Technical Notebook

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1. INTRODUCTION

The aim of this technical notebook is to present a series of useful guidelines on the best installation methods for thin porcelain tiles by defining the systems which MAPEI offers for the fixing of this type of product on internal and external walls and floors.

In fact, modern technology applied in the ceramics sector permits very thin porcelain tiles around 3-5 mm thick and up to 1x3 m to be manufactured. The reduced thickness, particularly large format and very low absorption rate typical of porcelain, therefore, make it extremely important to identify the correct fixing methods with extreme care and precision so that this type of tile is installed correctly.

As with any type of flooring and wall cladding product, the durability and functionality of thin porcelain tiles depend greatly on precise design parameters, suitable preparation of the substrate and correct fixing methods and techniques using adhesives, grouts mortars and sealants for the joints which are selected according to the type of tile product and its final use.

For more detailed information not available in this notebook, we recommend contacting the MAPEI Technical Services Department.
2. TYPES OF MATERIAL

The thin porcelain tiles available on the market may be divided into two main categories:

a) Tiles with thicknesses min. 3 mm and formats up to 1x3 m produced by compacting the dry, raw materials on feeder belts without moulds followed by firing in special furnaces at a temperature of +1200°C. This type of tile is offered in three different versions:

- at a thickness of min. 3 mm;

- with a reinforced back face by applying glass fibre mesh during the production cycle for a minimum thickness of approx. 3.5 mm, for higher resistance to pedestrian traffic;

- two 3 mm tiles sandwiched together with glass fibre reinforcement mesh (at the midpoint) between the two tiles for a total thickness of 7 mm, suitable for environments with more intense traffic.

b) Tiles with a variable thickness from 4 to 5 mm produced by pressing the raw materials into moulds, with no reinforcement mesh, followed by firing in special furnaces at a temperature of +1200°C.

The spread of this type of tile depends on certain advantages which characterise the tile, and which makes them preferable to traditional tiles, especially in restoration work where fewer grout joints are required. The advantages include:

- thinner profile: may be applied on old floors without excessively modifying the height of the floor, resulting in a reduction in the amount of demolition work required;

- lighter: easier handling, lower transport costs and lower structural impact;
- thinner profile, easier to cut;
- grouted joints have less pressure due to the large formats of the tiles;
- lower impact on the environment, lower quantities of raw materials and energy required per square metre.

Along with these advantages however, the special characteristics of this type of product, and in particular its reduced profile which makes it more fragile and subject to fracture, means that certain precautions must be taken during handling, preparation of the substrates and installation which differ from those adopted when fixing conventional tiles.

3. HANDLING THE TILES

The tiles weigh from approximately 7 to 13 kg per square metre (dependent on the thickness) (a 60x120 mm tile weight from 5 to 9 kg). The tiles may be moved, therefore, by hand. In the case of particularly large format tiles, more than one person may be required when handling.

In general, when moving tiles by hand, the following precautions should be taken:

a) always wear protective non-slip gloves;

b) always wear safety footwear.

Once the tiles have been removed from their packaging, care must be taken when putting them in position by resting the long side of the tiles on the ground at an angle of 30° with respect to the substrate. Particular attention should be paid when handling the tiles to avoid chipping or breaking the corners.
4. VERIFYING THE STATE AND TYPE OF SUBSTRATE

Thin porcelain tiles may be fixed on conventional substrates normally used in the building industry, such as concrete, cementitious and anhydrite screeds, screeds made from TOPCEM PRONTO or MAPECEM PRONTO, heated screeds, old ceramic floors, stone or metal, cementitious render or gypsum tiling, lightweight concrete blocks, plasterboard and internal substrates waterproofed with cementitious products such as MAPELASTIC or synthetic resin products such as MAPEGUM WPS and MAPELASTIC AQUADEFENSE.

The suitability of a substrate for this type of product must be checked before tiling: substrates must always be stable, well cured (strong enough to withstand the foreseen loads and type of use), dry, clean, free of foreign objects, (dust, grease, oil, wax, paint, stripping compound and any other material which could compromise the bond), free of cracks and perfectly flat.

Because of the reduced thickness of the tiles, the flatness of the substrate is particularly important. If there are voids or gaps in the substrate or in the adhesive layer, the tiles may fracture if subject to concentrated loads.

The flatness of the substrate must be checked with a straight-edge at least 2 m long by placing it on the surface of the screed in all directions (see Fig. 4.1). The maximum acceptable tolerance is ± 2 mm. If the high and low points exceed this value, the surface must be evened out using a suitable levelling product.

4.1 CONCRETE

Concrete must be well cured (for at least three months). The deflection in floor slabs must be less than 1/360 of the total span. Concrete substrates must be free of loose areas and surface treatments which could potentially compromise the bond (such as an anti-vapour coat, adhesive residues, resin, stripping compound, etc.).

To guarantee the durability of the tiled finish, it is also necessary to make sure that floor tiles laid on the ground are correctly isolated to avoid problems caused by rising damp.
4.2 CONVENTIONAL CEMENTITIOUS SCREEDS

The thickness of the screed must be sufficient to cope with the design requirements, equal to at least 4 cm in the case of un-bonded screeds. The composition of the mix must be assessed according to the mechanical performance required.

The flatness of the surface must be checked as described previously. The screed must be compact and homogenous through its entire thickness and any cracks in the screed must be monolithically sealed with epoxy resin, such as EPORIP, EPOJET or EPORIP TURBO.

Screeds must be cured sufficiently: the waiting time before installation is approximately 7-10 days per centimetre of thickness. Waiting times when installing on conventional screeds, therefore, may be particularly extended (in certain cases more than one month).

4.3 SCREEDS MADE FROM SPECIAL BINDERS OR PRE-BLENDED MORTAR

Waiting times before laying thin porcelain tiles may be reduced considerably by using special binders or pre-blended, normal-setting, quick-drying mortar such as TOPCEM or TOPCEM PRONTO, or quick-setting and drying mortar such as MAPECEM or MAPECEM PRONTO. All these products are also suitable for installing heated screeds without adding other admixtures. The use of pre-blended mortars also offers a better guarantee on the quality of inert materials, reduces the risk of dosage errors and is an excellent solution in those cases where acquisition and storage of raw materials is particularly difficult. Pre-blended mortars for screeds also carry the CE symbol, in compliance with UNI EN 13813 standards.

4.3.1 MAPECEM - MAPECEM PRONTO SCREEDS

Screeds made from MAPECEM or MAPECEM PRONTO are characterised by their rapid setting and drying times and controlled shrinkage. Their use permits thin porcelain tiles to be laid just 3 hours after installing the substrate. MAPECEM PRONTO is classified CT-C60-F10 A1, according to UNI EN 13813.
4.3.2 TOPCEM - TOPCEM PRONTO SCREEDS

Screeds made using TOPCEM or TOPCEM PRONTO are characterised by their normal setting times, with similar workability characteristics to conventional screeds, short drying times and controlled shrinkage. Thin porcelain tiles may be laid on these types of substrate 24 hours after installation. TOPCEM PRONTO is classified CT-C30-F6 A1fl according to UNI EN 13813 and certified by GEV Institute as EMICODE EC1 R Plus (very low emission level of volatile organic compounds).

