Selection chart of Grouts and Flexible Joints
The grout that decorates... your world

A range of high-quality, highly-functional products rich in colour for internal and external use. Solvent-free, with very low emission of volatile organic compounds (VOC) and certified in compliance with the most strict international standards. Suitable for all types and formats of floors and walls: ceramic tiles, cotto, stone material, mosaics and metal. Available as cementitious, grouting paste and epoxy grout. Mapei Coloured Grouts. The choice that completes every project. From Mapei, world leader in the production of grouts and adhesives. Mapei is by your side: let's take a deeper look together at www.mapei.it
Mapei Coloured Grouts

The grout that decorates... your world

Beauty which resists everything.
A range of high-quality, highly-functional products rich in colour for internal and external use. Solvent-free, with very low emission level of volatile organic compounds (VOC) and certified in compliance with the most strict international standards. Suitable for all types and formats of floors and walls: ceramic tiles, terracotta, stone material, mosaics and metal. Available as cementitious, grouting paste and epoxy grout. Mapei Coloured Grouts. The choice that completes every project. From Mapei, world leader in the production of grouts and adhesives.
Cementitious grouts

Mapei has a complete range of grouts for all types of internal and external ceramic, terracotta, stone and glass mosaic floors and walls.

For example, cementitious grouts are particularly suitable for residential use such as bathrooms, kitchens, swimming pools, external façades, balconies and terraces, for commercial environments such as grouting tiles in supermarkets, restaurants, airports and public buildings and for floors in industrial environments.

Ultracolor Plus

The safest joint. Mould proof

Cementitious grout with a perfect uniform colour.

- For internal and external use
- Anti-efflorescence
- Water-repellent with DropEffect®
- Mould-resistant with BioBlock® technology
- Available in 26 colours
- Very low emission level of volatile organic compounds (VOC)
- Mould-resistant with BioBlock® technology
- Available in 26 colours
- Very low emission level of volatile organic compounds (VOC)
- Classified CG2WA according to EN13888

CEMENTITIOUS GROUITS
<table>
<thead>
<tr>
<th><strong>CEMENTITIOUS GROUTS</strong></th>
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<tr>
<td><strong>Ultracolor Plus</strong></td>
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<tr>
<td>High-performance mortar for joints from 2 to 20 mm</td>
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<tr>
<td>Anti-efflorescence and mould-resistant (BioBlock®)</td>
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<td>Water-repellent (DropEffect®)</td>
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<td>Polymer-modified</td>
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<tr>
<td>Available in 26 different colours</td>
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<tr>
<td>For internal and external use</td>
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<tr>
<td>For all types of ceramic, stone, glass mosaic and marble floors and walls</td>
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<tr>
<td>For swimming pools</td>
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</tbody>
</table>

| **Keracolor SF**       |
| High-performance mortar for joints up to 4 mm |
| Smooth, white, compact and super fine |
| Polymer-modified |
| For internal and external use |
| For all types of pre-polished ceramic, terracotta, glass mosaic, stone and marble floors and walls |
| Ideal for grouting thin joints |

| **Keracolor GG**       |
| High-performance mortar for joints from 4 to 15 mm |
| Polymer-modified |
| Available in 18 different colours |
| For internal and external use |
| For all types of ceramic, terracotta, natural brick and stone floors and walls |
| For swimming pools |

| **Fuglastic**          |
| Liquid polymer admix for Keracolor FF, Keracolor GG and Keracolor SF |

| **Fuga Fresca**        |
| Acrylic resin-based paint in water dispersion to bring back the colour of joints between ceramic tiles |
| Available in 26 different colours (all colours from the Keracolor and Ultracolor Plus range) |

| **Keranet**            |
| Acid-based cleaning solution for ceramic tiles with cementitious joints available in powder and liquid form, supplied ready-to-use |
EPOXY GROUTS

Thanks to their technical characteristics, the range of grouting materials for epoxy joints is particularly suitable when particular requirements for hygiene and resistance to aggressive chemicals are required.

They are used, therefore, in residential and commercial environments to guarantee a highly attractive and decorative finish and no absorption along with their good performance figures, and in all industrial environments where very high resistance to chemicals and high strength are required, together with resistance to acids and hydrocarbons, such as for floors in the foodstuffs industries (meat factories, oil mills, etc.).
**Kerapoxy**

- Two-component anti-acid mortar for joints of at least 3 mm
- Available in 26 different colours
- For internal and external use
- For ceramic tiles, stone, cement-fibre and concrete
- Ideal for commercial environments
- Suitable for work-tops
- May also be used as adhesive

**Kerapoxy IEG**

- Two-component anti-acid mortar for joints of at least 3 mm
- Very high strength and chemical resistance
- Resistance to oily acids and aromatic hydrocarbons, including at high temperatures
- Smooth, compact, non-absorbent, easy-to-clean surface
- Available in colours 113 and 130 from the standard range
- For ceramic floors in the foodstuffs industries (ham curens, meat factories, oil mills, etc.)

**Kerapoxy Design**

- Two-component anti-acid mortar
- Highly attractive finish
- Translucent finish
- Available in 14 different colours and translucent
- For internal and external use
- For all types of ceramic and stone with a decorative, attractive finish for floors and coatings
- Ideal for glass mosaic
- May also be used as adhesive
- May be mixed with MapeGlitter for a wider range of colours and special ornamental finishes

**Kerapoxy CQ**

- Two-component anti-acid filler, ideal for grouting joints between ceramic tiles and mosaics
- Product certified by the University of Modena according to ISO 22196:2007 standards as a grouting mortar protected against the formation and proliferation of micro-organisms
- Easy to apply
- Very high strength and chemical resistance
- Excellent workability and easy to clean
- Excellent resistance to heavy traffic
- Available in 21 colours
- For industrial ceramic floors and coatings where high strength and a high level of hygiene are required

