
Installation Manual

Crossville's Technical Manual / Guidelines

Laminam 3+ and 5.6

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*Information listed here is subject to change.
Please refer to LaminambyCrossville.com
for the latest, most accurate information.*

Your exclusive source for
Laminam in the United States



04 1 THE PRODUCT

1.1 Laminam 3+

1.2 Laminam 5.6

05 2 PACKING SPECIFICATIONS

2.1 Laminam 1 Meter x 1 Meter

2.2 Laminam 1 Meter x 3 Meter

06 3 MATERIAL HANDLING

3.1 Fork Lift Requirements

07 3.2 Ideal Handling Equipment

3.3 Shipping and Unloading Requirements

3.4 Manual Handling and Storage

08 3.5 Euro-Grip/Euro-Slide Frame/Transporter

4 INSTALLATION

4.1 Current Applications Laminam 3+

4.2 Current Applications Laminam 5.6

09 4.3 Countertops

4.4 Suitable Substrates - Walls

4.5 Suitable Substrates - Floors

4.6 Substrate Requirements

4.7 Movement Joints

10 4.8 Install with Qualified Labor

5 INSTALLATION PROCESS

5.1 Installation Recommendations

10 5.2 Portable Work Station

11 5.3 Recommended Equipment

11-12 5.4 Use of Rail Cutters

12 5.5 Cutting and Drilling

5.6 Dry Cutting Electrical Boxes

5.7 Mortar Application

12-14 5.8 Application to the Substrate

15 5.9 Grouting

5.10 Edge Treatments and Profiles

16 5.11 Critical Review Points

6 CARE AND MAINTENANCE

6.1 Initial Care and Maintenance

7 TECHNICAL PERFORMANCE

7.1 Product Specifications

17 8 MORTAR AND GROUT SELECTION GUIDE

8.1 Manufacturer's Product Information

18 9 EXTERIOR DIRECT BOND GUIDELINES

9.1 Code Compliance and Approval

9.2 Installation Methods

9.3 Selection of Setting Material Company

19 9.4 Laminam Tech Guide

9.5 Qualified Labor

20 Contact Information

1. THE PRODUCT

1.1 Laminam 3+ Porcelain Tile Panels 1 METER x 3 METER and 1 METER x 1 METER

These porcelain tile panels are produced with an innovative tile technology. By pressing without the traditional die-mold commonly used throughout the tile industry, then firing with highly controlled kilns at a temperature of approximately 2200 degrees F, this breakthrough process successfully eliminates tension within the tile panel creating a uniformly large flat piece that can be cut or trimmed with precise accuracy. The Laminam 3+ porcelain tile panels also have a fiberglass mesh permanently adhered to the back for additional strength and flexibility.

All installation systems to utilize applicable TCNA Handbook detail and additionally the installation guidelines detailed in this manual.

- Interior walls and countertops
- Exterior Walls per exterior direct bond guidelines in section 9
- Cut to size is available with additional lead time and cost.
Check with Crossville customer service for details (931-484-2110)

1.2 Laminam 5.6 Porcelain Tile Panels 1 METER x 3 METER and 1 METER x 1 METER

These porcelain tile panels are produced with an innovative tile technology. By pressing without the traditional die-mold commonly used throughout the tile industry, then firing with highly controlled kilns at a temperature of approximately 2200 degrees F, this breakthrough process successfully eliminates tension within the tile panel creating a uniformly large flat piece that can be cut or trimmed with precise accuracy.

All installation systems to utilize applicable TCNA Handbook detail and additionally the installation guidelines detailed in this manual.

- Interior Floors slab on grade, below grade, or above grade concrete and over well-bonded and properly prepared tile, on, below, or above grade
- Laminam 5.6 porcelain tile panels over substrates supported by wood framing shall utilize TCNA Handbook details F141-15 STONE or F250-15 STONE. Consult the installation materials manufacturer you are using to confirm acceptability of this recommendation.
- Interior walls and countertops
- Exterior Walls per exterior direct bond guidelines in section 9
- Interior Stairs constructed per TCNA S151 - consideration should be given to appropriate DCOF and wear/impact resistance. Pre-formed stair nosing profiles should be considered.
- Cut to size is available with additional lead time and cost.
Check with Crossville customer service for details (931-484-2110)

2. PACKING SPECIFICATIONS

2.1	LAMINAM 1 METER X 1 METER	
	LAMINAM 3+ Porcelain Tile Panels	LAMINAM 5.6 Porcelain Tile Panels
PIECE	10.76 sq. ft. / piece	10.76 sq. ft. / piece
CARTON	3 pc. / carton	2 pc. / carton
SQ. FT. / CARTON	32.28 sq. ft. / carton	21.52 sq. ft. / carton
SQ. FT. / PALLET	807 sq. ft. / pallet	538.0 sq. ft. / pallet
LBS / PIECE	18.07 lbs. / piece	31.27 lbs. / piece
LBS / PALLET	1,843.14 lbs. / pallet	1,563.50 lbs. / pallet
CARTONS /PALLET	25 cartons / pallet	25 cartons / pallet

Note: Non-full crate orders of 5.6mm Laminam or mixed orders of 3+ and 5.6 mm will arrive on vertical A-frame type crates (depends on quantities, timing, and thicknesses on the order - check with Crossville Customer Service for details 931-484-2110). Full crate orders transferred to A-frames will incur additional charges and lead times.

