

# TECHNICAL BULLETIN – TB224

## FIXING THIN AND LARGE FORMAT SHEET PORCELAIN TILES

Date, Thursday, 19 February 2015

### INTRODUCTION & SCOPE

Since approximately 2006, several ranges of very large format, wafer thin porcelain tiles have come onto the market. They originated in Italy, and these tiles are manufactured on specialised machines which have since been exported to other areas.

This bulletin discusses some of the installation issues with these tiles and also recommendations for adhesive systems.

### PROPERTIES

Their properties are unusual in that they are very dense, hard and relatively brittle, and are supplied in large format including field dimensions of up to 3m x 1.2m at 3mm to 4.5mm thick.

The tiles can be used on walls and floors. Some of the available types are made by double layering so they are 7mm thick, which makes them stronger and similar in handling to medium thickness porcelain tiles.

Others however, mainly intended for floors, have heavily resin coated and bonded mesh on the back face as reinforcement. This can be either mesh fully embedded in the resin, or with the mesh bonded to the tile back with an adhesive such as a urethane and the mesh rear face bare. With some of the more recent clone versions this mesh is poorly bonded to the rear face and comes free with little applied force.

In terms of bonding, the un-backed types require adhesives that would normally be used for dense porcelain or glass. On the other hand, the mesh backed versions create some issues, the complexity of which is dependent on whether the embedding resin is epoxy or polyester based, and how well the mesh is bonded to the tile back face.

### FIXING AND HANDLING ISSUES

These tiles are so large (the smaller ones being 1m x 1m) that they are effectively handled like glazing, and require the same sort of suction-cup fitted frames used by glaziers to place plate glass. The following are all things that must be considered when laying these tiles, and the manufacturers' instructions can be crucial to achieving a good result;

- a) The substrate has to be almost dead level (typically max. variation from plane of not more than 3mm in 3m) and floors will usually require smoothing cements to be installed first.
- b) Coverage for floor tiles must be effectively 100% as any voids can result in areas where tiles can be punched through by point loads. Placement of the tiles and applying pressure to obtain the required adhesive spread and coverage is also problematic.
- c) Once placed on wet adhesive, the suction is so high that the tile can be almost impossible to lift and reposition, so accurate positioning before placement is vital.
- d) Flexible substrates could easily result in cracking of the tiles; even allowing for their nominally high flexural strength (hence requests to install on timber floors seem almost ludicrous and will not be entertained).
- e) *Drying of the adhesive can be delayed significantly, and whilst damp, the adhesive does not develop full strength. This can be critical for flooring applications or wind loaded facades.*
- f) There is a risk of alkalinity from cement C class adhesives degrading any bare fibreglass mesh the cement contacts.

### RESIN BACKINGS

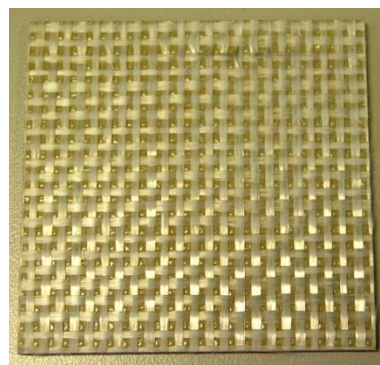
The purpose of the resin and mesh backing is to make an otherwise intrinsically weak tile strong enough for more heavy duty installations. Two types of resin seem to be commonly employed for mesh embedding. While both do their job of improving the flexion resistance of the tile, they also then create a difficult to bond to surface and so neither assists with the long term adhesion of the tiles onto the adhesive bed.

Polyester resin displays a second problem in that the polyester bonds are attacked by alkalinity in cement based adhesives, and this is far more severe where moisture (such as from the slow drying adhesive) is present (another problem is that it acts as a bond breaker).

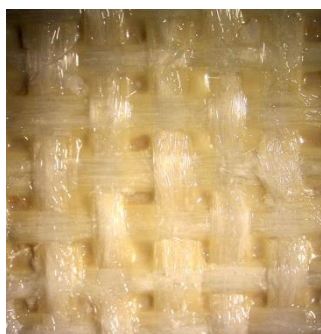
Epoxy resins when cured are simply very difficult to bond to because of the glassy and chemically inactive surface they present to the adhesive.