4.4 HEATED SCREEDS

With heated screeds, follow the instructions normally applied when installing screeds and follow the indications given by the manufacturer of the heating system. It is also important to commission the heating system before installing the screed, as prescribed by UNI EN 1264-4.

The length of time to wait before commencing the commissioning of the heating system depends on the material used to form the screed:

- screeds formed from MAPECEM or MAPECEM PRONTO: 24 hours
- screeds formed from TOPCEM or TOPCEM PRONTO: 4 days
- conventional screeds with plasticiser: approximately 21 days

The adhesive used on heated screeds must be an improved (C2) highly flexible (S2) type according to European Standard UNI EN 12004 (see section 7.1.2).

4.5 ANHYDRITE SCREEDS

Before laying the floor covering, the surface laitance to the screed must be mechanically abraded, all dust must be removed by vacuum and the surface must be primed (for example with PRIMER G or ECO PRIM T).

The screed must also be completely dry: the maximum acceptable level of moisture measured by carbide hygrometer is 0.5%. Always follow the instructions given by the manufacture of the anhydrite screed.
4.6 OLD FLOORS
In order to lay directly onto an existing ceramic, terrazzo or stone floor, make sure it is solid, well bonded to the substrate, has no cracks and that all traces of oil, wax, polish and grease have been thoroughly cleaned off using water and caustic soda or a special de-waxing product. All old paint and leading on marble must be eliminated. Cracked tiles and tiles which are not well bonded must be removed and the surface void repaired with a suitable smoothing and levelling compound, such as ADESILEX P4, NIVORAPID or PLANITOP FAST 330.

4.7 CONCRETE WALLS
Concrete must be well cured (for at 6 weeks at normal temperature). Concrete substrates must be free of laitance and surface treatments which could potentially compromise the bond (such as stripping compound, anti-vapour treatment, old paint, etc.).

4.8 CEMENT-BASED RENDER
The render must be well cured. If pre-blended products are used, follow the manufacturer’s instructions. When laying in external environments, the tensile adhesion strength of cement-based render must be at least 1 N/mm².

4.9 GYPSUM PLASTER
Gypsum substrates must be perfectly dry (with a maximum residual humidity level of 0.5% in weight), sufficiently strong and free of dust. It is important to treat this type of substrate with PRIMER G or ECO PRIM T and fix the tile only after it has completely dried. This type of application is only suitable for internal surfaces.

4.10 WALLS IN LIGHTWEIGHT CONCRETE BLOCKS
Because of the wide variety of products available on the market, different manufacturers must be contacted before deciding which product has the most suitable characteristics. Thin porcelain tiles may only be
fixed to this type of substrate in internal environments (after applying a coat of PRIMER G diluted at a rate of 1:2 with water). When installing on external surfaces, a layer of render made from NIVOPLAN + PLANICRETE or PLANITOP FAST 330 and reinforced with zinc-plated mesh must then be applied.

If porcelain is to be laid on particularly flexible surfaces, such as metal or wood, each single case must be carefully assessed by the MAPEI Technical Services Department.

5. CREATING FLAT SURFACES
As mentioned previously, the flatness of the surface is the most important characteristic of the substrate when laying thin tiles. If there are gaps under the tiles, they would represent a weak point in the finish. Irregularities in the surface, therefore, must be eliminated before laying the tiles with a suitable levelling mortar.

5.1 LEVELLING CONCRETE SUBSTRATES AND CEMENTITIOUS AND SPECIAL BINDER-BASED SCREEDS
Levelling internal surfaces may be carried out using:

- ULTRAPLAN, self-levelling, ultra-quick hardening smoothing and levelling compound for internal surfaces applied at a thickness from 1 to 10 mm. Class CT-C30-F7-A2_s according to EN 13813 and certified by GEV Institut as EMICODE EC1 R Plus (very low emission level of volatile organic compounds)

- ULTRAPLAN MAXI, self-levelling, ultra-quick hardening smoothing and levelling compound for internal surfaces applied at a thickness from 3 to 30 mm. Class CT-C35-F7-A2_s according to EN 13813,
certified GEV Institut as EMICODE EC1 R Plus (very low emission level of volatile organic compounds)

- **NIVORAPID** ultra-quick hardening, thixotropic cementitious smoothing and levelling compound for internal surfaces applied at a thickness from 1 to 20 mm. Class CT-C40-F10-A2, according to EN 13813 standards, certified GEV Institut as EMICODE EC1 R Plus (very low emission level of volatile organic compounds).

### 5.2 LEVELLING OLD CERAMIC, TERRAZZO AND STONE FLOORS

Levelling this type of internal and external surface may be carried out using the same products indicated in section 5.1 after carefully cleaning and de-waxing the surface and then applying a suitable primer, such as **ECO PRIM GRIP** or **ECO PRIM T**.

### 5.3 LEVELLING ANHYDRITE SCREEDS

Anhydrite screeds (with a maximum residual moisture content of 0.5%) may be levelled using the same products indicated in section 5.1 after applying a suitable primer, such as **PRIMER G** or **ECO PRIM T**.

### 5.4 LEVELLING CONCRETE WALLS AND CEMENTITIOUS RENDER

Substrates described in sections 4.7 and 4.8 may be levelled with the following products:

- **NIVOPLAN + PLANICRETE**, levelling mortar for internal and external walls, applied at a thickness from 2 to 20 mm, class GP-CSIV according to EN 998-1, used in combination with **PLANICRETE** synthetic latex rubber to improve the performance of cementitious mortar at a rate of 2 kg per bag of **NIVOPLAN**.
• **PLANITOP FAST 330**, quick-setting, fibre-reinforced cementitious mortar applied at a thickness from 3 to 30 mm for levelling internal and external vertical and horizontal surfaces. Class GP-CSIV according to EN 998-1 and MC-IR according to EN 1504-2 (C).

6. **WATERPROOFING INTERNAL FLOORS AND WALLS**

If internal surfaces where thin porcelain tiles are to be installed need to be waterproofed, one of the following products may be used:

• **MAPELASTIC**, two-component flexible cementitious mortar for waterproofing cementitious surfaces, class PI-MC-IR according to EN 1504-2 (C).

• **MAPELASTIC SMART**, two-component, highly-flexible cementitious mortar applied by brush or with a roller for waterproofing concrete surfaces, class PI-MC-IR according to EN 1504-2 (C).

• **MONOLASTIC**, one-component, flexible cementitious mortar for waterproofing balconies, terraces and bathrooms.

• **MAPELASTIC AQUADEFENSE**, ready-to-use, ultra-quick drying, flexible liquid membrane for waterproofing internal and external surfaces.

Waterproofing using **MAPELASTIC, MAPELASTIC SMART** and **MONOLASTIC ULTRA** must be guaranteed by applying an even layer 2 mm thick.

Waterproofing using **MAPELASTIC AQUADEFENSE** must be guaranteed by applying an even layer at least 1 mm thick.