2.2	LAMINAM 1 METER X 3 METER	
	LAMINAM 3+ Porcelain Tile Panels	LAMINAM 5.6 Porcelain Tile Panels
PIECE	32.29 sq. ft. / piece	32.29 sq. ft. / piece
CRATE	20 pc. / crate	13 pc. / crate
SQ. FT. / CRATE	645.80 sq. ft. / crate	419.77 sq. ft. / crate
LBS / PIECE	54.25 lbs. / piece	93.81 lbs. / piece
LBS / CRATE	1,285 lbs. / crate (includes crate weight)	1,419.53 lbs. / pallet (includes crate weight)
SQ. FT. MINIMUM ORDER	32.29 sq. ft.	32.29 sq. ft.
	Laminam Porcelain Tile Panels arrive in oversize crates. <u>These crates require proper receiving and handling equipment.</u>	Laminam Porcelain Tile Panels arrive in oversize crates. <u>These crates require proper receiving and handling equipment.</u>

FIG. 1 LAM-CRATE = minimum 44" fork length required for side lift



FIG. 2 LAM-CRATE = minimum 84" fork length required for end lift



FIG. 3 A-FRAME



3. MATERIAL HANDLING

3.1 Fork Lift Requirements

STANDARD FORK LIFT-SIDE

Handling of the Lam-crate – recommend 44” forks to handle the crate from the side. Important to have 44” forks so they extend all the way across the crate to support the back runner. As shown in fig. 4.

FIG. 4 – LAM-CRATE standard fork lift - side



CROSS RUNNERS

Shipments of Laminam crates will load with the narrow end of the crate facing out. Unloading will require a fork truck with a minimum of 84" forks and 5000 pound lift capacity.

If you have a fork length shorter than 84" you will miss the cross-runner and cause damage, especially when tilting back.

As shown in fig. 5 & 6.

It is important to support the cross runners. You can see the cross-runners in fig. 5.

FIG. 5 – LAM-CRATE – CROSS RUNNERS view of crate with 84" forks underneath

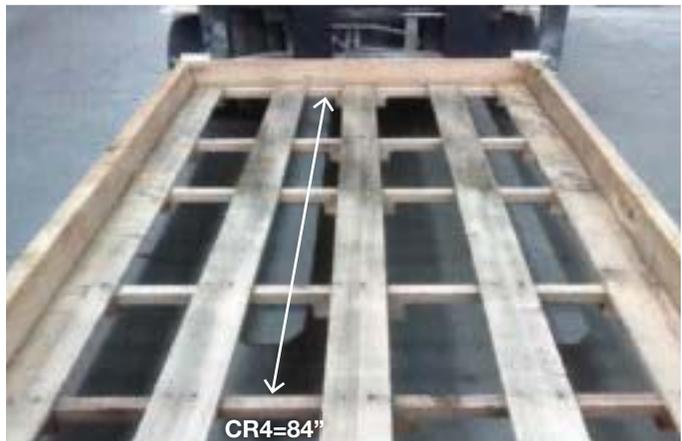


FIG. 6 – LAM-CRATE – CROSS RUNNERS Underside view with 84" forks



3. MATERIAL HANDLING

3.2 Ideal Handling Equipment

96" CRATE TRUCK / PALLET JACK

A crate truck or pallet jack is recommended to move crates in your warehouse. These units have 96" forks to lift crates straight up without tilting. 96" extended fork pallet jacks are also available from U-Line (800-295-5510) or Vestil (800-348-0868).

3.3 Shipping and Unloading Requirements

Container loads are stacked 8 crates high, weighing 10,000 pounds. If you have a direct container shipment, it requires different equipment.

Please contact Crossville for logistical assistance with container orders.

Crossville normally ships its crates a maximum of 3 crates high. Customers can handle these shipments with 5000 pound capacity fork lifts and 84" forks.

3.4 Manual Handling and Storage

Handling Video -

<http://bit.ly/HandlingPorcelainTilePanels>

Two installers should handle the tile panels, always keeping it perpendicular to the floor while protecting the corners from impact (fig. 8). Grip gloves are required when lifting and moving the tile panels to ensure positive hold and to protect hands against fiberglass backing and tile edges (3+ mm).

Position the tile panels on the long side allowing them to lean against a supporting wall while keeping cardboard or wooden strips suitably spaced beneath them (fig. 9).

- **CAUTION** - Crates come equipped with metal corner collars for stacking. To create awareness and avoid injury, paint, cover or remove these collars (fig. 10).

FIG. 7 – CRATE TRUCK FORKS & PALLET JACK



FIG. 8



FIG. 9



FIG. 10



3. MATERIAL HANDLING

3.5 European Tile Masters Euro-Grip/Euro-Slide Frame

To aid handling of 1 meter x 3 meter (39.4" x 118.1") tile panels, especially those weakened by drilled holes or openings and to assist the wall/floor application, a suitable frame with suction cups can be used. The Euro-Grip/Euro-Slide can be purchased from European Tile Masters (www.europeantilemasters.com) (Euro-Grip fig. 11a). The Euro-Grip/Euro-Slide can be reconfigured for use with sizes smaller than full tile panels.

Always check the adhesion of the suction cups on the tile panels prior to lifting.

For efficient moving of up to 8-16 tile panels, the Euro Transporter is available from European Tile Masters. (fig. 11b)

FIG. 11a



FIG. 11b

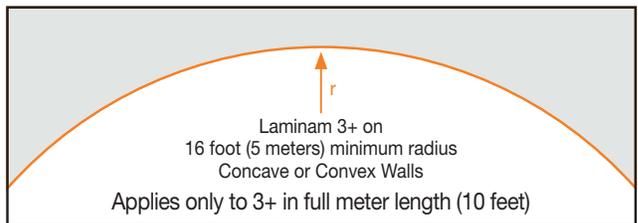


4. INSTALLATION

4.1 Current Applications Laminam 3+

- Interior Walls
- Exterior Walls (see section 9)
- Countertops
- Laminam 3+ Porcelain Tile Panels are NOT rated for floor applications
- Laminam 3+ can be used on walls in a concave or convex direction as long as the radius (r) of the curve equals or exceeds 5 meters (16.4 feet) - applies only to 3+ in full meter length (10 feet) (fig. 12)
- Tile over tile (walls) - consult setting material manufacturer for appropriate primer or other specific bonding requirements. Existing substrates must comply with section 4.6.

