PENETRON®

TOTAL CONCRETE PROTECTION

Crystalline Development Technologies For Durable Concrete Structures

PENETRON INTERNATIONAL LTD central offices and logistics in U.S.A.

PENETRON INTERNATIONAL LTD is recognized as an international leader in the field of concrete waterproofing, protection and repair. Over the past 20 years the **PENETRON®** family products have established their reputation by meeting the most demanding job specifications around the globe, from the semi-arctic rigors of Norway and Russia, to the torrid extremes of Saudi Arabia.

Based on Long Island, New York, the company was founded in 1979 by Robert J. Revera, a veteran of the concrete industry, who inspired **PENETRON®** with a strong commitment to high technical standards. As such, **PENETRON®** formulations undergo continuous refinement through the integration of the latest materials research, as well as input from construction professionals in the field.

Today, **sales and support network of PENETRON®**, extends to more than 105 countries, providing the company a broad channel to share its experience and expertise. By combining superior product performance with exceptional client support, **PENETRON®** continues to define credibility and excellence in protective concrete treatments for engineers, architects and contractors all over the world.

PENETRON HELLAS S.A., subsidiary of **PENETRON INTERNATIONAL LTD**, was established in Athens, in November 2006.

This new company will not only serve as a distribution point for **PENETRON®** products, in the wider area of South East Europe, but will also facilitate the expansion and technical support of the company's technologies.

The versatile use and effectiveness of the **PENETRON®** System has been demonstrated across a wide spectrum of critical applications, including nuclear reactors, chemical storage facilities and mass transit tunneling projects. The products follow the highest environmental and ecological standards, reflected by the numerous aquariums and reservoir projects in the company's portfolio.

From January 2012, **PENETRON HELLAS S.A.** is Total Quality certified:
ISO 9001, **ISO 14001** and **ISO 45001** – DQS certification by DQS Hellas.
Regarding production, the high demands of quality control, at **PENETRON**'s state-of-the-art blending facilities, have earned ISO 9001, ISO 14001 and ISO 45001 certifications.

Headquarters complex, logistics centre and training centre facilities of PENETRON HELLAS S.A., at Acharnes, Athens.

THE PENETRON® SYSTEM

Uses:

- Potable water reservoirs
- Sewage and water treatment tanks
- Aquariums
- Tunnels
- Foundations
- Elevator shafts
- Underground vaults
- Industrial installations
- Parking decks
- Traffic-bearing structures
- Base slabs
- Diaphragm walls
- Basements
- Concrete roofs
- Bathrooms
- Any concrete structure requiring protection from water or aggressive chemicals

PENETRON®

Used for waterproofing and chemical protection above and below ground level. Applied in slurry form

PENECRETE MORTAR®

Used for filling cracks and covers at joints, for filling form-tie holes, honey-combed areas and routed out cracks in mortar consistency

PENETRON ADMIX®

An admixture in powder form, mixed into new concrete at the time of batching for complete integral waterproofing, protection and durability or after mixing with water in the concrete transport drum

PENETRON® PLUS

Cementitious dry shake with quartz aggregates, used for the waterproofing and hardening of horizontal surfaces of fresh concrete, to be treated with helicopter or trowel

PENEPLUG®

Forms a rapid setting compound, capable of stopping severe leaks under pressure

PENETRON® INJECT

An advanced, two component water cut-off injection grout, with integral crystalline waterproofing ability. It waterproofs concrete and rock, by filling and sealing cracks and voids in depth

All PENETRON® products, apart from their special properties, achieve permanent waterproofing of concrete, by crystals development.

PENETRON®

DESCRIPTION:

PENETRON® cementitious capillary waterproofing products are formulations consisting of Portland cement, quartz sand (of special grade) and multiple activating chemicals, that provide the most effective and permanent concrete waterproofing.

Effectiveness:

PENETRON's waterproofing effect is achieved by the reaction of the various chemical components contained in the solution, when combined within the concrete matrix. The compound penetrates deep into the capillary tracts of the concrete by pressure of osmosis and forms crystals that completely seal the capillaries and shrinkage cracks, driving out moisture. The process works with or against the pressure of water. In the absence of moisture, PENETRON® components lie dormant.
Should moisture recur at any time, the chemical action and sealing process repeats itself automatically and advances even more deeply into the concrete. PENETRON® chemicals will continuously seal and reseal due to their chemical nature. Crystalline growth from capillary waterproofing has been measured as deep as nearly 1 meter from the point of application. PENETRON® is 100% compatible with concrete, brick, mortar and stone.

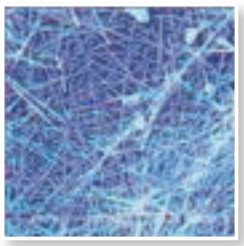
Uses:

PENETRON® is recommended for use in any concrete or block structure, where it is required to keep water in or out.
PENETRON® should also be applied to concrete or block structures exposed to potential water or chemical attack and thus requiring permanent waterproofing and protection. Its applicability to either the positive side (side exposed to water) or the negative side (side opposite the water) meets all waterproofing requirements.

Benefits:

- Becomes an integral part of the concrete, forming a complete body of strength and durability. PENETRON® should not be confused with conventional cementitious coatings or membranes.
- Penetrates deeply (up to 1 meter) and seals concrete's capillary tracts and shrinkage cracks up to 0,5 mm.
- Can be applied either from the positive or negative side side, where in the latter case it will drive the moisture out of the concrete.
- Waterproofing and chemical-resistance properties remain intact, even if the surface is damaged.
- Completely effective against high hydrostatic head pressure, up to 16 Atm.
- More effective overall and less costly than hydrolithic membrane or clay panel systems.
- Ease of application, labor-cost effective.
- Increases concrete's compressive strength (> 6%).
- Cannot come apart at the seams, tear or puncture.
- Does not require protection during backfilling, placement of steel or wire mesh and other common procedures, as long as the activation of the crystals has progressed (at least 2-3 days with good wetting of the backfilling material, if this is done in less than 7 days from application).
- Permits concrete to breathe, eliminating water vapor buildup and leaving the concrete completely dry.
- Resists chemical attack (pH 3 -11 constant contact; pH 2 -12 periodic contact) and provides a wide range of protection from freeze/thaw cycles, aggressive subsoil waters, sea water, carbonation, chlorides, sulfates and nitrates.
- Can be applied to moist or green concrete.
- Protects reinforcing steel.
- Non toxic.
- Certification according to EN 1504-2, EN 1504-3 & EN 1504-7.
- Approved for potable water use (certification NSF 61).
- No extensive curing times (except in very hot or low-humidity conditions).
- Singapore Green Label Certification.
- Environmental Product Declaration (EPD).
- Greenguard Gold Certification.
- Zero VOC – PENETRON powdered products contain zero volatile organic compounds and are safe for use both outdoors and in confined indoor spaces.

