



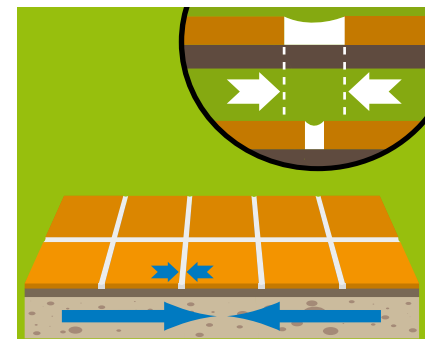
## GROUTING JOINTS

### FUNCTIONS OF A TILE GROUT

The grouting material used in filling tile joints has mainly two distinct functions:

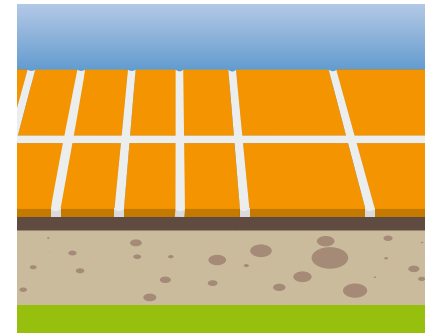
#### Physical function.

- Protects the tile covering and its base against abrasion, and corrosive effects of water and liquid chemicals.
- It compensates the movements and absorbs the stress formed on the covering by thermal and mechanical effects.



#### Decorative function.

- Varying wideness of the joint allows flexibility in covering design.
- It yields a unified outlook of the covering by compensating the size variations of tiles.
- Wall and floor coverings with different formatted tiles are combined by joints.
- Colour options for grouting materials provide decorative fertility.



### EN 13888 STANDARD

EN 13888 Standard identifies the test and performance criteria to classify the grouting materials used in filling tile joints. According to the standard, the grouting materials are classified by their performances.

Tile grouts are categorized according to their chemistry and these categories are abbreviated by letters of the alphabet:

#### **CG** Cement Based

Cement based powder grouting material is mixed with a specific amount of water or some other liquid to use.

#### **RG** Reactive Resin Based

Two or more components of the grouting material (including one component as the resin and one another as the hardener) are mixed in specific amounts to use.

The grouting material in one of the chemistry categories is classified into one the two performance classes according its performance level in defined tests:

Class 1	Class 2
<p>(Normal) <b>Standard Performance</b> grouting material. It validates the minimum required performance level in tests.</p> <p>It is suitable for standard applications requiring no special performance.</p>	<p>(Improved) <b>High Performance</b> grouting material. It validates higher performance levels in comparison to standard performance adhesives.</p> <p>It is suitable for applications with types of works subject to coercive environmental forces requiring special performance.</p>

Primary Technical Performance Requirements	CG1
Abrasion resistance	: < 2000 mm <sup>3</sup>
Bending strength	: ≥ 3,5 MPa (N/mm <sup>2</sup> )
Bending strength (freeze-thaw cycle)	: ≥ 3,5 MPa (N/mm <sup>2</sup> )
Compressive strength	: ≥ 15 MPa (N/mm <sup>2</sup> )
Compressive strength (freeze-thaw cycle)	: ≥ 15 MPa (N/mm <sup>2</sup> )
Shrinkage	: < 2 mm/m
Water absorption (after 30 minutes)	: < 5 gr
Water absorption (after 240 minutes)	: < 10 gr

Additional Technical Performance Requirements (in addition to CG1)	CG2
Extra-high abrasion resistance	: < 1000 mm <sup>3</sup>
Water absorption (after 30 minutes)	: < 2 gr
Water absorption (after 240 minutes)	: < 5 gr

Technical Performance Requirements	RG
Abrasion resistance	: < 250 mm <sup>3</sup>
Bending strength	: ≥ 30 MPa (N/mm <sup>2</sup> )
Compressive strength	: ≥ 45 MPa (N/mm <sup>2</sup> )
Shrinkage	: < 1,5 mm/m
Water absorption (after 240 minutes)	: < 0,1 gr



## REQUIRED - ESSENTIAL FEATURES FOR A TILE GROUT

Below are the features of a grouting material when it is wet, during application and before it hardens:

- **Workability** (easy application and good spreading performance of the grouting material).
- **Water retention capacity** (for sufficient hydration and bonding performance of the cement based grouting material even on high porosity surfaces).
- **Reduced flow** (non-flowing of the grouting material ensuring fast and efficient wall tiling).
- **Wetness capability** (on the substrate and tile back).
- **Sufficient workability time**.