FIG. 12



4.2 Current Applications Laminam 5.6

- Interior Walls
- Exterior Walls (see section 9)
- Countertops
- Interior Floors slab on grade, below grade, or above grade concrete-minimum cure 90 days.
- Interior Floors tile over tile on slab on grade, below grade, or above grade concrete.
- Deflection requirements for above grade installations to be per TCNA Handbook: "Floor systems over which tile will be installed shall be in compliance with the IRC for residential applications, the IBC for commercial applications, or applicable building codes. Maximum allowable deflection under live load not to exceed L/360".
- Interior Stairs constructed per TCNA S151 - consideration should be given to appropriate DCOF and wear/impact resistance. Pre-formed stair nosing profiles should be considered.
- Acceptable substrates to be in accordance with Tile Council of North America (TCNA) and ANSI guidelines.
- For tile over tile applications refer to specific setting material manufacturer recommendations for additional surface preparation including primers or other specific bonding requirements.
- Laminam 5.6 porcelain tile panels over substrates supported by wood framing shall utilize TCNA Handbook details

F141-15 STONE or F250-15 STONE. Consult the installation materials manufacturer you are using to confirm acceptability of this recommendation.

- Laminam 5.6 porcelain tile panels should not be used on elevator floors due to excessive deflection of elevator substrates.
- Laminam 5.6 porcelain tile panels should not be used in installations exposed to steel wheel traffic.
- Laminam 5.6 porcelain tile panels when considered for heavy commercial (shopping malls, airports) applications will be considered on a case by case basis. Extra heavy commercial (food plants, dairies) applications are not recommended.
- Laminam 5.6 porcelain tile panels have been tested and have been found acceptable for use with liquid trowel applied crack isolation membranes (see section 8 for specific products). Laminam 5.6 porcelain tile panels are NOT acceptable for use with other crack isolation, sound reduction, or uncoupling membranes until additional testing can be completed to verify the deformability and specific performance of individual membranes. Additional membranes will be added to section 8 when tested.

4. INSTALLATION

4.3 Countertops

Extruded foam boards (1½ to 2 inches) from manufacturers such as Schluter and wedi are the preferred method of countertop installation for both the 3+ and the 5.6 mm Laminam. Their ease of installation, inherent water/vapor resistance, and high density composition eliminate many of the stresses that can be created with the traditional layered approach of plywood, backer board, and/or mortar beds. Crossville has found the following steps insure full supportive coverage and precise cutting of the combined assembly: **Step 1**, the installation of the extruded foam board to the base cabinets. **Step 2**, the Laminam 3+ or 5.6 should then be installed to the extruded foam board following the mortar application method detailed in Section 5.7 of this Technical Guide. **Step 3**, allow the assembly to cure 24 hours. **Step 4**, measure and template all cut outs in the countertop, cut from the top down using right angle grinder, diamond tipped hole saw and utility knife. When using these materials the respective manufacturer's instructions and detailed installation guidelines should be followed. If using a traditional installation approach TCNA Handbook details C511, C512 or C513 should be followed.

4.4 Suitable Substrates – Walls 3+ (Interior and Exterior)

- Existing ceramic tile - see section 4.1
- Appropriate backer boards for tile as referenced and detailed by the TCNA Handbook for Ceramic Tile Installation
- Properly prepared concrete and CMU walls
- Gypsum board/dry wall (Interior dry areas only)
- Mortar beds in accordance with ANSI A108.1B

4.5 Suitable Substrates – Floors 5.6

- Slab on grade, below grade, or above grade concrete in accordance with ANSI A108 and TCNA Handbook
- Existing ceramic tile over slab on grade, below grade, or above grade concrete (well bonded and properly prepared) - see section 4.2
- Mortar beds over concrete in accordance with ANSI A108.1B
- Laminam 5.6 porcelain tile panels over substrates supported by wood framing shall utilize TCNA Handbook details F141-15 STONE or F250-15 STONE. Consult the installation materials manufacturer you are using to confirm acceptability of this recommendation.
- Laminam 5.6 can be used on walls, suitable substrates as designated in section 4.4 (interior and exterior)

4.6 Substrate Requirements – Walls and Floors

The installation contractor should examine substrates and advise General Contractor and Architect of existing conditions and surface contamination which will require correction before the work commences.

Substrates are to comply with deflection requirements called for by International Building Code (IBC), International Residential Code (IRC), or applicable local building code.

Maximum substrate variation not to exceed 1/8" in 10' (3mm in 3m) and 1/16" in 24" (1.5mm in 60 cm) when measured from surface high points with a straight-edge, floors may require self-leveling underlayments or recessed slabs designed to accept a properly prepared mortar bed.

In order to achieve accurately comparable labor quotes the specification must contain language indicating that the work is to be bid assuming the substrates are within the required tolerances. If the substrates are found not to be within those tolerances, language and/or pricing should be included in the installation contractor's bid which qualifies which trade is to do the work needed to bring the substrate into required tolerances. (Include in CSI Div. 3 & 9).

4.7 Movement Joints

Refer to Tile Council of North America (TCNA) Detail EJ-171 for industry guidelines.

Existing joints in substrate are to be carried through the porcelain tile panels. Movement joints are required where the tile panels meet restraining surfaces (e.g. perimeter walls, curbs, columns, corners, etc.) and at all changes in-plane in the tile work.

Joints are to be clean and free of all contaminants and thin-set mortar.

