SMARTSYSTEM SOLUTIONS

System data sheet
Edition September 2020

PCI® Für Bau-Profis

System for Concrete Repair

Multi-use system for the refurbishment of concrete with structural requirements

Brief description:
Multi-use system for the refurbishment of concrete with structural requirements such as balconies and stairs.

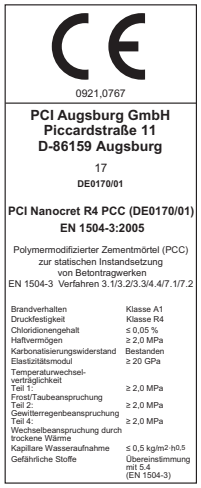
System benefits:
- Harmonized products
- Simple, convenient handling

Worksteps	Products
Corrosion protection	1 **PCI Legaran® RP / PCI Nanocret® AP** Corrosion protection for bridges and civil engineering structures to Rili SIB
Repair mortar	2 **PCI Nanocret® R4 Rapid** Fast-acting repair mortar for concrete structures or **PCI Nanocret® R4 PCC** Heavy-duty repair mortar for concrete structures on floors, walls and overhead application
Fairing coat for surfaces	3 **PCI Nanocret® FC** Fiber-reinforced concrete smoothing compound for walls and soffits or **PCI Barrafill® L** Cementitious fairing coat for concrete wall surfaces
Surface protection	4 **PCI Polyflex®** Flexible surface protection for facades and civil engineering structures or **PCI Betonfinish® W** Surface protection for facades and civil engineering structures

Concrete refurbishment – codes of practice applicable in combination with EN 1504

EN 1504

European standard EN 1504 ”Products and systems for the protection and repair of concrete structures” lays down the requirements applicable to concrete refurbishment products and contains recommendations concerning the planning, performance and supervision of the work concerned. The transposition of EN 1504 into national standards and the introduction of supplementary rules for the performance of work ensures that concrete refurbishment work is always performed to constantly high quality levels. The CE mark based on the standard lays the foundation for the sale of products. Supplementary national codes and standards covering additional requirements for products and work must also be taken into consideration.



CE

0921,0767

PCI Augsburg GmbH
Piccardstraße 11
D-86159 Augsburg

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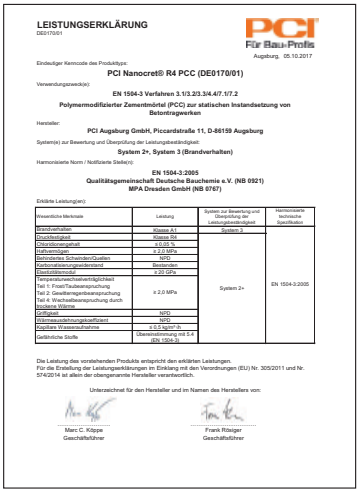
DE0170/01

PCI Nanocret R4 PCC (DE0170/01)
EN 1504-3:2005

Polymermodifizierter Zementmörtel (PCC) zur statischen Instandsetzung von Betontragwerken
EN 1504-3 Verfahren 3.1/3.2/3.3/4.4/7.1/7.2

Brandverhalten	Klasse A1
Druckfestigkeit	Klasse R4
Chloridionengehalt	≤ 0,05 %
Haftvermögen	≥ 2,0 MPa
Karbonatisierungswiderstand	Bestanden
Elastizitätsmodul	≥ 20 GPa
Temperaturwechsel-verträglichkeit Teil 1: Frost/Taubeanspruchung	≥ 2,0 MPa
Teil 2: Gewitterregenbeanspruchung	≥ 2,0 MPa
Teil 4: Wechselbeanspruchung durch trockene Wärme	≥ 2,0 MPa
Kapillare Wasseraufnahme	≤ 0,5 kg/m2·h0,5
Gefährliche Stoffe	Übereinstimmung mit 5.4 (EN 1504-3)