If the substrate has micro-cracks, it must be reinforced using **MAPETEX SEL** micro-perforated non-woven polypropylene fabric for reinforcing waterproofing membranes.
MAPELASTIC, MAPELASTIC SMART, MAPELASTIC AQUADEFENSE and MONOLASTIC systems may be used on all types of substrate normally used in the building industry, as long as they are solid, well-bonded to the existing substrate and there are no foreign objects on the surface. A coat of PRIMER G must be applied beforehand on gypsum-based substrates.

- MAPEGUM WPS, quick-drying flexible liquid membrane for waterproofing internal surfaces. It is certified by GEV Institut as EMICODE EC1 Plus (very low emission level of volatile organic compounds).

Waterproofing using MAPEGUM WPS must be guaranteed by applying an even layer 1 mm thick.

If the substrate has micro-cracks, the MAPEGUM WPS system must be reinforced with MAPENET 150 or MAPETEX SEL. The MAPEGUM WPS system may be applied directly on the following surfaces: plasterboard, gypsum plaster and cement-based render, marine plywood and cement and anhydrite-based screeds. Existing ceramic and stone finishes must be treated beforehand by applying a coat of ECO PRIM T.
7. INSTALLING, SEALING AND GROUTING THIN PORCELAIN TILES

7.1 FIXING ONTO INTERNAL SURFACES

The adhesive used for fixing thin porcelain tiles must be chosen carefully to ensure that it remains perfectly bonded over the years, to avoid deformation and to guarantee the highest level of reliability under all conditions (on internal and external walls and floors).

Below is a check-list of essential precautions which must be taken when designing the installation system and when actually installing the tiles.

1. Laying tiles with joints at least 2-3 mm wide, is extremely important for this type of tile in particular for the following reasons:

   - reduces the impact of dimensional differences between the tiles;

   - helps to reduce the modulus of elasticity and, therefore, the rigidity of the tiled surface. In fact, when fixing tiles butted up against each other, the tiled finish is more or less comparable to a continuous slab and is as rigid as a single tile. If tiles are laid with a small joint, the modulus of elasticity of the tiled surface is reduced since the modulus of elasticity of the grout is much lower than that of porcelain. As a result, grouted joints help a surface follow the different movements between the substrate and the tiled finish due to settling of the structure, hygrometric shrinkage, thermal expansion, etc., thus helping avoid stresses and, therefore, potential detachment of the tiles.

2. Create movement joints: apart from following the exact pattern of the structural joints, perimeter deformation and movement joints must be created every 25 m².
3. The adhesive must be applied with a notched trowel using the back-buttering technique, that is, the adhesive must be applied on both the back of the tile and on the substrate, to guarantee that the tile received 100% average. Double spreading is necessary and essential to avoid leaving voids on the back of the tile.

4. The correct choice of adhesive: choosing the right adhesive is fundamental to guarantee that a tiled surface remains sound and reliable over the years. This is why it is important to determine at the outset exactly which type of porcelain is to be laid (with or without reinforcement mesh), the size of the tile, the substrate on which it is to be laid, the final use, etc. Due to the extremely low porosity of this material, together with the possible use of reinforcement mesh it’s important use class C2 adhesives according to EN 12004 and with class S1 deformability when laying large format tiles. When such large tiles are used, we strongly recommend using two-component, highly-flexible class S2 products according to EN 12004.
7.1.1 LAYING ON INTERNAL FLOORS

Internal floors for pedestrian and light commercial use may be laid on the following substrates prepared as described in section 5. Such floors, therefore, may be laid on cementitious screeds, anhydrite screeds with residual humidity < 0.5% in weight (before applying PRIMER G), old floors and high performance screeds such as TOPCEM, TOPCEM PRONTO, MAPECEM or MAPECEM PRONTO using the following adhesives:

**RECOMMENDED ADHESIVES**

<table>
<thead>
<tr>
<th>Tiles with and without glass fibre reinforcement mesh</th>
<th>NORMAL SETTING</th>
<th>QUICK SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of tile</td>
<td>ADHESIVE</td>
<td>CLASS ACCORDING TO EN 12004</td>
</tr>
<tr>
<td>&lt; 5000 cm² (the longer side must be no more than 100 cm)</td>
<td>KERAFLEX MAXI S1</td>
<td>C2TES1</td>
</tr>
<tr>
<td></td>
<td>ULTRALITE S1</td>
<td>C2TES1</td>
</tr>
<tr>
<td>&gt; 5000 cm²</td>
<td>KERABOND + ISOSTATIC</td>
<td>C2ES2</td>
</tr>
<tr>
<td></td>
<td>ULTRALITE S2</td>
<td>C2ES2</td>
</tr>
</tbody>
</table>

7.1.2 LAYING ON INTERNAL HEATED FLOORS

Tiles must be laid on screeds with encapsulated heating system after commissioning the heating system with the following MAPEI products:

**RECOMMENDED ADHESIVES**

<table>
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<td>C2ES2</td>
</tr>
<tr>
<td></td>
<td>ULTRALITE S2</td>
<td>C2ES2</td>
</tr>
<tr>
<td>&gt; 5000 cm²</td>
<td>ULTRALITE S2</td>
<td>C2ES2</td>
</tr>
<tr>
<td></td>
<td>ULTRALITE S2 QUICK</td>
<td>C2ES2</td>
</tr>
</tbody>
</table>

7.1.3 FIXING TO INTERNAL WALLS

Use the following adhesives for fixing all types of thin porcelain tiles (with or without reinforcement mesh) on cementitious plaster, gypsum render (after applying PRIMER G), plasterboard, cement-fibre panels and existing ceramic or stone:
RECOMMENDED ADHESIVES

Tiles with and without glass fibre reinforcement mesh

<table>
<thead>
<tr>
<th>Size of tile</th>
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</tr>
<tr>
<td></td>
<td>ULTRALITE S2</td>
<td>C2ES2</td>
</tr>
</tbody>
</table>

7.2 FIXING TO EXTERNAL WALLS

General rules

The fixing of thin porcelain tiles on façades, as with conventional thickness clinker and porcelain tiles, needs to be evaluated correctly before starting. General rules: these are some of the fundamental rules that must be followed:

1. The adhesive chosen must be an improved class (C2), deformable (S1) or highly deformable (S2) type according to EN 12004;

2. The back-buttering technique must be used; the adhesive must be applied with a notched trowel on both the back of the tile and on the substrate, to guarantee that the tile is buttered 100% average. The back-buttering technique is necessary and essential to avoid problems caused by voids on the back of the tiles and the collection of rainwater which, in freezing weather, could create stresses and debonding of the tiles. Back-buttering is also necessary so that stresses, caused by different movements in the substrate and the tiled finish due to temperature change for example, are distributed evenly and over a larger area;

3. The tiles must be tamped down in position using a rubber trowel to eliminate air pockets between the back of the tiles and the substrate. This precaution will avoid the formation of stresses caused by water vapour during temperature variations;

Fig. 7.10 - An example of installing thin porcelain tiles on wall or floor internal

Fig. 7.11 - An example of laying thin porcelain tiles on internal wall or floor
4. particularly in hot climates and during inclement weather (such as strong winds), we recommend using class “E” adhesives (with a extended open time) according to EN 12004. Install tiles within the given open time of the adhesive (while it is still fresh) to guarantee perfect transfer of the adhesive onto the back of the tiles;

