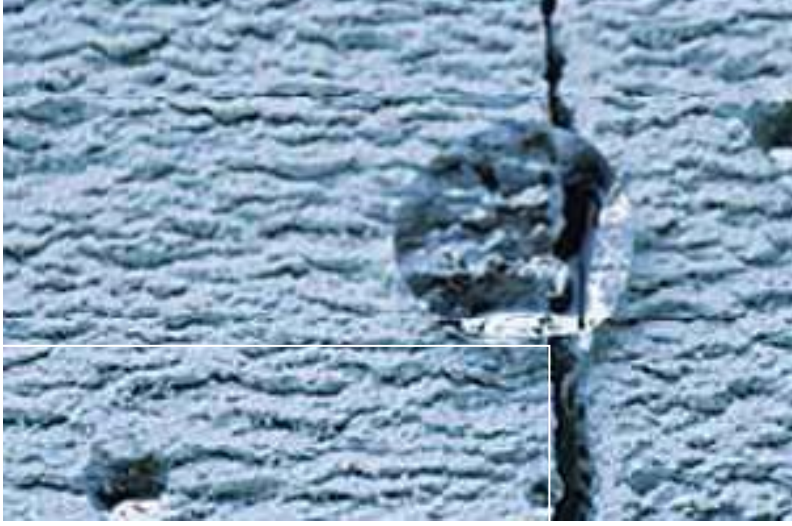
Cool Barrier Concrete P

Effective Protection through Water-Repellent Treatment and NOx Removal Performances

Moisture and heat is always a culprit in damage to masonry. Even cement based building structures can be brought to their knees. Water also acts as an undesirable transport medium for aggressive substances, such as the chloride ions. On the other hand, urban pollution changes the aesthetic value of the building, decreases the durability of the materials and influences the intensity of the whole construction. A trustworthy way to afford a reliable protection of building's masonry and roofing materials is to use Concrete P product that prevents water from being absorbed in the first place and transforms harmful pollutants into harmless residues.

Cool Barrier Concrete P



Freeze/Thaw Cycles And Sea Salt Attack Concrete

Structural damages always involve moisture. Although water is important in making concrete, it can also be destructive. Furthermore, it carries aggressive substances such as chloride ions from road salts into the concrete. Water is also a reaction medium and partner for destructive chemical processes that particularly attack the reinforcement steel by corrosion.

Concrete Absorbs Water

When concrete and other mineral building materials come into contact with water, they absorb an amount which depends on their porosity. This contributes to the following forms of damage:

Typical Structural Damage

- Concrete destruction by corrosion of the reinforcing steel (chloride induced)
- Chemical corrosion, e.g. binder trans-formation by acidic gases (SO, NO_2, CO_2)
- Cracks by swelling and shrinkage
- Frost damage and freeze/thaw damage by road salts
- Efflorescence and salt damage by hydration and crystallization
- Lime leaching
- Rust stains
- Dirt pick-up and stains
- Fungal, moss, lichen and algal growth
- Impaired thermal insulation

LONG LASTING PROTECTION FOR BUILDING'S FABRIC

Cool Barrier Concrete P is based on a solventless silicone microemulsion concentrate of silanes and siloxanes and on a special photocatalytic Titanium Dioxide useful to obtain a high photocatalytic effect, such to make the treated surfaces self-cleaning, water-repellent and NOx eating.

The mechanisms of water uptake by building materials are as varied as the possible forms of damage to the building.

When mineral building materials come into contact with water, they absorb an amount which depends on their porosity. The result is various forms of damage. Many of these forms of damage can be prevented, or at least reduced or kept at bay for longer, by means of impregnation. Creation of a water-repellent zone considerably reduces the uptake of water and aggressive substances; the masonry remains dryer, and is consequently less prone to the kinds of damage referred to above.

However, this is only true of capillary water uptake, which is the “natural” water uptake by building materials when they come into contact with water – when a facade is exposed to rain, for example. There are various mechanisms of water absorption other than capillary water uptake, and these include condensation, capillary condensation, and hygroscopic water uptake.