For surfaces that will receive permanent water, allow the material to cure for 12 days. In the case of hot and corrosive liquids, allow the surface to cure for 18 days.

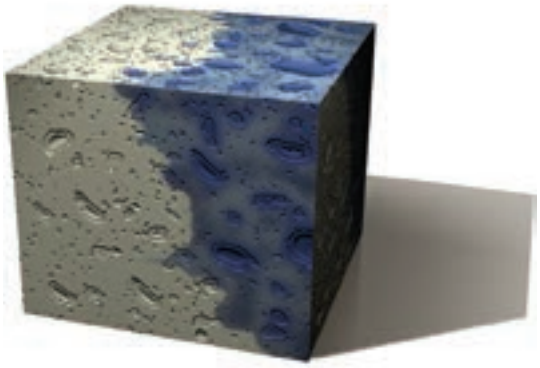


Microscopic examination of concrete at 28 days. Crystalline development.

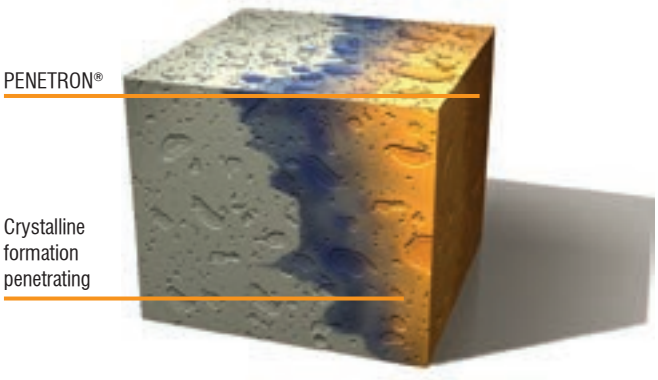
THE PENETRON® SYSTEM

How PENETRON® waterproofs concrete

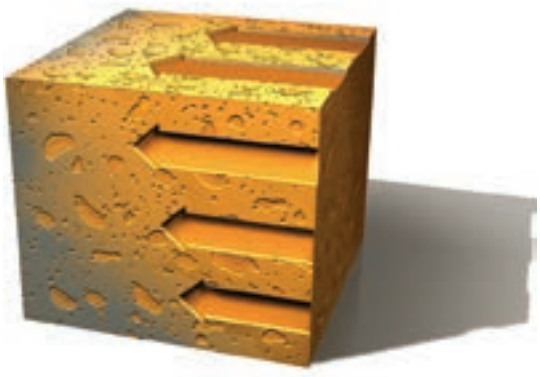
Typical concrete structure with moisture



PENETRON® may be applied to positive or negative surface in a variety of forms



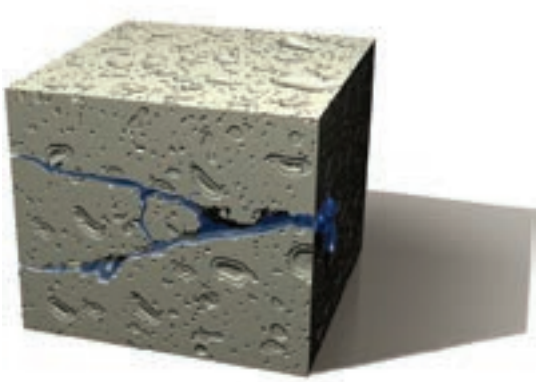
PENETRON® penetrates as far as 1 meter deep, becoming an integral part of concrete



PENETRON® crystals spread throughout the concrete substrate, increasing compressive strength and continuing to protect concrete from intrusion by water or chemicals permanently

How PENETRON® waterproofs a crack

A typical leaking crack



1

The chemical reaction starts as soon as PENETRON® is applied to concrete

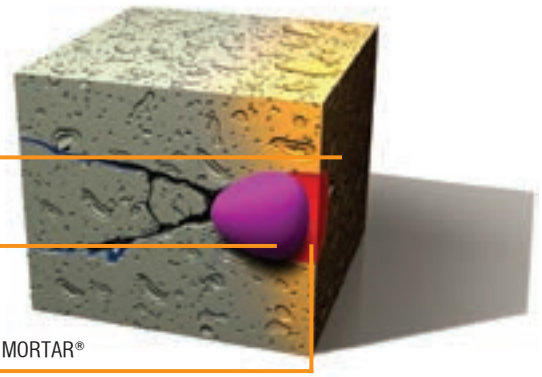


Illustration 2 shows a cut-out crack which has been packed with PENEPLUG® and PENECRETE MORTAR® and sealed with PENETRON®

2

PENETRON's in-depth effect completely protects the concrete structure

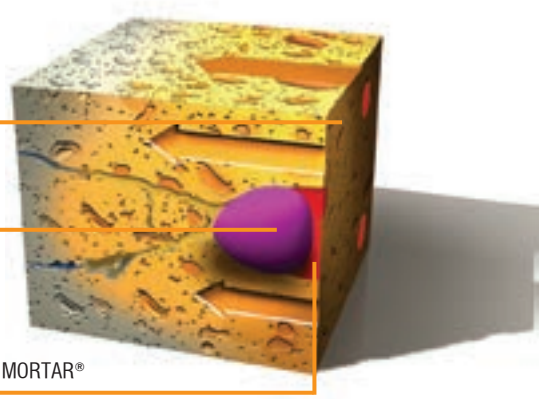


Illustration 3 shows how PENEPLUG ® not only stops leaks at the plug point, but continues to force crystals deeper into the crack and surrounding concrete, forming a complete seal

3

THE PENETRON SYSTEM

PENECRETE MORTAR®

DESCRIPTION:

PENECRETE MORTAR® is a cementitious, ready-mixed waterproof repairing and sealing mortar.

Uses:

Used in conjunction with PENETRON® for:

- Waterproofing of construction joints.
- Installation of seal strips, reglets and coves at joints to assure water tightness.
- Patching of tie holes and faulty construction joints.
- Filling of routed out cracks (not structural).
- Patching of tie holes and pointing applications.