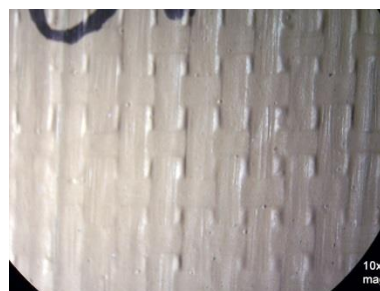
Mesh backed tile with the mesh fully embedded in resin. Epoxy resins are difficult to bond to, whilst polyester resins can be attacked by C class tile adhesives.



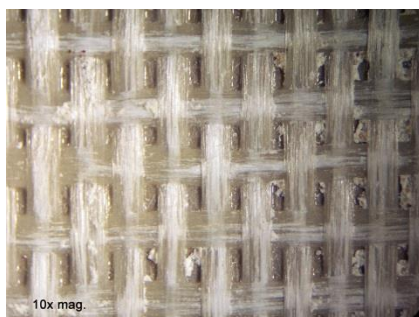
Mesh backed tile with mesh adhered to the tile back with resin, but not embedded (bare mesh). The fibreglass must be alkaline resistant where C class tile adhesives are to be used.



Bare mesh backed tile where the glass has been degraded by contact with alkaline lime water over a several month period.



Bare mesh backed tile where rear face of the mesh has been protected a primer coat (WPM368) prior to several months exposure to lime water.



Mesh backed tile showing some degradation after several months immersed exposure and bonded to concrete with X77 adhesive.



Bare mesh backed tile where rear face of the mesh has been protected a primer coat (WPM368) and then bonded with X77 to concrete. The sample was immersed for several months in water. Coating has protected surface.

#### ADHESIVE RECOMMENDATIONS

All floor recommendations are for masonry such as straight concrete, or smoothing cement covered concrete surfaces. Walls should also be masonry, in the case of blocks and brickwork; they need to be rendered to achieve flatness. Sand-cement screed beds are not recommended unless they can be laid to almost dead-level smoothness and flatness.

Tiling of suitable fibre-cement or plasterboard sheeting may be feasible on internal walls, however caution is required to obtain a smooth and flat surface beforehand, and not to tile over any movement or expansion joints. Given the size of these tiles vs the size of the sheets, this may be problematic in the design sense. The walls also need to be stiff enough to offer support for these thin tiles to resist impact or movement damage.

**WARNING** – For external fibre-cement sheet wall and façade applications, Ardex does not at this time offer a recommendation for an adhesive system to install these types of large tiles.

Currently there are only two types of external fibre-cement façade sheet recommended for tiling, but due to problems with the tiles being placed over sheet joints Ardex has concerns about the long performance of this application.

External lightweight facades require movement joints and are also subject to higher degrees of deflection and flexing due to diurnal temperature changes and wind loadings. There is a degree of risk that where these tiles are placed over sheet joints, movement can produce cracking in the tile that follows the underlying joints.

**For the 'normal' types of tile, those without mesh backing, rapid cure F rated C class cement based adhesives commonly used with porcelain tiles will work. Ardex GmbH has done extensive adhesive testing with the European sourced versions of these tiles and noted it is also feasible to use certain non-F rated C class adhesives, however the physical drying of the adhesive (that is loss of excess moisture, NOT cure time) can be adversely effected, especially where the substrate is also non-porous (for example with a membrane). This means that the strength properties are inhibited for a considerable period of time after installation which can have issues with the load performance of the installation.**

**Floors and wind loaded facades in particular are of concern in this case. The combination of the slow drying and the need for maximum contact coverage make adhesive choice critical for floor tile installations. Delayed drying also has an impact on the development of alkaline attack of glass mesh, because the extended presence of moisture permits the leaching of alkaline materials from the cement based adhesives.**

**There are also issues with obtaining full adhesive contact coverage which need to be considered carefully with any installation of these tiles. Flow bed type mortars will always perform better than relatively rigid anti-slump adhesive.**

Where the embedded mesh backed tile types are used, the choice of adhesives is restricted because of the embedding resin properties, whereas the bare (exposed) mesh backed tiles can use a back face coat application of primer/moisture barrier to improve the bond performance and protection of the glass mesh from alkaline attack.

The installation of a moisture barrier on the substrate may be required where Ardex S16 is used on internal floors that are defined damp (as per AS1884-2012) because these large format tiles can act as an impermeable surface (similar to sheet vinyl) and could create moisture stability problems for the adhesive.

All of the adhesives listed can be used with Ardex waterproof membranes for internal wet area applications as required.