**MapeGlitter**

- Metallic coloured glitter
- Added to Kerapoxy Design up to 10% by weight, to make grouting mortar with a shiny, metallic finish
- Available in Light Gold and Silver
- Ideal for metal tiles, mosaic and glass tiles

**Kerapoxy P**

- Two-component anti-acid mortar for joints of at least 3 mm
- Very high strength and chemical resistance
- Suitable for large surfaces
- Easy to apply by trowel
- Available in colour 113 from the standard range
- For industrial ceramic floors and coatings, including particularly large spreads

**Kerapoxy Cleaner**

- Special cleaner for epoxy grout
- Suitable for cleaning operations after completing laying work and for removing traces and stains of epoxy grout (such as Kerapoxy, Kerapoxy P, Kerapoxy Design and Kerapoxy CQ) from the surface of ceramic and glass coverings
Mapei has developed a range of paste products which, because of their nature, are particularly easy to use. The range includes a flexible polymer grout suitable for coatings on façades, including those applied on flexible substrates, and a highly thixotropic adhesive paste which bonds immediately with no slip.
### Flexcolor
- Paste filler for joints from 2 to 10 mm
- Ready to use
- Mould-resistant (BioBlock®)
- Water-repellent (DropEffect®)
- Available in white (100), silver grey (111) and beige 2000 (132)
- For internal floors and internal and external walls
- For ceramic tiles and mosaic
- Ideal for flexible substrates

### Fix & Grout Brick
- Adhesive paste for internal and external bonding
- Ready to use
- Easy to apply, guaranteed laying
- Mould-resistant with BioBlock® technology
- Available in white, grey and beige
- Highly flexible, excellent bond, good resistance to UV rays and ageing
- Resistant to temperatures up to +70°C
- Thixotropic consistency for an immediate bond with no slip
- Particularly suitable for brick slips and cementitious conglomerate elements lightened with synthetic resin

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**MAPEI**

07
Mapei has developed a range of special products for grouting architectonic stone flooring which are ideal for use under various conditions, such as to withstand heavy loads and intense traffic. Paving stones are used to make the most beautiful squares and ancient town centres, but are also used for pedestrian areas, pavements, cycle lanes and heavily trafficked roads, as well as in residential buildings such as for external courtyards, stairways and landings.

Mapestone System
The innovative installation system for porphyry and interlocking stone flooring, to make installing quick and long-lasting.

- Less maintenance
- Less noise
- Lower risk of falling
- Flooring rapidly put into service
- Resistant to freeze-thaw cycles and de-icing salts
- High resistance to wear and tear from public transport and commercial vehicles

Choose Mapestone. Time will prove you right.

JOINTS IN ARCHITECTONIC STONE FLOORING
SYSTEMS FOR LAYING PORPHYRY AND ROUGH-CUT STONE

### Keracolor PPN
- Quick-setting pozzolan mortar for grouting paved floors with joints from 5 to 30 mm
- Very low water absorption
- High mechanical strength
- Ideal for stone floors subjected to heavy loads and intense traffic, such as courtyards in commercial centres, car-parks and public squares and roads with urban traffic

### Mapestone PFS 2
- Pre-blended mortar for grouting joints in architectonic stone flooring
- High compressive strength (C30/37/XF4)
- High resistance to freezing weather (XF3)
- High resistance to de-icing salts (VF4 exposure class)
- High resistance to abrasion
- Suitable for grouting architectonic flooring made from small blocks, smolieri bricks, cobblestones, slabs or blocks.
- Suitable for making piazzas, roads, pavements, car-parks, pedestrian crossings, roundabouts and speed humps.

### Mapestone PFS PCC 2
- Pre-blended, polymer-modified mortar for grouting joints in architectonic stone flooring
- Low modulus of elasticity (20 GPa)
- High resistance to freezing weather (XF3)
- High resistance to de-icing salts (VF4 exposure class)
- High resistance to abrasion
- Suitable for grouting architectonic flooring made from small blocks, smolieri bricks, cobblestones, slabs or blocks.
- Suitable for use in piazzas, roads, pavements, car-parks, pedestrian crossings, roundabouts and speed humps.
A complete range of coloured products for any request of sealing of floorings and coatings made of ceramic tiles, natural stone and glass mosaics.

- Easy to use
- High performances
- Quick to apply
- Wide range of colours
- Granted results
- Certified according to the most severe international standards
- With very low emission of volatile organic compounds (VOC)

ELASTIC JOINTS

Mapei has a complete range of sealants developed through constant research with the aim of introducing high quality products on the market to make application easy, quick and guaranteed. Only a few of the products from the range are presented in this document, and their characteristics make them suitable for specific applications for ceramic, natural and glass floor coatings. In particular, several one and two-component acrylic, silicone and polyurethane sealants will be presented.
**FLEXIBLE JOINTS**

**Mapesil AC**
- Pure aceto silicon sealant
- Contains no solvents
- Low modulus of elasticity
- Mould resistant
- High strength, high thermal and chemical resistance
- Available in 26 different colours and transparent
- For glass, ceramic, sanitary wares and varnished surfaces
- Ideal for floor joints and grouting tiles in damp environments and swimming pools
- May be used on concrete, wood, metal, elastics and rubber after treating with Primer FD

**Mapesil LM**
- Neutral silicone sealant
- Odourless
- Does not stain stone surfaces
- High bond strength with no primer on a wide range of substrates
- Excellent resistance to inclement weather and ageing
- Available in white (100), grey (110), grey (112), cement grey (113), grey (114), black (120), Jasmine (130), beige (132) and transparent
- Ideal for natural stone and ceramic tiles on façades

**Mapesil PU20**
- Two-component, high flow epoxy-polyurethane sealant
- High modulus of elasticity, high strength
- High chemical resistance
- High flow, quick and easy application on floors
- Pre-dosed two-component product
- Available in grey (113)
- Ideal for industrial floors, car-parks, garages, courtyards, commercial areas, warehouses and production areas