Benefits:

- Can be applied to green concrete
- Can be skim coated or feather edged.
- Can be applied to moist concrete.
- Fast setting.
- Inorganic: no polymers.
- Non flammable.
- Resists abrasion and mechanical wear.
- Resists freeze-thaw cycles
- Certification according to EN 1504-3.
- Freeze/thaw resistant.
- Certified for use in contact with potable water (certification EPA).
- Can be applied by hand, using gloves, in thickness up to 30 mm.
- Zero VOC - Penetron powdered products contain zero volatile organic compounds and are safe for use both outdoors and in confined indoor spaces
- Greenguard Gold Certification.

All data are average values obtained under laboratory conditions.

Impractical use, temperature, humidity and absorbance of the substrate may influence given values.

Technical Data:

CONSUMPTION AND YIELD OF 22.68 KG BAG

	Size	Consumption	Yield/bag
	mm	Kg/m	m
Cracks, U-shaped	25x25	1,3	15,3
Reglets	25x25	1,3	15,3
Coves, Triangular	38x38	1,3	15,3
Tie Holes	25x25x25	-	600 nos

Honeycomb patching approximately 0.011 m^3/bag
All above values are approximate, depending on surface conditions.

PHYSICAL DATA

Aggregate State	Powder
Color	Cement Grey
Bulk Density	1,81 Kg/L
Pot Life	30 minutes
Setting Final	Approximately 2 hours
Potable Water	Approved

TECHNICAL DATA

	Compressive Strength ASTM C-109	Tensile Strength ASTM C-190
1 day	11 MPa	2,2 MPa
3 days	16 MPa	3,6 MPa
7 days	40 MPa	5,0 MPa
28 days	47 MPa	6,2 MPa

PENECRETE MORTAR® is applied to the desired surface in a mortar consistency using a spatula.

PENETRON® PLUS

THE PENETRON SYSTEM

Benefits:

- In addition to the waterproofing effect through crystalline development, it improves the resistance to surface abrasion of concrete.
- Ease of application and laborcost effective.
- Certrification according to EN 1504-3.
- Singapore Green Label Certification.
- Greenguard Gold Certification.
- Zero VOC - Penetron powdered products contain zero volatile organic compounds and are safe for use both outdoors and in confined indoor spaces.

Technical Data:

PENETRON® system has been tested against many standards, including:

- Compressive Strength ASTM C-39.
- Microscopic Examinations ASTM C-457.
- Chloride Content AASHTO T260.
- Chemical Analysis (Infrared Spectroscopy) Perkin Elmer Method 990-9647.
- Water Permeability – Handbook of Concrete Engineering.
- Chemical Resistance ASTM C267-77.
- Bond Strength of Chemical Resistant Mortar ASTM C-321.
- Permeability U.S. Army Corps of Engineers CRD-C-48-73.
- Freeze/Thaw and De-icing Chemical Resistance ASTM C-672-76.
- Radiation Resistance U.S.A. Standard.
- Radiation Resistance Russian Republic.

PENETRON® PLUS is applied by sieve and then floated using a helicopter or trowel.

DESCRIPTION:

PENETRON® PLUS is a special formulation designed specifically for dry shake application on horizontal concrete, prior to finishing (trowel or helicopter).

PENEPLUG®

THE PENETRON SYSTEM

Benefits:

- Ease of application.
- Inorganic.
- Non Flammable.
- Certification according to EN 1504-3.
- No odor or fumes.
- Approved for potable water use in combination with PENETRON® coating.
- Hardens in about 30 seconds after mixing with water.
- Durable material.
- Can be used in underwater conditions.
- Greenguard Gold Certification.
- Zero VOC - Penetron powdered products contain zero volatile organic compounds and are safe for use both outdoors and in confined indoor spaces.

DESCRIPTION:

PENEPLUG® is a fast-setting cementitious waterstop. It is recommended for:

- Plugging/stopping water leaks.
- Sealing of leaky joints, form tie holes or cracks.

PENETRON ADMIX®

DESCRIPTION:

PENETRON ADMIX® is added to the concrete mix at the time of batching or after mixing with water in the concrete transport drum. The concrete then becomes permanently sealed against the penetration of water or other liquids from any direction and is also protected from deterioration due to harsh environmental conditions.

Uses:

- Potable water tanks (certification according to NSF 61).
- Sewage and water treatment plants.
- Subway and other tunnel systems.
- Underground vaults.
- Foundations.
- Swimming pools.
- Pre-cast components or shotcrete applications.

Advantages:

- Resists extreme hydrostatic pressure from either positive or negative surfaces.
- Becomes an integral part of the concrete.
- Highly resistant to aggressive chemicals.
- Can seal hairline cracks of up to 0.5mm.
- Allows concrete to breathe.
- Non toxic.
- Less costly to apply than most other methods.
- Permanent.
- Added to the concrete at time of batching and therefore not subject to climatic restraints.
- Singapore Green Label Certification.
- Environmental Product Declaration (EPD).
- Contains green chromatic indicator (Green Tracer) for proper application.
- Improves the durability of concrete.
- Permeability Reducing Admixture for Hydrostatic conditions (PRAH).
- Zero VOC – PENETRON powdered products contain zero volatile organic compounds and are safe for use both outdoors and in confined indoor spaces

Technical Data:

Note: The PENETRON ADMIX® has been specially formulated to meet varying project and temperature conditions (see Setting Time and Strength). Consult with a PENETRON® Hellas SA Technical Representative. PENETRON ADMIX® is CE certified according to EN 934 - 2:2009+A1:2012.
PENETRON ADMIX® has been tested against many standards, including:

- Compressive Strength ASTM C-39.
- Microscopic Examinations ASTM C-457.
- Chloride Content AASHTO T260.
- Chemical Analysis (Infrared Spectroscopy Perkin Elmer Method 990-9647).
- Water Permeability - Handbook of Concrete Engineering.
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- Permeability U.S. Army Corps of Engineers CRD-C-48-73.
- Freeze/Thaw and De-icing Chemical Resistance ASTM C-672-76.
- Radiation Resistance U.S.A. Standard.
- Radiation Resistance Russian Republic.

Setting Time and Strength: The setting time of concrete is affected by the chemical and physical composition of ingredients, temperature of the concrete, and climatic conditions.

Retardation of set may occur when using PENETRON ADMIX®. The amount of retardation will depend upon the concrete mix design and the dosage rate of the admixture. However, under normal conditions, PENETRON ADMIX® will provide a normal set concrete. Concrete containing PENETRON ADMIX® may develop higher ultimate strength than plain concrete. **Trial mixes should be carried out under project conditions to determine setting time of the concrete.**

Limitations: When incorporating PENETRON ADMIX®, the temperature of the concrete mix should be above 40˚F(4˚C).

Technical Services: For more instructions, alternative application methods or information concerning the compatibility of the PENETRON® treatment with other products or technologies, contact the Technical Department of PENETRON® Hellas S.A. or your local PENETRON® representative.