Below are the features of a grouting material after it hardens and completes its curing:

- **High bonding performance** (on the tile and the substrate).
- **High deformability** (the grouting material should absorb the stresses and compensate the movements forming between the substrate and the tiling layer in fluctuating thermal conditions).
- **Reduced water absorption** (water repellent feature and better imperviousness) (reduced coloring and efflorescence risk, improved color stability provided by hydrophobic dispersion additives).
- **Improved abrasion resistance** (robustness) (high resistance to physical effects and chemicals).

## FACTORS AFFECTING TILE GROUT SELECTION

Surface absorptivity of the tile (water permeability).

When the grouting material contacts with tile sides, it engages physically with small irregularities, pores (absorbed by the tile and substrate with capillary forces) etc. in the surface and forms a strong bond when grouting material sets in those pores, resulting in a mechanical keying action to bond.

- Tiles with different formats such as glass, marble, ceramic or porcelain may have different surface absorptivities (water permeability).

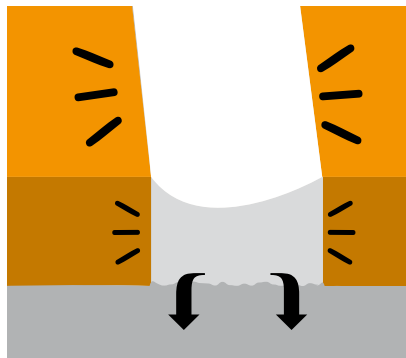
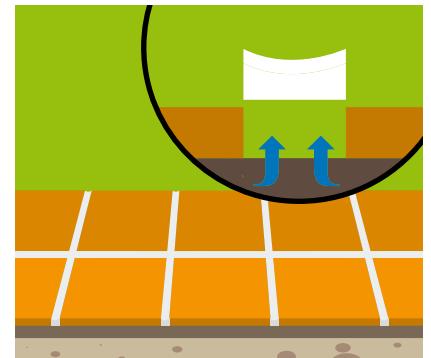
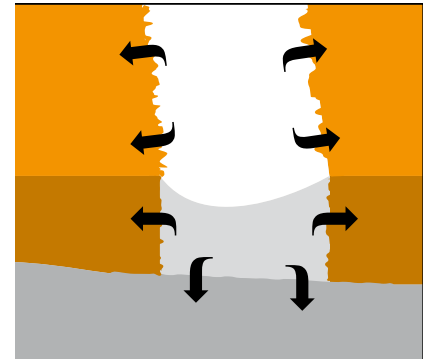
When grouting is done with a low adhering performance grouting material into the joints of impervious tiles, the adherence is much weaker resulting in grouts de-bonding from its base.

- When the covering materials has very low or no absorptivity (such as porcelain or glass), then the standard type grouting materials cannot be absorbed into the material and there is no allowance for a mechanical bonding.

- Impervious tiles may have no irregularities or pores where the grouting material would engage.

- Bonding of the grouting material onto impervious surfaces (of the substrate or tile sides) with a sufficient adherence performance is yielded by chemical additives named polymers (organic resins). Polymers provide the physical bonding of the adhesive.

- To provide improved bonding, tile may be produced with irregularities, pores or roughness on the sides.



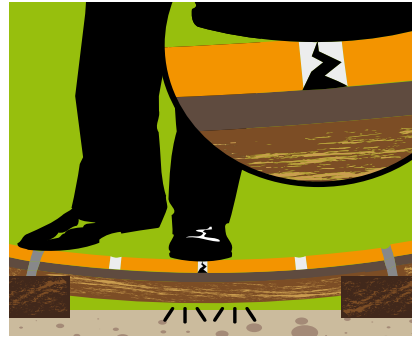
- According to definitions above, standard performance tile grout is suitable with tiles with water absorption rate  $\geq 3\%$  (wall and floor tiles, marble and etc.), whereas high performance tile grout is required for tiles with water absorption rate  $< 3\%$  (glass mosaics, porcelain tiles and etc.). However, if coercive environment forces are subjected after tiling, high performance tile grout should be chosen.