**Mapesil PU45**
- One-component, thixotropic polyurethane sealant and adhesive
- Single product for flexible bonds and seals
- High modulus of elasticity, high resistance to traffic
- High sucker effect for bonding on vertical surfaces and ceilings
- Paintable
- High bond strength, no primer required
- Compatible with all absorbent mineral substrates, metal surfaces, varnished surfaces, wood, stone, brickwork and glass
- Available in white, grey (111), grey (113) and black (600 ml, grey (111) and black (600 ml)
- Ideal for sealing civil and industrial floors and flexible bonding of construction features instead of using screws, nails and lightweight fittings

**Mapesil PU30**
- Two-component, thixotropic epoxy-polyurethane sealant
- High modulus of elasticity, high strength
- High chemical resistance
- Thixotropic consistency for application on vertical surfaces
- Pre-dosed two-component product
- Available in grey (113)
- Ideal for vertical and horizontal joints in car-parks, garages, commercial areas, warehouses and production areas

**Mapesil PU50 SL**
- One-component castable polyurethane sealant
- High flow, quick and easy application on floors
- Low modulus of elasticity to avoid detachment from the edges of joints
- Paintable
- High bond strength, no primer required
- Highly flexible even at low temperatures
- Ideal for civil and industrial floors, shopping centres, car-parks and runways subjected to large movements and with a slope up to 2%
The stain proof grout.

Mapei Kerapoxy grouts
A complete range of epoxy grouts developed for the residential and commercial sector.

- For internal and external use
- Non-absorbent, very high resistance to acids, oils, dirty and impacts
- Can be rapidly mixed
- Easy to be applied and cleaned
- Suitable for baths, kitchens and swimming-pools
- Very low emission of volatile organic compounds (VOC)
- Classified RG according to EN 13888
- Suitable for creating floors and walls in compliance with the HACCP system and the requirements of EC Regulation No. 852/2004 regarding hygiene and foodstuffs
- Available in a wide range of colours
What are tile joints for?

It is very important that tiles are installed with large joints between each tile, especially with large formats and tiles installed on external surfaces, for the following reasons:

Any difference in the dimensions of the tiles has less influence. This is confirmed by the maximum permitted step between tiles according to Technical Report CEN/TR13548 ("General rules for the design and installation of ceramic tiling"). According to the aforementioned Technical Report, the maximum acceptable step between tiles is 1 mm for joints up to 6 mm wide and 2 mm for joints wider than 6 mm. It is clear, therefore, that as the width of the joint increases, any steps between tiles have less of an impact.

They considerably reduce the modulus of elasticity and, therefore, the stiffness of the tiling. While the stiffness of tiling installed by butting the tiles together is comparable to that of a stiff, seamless surface as if it were a single tile, when tiles are installed with “open” joints, each of the tiles which form the tiled surface is a single element and, within certain limits, has a certain degree of movement. This characteristic helps the tiling withstand stresses induced by the different degrees of movement between the various layers that make up the system, and provides efficient protection against the risk of tiles lifting or becoming detached from the floor. This reduces, therefore, the risk of compressive forces being generated in the tiling due to small movements in the floor or dimensional instability in the substrate, thus provoking detachment and/or cracking of the tiling.

They allow the amount of filler, or grout, in the joints to be calibrated correctly. This leads to a number of advantages, such as the durability of the grout and its aesthetic, mechanical and functional characteristics.

For these and many other reasons, installing tiles with a wide joint is a requirement of numerous international standards.

Tile joints: the detail that makes all the difference!
International standards

Up until the 1990’s, the situation of international standards covering products for the installation of ceramic tiles and natural stone were extremely complicated and non-uniform. Each European and non-European country had its own set of standards issued by national institutes representing each country. This situation obviously posed serious problems for companies with a vocation for international commerce, such as Mapei. Certifying each product in different countries represented a considerable cost for such companies, and dedicated research teams were required to reproduce the various national test conditions required in our laboratories. Also, there were so many contradictions between the various standards that it would have been necessary to adapt the formulations and products in order to satisfy the minimum requirements for each single country. And what is more, at the beginning of the 1980’s, many national standards were obsolete and no longer relevant to the latest application techniques and the new types of covering materials which were taking a foothold during that period. In order to address this situation, in 1989 CEN, the European Standards Committee, formed a dedicated technical group with the aim of developing a series of standards for tiling adhesives and grouts. Mapei has always taken an extremely proactive and propositional position within this group over the years, taking on the role of Chairman. Up until now the technical group has met a total of 44 times, and in 2001 issued Euronorm EN 12004 regarding the specifications and requirements for tiling adhesives, and in 2002 Euronorm EN 13888 which establishes the specifications and requirements for grouts. Revisions of these standards were published in 2007 and 2009. The European approach was used as a model to create a group within the ISO (International Standard Organisation) 189 committee, dedicated to the standardisation of ceramic tiles. Mapei also played a key role in this activity, with the manager of Mapei Corporation Research & Development, acting as group coordinator. In this case, the group has published the ISO 13007 standard which is dived into 4 parts:

ISO 13007 – 1:
terms, definitions and specifications for adhesives

ISO 13007 – 2:
test methods to determine the characteristics of adhesives

ISO 13007 – 3:
terms, definitions and specifications for grouts

ISO 13007 – 4:
test methods to establish the properties of grouts

ISO 13007 - 1 and ISO 13007 - 3 were published in December 2004, while ISO 13007 – 2 and ISO 13007 – 4 were published in September 2005. The ISO standards were then approved and published by various national institutes.

