

MANUAL FOR INSTALLING LARGE FORMAT CERAMIC TILES



The information and advice contained in this manual are for indication purposes only and do not reflect all the different situations that may be encountered on site. In the event of situations or conditions not covered by this manual, the MAPEI Technical Services team is available to help identify the most appropriate solution for each specific intervention. For further details about our products consult the relative product Technical Data Sheets available on our website www.mapei.it.



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Introduction

The aim of this manual is to provide a series of useful guidelines on the most appropriate installation methods for large format porcelain tiles by defining which systems MAPEI has available for installing this type of material on internal and external walls and floors.

Over the last few years, manufacturers of ceramic tiles have extended their range of large format tiles. Apart from the 3 and 5 mm thick 3 m x 1 m formats, they are now proposing formats that can reach sizes of up to 1.6 m x 3.2 m and thicknesses ranging from 5 mm up to 12 mm.

Maapei has always worked closely with leading manufacturers of large format tiles and has also progressed in line with these new products by developing and producing new products suitable for installing these types of material.

The particularly large format and extremely low absorption rate, typical characteristics of porcelain, means that it is very important to identify the most suitable installation method for this type of tile with extreme care and precision. As with any floor and wall dressing, the durability and functionality of slim porcelain is also highly dependent on precise design parameters, appropriate substrate preparation and correct installation methods using adhesives, grouting mortars and joint sealants which have been chosen according to the type of dressing material and its area of use.

Always refer to the current local norms and standards.

2 Types of material

There are various sizes and thicknesses of large format tiles currently available on the market, with some formats reaching dimensions of up to 3.2 m x 1.6 m and slim tiles with thicknesses ranging from as low as 3 mm up to 12 mm.

The technique used for the correct handling, substrate preparation and installation is the same for both slim tiles and large format tiles.

The information contained in this document is based on current local norms and standards and the experience Mapei has matured in this sector.



Basic rules for correct installation

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When installing large format tiles the most appropriate adhesive must be chosen in order to ensure they remain perfectly bonded over the years, prevent deformation in the tiles and guarantee the maximum reliability wherever they are installed (on walls or floors and internally or externally).

Taking into consideration what is stipulated and prescribed by current norms and standards, some of the main principles that need to be considered when designing tile installation and then followed during the actual installation phase are listed below.

- The first step when installing tiles is to make sure the substrate has no cracks and that it is dry, well cured and even, clean and flat.
- Tiles must be installed with grout lines at least 2 mm wide. The width of the grout lines must be calculated and increased, where required, according to the surrounding conditions, the area of use, the size of the tiles and the type of substrate.

Grout lines are particularly important when installing large format tiles because:

- they reduce the effect of out of flatness between the tiles;
- they considerably reduce the modulus of elasticity and, therefore, the rigidity of the tiling: in fact, when tiles are installed and butted against each other, tiling is considered to be practically the same as a continuous, rigid single tile. If tiles are installed with grout lines, the modulus of elasticity of the tiled surface is reduced because the modulus of elasticity of the grout is much lower than that of the tiles. As a result, a surface with grout lines is able to follow the differential movements between the substrate and the tiling caused by settling in the structure, hygrometric shrinkage, thermal expansion, etc., thus helping prevent the generation of dangerous stresses that could potentially cause detachment of the tiles.
- Apart from following the layout of structural joints, distribution joints must also be included. When installing tiles on internal surfaces, perimeter deformation joints and distribution joints must be created every 25 m². When installing tiles on external surfaces, the surface must be divided into pitch areas of no more than 9-12 m².
- Choosing the right adhesive is fundamental in guaranteeing that a tiled surface remains sound and reliable over the years. In order to choose the most appropriate adhesive, it is important to determine at the offset exactly which type of tiles are to be installed, the dimensions of the tiles, the substrate

on which they are to be installed, their area of use, etc. It is also necessary to take into consideration that the almost zero absorption rate of porcelain, along with the inclusion of strengthening mesh where prescribed, imposes the use of class C2 adhesives according to EN 12004 standards. For medium formats it is preferable to use deformable adhesives from class S1 according to EN 12004, while for large formats it is strongly recommended to use highly deformable products from class S2 according to EN 12004.

When working in hot climates and during bad weather (strong winds, etc.) in particular, it is recommended to use class “E” adhesives (with extended open time) according to EN 12004. In all cases, tiles must be installed while the adhesive is still wet, or within its “open time”, in order to guarantee sufficient transfer of adhesive onto the back of the tile.

When installing tiles in the winter or in cold climates, it is preferable to use rapid-setting class “F” adhesives according to EN 12004. In fact, these adhesives complete setting and reach high levels of adhesion within a few hours of application, so that temperatures during the night below freezing point do not turn the mixing water into ice. Rapid adhesives are also recommended when surfaces need to be put back into service quickly.

- The adhesive must always be applied using the double-buttering technique, that is, the adhesive must be applied on both the substrate and on the back of the tile using a spreader with notches that guarantee the back of the tile is almost completely wetted. Double-buttering is necessary and indispensable to avoid problems caused by gaps in the back of the tiles which, in the case of external tiling, could lead to rainwater collecting and, in freezing weather, create stresses that could cause the tiles to be broken or become detached. Double-buttering is also necessary to distribute stresses more evenly over a wider area, which are generated by differential movements between the tiling and the substrate due, for example, to variations in temperature in the case of external tiling.



Installing a tile using the double-buttering technique

- Once the tiles have been installed, they must then be tapped all over the surface to prevent the formation of air pockets between the back of the tile and the substrate. It is particularly important that this step is carried out on external tiling to prevent stresses being generated by water vapour that forms during temperature variations.