- The edges of the porcelain tile panels are not eased or beveled making them susceptible to damage from heavy rolling loads and impact. Full and flush movement and grout joints should be specified to minimize edge impact.
- Minimum Shore A hardness rating of 35 or greater (per the TCNA Handbook) should be specified for all movement joints in traffic situations. Compressible joint fillers with less than a Shore A hardness of 35 should not be used.
- All expansion joints specific to structural movement: material types and placement should be specified by architectural/engineering authority on the project.
- For interior walls and floors an 1/8 inch movement joint installed every 20 feet will accommodate the needed movement of the tile layer on grade, below grade, or above grade* (all other requirements such as perimeter joints etc. in EJ-171 should followed).
- **Assuming a class 25 sealant installed at 70°F, using a high temperature of 105°F and a low temperature of 40°F.*
- *If specific movement joint requirements need to be calculated, use the anticipated temperature differentials, the appropriate class of sealant and a thermal expansion coefficient of 6.5×10^{-6} in/in/°C.*
- For exterior movement joints see section 9.

4. INSTALLATION

4.8 Install with Qualified Labor

Crossville strongly recommends the use of trained professional contractors for the installation of these porcelain tile panels. The following programs are well established and a good source for quality installation companies:

- ACT – Advance Certifications for Tile Installers
- CTEF – Certified Tile Installer Program
- TCAA – Trowel of Excellence
- International Masonry Institute (IMI)
- NTCA Five Star Contractor Program
- Journeyman Tile Setter Apprenticeship Programs
- **And** completion of Crossville sponsored training provided by Crossville Inc., a Crossville distributor, or other tile panel specific training authorized/approved by one of the above organizations
- Find a list of Laminam Trained Contractors at crossvilleinc.com/solutions/laminam

5. INSTALLATION PROCESS

5.1 Installation Recommendations

For the most efficient and consistent cutting of the Laminam porcelain tile panels, Crossville recommends the Kera Cutter Rail System* by Sigma (fig. 13) or the Euro-Rail Cutter* by ETM. For usage guide on the Sigma Kera-Cut, see YouTube @ KERA-CUT presentation SIGMA.

- For transport of the rail cutter, 6" to 8" pvc pipe w/fitted couplings for end closure (fig. 16)

Crossville also recommends that portable work stations be assembled to insure proper support and fabrication of the tile panels.

* Available from European Tile Masters (ETM) 954-917-3599

5.2 Portable Work Stations

Portable work stations consist of:

- ¾" cabinet grade plywood cut into three, 4 foot square sections each with handles
- 8 hinge plates with 4 chain mount cotter pins (fig. 14)
- 2" flat aluminum strips screwed to each end of the center piece to reinforce & maintain table flatness
- 4 heavy duty collapsible sawhorses (fig. 15)
- Manufactured tables are available from various suppliers such as Raimondi (fig. 17) and ETM (fig. 18)

FIG. 18



FIG. 13



FIG. 14 - Underside of the Assembled Work Station



FIG. 15



FIG. 16



FIG. 17



5. INSTALLATION PROCESS

5.3 Recommended Equipment

- Trowels - Euro Trowel, Raimondi Flow Ridge, or Superior Premium Notch for application to the floor or wall substrate and for application to back of the tile panel (fig. 19). The Flow Ridge and Premium Notch come in various notch heights, consult mortar manufacturer for appropriate notch size for application to the back of the tile panel and the substrate.
- Pressure pliers for snapping the scored 3+ tile panels (fig. 20)
- The Sigma Separator provides precise pressure when breaking the score line, particularly helpful with the thicker 5.6mm Laminam (fig. 21)
- Raimondi coated beat in paddle (fig. 22)
- Right angle grinder for L-cuts and electrical box cuts
- 4" continuous rim diamond blade such as Alpha LM0438
- Sigma Kera-Edge for profiling and bullnosing Laminam 5.6 mm tile panels (fig. 23)
- Diamond tip hole saw (fig. 24)
- Lippage control straps and caps (fig. 25)
- 60-400 grit diamond hand pads for edge smoothing & removal of excess fiberglass backing (fig. 26)
- Grip gloves for handling the tile panels
- Safety glasses
- Laminam 3+ and 5.6 porcelain tile panels tiles require a two person crew minimum
- Dust and Mist Respirator:
The Laminam 3+ tile panels have a reinforcing fiberglass mesh, the residue can be irritating to skin, eyes and lungs

5.4 Use of Rail Cutters - <http://bit.ly/CuttingDrilling>

Cutting and Drilling Video - <http://bit.ly/CuttingDrilling>

- First, clean the surface of the tile panel and the suction cups to ensure better suction to the face of the tile panel.
- Use a rail cutter (fig. 27) to score the porcelain tile panel surface from end to end. Begin the scoring process with a small backward motion then proceed forward continuously with a firm downward pressure on the scoring handle. Note: A smaller diameter cutting wheel may be preferable for pebbled or textured finishes.
- The rail will provide guidance and precision to the cut. Maintain a smooth, firm continuous movement. Do not interrupt or restart.
- With the suction cups still attached, use the rail cutter as a handle to maneuver and reposition the scored tile panel to the edge of the work table.
- Center the pressure pliers (Laminam 3+) or separator (Laminam 5.6) over the score line on **one** end of the tile panel. Gently apply pressure and the tile panel will break (fig. 20 & 21). Once the material starts to break down the score line, you may, depending on the width of the piece you are trying to remove, need to use hand pressure to work the break from the starting point to the other end of the tile.

FIG. 19



FIG. 20



FIG. 21



FIG. 22



FIG. 23



FIG. 24



FIG. 25



FIG. 26



FIG. 27



5. INSTALLATION PROCESS

5.4 Use of Rail Cutters (cont'd)

- For the 3+ material, fold the tile panel past 90 degrees and cut the fiberglass backing using a utility knife, then remove the severed piece.
- Use a 60-400 grit diamond pad to ease the cut edge and remove the excess fiberglass backing - most effective and dust is minimized when used wet (fig. 26).

