TEC®

EXTERIOR TILE

INSTALLATION GUIDE

INSTALLING TILE OUTSIDE THE BUILDING

Tiled exterior features—such as walls, patios, and walkways—make a powerful first impression. A well-executed exterior installation can attract customers to a business, add curb appeal to a home, or complete a public space. Although worthwhile, exterior installations present potential complications as there may be great temperature variation between the summer and winter months.

Before any installation, the following must be considered: substrate condition, environmental factors, and the intended use of space. These factors are especially critical for exterior applications, and must be taken into account through every project step—from product specification to installation.

The right installation materials—effectively installed to work as one system from substrate to sealant—help outdoor tile installations withstand the elements and protect building owners in the future.

TILE SELECTION

For exterior installations, careful tile selection is essential. Historically, porcelain tile has been the most commonly recommended material for outdoor projects. However, any tile within the acceptable porosity range can be used, as long as it meets other requirements for exterior installations. Paper-back, mesh-back, or dot-mounted tile on exteriors should not be used unless the manufacturer guarantees the material is suitable for this type of installation.

Climate-specific challenges should also be considered throughout the specification process. For example, if an installation will be subjected to freeze/thaw conditions, the tile should be frost-resistant. Denser materials with a porosity of less than 0.5 percent—such as porcelain—tend to have more frost-resistance. These tiles are classified as ‘impervious.’ The higher the amount of water absorption, the greater the likelihood of damage caused by stress generated by freeze-thaw action. ASTM C1026, *Standard Test Method for Measuring the Resistance of Ceramic and Glass Tile to Freeze-Thaw Cycling*, is the standard used for tile in freeze-thaw conditions.

For outdoor floor installation in any climate, installers must consider tile texture. Since outdoor floor installations will be exposed to the elements, installers should take caution to avoid materials that get especially slippery. Unglazed materials are often ideal for outdoor floor installations, as they normally have nonslip properties. Textured tiles can also minimize the likelihood of slipping. On walls, almost any type of tile can be used—including ceramic, glass, or stone.

Sustainability goals may also influence exterior tile selection. Light-colored tiles for site hardscaping can lower a site’s heat absorption, or heat island effect. Tiles with a solar reflective index (SRI) of 29 or greater can contribute toward compliance in Leadership in Energy and Environmental Design (LEED) by complying with New Construction (NC) v2.2’s Sustainable Sites (SS) Credit 7.1, *Heat Island Effect−Non-roof*.

SUBSTRATE PREPARATION

TEC® Multi-Purpose Primer can allow direct ceramic tile installation on many difficult-to-bond-to substrates such as metal, unscarified glazed ceramic, and gypsum.

Whether a project involves remodeling a tiled exterior area or starting from scratch, substrate preparation is the key. Concrete is the ideal substrate for exterior floor installations, while other firm substrates, including backer board or concrete masonry unit (CMU) walls, can be employed for wall installations. When setting tile on existing concrete, curing compounds must be addressed. These products can prevent proper bonding of mortar to the concrete surface, so they should be removed by mechanical cleaning and profiling methods. Once the concrete is clean, dry, and free of bond breakers, use TEC® Multipurpose Primer to enhance the bond. It is important to look for a primer produced by the same manufacturer of any patching or levelers used, and to be certain it is compatible with all other products used.

Laitance—a thin layer of hard, weak cement—can also affect the substrate's bonding potential. The concrete's surface layer may appear strong and stable, but actually risks causing bond failure. Laitance can be identified by scraping the concrete with a razor blade to see whether it scratches or powders. Formal testing can then be undertaken by measuring the concrete surface's tensile strength with specialized equipment. The remedy for a weak layer of laitance is removal, often by sandblasting. One should consult with the manufacturer of the setting and leveling materials for tensile strength requirements.

A patching compound, like TEC® Fast-Set Deep Patch, can be used to address substrate variation.

After these preliminary steps, any variation in the substrate should be corrected. An appropriate patching compound compatible with the mortar should be used to meet the flatness requirements of TCNA. For tile less than 15 in. (381 mm) in size, this requirement is 1/4 in. in 10 ft (6.3 mm in 3.05 m), and for tile with at least one edge over 15 in. (381 mm) in any one direction, the requirement is 1/8 in. in 10 ft. (3.2 mm in 3.05 m). Exterior floors, decks, or patios should be sloped to allow for drainage. Concrete on grade should also have a gravel bed or other means of drainage below the slab. Drainage is particularly important for installations subject to freeze/thaw cycling, snow and ice accumulation, or use of snow-melting chemicals, as these conditions can cause degradation over time.