LEISTUNGSERKLÄRUNG
DE0170/01

PCI
Für Bau-Profis

Augsburg, 05.10.2017

Eindeutiger Kenncode des Produkttyps:
PCI Nanocret® R4 PCC (DE0170/01)

Verwendungszweck(e):
EN 1504-3 Verfahren 3.1/3.2/3.3/4.4/7.1/7.2
Polymermodifizierter Zementmörtel (PCC) zur statischen Instandsetzung von Betontragwerken

Hersteller:
PCI Augsburg GmbH, Piccardstraße 11, D-86159 Augsburg

System(e) zur Bewertung und Überprüfung der Leistungsbeständigkeit:
System 2+, System 3 (Brandverhalten)

Harmonisierte Norm / Notifizierte Stelle(n):
EN 1504-3:2005
Qualitätsgemeinschaft Deutsche Bauchemie e.V. (NB 0921)
MPA Dresden GmbH (NB 0767)

Erklärte Leistung(en):

Wesentliche Merkmale	Leistung	System zur Bewertung und Überprüfung der Leistungsbeständigkeit	Harmonisierte technische Spezifikation
Brandverhalten	Klasse A1	System 3	EN 1504-3:2005
Druckfestigkeit	Klasse R4	System 2+	
Chloridionengehalt	≤ 0,05 %		
Haftvermögen	≥ 2,0 MPa		
Betonstatus Schwinden/Quellen	NPD		
Karbonatisierungswiderstand	Bestanden		
Elastizitätsmodul	≥ 20 GPa		
Temperaturwechselbeständigkeit Teil 1: Frost/Taubeanspruchung Teil 2: Gewitterregenbeanspruchung Teil 4: Wechselbeanspruchung durch trockene Wärme	≥ 2,0 MPa		
Griffigkeit	NPD		
Wärmeausdehnungskoeffizient	NPD		
Kapillare Wasseraufnahme	≤ 0,5 kg/m²·h		
Gefährliche Stoffe	Übereinstimmung mit 5.4 (EN 1504-3)		

Die Leistung des vorstehenden Produkts entspricht den erklärten Leistungen.
Für die Erstellung der Leistungserklärungen im Einklang mit den Verordnungen (EU) Nr. 305/2011 und Nr. 574/2014 ist allein der obengenannte Hersteller verantwortlich.

Unterzeichnet für den Hersteller und im Namen des Herstellers von:

Marc C. Köppe
Geschäftsführer

Frank Rösiger
Geschäftsführer

GERMANY

In Germany, concrete repair work is subject to the following 3 national codes of practice:

DAfStb code of practice ”Protection and Repair of Concrete Structural Elements”

This Code of Practice, also referred to as ”Rili StB”, applies to all concrete structures to be repaired. The code of practice states requirements in areas including the planning, performance and monitoring of protection and repair work.

ZTV-ING

This code of practice was issued by the German Federal Highway Research Institute and lays down requirements for concrete repair work on industrial and traffic structures owned by the federal government.

ZTV-W

This guideline was issued by the German Federal Institute for Hydraulic Engineering and describes the repair of the concrete components of federal hydraulic structures.

SWITZERLAND

In Switzerland, the CIVIL WORKS DEPARTMENT of the Canton of Graubünden states more stringent requirements for repair products in addition to SN EN 1504. The products that have been tested and approved are published in an Internet list. This list is regarded as an additional seal of quality in Switzerland.

AUSTRIA

The national code ”Maintenance and repair of concrete and reinforced concrete structures” lays down requirements for repair work on the basis of ÖNORM EN 1504. The ÖBV seal of approval confirms compliance with the requirements stated in the ÖBV code. A list of specialist companies and approved products for repairs to concrete and reinforced concrete structures is provided in the form of a database. Since 2012, information on the certified mode of application (h = manual, m = mechanical”) has also been provided.

