شركة المرصد العالمي المتخصص لتشييد المباني

GSO – Global Specialized Observatory

حلول متكاملة لجودة البناء وحماية المنشأت

Krystol T1®

Concrete Waterproofing

معالجة خرسانية كريستالية متكاملة ضد الرطوبة

Crystalline Concrete Waterproofing



- Permanent Waterproofing
- Penetrates Deep
- Self-Sealing Cracks
- Non-Toxic & Eco-Friendly

تكنولوجيا كريستول المتطورة

لحماية الخرسانة من الداخل إلى الخارج

- Trusted Worldwide Since 1973
- Proven Performance in Demanding Environments
- Quality You Can Build On

TECHNICAL DATA SHEET

Surface Applied Concrete Waterproofing

Krystol® T1



DESCRIPTION

Krystol T1 is a surface applied waterproofing treatment based on advanced Krystol® crystalline technology that transforms concrete into a permanent waterproof barrier. Krystol® migrates into the concrete and drives a catalytic reaction using cement and water to grow a protective crystalline network through the concrete's pores, cracks, and micro-cracks. Any moisture introduced over the lifespan of the concrete will initiate new crystallization, ensuring permanent protection.

BENEFITS

- Contains advanced Krystol® crystalline waterproofing technology.
- Permanent integral protection.
- Provides low permeability - Effective to 140 m (460) feet of head pressure.
- Reliably self-seals hairline cracks up to 0.5 mm (0.02 inches) and effectively self-heals micro-cracks.
- Proven protection against:
  - Water penetration
  - Salts/chlorides and corrosion
  - Sulfate attack
  - Aggressive chemicals and H_2S sewer environments.
  - Freezing-thawing cycles
  - Alkali-silica reaction (ASR)
- Non-corrosive – does not contain chlorides
- Use on new or existing concrete
- Not harmed by UV rays.
- Allows concrete to breathe
- Can be applied from either the positive (wet) or negative (dry) side of the concrete
- Non-toxic – zero VOC – Contributes to LEED credits – Concrete remains recyclable
- Certified to NSF/ANSI/CAN No. 61 – safe for contact with potable water

WHERE TO USE

- Basements and foundations
- Marine structures
- Elevator pits and equipment pits
- Parking structures
- Pools and water features
- Water reservoirs and tanks
- Tunnels, pipes, manholes and vaults
- Bridge decks and support structures
- Retaining walls
- Maintaining and protecting infrastructure

TECHNICAL DATA SHEET

Surface Applied Concrete Waterproofing

TECHNICAL DATA

Packaging and yield	25kg (55 lb.) pail – Covers up to 20 m^2 (225 square feet) 5 kg (11 lb.) pail – Covers up to 4 m^2 (45 square feet)
Color	Available in Grey or White (see Limitations section below)
VOC content	0 g/L
Shelf-Life	At least 3 years for unopened pails when stored in a dry enclosed area
Mix Ratio	3.5 parts powder to 1 part water by volume (based on loose powder) Each 25 kg (55 lb.) pail takes approx. 6.5 Liters or 1.7 gallons of water
Working time (20°C / 68°F, 50% RH)	30 minutes
Hardening time (20°C / 68°F, 50% RH)	5 hours
Hydrostatic head resistance	140 m (460 feet) tested to USACE CRD-C48
Typical rate of crystal penetration	2-10 mm (0.08-0.40 inches) per week
Self-sealing of cracks	≤ 0.5 mm (0.08 inches)
Pull-off Strength (ASTM C1583)	3.1 MPa (450 psi)

TEST RESULTS

Water Permeability	DIN 1048: Part 5 (0.5 MPa/72.5 psi hydrostatic pressure for 72 hours): • Krystol T1 treated samples had an 85.6% reduction in permeability over the same untreated (control) concrete; 5.3 mm (0.21 in) vs. 36.7 mm (1.45 in). - *Kuwait University, 2004* • Krystol T1 treated samples had 25 mm (0.98 in) of water penetration while the equivalent untreated concrete showed 100 mm (3.94 in), or a 75% reduction in permeability. *Metro Testing.* USACE CRD-C48 (1.38 MPa / 200 psi for 14 days) • Krystol T1 treated samples were split in half and water penetration depths measured. Controls had an average penetration depth of 50mm while Krystol T1 treated samples averaged 5mm, demonstrating a 90% reduction in water permeability. *Kryton Research Center* IS: 2645-2003 (0.2 MPa, 29 psi for 8 hours) • Water percolation test – Plain Mortar 195 ml, Krystol T1 Treated Zero (Nil). *Shriram Institute for Industrial Research*
Crack Sealing	• Krystol T1 sealed leaking cracks in concrete block 7 days after application. *Seoul National University of Technology.* • Testing of several crystalline coatings found that Krystol T1 was the only product to fully seal and resist 0.45 MPa of water pressure (65 psi), the maximum of the apparatus. *Port Authority of New York and New Jersey*