- Reactive resin based tile grout bond with much higher strength into the joint and provide very high technical performance in comparison to cement based tile grout.

## Flexible substrates.

Wooden floors and pannels, gypsum boards may move or flex when exposed to loading (stepped on or pressed), which will cause instability of the covering leading to disbonding and cracking problems. Before tiling application, the loose boards or parts should be replaced, pannels laid on joists or battens should be reinforced and fixed to stabilize.

■ When tiling onto flexible substrates, covering system and the substrate should deflect in conformity according to the load applied. The tile grout should be flexible to absorb the amount of movement or in mismatch joints will either delaminate or crack.

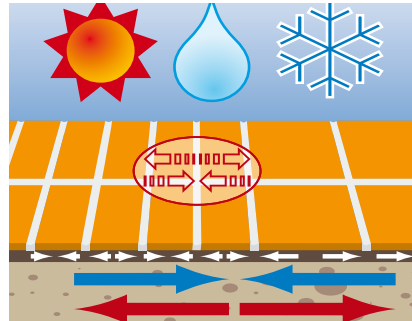
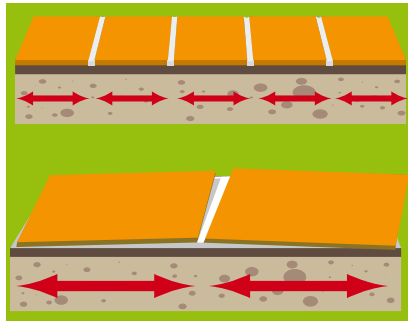


■ High performance tile grouts have flexible character.

## Covering material size and weight.

Deflection and the tension forming between the substrate and covering will be exacerbated across each tile's width for large tiles.

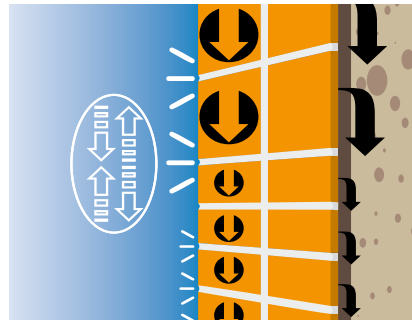
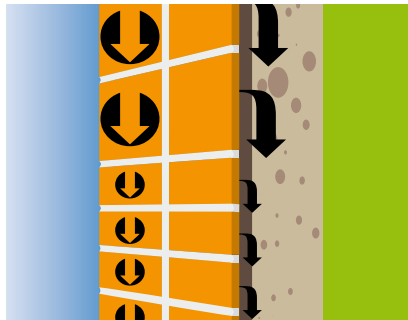
■ When tiling middle and large sized (>33x33 cm) tiles, flexible tile grouts with high performance should be selected to maintain required flexibility to absorb the tension and movement between the tiles.



In vertical tiling applications, tile weight per  $m^2$  is critical.

■ Heavy tiles may sag by gravity effect and squeeze the underlying tile. In a very rigid covering system, the underlying tile may not resist the sagging load of the upper tile and delaminate from the substrate.

■ Large tiles have less joint area to absorb the movements occurring on the covering.

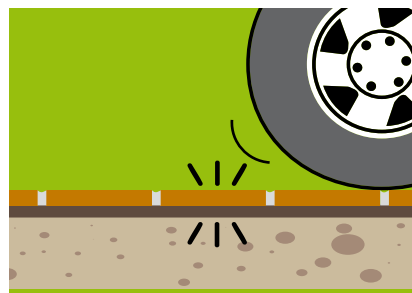
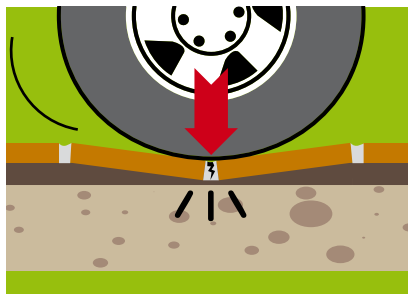


## Area of use.

For areas exposed to light pedestrian traffic, standard performance tile grouts provide the required technical performance.