Verifying the type and condition of the substrates

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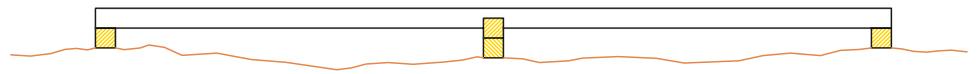
Large format tiles may be installed on all substrates normally used in the building industry such as concrete, cementitious and anhydrite screeds, screeds made from special binders such as **TOPCEM PRONTO** or **MAPECEM PRONTO**, heated screeds, old ceramic and stone floors, metal, cement-based and gypsum-based render, expanded cement blocks, aerated concrete blocks, plasterboard and internal substrates waterproofed with cementitious products such as **MAPELASTIC** or synthetic resin-based products such as **MAPEGUM WPS** and **MAPEPLASTIC AQUADEFENSE**.

It is very important to know the composition of the substrate before commencing installation.

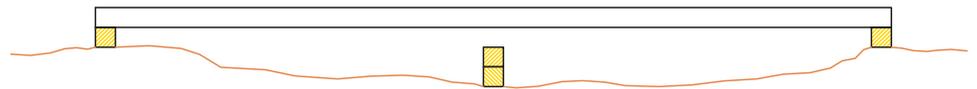
The suitability of a substrate for this type of installation must be checked beforehand. As specified by current standards substrates must always be:

- sound with no cracks;
- cured and dimensionally stable;
- strong (strong and resistant enough for the loads expected and the area of use);
- dry;
- clean and free of loose parts (dust, grease, oil, wax, paint, form-release compound and any other material which could affect adhesion);
- perfectly flat.

Since the tiles to be installed are so large and slim, flatness is a particularly important aspect of substrate preparation. In fact, the presence of voids or gaps in the installation bed could lead to the tiles being fractured if subjected to concentrated loads. According to the ISO 7976-1:1989 method, the flatness of the substrate can be checked by placing a straight-edge at least 2 m long on the substrate in all directions: the recommended tolerance is ± 3 mm. If the flatness of the substrate is not within this tolerance, it must be levelled off before installing tiles with a levelling product such as **ULTRAPLAN**, **ULTRAPLAN MAXI**, **PLANITOP FAST 330** or **NIVORAPID**.



Negative deviation: within tolerance



Negative deviation: out of tolerance



Positive deviation: within tolerance



Positive deviation: out of tolerance

Checking flatness

The following is a description of some of the most common substrates:

- **CONCRETE:** the concrete must be sufficiently cured (at least three months curing time). The bend in floor slabs must be less than $1/360$ of the total gap. Concrete substrates must be free of loose portions and surface treatments which could potentially affect adhesion (such as an anti-vapour coat, old adhesive, resin, form-release compound, etc.). To guarantee the durability of the tiling, it is also necessary to make sure that floor slabs laid on the ground are correctly isolated to prevent problems caused by rising damp.

- **TRADITIONAL CEMENTITIOUS SCREEDS:** the thickness of the screed must be sufficient for the specified stratigraphic layout; at least 4 cm in the case of isolated screeds, which must be evaluated according to the design stresses acting on them. The composition of the mix must be designed according to the mechanical performance required.

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



Screeds must be cured sufficiently: the curing time before installing tiling is around 7-10 days per centimetre of thickness. The curing time when installing tiles on conventional screeds, therefore, may be particularly long (in certain cases more than one month).



Sealing cracks in a substrate with EPORIP

■ **SCREEDS MADE FROM SPECIAL BINDERS OR READY-MIXED MORTAR:**

waiting times before installing tiles may be reduced considerably by using special binders or ready-mixed, normal-setting, quick-drying mortar such as **TOPCEM** or **TOPCEM PRONTO**, or rapid-setting and drying mortar such as **MAPECEM** or **MAPECEM PRONTO**. All these products are also suitable for installing heated screeds without the need for other admixtures. The use of ready-mixed mortars in particular also offers a higher guarantee on the quality of inert materials, reduces the risk of dosage errors and is an excellent solution in those cases where the acquisition and storage of raw materials is particularly difficult.

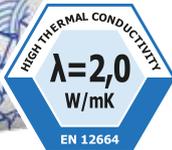
Ready-mixed screed mortars also carry CE marking as prescribed by EN 13813 standards.

Screeds made from **MAPECEM** or **MAPECEM PRONTO** are characterised by their rapid setting and drying properties and controlled shrinkage. Their use allows tiles to be bonded just 3 hours after installing the substrate.

Screeds made from **TOPCEM** or **TOPCEM PRONTO** are characterised by their normal setting times, similar workability characteristics to conventional screeds, short drying times and controlled shrinkage. Tiles may be installed on these types of substrate after just 24 hours.



Installing a screed made from **TOPCEM PRONTO**



- **HEATED SCREEDS:** in the case of conventional and compact heated screeds, follow the instructions normally applied when installing screeds and follow the indications given by the manufacturer of the heating system.

Conventional heated screeds may be made from **TOPCEM**, **TOPCEM PRONTO**, **MAPECEM** or **MAPECEM PRONTO**. **TOPCEM PRONTO** in particular is characterised by its high thermal conductivity ($\lambda = 2 \text{ W/mK}$ according to EN 12664).