### **Non mesh backed tiles**

#### **FLOORS – INTERNAL**

Ardex S16 ± Ardex E90\* (*internal only – dry area floors*)

Ardex Abapoxy (mixed with sufficient filler to make a paste)

Ardex WA100\*

Ardex Quickbond ± Abalastic\*

Ardex X78 ± Ardex E90 (*this adhesive is non-F rated and can be subject to delayed drying*).

\*Smaller tile sizes are recommended to allow sufficient pressure to be applied, and hence achieve fuller adhesive bedding when the tiles are laid.

#### **WALLS – INTERNAL**

Ardex S16 ± Ardex E90\* (*internal only*)

Ardex Abapoxy (mixed with sufficient filler to make a paste)

Ardex WA100 and WA epoxy adhesives

Ardex Quickbond ± Abalastic\*

Ardex X77 ± Ardex E90\* (*this adhesive is non-F rated and can be subject to delayed drying*)

Ardex X18 ± Ardex E90\* (*this adhesive is non-F rated and can be subject to delayed drying*)

Ardex X78 ± Ardex E90 (*this adhesive is non-F rated and can be subject to delayed drying – use an 8mm notch trowel*).

\*Smaller tile sizes are recommended to allow sufficient pressure to be applied, and hence achieve fuller adhesive bedding when the tiles are laid.

## Embedded mesh and bare mesh backed tiles

### WALLS AND FLOORS INTERNAL

#### Embedded in Polyester Resin

Ardex S16 + Ardex E90\* (dry only)

Ardex Abapoxy (mixed with sufficient filler to make a paste)

Ardex WA100 and WA epoxy adhesives

#### Embedded in Epoxy Resin

Ardex Abapoxy (mixed with sufficient filler to make a paste)

Ardex WA100 and WA epoxy adhesives

#### Bare mesh backed

Primer/barrier coats - applied to the rear face of the mesh and allowed to dry .

Applied at 3m<sup>2</sup>/litre -Ardex WPM300 / WPM300+broadcast or Ardex WPM368

Applied at 4-6m<sup>2</sup>/litre-Ardex P9

Adhesives-

Ardex S16 ± Ardex E90\* (internal only)

Ardex Abapoxy (mixed with sufficient filler to make a paste)

Ardex WA100 and WA epoxy adhesives

Ardex Quickbond ± Abalastic\*

Ardex X78 ± Ardex E90 (this adhesive is non-F rated and can be subject to delayed drying – use an 8mm notch trowel).

Wall - Ardex X77 ± Ardex E90\* (this adhesive is non-F rated and can be subject to delayed drying)

Wall - Ardex X18 ± Ardex E90\* (this adhesive is non-F rated and can be subject to delayed drying).

\*Smaller tile sizes are recommended to allow sufficient pressure to be applied, and hence achieve fuller adhesive bedding when the tiles are laid.

### WALLS AND FLOORS EXTERNAL – Any type

Ardex reserves the right to make recommendations or none, on an individual site by site basis.

The use of any cementitious based adhesives with the polyester resin backed tiles should be strongly discouraged due to the potential for decomposition of the polyester resin in damp external situations.

## GROUTS

Standard grouts can be used with these tiles, however it needs to be recognised that the 3mm tiles are at the bottom end of the recommended minimum grout thickness, and colour variations are more likely to occur due to the presence of any voids in the adhesive coverage. In other words, all joints to be grouted should be raked free of adhesive to achieve a uniform depth for the grout.

It may be more desirable to use the non sanded grout Ardex FS-DD to obtain smoother grout lines.

## QUALIFICATIONS

Ardex reserves the right to modify these recommendations from time to time, due to internal testing and also advice from Ardex GmbH.

#### **IMPORTANT**

This Technical Bulletin provides guideline information only and is not intended to be interpreted as a general specification for the application/installation of the products described. Since each project potentially differs in exposure/condition specific recommendations may vary from the information contained herein. For recommendations for specific applications/installations contact your nearest Ardex Australia Office.

#### **DISCLAIMER**

The information presented in this Technical Bulletin is to the best of our knowledge true and accurate. No warranty is implied or given as to its completeness or accuracy in describing the performance or suitability of a product for a particular application. Users are asked to check that the literature in their possession is the latest issue.

#### **REASON FOR REVISION - ISSUER**

Complete revision of bulletin after testing performed (TSD696).

#### **DOCUMENT REVIEW REQUIRED**

24 months from issue

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