The floors of public places (hospitals, malls, and public buildings) and industrial areas (factories, warehouses) are exposed to heavy loads such as pedestrian or vehicle traffic. Loads will create pressure and vibration on the covering.

■ The tile grout must be high performance class with flexibility to bear the expected loads the area is subject to.



# GROUTING JOINTS

Any area of the tile grout that has no contact on the substrate and has voids under is vulnerable when subjected to a localized load. These fragile points will let cracks.

■ For the tile grout to correspond the loading homogenously on all along covering area, full filling of the grout joint is required.

In areas such as auto services, food factories, laboratories and etc. where the covering is exposed to various chemicals, epoxy resin based grouts providing very high resistance to chemicals should be used for tile grouting.

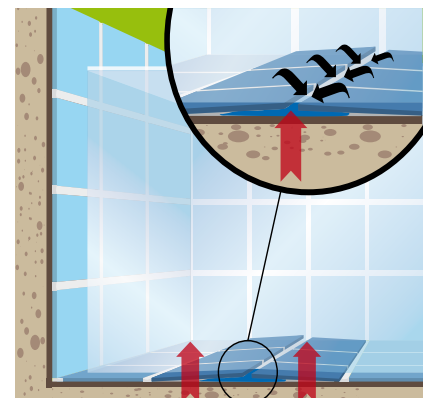
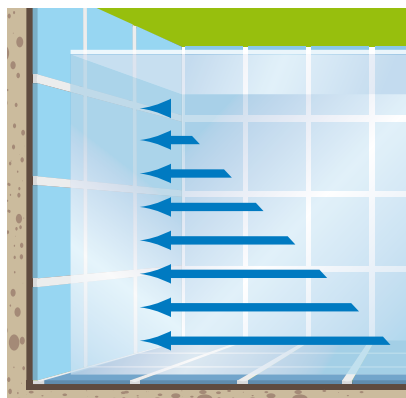
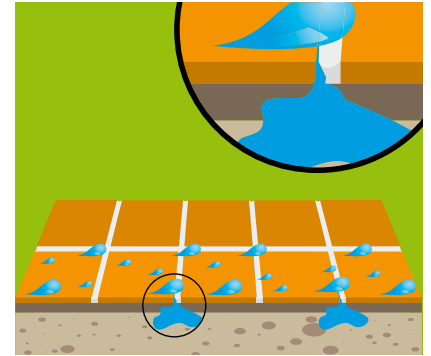
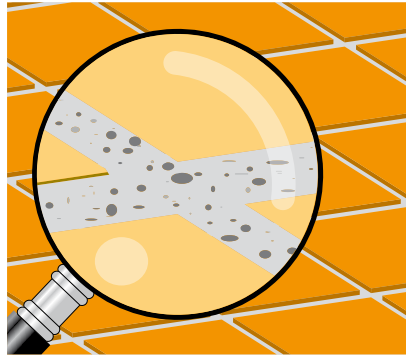
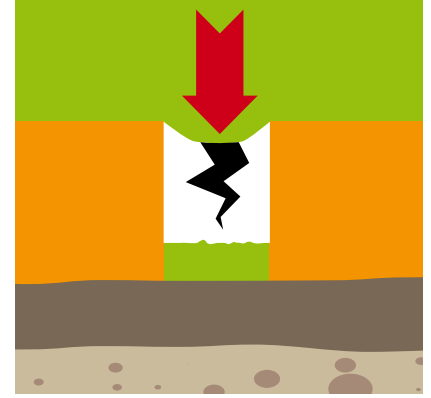
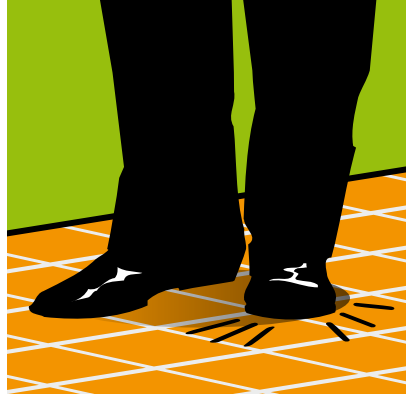
■ If the tile grout do not resist against corrosive effects of the chemicals, it will decompose leaving the coverings base and the substrate open to corrosive effects.