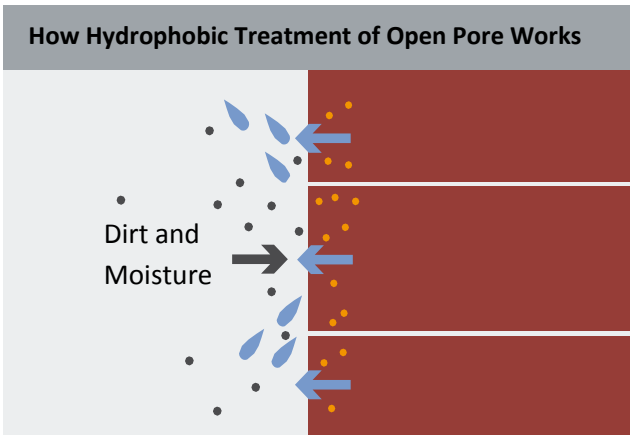
Cool Barrier Concrete P is a 10% silane/siloxane emulsion, general-purpose water repellent, that is already diluted with water to suit the consistency of the substrate in question. Before the emulsion is applied, it is advisable to stir it briefly so as to ensure that it is homogeneous.

Cool Barrier Concrete P rapidly confers discernible water repellency on the building material, although the active agent takes a few days to some weeks to form completely. The exact length of time will depend on the alkalinity of the substrate. Since the emulsion breaks once it has been applied, and there is a pronounced beading effect as soon as the water has evaporated, the amount of active agent leached out by rain during the relatively long curing period is negligible.

Stone fabric damaged by the effects of salt and moisture.

Algal growth on exposed construction elements with a high moisture content.

Stone dirt pick up by the effects of atmospheric pollution.



Cool Barrier Concrete P protects against water, salts and grime. Water vapor can escape despite the water-repellent hydrophobic impregnating agent.

Make Water and Dirt Simply Roll Off

Hydrophobic impregnation with **Concrete P** causes construction materials to repel water yet remain open to diffusion, there-by allowing them to breathe. The result is that water simply rolls off the surface, and water vapor escapes unhindered. This allows any existing damp areas to dry out, which also maintains the material's aesthetic appearance clean and enhances ability to insulate.

✓ Long-Lasting Roof Tiles

Hydrophobic roof tiles with **Concrete P** effectively prevent salt efflorescence and prolong the lifetime of tiles.

✓ Attractive Facades

Facing bricks treated with **Concrete P** stay clean for a long time. **Concrete P** allows mortar residue to be easily removed and prevents salt efflorescence. Furthermore, it slows algal growth as well as dirt pickup.

✓ Clean Floor Tiles

Both internal and external salts can easily efflorese from unsintered, unglazed floor tiles and flowerpots. Water repellent hydrophobic impregnation with **Concrete P** stops this process for good and makes cleaning easier.

RESOURCES ARE NOT INEXHAUSTIBLE

Energy efficiency is on the world's agenda. Bricks and other heavy clay ceramics need to be fired at high temperatures to reduce the amount of water they take up, and render them frost-resistant.

Methods for manufacturing bricks at a lower firing temperature to save energy result in a more open-pored structure. This causes greater water absorption, which can be offset with **CONCRETE P**.

Furthermore, thermal insulation, an issue closely associated with energy efficiency, can only be satisfactorily achieved by applying a water-repellent, impregnating agent.

After all, optimum thermal insulation requires dry masonry. Five percent moisture content is enough to the insulating ability by as much as 60 percent.

Concrete P Means:

- **Durability**
- **Attractive appearance**
- **Thermal insulation**
- **Energy efficiency**

New Functionalities to Improve Air Quality

Photocatalysis is a natural reaction occurring in presence of light, water and oxygen. The reaction is accelerated by a catalyst (Titanium dioxide – TiO2) and it is activated by the energy of the UV light ("photo"). When the treated with Concrete P surface is exposed to UV light, electron-hole pairs are generated, facilitating reduction and oxidation reaction through the formation of adsorbed free radicals on Concrete P surface. These radicals are extremely highly reactive species, capable to degrade the pollutants hitting or absorbed onto the photocatalytic surface: the reaction of degradation converts harmful materials, such as nitrogen oxides, sulphur oxides, VOC (volatile organic compounds) into harmless substances.

The catalyst used in the formulation of Concrete P is not consumed by this reaction, ensuring a continuous process during the service life of a photocatalytic surface.

