

**PENETRON**<sup>®</sup>  
TOTAL CONCRETE PROTECTION

## Crystalline Development Technologies For Durable Concrete Structures





PENETRON INTERNATIONAL 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 of products has established its 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, **PENETRON's** sales and support network, 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, 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 **OHSAS 18001** – 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 and ISO 14001 certifications.



Headquarters complex, logistics centre and training centre installations of PENETON Hellas S.A., at Acharnes, Athens.

# THE PENETRON® SYSTEM

## Uses:

- Drinking 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, and to fill form-tie holes, honey-combed areas and routed out cracks in mortar consistency.



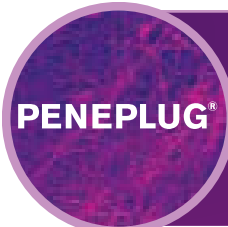
**PENETRON ADMIX®**

An additive mixed into new concrete at the time of batching for complete integral waterproofing.



**PENETRON PLUS®**

A dry shake, powder formulation used for horizontal surfaces and precast. It is a selected blend designed for ease of trowel-in application.



**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 fissures.



## DESCRIPTION:

PENETRON® cementitious capillary waterproofing products are formulations consisting of common cement, quartz sand (of special grade) and multiple activating chemicals that provide the most effective 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 to drive out moisture. The process works with or against the pressure of water. In the absence of moisture, PENETRON® components lie dormant.

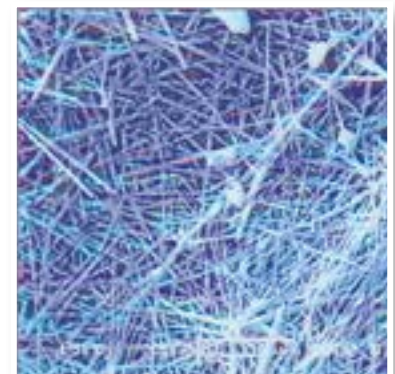
Should moisture recur at any time, the chemical action and sealing process repeats itself automatically and advances even more deeply into the concrete. PENETRON® chemicals will continuously seal and reseal due to their chemical nature. Crystalline growth from capillary waterproofing has been measured 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 a coating or membrane
- Penetrates deeply (up to 1 meter) and seals concrete's capillary tracts and shrinkage cracks
- Can be applied from either the positive or negative side
- 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
- Seals cracks of up to 0.4mm. Does not merely mask or bridge hairline and shrinkage cracks
- 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, carbonates, chlorides, sulfates and nitrates
- Can be applied to moist or green concrete
- Protects reinforcing steel
- Non toxic
- Certification according to EN 1504-3
- Approved for potable water use (certification NSF 61)
- No extensive curing times (except in very hot or low-humidity conditions)



Microscopic examination of concrete at 28 days.