5. when fixing during the winter or in cold climates, it is preferable to use quick-setting class “F” adhesives according to EN 12004. In fact, these adhesives curve and reach a high bond strength within a 2-3 hours to avoid even lower temperatures during the night below +0°C which could cause the mixing water to freeze;

6. the tiles must be laid with a large joint between them. The width of the joint must be determined according to local climate conditions, the size of the tiles and the flexibility of the substrate. Most international standards state that laying tiles without a joint is unacceptable. Joints are particularly important when laying large tiles to help hide variations in flatness. The joints are sealed with ready-to-use cementitious, epoxy or polymer products which have lower elasto-mechanical characteristics than the tiles. Therefore, when deformation occurs in the substrate or in thin porcelain tiles due to high temperature variations, for example, the joints avoid high stresses being transmitted to the adhesive and causing debonding of the tiles;

7. flexible movement joints around 1 cm wide must be included in line with corners and string-courses, and the surface must always be divided into bays of a maximum of 9-12 m²;

8. structural joints to the building must be followed.
7.2.1 MAPEI ADHESIVES FOR FIXING TILES ON FAÇADES WITHOUT GLASS FIBRE REINFORCEMENT MESH

<table>
<thead>
<tr>
<th>Size of tile</th>
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<td>KERABOND + ISOLASTIC</td>
<td>C2ES2</td>
<td>KERAQUICK + LATEX PLUS</td>
</tr>
<tr>
<td></td>
<td>ULTRALITE S2</td>
<td>C2ES2</td>
<td>ULTRALITE S2 QUICK</td>
</tr>
</tbody>
</table>

Fig. 7.14 - An example of fixing thin porcelain tiles on a waterproofing system

7.2.2 MAPEI ADHESIVES FOR FIXING TILES ON FAÇADES WITH GLASS FIBRE REINFORCEMENT MESH

<table>
<thead>
<tr>
<th>Size of tile</th>
<th>RECOMMENDED ADHESIVES</th>
<th>ADHESIVES</th>
<th>CLASS ACCORDING TO EN 12004</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5000 cm²</td>
<td>KERABOND + ISOLASTIC</td>
<td>C2ES2</td>
<td>ULTRALITE S2 QUICK</td>
</tr>
<tr>
<td></td>
<td>ULTRALITE S2</td>
<td>C2ES2</td>
<td>ELASTORAPID</td>
</tr>
<tr>
<td>&gt; 5000 cm²</td>
<td>KERALASTIC T</td>
<td>R2T</td>
<td>KERAQUICK + LATEX PLUS</td>
</tr>
</tbody>
</table>

Fig. 7.15 - An example of fixing thin porcelain tiles on a waterproofing system

Fig. 7.16 - An example of fixing thin porcelain tiles on a waterproofing system
7.3 FIXING TO SPECIAL SUBSTRATES

7.3.1 MAPEI ADHESIVES FOR FIXING TO INTERNAL WATERPROOFING SYSTEMS

When fixing thin porcelain tiles on surfaces waterproofed with the products mentioned in section 6, MAPEI recommends the following products:

<table>
<thead>
<tr>
<th>SIZE OF TILE (cm²)</th>
<th>NORMAL SETTING</th>
<th>QUICK SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5000 (longer side no more than 100 cm)</td>
<td>KERAFLEX MAXI S1, ULTRALITE S1</td>
<td>C2TES1, C2TES1</td>
</tr>
<tr>
<td>&gt; 5000</td>
<td>KERABOND + ISOLASTIC, ULTRALITE S2</td>
<td>C2ES2, C2ES2</td>
</tr>
</tbody>
</table>

7.3.2 MAPEI ADHESIVES FOR FIXING TO WORKTOPS, WOODEN SURFACES, MARINE PLYWOOD AND METAL

Which system to use must be assessed according to the type of substrate, its stability and the final service conditions.

On the aforementioned stable substrates, which must be firmly fixed and not subject to deformation, MAPEI recommends the use of the following products:

<table>
<thead>
<tr>
<th>SIZE OF TILE (cm²)</th>
<th>NORMAL SETTING</th>
<th>QUICK SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5000 (longer side no more than 100 cm)</td>
<td>KERALASTIC</td>
<td>R2, R2T</td>
</tr>
<tr>
<td>&gt; 5000</td>
<td>KERALASTIC T</td>
<td>R2T</td>
</tr>
</tbody>
</table>

7.4 EXPANSION AND MOVEMENT JOINTS

When fixing thin porcelain tiles, centre over all existing expansion joints to the substrate and on the walls.

Create 1 cm movement joints on particularly large surfaces dividing the surface as follows:
a) on substrates subject to movement or flexing, form bays approximately 9-12 m²;

b) on stable surfaces the joints may be formed approximately every 16-25 m²;

c) fix the tiles leaving a gap of approximately 5 mm between walls, columns, sharp corners, etc. Use MAPESIL AC to fill movement joints on internal walls and floors, while for external applications use MAPESIL LM for wall cladding and MAPESIL AC for floors.

For particular mechanical strength requirements, MAPEFLEX PU20, MAPEFLEX PU21, MAPEFLEX PU45 and MAPEFLEX PU50 SL must be used.

The sealant will only function correctly in terms of water-tightness and duration if the joints are the correct size. As a general rule, sealing must be carried out according to the recommendations in the table below:

<table>
<thead>
<tr>
<th>a - width of joint</th>
<th>b - depth of joint</th>
</tr>
</thead>
<tbody>
<tr>
<td>from 0 to 4 [mm]</td>
<td>make a wider joint</td>
</tr>
<tr>
<td>from 5 to 9 [mm]</td>
<td>b = a</td>
</tr>
<tr>
<td>from 10 to 20 [mm]</td>
<td>b = 10 [mm]</td>
</tr>
<tr>
<td>from 21 to 40 [mm]</td>
<td>b = a/2 [mm]</td>
</tr>
<tr>
<td>more than 40 [mm]</td>
<td>make a narrower joint</td>
</tr>
</tbody>
</table>

For particular mechanical strength requirements, MAPEFLEX PU20, MAPEFLEX PU21, MAPEFLEX PU45 and MAPEFLEX PU50 SL must be used.

The sealant will only function correctly in terms of water-tightness and duration if the joints are the correct size. As a general rule, sealing must be carried out according to the recommendations in the table below:

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</tr>
<tr>
<td>from 5 to 9 [mm]</td>
<td>b = a</td>
</tr>
<tr>
<td>from 10 to 20 [mm]</td>
<td>b = 10 [mm]</td>
</tr>
<tr>
<td>from 21 to 40 [mm]</td>
<td>b = a/2 [mm]</td>
</tr>
<tr>
<td>more than 40 [mm]</td>
<td>make a narrower joint</td>
</tr>
</tbody>
</table>
To calibrate the depth of the sealant (according to the indications in the table above) and prevent it adhering to the bottom of the joint, insert **MAPEFOAM** closed-cell polyethylene cord in the joint by pressing it down lightly with a specially shaped trowel or wooden slat.

### 7.5 GROUTING

Before grouting the joints between each tile wait as follows:

- 2-3 hours if a quick setting adhesive has been used;
- 24 hours if a normal-setting or reactive resin adhesive has been used (such as **KERALASTIC**).