Compact heating systems made from pre-formed, self-adhesive plastic, gypsum-fibre or cement-fibre panels bonded to the floor or an existing screed may be embedded and levelled off with **NOVOPLAN MAXI** mortar with high conductivity heating systems $\lambda = 1.7 \text{ W/mK}$ according to EN 12664. **NOVOPLAN MAXI** may be used to form layers from 3 to 40 mm thick, depending on the type of application. Before embedding and levelling off the panels with **NOVOPLAN MAXI**, remove all traces of dust from the panels and prime them with **ECO PRIM T**.

Before installing tiles, it is important to switch on and run the heating system as prescribed by EN 1264-4 standards. Waiting times during the heating cycle depend on the material used to make the screed.

The adhesive to use on heated screeds must be improved (C2) and highly deformable (S2) according to the European standard EN 12004.



A compact heated substrate made from **NOVOPLAN MAXI**



- **ANHYDRITE SCREEDS:** before installing tiles, anhydrite screeds must be sanded, de-dusted and primed (with **PRIMER G** or **ECO PRIM T**, for example). They must also be perfectly dry: the maximum permitted moisture content is 0.5% for heated screeds 0.3%. Always follow the instructions given by the manufacture of the anhydrite screed.



Application of **PRIMER G**

- **EXISTING FLOORS:** in order to install tiles over old ceramic, terrazzo or natural stone flooring, make sure it is sound, well bonded to the substrate, has no cracks and that all traces of oil, wax and greasy substances have been completely removed with water and caustic soda or a special de-waxing product. All old paint and leading on marble must be eliminated.
If some of the tiles are cracked or not well bonded to the substrate, they must be removed and the gaps in the surface must be repaired with a suitable levelling product such as **ADESILEX P4**, **NIVORAPID** or **PLANITOP FAST 330**.



Installing tiles over an old floor

- **CONCRETE WALLS:** the concrete must be sufficiently cured (at least three months at normal temperatures). Concrete substrates must have no traces of laitance or surface treatments which could affect adhesion (form-release compound, anti-vapour treatment, old paint, etc.).
- **CEMENT-BASED RENDER:** render must be sufficiently cured. If a ready-mixed product is used, follow the manufacturer's instructions. In all cases, when installing tiles on external surfaces, the tear strength of cement-based render must be at least 1 N/mm².
- **GYPSUM RENDER:** gypsum substrates must be perfectly dry (maximum residual moisture content 0.5 %), sufficiently sound and free of all traces of dust. It is very important that this type of substrate is treated with **PRIMER G** or **ECO PRIM T** and that tiles are only installed when the primer is perfectly dry. This type of application is only suitable for internal areas.
- **WALLS IN AERATED CEMENT BLOCKS:** because of the wide variety of products available on the market, the manufacturer must be contacted to find out its characteristics and suitability. Tiles may only be installed in internal areas on this type of substrate and only after treating the surface with a coat of **PRIMER G** diluted 1:2 with water. When installing tiles in external areas, a layer of render made from **NIVOPLAN + PLANICRETE** or **PLANITOP FAST 330** reinforced with galvanized mesh must be previously applied.

If tiles are to be installed on particularly deformable substrates, such as metal or wood, each single case must be carefully assessed by MAPEI Technical Services. For further information on this subject refer to the "Guide to installing ceramic tiles" and the technical manual "Installation of screeds", available at the website www.mapei.it.



Choosing the right adhesive

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Choosing the right adhesive is fundamental to ensure a durable, sound bond over the years and depends on the type of substrate, the type and format (dimensions and thickness) of the tiles, the area of use and the surrounding conditions.

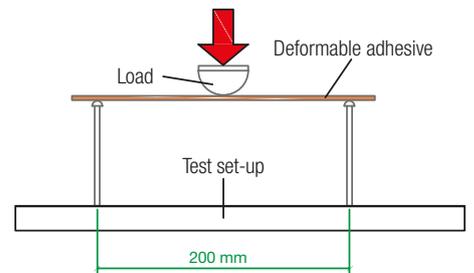
As previously mentioned in section 3, if we bear in mind the prescriptions of current standards, when installing this type of material it is recommended to use high adhesion cementitious adhesives, that is, class C2 according to EN 12004. For certain types of substrates it is more appropriate to use reactive adhesive, or class R2 according to EN 12004.

Standards always prescribe the use of deformable adhesives, class S1 or S2 according to EN 12004. For medium sized formats class S1 adhesives are recommended, while for large formats it is strongly recommended to use highly deformable class S2 products.

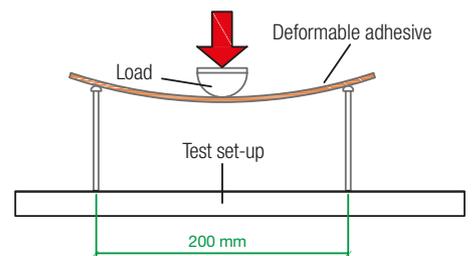
The deformability of adhesive is determined through flexural tests (the method described in EN 12004 - ISO 13307) which measures transversal deformation. A sample of adhesive is subjected to a load test as shown in diagrams 1 to 3 below. To achieve class S1, the deformability of the sample must be at least 2.5 mm and for class S2 it must be at least 5 mm.



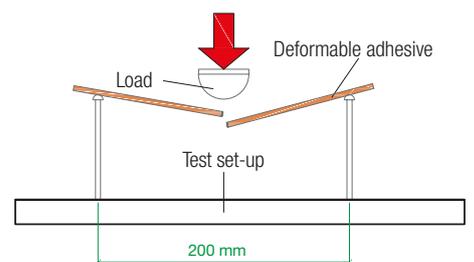
Measuring the deformability of cementitious adhesive



1. Test set-up to measure the flexibility of a thin layer of adhesive according to its deformation



2. Measuring maximum deformation



3. Failure of test piece

Flexural tests

When installing tiles in climates that require the use of adhesive with extended open time, it is preferable to use products from class E according to EN 12004.