# THE PENETRON® SYSTEM

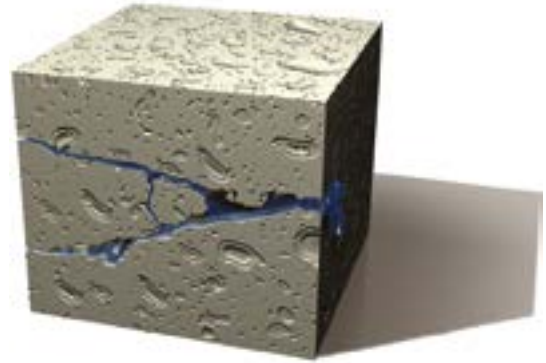
## How PENETRON® waterproofs concrete

Typical concrete structure  
with Moisture

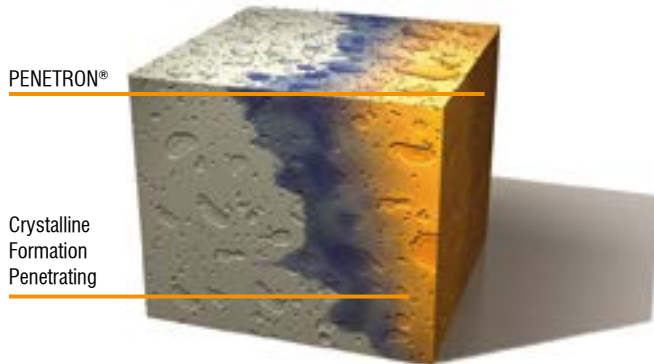


## How PENETRON® waterproofs a crack

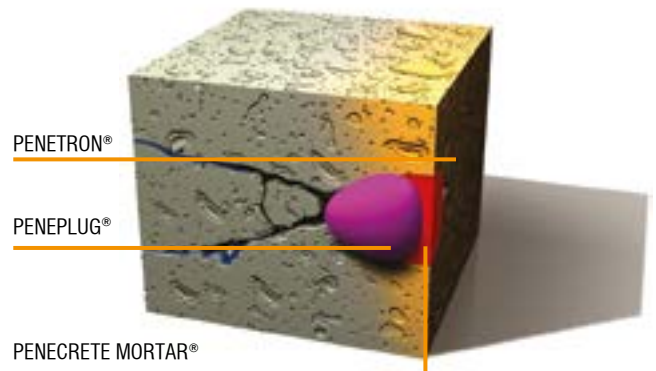
A typical leaking crack



PENETRON® may be applied to Positive  
or Negative surface in a variety of forms



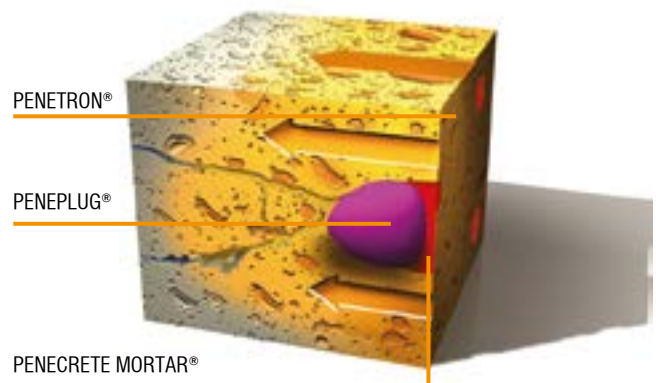
The chemical reaction starts as soon as PENETRON®  
is applied to concrete



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



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



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

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

1

2

3



# PENECRETE MORTAR®

## DESCRIPTION:

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

### Uses:

#### Used in conjunction with PENETRON® for:

- 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
- Waterproof sacking of concrete "bugholes"
- Repairing of spalled and honeycombed areas

### Benefits:

- Can be skim coated or feather edged
- Can be applied to moist concrete
- Fast setting
- Inorganic: no polymers
- Nonflammable
- Resists abrasion and mechanical wear
- Certification according to EN 1504-3
- Freeze/thaw resistant
- Certified for use in contact with potable water (certification NSF 61)
- Can be applied by hand pointing, trowel or brush

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 50LB. (22.68KG) BAG

	Size		Consumption		Yield/bag	
	inch	(mm)	Lb/ft	(Kg/m)	ft	(m)
Cracks, U-shaped	1x1	(25x25)	1,0	1,3	50	15,3
Reglets	1x1	(25x25)	1,0	1,3	50	15,3
Coves, Triangular	1,5x1,5	(38x38)	1,0	1,3	50	15,3
Tie Holes	1x1x1	(25x25x25)	-	-	600 nos	

Honeycomb patching approximately 0.4ft<sup>3</sup> (0.011 m<sup>3</sup>)/bag

All above values are approximate depending on surface conditions.