Dosage rate: PENETRON ADMIX® 0,8% - 1% of cement by weight.

Note: Under certain conditions, the dosage rate may be between 1 - 3% depending on the quantity and type of total cementitious materials.

Consult with PENETRON® Hellas' Technical Department for assistance in determining the appropriate dosage rate and for further information regarding enhanced chemical resistance, optimum concrete performance or meeting the specific requirements and conditions of your project.

Preparation:

1. Ready Mix Plant - Dry Batch Operation Add PENETRON ADMIX® in powder form to the drum of the readymix truck. Drive the truck under the batch plant and add 60 % - 70 % of the required water along with 136 - 227 kg of aggregate. Mix the materials for 2-3 minutes to ensure the Admix is distributed evenly throughout the mix water. Add the balance of materials to the ready-mix truck in accordance with standard batch practices.

2. Ready Mix Plant - Central Mix Operation Mix PENETRON ADMIX® with water to form a very thin slurry (e.g., 18 kg of powder mixed with 22,7 L of water). Pour the required amount of material into the drum of the ready-mix truck. We recommend, for ease of mixing, that half a bag (9 Kg of powder) be mixed with 11,5 L of water. Pour the concrete into the truck and mix for at least 5 minutes to ensure even distribution of the PENETRON ADMIX® throughout the concrete. **Water mixtures with PENETRON ADMIX® should be added immediately after mixing, without delay.**

3. Precast Batch Plant Add PENETRON ADMIX® to the rock and sand, then mix thoroughly for 2-3 minutes before adding the cement and water. The total concrete mass should be blended using standard practices.

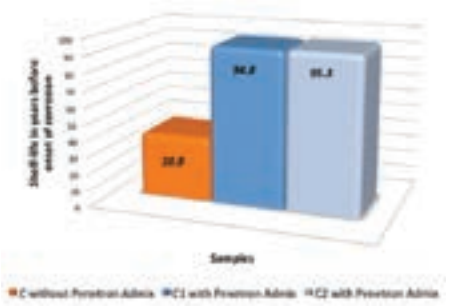
Note: It is important to obtain a homogeneous mixture of PENETRON ADMIX® with the concrete. Therefore, do not add dry PENETRON ADMIX® powder directly to wet concrete, as this may cause clumping and hinder thorough dispersion.

PENETRON ADMIX® SYSTEM for Total Concrete Protection

- Permanent Waterproofing
- Corrosion Protection
- Strength Improvement
- Resistance to Chemical Stress
- Resistance to Frost

} = Durable Concrete

PENETRON ADMIX®: adds 60 years to the life cycle of concrete in corrosive environment (study by ACI for crystal growth admixtures)



Concrete Admixtures CE Certification EN 934 - 2:2009+A1:2012

PENETRON®
TOTAL CONCRETE PROTECTION

PENETRON® INJECT

DESCRIPTION:

New technology, two component integral crystalline waterproofing crack-injection system. Application by cement-injection-pump. Suitable for permanent waterproofing and repairing concrete cracks in basements, tunnels, tanks, pools, bridges, sewage tanks, canals, construction joints etc.

USES:

- Tunnels and subway systems.
- Mines.
- Foundations.
- Water retaining structures.
- Sewage and water treatment plants.
- Bridges, dams and roads.
- Parking structures.
- Construction joints.
- Basement retaining walls.
- Channels.
- Tanks.
- Underground concrete constructions.

BENEFITS:

- Becomes an integral part of concrete.
- Penetrates deeply due to its extremely low viscosity and micro-fine particle size.
- Has a very stable and low heat of reaction, allowing for a controlled injection and ability to fill larger voids completely.
- Protects embedded steel (reinforcing steel, wire mesh and rock anchors) in areas around injection sites.
- Can be injected into moist or wet areas.
- Contains no organic or combustible solvents or other harmful ingredients.
- Non-toxic.
- Easy to use and labor-cost effective.
- Only water is required for clean up.
- Certification according to EN 1504-5.
- By filling and sealing cracks and voids in depth

Application of PENETRON® INJECT, integral crystalline crack-injection system

Application:

Surface Preparation: Prepare crack to receive repair materials by saw, cutting along the length of the crack, at a width of approximately 20 to 25 mm. Sawcut should be in a reverse “V” or “U” shaped channel to prevent repair materials from popping out. Remove the concrete in the crack area to a depth equal to the width of the sawcut or 50% deeper [e.g., if an 20 mm wide sawcut is made, an 20-30 mm depth channel should be cut out]. Clean the sawcut channel with a water pressure washer >200 bar and drill holes to receive the injection packers. Diameter and depth of the holes will be defined by the type and style of injection packer used. Distance between holes should be around 25 to 35 cm.

Mixing: Put PENETRON® INJECT - PART B (Liquid) into the mixing bucket. Add the required amount of water to the bucket and mix. Remove 10% of this mixture and store for later re-addition. Slowly add PENETRON® INJECT - PART A (Powder) to the 90% mixture mixing continuously, with a suitable mixing tool. Mix for at least 2 minutes, until a smooth, homogeneous, lump free mix is achieved. Add the stored 10% mixture to the combined powder/liquid mix and continue to mix for one more minute. This completed mixture should have a viscosity of approximately 30 seconds in a DIN 4 mm cup. In cases where an extremely low viscosity mix is needed (e.g., to fill very fine cracks), additional water (an additional 0,5 L to a maximum of 1 L) can be added until a viscosity of 18 DIN-seconds is reached. Once this mixture has achieved the required viscosity and is placed in the injection pump, it is ready for injection. It is helpful to slightly agitate the mix from time to time (every 10 to 15 minutes) in case all of the mix is not used immediately. Initiation of the curing reaction can be noted by an increase in the viscosity. To avoid solidification in the equipment, the remaining mix should be cleaned of the funnel, pump and injection tubes. Pot life times are based on a temperature of 20 ˚C. In higher temperatures the pot life and workability will be reduced. In such cases more of PENETRON® INJECT - PART B (Liquid) can be added with a corresponding and equal reduction of mix water. PENETRON HELLAS S.A. strongly recommends trial testing, should such changes from the standard instructions be necessary.

Normal Set Mix Ratio (100 - 120min):

PENETRON® INJECT (Part A – powder) 1 bag 25 kg mixed with 2 L of PENETRON® INJECT (Part B – liquid) and 9 L of clean water.

Fast Set Mix Ratio (30 - 60min):

PENETRON® INJECT (Part A – powder) 1 bag 25 kg mixed with 1 L of PENETRON® INJECT (Part B – liquid) and 10 L of clean water.