Class F adhesives are the preferred choice when rapid-setting times and high adhesion within a few hours of application are required.

Another essential requirement when installing large format tiles is that the adhesive must guarantee a high level of wetting of the back of the tiles so that gaps are not created, otherwise the soundness and durability of the bond could be affected.



Choosing adhesive with good wetting capacity on the back of the tile

Bearing in mind these types of tile cannot be tapped down too firmly (because of their high overall size/thickness ratio there is a risk of them breaking), to guarantee high wetting of the tiles, Mapei has developed a formulation for adhesives that contain **ULTRALITE** technology.

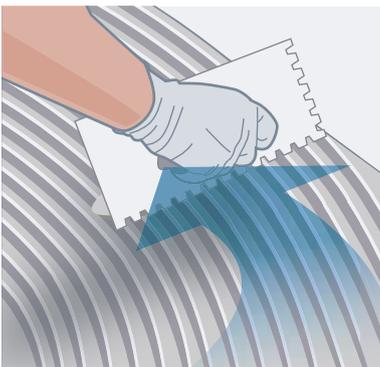


The **ULTRALITE** adhesives range



Adhesives containing **ULTRALITE** technology are characterised by their lower density compared with traditional products and are known as lightweight adhesives. The advantages of adhesives from the **ULTRALITE** range are:

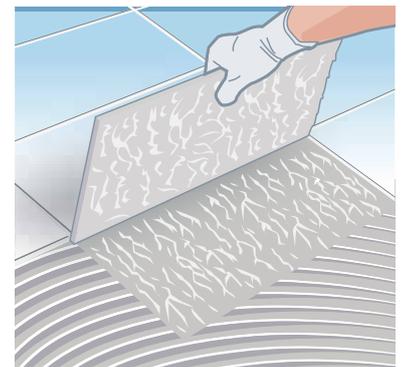
- higher yield;
- since this is a “lightweight” product, the weight of the adhesive applied to the back of the tiles has very little effect on their overall weight;
- lower transport costs; bags of adhesive are lighter (only 15 kg for the same volume, compared with traditional bags weighing 25 kg);
- the mix has a “creamy” consistency which gives it excellent workability and makes application easier and quicker;
- high wetting capacity on the back of the tiles;
- environment-friendly: these products contain more than 20% of recycled materials and help obtain LEED credits;
- perfect adhesion to all types of substrate normally used in the building industry;
- high white balance for all white adhesives from the **ULTRALITE** range.



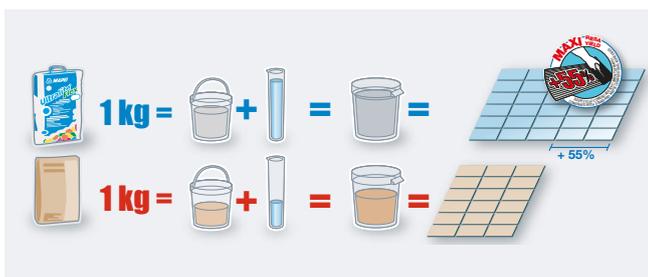
Easier to apply compared with traditional adhesives



Lighter bags (15 kg) with practical grips for easier handling



Excellent wetting capacity on the back of tiles



Ultralite Flex has up to 55% higher yield than other adhesives with the same classification



Bags of Ultralite Flex: 100 off
Yield: approx. 600 m²

Bags of conventional adhesive: 60 off
Yield: approx. 360 m²

In order to achieve high wetting, a compact layer of adhesive must be applied (full wet bed method) using the double-buttering technique.

The following tables take into consideration current standards and Mapei's consolidated experience in this sector. It contains a list of recommended Mapei installation adhesives and their use according to whether tiles are installed on walls or floors, or internally or externally, and according to the type of substrate material and the format of the tiles.

5.1 Mapei adhesives for installing tiles on internal floors and walls

Internal floor and wall tiles may be installed on the following types of substrate as long as they have been prepared as specified in section 4.

Internal floor tiles may be installed on cementitious screeds, anhydrite screeds with a residual moisture content of < 0.5% in weight (after applying **PRIMER G** or **ECO PRIM T**), heated screeds, existing floors, high performance screeds such as those made from **TOPCEM**, **TOPCEM PRONTO**, **MAPECEM** or **MAPECEM PRONTO** and on surfaces waterproofed with products from the **MAPELASTIC** line or **MAPEGUM WPS**.

When installing tiles on screeds with embedded heating elements, this must only be carried out after the heating system has been switched on and run for a while.

All types of internal wall tiles may be installed on cementitious render, gypsum-based render (after applying **PRIMER G** or **ECO PRIM T**), plasterboard, cement-fibre panels, old ceramic and stone.