As the ground freezes and thaws, moisture levels change. This process causes substrates, adhesives, and tile to expand, contract, and even crack. Waterproofing and crack-isolation membranes, like TEC® HydraFlex™–, can alleviate the demands put on exterior tile installations. American National Standards Institute (ANSI) A118.10,

Specifications for Waterproof Membranes, is the relevant standard for waterproof membranes, while ANSI 118.12, *Specifications for Crack Isolation Membranes*, details specifications for crack-isolation membranes.

Waterproofing and crack isolation membranes prevent in-plane cracks in the substrate from telegraphing to the tile along with protecting the substrate from water damage. They help prevent problems associated with saturation and moisture expansion, and are applied to the substrate's surface and allowed to cure before tiling begins.

The tile is bonded directly to a waterproofing and crack-isolation membrane.

Crack-isolation properties are particularly important for projects in freeze/thaw environments. A membrane allowing the direct bonding of tile for an efficient installation should be specified.

A water-resistive barrier (WRB), waterproof membrane, or vapor retarder membrane may be required as per local building codes.

Excessively porous substrates may prevent formation of a strong bond. Porosity in a substrate can be determined by the water droplet test—if the water disappears in under a minute, the substrate is porous. The application of a primer can minimize the pull of moisture from the mortar into the substrate, ensuring proper curing and bonding. Please follow proper dilution ratios for Multipurpose Primer located on the product data sheet.

MORTAR SELECTION

An important element of ensuring an installation performs as expected and has a long service life is choosing the proper setting materials. It is critical to select mortars and grouts specifically engineered to safeguard against natural elements when installing in a harsh exterior environment.

The best mortars for exterior installations combine bond strength with flexibility to allow for shifts in the substrate caused by changing moisture and temperature levels. Latex/polymer-modified mortars are often best equipped for these conditions. These mortars are designed to reduce water absorption and provide greater bond strength and resistance to shock and impact. A mortar complying with ANSI A118.15, *Specifications for Improved Modified Dry-set Cement Mortar,* would be in this category. Organic adhesives (mastics) should never be used on exteriors.

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Most mortars today have a dry form of polymer already blended in the bag, to which only water is required for mixing. However, liquid latex mixed with an

unmodified mortar can still meet ANSI A118.4, *Specifications for Modified Dry-set Cement Mortar*. This standard denotes mortars designed for exterior conditions or for use with hard-to-bond-to substrates.

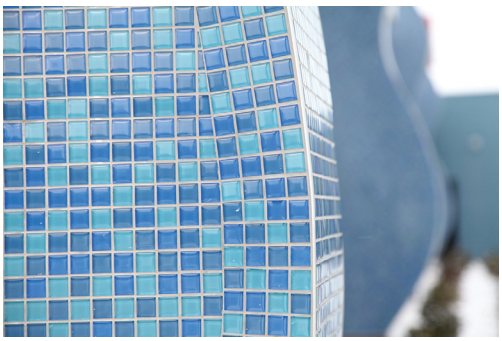
The newer designation of ANSI A118.15 indicates applications with increased bond strength requirements, helping identify the best mortar types for exterior applications. Admixtures may increase mortar performance and flexibility in cold weather, helping it withstand the expansion and contraction associated with freezing and thawing.

GROUT SELECTION

Grout is also an integral part of an installation's longevity. High-performance grouts offer increased bond strengths, flexural strengths, and lower water absorption to resist frost damage. Mold and mildew resistance help exterior grouts hold up to frequent moisture exposure. Generally, epoxy grouts are not recommended for exterior installations.

In especially demanding environments, grout additives are often mixed with cement grouts (in place of water) to create stain-resistant, stronger, denser grout more able to endure freeze/thaw action and resist water penetration. Additives can also increase grout flexibility, providing crack resistance.

Just like with mortars, there are high-performance grouts with the polymers already blended in the bag so that only water needs to be added. Grouts complying with ANSI A118.7, *Polymer- modified Tile Grouts for Tile Installations*, are recommended for exterior applications.



Glass tile has low porosity, making it appropriate for this outdoor installation.

Tile selection can impact grout specification for exterior installations. For example, some glass tile—such as those used on pools or walls—may be easily scratched, and therefore will require unsanded grout, since sanded grout may damage delicate surfaces. Beyond that, narrow grout joints of 1/16 to 1/8 in. (1.6 to 3.2 mm), which demand unsanded grout, are often preferred for stone tile installations.

Sanded grout adds stability to joints between 1/8 and 1/2 in. (3.2 and 12 mm), as its composition prevents grout shrinkage. Use a minimum of 3/8 in. (10 mm) wide control joints on exterior tile installations, because of temperature fluctuations. Tile control joints should be located over the control joints in the substrate, as well as above any cold joints.

High-performance universal grouts, which can be unsanded or sanded, are available in various colors, with aesthetic goals determining the selection. Matching the grout to the tile color visually minimizes the grout joint for a more continuous design, but contrasting hues lead to a dramatic look that draws attention to individual tiles (and, unfortunately, any irregularities found in the installation).