Application: Place and tighten the injection packers. Partially fill the bottom of the channel and around each injection packer with PENEPLUG®, so that escaping water is able to flow only through the injection packers. Brush on a slurry of PENETRON® on PENEPLUG® and along the remaining visible channel surfaces, as well as 70-100 mm on the sides of the channel. As soon as the PENETRON® slurry is dry to the touch but still green, fill the remaining channel with PENECRETE MORTAR®.PENECRETE MORTAR® should be dry packed into the channel, using a wood block and hammer to ensure a tight fit with no voids. Allow PENETRON® / PENECRETE MORTAR® / PENEPLUG® to completely set and dry for 2-3 days. During this time, water may flow freely through the injection packers. Start injecting PENETRON® INJECT from the lowest injection packer. Pump until PENETRON® INJECT starts to flow from the next highest injection packer or until the pressure rises (maximum pressure - 5 bar). Close the first injection port and begin filling from the second injection packer. Follow this sequence until the entire length of the repair is filled. Allow PENETRON® INJECT to cure and harden for at least 2 days. At this point, a visual inspection can confirm that all leaks have been stopped and the injection packers can be loosened and removed. Dry pack all holes left by the injection packers with PENECRETE MORTAR®. Use a dowel to tightly compress PENECRETE MORTAR® into the holes.

PENETRON® INJECT can be applied using most standard injection procedures; however, as each individual application case will have its own unique parameters, please contact PENETRON HELLAS S.A. for the most accurate support for your project.

SPECIAL CONSIDERATIONS

DO NOT apply PENETRON® INJECT at temperatures below 4˚C, on a frozen substrate or if temperature drops below 0˚C, during the curing period (approximately 24 hours).

GENERAL INSTRUCTIONS

General Instructions

- The concrete or concrete block surface to receive the PENETRON® system must be structurally sound and free of dirt, soil, oil, release agents, latence or any other foreign materials that may impair the bond, penetration and/or overall performance of PENETRON® materials.
- Extremely smooth concrete surfaces must be waterblasted, sandblasted or acid etched to make sure that the concrete surface has an open capillary system. The surface to be treated should never have a shiny appearance.
- Rout out visible cracks, exceeding 0.5 mm in size to a depth of 20 mm to 25 mm. Also rout out honeycombed pockets, holes and faulty construction joints to sound concrete. Construction joints should be routed out with a formed 25 mm x 25 mm reglet.
- Wet down dry surfaces lightly prior to the application of the PENETRON® system. Moisture must be present in the concrete substrate to ensure maximum chemical penetration. Surfaces 2 days after the forms removal are ideal for the application of PENETRON®.

Mixing

PENETRON®

For brush application, 1 bag is mixed with 12-13 L of water, but it is better to mix half of a bag with 6-6.5 L of water.

For spray application, 1 bag is mixed with 14-15 L of water.

For pourable application, 1 bag is mixed with 15-18 L of water.

Stir the slurry mixture frequently during the application and prepare only as much as can be applied within a 25 minute period.

PENECRETE MORTAR®

Add water to PENECRETE MORTAR® powder (indicatively 1 bag is mixed with 4 lt of water), until a medium stiff consistency is obtained. Prepare only as much PENECRETE MORTAR® as can be applied within a 25 minute period.

PENEPLUG®

Pour a handful and mix in a small container (bowl/pail). Standard mix ratio at 20 °C is 1kg PENEPLUG® and approximately 0,170 L of water. Gloves and protective glasses must be worn. Add just enough water to form a mix that has a dry pack/dry earth consistency. Do not knead the material too many times.

PENETRON® Application

- Apply PENETRON® coating by masonry-type brush (artificial fibers, if available). For spray applications, drop hopper or piston pump type equipment is recommended.
- Prior to application of PENETRON® coatings, fill form tie holes, routed out cracks, honeycombed pockets, reglets and seal strips at construction joints with PENECRETE MORTAR® in laminating layers of 2,5 cm to 3 cm. It is also possible to mix PENECRETE MORTAR® with PENEPLUG® in proportions based on needs. Prime concrete surfaces of these areas with one slurry coat of PENETRON® prior to applying PENECRETE MORTAR®.
- PENETRON® slurry must be applied to damp concrete and concrete block surfaces only in specified quantities: First coat should have a thickness of just under 1,0 mm; second coat should be applied when first coat is slightly fresh to the touch. A light misting of water may be required between coats in hot/dry climates.

Horizontal concrete surfaces: Apply PENETRON® slurry in one (1) coat with stiff bristle brush/broom or squeegee.
Dry sprinkle PENETRON® or PENETRON® PLUS on “still plastic” concrete by broadcasting or use of a fine mesh sieve, in quantities that are specified. Work PENETRON® powdered slab surface with wood float or power trowel until required finish has been achieved.

PENECRETE MORTAR® Application

- Mix PENECRETE MORTAR® by hand or paddle mixer, until a stiff mortar consistency is achieved.
- Apply by brush the bonding coat of PENETRON® slurry.
- Apply PENECRETE MORTAR® when the primer layer is slightly fresh.
- Depth of PENECRETE MORTAR® application should not exceed 3 cm.
- Time elapsed between bonding coat and PENECRETE MORTAR® should not exceed six hours.

PENEPLUG® Application

- After following mixing procedure, quickly form into a wedge and force it into the leak.
- Apply as much pressure as possible, by pressing with both hands.
- After leak has stopped, fill void of surface with PENECRETE MORTAR®.
- In case of a large leak, use water drainage hoses.

Coverage

- Horizontal concrete surfaces: PENETRON® from 1,4 kg to 1,6 kg/m^2. Applied in one (1) slurry coat or powder application, when concrete reaches initial set. Trowel or float to specified finish. PENETRON® PLUS powder application at 0,5 Kg/m^2 - 0,7Kg/m^2, when concrete reaches initial set. Trowel or float to specified finish.
- Vertical concrete or block surfaces: PENETRON® from 1,4 kg to 1,6 kg/m^2. total. Applied in two (2) coats (0,8 kg per coat).

Curing

- Wetting 2-3 times a day for 3-5 days. In case of heatwave and low humidity, wetting should be done 4-5 times a day. In these extreme conditions curing — using a light water misting — must begin as soon as the PENETRON® coating has hardened sufficiently, so as not to be damaged. Under most conditions, it is sufficient to mist the areas treated with PENETRON® three times a day, for the first day. In extremely hot climates, spraying may be required more frequently and for several days.
- PENETRON® PLUS (trowel applied): Follow concrete specifications for curing procedures.

