterior-grade plywood on joists at 16" o.c.
- Max. variation in plywood surface shall not exceed 1/8" in 10'-0" from the required plane.

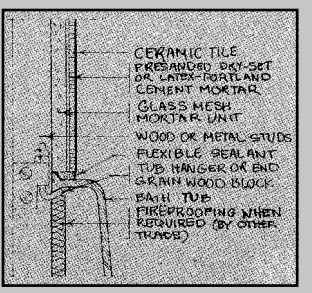
**Expansion Joint (architect must specify expansion joints and show location and details on drawings):**

- Expansion joints mandatory in accordance with Method EJ171.

**Installation Specifications:**

- Glass-mesh mortar unit – in accordance with manufacturer's literature.
- Tile – ANSI A108.5.
- Grout – ANSI A108.10.

**Bathtub Walls with Glass-Mesh Mortar Units**




**Recommended Uses:**

- In tub enclosures and tub showers over dry, well-braced wood studs, furring or metal studs.

**Requirements:**

- Use in conjunction with Method W224.
- Stud spacing not to exceed 16" o.c.
- Minimum stud depth – 3 5/8".
- Metal studs – 20 gauge (0.039") or heavier.

**Materials:**

- Glass-mesh mortar units – certified by manufacturer as suitable for intended use.
- 2"-wide glass fiber mesh tape.
- Dry-set mortar – ANSI A118.1.
- Latex-portland cement mortar – ANSI A118.4.
- Grout – ANSI A118.6, specify type.
- Elastomeric caulking – silicone rubber.
- Metal studs – ASTM C645.

**Preparation by Other Trades:**

- Over metal studs – see Method W244.
- Studs – install square and plumb.
- Opening for recessed tub – not to exceed more than length of tub.
- Bathtub – install level and supported with metal hangers or on wood framing members.
- Fire and sound ratings – extend gypsum board required for ratings down to the floor behind the tub so that construction will be the same as the tested assembly. Glass-mesh mortar units may be part of, or installed over the rated assembly.

**Preparation by Tile Trade:**

- Provide a 1/8" spacing at horizontal and vertical joints and corners of glass-mesh mortar units and corners of glass-mesh mortar units and fill space solid with dry-set or latex-portland cement mortar.
- Embed 2"-wide glass fiber mesh tape in a skim coat of the same mortar over joints and corners.

**Installation Specifications:**

- Glass-mesh mortar units – in accordance with manufacturer's directions.
- Tile – ANSI A108.5.
- Grout – ANSI A108.10.

1988 *Handbook for Ceramic Tile Installation*/Tile Council of America

312/606-4523) and is composed of an inner core of sand, cement and other ingredients plus an outer skin (front and back) of woven fiberglass mesh. They can be nailed or screwed and the recommended gaps between boards and fixtures are covered with fiberglass mesh tape and filled with the same latex-modified thinset used to affix the tiles to the board. On wet installations, I always cover backer boards with NOBleseal T/S. The TCA spec for using cement backer board in a bathtub enclosure is shown above.

**The comment I hear most from disgruntled tile consumers is that the grout must not be any good. Well, that simply is not the case. What is happening on most jobs is that the structure is moving.**

### The Grout's No Good

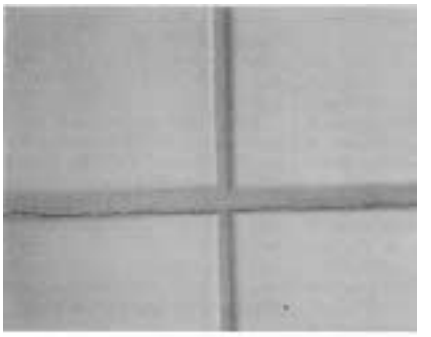
There are a number of features, common to both methods described above, that ensure that the finished work will never be destroyed by structural movement or water damage. The comment I hear most from disgruntled tile consumers is "the grout must not be any good." Well, that simply is not the case. What is happening on most jobs is that the structure is moving (expansion or contraction). The grout, being weaker in tension than most tiles, and often stronger in compression, will crack when the joints expand and either crumble or chip the edges of the tiles when the joints contract.

The asphalt gum and tar paper provide excellent waterproofing and allow the tile-mounted mortar bed to slip against the substructure. It is the traditional, low-tech equivalent of NoBleseal T/S.