The advantages deriving from using products on site which comply with ISO standards are obvious and immediate. Firstly, the classifications defined by the standards offer a clear identification of the properties of products so they may then be selected according to the specific application and prevent them being replaced by other products with inferior characteristics. Also, the practice of classifying products has undoubtedly led to more transparency regarding the quality of products available on the market. Classification requirements and their relative testing methods were chosen using simplicity and repeatability as their main criteria. They must also represent characteristics which really reflect the most critical application aspects of the product.
Cementitious grouts

EN 13888
Cementitious grouts in this standard are defined as CG and are divided into two main classes, CG1 and CG2. These are the normal and improved classes respectively, and are followed by special classes: A for products with high abrasion resistance and W for products with low water absorption. A typical class CG1 grout may be considered sufficient for installing ceramic or porcelain tiling not subject to excessive variations in temperature and humidity in residential and commercial environments. For areas subject to prolonged periods of high humidity and thermal shock or intense traffic, on the other hand, conditions typically found in high-intensity commercial and industrial environments, a class CG2 grout is recommended. Even though the standard does not distinguish between normal-setting and rapid-setting grout, it is recommended to use the latter type when surfaces need to be put back into service quickly, for example in retail, airports, public areas, swimming pools, etc.

Class A is required when the area is subject to intense foot or trolley traffic when in service such as in supermarkets, or if there is a continuous flow of water, typical of fountains. W class products, on the other hand, are recommended when the installation is subjected to continuous immersion in water, such as tiling in fountains and swimming pools. In the test carried out as prescribed in the standard (Figures 1 and 2), a 10 x 10 cm sample of the product is subjected to a continuous, constant flow of spheres of abrasive material. At the end of the test, the loss in weight is measured. To measure the risk of cracking due to hygrometric shrinkage in the product, the test prescribed in the standard (Figure 3) measures the amount of movement in a 4 x 1 x 16 cm test sample cured for 28 days. A product with adequate dimensional stability (that is, very little hygrometric shrinkage) may also be used to tile surfaces where the width of the joints varies. Testing is carried out after 28 days and include compressive and flexural strength tests, which are carried out on samples measuring 4 x 4 x 16 cm (Figure 4).

Appropriate products may even be employed without any particular problem for tiled surfaces subject to particularly heavy traffic. Excessive water absorption by the grout may have a disastrous effect on the entire tiled surface if it is subjected to constant immersion in water and tiles become detached. The standard prescribes a test in which the amount of water a product absorbs is estimated by measuring capillary lift. Samples are cured for 28 days, partially immersed in water and their increase in weight is measured after being immersed for 30 minutes and 4 hours (Figure 5). Products with low water absorption may be successfully used even in critical situations, such as mosaic tiles in swimming pools.

Grouts made by Mapei, such as Keracolor FF for joints up to 6 mm wide, Keracolor GG for joints from 4 to 15 mm wide and Ultracolor Plus for joints from 2 to 20 mm wide, are all part of the improved class of grouts CG2WA and, as such, are guaranteed when used in particularly critical site conditions, such as those described above. Apart from being class CG2, Ultracolor Plus is also a fast setting grout, ideal therefore for applications which need to be put back into service quickly with a maximum set to foot traffic time of 3 hours.
DROPEFFECT®

Amongst the added characteristics of Mapei grouts, which are not covered by current standards and which guarantee that they are colour-fast and easy to clean, there is the so-called DropEffect® technology which allows grouted joints to be created which are particularly water repellent. Thanks to this technology, liquids deposited on the surface are not absorbed but remain on the surface in the form of droplets, so joints are much easier to clean.

BIOBLOCK®

In damp environments, on the other hand, BioBlock® technology inhibits the formation and proliferation of various types of mould on the surface of grouted joints, which not only cause an unsightly finish, but also has a negative effect on pollution levels in internal environments and inevitable consequences on the health of final users.

EFFLORESCENCE FREE

Ultracolor Plus also has characteristics which guarantee against the formation of efflorescence, one of the most unsightly defects on ceramic tiling, which forms on both internal and external façades. Figure 6 shows the surface of a product with efflorescence. The classic white streaks are typical of formulas based on the use of Portland cement as a binder. If a thin section of the joint is analysed through a microscope, the type of chemical which forms the efflorescence may be identified on the surface of the product due to the reaction between carbon dioxide contained in the atmosphere and calcium hydroxide produced by hydration of the cement, represented by the thin white superficial line (Figure 7). Further experimental support into the morphologic and chemical study of the efflorescence may be made using an electronic scansion microscope, an instrument which can produce highly magnified images (up to 800,000x magnification) of the surface of the product and assess the exact chemical composition of the surface. Figure 8 shows the images taken using this technique, which are then used to observe how the efflorescence is made up of numerous groups of flat crystals which, upon analysis, are formed by calcium carbonate. The binder in Ultracolor Plus does not contain Portland cement, that is, the source of carbonate, which makes the product completely immune from the formation of efflorescence. Ultracolor Plus, therefore, is an ideal product for colour stability. The aesthetic stability guaranteed by this product obviously does not compromise the characteristics described in the standards, as confirmed by its CG2 classification status. Ultracolor Plus, therefore, is a grout which offers the highest guarantee on site, prevents problems due to mechanical and thermal stresses, anti-aesthetic effects due to instability of the colour and is nowadays a product with unique characteristics which has no rival on the market.
From a standards point of view the issue related to epoxy grouts is relatively simple since the standard specifies only one class (RG), and all epoxy grouting mortars which meet the minimum requirements are in this class.

Specifications for reactive sealants

<table>
<thead>
<tr>
<th>Main characteristics</th>
<th>Requirement</th>
<th>Test method</th>
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</thead>
<tbody>
<tr>
<td>Resistance to abrasion</td>
<td>≤ 250 mm³</td>
<td>EN 12808-2</td>
</tr>
<tr>
<td>Flexural strength after dry storage</td>
<td>≤ 30 N/mm²</td>
<td>EN 12808-3</td>
</tr>
<tr>
<td>Compressive strength after dry storage</td>
<td>≤ 45 N/mm²</td>
<td>EN 12808-3</td>
</tr>
<tr>
<td>Shrinkage</td>
<td>≤ 1.5 mm/m</td>
<td>EN 12808-4</td>
</tr>
<tr>
<td>Water absorption after 240 mins.</td>
<td>≤ 0.1 g</td>
<td>EN 12808-5</td>
</tr>
</tbody>
</table>

Because the values are so high, Euronorm EN 13888 does not have any other sub-classes. All Mapei epoxy grouts are classified RG because they meet all the aforementioned requirements.