Neutralization

- Treated surfaces to receive paints or other protective coatings should be neutralized with a vinegar/water solution or a muriatic acid/water solution (5 to 10%). Rinse all treated surfaces thoroughly with water.
- For application on cisterns and drinking water reservoirs, follow EPA requirements. Regarding special tanks, aquariums and industrial or processing installations, please contact a PENETRON® representative.

Temperature Requirement

- The PENETRON® system can be applied in coating or in mortar form when the temperature is above 0˚C.
- PENETRON® PLUS (trowel applied) can be applied in temperatures where concrete can be placed. Follow concrete specifications for protection requirements, according to standard concrete procedures.

PENETRON® INJECT application in tunnels

Bridge repair


PENETRON
TOTAL CONCRETE PROTECTION
AFTER
BEFORE
W.W.T.P. protection


PENETRON
TOTAL CONCRETE PROTECTION
PENETRON
TECHNICAL SUPPORT
Biogas tanks waterproofing & protection

CAVITY-FILL METHOD

Cavity-Fill Method

PENETRON® Slurry and PENECRETE MORTAR®

Proven Performance: The slurry-filled cavity allows the active chemicals in PENETRON® to react with moisture, creating a non soluble crystalline formation within the concrete pores and capillary canals. In this way, the wall eventually becomes permanently sealed and water and dampness are excluded from any direction. The system actually improves over time, as the crystals reach greater depth and increase in density. It may be necessary, in cases of matrix deterioration, to drill adjoining holes and fill the cavities with fresh cement mortar, to allow PENETRON® something of substance to work on. Then, fill the adjoining hole as per PENETRON® method.

Cavity-Fill Method

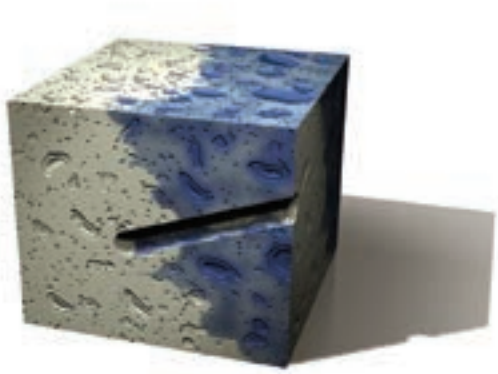
Solving the Problem of Rising Damp

Drill holes 20 mm to 25 mm in diameter, in a 15 to 20 cm on center pattern, at an angle of 40˚ to 80˚up to three-quarters of the way through the wall. Wash out cut holes. Remove free-standing water from holes with a vacuum or blow out with air.
Using a funnel or pump, pour loose slurry to fill drilled out cavity.
Gently tap each drilled hole with sized wood dowel or steel bar.
Close cavity (drilled hole) off with PENECRETE® MORTAR.

PENETRON® **PENECRETE MORTAR®**

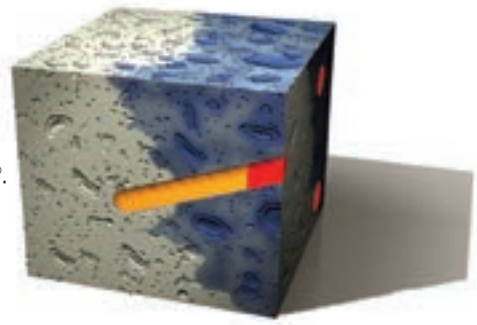
1

Drill 2.0-2.5 cm holes at 40-80˚ angle up to 3/4 way through the wall.



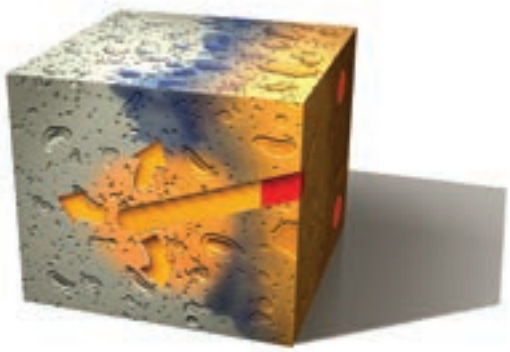
2

Fill the drilled cavity with PENETRON® slurry and seal with PENECRETE MORTAR®. Repeat, if necessary, using an on-center pattern.



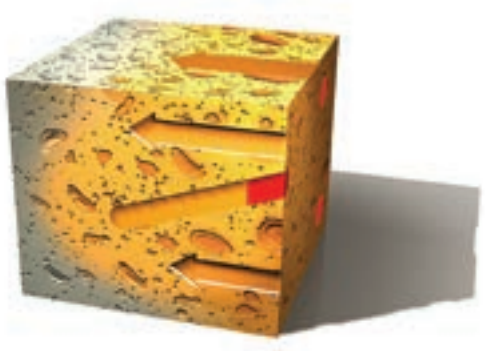
3

Coat the outer surface with PENETRON®. Crystals will begin to penetrate from both inside and outside of the wall.



4

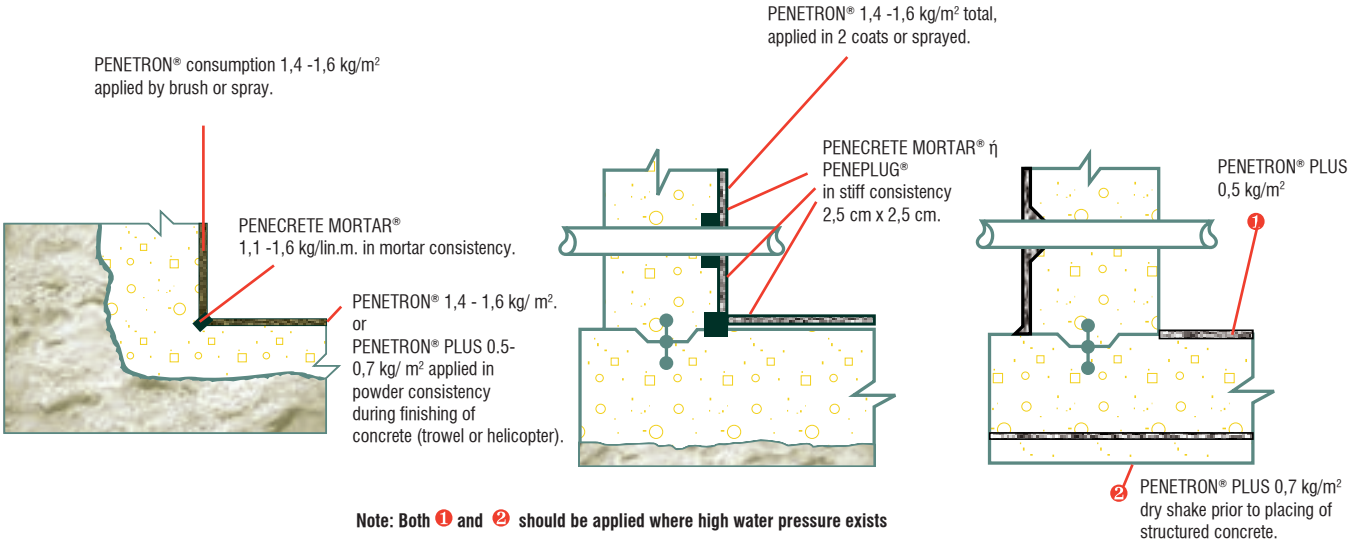
PENETRON® will continue to spread, providing strength and protection to interior and exterior of the concrete.