5.5 Cutting and Drilling

Cutting and Drilling Video - <http://bit.ly/CuttingDrilling>

- Use diamond tipped hole saws in various diameters.
- DO NOT USE HAMMER DRILLS.
- Moderate pressure and speed are enough to minimize bit-walk and begin the hole. Water will cool the tile and provide lubrication to the drill bit.
- For large radius or curved cuts a diamond grit jig saw blade by Bosch (T130DG) provides good results.

5.6 Dry Cutting Electrical Boxes

Cutting and Drilling Video - <http://bit.ly/CuttingDrilling>

- It is recommended for electrical box cuts, before using a right angle grinder for the straight cuts (fig. 31), that four pilot holes should be drilled in each corner (fig. 29), these holes will help relieve surface tension and vibration where the straight cuts intersect.
- Cutting must be from the tile panel face to the back, fully supporting the underside of the tile panel on a flat surface while cutting will help reduce stress and avoid cracking.
- For smaller cuts and corner cuts the use of a simple high quality glass cutter such as the TOYO Pistol Grip Super Cutter (800-505-6311) and adjustable straight edge can be a useful alternative (fig. 30). In addition manual tile cutters and right angle grinders with a proper dry cut porcelain blade are also effective.

5.7 Mortar Application

- Installations are to comply with current revisions of ANSI A108.02, A108.1B and ANSI A108.5.

Crossville has found through its training and testing that maximum edge to edge coverage is achieved through a series of the following best practices (and the embedding techniques

listed in section 5.8):

- Mix the chosen mortar to the wettest recommended consistency, providing maximum open time and greater adjustability when the tile panel is placed. Consult mortar manufacturer for appropriate mix ratios for use with porcelain tile panels.
- Mist down the substrate with a garden sprayer or damp sponge (no pooling or standing water) to make sure the moisture in the thin-set is not lost too quickly and the open time is not reduced.
- Be sure to scratch/key the mortar into the substrate and tile panel with the flat side of the trowel before combing.
- Overspread the mortar by at least an inch wider than the tile panel you plan to embed. This is to ensure full support of mortar at the tile edges.
- Do not allow mortar to “skin over”.
- Use the appropriate trowel (fig. 19) to apply the mortar to the wall, floor, or countertop and to the back of the tile panel.
- Mortar ridges on both the tile panel back and substrate must be parallel to each other, combing at right angles to the long side of the tile panel. Use the appropriate trowels and troweling technique (hold at least a constant 45° angle) and take care to keep the ridges straight and of consistent height. This is crucial to achieving maximum coverage. (fig 32)
- On walls the use of a plastering hawk can greatly increase the efficiency of install.
- On both floors and walls the resulting embedded mortar layer (using the double coat approach) will be approximately 5mm (slightly less than ¼ inch)

5.8 Application of the Tile Panel to the Substrate

Wall Installation Video -

<http://bit.ly/PorcelainTilePanelsWallInstallation>

- **WALLS:** Use the suction cupped frame to place the mortared tile panel onto the substrate and align prior to removal of the suction cupped frame. (fig. 34 & 35)
- **WALLS:** Using a rubber grout float or Raimondi coated beat in paddle, tamp the centerline of the tile panel along its entire length prior to removing the suction cupped frame to provide initial adhesion of the tile panel to the wall. Once the suction cupped frame has been removed use a high-speed cordless orbital sander with pad or the Raimondi coated beat in paddle, work from the centerline of the tile panel outward

FIG. 28



FIG. 29



FIG. 30

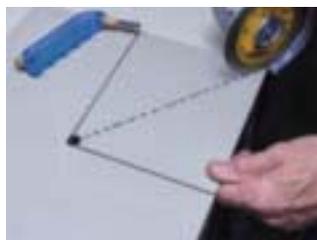


FIG. 31



5. INSTALLATION PROCESS

5.8 Application of the Tile Panel to the Substrate (cont'd)

to the edges, this pressure will collapse the ridges, force air from behind, and maximize edge to edge coverage. A traditional 2 x 4 beat in block and rubber mallet should not be used as it places too much point load on the tile face and can cause fracturing/cracking of the tile panel.

- **WALLS:** When installing multiple tile panels, lippage control straps and caps are required to minimize lippage between tile panel edges. The lippage control systems are designed only to fine tune lippage between tile edges, the main alignment of tile edges should be accomplished through proper mortar application and embedding techniques. After the **first** tile panel has been installed and the mortar has been spread for the second tile panel, place the straps uniformly along the edge of the **first** tile panel (two inches from the corner and approximately every 10 inches along the length), DO NOT apply the lippage control cap at this time. Once the second tile panel is in place and the same embedding procedure described above is accomplished insert the appropriate grout spacer and lippage control cap and then cinch down the lippage control caps tightly to bring adjoining tile edges into alignment. (fig. 36 & 39)
- **WALLS:** Using a high-speed cordless sander with pad work along the edges of the tile panel and between each of the lippage control straps and caps, some additional tightening of the caps may be necessary. The combined use of a vibrating sander and cap tightening effectively increases mortar coverage along the vulnerable edge of the tile panel while at the same time minimizing edge lippage. (fig. 36)

Floor Installation Video -

<http://bit.ly/PorcelainTilePanelFloorInstall>

- **FLOORS:** Use the suction cupped frame to place the mortared tile panel onto the substrate and align prior to removal of the suction cupped frame. (fig. 37 & 38)
- **FLOORS:** Insuring maximum coverage between the tile panel and the substrate is critical to a successful installation. Crossville has found through its training and testing that the mortar application techniques described in section 5.7 along with the specific walking pattern described below is the most reliable and efficient way to eliminate voids in the mortar while maximizing edge to edge coverage (fig. 32 & 33). Care should be taken to remove any dried mortar or other debris from footwear.