The joints may be grouted with the following products:

- **KERACOLOR FF**, pre-blended, high-performance, polymer-modified cementitious grout with water-repellent DropEffect® technology for (grouting) joints up to 6 mm wide, class CG2WA according to UNI EN 13888 and certified by GEV Institut as EMICODE EC1 R Plus (very low emission level of volatile organic compounds).

- **KERACOLOR GG**, pre-blended, high-performance, polymer-modified cementitious grout for (grouting) joints from 4 to 15 mm wide, class CG2WA according to UNI EN 13888 and certified by GEV Institut as EMICODE EC1 R Plus (very low emission level of volatile organic compounds).

- **FUGOLASTIC**, liquid polymer admixture for **KERACOLOR FF**, **KERACOLOR GG** and **KERACOLOR SF**.

- **ULTRACOLOR PLUS**, special high-performance, anti-efflorescence, quick-setting and drying polymer-modified grout with water-repellent DropEffect® and mould-resistant Bioblock® technology for grouting.
joints from 2 to 20 mm wide, class CG2WA according to UNI EN 13888 and certified by GEV Institut as EMICODE EC1 Plus (very low emission level of volatile organic compounds).

When grouting joints wider than 2 mm, it is essential that FUGOLASTIC is added to KERACOLOR FF (without diluting it with water).

For grouting façade walls, we recommend using FLEXCOLOR ready-to-use polymeric grout, with water-repellent DropEffect® and mould-resistant Bioblock® technology for grouting joints from 2 to 10 mm wide instead of the products mentioned above. As mentioned previously, the use of these products allows the bay size to be increased and eliminate flexible expansion joints (on smaller façades). In such cases, contact the MAPEI Technical Services Department for information.

When high strength and high chemical resistance combined with a decorative, attractive finish are required the following epoxy grouts may be used:

- **KERAPOXY**, two-component, acid resistant epoxy mortar available in 26 different colours for joints at least 3 mm wide, class RG according to UNI EN 13888, certified GEV Institute as EMICODE EC1 R Plus (very low emission level of volatile organic compounds).

- **KERAPOXY DESIGN**, two-component, acid resistant, decorative epoxy mortar available in 15 different colours (for joints), class RG according to UNI EN 13888, certified GEV Institute as EMICODE EC1 R Plus (very low emission level of volatile organic compounds).
8. MAPEI TECHNICAL SPECIFICATIONS
INSTALLATION OF THIN PORCELAIN TILES

8.1 INSTALLATION OF INTERNAL FLOORING

8.1.1 INSTALLATION WITH NORMAL-SETTING ADHESIVE
ON CEMENTITIOUS SCREEDS, ANHYDRITE SCREEDS
(AFTER PRIMING) AND CONCRETE OR OVERLAYING
EXISTING FLOORING

• Supply and installation of thin porcelain tiles (with or without glass
  fibre reinforcement mesh) in formats up to 5,000 cm² on cementitious
  screeds, anhydrite screeds with residual humidity lower than 0.5% (after
  applying primer diluted 1:1 in water, such as PRIMER G produced by
  MAPEI S.p.A.), concrete substrates and existing ceramic, terrazzo or
  stone flooring with the following adhesives:

  1. high-performance, deformable, cementitious adhesive with extended
     open time and no vertical slip, class C2TES1 according to UNI EN 12004
     standards (such as KERAFLEX MAXI S1 produced by MAPEI S.p.A.);

  2. high-performance, deformable, cementitious adhesive with extended
     open time, no vertical slip and good back-buttering capacity, class
     C2TES1 according to UNI EN 12004 standards (such as ULTRALITE S1
     produced by MAPEI S.p.A.).

• Supply and installation of thin porcelain tiles (with or without
  glass fibre reinforcement mesh) in formats larger than 5,000 cm² on
  cementitious screeds, anhydrite screeds with residual humidity lower
  than 0.5% (after applying primer diluted 1:1 in water, such as PRIMER G
  produced by MAPEI S.p.A.), concrete substrates and existing ceramic,
  terrazzo or stone flooring with the following adhesives:

  1. high-performance, highly-deformable, cementitious adhesive with
     extended open time, class C2ES2 according to UNI EN 12004 standards
     (such as KERABOND + ISOLASTIC produced by MAPEI S.p.A.);
2. one single component, high-performance, highly-deformable, lightweight cementitious adhesive with extended open time, very high yield, good trowelability and high back-buttering capacity, class C2ES2 according to UNI EN 12004 standards (such as ULTRALITE S2 produced by MAPEI S.p.A.).

After checking the flatness of the substrate and, where necessary, levelling off the surface with a suitable levelling product, install tiles using the back-buttering technique with a suitable gap between each tile for grouting.

### 8.1.2 INSTALLATION WITH RAPID-SETTING ADHESIVE ON CEMENTITIOUS SCREEDS, ANHYDRITE SCREEDS (AFTER APPLYING PRIMER) AND CONCRETE OR OVERLAYING EXISTING FLOORING

- Supply and rapid installation of thin porcelain tiles (with or without glass fibre reinforcement mesh) in formats up to 5,000 cm² on cementitious screeds, anhydrite screeds with residual humidity lower than 0.5% (after applying primer diluted 1:1 in water, such as PRIMER G produced by MAPEI S.p.A.), concrete substrates and existing ceramic, terrazzo or stone flooring with the following adhesives:

1. two-component, high-performance, rapid-setting, deformable cementitious adhesive, class C2FS1 according to UNI EN 12004 standards (such as GRANIRAPID produced by MAPEI S.p.A.);

2. one single component, high-performance, deformable, rapid-setting and hydrating, lightweight cementitious adhesive with no vertical slip, very high yield and good trowelability, class C2FTS1 according to UNI EN 12004 standards (such as ULTRALITE S1 QUICK produced by MAPEI S.p.A.).

- Supply and rapid installation of thin porcelain tiles (with or without glass fibre reinforcement mesh) in formats larger than 5,000 cm² on cementitious screeds, anhydrite screeds with residual humidity lower
than 0.5% (after applying primer diluted 1:1 in water, such as PRIMER G produced by MAPEI S.p.A.), concrete substrates and existing ceramic, terrazzo or stone flooring with the following adhesives:

1. two-component, high-performance, highly-deformable, rapid-setting cementitious adhesive with extended open time and no vertical slip, class C2FTES2 according to UNI EN 12004 standards (such as ELASTORAPID produced by MAPEI S.p.A.);

2. one single component, high-performance, highly-deformable, rapid-setting and hydrating, lightweight cementitious adhesive with extended open time, very high yield, good trowelability and high back-buttering capacity, class C2FES2 according to UNI EN 12004 standards (such as ULTRALITE S2 QUICK produced by MAPEI S.p.A.).

After checking the flatness of the substrate and, where necessary, levelling off the surface with a suitable smoothing product, install tiles using the back-buttering technique with a suitable gap between each tile for grouting.