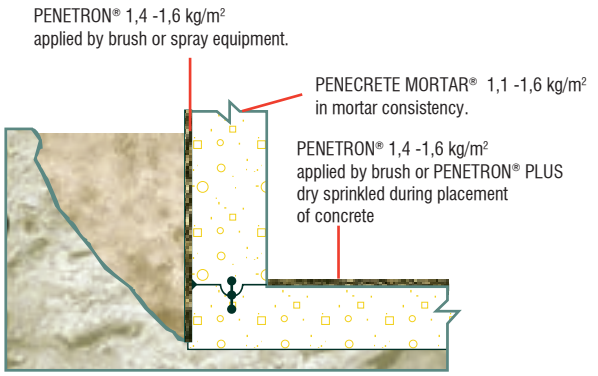
House of Rest
Burial Place of Czar
Nicholas II
St. Petersburg, Russia

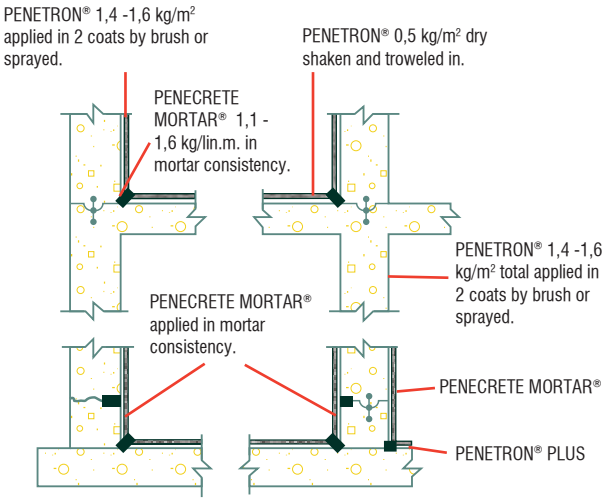
APPLICATION INSTRUCTIONS

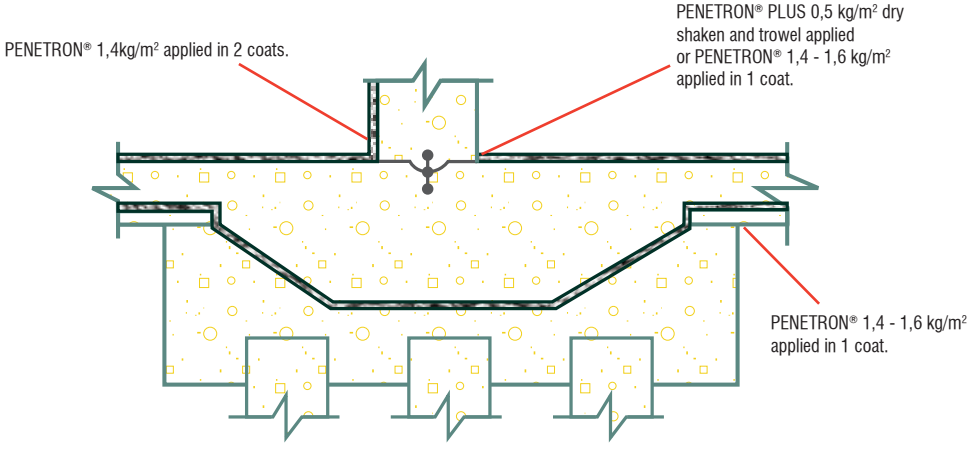
Application Instructions



Note: Both ❶ and ❷ should be applied where high water pressure exists







Note: Where PENEBARs SW water-expanding strips for cold joints.

PROJECTS

The PENETRON® system has been successfully used in projects in over 60 countries worldwide

Project: Seabrook Nuclear Power Project
Location: Seabrook, NH, USA
Date: 1986
Description: Seabrook is a 1.160-megawatt pressurized water nuclear reactor that provides about 7% of the electricity used in the six New England states – enough electricity for about 1,000,000 homes.
Two underground tunnels, which are used for carrying steam-condensing water, for a three mile distance, from the ocean to the plant, along with the foundations of the plant, the underground facilities and all the protective spillways, were treated with the PENETRON® system, in 1986. Apart from the guaranteed waterproofing and chemical resistance performance protecting the concrete, the client was pleased with the additional benefit of PENETRON®, the significant reduction in gamma radiation, in case of accident. Products that were used include PENETRON®, PENECRETE MORTAR® and PENEPLUG®.

Project: Statue of Liberty
Location: New York, USA
Date: 1986
Description: Located in New York Harbor, the Statue of Liberty is one one of the most recognizable symbols of political freedom and democracy. The Statue was extensively restored in time for its spectacular centennial celebration, on July 4, 1986.
Although a heating system was installed in the base of the statue in 1949, the huge mass of stone, concrete and earth progressively chills through winter and is at its coldest in March, when the air outside gets warmer. The moist air, coming off the water regularly, saturated the walls, resulting in moisture inside the pedestral and causing deterioration of the structure and its fixtures. This problem has now been eliminated by the use of the PENETRON® system in the restoration. Underground vaults and utility rooms were also treated.

Project: Kariba Dam
Location: Zimbabwe
Date: 1960
Description: This magnificent dam was completed in 1960 and was the largest man-made dam ever built. It provides electricity to Zambia and Zimbabwe, damming Africa's fourth largest river (the Zambezi River). It also supports a thriving local fishing industry.
The PENETRON® system was used in 1991 to remedy water leakage and thoroughly moist concrete areas. Areas treated with the PENETRON® system include parts of the main dam structure and adjacent areas, as well as utility rooms.