The following adhesives are recommended for this type of application:

Type of substrate (*) (**)	Size of tile	NORMAL SETTING		RAPID SETTING	
		Adhesive	Class according to EN 12004	Adhesive	Class according to EN 12004
Cementitious screeds or renders Anhydrite screeds or renders Self-levelling products Concrete Cement-fibre panels Plasterboard Old ceramic Terrazzo Stone	surface ≤ 3600 cm ² side ≤ 60 cm	KERAFLEX MAXI S1 KERAFLEX MAXI S1 ZERØ ULTRALITE S1	C2TE S1 C2TE S1 C2TE S1	GRANIRAPID ULTRALITE S1 QUICK	C2F S1 C2FT S1
	surface > 3600 cm ² side ≤ 120 cm				
	surface > 1 m ² side > 120 cm	ULTRALITE S2 KERABOND + ISOLASTIC	C2E S2 C2E S2	ULTRALITE S2 QUICK ELASTORAPID	C2FE S2 C2FTE S2
Heated screeds	surface ≤ 3600 cm ² side ≤ 60 cm	ULTRALITE S1 KERAFLEX MAXI S1 KERAFLEX MAXI S1 ZERØ	C2TE S1 C2TE S1 C2TE S1	ULTRALITE S1 QUICK GRANIRAPID	C2FT S1 C2F S1
	surface > 3600 cm ² side ≤ 120 cm	ULTRALITE S2 KERABOND + ISOLASTIC	C2E S2 C2E S2	ELASTORAPID	C2FTE S2
	surface > 1 m ² side > 120 cm	ULTRALITE S2 KERABOND + ISOLASTIC	C2E S2 C2E S2	KERAQUICK MAXI S1 + LATEX PLUS	C2FT S2
Waterproofing systems (from the MAPELASTIC range and MAPEGUM WPS)	surface ≤ 3600 cm ² side ≤ 60 cm	KERAFLEX MAXI S1 KERAFLEX MAXI S1 ZERØ ULTRALITE S1	C2TE S1 C2TE S1 C2TE S1	GRANIRAPID ULTRALITE S1 QUICK KERAQUICK MAXI S1	C2F S1 C2FT S1 C2FT S1
	surface > 3600 cm ² side ≤ 120 cm	ULTRALITE S2 KERABOND + ISOLASTIC	C2E S2 C2E S2	ULTRALITE S2 QUICK KERAQUICK MAXI S1 + LATEX PLUS	C2FE S2 C2FT S2
	surface > 1 m ² side > 120 cm				
Wood PVC, rubber and linoleum Metal surfaces Resin	All formats	KERALASTIC KERALASTIC T ULTRABOND ECO PU 2K	R2 R2T R2T	KERAQUICK MAXI S1 + LATEX PLUS	C2FT S2

(*) Gypsum and anhydrite-based surfaces must always be treated beforehand with **PRIMER G** or **ECO PRIM T**

(**) Non-absorbent substrates should be treated beforehand with **ECO PRIM GRIP** if necessary



5.2 Mapei adhesives for installing tiles on external walls

The following adhesives are recommended for this type of application:

Type of substrate	Size of tile (***)	NORMAL SETTING		RAPID SETTING	
		Adhesive	Class according to EN 12004	Adhesive	Class according to EN 12004
Cementitious render Concrete	surface ≤ 3600 cm ² side ≤ 60 cm	KERAFLEX MAXI S1 KERAFLEX MAXI S1 ZERØ ULTRALITE S1	C2TE S1 C2TE S1 C2TE S1	ULTRALITE S1 QUICK	C2FT S1
	surface > 3600 cm ² side ≤ 120 cm	ULTRALITE S2 KERABOND + ISOLASTIC	C2E S2 C2E S2	ELASTORAPID ULTRALITE S1 QUICK	C2FTE S2 C2FT S1
	surface > 1 m ² side > 120 cm	ULTRALITE S2 KERABOND + ISOLASTIC	C2E S2 C2E S2	ULTRALITE S2 QUICK KERAQUICK MAXI S1 + LATEX PLUS	C2FE S2 C2FT S2

(***) For tiles with reinforcement mesh and one side ≥ 120 cm use class R2/R2T adhesives such as **KERALASTIC**, **KERALASTIC T** or **ULTRABOND ECO PU 2K**

The installation instructions in the above tables are for indication purposes only and for normal conditions. For further information please refer to the relative Technical Data Sheet for each product. Defining the most appropriate installation system is highly dependent on specific site conditions and the format of the tiles. For particular installation situations please contact Mapei Technical Services or refer to the relative technical manual.



6

Movements in large format tiles

The handling of large format tiles should be done with great care and should be carried out by at least two people using special tools and equipment, both while handling the tiles while they are still wrapped and during any cutting, drilling and installation operations. Special care is required because it is easy to bend and even break large format tiles if they are not handled and lifted correctly.

Because of the sheer size of the tiles, always make sure beforehand that there is enough room and space on site to manoeuvre them easily.

It is recommended to bring the boxes and crates containing the tiles as close as possible to the installation area to reduce the distance you have to carry them as much as possible.

Once the tiles have been removed from their packaging, care must be taken when putting them in positioning by resting the long side of the tiles on the ground at an angle of 30° to the support. Pay particular attention to the corners of the tiles to avoid chipping or breaking them during handling.

To facilitate handling the tiles, it is recommended to carry and install them with runners and frames with suction cups to keep them more rigid and limit any twisting or bending.

There are two types of suction cups available, the traditional type and those with an in-built pump. The latter type is more secure and provides a better grip and the vacuum in the suction cup can be re-established using the pump, even after a certain period of time. Always make sure a good vacuum has been created between the lifting device and the surface of the tile.

It is recommended to clean the surface of the tile and the suction cups with a damp sponge to get a better grip.