### 8.1.3 INSTALLATION WITH NORMAL-SETTING ADHESIVE ON INTERNAL CEMENTITIOUS HEATED SCREEDS

- Supply and installation of all formats of thin porcelain tiles (with or without glass fibre reinforcement mesh) on heated screeds with the following adhesives:

1. high-performance, highly-deformable cementitious adhesive with extended open time, class C2ES2 according to UNI EN 12004 standards (such as KERABOND + ISOLASTIC produced by MAPEI S.p.A.);

2. one single component, high-performance, highly-deformable, lightweight cementitious adhesive with extended open time, very high yield, good trowelability and high back-buttering capacity, class
C2ES2 according to UNI EN 12004 standards (such as **ULTRALITE S2** produced by MAPEI S.p.A.).

After checking the flatness of the substrate and, where necessary, levelling off the surface with a suitable levelling product, install tiles using the back-buttering technique with a suitable gap between each tile for grouting.

### 8.1.4 INSTALLATION WITH RAPID-SETTING ADHESIVE ON HEATED SCREEDS

- **Supply and rapid installation of thin porcelain tiles (with or without glass fibre reinforcement mesh) in formats up to 5,000 cm²** on heated screeds with the following adhesives:

  1. two-component, high-performance, highly-deformable, rapid-setting cementitious adhesive with extended open time and no vertical slip, class C2FTES2 according to UNI EN 12004 standards (such as **ELASTORAPID** produced by MAPEI S.p.A.);

  2. one single component, high-performance, deformable, rapid-setting and hydrating, lightweight cementitious adhesive with no vertical slip, very high yield and good trowelability, class C2FS1 according to UNI EN 12004 standards (such as **ULTRALITE S1 QUICK** produced by MAPEI S.p.A.).

- **Supply and rapid installation of thin porcelain tiles (with or without glass fibre reinforcement mesh) in formats larger than 5,000 cm²** on heated screeds with the following adhesives:

  1. two-component, high-performance, highly-deformable, rapid-setting cementitious adhesive with no vertical slip, class C2FTS2 according to UNI EN 12004 standards (such as **KERAUICK + LATEX PLUS** produced by MAPEI S.p.A.);
2. one single component, high-performance, highly-deformable, rapid-setting and hydrating, lightweight cementitious adhesive with extended open time, very high yield, good trowelability and high back-buttering capacity, class C2FES2 according to UNI EN 12004 standards (such as ULTRALITE S2 QUICK produced by MAPEI S.p.A.).

After checking the flatness of the substrate and, where necessary, levelling off the surface with a suitable levelling product, install tiles using the back-buttering technique with a suitable gap between each tile for grouting.

8.2 INSTALLATION OF INTERNAL WALL TILES

8.2.1 INSTALLATION WITH NORMAL-SETTING ADHESIVE ON CONCRETE, EXISTING CERAMIC, TERRAZZO, STONE BACKGROUNDS, CEMENT OR GYPSUM-BASED RENDER (AFTER PRIMING), PLASTERBOARD OR CEMENT-FIBRE PANELS

• Supply and installation of thin porcelain tiles (with or without glass fibre reinforcement mesh) in formats up to 5,000 cm² on concrete, existing ceramic, terrazzo, stone backgrounds, cement or gypsum-based render (after applying primer diluted 1:1 in water, such as PRIMER G produced by MAPEI S.p.A.), plasterboard or cement-fibre panels with the following adhesives:

1. high-performance, deformable, cementitious adhesive with extended open time and no vertical slip, class C2TES1 according to UNI EN 12004 standards (such as KERAFLEX MAXI S1 produced by MAPEI S.p.A.);

2. high-performance, deformable, cementitious adhesive with extended open time, no vertical slip and good back-buttering capacity, class C2TES1 according to UNI EN 12004 standards (such as ULTRALITE S1 produced by MAPEI S.p.A.).
• Supply and installation of thin porcelain tiles (with or without glass fibre reinforcement mesh) in formats larger than 5,000 cm² on concrete, existing ceramic, terrazzo, stone backgrounds, cement or gypsum-based render (after applying primer diluted 1:1 in water, such as PRIMER G produced by MAPEI S.p.A.), plasterboard or cement-fibre panels with the following adhesives:

1. high-performance, highly-deformable cementitious adhesive with extended open time, class C2ES2 according to UNI EN 12004 standards (such as KERABOND + ISOLASTIC produced by MAPEI S.p.A.);

2. one single component, high-performance, highly-deformable, lightweight cementitious adhesive with extended open time, very high yield, good trowelability and high back-buttering capacity, class C2ES2 according to UNI EN 12004 standards (such as ULTRALITE S2 produced by MAPEI S.p.A.).

After checking the flatness of the substrate and, where necessary, levelling off the surface with a suitable levelling product, install tiles using the back-buttering technique with a suitable gap between each tile for grouting.

8.2.2 INSTALLATION WITH RAPID-SETTING ADHESIVE ON CONCRETE, EXISTING CERAMIC, TERRAZZO, STONE BACKGROUNDS, CEMENT OR GYPSUM-BASED RENDER (AFTER PRIMING), PLASTERBOARD OR CEMENT-FIBRE PANELS

• Supply and rapid installation of porcelain tiles (with or without glass fibre reinforcement mesh) in formats up to 5,000 cm² on concrete, existing ceramic, terrazzo, stone backgrounds, cement or gypsum-based render (after applying primer diluted 1:1 in water, such as PRIMER G produced by MAPEI S.p.A.), plasterboard or cement-fibre panels with the following adhesives:
1. two-component, high-performance, rapid-setting, highly-deformable cementitious adhesive with extended open time and no vertical slip, class C2FS1 according to UNI EN 12004 standards (such as GRANIRAPID produced by MAPEI S.p.A.);

2. one single component, high-performance, deformable, rapid-setting and hydrating, lightweight cementitious adhesive with no vertical slip, very high yield and good trowelability, class C2FTS1 according to UNI EN 12004 standards (such as ULTRALITE S1 QUICK produced by MAPEI S.p.A.).

- Supply and rapid installation of porcelain tiles (with or without glass fibre reinforcement mesh) in formats larger than 5,000 cm² on concrete, existing ceramic, terrazzo, stone backgrounds, cement or gypsum-based render (after applying primer diluted 1:1 in water, such as PRIMER G produced by MAPEI S.p.A.), plasterboard or cement-fibre panels with the following adhesives:

  1. two-component, high-performance, highly-deformable, rapid-setting cementitious adhesive with no vertical slip, class C2FTES2 according to UNI EN 12004 standards (such as ELASTORAPID produced by MAPEI S.p.A.);

  2. one single component, high-performance, highly-deformable, rapid-setting and hydrating, lightweight cementitious adhesive with extended open time, very high yield, good trowelability and high back-buttering capacity, class C2FES2 according to UNI EN 12004 standards (such as ULTRALITE S2 QUICK produced by MAPEI S.p.A.).
8.3 INSTALLATION OF EXTERNAL WALL TILES

8.3.1 INSTALLATION OF THIN PORCELAIN TILES WITHOUT GLASS FIBRE REINFORCEMENT MESH WITH NORMAL-SETTING ADHESIVE ON CONCRETE OR CEMENT-BASED RENDER ON FAÇADES

- Supply and installation of tiles without glass fibre reinforcement mesh in formats up to 5,000 cm² on concrete or render (after verifying their strength) with the following adhesives:

  1. high-performance, deformable, cementitious adhesive with extended open time, class C2TES1 according to UNI EN 12004 standards (such as KERAFLEX MAXI S1 produced by MAPEI S.p.A.);

  2. high-performance, deformable, cementitious adhesive with extended open time, no vertical slip and good back-buttering capacity, class C2TES1 according to UNI EN 12004 standards (such as ULTRALITE S1 produced by MAPEI S.p.A.).