In case of outdoor pool, terrace, balcony and facade tiling, all substrates and covering systems will shrink and expand naturally due to temperature fluctuations and humidity. Particularly, when seasonal temperature changes are severe, shrinkage and expansion will exacerbate. Tile grouts in such applications will also be exposed to the vulnerable and corrosive effects of rain, snow, freeze, UV and etc.

■ The tile grout should be flexible type to absorb the amount of movements with a high performance bonding ability. Additionally, the tile grout should have water repellent property in order to resist the corrosive effects of water. Otherwise, water seeps through the grout cracks under the covering and may freeze in cold weathers. This will cause volume expansion and therefore tension under the covering. Tension may cause delaminating, cracking or deformations of the covering.

In pools and water tanks movements occur due to water pressure varying with weight water.

■ Once the pool or water tank is filled, there will be some movement due to the effect of water pressure on the walls and the overall weight of water in the pool. When the pool is emptied inertial forces will be formed on the pool walls and base. These movements will cause tension in the covering system. The bonding strength of the tile grout must not be affected by the movements caused by opposite forces. If tile grouts crack or blow away from their base under tension, the pool shell will be exposed to the corrosive effects of water.



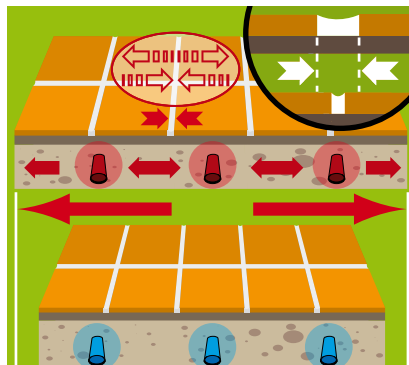
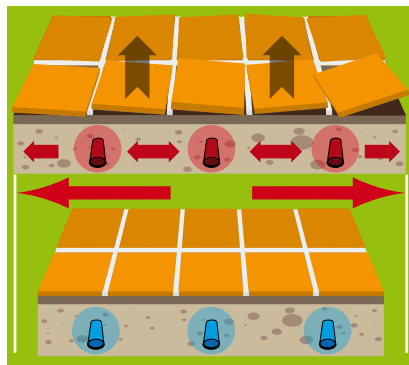
■ Tile grouts particularly developed for pool tiling with high performance, flexibility, water repellency and resistance to pool cleaning chemicals should be selected in pool tiling.

■ Epoxy resin based grouting materials with high resistance to corrosive chemicals and abrasion should be selected particularly in applications of olympic pools (exposed to high water pressure and frequent use of corrosive pool cleaning materials) and pickle production pools (exposed to constant acidic liquid contact) and thermal pools (exposed to very strong thermal effects).



Tiling onto under floor heated systems; the tiles usually have a lower coefficient of thermal expansion. For a given temperature rise tiles will expand less than the substrate and stresses will be formed between the tiles and the substrate. In such a case, the tile grout should absorb the tension and the movements occurring between the tiles. Otherwise, the tiles may delaminate or blow away from their base. Same rule applies for the substrates on heat transmitting systems and insulation applications.

■ In these typical applications, the tile grout should be high performance class providing flexibility enough to work compatible to the movements occurring in the substrate.



## APPLICATION (CG CLASS – SINGLE COMPONENT / CEMENT BASED)

### Surface preparation.

- Grouting should start after the adhesive has set and dried. Instructions of the adhesive producer should be followed. Grouting material's colour may taint due to adhesive's cement content and colour.
- The joints and tile surface must be clean in order to ensure the grouting material bonds properly. Surfaces should be clean and free from dust, dirt, grease or any other contaminating barrier.
- Ensure that the tiles are firm.
- Joints on high porosity substrates or surfaces (ie, gypsum plasters or non-glazed tiles) should be wetted before grouting.
- The surfaces exposed to direct sun light and have a surface temperature above +35 °C must be cooled by damping. If not, early shrinkage causing cracks will occur due to immediate mixing water loss by evaporation.

### Mixing of the grouting material.

CG class - cement based powder grouting material is mixed with a specific amount of water to use.