Chloride Permeability	• After 90 days ponding in 10% Calcium Chloride Solution, acid soluble chloride ion content was determined at various depths. Krystol T1 treated concrete showed a reduction over the control of 62.9% at 5 mm (0.2 in), 83.8% at 10 mm (0.4 in) and 94.6% at 15 mm (0.5 in). *HBT Agra Ltd.* • ASTM C1202 (Rapid Chloride Permeability Test) – Control Concrete, 2564 Coulombs (moderate), Krystol T1 treated concrete < 100 Coulombs (negligible). *NBTC Group, Kuwait.*
Depth of (Krystol) Penetration	• Concrete was treated with 3mm of plaster, followed by Krystol T1. After curing, the Krystol T1 and plaster were removed and tested for permeability following DIN 1048-5 (0.5 MPa, 72.5 psi for 72 hours). The treated samples were 51% less permeable than the untreated concrete, even after the coating was removed. Krystol penetrated through the plaster layer and into the concrete itself. *MateriaLab, Hong Kong.* • "Crystal growth in capillary porosity was observed in fracture surfaces of the concrete cylinders used in these tests at locations up to 4 inches (100mm) away from the coated surface. This validates the claim of in-depth penetration achieved with the "Krystol." *HBT Agra Ltd.*
Water Absorption (BS 1881: Part 2)	• Untreated concrete had absorption of 1.8 ml/m^2.s. Krystol T1 treated concrete was NIL and was "too impermeable to be sensitive to a longer term test." *Sirim QAS International, Malaysia.*
Sulfate Resistance	• After 21 wet/dry cycles in a high sulfate solution, Krystol T1 treated concrete showed no strength loss whereas untreated concrete showed significant strength loss. *HBT Agra Ltd.*
Hydrocarbon Resistance	• Krystol T1 increased resistance to gasoline ~5 times, Diesel Fuel and Transformer Oil ~8 times. *Czech Technical University Klokner Institute.*
Bio-acid/H_2S Resistance	• Load deflection testing showed Krystol T1 treated samples where ~85% stronger than controls after exposure in a bio-acid (sewer) test chamber. *University of British Columbia.*
Alkali Silica Reaction	• Krystol T1 was shown to slow down and delay ASR and related damage in ASR affected concrete. - *University of Ottawa.*

Properties are typical obtained under laboratory conditions. Reasonable variation can be expected on-site due to specific project factors.

APPLICATION

General Procedure: Mix Krystol T1 to a thick but spreadable consistency (approximately 3.5 parts powder to 1 part clean water by volume). Apply evenly to properly prepared concrete that is in a saturated-surface-dry (SSD) condition using a sprayer, brush or broom at a rate of 1.2 – 1.6 kg/m^2 (2.2 – 3 lb/yd^2). For additional coats, apply the second coat when Krystol T1 has set hard (6 to 24 hours depending on conditions). Protect from frost, rain, traffic and rapid drying for 24 hours. Wet cure for at least 3 days (7 days for potable water tanks). For full instruction, see:

- Application Instruction 2.11 — Waterproofing with Surface Treatment.
- As part of the Krystol Leak Repair System - Application Instruction 5.12 — Waterproofing Cracks, Holes and Joints.

Drawings, CAD details and specification language: See www.kryton.com/technical-info/ or contact your authorized Kryton representative.

COVERAGE

One-coat Application	Standard Coverage:	1.2 kg/m^2 (covers approx. 20 m^2 or 225 sq feet) per pail).
	Enhanced Protection:	1.6 kg/m^2 (covers approx. 16 m^2 or 170 square feet per pail).
Multi-coat Application	Each coat may be applied as low as 0.8 kg/m^2 (covers approx. 32 m^2 or 340 square feet per pail).	

LIMITATIONS

Air and surface temperature at the time of application must be at least 4°C (40°F). The Krystol T1 Concrete Waterproofing is an effective waterproofing system for rigid concrete structures only and may not be reliable for structures with moving cracks or joints. Consult your Kryton representative for project specific recommendations. This product application is not intended as an aesthetic finish. As a result of varying substrate conditions, such as porosity and moisture availability, this application may exhibit uneven crystal growth, uneven texture and uneven color. If desired, an aesthetic finish may be applied over the application once it has been properly cured and prepared.