- Supply and installation of tiles without glass fibre reinforcement mesh in formats larger than 5,000 cm² on concrete or render (after verifying their strength) with the following adhesives:

  1. high-performance, highly-deformable cementitious adhesive with extended open time, class C2ES2 according to UNI EN 12004 standards (such as KERABOND + ISOLASTIC produced by MAPEI S.p.A.);

  2. one single component, high-performance, highly-deformable, lightweight cementitious adhesive with extended open time, very high yield, good trowelability and high back-buttering capacity, class C2ES2 according to UNI EN 12004 standards (such as ULTRALITE S2 produced by MAPEI S.p.A.).
After checking the flatness of the substrate and, where necessary, levelling off the surface with a suitable MAPEI levelling product, install tiles using the back-buttering technique with a suitable gap between each tile for grouting, and form elastic movement joints (sealed) using an appropriate silicone sealant at a maximum of 12 m² intervals.

8.3.2 RAPID INSTALLATION OF THIN PORCELAIN TILES WITHOUT GLASS FIBRE REINFORCEMENT MESH WITH RAPID-SETTING ADHESIVE ON CONCRETE OR CEMENT-BASED RENDER ON FAÇADES

- Supply and rapid installation of tiles without glass fibre reinforcement mesh in formats up to 5,000 cm² on concrete or render (after verifying their strength) with the following adhesives:

  1. two-component, high-performance, highly-deformable, rapid-setting cementitious adhesive with no vertical slip, class C2FTES2 according to UNI EN 12004 standards (such as ELASTORAPID produced by MAPEI S.p.A.);

  2. one single component, high-performance, deformable, rapid-setting and hydrating, lightweight cementitious adhesive with no vertical slip, very high yield and good trowelability, class C2FTS1 according to UNI EN 12004 standards (such as ULTRALITE S1 QUICK produced by MAPEI S.p.A.).

- Supply and rapid installation of tiles without glass fibre reinforcement mesh in formats larger than 5,000 cm² on concrete or render (after verifying their strength) with the following adhesives:

  1. two-component, high-performance, highly-deformable, rapid-setting cementitious adhesive with no vertical slip, class C2FS2 according to UNI EN 12004 standards (such as KERAQUICK + LATEX PLUS produced by MAPEI S.p.A.);
2. one single component, high-performance, highly-deformable, rapid-setting and hydrating, lightweight cementitious adhesive with extended open time, very high yield, good trowelability and high back-buttering capacity, class C2FES2 according to UNI EN 12004 standards (such as ULTRALITE S2 QUICK produced by MAPEI S.p.A.).

After checking the flatness of the substrate and, where necessary, levelling off the surface with a suitable MAPEI levelling product, install tiles using the double-buttering technique with a suitable gap between each tile for grouting, and form elastic movement joints sealed using an appropriate silicone sealant at a maximum of 12 m² intervals.

8.3.3 INSTALLATION OF THIN PORCELAIN TILES WITH GLASS FIBRE REINFORCEMENT MESH WITH NORMAL-SETTING ADHESIVE ON CONCRETE OR CEMENT-BASED RENDER

• Supply and installation of tiles with glass fibre reinforcement mesh in formats up to 5,000 cm² on concrete or render (after verifying their strength) with the following adhesives:

1. high-performance, highly-deformable cementitious adhesive with extended open time, class C2ES2 according to UNI EN 12004 standards (such as KERABOND + ISOLASTIC produced by MAPEI S.p.A.);

2. one single component, high-performance, highly-deformable, lightweight, cementitious adhesive with extended open time, very high yield, good trowelability and high back-buttering capacity, class C2ES2 according to UNI EN 12004 standards (such as ULTRALITE S2 produced by MAPEI S.p.A.).

• Supply and installation of tiles with glass fibre reinforcement mesh in formats larger than 5,000 cm² on concrete or render (after verifying their strength) with two-component, high-performance, polyurethane
adhesive with no vertical slip, class R2T according to UNI EN 12004 standards (such as KERALASTIC T produced by MAPEI S.p.A.).

After checking the flatness of the substrate and, where necessary, levelling off the surface with a suitable MAPEI levelling product, install tiles using the back-buttering technique with a suitable gap between each tile for grouting, and form elastic movement joints (sealed) using an appropriate silicone sealant at a maximum of 12 m² intervals.

### 8.3.4 INSTALLATION OF THIN PORCELAIN TILES WITH GLASS FIBRE REINFORCEMENT MESH WITH RAPID-SETTING ADHESIVE ON CONCRETE OR CEMENT-BASED RENDER

- Supply and installation of tiles with glass fibre reinforcement mesh in formats up to 5,000 cm² on concrete or render (after verifying their strength) with the following adhesives:
  
  1. two-component, high-performance, highly-deformable, rapid-setting cementitious adhesive with no vertical slip, class C2FTES2 according to UNI EN 12004 standards (such as ELASTORAPID produced by MAPEI S.p.A.);

  2. one single component, high-performance, highly-deformable, rapid-setting and hydrating, lightweight cementitious adhesive with extended open time, very high yield, good trowelability and high back-buttering capacity, class C2FES2 according to UNI EN 12004 standards (such as ULTRALITE S2 QUICK produced by MAPEI S.p.A.).

- Supply and installation of tiles with glass fibre reinforcement mesh in formats larger than 5,000 cm² on concrete or render (after verifying their strength) with two-component, high-performance, highly-deformable, rapid-setting cementitious adhesive with no vertical slip, class C2FS2 according to UNI EN 12004 standards (such as KERAQUICK + LATEX PLUS produced by MAPEI S.p.A.).
After checking the flatness of the substrate and, where necessary, levelling off the surface with a suitable MAPEI levelling product, install tiles using the back-buttering technique with a suitable gap between each tile for grouting, and form elastic movement joints (sealed) using an appropriate silicone sealant at a maximum of 12 m² intervals.

8.4 SPECIAL INSTALLATION CASES

8.4.1 INSTALLATION OF THIN PORCELAIN TILES ON INTERNAL WATERPROOFING SYSTEMS (SUCH AS MAPELASTIC, MAPELASTIC AQUADEFENSE OR MAPEGUM WPS)

- Supply and installation of thin porcelain tiles (with or without glass reinforcement mesh) in formats up to 5000 cm² on waterproofing systems (such as MAPELASTIC or MAPEGUM WPS produced by MAPEI S.p.A.) with the following adhesives:

  1. high-performance, highly-deformable, cementitious adhesive with extended open time, class C2TES1 according to UNI EN 12004 standards (such as KERAFLEX MAXI S1 produced by MAPEI S.p.A.);

  2. high-performance, deformable, cementitious adhesive with extended open time, no vertical slip and good back-buttering capacity, class C2TES1 according to UNI EN 12004 standards (such as ULTRALITE S1 produced by MAPEI S.p.A.).