- Do not add more or less water into the mixture than it is specified on the technical legends on the product packaging or technical data sheets.
- The paste should rest for 5 minutes prior to application and should be applied after remixing.
- Do not add more water than specified to get a fluid form or extend pot life (working time).
- The components are mixed (gradually add powder to the clean water) to a smooth and homogenous paste in a bin.



- For a smooth and homogenous paste, it is recommended to use a low cycled electrical drill-mixer for mixing.
- The paste should be in a consistence such that it does not flow when handled with a trowel.
- The paste should rest for 5 minutes prior to application and should be applied after remixing.

### Application.

Fill the grouting material in the joints completely with a suitable squeegee or a rubber float leaving no voids.

- Remove the excess grouting material immediately using a rubber float moved diagonally (at 45°) across the tiles before it hardens.
- If moved parallel to the tiles the grouting material within the joints may be removed causing a deformed grout surface.
- Work on a small area at a time. Be particular about tiles with soft surface which can be scratched during grouting.



- Always follow the same direction across tiles when applying the grouting material.

## Cleaning.

Time for cleaning the excess grouting material from tile surface is when the grout has started to dry.

■ Time is 10-15 minutes in moderate conditions, but it may vary due to ambient conditions (ambient temperatures, humidity and etc.). Durations will be shortened for applications with inconvenient conditions (due to high ambient temperatures, dry air and strong wind and fixing onto high porosity substrates), and may extend in lower temperatures and/or high humidity conditions, or when grouting impervious or sealed tiles.

■ Exact time may be determined by touching the grouting material. When the material slightly gets on the finger, cleaning phase should start immediately.

■ To clean the tiles use a dampened cleaning pad or sponge. Use only clean and non-chalky water to dampen the pad or sponge.

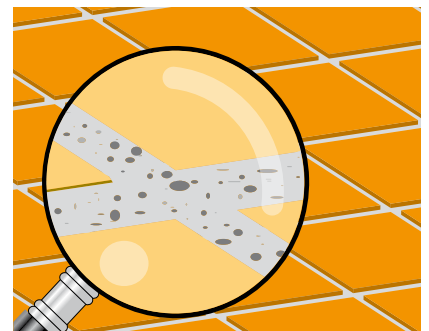
■ Move the pad or sponge diagonally (at 45°) or in circular motion across the tiles in order not to cause any deformations. Continue wiping the tiles until all residues are moved.

■ Wet cleaning will cause the set grout to be weak, discrete holes and grains on grout surface, and surface discolouration and variation which will be more noticeable with darker grouting colours.

■ In case of cleaning earlier or later, yet wet or hardened grout residues may deform the grouts and cause scratches and colour variations on grouts surface.

Final cleaning to remove the grouting material residues should be done when dry (in 1 day at the very latest). The tiles should be cleaned and polished with a clean and dry cloth.

■ The residues on tiles are cleaned gently with the cloth in circular motion. Continue wiping the tiles until all residues are moved.



- If any residues remain after final cleaning, wait for 10 days and treat the tiles with acidic content tile cleaning material to loosen and remove these residues.



#### Precautions.

- Grouted surfaces must be protected for at least 24 hours from direct sun light, frost and rain.
- In hot, dry and windy conditions, wetting the surface of the grouts a few hours after the application will yield a better final product performance.
- To improve the technical performance of the grouting material (improved resistance and flexibility and water repellency features), it is recommended to add performance improving additive into the mixing water.

## APPLICATION (RG CLASS-TWO COMPONENTS/EPOXY RESIN BASED)

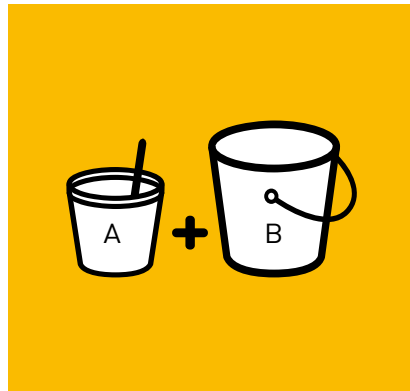
#### Surface preparation.