Epoxy grouts are normally used when particularly hygienic surfaces are required, or if there are particular strength or chemical resistance requirements. They are particularly suitable, therefore, in industrial environments and in the residential sector in areas such as bathrooms, kitchens, laundry rooms, etc. where total cleanability of the joints is important.

The use of MAPEI epoxy grouts allows floors, walls, worktops, etc. to comply with the HACCP system and the requirements of EC Regulation No. 852/2004 regarding the hygiene of foodstuffs.

Colour

There are no national or international standards which cover this issue related to the aspect of the grout, even if it is one of the main characteristics to take into consideration to meet a client’s requirements.

Mapei grouts (cementitious and epoxy) are available in a wide variety of colours (more than 50 if we consider the various colour ranges) to satisfy even the most demanding client. And if we also consider the addition of MapeGlitter coloured metallic glitter, available in 22 different colours, to Kerapoxy Design (two-component, anti-acid, translucent, decorative epoxy mortar for grouting glass mosaic, ceramic tiles and stone with a highly attractive finish), the number of possible colour combinations is even higher.

The durability and uniformity in colour of MAPEI grouts is guaranteed by their special formulation and the use of pigments which remain stable if subjected to UV rays or other atmospheric phenomena. All our products undergo accelerated ageing tests using a weatherometer (Figure 9), a very useful instrument used to assess the reaction of products exposed to various weather cycles, such as sunlight, rain (including acid rain) and temperature variations.

Before being put on the market, all Mapei grouts are subjected to rigorous quality control tests in compliance with the ISO 9001 system, certification awarded to the company in 1994. A special instrument called spectrophotometer is used to check the colour of cementitious and epoxy grouts before they are put on sale to make sure they comply with Mapei quality standards and that every production batch is the same (Figures 10 and 11).
Emissions

VOC what are they?

We are all aware about the dangers from environmental pollution, and we all know, for example, the damage that benzene from cars can do to our wellbeing.

There is also another type of pollution around us called “INDOOR” pollution. In fact, the quality of the air around us is heavily influenced by all the volatile organic compounds (VOC) emitted from furniture, adhesives and paint. We have all at sometime perceived a strong odour after applying a product, assembling a piece of furniture or painting the walls in our home. And we have all had to open the windows for a certain amount of time in an effort to get rid of that strange smell. Or just cleaning the floors in our home, we sometimes smell strong odours which may irritate us. All these odours are due to the volatility of certain compounds contained in the wood used to make furniture, in varnishes and in detergents. These compounds are called VOC, Volatile Organic Compounds. VOC may be cancerogeneous, such as the benzene emitted by cars, certain types of furniture are well-known for their emission of formaldehyde, while pine wood releases certain substances which have a pleasant smell, but may also be irritating.

How do VOC influence our day to day life in our homes? It is quite thought provoking if we consider that, according to recent studies, the air in even highly polluted cities, such as Athens and Milan, may be less polluted with VOC than the air in our homes. We spend around 90% of our time in closed environments: the home, work, school, cinema,....

It is widely known that most volatile organic compounds can be irritating for our mucous membranes. Many of them have a highly concentrated neuro-toxic action (benzene, toluene, cyclohexane, styrene and chlorines), while others are thought or known to cause cancer (formaldehyde and benzene).

This is why it is so important to guarantee good quality air in the buildings we use by modifying our behaviour and using products which emit the lowest possible amount of volatile organic compounds.

Mapei’s engagement

For more than 10 years, MAPEI’s R&D analysis laboratory has been assessing the eco-sustainability of MAPEI products using techniques prescribed by current standards and instruments which only the best-equipped laboratories have access to. There are currently twelve environmental simulation chambers in MAPEI’s R&D laboratories dedicated to evaluating the VOC content of products for the building industry in compliance with ISO 16000 standards (Indoor Air) (Figure 12).

The product to be tested is placed on a sheet of non-absorbent glass with a defined surface area, weighed and then immediately transferred into one of the environmental simulation chambers available in our laboratory (Figures 13 and 14). The ratio between the area of the sample and the volume of the chamber is very important, in that it simulates the real situation found in an apartment (floor area/room volume ratio).

The temperature and relative humidity in the chambers is tightly controlled (T= 23°C and R.H. =50%), and they are flushed with purified air. The flow of air means that the air in the chamber is completely exchanged every two hours.

After 3 and 28 days, a sample of the air in the chamber is taken using special pumps and cartridges which hold all the VOC. The cartridges are then developed with GC/MS (gas chromatography/mass spectrometry) to obtain a type-quantitative analysis of the VOC present in the air in the chambers.
GEV EMICODE

In order to carry the EMICODE label, a product must be solvent free, must not be labelled as toxic, must have a complete Safety Data Sheet and all the carcinogenic compounds and volatile organic compounds emitted by the product must be measured.

With an environmental simulation chamber, the emission of volatile organic compounds is measured after 3 and 28 days. This parameter is called TVOC (total volatile organic compounds). It is expressed in µg/m³ and is the sum of the concentrations of all the volatile compounds.

After 3 days, the level of carcinogenic compounds must also be measured, such as benzene (limit = 2 µg/m³), formaldehyde (limit = 50 µg/m³) and any residual monomers. After 28 days, on the other hand, the level of semi-volatile compounds is measured, and then all the concentrations are added together. This parameter is called TSVOC (total semi-volatile organic compounds). The semi-volatile compounds are all those high boiling substances, such as certain types of plasticiser, which remain in the environment for a long time and which decrease very slowly. Even though almost all these substances are neither toxic nor harmful to a person’s health, it is just as important to measure their emissions in that they have an effect on the quality of internal air for a very long time.