- Supply and installation of all types of tile (with or without glass reinforcement mesh) in formats larger than 5000 cm² on waterproofing systems (such as MAPELASTIC or MAPEGUM WPS produced by MAPEI S.p.A.) with the following adhesives:

  1. high-performance, highly-deformable, cementitious adhesive with extended open time, class C2ES2 according to UNI EN 12004 standards (such as KERABOND + ISOLASTIC produced by MAPEI S.p.A.);
2. one single component, high-performance, highly-deformable, lightweight cementitious adhesive with extended open time, very high yield, good trowelability and high back-buttering capacity, class C2ES2 according to UNI EN 12004 standards (such as ULTRALITE S2 produced by MAPEI S.p.A.).

After checking the flatness of the substrate and, where necessary, levelling off the surface with a suitable MAPEI levelling product, install tiles using the back-buttering technique with a suitable gap between each tile for grouting, and form elastic movement joints (sealed) using an appropriate silicone sealant at a maximum of 12 m² intervals.

8.4.2 RAPID INSTALLATION OF THIN PORCELAIN TILES ON INTERNAL WATERPROOFING SYSTEMS (SUCH AS MAPELASTIC, MAPELASTIC AQUADEFENSE OR MAPEGUM WPS)

• Supply and rapid installation of thin porcelain tiles (with or without glass reinforcement mesh) in formats up to 5000 cm² on waterproofing systems (such as MAPELASTIC or MAPEGUM WPS produced by MAPEI S.p.A.) with the following adhesives:

1. two-component, high-performance, highly-deformable, rapid-setting cementitious adhesive with no vertical slip, class C2FTES2 according to UNI EN 12004 standards (such as ELASTORAPID produced by MAPEI S.p.A.);

2. one single component, high-performance, deformable, rapid-setting and hydrating, lightweight cementitious adhesive with no vertical slip, very high yield and good trowelability, class C2FTS1 according to UNI EN 12004 standards (such as ULTRALITE S1 QUICK produced by MAPEI S.p.A.).
• Supply and rapid installation of thin porcelain tiles (with or without glass reinforcement mesh) in formats larger than 5000 cm² on waterproofing systems (such as MAPELASTIC or MAPEGUM WPS produced by MAPEI S.p.A.) with the following adhesives:

1. two-component, high-performance, highly-deformable, rapid-setting cementitious adhesive with no vertical slip, class C2FS2 according to UNI EN 12004 standards (such as KERAQUICK + LATEX PLUS produced by MAPEI S.p.A.);

2. one single component, high-performance, highly-deformable, rapid-setting and hydrating, lightweight cementitious adhesive with extended open time, very high yield, good trowelability and high back-buttering capacity, class C2FES2 according to UNI EN 12004 standards (such as ULTRALITE S2 QUICK produced by MAPEI S.p.A.).

Install tiles using the back-buttering technique with a gap at least 5 mm wide (variable according to format) between each tile for grouting, and form elastic movement joints (sealed) using an appropriate silicone sealant at a maximum of 12 m² intervals.

8.4.3 INSTALLATION ON METAL OR WOODEN SUBSTRATES
• Supply and installation of all types of tile (with or without glass fibre reinforcement mesh) on horizontal metal or wooden substrates, if firmly anchored, with the following adhesives:

1. two-component, high-performance, polyurethane adhesive, class R2 according to UNI EN 12004 standards (such as KERALASTIC produced by MAPEI S.p.A.);

2. two-component, high-performance, polyurethane adhesive with no vertical slip, class R2T according to UNI EN 12004 standards (such as KERALASTIC T produced by MAPEI S.p.A.).
After checking the flatness of the substrate and, where necessary, levelling off the surface with a suitable MAPEI levelling product, install tiles using the back-buttering technique with a suitable gap between each tile for grouting, and form elastic movement joints at a maximum of every 12 m² sealed using an appropriate silicone sealant.

### 8.4.4 RAPID INSTALLATION ON METAL OR WOODEN SUBSTRATES

- Supply and installation of all types of tile (with or without glass fibre reinforcement mesh) on horizontal metal or wooden substrates, if firmly anchored, with two-component, high-performance polyurethane adhesive, class C2FS2 according to UNI EN 12004 standards (such as KERAQUICK + LATEX PLUS produced by MAPEI S.p.A.).

After checking the flatness of the substrate and, where necessary, levelling off the surface with a suitable MAPEI levelling product, install tiles using the back-buttering technique with a suitable gap between each tile for grouting, and form elastic movement joints (sealed) using an appropriate silicone sealant at a maximum of every 12 m².

### 8.5 PRODUCTS FOR GROUTING JOINTS

#### 8.5.1 CEMENTITIOUS GROUT

Joints between tiles may be grouted with cementitious grouting mortar with the following characteristics:

- high-performance, anti-efflorescence, rapid-setting and drying, water-repellent, anti-mould grout, class CG2WA according to EN 13888 standards (such as ULTRACOLOR PLUS produced by MAPEI S.p.A.), followed by a thorough cleaning of the surface with a suitable detergent, rinsing of the surface and the removal of excess water with suitable equipment, and any other operations necessary to complete work according to specifications;
• high-performance, polymer-modified, water-repellent grout with DropEffect® technology for grouting tile joints up to 6 mm wide, class CG2WA according to UNI EN 13888 standards (such as KERACOLOR FF produced by MAPEI S.p.A.), followed by a thorough cleaning of the surface with suitable detergent, rinsing of the surface and removal of excess water with suitable equipment, and any other operations necessary to complete work according to specifications;

• high-performance, polymer-modified grout for tile joints up to 15 mm wide, class CG2WA according to UNI EN 13888 standards (such as KERACOLOR GG produced by MAPEI S.p.A.), followed by a thorough cleaning of the surface with suitable detergent, rinsing of the surface and removal of excess water with suitable equipment, and any other operations necessary to complete work according to specifications.

8.5.2 READY-TO-USE GROUT

Joints between tiles may be with ready-to-use, polymer filler grout with water-repellent DropEffect® and mould resistant BioBlock® technology for joints at least 2 mm wide in ceramic tiles (such as FLEXCOLOR produced by MAPEI S.p.A.), followed by a thorough cleaning of the surface with suitable detergent, rinsing of the surface and removal of excess water with suitable equipment, and any other operations necessary to complete work according to specifications.

8.5.3 EPOXY GROUT

Joints between tiles may be grouted with:

• two-component, easy-application, easy-clean, anti-acid, epoxy grout for tile joints at least 2 mm wide, class RG according to UNI EN 13888 standards (such as KERAPOXY CQ produced by MAPEI S.p.A.), followed by a thorough cleaning of the surface with suitable detergent, rinsing of the surface and elimination of excess water with suitable equipment, and any other operations necessary to complete work according to specifications;
• two-component, anti-acid, epoxy grout, class RG according to UNi EN 13888 standards (such as KERAPOXY produced by MAPEI S.p.A.), followed by a thorough cleaning of the surface with suitable detergent, rinsing of the surface and elimination of excess water with suitable equipment, and any other operations necessary to complete work according to specifications.
Technical Notebook
SYSTEMS FOR INSTALLING THIN PORCELAIN TILES

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