Start at the center point of the tile panel, and walk with small shuffling steps down the full length of the tile taking care to stay only in the center portion, then return to the center point and take small shuffling steps across the widths of the tile panel compressing the mortar ridges and forcing any entrapped air to escape along the tile panel's edge. Continue this shuffling process until the entire tile panel has been compressed in the mortar. This process should take approximately 4 - 5 minutes for a full 1Mx3M tile panel.

FIG. 32



FIG. 33



FIG. 34



FIG. 36



FIG. 35



5. INSTALLATION PROCESS

5.8 Application of the Tile Panel to the Substrate (cont'd)

Coverage Video - <http://bit.ly/CoverageDemo>

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- **FLOORS:** Using a high-speed cordless sander with pad work along the edges of the tile panel and between each of the lippage control straps and caps, some additional tightening of the caps may be necessary. The combined use of a vibrating sander and cap tightening effectively increases mortar coverage along the vulnerable edge of the tile panel while at the same time minimizing edge lippage. (fig. 36)
- **FLOORS:** Due to room configuration or job size it will be necessary to work **ON** freshly installed tile panels. When doing so, the use of a large piece of masonite or double walled heavy cardboard works well to protect the face of the tile from tool damage or ground in construction dirt, as well as disperse concentrated weight. Freshly set tiles should not be walked on after 90 minutes. This is to ensure that the bonding mortar is not compromised as it begins to cure.
- **WALLS & FLOORS:** When cleaning excess mortar from the substrate make sure to leave the gaps open at the edge of the tile panel by cutting the mortar down and pulling away from the tile edges in a parallel direction to the ridges. This will facilitate further removal of air and collapse of the mortar ridges during the embedding procedures.
- **WALLS & FLOORS:** Remove excess mortar from the tile panel's surface and "clean-out" between the joints to the full depth (1/8" or 1/4") of the tile panel while mortar is still fresh, this will insure an adequate amount of grout to fill the joint. **Take extra time and be thorough on this step.**
- **WALLS & FLOORS:** Lippage control systems that allow for removal and replacement of the cap (after bringing the tiles into alignment) will allow for effective removal of excess mortar around the strap while the mortar is still fresh. After completing the removal of excess mortar, replace the caps on the straps and retighten to ensure complete alignment of the tile edges. **This will reduce the possibility of damage**

FIG. 37



FIG. 38



FIG. 39



to the tile the following day when clearing the grout joint of cured mortar. Video at: <http://bit.ly/1hodjiW>

- **WALLS & FLOORS:** For ending a day's work that will continue the next day, the most crucial step is to make sure the last tile panel is fully embedded and is checked with a straight edge for flatness/squareness across the surface before leaving it to cure. Consult the lippage control device manufacturer for their procedure of how to address ending one day's work that will tie a cured tile panel into a new tile panel the next day.
- Grout application times can vary from 24 hours to 72 hours; refer to specific guidelines from the grout manufacturer.

5. INSTALLATION PROCESS

5.9 Grouting

WALLS

- Crossville has found that there are many lippage control systems available. For timing and method/timing of removal refer to lippage control system manufacturer's requirements.
- 2mm to 3mm grout joint size is recommended based on wall flatness.
- Use of commercially available sanded, unsanded or epoxy grout is acceptable, appropriate caulking material is also acceptable for wall installations. See Selection Guide, page 17.
- Install and clean per manufacturer's instructions.

FLOORS

- **Polished finishes require a penetrating sealer (impregnator) prior to grouting.**
- Crossville has found that there are many lippage control systems available. For timing and method/timing of removal refer to lippage control system manufacturer's requirements.
- Use a minimum of 3mm (1/8") grout joint size due to lack of floor flatness and variable tolerances in field-cut tile panels.
- For residential and light commercial applications the use of sanded grout is acceptable. For commercial applications epoxy grout is required.
- The edges of the porcelain tile panels are not eased or beveled, making them susceptible to damage from heavy rolling loads and impact. Full and flush movement joints and grout joints should be specified to minimize edge impact.
- Setting mortars and their recommended cure times can vary significantly from 72 hours to 7 days. Therefore it is critical to refer to the specific mortar manufacturer's requirements for opening the floor to foot traffic.
- Install and clean per manufacturer's instructions.

5.10 Edge Treatments and Profiles

To complete and finish the installation, profiles for corners, deco-bands, edges, and movement joints are available from quality suppliers such as Blanke, Custom, or Schluter (fig. 40-42).

- Laminam 3+: 6.0-8.0 mm profiles recommended
- Laminam 5.6: 8.0-10.0 mm profiles recommended
 - Follow manufacturer's instruction for placement/insertion of profiles into the tile work. Ensure that supporting mortar is present at the edge of the tile.
- For other edge finishing techniques see (fig. 43-44)

See page 9 for information on movement joints.

FIG. 40

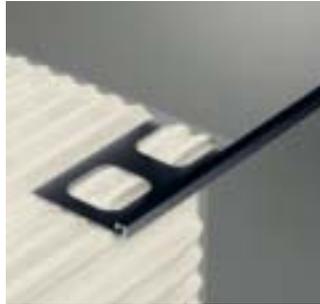


FIG. 41



FIG. 42



Laminam 3+ and 5.6mm Using Profiles

FIG. 43



Laminam 5.6mm Field Applied Bullnose

FIG. 44



Laminam 5.6mm Back Mitered & Epoxied

5. INSTALLATION PROCESS

5.11 Critical Review Points

- Proper fork length (84") for handling crates from the short side.
- Review list and knowledge of recommended tools.
- Prior to applying mortar, make sure to clean the back of the tile and the substrate to remove any dust or other contaminants.
- Coverage: use wettest mortar mix ratio, directional troweling perpendicular to the long edge of the tile panel, embedding techniques.
- Maximize edge coverage and minimize lippage: lippage control systems, cordless sander along the perimeter edge & between the lippage control straps.
- Using the tools and best practices to minimize lippage between tiles to 1/64" (0.4mm) or less will greatly increase the finished installations ability to withstand the rolling loads used in most commercial applications.
- Using grouting techniques that insure the grout joint remains full and flush will also aid in the finished installation's ability to withstand edge impact. Particularly with epoxy grouts, use a new epoxy float with unworn sharp edges. Use steady pressure to overfill the joint and force epoxy grout into any remaining voids beneath the tile panel edge.