The following table contains the limits set by GEV to classify a product with the EMICODE label.

| EC 1 PLUS | 750 | 60 / 40 |
| EC 1 | 1000 | 100 / 50 |
| EC 2 | 3000 | 300 / 100 |

EMISSIONS DANS L’AIR INTERIEUR

Since September 2011, there has been a new label in France for construction products. And since September 2011, this label is obligatory for all new products introduced onto the market after that date, and will be extended to include all building products as of September 2013. The “logo sanitaire” label is based on the emissions from a product measured in an environmental simulation chamber 28 days after application. Limits for TVOC and for 11 organic compounds in particular have been set (formaldehyde, acetaldehyde, toluene, tetrachloroethylene, xylene, 1,2,4-trimethylbenzene, 1,4-dichlorobenzene, ethyl benzene, n-butylacetate, 2-butoxyethanol and styrene). Every product checked is then classified, from A+ (very low emissions) to C (high emissions).

Ü MARK GERMAN DIBT

The Ü mark label is obligatory in Germany for all building products used for flooring. This mark, issued by DIBt (Deutsches Institut für Bautechnik), certifies that a product complies (Ü stands for Übereinstimmung which means “compliant”) with the limits set by DIBt for emissions after 3 and 28 days in an environmental simulation chamber. The Ü mark has been obligatory since the 1st of January 2011 for all wood adhesives. This obligation was then extended in January 2012 to include all types of flooring adhesive. The DIBt evaluation scheme established limits for carcinogenic compounds after 3 and 28 days, for TVOC after 3 and 28 days and for TSVOC after 28 days. To receive the Ü mark for a product, the manufacturer must exhibit numerous documents, including the Safety Data Sheets of the finished product and all the raw materials. The product is then tested in an environmental simulation chamber and, if the emissions of VOC comply with the set limits, the obligatory mark is awarded.

M1 FINLAND

The M1 mark, well known in Scandinavian countries, is a voluntary system used to verify emissions from construction products. Since the reference standard is ISO 16000, the emissions test is the same as the one applied for other labels. The M1 mark, however, is not limited to emissions, but also includes testing for odours.

The following table contains a summary of the limits for each class of product of EMISSIONS DANS L’AIR INTERIEUR certification.

<table>
<thead>
<tr>
<th>Class</th>
<th>C</th>
<th>B</th>
<th>A</th>
<th>A+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formaldehyde</td>
<td>&gt; 120</td>
<td>&lt; 120</td>
<td>&lt; 60</td>
<td>&lt; 10</td>
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<tr>
<td>Acetaldehyde</td>
<td>&gt; 400</td>
<td>&lt; 400</td>
<td>&lt; 300</td>
<td>&lt; 200</td>
</tr>
<tr>
<td>Toluene</td>
<td>&gt; 600</td>
<td>&lt; 600</td>
<td>&lt; 450</td>
<td>&lt; 300</td>
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<tr>
<td>Tetrachloroethylene</td>
<td>&gt; 500</td>
<td>&lt; 500</td>
<td>&lt; 350</td>
<td>&lt; 250</td>
</tr>
<tr>
<td>Xylene</td>
<td>&gt; 400</td>
<td>&lt; 400</td>
<td>&lt; 300</td>
<td>&lt; 200</td>
</tr>
<tr>
<td>1,2,4-Trimethylbenzene</td>
<td>&gt; 2000</td>
<td>&lt; 2000</td>
<td>&lt; 1500</td>
<td>&lt; 1000</td>
</tr>
<tr>
<td>1,4-Dichlorobenzene</td>
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<td>&lt; 120</td>
<td>&lt; 90</td>
<td>&lt; 60</td>
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<tr>
<td>Ethylbenzene</td>
<td>&gt; 1500</td>
<td>&lt; 1500</td>
<td>&lt; 1000</td>
<td>&lt; 750</td>
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<tr>
<td>n-Butylacetate</td>
<td>&gt; 10000</td>
<td>&lt; 10000</td>
<td>&lt; 7500</td>
<td>&lt; 4800</td>
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<tr>
<td>2-Butoxyethanol</td>
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<td>&lt; 2000</td>
<td>&lt; 1500</td>
<td>&lt; 1000</td>
</tr>
<tr>
<td>Styrene</td>
<td>&gt; 500</td>
<td>&lt; 500</td>
<td>&lt; 350</td>
<td>&lt; 250</td>
</tr>
<tr>
<td>TVOC</td>
<td>&gt; 2000</td>
<td>&lt; 2000</td>
<td>&lt; 1500</td>
<td>&lt; 1000</td>
</tr>
</tbody>
</table>
LEED general overview

In 1998, the USGBC (United States Green Building Council) introduced the first standard for the LEED Green Building Rating System as a design and construction guide for sustainable buildings. More and more architects and construction companies now require LEED certification as a selling point for their clients. According to the USGBC, LEED (Leadership in Energy and Environmental Design) represents excellence in energy and eco-sustainable design and encourages and accelerates the adoption of building practices and eco-sustainable development on a global scale through the creation and application of performance standards which are universally shared and accepted.

LEED is a voluntary system, based on consent, for the design, construction, and management of high-performance sustainable buildings. The LEED certification system is a standard which is applied in more than 100 countries worldwide.

MAPEI develops LEED-compliant products and systems which meet the requirements of the construction industry by offering readily available support and all the documentation required for building companies that wish to obtain LEED certification for their projects.

Since 2009, GBC Italia has developed a LEED protocol for new builds based on the American model. Numerous countries apply protocols developed by their local Green Building Council based on the American protocol, such as Dubai, Australia, South Africa,…

MAPEI HELPS OBTAIN IMPORTANT CREDITS FOR EACH OF THE PROTOCOLS APPLIED.