Cleaning the surface of the tile and suction cup

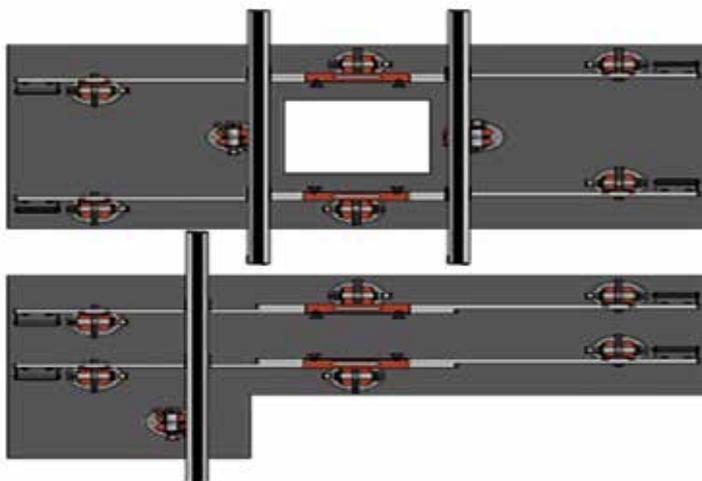


Applying a pump-action suction cup



Correct handling of a tile

If the tile has been cut and is potentially weaker in that area, it is recommended to add more runners or cross-members to reduce any bend or twist.



Position of runners and cross-members to handle and move a tile with a section cut from it

7

Cutting and making holes in large format tiles

If you need to make a straight cut along a tile, make holes for pipework or switchboxes or make any other type of cut, it is recommended to take the following precautions when carrying out these operations.

To get a neat cut or to make an accurate hole, the tile must be placed on a stable, flat and sturdy work surface.



Cutting table with aluminium profiles

When making a straight cut, place the cutting guide on the tile along the line to be cut and block it in place with suction cups.



Cutting guide to make a straight cut

Make a small cut 1 to 2 cm long at each end of the tile from the inside towards the outside and then complete the cut from one end to the other. Make sure you apply the same amount of pressure on the cutting tool for the entire length of the cut.



Making a cut in a tile

Once the cut has been completed, remove the cutting guide and move the tile so that the cut made in the surface sits over the edge of the work surface, then break each end of the tile along the line of the cut with tile snips. The tile is then broken in two by simply bending it until the two pieces come apart.



Creating a fracture with tile snips



Breaking the tile in two

It is generally recommended to use two people for this operation so that the cut piece doesn't fall or break.

If there is reinforcement mesh in the tile this can be cut and trimmed with a cutter.

The edges of the tile may be sharp or uneven after it has been broken; clean and smooth the edges with a diamond pad or an abrasive disk.



Smoothing off the cut edges

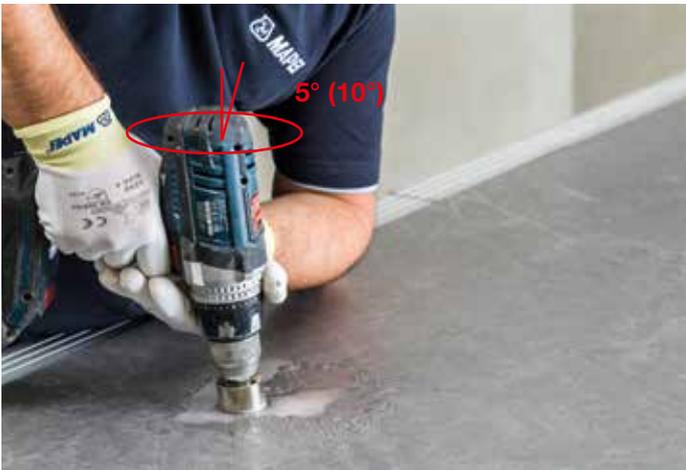
If a tile needs to be cut in two different directions, a hole must be drilled in the corner before cutting it.

A straight cut may also be made with a disk cutter. In this case the disk cutter runs along the cutting guide and a through cut or a partial cut may be made. In this case, the tile will have a cleaner and better defined edge than by cutting and breaking the tile.



Making a straight cut with a disk cutter

If round holes have to be made in a tile, use a dry or wet diamond cutter. Once the tile has been positioned on the work surface and the position of the hole has been marked out, start making the hole with the cutting head placed at an angle with respect to the tile so that it cuts through it more accurately. Once the cutting head has started to make the hole, press down and apply a small circular movement. Keep the cutting area wet if using the wet method or remove all the resulting dust during the drilling operation if using the dry method.



Sequence to make a round hole

If you need to make a rectangular hole in a tile, start by making a round hole at each corner of the rectangle and then make straight cuts between each hole with a disk cutter with a diamond disk. This will prevent excessive stresses being generated at the corners of the rectangle which could then form a crack in the tile itself.



Sequence to make a rectangular hole



Installation technique for large format tiles

8



As described in section 5, the adhesive must be chosen according to the type of substrate material, the type and size of the tiles and the area of use.



Mixing the adhesive

To install large format tiles, we suggest the double-buttering technique to apply the adhesive, that is, on both the back of the tile and on the substrate the tile is to be installed on.

A trolley is a handy way of standing a tile to make application of the adhesive on the back of the tile easier.

Before applying the adhesive, make sure the back of the tile is clean and there is no ceramic or magnesium dust present. If necessary clean the back of the tile with a damp sponge dipped in a mixture of water and acid detergent.

The spreader to use for applying the adhesive must be chosen according to the type of substrate material. It is recommended to use a notched spreader with sloping notches to apply the adhesive on the substrate to get better distribution, whereas the spreader used to apply the adhesive on the back

of the tile should have smaller notches so that almost 100% of the surface is wetted with adhesive.