7. TECHNICAL PERFORMANCE

7.1 Product Specifications

PHYSICAL AND CHEMICAL PROPERTIES	NORM TEST METHOD	Laminam3+ and 5.6
Size	Laminam	Maximum deviation on the side +/- 0.5 mm
Size	Laminam	Maximum deviation on the diagonal +/- 1.0 mm
Weight kg/m ²	Laminam	3+ Average value 8.2 5.6mm Average Value 14
Surface Quality (% Of Tiles With No Visible Flaws)	ISO 10545-2	> 95%
Water Absorption	ASTM C373	Average value ≤ 0.1%
Breaking Load In Newtons	ISO 10545-4	3+ Average value 700 5.6mm Average Value 1100
Bending Strength In N/mm ² (MOR)	ISO 10545-4	3+ Average value 50 5.6mm Average Value 50
MOHS Scale of Hardness	UNI EN 101	≥ 6
Resistance To Deep Abrasion	ISO 10545-6	≤ 175 mm ³
Coefficient Of Linear Thermal Expansion (10-6/°C)	ISO 10545-8	6.6
Resistance To Thermal Shock	ISO 10545-9	Resistant
Chemical Resistance	ISO 10545-13	No visible effect
Stain Resistance	ISO 10545-14	Class 5
Frost Resistance	ISO 10545-12	Resistant
Flame Spread and Smoke Development	ASTM E84-12a.	Flame Spread = 0 Smoke Develop = 15

6. CARE AND MAINTENANCE

6.1 Initial Care and Maintenance

The single-most important step for future daily maintenance involves the complete removal of grout film/residue and construction dirt after the Laminam porcelain tile panel products have been installed. Refer to the grout manufacturer's printed instructions for proper mixing, curing, and cleaning instructions. These are critical when working with epoxy grouts.

In most cases, Laminam porcelain tile panels can be cleaned successfully by scrubbing the installation with hot water and a neutral detergent, followed by a thorough rinsing.

For further details and specific recommendations please refer to Crossville's Care and Maintenance Guide at crossvilleinc.com or call Crossville Technical Services at 931-484-2110.

8. MORTAR AND GROUT SELECTION GUIDE

* Consult mortar manufacturer for appropriate mix ratios for use with porcelain tile panels and for the proper mortar for specific applications.

8.1 Manufacturer's Product Information

Manufacturer	Surface Preparation	Mortar Systems Floors and Walls*	Grout Systems Floors and Walls	Caulks-Sealants	Crack Isolation Membranes
Ardex 888-512-7339	8+9 (tile over tile) P51 & P82 primer Liquid BackerBoard AM 100	Walls: ARDEX X77 (E90 Additive required for 3+) Floors: ARDEX X78	ARDEX FL ARDEX WA Epoxy	ARDEX SX 100% Silicone	ARDEX 8+9
Blanke 800-787-5055		Tested with Laticrete 254 Platinum	Tested with Laticrete Spectralock Pro Premium Grout		Blanke Permat
BOSTIK 800-726-7845	Universal Primer Pro Bostik SL 100 or SL 175 Webcrete 95 UltraFinish Pro	Reflex Mortar Big Tile & Stone Mortar	EzPoxy EzClean Ceramic Tile Grout with 1900 Modified Epoxy Admix	Pure Silicone Caulk Chem Calk 955SL 915FS	Ultraset Advanced Gold Plus
Custom 800-272-8786	Skim Coat & Patch Underlayment LevelQuik RS Self Leveling Underlayment LevelQuik Latex Primer MBP Multi-Surface Bonding Primer (tile over tile)	ProLite Large Format Mortar (5.6) MegaLite Crack Prevention Mortar (3+)	Polyblend Prism CEG Lite Epoxy Grout	Custom Commercial 100% Silicone Caulk	RedGard
LATICRETE 800-243-4788 x235	Laticrete 3701 Fortified Mortar Bed Laticrete NXT Plus with NXT Primer Laticrete NXT Patch Laticrete NXT Skim	Laticrete 254 Platinum Laticrete 4-XLT	Laticrete Permacolor Grout Laticrete Permacolor Select Grout Laticrete Spectralock PRO Premium Grout	Laticrete Latacil 100% Silicone	Hydro Ban
Mapei 800-992-6273	ECO Prim Grip (tile over tile) Ultraplan M-20 Plus, Primer T Mapecem Quickpatch	Kerabond T/Keralastic UltraFlex LFT Ultralite S2	Ultracolor Plus Kerapoxy	Mapei Mapesil 100% Silicone Sealant	Mapelastick CI
TEC 800-832-9023	TEC Multipurpose Primer EZ Level Premium Self Leveling Underlayment Smooth Start Self Leveling Underlayment VersaPatch Latex Modified Floor Patch and Leveler Fast Set Deep Patch	TEC 3N1 Performance Mortar Ultimate Large Tile Mortar	Power Grout AccuColor EFX Epoxy Grout	AccuColor 100 100% Silicone Sealant	HydraFlex Waterproofing Crack Isolation Mambrane

9. EXTERIOR DIRECT BOND GUIDELINES (WALLS) Recommended Project Requirements/Specifications

LAMINAM by Crossville[®] – Exterior Vertical Surfaces Field
Applied Direct Bond Method

LAMINAM 3+ or 5.6 mm

The use of full size tile panels (1Mx3M) for ground floor installations is acceptable. For installations higher than ground floor, tile panel size is limited to a maximum of 1 square meter, due to logistics, open air environments, and mortar limitations.