How flooring products help earn LEED credits

LEED certification is only applied to the building project itself, and not to the products or services. The products are not certified, but can help obtain award points for LEED certification. The total number of credits obtained earn various levels of LEED certification, with “Platinum” being the best.

MATERIALS AND RESOURCES:
MR CREDIT 4, CONTENT OF RECYCLED MATERIALS

Constructors can contribute 1 LEED point if the content of recycled materials accounts for 10% of the total cost of the material, and 2 points if the content of recycled materials accounts for 20% of the total cost of the material. The points are only awarded if the sum of the content of recycled materials in all the materials used in the project account for at least 10% or 20% of the total value. The content of recycled materials may be from pre-consumption (waste during manufacturing, for example) or post-consumption (waste from consumers). If the content of recycled materials is from pre-consumption waste only, only half of this goes towards the credit points. Kerapoxy Design epoxy mortar from Mapei, for example, contains more than 20% recycled material and, therefore, helps earn 2 credit points.

MATERIALS AND RESOURCES:
MR CREDIT 5, LOCALLY-SOURCED MATERIALS

Materials may help earn 2 points if extracted and manufactured within a radius of 350 km from the site (500 miles for the USA protocol). The LEED standard promotes the use of locally-sourced materials, in that it reduces the impact of transport on the environment. During the construction of a building, the constructor must quantify the percentage of all the locally-sourced materials used in the project: 10 % of the total of materials used earns 1 point, while 20% earns 2 points.

MAPEI Italia has 2 production facilities in strategic positions in the north, centre and south of Italy, and in many cases is able to supply a product within the set distances. Most raw materials are extracted within a radius of 350 km from the production facility. This leads to a saving in fuel costs for transport and reduces the risk of atmospheric pollution from exhaust gases.

MATERIALS WITH LOW LEVELS OF EMISSIONS

The Italian protocol is different to the American version regarding the classification of materials with low levels of emissions. In fact, the American LEED standards includes an assessment method for VOC based on the SCAQMD (South Coast Air Quality Management District) Rule 1168, which is used to calculate VOC content in g/l. For the Italian protocol, on the other hand, low-emission materials are those products which comply with GEV’s EC1/EC1PLUS classification, and the assessment of VOC emissions is expressed in µg/m³. The Italian protocol, therefore, is much more severe than the American version.

ITALIAN PROTOCOL

QI CREDIT 4.1 LOW EMISSION MATERIALS, ADHESIVES, PRIMERS, SEALANTS, CEMENTITIOUS, MATERIALS AND WOOD FINISHES

One LEED point may be earned if all the adhesives, primers, self-leveling products, cementitious products and wood varnishes are classified GEV EMICODE EC1/EC1PLUS. The aim of this credit is to reduce contaminants with an unpleasant smell or that are irritating and/or harmful for the health of installers and end users from inside the building. Mapei has a vast range of products certified EC1 and EC1PLUS that guarantee very low emissions of volatile organic compounds and, as a result, the quality of the air breathed inside the building.

AMERICAN PROTOCOL

IAQ credit 4.1 ADHESIVES AND SEALANTS

All the products must comply with Rule 1168 (California).

It measures the content of VOC in the product, expressed in g/l, and the type of VOC doesn’t matter because this method makes no distinction between toxic, carcinogenic or just an unpleasant odour…
MAPEI and Sustainability

Certified Quality

CE MARKING
All MAPEI adhesives have been awarded CE marking in compliance with Euronorm EN 12004 annex ZA, as prescribed by the current European Directive 89/106/EEC.

EMICODE EC1 PLUS
EMICODE EC1
EMICODE EC1R PLUS
EMICODE EC1R
All MAPEI ECO products are certified and labelled EMICODE EC1 and EMICODE EC1 PLUS “products with very low emission of volatile organic compounds” in compliance with the guidelines issued by GEV (a German body which monitors emissions from construction materials).

GREEN INNOVATION
This logo identifies MAPEI products which, thanks to their various characteristics, help in the design, construction and maintenance of eco-sustainable buildings.

EN 12004
EN 13888
ISO 13007-1
ISO 13007-3
All MAPEI mortars for installing and grouting ceramic tiles and stone conform to Euronorms EN 12004 and EN 13888 and the international standards ISO 13007-1 and 13007-3.

BIOBLOCK
This MAPEI technology impedes the formation and proliferation of various types of mould in damp conditions, and helps create a more hygienic, healthy environment for final users.

DROPEFFECT
MAPEI technology based on the use of special hydrophobising additives, which allows surfaces to be treated that are characterised by high water repellence, their tendency to attract less dirt and excellent durability.

LOGO SANITAIRE - émissions dans l’air intérieur
The sanitaire logo is obligatory in France, and must be applied on all construction products for internal use sold from the 1st of January 2012 (and from 1/9/2013 for products on the market prior to this date). It is similar to the energy efficiency label applied on household appliances, and indicates the class of the product (A+ is the highest and C is the lowest) regarding the emission of volatile organic compounds (VOC). Ref. French Decree n° 2011-321 and successive annexes, with the aim of reducing emissions in buildings to safeguard the quality of indoor air and, as a result, the health of final users.

LEED
LEED is a voluntary system for the design, construction and management of high-performance, sustainable buildings. The LEED certification system indicates the requirements for constructing environmentally sustainable buildings in terms of energy and the consumption of natural resources involved in the construction process. The LEED protocol was created in the USA, and is currently applied in more than 100 countries.

LOGO SANITAIRE - émissions dans l’air intérieur
M1 FINLAND
This mark, widely known in Scandinavian countries in particular, is a voluntary label which assesses both the level of VOC emissions and odours from products.

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In Germany, the Ü mark label is also obligatory for all construction materials for flooring, and is based on a material’s emission of VOC.