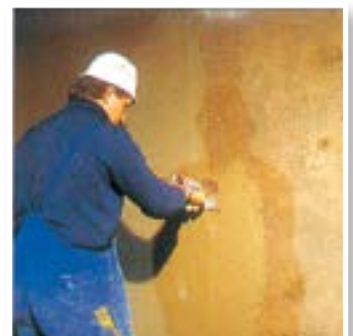
#### PHYSICAL DATA

Aggregate State	Powder
Color	Cement Grey
Bulk Density	1,81 Kg/l (112 lb/ft <sup>3</sup> )
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 (1600 psi)	2,2 MPa (320 psi)
3 days	16 MPa (2400 psi)	3,6 MPa (520 psi)
7 days	40 MPa (5800 psi)	5,0 MPa (730 psi)
28 days	47 MPa (6900 psi)	6,2 MPa (900 psi)

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



# PENETRON® PLUS

THE  
PENETRON  
SYSTEM



## Benefits:

- Improves the abrasion resistance of the concrete
- Ease of application and laborcost effective
- Increases concrete's ompressive strength
- Certification according to EN 1504-3
- Approved for potable water use (Certification according to NSF 61)

## Technical Data:

**PENETRON® SYSTEMS have 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**

# 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



## 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. 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

### Advantages:

- Resists extreme hydrostatic pressure from either positive or negative surfaces
- Becomes an integral part of the substrate
- Highly resistant to aggressive chemicals
- Can seal hairline cracks of up to 0.4mm
- 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
- Increases flexibility in construction scheduling



Changi Airport Terminal 3, Singapore

### 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 Technical Representative for the most appropriate PENETRON ADMIX® for your project. PENETRON ADMIX® is CE certified according to EN 934-2:2006. 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)
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- Chemical Resistance ASTM C267-77 Bond Strength of Chemical Resistant Mortar ASTM C-321
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- 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 Admix. However, under normal conditions the 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 and strength 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 International Ltd. 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 300 - 500 lb. (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., 40 lb./18 kg. of powder mixed with 6 gallons/22.7 liters of water). Pour the required amount of material into the drum of the ready-mix truck. The aggregates, cement and water should be batched and mixed in the plant in accordance with standard practices (taking into account the quantity of water that has already been placed in the ready-mix truck). Pour the concrete into the truck and mix for at least 5 minutes to ensure even distribution of the PENETRON ADMIX® throughout the concrete.

**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.



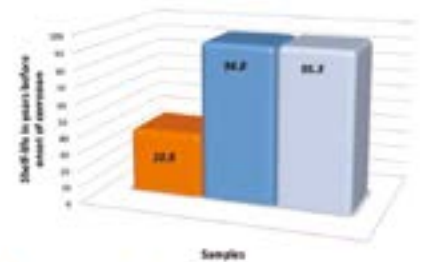
# PENETRON ADMIX® SYSTEM for Total Concrete Protection

- Permanent Waterproofing
- Anti-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)



■ C without Penetron Admix ■ C1 with Penetron Admix ■ C2 with Penetron Admix

**Concrete Admixtures C € Certification EN 934-2:2006**



# 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

### BENEFITS:

- Becomes an integral part of concrete, forming a complete body of strength and durability
- 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 (such as amines, which can cause heavy skin irritation) unlike other organic-based injection materials
- Easy to use and labor-cost effective
- Only water is required for clean up
- No solvents are needed for dilution and cleaning of equipment
- Certification according to EN 1504-5

### Application:

**Surface Preparation:** Prepare crack to receive repair materials by saw cutting along the length of the crack at a width of approximately 3/4" to 1" (20 to 25 mm). Sawcut should be in a reverse "V" or "U" shaped channel to avoid 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 1" (20 mm) wide sawcut is made, an 1 1/2" (20-30 mm) depth channel should be cut out]. Clean the sawcut channel with a water pressure washer (3,000 psi minimum) and drill holes to receive the injection packers. Diameter and depth of the holes will be as 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 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 an additional one 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 Lt (0.5 quart) to a maximum of 1 Lt (1 quart)] can be added until a viscosity of 18 DIN-seconds is reached. Once this mix is poured into the funnel of the injection pump, it is ready to be injected. It is helpful to slightly agitate the mix from time to time (about each 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 out of the funnel, pump and injection tubes. Pot life times are based on a temperature of 68 °F (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 in mix water. PENETRON HELLAS 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 Lt of PENETRON® INJECT (Part B – liquid) and with 9 Lt of clean water.