Fitness for purpose of system with respect to the principles and methods stated in EN 1504

Part 9 of EN 1504 states the basic principles which are to be applied either separately or in combination for the protection or repair of concrete supporting structures. Protection and repair principles must be selected to avoid or stabilize damaging processes within the concrete or on reinforcement steel. The following products of the system are relevant for these applications.

Principle and definition	Procedure	D	A	CH	Recommended products
Principle 1 Protection against the ingress of adverse agents, e.g. water, other liquids, vapor, gas, chemicals and biological agents	1.1 Hydrophobic impregnation		X	X	PCI Silconal® 303
			X	X	PCI Silconal® 328/329
	1.3 Surface coating with and without crack-bridging properties	X	X	X	PCI Betonfinish W, PCI Polyflex®, PCI Barraseal® Turbo
Principle 2 Adjusting the moisture content in the concrete	2.1 Hydrophobic impregnation		X	X	PCI Silconal® 303
			X	X	PCI Silconal® 328/329
	2.2 Surface coating	X	X	X	PCI Betonfinish W, PCI Polyflex®, PCI Barraseal® Turbo
Princple 3 Concrete restoration • with respect to shape and function • by partial replacement	3.1 Manual application of mortar	X	X	X	PCI Nanocret® R4/R3/R2/FC/R4 PCC/ R4 SM/R4 Fluid, PCI Barrafil® L
	3.3 Application of concrete or mortar	X	X	X	PCI Nanocret® FC
Principle 8 Increasing resistivity	8.2 Sealing	X	X	X	PCI Betonfinish W, PCI Polyflex®, PCI Barraseal® Turbo