Concrete P has the following features:

High photocatalytic action which guarantees:

- an excellent self-cleaning action of the treated surface
- a remarkable reduction of pollutants such as NOx and SOx
- anti-algae and fungi resistance

Focus on NOx

Nitrogen dioxide (NO_2) is a reactive gas that is mainly formed by oxidation of Nitrogen Monoxide. High temperature combustion processes (e.g. those occurring in car engines and power plants) are the major sources of nitrogen oxides, NOx. A small part is directly emitted as NO_2, typically 5–10% for most combustion sources, with the exception of diesel vehicles. There are clear indications that for traffic emissions, the direct NO_2 component is increasing significantly due to increased penetration of diesel vehicles, especially newer diesel vehicles. Such vehicles can emit up to 50% of their NOx as NO_2 because their exhaust after treatment systems increase the direct NO_2 emissions.

Effects on Human Health

Negative health effects can be seen as a result of short-term exposure to NO_2 (e.g. changes in lung function in sensitive population groups) and long-term exposure (e.g. increased susceptibility to respiratory infection). Epidemiological studies have shown that diseases such as bronchitis in asthmatic children increase in association with long-term exposure to NO_2. Reduced lung function is also linked to NO_2 at concentrations.

It should be noted that as NO_2 is highly correlated with other pollutants (in particular PM) and it is difficult to differentiate the effects of nitrogen dioxide from those of other pollutants in epidemiological studies. Nitrogen compounds have acidifying effects but are also important nutrients. Excess deposition of atmospheric nitrogen can lead to a surplus of nutrient N in ecosystems, causing eutrophication (nutrient oversupply) in terrestrial and aquatic ecosystems. Excess nitrogen supply can lead to changes in unique terrestrial, aquatic or marine animal and plant communities, including biodiversity loss.

Nitrogen oxides play a major role in the formation of ozone. They also contribute to the formation of secondary inorganic aerosols, through nitrate formation, contributing to PM_{10} and $PM_{2.5}$ concentrations.

Concrete P

Table 1 shows, the Concrete P agent reduced the water vapor permeability by less than 10 %.

Table 1				
Mortar slabs	Dilution	Agent absorption [g/m^2]	Weight loss [g/d]	Water-vapor permeability [g/m^{2}d]
Untreated	-	-	0.70	110.6
Concrete P	No	480	0.65	102.3

The Effectiveness of Concrete P: Water Absorption

Table 2 below shows test results for water uptake, beading and penetration depth of Concrete P applied to different substrates. All substrates were impregnated by means of immersion (immersion times: 1 minute for mortar and concrete, 5 minutes for all other substrates). Water absorption was determined 14 days after impregnation, again by way of immersion (specimens were covered with 5 cm of water, in accordance with EN 12859). To determine the penetration depth, a specimen of each product was broken 14 days after Impregnation and dyed water was dripped onto the fracture surface.

Table 2				
Sand-lime brick	**Dilution**	**Absorption [g/cm^2]**	**Penetration depth [mm]**	**Water absorption [%] 24h**
Untreated	-	-	-	12.9
Concrete P	No	557	0.5-2	1.0
Brick		Absorption [g/cm^2]	Penetration depth [mm]	Water absorption [%] 24h
Untreated	-	-	-	18.2
Concrete P	No	1669	32-48	0.50
Clinker-brick		Absorption [g/cm^2]	Penetration depth [mm]	Water absorption [%] 24h
Untreated	-	-	-	2.6
Concrete P	No	124	4-9	0.13
Yellow Sandstone		Absorption [g/cm^2]	Penetration depth [mm]	Water absorption [%] 24h
Untreated	-	-	-	5.8
Concrete P	No	311	1.5-5	2.7
Concrete (grade C30/37)		Absorption [g/cm^2]	Penetration depth [mm]	Water absorption [%] 28d
Untreated	-	-	-	3,6
Concrete P	No	76	1-2	2.4

The Effectiveness of Concrete P: NOx Removal

Concrete P was applied on red concrete sample against NOx. The measurement results are presented in Fig. 1: The NOx concentration removal exceeds the 0, 40 ppm.

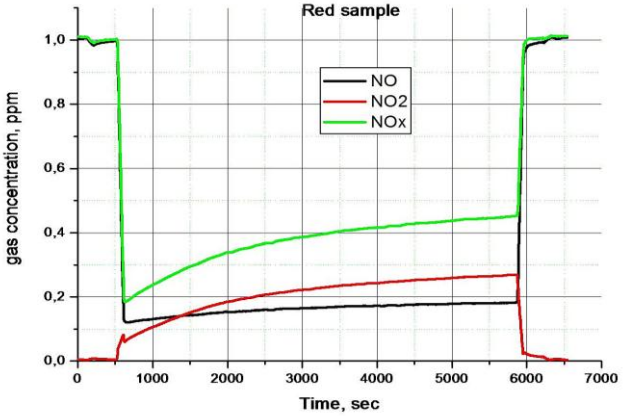


Figure 1. NOx Removal Test according to ISO 22197-1

Product description

Cool Barrier Concrete P is a solventless emulsion, based on a mixture of silane and siloxane. Cool Barrier Concrete P serve as high quality, general-purpose water repellents for impregnating and priming mineral surfaces.