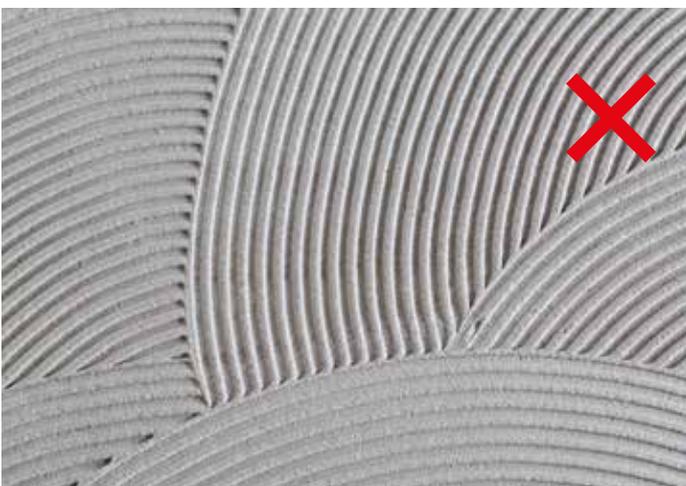
To apply and spread the adhesive on the back of the tile, we suggest using a spreader with 3 mm pitch square notches. The adhesive must be applied in straight lines parallel to the short side of the tile to reduce the distance travelled by the air being pushed out.

When spreading adhesive on the substrate, on the other hand, it is recommended to use a spreader with sloping notches with a pitch of at least 10 mm, depending on the flatness of the substrate. Using a spreader with sloping notches forces the trails of adhesive between the notches to fold over each other and this domino effect helps fill all the gaps and reduces the risk of entraining air bubbles into the bed of adhesive to a minimum.

After applying an initial thin layer of adhesive to remove any dust on the substrate, the adhesive must then be spread on the substrate in a straight line in the same direction as the adhesive applied on the back of the tile.



A spreader with sloping notches to spread the adhesive on the substrate and with square notches to spread the adhesive on the back of the tile



How to spread the adhesive correctly



The adhesive is spread in the same direction on the back of the tile and on the substrate

After applying the adhesive using the double-buttering method, it is recommended to use runners and cross-members or a frame with suction-cups to make handling the tiles easier and safer.

The tiles are installed by placing the ribs of adhesive on the substrate and on the back of the slab parallel to help push the air out; never install the tile with the ribs of adhesive crossing each other.



Installing a tile

To ensure the tile is completely bonded and that all the air has come out, go over the surface of the tile with a vibro-plate or tap the surface by hand with a special anti-bounce float made from rubber.

We suggest tapping the tile from the centre working towards the edges in the same direction as the ribs of adhesive, that is, parallel to the short side, to ensure all the air under the tile is forced out.



Tapping the tile by hand or going over the surface with a vibro-plate

Any air bubbles that form could represent a weak point for the installed tiles, particularly when installing internal floor tiles where gaps could lead to the tiles being broken if subjected to concentrated loads.

In the case of tiles installed externally, the presence of gaps could cause water to collect. This could lead to the tile becoming detached due to stresses caused by freeze/thaw cycles of water that penetrates under the tile in winter or by pressure generated in summer by water vapour.

This is why double-buttering and tapping the tile down are very important steps to be done carefully, during the procedure.

The same technique is used to install both floor and wall tiles.

When installing tiles on facades, the design engineer must assess whether additional mechanical safety fasteners are required.



Installing a wall tile



Grouting large format ceramic tiles

9



The width of grout lines must be established during the design phase and is based mainly on the type of substrate material, the size and type of the tiles and the area of use (wall or floor, internal or external).

In all cases, the minimum recommended width between each tile is 2 mm and the width increases according to the area of use and the stresses expected when in service.

To maintain the correct gap between each tile and reduce out-of-flatness between tiles, it is recommended to use levelling spacers (around one spacer every 50 cm). It is important to place the spacers in position before installing adjacent tiles and it is also important to embed the spacers in the adhesive to prevent voids or gaps forming under the tiles in correspondence with the spacers, otherwise these could create weak points and potential breakage of the tile.



Placing the spacers in position

To simplify this part of the procedure, a special positioning tool may be used to position the tiles. It consists of two groups of suction-cups, one for each tile, and a central threaded mechanism which is used to correct the width of the grout line between the two tiles and bring the tiles to the position required.



Tile-positioning tool

Always make sure the grout lines are clean before grouting. If there are traces of adhesive in the grout lines after tapping the tiles into place, and the amount of adhesive in the grout line doesn't allow at least $\frac{2}{3}$ of the depth to be grouted, the adhesive must be removed mechanically with a cutter, scraper, etc.

Before filling the grout lines between the tiles you must wait approximately:

- 2-3 hours if rapid-setting adhesive has been used;
- 24 hours if normal-setting or reactive adhesive has been used.

The grout lines may be filled with cementitious grout, such as **ULTRACOLOR PLUS**, or with epoxy grout, such as **KERAPOXY**, **KERAPOXY DESIGN** or **KERAPOXY CQ**:

- **ULTRACOLOR PLUS** is a high performance, rapid-setting and drying, polymer-modified, anti-efflorescence mortar with water-repellent DropEffect® technology and mould-resistant BioBlock® technology. It is a class CG2WA product according to EN 13888 standards and is certified EMICODE EC1 Plus by the GEV Institute (very low emission of volatile organic compounds).