#### Fast Set Mix Ratio (30 - 60min):

PENETRON® INJECT (Part A – powder) 1 bag 25 kg mixed with 1 Lt of PENETRON® INJECT (Part B – liquid) and with 10 Lt 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 3 to 6 inches (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 for the most accurate support for your project.

#### SPECIAL CONSIDERATIONS

DO NOT apply PENETRON® INJECT at temperatures below 40°F (4°C), to a frozen substrate or if temperatures will drop below freezing during the curing period (approximately 24 hours).



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

# 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, laitance 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 the concrete surface has an open capillary system. The surface to be treated should never have a shiny appearance.
- Rout out visible cracks exceeding 0.4 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 strata to ensure maximum chemical penetration. Surfaces should be damp when PENETRON® products are applied.

## Mixing

### PENETRON®

**Brush application:** 0.8 kg./sq.m. 5 parts PENETRON® to 2.5 - 3 parts water (5:3).  
1.1 kg./sq.m. 3 parts PENETRON® to 2 - 2.5 parts water.

**Spray application:** 0.8 kg./sq.m. 5 parts PENETRON® to 3 - 3.5 parts water (varies with climate and spray equipment). 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, 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). Gloves must be worn. Add just enough water (drops) to form a mix that has a dry pack/dry earth consistency.

## 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 in laminating layers of 2.5 cm to 3 cm. 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 dry 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. If working (mud) slab applications, contact PENETRON® representative.

## PENECRETE MORTAR® Application

- Mix PENECRETE MORTAR® by hand or paddle mixer to a stiff mortar consistency.
- Apply by brush the bonding coat of PENETRON® slurry.
- Apply PENECRETE MORTAR®.
- 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 standing on and/or tapping hard with a wedge of wood and a hammer.
- After leak has stopped, fill void to surface with PENECRETE MORTAR®.

## Coverage

- Horizontal concrete surfaces: PENETRON® at 1.4 kg. to 1.6 kg./sq.m. 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./sq.m., when concrete reaches initial set. Trowel or float to specified finish
- Vertical concrete or block surfaces: PENETRON® at 1.4 kg. to 1.6 kg./sq.m. total. Applied in two (2) coats (0.8 kg. per coat).

## Curing

- Except for extremely hot weather and very low humidity, curing of the PENETRON® system is not required. 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 (1 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 32°F (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**  
TOTAL CONCRETE PROTECTION



PENETRON INJECT application in tunnels

**PENETRON**  
TOTAL CONCRETE PROTECTION



Bridge repair



# 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, and then fill the adjoining hole as per PENETRON® method.

## Cavity-Fill Method

### Solving the Problem of Rising Damp

Drill holes 2.0 cm to 2.5 cm 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®

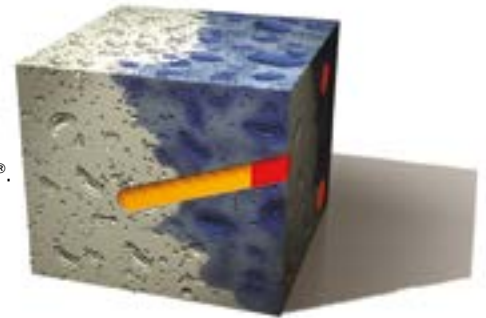
# 1

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 as 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.