Properties

Cool Barrier Concrete P emulsion contains a stabilized mixture of silanes and siloxanes that are susceptible to hydrolysis. Hydrolysis occurs only after application to the substrate, which breaks the emulsion. Alcohol is released and the emulsion is converted into a silicone resin water repellent.

Cool Barrier Concrete P reduces the capillary absorption of the building which it has penetrated, but does not clog pores or capillaries. There is therefore little or no impairment of the building material´s ability to "breathe".

Special features

- good depth of penetration
- resistance to alkalis
- rapid development of water repellency
- provides good adhesion for paints
- water-based and environmentally compatible
- stable in storage, even when diluted

Application

Cool Barrier Concrete P is excellent water repellent for many absorbent mineral substrates, such as bricks, sand-lime brick, natural sandstone and mineral plasters. It is suitable also for less absorbent, dense natural stone, especially limestone, marble and reinforced concrete for bridges and roads.

General

Owing to its aqueous consistency and storage stability Cool Barrier Concrete P is ideal for in-plant impregnation of building materials made of clay, aerated concrete, sand-lime brick, fibrous cement, mineral fibers and lightweight aggregate.

Processing

Apply the ready-to-use solution in the usual way; flooding is the preferred way. Two "wet on wet" coats are needed to ensure complete coverage. Owing to the content of wetting agent in Cool Barrier Concrete P re-impregnation at a later date does not present any difficulties. If it starts to rain, stop treatment and cover the impregnated areas.

CAUTION

- **Cool Barrier Concrete P should always be applied under trial because it can change the colour aspect of the surface.**

Storage

The 'Best use before end' date of each batch is shown on the product label.
Storage beyond the date specified on the label does not necessarily mean that the product is no longer usable. In this case however, the properties required for the intended use must be checked for quality assurance reasons.
Cool Barrier Concrete P contains minor amounts of a preservative that protects the emulsion against microbial contamination and fungal attack.

Safety notes

Comprehensive instructions are given in the corresponding Material Safety Data Sheet.

Product data*

Appearance: Clear to milky		
Active substance content, approx.	[wt %]	10
Density at 25 °C, approx.	[g/cm³]	0.95
Viscosity, dynamic at 25 approx.	[°C]	12 mPa s

*These figures are intended as a guide and should not be used in preparing specifications.

Applications	Cool Barrier Concrete P
Sandstone	■
Sand-lime brick	■ ■ ■
Porous limestone	■
Marble	
Granite	■
Brick and Unglazed Tiles	■ ■ ■
Mineral plaster	■ ■ ■
Concrete	■ ■
Reinforced Concrete	■
■ Sutable ■ ■ Highly Suitable ■ ■ ■ Very Highly Suitable	

The figure quoted below is intended as an application guide only.
Field tests are necessary for the determination of the exact needed quantities

Material	Cool Barrier Concrete P lit/m^2
Concrete	[l/m²] 0.25 – 0.5
Plaster	[l/m²] 0.25 – 0,3
Sand-lime brick	[l/m²] 0.25 – 0.4
Brickwork	[l/m²] 0.25 – 0,3
Unglazed Ceramic Tiles	[l/m²] 0.30 – 0,5
Natural stone	[l/m²] 0.05 – 1.0

NOTE:

The data presented in this leaflet are in accordance with the present state of our knowledge, but do not absolve the user from carefully checking all supplies immediately on receipt. We reserve the right to alter product constants within the scope of technical progress or new developments.
The recommendations made in this leaflet should be checked by preliminary trials because of conditions during processing over which we have no control, especially where other companies' raw materials are also being used.
The recommendations do not absolve the user from the obligation of investigating the possibility of infringement of third parties' rights and, if necessary, clarifying the position. Recommendations for use do not constitute a warranty, either express or implied, of the fitness or suitability of the products for a particular purpose.