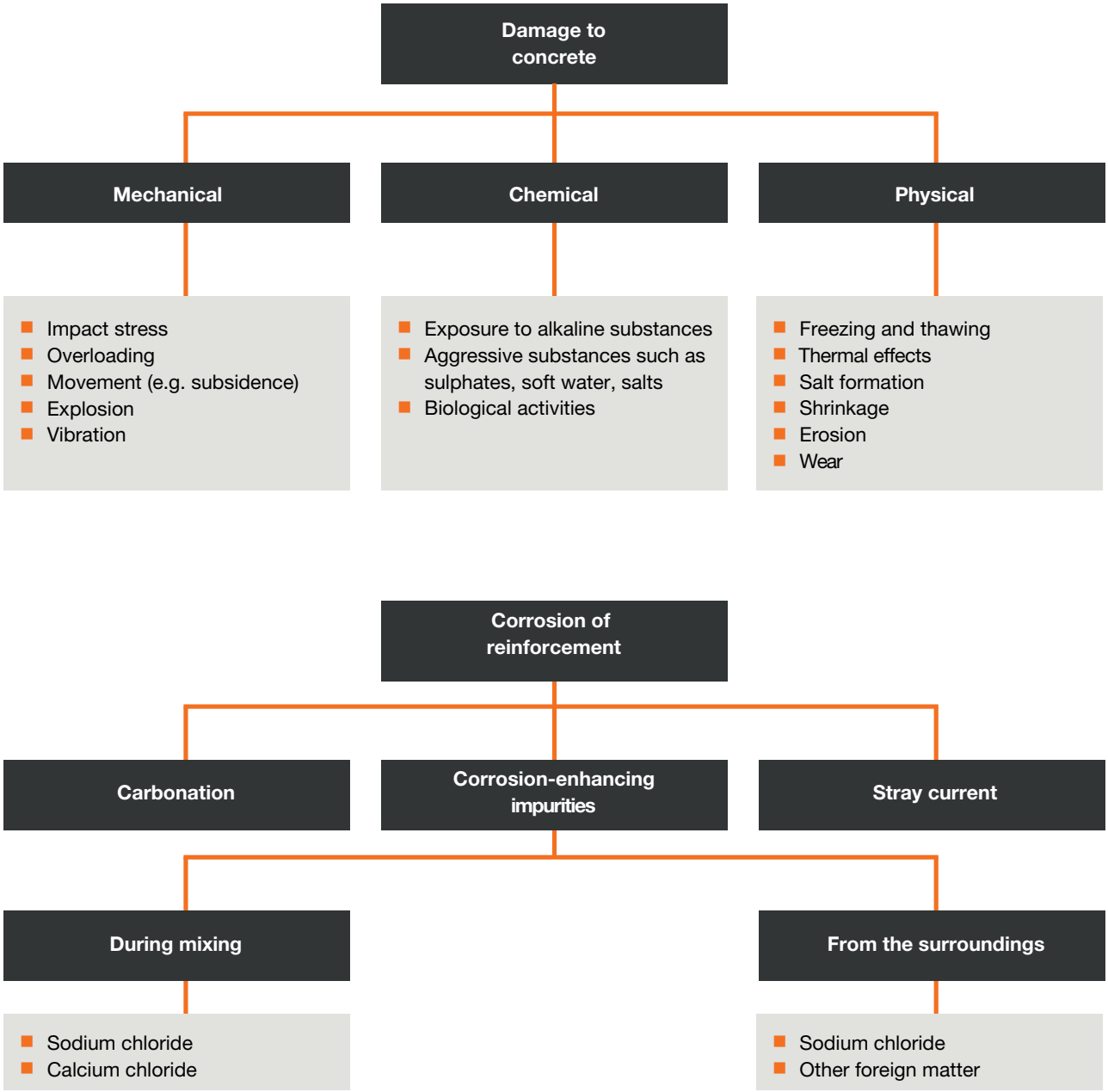
Surface protection systems

Product requirements for surface protection systems are stated in EN 1504-2. Additional information regarding repair and protection work are included in the DAfStb code (Rili SIB 2001). The relevant products of the system are listed below classified in accordance wth Rili SIB 2001.

	OS 1	OS 1	OS 4	OS 5a	OS 5b
Faring coat			PCI Nanocret® FC	PCI Nanocret® FC	
Hydrophobic coating	PCI Silconal® 328	PCI Silconal® 329	(PCI Silconal® 328)	PCI Silconal® 328)	
Rigid coating			PCI Betonfinish W		
Flexible coating				PCI Polyflex®	PCI Barraseal® Turbo

Causes of damage

There are many causes of damage to concrete. Apart from overloading as a result of growing traffic loads, rehabilitation is often required as a result of errors in design, tendering and construction or the selection of inappropriate materials. All types of damage, whether resulting from a single cause or a combination of different causes, must be identified and documented. The main causes of damage are shown in the diagram below:



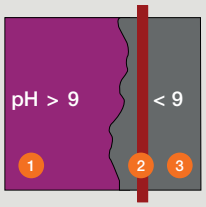
Preparation of concrete

Relatively ”gentle” methods of substrate preparation such as water jetting or blast cleaning (sand or shot blasting) have proved to be effective in practice. Thermal procedures such as flame blasting or methods involving hard impact on the concrete such as the use of hammer drills must be regarded critically as they may damage the structure of the concrete.
Many types of foreign matter can be removed from concrete by water jetting at a pressure of up to about 600 bar. However, this treatment alone is normally not adequate for the preparation of the concrete surface as it does not remove areas of inadequate strength or parts of the substrate with poor adhesion. Also, the surface of the substrate is not roughened sufficiently.
Very-high-pressure water jetting at pressures as high as 2,500 bar or more can remove foreign matter, fine mortar layers, weak layers and treatment films from concrete. The damaged concrete is removed to a sufficient depth and the concrete substrate is adequately roughened. This method can also be used for de-rusting reinforcement bars.
Sandblasting: in contrast to water jetting, this method uses a jet of solid abrasive and calls for effective protection against the development of dust. The material removal depth and the surface roughness are also determined by the pressure and the type of blasting agent used.