- Grouting should start after the adhesive has set and dried. Instructions of the adhesive producer should be followed.
- The joints and tile surface must be clean in order to ensure the grouting material bonds properly. Surfaces should be clean and free from dust, dirt, grease or any other contaminating barrier.
- Ensure that the tiles are firm.
- The surfaces exposed to direct sun light and have a surface temperature above +30 °C must be cooled by damping.

#### Mixing of the grouting material.

RG class – epoxy resin based grouting material is prepared by mixing of the two components (Component A – epoxy resin and Component B – hardener) with a specific mixing rate to use.

- Do not add any water or other additives into the mixture than it is specified on the technical legends on the product packaging or technical data sheets, and conform to the mixing rate of the components.
- Do not add more or less of the components than specified to get a fluid form or extend pot life (working time). Do not add water.
- Gradually add the entire hardener component (component B) to the epoxy resin component (component A) in a bin, and mix to a smooth and homogenous paste with a uniform colour for at least 3 minutes.



- For a smooth and homogenous paste, it is recommended to use a low cycled electrical drill-mixer for mixing.
- The paste should be in a consistence such that it does not flow when handled with a trowel.



## Application.

Fill the grouting material in the joints completely and thoroughly with a hard rubber float or steel trowel leaving no voids. Work on a small area at a time.

■ Epoxy grouting material should not be spread on tiles as cement-based products. Once the epoxy hardens, it will be very difficult to remove the material residues on tiles. Besides, this application method will provide savings in quantity and easiness in cleaning.



■ Remove the excess grouting material immediately using a rubber float moved diagonally (at 45°) across the tiles before it hardens. If moved parallel to the tiles the grouting material within the joints may be dragged from the joints causing a deformed grout surface. Always follow the same direction across tiles when applying the grouting material. If the joints are wide, particular care is required.

## Cleaning.

Time for cleaning the excess grouting material from tile surface is when the grout has started to dry. Duration may vary due to ambient temperature (longer in lower temperatures, shorter at higher temperatures).

■ Exact time to start cleaning may be determined by touching the grouting material. When the material slightly gets on the finger, cleaning phase should start immediately.

■ Warm and clean water should be used for cleaning process.

■ Use cleaning pads, particularly designed for epoxy grouting works. As the first phase of cleaning process, select a thick textured pad for rough cleaning. Move the pad in circular motion across the tiles in order not to cause any deformations.

■ In the second phase of cleaning process, select a thin textured pad for smooth cleaning and apply as described above.

■ Final cleaning and rinsing should be done with a damp sponge. Use only clean and non-chalky water to dampen the pads and sponge.

■ Move the sponge diagonally (at 45°) or in circular motion across the tiles in order not to cause any deformations. Continue wiping the tiles until all residues are moved.

■ If any stickiness is felt when touched on the tile surface, repeat final cleaning.



## Precautions.

■ Grouted surfaces must be protected for at least 24 hours from direct sun light, frost and rain.

## PRECAUTIONS

In fixing transparent and light colored tiles and natural stones, particularly when they are highly porous, the covering material may absorb the grouting material. This causes the formation of stains and colourations visible on the covering surface.

■ In fixing porous tiles and natural stones, a sample application should be carried to observe the possibility of the formation of stain and colourations.

The grouting material may be perceived with a different tone of its colour when applied into the joints of tiles with different colour and varying porosity.

■ The grouting material is perceived with a darker and intense tone of its colour when applied into the joints of a lighter coloured and higher porosity covering.

Grouting materials contain colour pigments which activate with mixing.

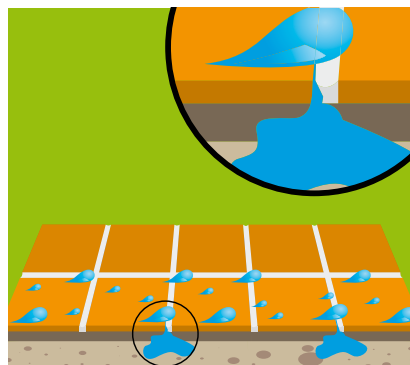
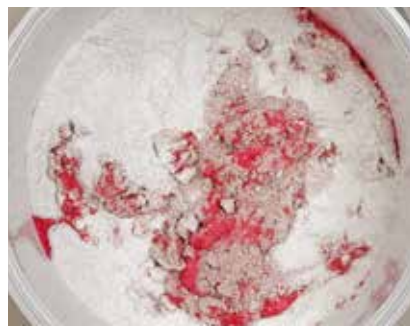
■ For powder (cement based) grouting materials; the colour of the powder form may be in very light colours than the expected final colour.