### Expansion Joints

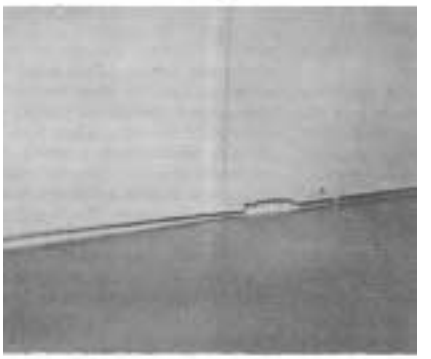
Both types of jobs also need expansion joints to allow the individual tiled surfaces to absorb a measured amount of movement in a structure. This applies to both vertical and horizontal installa-

# Tile Troubles



*This New England floor was laid on plywood with an epoxy-based thin-set. Unfortunately, the plywood was wet from being stored outside. When the plywood dried in winter and shrank, the tile joints cracked.*

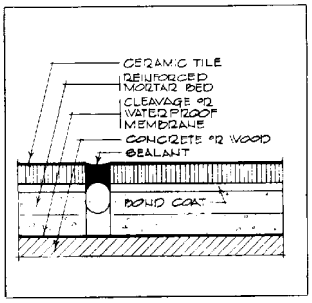
*Here, thin-set mortar that oozed between the tiles show through the grout joint. All joints should be raked out to a uniform depth.*



*Where tile meets a dissimilar material, such as this wood cabinet, a caulked expansion joint is needed. Here, the grout joint cracked.*

*Gauged stone like slate or marble can be set and grouted using tilesetting methods. But in this case, the setter butted the slate directly against the wooden baseboard with no expansion gap, there is no caulk between the door casing and slate (collects dirt), and the slate has cracked because it is not supported with a full bed of thin-set adhesive.*

*What's that about the good old days? Nothing was used to bond these vitreous (non-absorptive) tiles to the mortar base they were set into in 1927. Consequently, they came loose over the years (left). The cove joint cracked and filled with dirt (no expansion joint), and the cove tiles nearly all cracked due to insufficient mortar behind them.*




*TCA Handbook*

**Figure 2.** *TCA specs call for control joints wherever tile abuts restraining surfaces such as columns or perimeter walls, or where tile surfaces exceed specified dimensions: 12 to 16 feet for wet installations, 24 to 36 feet for dry*

tions. In addition, the joints allow for movement between dissimilar materials. The expansion/contraction rates of tile, cast iron, and plastic are all different. Grout the joints between tile and these other materials and you will be regrouting the joint forever. Caulk it, and you are worry free for ten years or so when the caulk has to be replaced.

The TCA and ANSI books have specific information concerning the proper placement and frequency of expansion joints for various installations. For example, the TCA handbook recommends an expansion joint every 12 to 16 feet in each direction for interior tilework, where it is exposed to moisture or direct sunlight (see Figure 2). When working out of the Sunbelt, I place joints no more than 12 feet apart for all tile jobs.

### Additives

The latex (or acrylic) additives effect marvelous changes in the composition of cured mortar. Most notable is the ability of latex-modified mortars to bend, stretch, and compress without cracking. Additives also increase the water resistance of mortar. The manufacturers of these additives would have a fit if I wrote that they make mortar "waterproof," but in my own experience, and in tests, as long as there are no cracks, water will not penetrate. The latex particles fill the air spaces left in mortar made of sand, cement, and plain water.

### Taking a Look at Floors

The industry has had an opportunity to take a long look at thin-bed floor installations. Some materials, like particle, flake, or chip boards have been ruled out entirely. Plywood seemed to be okay for years when it was primarily a Sunbelt method. But when tile markets began to expand in more moderate climates, problems became more apparent.

Strict compliance with ANSI/TCA standards might keep you out of trouble with plywood substrates. (For example, leave 1/8- to 1/4-inch gaps between sheets of plywood underlayment, and leave no more than 1/16-inch variation from level over 3 feet.) But one thing is clear: The best thin-bed floor installations use cement backer boards as the setting bed. For floor use, the boards must be laminated to the subfloor with a latex or epoxy thin-set as well as being staked down with nails or screws (see TCA spec on page 45). If a thin-bed setter combines the strength of backer board with the performance of an isolation/waterproofing membrane like Nobleseal T/S, he can create floors as durable as a mortar-bed installation.

There are numerous recognized thin-bed methods you can be confident with. Whichever one you choose, it is important that you follow the manufacturer's instructions and industry specs to the letter. Shortcuts in the preparation work will come back to haunt you. And old ways are not necessarily the best ways either: For example, soaking tile was essential in mud work, but will guarantee a poor bond to most thin-sets. With modern materials, you must use modem techniques. But there's one old-fashioned technique that applies to all installations: careful workmanship and attention to detail. ■

*Michael Byrne is a tilesetter and consultant, and principal of Ceramic Tile Associates in Burlington, Vt. His new book,* Setting Ceramic Tile, *is reviewed in* The Journal, *10/88.*