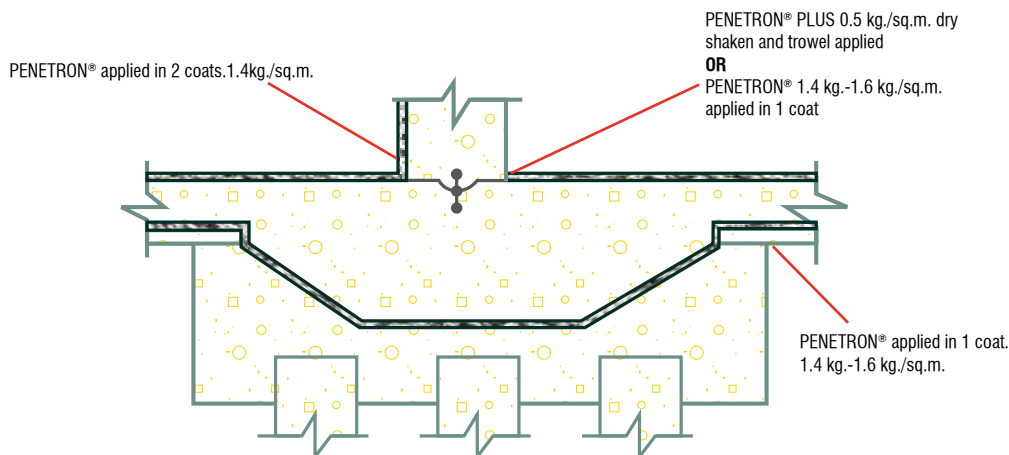
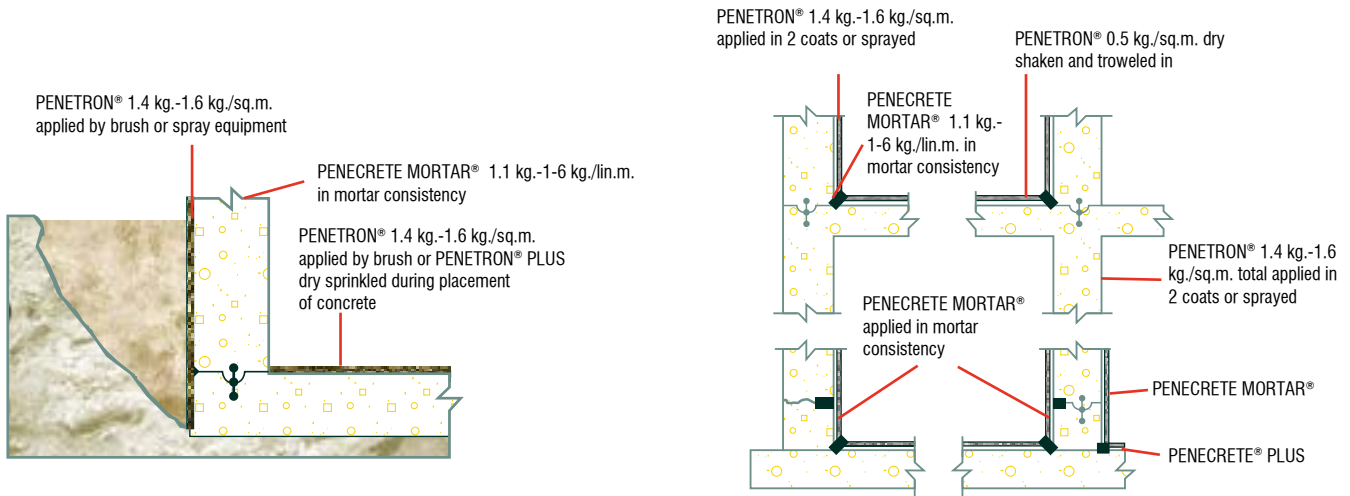
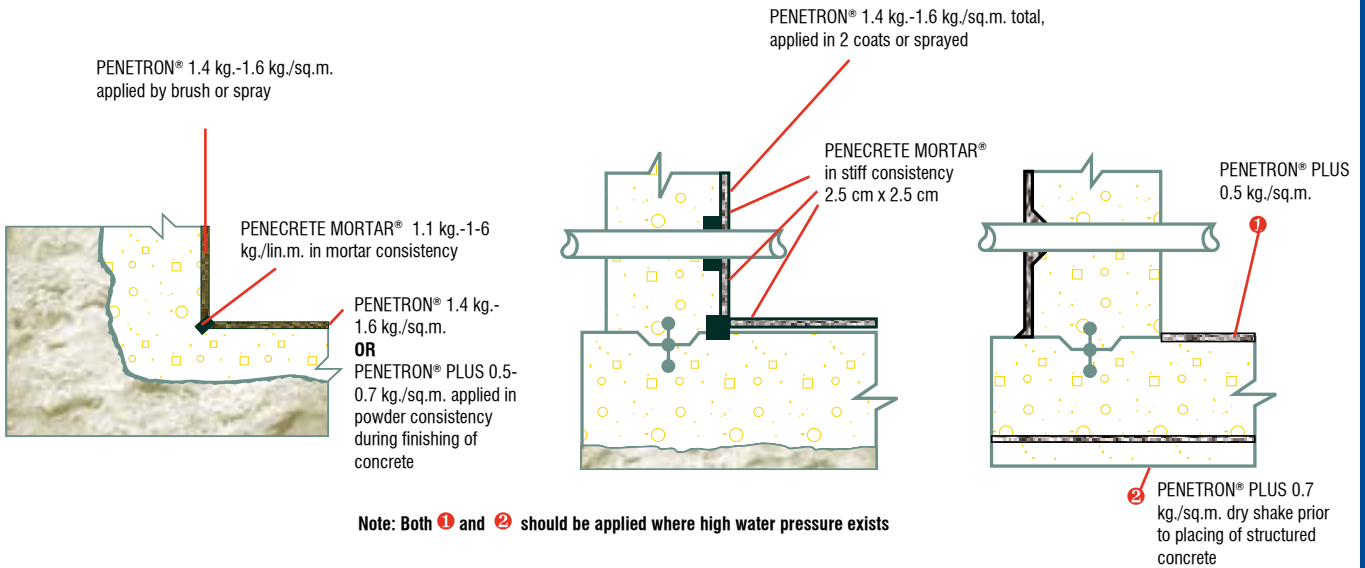