Cementitious grouting materials, particularly high performance class products, have improved water repellency but not absolutely impermeable.

■ Before tiling and grouting wet areas (bathroom, shower, etc.), it is recommended to apply water proofing first.

Before tiling applications in industrial floors, auto services, food factories and etc. the acid and alkali content of the conditions the covering will be exposed to should be determined thoroughly. The chemicals contacting with tile grouts may have hazardous effect, and a pre-testing of grout resistant should be held. Particularly, in tiling application in milk and dairy product factories, it is recommended to consult grouting material producer for technical advice.

■ Common cleaning materials like bleach, lime remover and etc. may cause surface discolouration and colour variation. Cleaning of tile grouts should be done with appropriate materials.



When components of the grouting material does not mix homogenously and with specified mixing rates, the final grout performance will fail, and therefore, the grout will easily be removed from its joint.

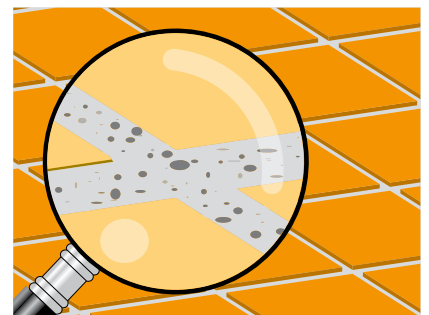
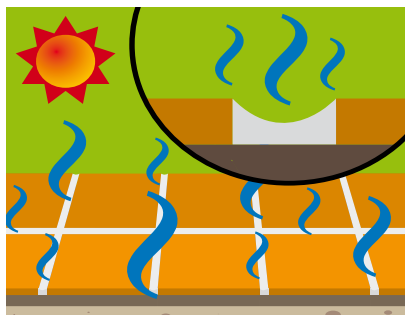
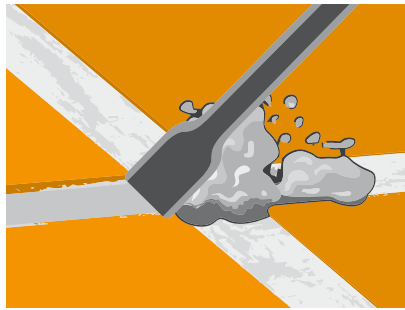
■ In the case discussed above, the tile grout will not have the expected colour performance while forming discolouration and colour variation along grouts.

Expansion joints should be incorporated to allow for slight movements due to changes in temperature, humidity and thermal and mechanical loads formed on the surface and substrate. Expansion joints should be provided considering heat transmitting systems and insulation applications, floors exposed to heavy traffic and pedestrian loads, wide-ness of the area, where tiling meets other materials, along all internal corners, existing movement joints or changes in background material.

■ Expansion joints should be insulated by using proper profiles or mastics. CG or RG class grouting materials are not appropriate for expansion joints.

If cement based grouting material is mixed with more mixing water than it is specified, sudden and severe drying of the mixing water is possible, particularly in hot and dry conditions.

■ Discrete holes and grains will form on the grout surfaces exposed to the drying effect described above.



## Efflorescence effect.

In case of a false grouting application of the cement based grouting material, discrete holes and grains on grout surface, and surface discolouration and variation which will be more noticeable with darker grouting colours will form.

■ As the excessive mixing water of the grout or adhesive will dry through the grout, the water will carry dissolved salts (as by product of the hydration process of cement and water) and cause a white deposit on the surface of the grout, known as efflorescence (whitening)

The efflorescence effect may exacerbate with increased amount of the drying water.

■ Efflorescence can sometimes happen anyway but chances are increased if more water is dried through the grout. If the joints are grouted before the drying of the adhesive is complete, water will be trapped. Trapped water will increase drying water amount.

■ Wet grouting material mixed with more water than specified, using a wet sponge for cleaning in grouting application or exposing of the grout surface to water very soon after application, all these conditions will increase the amount of water dried. Thus, possibly the efflorescence effect will be exacerbated.