FILO is not recommended in exterior applications

9.1 Code compliance and approval of building authorities

Secure documentation/approval from building authority that the project complies with the provisions of the IBC (International Building Code).

A: LAMINAM by Crossville[®] 3+ porcelain tile panels are 3 millimeters thick, with an added layer of fiberglass mesh for increased strength and flexibility. LAMINAM 5.6 porcelain tile panels are 5.6 mm thick with no additional fiberglass layer. LAMINAM 3+ and 5.6 are suitable for exterior vertical direct bond applications if the project is in compliance with the International Building Code.

B: International Building Code Current Language

2009 IBC states a size limitation for exterior adhered veneers of 5 square feet with no side over 36 inches.

2012/2015 IBC (Chapter 14- Section 1405.10.2) requires that exterior adhered porcelain tile be a maximum of 24 inches in any face dimension and not more than 3 square feet in total facial area. In addition, Table 1405.2 states a minimum thickness of weather coverings (in this case porcelain tile) of 1/4 inch or 6.35 mm.

C: If the project design does not meet these requirements, then project architect or engineer should seek local code approval for the use of a thinner and/or larger format porcelain tile finish material for the exterior veneer.

Section [A] 104.11 of 2012/2015 IBC contains the generic language for obtaining this type of approval by the local building official for alternative materials. The provisions of the code are not intended to prevent the installation of any material or prohibit any design or method of construction not specifically prescribed by this code. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

<http://crossvilleinc.com/wordpress/wp-content/uploads/2016/02/REQUESTFOR-APPROVAL-OF-ALTERNATIVE-MATERIALS.pdf>

Requirement: A document confirming existing code compliance or approval of alternative material by the local building official is required. This document must be provided by the project's architectural/engineering authority.

9.2 Installation Methods

Movement Joints: Installation of LAMINAM 3+ and 5.6 on exterior walls will be in accordance with the applicable Tile Council of North America (TCNA) Handbook exterior wall details. Movement joints shall be in compliance with EJ-171 of the current TCNA Handbook. While the size and interval of movement joints must be in accordance with the TCNA guidelines and specified by the architectural/engineering authority with strict attention to the environmental demands of the project, at a minimum Crossville recommends that all joints be at least 3/16 inch and all joints treated as soft joints (no hard grouting materials in any joint)*. LAMINAM tiles have similar expansion and contraction characteristics when compared to traditional thickness porcelain tile, their reduced thickness means that they will reach maximum thermal gain and cycle through expansion/contraction more rapidly than a traditional thickness tile. For this reason, proper movement accommodation is extremely critical for success of the installation.

* **Note:** Joint width calculations were done using a coefficient of thermal expansion of 6.5×10^{-6} in/in/ °C for the Laminam tiles and installation of a class 25 sealant material at 70 °F, using a high temperature of 190°F and a low temperature of -30°F.

Cap Flashing: The elimination of water intrusion into the bond coat is extremely critical for success of any exterior applied veneer. Proper detailing of capping and/or flashing at the roof line or at the top of the exposed tile layer is necessary. If not properly specified and installed, efflorescence, latex leaching, and freeze thaw damage can occur.

Requirement: Ensure the architect/engineer is aware of these statements and that movement joint/grout joint detail and cap flashing language is provided in the specification.

9.3 Selection of Setting Material Company

Only setting material companies with specific installation guidelines for exterior direct bond wall applications using porcelain tile panels should be considered. Ensure that the setting material company specified can provide products and installation specifications for exterior vertical application of 3+ and 5.6 mm porcelain tile panels. A list of setting material companies with experience in this application are identified in Section 8

Requirement: Ensure the project architect/engineer has knowledge of the setting materials being used, and that those setting materials are specifically recommended for exterior vertical applications of porcelain tile panels. A pre-construction meeting and mock-up of appropriate scale is required to be in the project specification.

9.4 Laminam Technical Guide

Provide this LAMINAM Technical Guide to the project architect/engineer and recommend the specification of the installation instructions for LAMINAM 3+ or 5.6 mm that are contained in the LAMINAM by Crossville® Technical Guide.

Requirement: Language to be in the specification that references the Technical Guide and its installation practices.

9.5 Qualified Labor

LAMINAM by Crossville® has great potential in exterior vertical applications: its lightweight nature and aesthetic qualities make a great material for cladding. However, the potential for failure in outdoor environments is greatly increased when qualified labor is not utilized. Crossville recommends the use of qualified labor for the installation of LAMINAM 3+ and 5.6 mm for all installations, this becomes even more critical on a vertical exterior field (direct bond) applied installation. Suggestions for the necessary labor qualifications are listed below:

- ACT – Advanced Certifications of Tile Installers
- CTEF – Certified Tile Installer Program
- TCAA – Trowel of Excellence
- International Masonry Institute (IMI)
- NTCA Five Star Contractor Program
- Journeyman Tile Setter Apprenticeship Programs
- And completion of Crossville Sponsored Training provided by Crossville Inc., a Crossville distributor, or other tile panel specific training authorized/approved by one of the above organizations.

In addition these listings are available within Section 4.8 of this guide and in section 1.5 of the LAMINAM Guide Specification:

http://crossvilleinc.com/wordpress/wp-content/uploads/2014/05/Laminam-Guide-Specification-3-Walls-and-5_6-Floors-5-12-15.pdf

Requirement: Language to be in the specification that references the labor qualifications recommended in the LAMINAM Guide Specification.

The foregoing suggested project requirements and/or specifications are offered as guidelines only. Each project has its own unique characteristics and requirements, and the project's architect/engineer and design professionals must determine the appropriate requirements and specifications in each instance.

Crossville makes no warranties or representations regarding the applicability of the foregoing guidelines to any given project, and assumes no liability for and shall not be responsible for the use or failure to use these guidelines.

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