The largest grains in the aggregate should be exposed but should still be firmly anchored in the concrete matrix.

Testing for carbonation with phenolphthalein

If concrete is carbonated, its alkalinity is reduced and it can no longer adequately protect reinforcement steel in the concrete against corrosion. The extent to which concrete is affected by carbonation can be identified by applying phenolphthalein to a fresh fracture surface or a freshly removed drill core. The indicator solution is simply sprayed onto the surface concerned. While there is no color change in the carbonated area, areas which are sufficiently alkaline adopt a violet color. This allows carbonated areas to be made visible. In addition to carrying out this test, the concrete cover over the reinforcement steel should be checked using an appropriate reinforcement bar detector.



If the pH falls below 9, the reinforcement bars are no longer adequately protected against corrosion.

1. Non-carbonated concrete
2. Reinforcement bar
3. Carbonated concrete

Here, the concrete provides adequate protection. The violet color indicates that the concrete is sufficiently alkaline.

Cosmetic repairs to concrete with PCI Barrafil® L

Exposed concrete

Concrete is not only the most widely used construction material. Thanks to its appearance, it is also becoming increasingly popular with architects as an exposed material. This leads to increased cosmetic requirements. In Germany, concrete surfaces are dealt with by DIN EN 206-1, DIN 1045 and the Visible Concrete Code of the Concrete and Civil Engineering Association. In contrast, unified requirements are stated in ÖNORM B 2211 in Austria and in Swiss standard SIA 118/262 in Switzerland. The Swiss standard divides formwork into four types:

Concrete surfaces

Type 1: Normal concrete surface
Type 2: Concrete surface with uniform structure

Exposed concrete surfaces

Type 3: With board structure
Type 4: With panel structure

- Uniform surface structure without projecting edges, burrs and porous sections
- A moderate number of pores caused by air inclusion is allowed
- The color should be as uniform as possible

Differences in the color of exposed concrete caused by different types of formwork

Cosmetic repairs to concrete with PCI Barrafil® L

Site effects

In addition to the basic color of a cementitious product, the final colour tone is determined by conditions on site. These conditions often occur in combination.

Factor	Color	
	lighter	darker
Water quantity	high	low
Humidity	high	low
Curing	slow	fast
Temperature	low	high
Post-treatment	long	short

Important notes:

- Differences in the absorbency of the substrate can be compensated for by pre-wetting the surface. This reduces color fluctuations.
- Where the color tone must meet stringent requirements, it is essential to measure the quantities of mortar and gauging water precisely.
- In the case of repairs to large surfaces, lime washouts may occur if the surface is exposed to rain soon after installation.
- The colors of weathered surfaces adapt to each other more rapidly.
- Surfaces which are not exposed to the weather will remain relatively unchanged for many years.
- The setting time will be longer if too much gauging water is used or the temperature is lower.

PCI Barrafil® L

PCI Barrafil® L was developed especially for cosmetic work on concrete surfaces. The optimized formulation of PCI Barrafil® L results in a significant reduction in color differences caused by site effects.

- Available in grey and dark grey, allowing color adjustment
- PCI Barrafil® L is certified to EN 1504 – 3 and quality is continuously monitored by independent inspectors
- Containers can be re-closed, allowing the quantity required to be removed
- Restoration of damaged edges and corners
- Filling of cavities, honeycombs and tie holes
- Layer thickness: large areas up to 7 mm, breakouts up to 10 mm

Color adjustment

Apart from durability, appearance is a key factor in cosmetic work. This is especially important when repairing sections of a surface or filling cavities.

As PCI Barrafil® L is available in grey and dark grey versions, the color can be adjusted to match the concrete surface.

A range of tones can also be obtained by mixing the two versions. Both PCI Barrafil® L powders and mixed mortars can be mixed in grey and dark grey.