Project: Monterey Bay Aquarium
Location: Monterey, CA, USA
Date: 1982
Description: The Monterey Bay Aquarium is one of the main tourist attractions in the U.S.A.. More than 1,7 million people visit the aquarium annually. It was completed in 1982 and is dedicated to the conservation of the oceans. The PENETRON® system was used to successfully waterproof and protect all tanks from the effects of seawater, including the pools of dolphins and sea lions.

PROJECTS

The PENETRON® system has been successfully used in projects in over 60 countries worldwide

Project: House of Rest, burial place of Czar Nicholas II
Location: St. Petersburg, Russia
Date: 1995
Description: This cathedral is of immense importance in Russia, as most of Russia's pre-revolutionary rulers from Peter the Great and onwards are buried here. The cathedral complex, which dates back to 1718, has had a tumultuous history, suffering extensive damage from fire, storms and looting. In 1995 this project underwent a major repair and maintenance treatment in preparation for the burial of the last Russian Czar Nicholas II and his family in St. Catherine Chapel (80 years after his death). The PENETRON® system was chosen as the best solution to protect and waterproof all above and below grade masonry for this important project.

Project: Singapore Changi Airport Terminal 3
Location: Changi, Singapore
Date: 2003
Description: Changi Airport is a symbol of national pride, a worldwide benchmark of excellence, built at a cost of $1,5 billion. Terminal 3 incorporates the most innovative systems and facilities to ensure hassle-free movement of passengers, while aiming for an architecture of synthesis and expression.
The PENETRON® system was chosen for the waterproofing and protection of the entire foundation and slab of T3. 140.000 m^3 of concrete were treated with PENETRON® ADMIX, with sporadic use of other components of the PENETRON® system, such as PENETRON® slurry and PENECRETE MORTAR®. The crack bridging abilities of the PENETRON® system have been superbly demonstrated on this project.

Project: Lutetian Garden
Location: JinZhou, China
Date: 2002
Description: Prior to PENETRON® application on this huge development 4 hours north of Beijing, abundant cracking had occured, resulting in serious leakage. All leaks were stopped with PENEPLUG® and cracks were repaired with PENECRETE MORTAR®. The entire sub-structure was then double-coated with PENETRON® and the underground carpark, connecting the two buildings, was treated with the PENETRON® system. The project, finished in 2002, is now considered the city's top residential property.
The owner was so pleased with the results that he had his own penthouse terrace waterproofed with PENETRON®, rather than the product originally specified for exposed areas.

Project: Rigas Udens Biological treatment plant
Location: Riga, Latvia
Date: 1996
Description: Municipal enterprise «Rigas Udens» supplies the city with potable water from abstraction sites located outside of Riga City, including surface water intakes (The Daugava) and ground water intakes (Baltezers area, Zakumuiza and others).
All aerotanks and channels were treated with the PENETRON® system in 1996-97. Products that were used include PENETRON®, PENECRETE® and PENEPLUG®. The PENETRON® system was chosen for its ability to protect concrete against chemical attack in addition to its guaranteed waterproofing performance.

TECHNICAL DATA

Concrete with PENETRON ADMIX®		
European Certification	EN 934-2	
Water Permeability	DIN 1048	After 56 days ≤ 5,35 x 10^{-13} m/sec
Compressive Strength	(ASTM C39)	After 28 days ≥ 6%
Approved for use with potable water	NSF 61	
Enviromental Product Declaration (EPD)	ISO 14025 & EN 15804	Low environmental impact
Singapore Green Label Certification		
Greenguard Gold		

PENETRON® Coated Concrete		
European Certification	EN 1504-2, EN 1504-3 & EN 1504-7	Protection, repair and structural strengthening of reinforced concrete structures and protection of reinforcement from corrosion
Water Permeability	(CDR-C-48-73)	After 28 days ≤ 1,9x10^{-14}cm/sec (before treatment 1,8x10^{-11}cm/sec)
Water Permeability under head pressure	(CDR-C-48-73)	Can withstand ≥ 232 PSI (514 ft. head water pressure or 156,78m) or 1,54 MPa (16 Bar) with no measurable leakage
Compressive Strength	(ASTM C39)	After 28 days ≥ 6%
Freeze/Thaw Cycle Test	(ASTM C-672-76)	50 Cycles - Marked decrease in erosion compared to untreated samples
Chemical Resistance	(ASTM C-267-77)	Resistant to alkaline/acid conditions. pH range 3 -11 constant contact
Radiation Resistance	(ASTM N69-1967)	No effect from gamma radiation ≥ 5,76x10^{4} Rads
	(ISO 7031)	No effect from gamma radiation 50 M Rads
Chloride Content	(AASHTO T-260)	Negligible amounts of chlorides are contained in waterproofing substance. Penetron's waterproofing effects are NOT related to chlorides
Non toxic	(BS 6920: Section 2.5)	PASSES European Union Environmental Lic
	(16 CFR 1500)	PASSES European Union Environmental Lic
Approved for use with potable water	NSF 61	US EPA and State of New York DOH
Enviromental Product Declaration (EPD)	ISO 14025 & EN 15804	Low environmental impact
Singapore Green Label Certification		
Greenguard Gold		

CAUTION

Use rubber gloves during mixing and application. Use goggles during spraying and overhead applications. The effect of PENETRON® on the skin can be neutralized with a vinegar (household strength) and water solution. **PENETRON PRODUCTS ARE NON TOXIC.**

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Swimming pool waterproofing

Permanent waterproofing of undersea bar-restaurant

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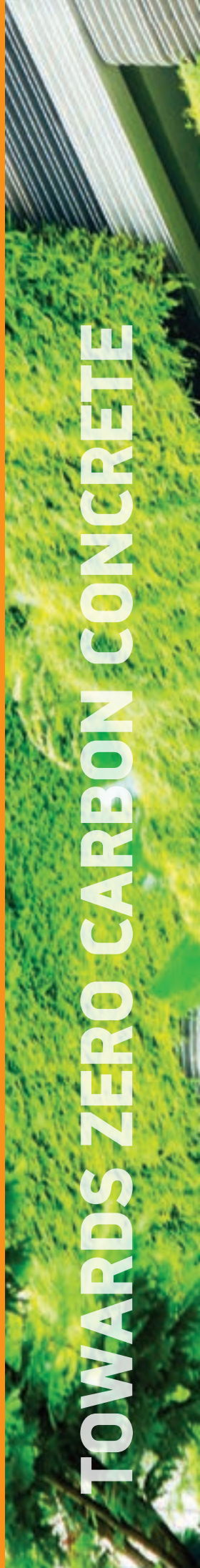

TOWARDS ZERO CARBON CONCRETE