House of Rest  
Burial Place of Czar  
Nicholas II  
St. Petersburg, Russia



# APPLICATION INSTRUCTIONS

## Application Instructions



Note: 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 used to carry steam-condensing water three miles from the Ocean to the plant, together with foundations of the plant, underground facilities and all 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 PENETRON's additional benefit of significant reduction in gamma radiation in case of accident. Products used include PENETRON®, PENECRETE MORTAR® and PENEPLUG®.



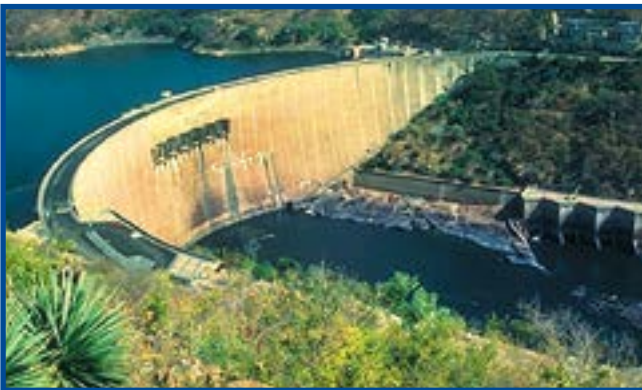
**Project:** Statue of Liberty

**Location:** New York, USA

**Date:** 1986

**Description:** Located in New York Harbor, the Statue of Liberty is one of the most universal symbols of political freedom and democracy. The Statue was extensively restored in time for her spectacular centennial 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 becomes warmer. The moist air coming off the water routinely saturated the walls, resulting in moisture inside the pedestal, 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 conservation of the oceans. The PENETRON® SYSTEM was used to successfully waterproof and protect all tanks from the effects of seawater, including the dolphin and sea lion pools.



# 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 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<sup>3</sup> 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 occurred, 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 were 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 drinking 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 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 <sup>-13</sup> m/sec
Compressive Strength	(ASTM C39)	After 28 days = >6%
Approved for potable water use	NSF 61	

## PENETRON® Coated Concrete

European Certification	EN 1504-3	Repair and structural strengthening of reinforced concrete structures
Water Permeability	(CDR-C-48-73)	After 28 days = < 1.9x10 <sup>-14</sup> cm/sec (before treatment 1.8x10 <sup>-11</sup> 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 <sup>4</sup> 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 potable water use	NSF 61	US EPA and State of New York DOH

## 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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