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**CERTIFICATION OF GROUTS AND FLEXIBLE JOINTS**

<table>
<thead>
<tr>
<th>GROUTS</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FIX &amp; GROUT BRICK</strong></td>
<td>EN 12004</td>
<td>D2T</td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td><strong>FLEXCOLOR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td><strong>KERACOLOR FF</strong></td>
<td>CG2WA</td>
<td>EC1 R PLUS</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>KERACOLOR GG</strong></td>
<td>CG2WA</td>
<td>EC1 R PLUS</td>
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<td>3 points</td>
</tr>
<tr>
<td><strong>KERACOLOR PPN</strong></td>
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<td></td>
<td></td>
<td></td>
<td>2 points</td>
</tr>
<tr>
<td><strong>KERACOLOR SF</strong></td>
<td>CG2WA</td>
<td>EC1 R PLUS</td>
<td></td>
<td></td>
<td>3 points</td>
</tr>
<tr>
<td><strong>KERAPOXY</strong></td>
<td><strong>EN 12004</strong></td>
<td>R2T</td>
<td>RG</td>
<td>EC1 R PLUS</td>
<td></td>
</tr>
<tr>
<td><strong>KERAPOXY CQ</strong></td>
<td>RG</td>
<td>EC1 R PLUS</td>
<td></td>
<td></td>
<td>2 points</td>
</tr>
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<td><strong>KERAPOXY DESIGN</strong></td>
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<td>R2</td>
<td>RG</td>
<td>EC1 R PLUS</td>
<td></td>
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<tr>
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<td>EC1 R PLUS</td>
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</tr>
<tr>
<td><strong>KERAPOXY P</strong></td>
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<td>EC1 PLUS</td>
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<table>
<thead>
<tr>
<th>FLEXIBLE JOINTS</th>
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<td></td>
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<td>EC1 R</td>
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<tr>
<td><strong>MAPESIL AC</strong></td>
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<td></td>
<td></td>
<td></td>
<td>EC1 PLUS</td>
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</table>

In addition to meeting the requirements of national standards, the fillers for tile joints and elastic joints also comply with certification locally applied in various countries.
## SELECTION CHART

<table>
<thead>
<tr>
<th>TYPE OF COATING MATERIAL</th>
<th>WHERE TO USE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mosaic</td>
</tr>
<tr>
<td>CEMENTITIOUS GROUNTS</td>
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</tr>
<tr>
<td>ULTRACOLOR PLUS</td>
<td></td>
</tr>
<tr>
<td>(joints from 2 to 20 mm)</td>
<td>■</td>
</tr>
<tr>
<td>KERACOLOR SF</td>
<td></td>
</tr>
<tr>
<td>(joints up to 4 mm)</td>
<td>■</td>
</tr>
<tr>
<td>KERACOLOR FF</td>
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</tr>
<tr>
<td>(joints up to 6 mm)</td>
<td>■</td>
</tr>
<tr>
<td>KERACOLOR GG</td>
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<tr>
<td>(joints from 4 to 15 mm)</td>
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<tr>
<td>EPOXY GROU TS</td>
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<tr>
<td>KERAPOXY</td>
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<tr>
<td>(joints of at least 3 mm)</td>
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<tr>
<td>KERAPOXY DESIGN</td>
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<tr>
<td>(joints from 2 to 7 mm)</td>
<td>■</td>
</tr>
<tr>
<td>KERAPOXY P</td>
<td></td>
</tr>
<tr>
<td>KERAPOXY CQ</td>
<td></td>
</tr>
<tr>
<td>KERAPOXY IEG</td>
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</tr>
<tr>
<td>READY-TO-USE PASTE PRODUCT</td>
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<td>FLEXCOLOR</td>
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<tr>
<td>FIX &amp; GROUT BRICK</td>
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<tr>
<td>PRODUCT FOR ARCHITECTONIC STONE FLOORING</td>
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<td>KERACOLOR PPN</td>
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<tr>
<td>MAPESTONE PFS 2</td>
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<td>MAPESTONE PFS PCC 2</td>
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<td>FLEXIBLE JOINTS</td>
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<td>MAPEFLEX PU46</td>
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<tr>
<td>MAPEFLEX PU50SL</td>
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</tr>
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</table>

■ = fit for use  ■ = particularly recommended by Mapei  * = with FUGOLASTIC
<table>
<thead>
<tr>
<th>Tile size (mm)</th>
<th>Joint (mm)</th>
<th>Ultracolor Plus kg/m²</th>
<th>Keracolor SF kg/m²</th>
<th>Keracolor FF kg/m²</th>
<th>Keracolor GG kg/m²</th>
<th>Kerapoxy P kg/m²</th>
<th>Kerapoxy CQ kg/m²</th>
<th>Kerapoxy IEG kg/m²</th>
<th>Flexcolor kg/m²</th>
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</thead>
<tbody>
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<td>1.3</td>
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<td>100x200x6</td>
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<td>250x330x8</td>
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\[ \frac{A+B}{A \times B} \times C \times D \times K = \text{kg/m}^2 \]

**K values:**
- ULTRACOLOR PLUS: 1.6
- KERACOLOR SF: 1.5
- KERACOLOR FF: 1.3
- KERACOLOR GG: 1.6
- KERAPoxy P: 1.6
- KERAPoxy CQ: 1.6
- KERAPoxy IEG: 1.4
- KERAPoxy DESIGN: 1.6
- FLEXCOLOR: 1.6

Reference guide to calculate consumption on www.mapei.it
The table shows the 15 base colours available for **Kerapoxy Design**. All the colours in the **Kerapoxy Design** range may be mixed with gold and silver **MapeGlitter** to create a wider choice of colours.

Due to the printing processes involved, the colours should be taken as merely indicative of the shades of the actual product. For an accurate colour representation, please refer to Mapei “**Coloured Grouts**” samples. Colours can be affected by the surface (where they are used) and the brightness of the environment.