Color range obtained by mixing PCI Barrafil® L grey and dark grey

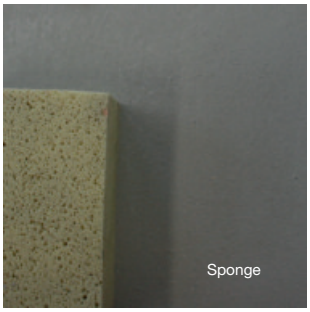
Grey	3 parts	1 part	1 part	
	1 part	1 part	3 parts	Dark grey

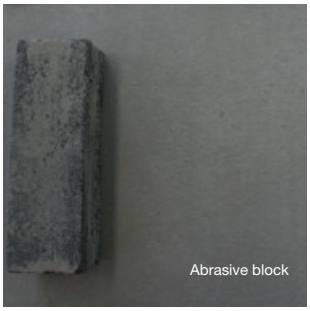
*There may be deviations from the actual color as a result of the printing process.

Important note: The color tone can only be finally determined after the material has hardened.

It is recommended to prepare a sample before starting work.

Adjustment of surface structure with PCI Barrafill® L





Substrate preparation

• Very dry substrate absorbs water from the mortar at the contact surface, reducing its strength and the adhesion of the contact layer

• The substrate must be rough and clean
• Free from release agents and loose sections

• Pre-wet the substrate thoroughly with a sponge, brush, hose or spray

• When the mortar is applied, the surface must be matt and moist
• Water accumulations must be avoided

Mixing of PCI Barrafill® L

Manually

- For minor cosmetic repairs
- Simply mix the quantity required by hand
- Pour powder into the container and add water
- Mix homogeneously using a spatula

Mechanically

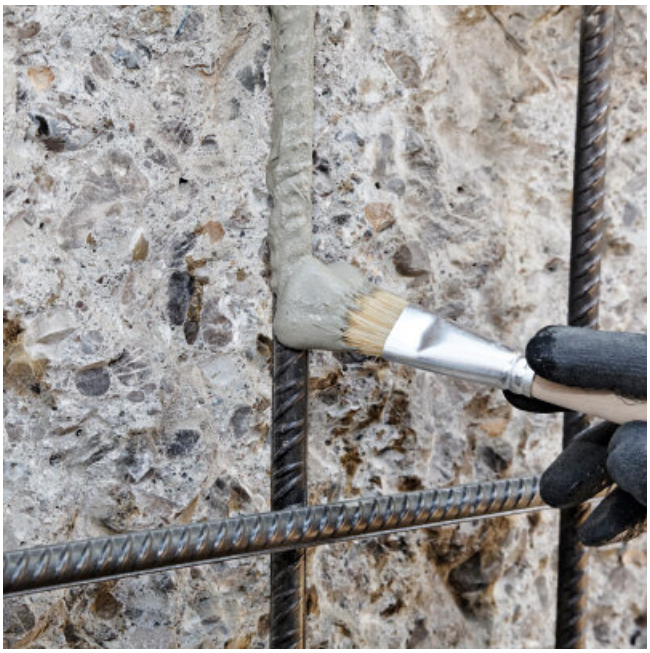
- For larger areas
- Pour water into the container and add PCI Barrafill® L, stirring continuously with a stirrer
- Stir until a homogeneous mixture is formed
- Wait at least 30 seconds before adding more water

Removal of loose concrete

Loose, brittle or carbonated concrete around the corroded reinforcement bars must be removed and the bars must be de-rusted. To avoid undercutting, the edges where concrete is removed should be cut off at an angle of at least 90°. To prevent the top surface layer of neighboring and damaged concrete from being disbonded, the angle should be no more than 135°. In addition, the edges should be roughened sufficiently to allow mechanical bonding between the original concrete and the repair product. More than 2 cm of concrete under the reinforcement bars should be removed. The pull-off strength should be in excess of 1.5 N/mm² on average, with no individual values below 1.0 N/mm².