ULTRACOLOR PLUS cementitious grouting mortar



- **KERAPOXY** is a two-component, anti-acid epoxy mortar classified as RG according to EN 13888 standards and is certified EMICODE EC1 R Plus by the GEV Institute (very low emission of volatile organic compounds).
- **KERAPOXY DESIGN** is a decorative, two-component, anti-acid epoxy mortar classified as RG according to EN 13888 standards and is certified EMICODE EC1 R Plus by the GEV Institute (very low emission of volatile organic compounds).
- **KERAPOXY CQ** is a two-component, easy-to-apply, anti-acid epoxy mortar with excellent cleanability classified as RG according to EN 13888 standards. It contains bacteriostatic BioBlock® technology and is certified by the University of Modena according to ISO 22196:2007 standards as a protective grout against the formation and proliferation of microorganisms and EMICODE EC1 R Plus by the GEV Institute (very low emission of volatile organic compounds).



The **KERAPOXY** range of epoxy grouts

The grouting is cleaned by using a small amount of water and an abrasive pad (such as Scotch-Brite) followed by a firm cellulose sponge, taking care not to remove the grout.

Unlike cementitious grouts, floor and wall tiles grouted with epoxy mortar must be cleaned while the grout is still “wet” and, if necessary, more water needs to be used to clean the tiles so that all traces of the epoxy grout are completely removed.



Grouting the tiles



Cleaning the grout with a Scotch-Brite pad finishing off the grouted tiles with a sponge

Mapei grouts are available in a wide range of colours, as per the new range of Mapei Coloured Grouts, which has been specifically created to create a perfect match between the colour of the grout and tiles so that the grout lines are less noticeable. By using these products the grout lines remain between the tiles but they are less visible and they don't interfere with the effect created by floor and wall tiles, for example, with a marble or wood effect finish.



Sealing joints

10.

When installing large format tiles joints need to be created to prevent detachment of the tiles due to the effect of thermal expansion/contraction.

Therefore, when installing tiles, the layout of expansion joints in the sub-layer and in walls must be respected.

Expansion joints at least as wide as the existing joints must be created in correspondence with structural joints in the substrate.

Where there are two or more surfaces in different materials (such as between reinforced concrete and brickwork) it is important to include an expansion joint.

It is also important to form joints around the perimeter of fixed elements of the load-bearing structure such as walls, steps, columns, etc.

Make 1 cm distribution joints if particularly large surface areas are to be laid, dividing the surface as follows:

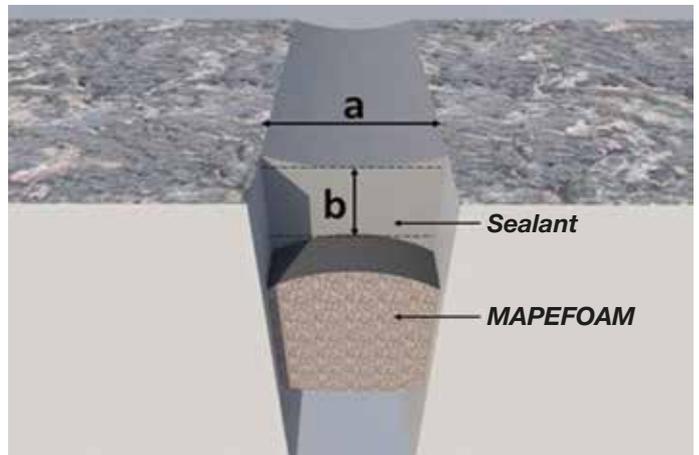
- a) on substrates subject to movement or flexure, form squares approximately 9-12 m²;
- b) on stable surfaces the joints may be formed approximately every 16-25 m²;
- c) install tiles leaving a gap of approximately 5 mm between walls, columns, edges, corners, etc.

Since large format tiles are often chosen to enable large areas of seamless flooring to be created, to increase this effect and avoid having to cut the tiles in correspondence with the joints, it is possible to include an antifracture membrane, such as **MAPETEX SYSTEM**. The sheets of **MAPETEX SYSTEM** are bonded to the substrate so they straddle the joints in the screed (as long as they are not structural joints) with rapid, deformable adhesive. While the layer of adhesive is drying, whole tiles may then be installed without having to cut them in correspondence with the joints in the screed.

The width of the joint is determined according to the thickness and size of the tiles, the characteristics of the substrate, the area of use and the loads present. The sealant will only function correctly in terms of water-tightness and duration if the joints are the correct size.

As a general rule, joints must be sealed according to the indications in the following table:

A - width of joint	B - depth of joint
from 0 to 4 (mm)	increase the width of the joint
from 5 to 9 (mm)	$b = a$
from 10 to 20 (mm)	$b = 10$ (mm)
from 21 to 40 (mm)	$b = a/2$ (mm)
more than 40 (mm)	reduce the width of the joint



Size of the joint

Use **MAPESIL AC** to fill expansion joints in internal walls and floors, while for external applications use **MAPESIL LM** for wall tiles and **MAPESIL AC** for floor tiles.



Perimeter joint sealed with **MAPESIL AC**

For particular mechanical strength requirements, sealants such as **MAPEFLEX PU20**, **MAPEFLEX PU21**, **MAPEFLEX PU45 FT** and **MAPEFLEX PU50 SL** must be used.



References

11.



**FERRARI & MASERATI
SHOWROOM,
JEDDAH - SAUDI ARABIA**

**ROAD TUNNEL IN THE VALICO
BY-PASS, CASTIGLIONE DE'
PEPOLI (BO) - ITALY**



**ZARA FASHION SHOP,
OSLO - NORWAY**



For further information about Mapei products refer to the relative Technical Data Sheet of the products available at www.mapei.it.

For more detailed information not available in this manual we recommend contacting the MAPEI Technical Services Department.

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