Efflorescence, a whitish, crystalline, or powdery deposit on grout lines and tile surfaces, can mar even the most carefully considered exterior grout-tile combinations. On exterior installations, efflorescence is often the result of moisture below the tiled area's surface that migrated upward. In some rare circumstances, prolonged exposure to rain can cause efflorescence—especially with porous grout. Careful grout selection can prevent efflorescence from affecting an installation's appearance. TEC® Power Grout® was specifically designed for efflorescence resistance.

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Sealers and caulks/sealants can prevent external moisture from penetrating a tiled area, further protecting it from external elements. For many, a 100% silicone caulk has become the product of choice for the flexible sealant required in wet areas. These caulks/sealants prevent mildew and cracking in the grout joints. When needed, a penetrating sealer can reduce moisture penetration, without changing the grout's appearance. These sealers are designed to completely penetrate into a porous surface without changing its appearance, and are available for a full range of porous tiles, stone, and grouts.

Above all, materials must work together as a system to combat the challenges exterior conditions present. Substrate preparation products, mortar, and grout should all be compatible. For this reason, one may wish to consider using a single source for all installation materials. (This also makes any warranty considerations an easier process.)

SETTING STRATEGIES

To determine the most effective installation strategies for a particular project, exterior installation sites should be evaluated in advance by the tile installer. It must be determined whether the installation will be exposed to direct sunlight all day or part of the day, whether it will be exposed to harsh winds, and if it is possible to protect the installation from the sun with a temporary shelter.

Moisture can be lost to the atmosphere when the installation is conducted or allowed to cure in direct sunlight on hot, dry days. Excessive heat can prevent fresh mortar from properly curing and developing the necessary strength for long-term installation. So, on hot days, the installation should be shielded from direct sunlight by tenting. This helps keep both the materials and the installers safe and cool. If this is impossible, the installation team may have to work at night.

Cold temperatures present the opposite problem. An outdoor project should not be scheduled if extreme cold is anticipated. Tile should not be installed at temperatures below 54ºF (12ºC) when using portland cement mortars, dry-set mortars, or latex-portland cement mortars. Bond coat and temperature should be maintained at a minimum of 54ºF (12ºC) or a maximum of 100ºF (38ºC) until cured. However, certain rapid-set, dry-set, or latex mortars may be suitable for temperatures as low as 41ºF (5ºC). The manufacturer's instructions should be consulted when one anticipates needing to install in those conditions.

Epoxy mortars and grouts should not be applied at temperatures below 61ºF (16ºC) or above 90ºF (32ºC), unless there are specific manufacturer recommendations. It should also be noted cooler temperatures increase cure times. This means when temperatures drop, the installation requires extra time to cure before it is safe for foot traffic.

100% silicone caulk and a high-performance grout and mortar were used on this demanding installation.

The installation team must understand the unique mortar coverage requirements of exterior installations. These outdoor applications require 95% coverage—this requirement increases to 100% with natural stone. Substrate variation, bonding material, trowel selection, and trowelling technique are critical factors to consider when trying to achieve proper coverage. If voids of mortar beneath the tile exceed the industry requirement, they can accumulate moisture. In freeze/thaw climates, this water can freeze and expand, causing degradation and bond failure of the thin-set.

To achieve the required coverage, set the tile on freshly notched thin-set mortar, and sliding it back and forth perpendicular to the notches. Back-buttering can also be used to meet coverage requirements. This involves applying a thin coat of mortar to the back side of the tile with the flat side of the trowel immediately before setting.

The dot method should never be used with cement-based mortars for wall applications. With this method, the installer puts globs, or dots, of mortar on the back of the tile, rather than carefully trowelling it. Although it may seem like it saves time and reduces material expenditures, the resulting voids in coverage leave tile susceptible to moisture trapping, which can cause debonding or compromise the bond.

Even the most carefully installed exterior projects may suffer from lippage—a condition occurring when tiles are not laid to a uniform level, so one edge or corner of a tile is higher than the edges or corners of an adjacent tile. Some degree of lippage is normal for exterior installations. However, lighting conditions can significantly worsen its appearance. Light shining on exterior installations at a flat angle, parallel to the surface, can accentuate normal and acceptable inconsistencies. Having temporary lighting that mimics the planned lighting scheme, or awareness of these overly exposed areas, helps ensure the lighting and tiled installation work together.

CONCLUSION

Selecting and effectively using high-quality products for exterior projects requires careful consideration of various factors. No two exterior projects are exactly the same, but a comprehensive understanding of the conditions that should drive product selection will always contribute to more successful installations. Ensuring the material qualities are not only rated for exterior use, but also work together as a system, pays off in the creation of a beautiful and durable installation.