De-rusting of reinforcement bars and application of corrosion protection

Together with the cleaning steps described above, the reinforcement bars should be de-rusted. Reinforcement steel exposed to corrosion risks must be exposed up to sections which are free from rust. Before the coating is applied, surfaces must be processed to obtain preparation grade SA 2 ½ in accordance with DIN EN 1504-10. This standard requires that surfaces must be freed from scale, rust and coating to the point where any residue on the steel surface is only visible as slight shading in the pores.



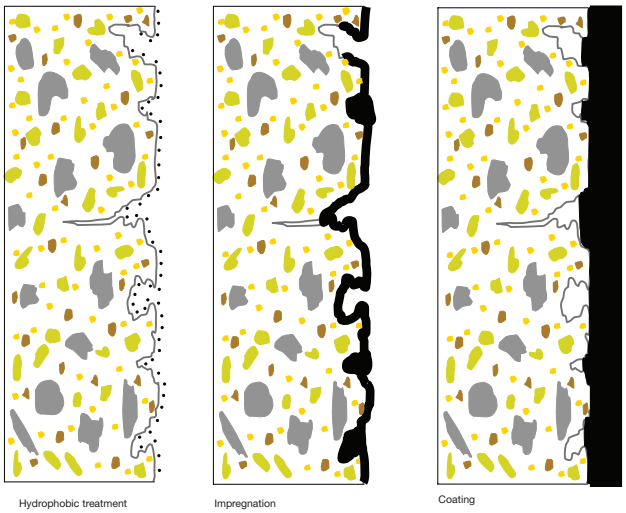
Corrosion prevention by surface protection

Concrete building components can be effectively made more durable by keeping water and detrimental gases away from the concrete. Surface protection systems not only improve the appearance of the concrete by allowing the use of colors but also keep carbon dioxide away and prevent carbonation of the concrete. DIN EN 1504-2 distinguishes between hydrophobic (water-repellent) agents, impregnating agents and coatings.

Hydrophobic treatment: The concrete is treated to create a water-repellent surface. The pores and capillaries on the concrete are not filled but lined. A film is not produced. There is no change in the appearance of the concrete surface.

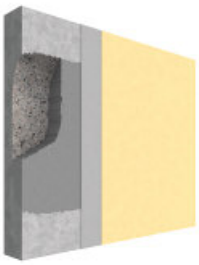
Impregnation: The concrete is sealed to reduce surface porosity. The pores and capillaries are largely filled. A thin but non-homogeneous film is formed on the surface of the concrete.

Coating: A closed protective layer is formed on the surface of the concrete.



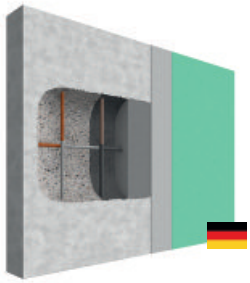
Overview of Construction Systems

System for Concrete and Masonry Refurbishment

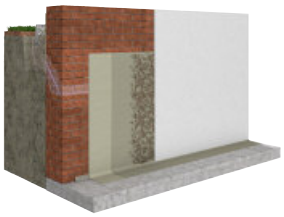


System for Concrete Repair

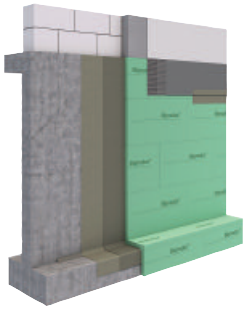
System for Structural Repair (PCC)



System Barra



System Barraseal Turbo



System Pecimor

System BT 21

System for Double-Leaf Brickwork

www.pci-augsburg.de

The specifications in the valid technical data sheets are to be followed for the use of the PCI products mentioned.

System for Concrete Repair, edition September 2020 (German edition February 2019)
Any subsequent publication supersedes this edition; the latest edition is always available on the Internet under www.pci-augsburg.de

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zertifiziertes Qualitäts-managementsystem