SAFETY

Read the Safety Data Sheet (SDS) for this product. For professional use only. This product becomes caustic when mixed with water or perspiration. Avoid contact with skin or eyes. Avoid breathing dust. Wear long sleeves, safety goggles and impervious gloves.

WARRANTY

Kryton International Inc. (Kryton) warrants that Kryton products are free from manufacturing defects and comply with the specifications given in their respective technical data sheet. Because conditions of use, such as site conditions, surface preparations, workmanship, concrete ingredients, weather, structural issues and other factors are beyond the control of Kryton, no warranty can be given as to the results of use. Purchaser agrees to seek the advice of qualified professionals and to determine for themselves the suitability of the products for their intended purpose and assumes all risks. Purchaser's sole remedy is limited to replacement of any product proven defective or at Kryton's option refund of the purchase price paid. THIS LIMITED WARRANTY CONTAINS THE ENTIRE OBLIGATION OF KRYTON. NO OTHER WARRANTIES, EXPRESS OR IMPLIED, SHALL APPLY INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. KRYTON SHALL NOT BE LIABLE UNDER ANY LEGAL THEORY FOR SPECIAL OR CONSEQUENTIAL DAMAGES. No representative of Kryton has the authority to make any representations or provision except as stated herein. Kryton reserves the right to change the properties of its products without notice.

APPLICATION INSTRUCTION

Surface-Applied Concrete Waterproofing

2.11

SMART CONCRETE®

Krystol T1® Concrete Waterproofing

DESCRIPTION

Krystol T1 is a surface applied crystalline slurry treatment that transforms new or existing concrete into a permanent waterproof barrier.

Krystol T1 lowers the permeability of the concrete to protect against the ingress of water and waterborne chemicals. Since it becomes integral to the concrete, it can be applied to either the positive (wet) or negative (dry) side of the water pressure which allows reliable hydrostatic waterproofing protection and remediation for even the most difficult applications.

Drawings and Specifications:

For section drawings, CAD details and specification language related to this product, visit www.kryton.com/technical-info/ or contact your authorized Kryton representative.

LIMITATIONS

The Krystol T1 Concrete Waterproofing is an effective waterproofing system for rigid concrete structures only and may not be reliable for structures with unstable, moving cracks or joints. Consult a Kryton representative for project specific recommendations. Air and surface temperature at the time of application must be at least 4°C (40°F).

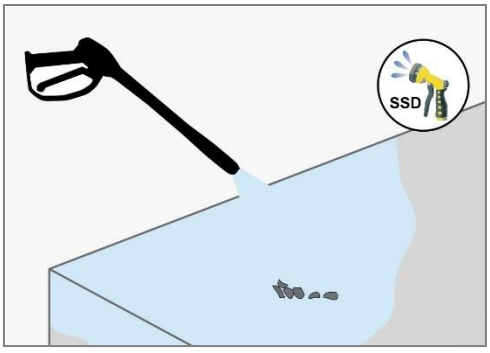
SAFETY

Read the Safety Data Sheets (SDS) for this product. For professional use only. This product becomes caustic when mixed with water or perspiration. Avoid contact with skin or eyes. Avoid breathing dust. Wear long sleeves, safety goggles, impervious gloves and appropriate dust mask.

STEP 1: SURFACE PREPARATION

1. Stop all leaks and repair all concrete defects such as cracks, faulty construction joints, pipe penetrations and honeycombing using the following repair procedures:
    a. Repair Application Instruction 5.12 - Waterproofing Cracks, Holes & Joints
    b. Repair Application Instruction 5.21 - Patching and Parging Defective Concrete and Masonry
    c. Repair Application Instruction 5.32 - Waterproofing Pipe Penetrations

    Prepare the surface by high pressure water blasting (minimum 3,000 psi), scarifying, shot blasting or sandblasting. Concrete surfaces must be clean and free of paint, sealers, form release agents, dirt, laitance or any other contaminates. The concrete must be open-pore and absorptive such that water placed on the surface will soak in.



    NOTE: Acid etching is not recommended. If acid etching must be used, all traces of acid must neutralized and rinsed away before applying the Krystol T1.
2. Surfaces to receive Krystol T1 must be brought to a saturated-surface-dry (SSD) condition. The concrete must be completely saturated with water, but all surface water must be removed before applying Krystol T1. Thoroughly soak the surface with water; then remove excess water with a sponge or vacuum just before applying Krystol T1.

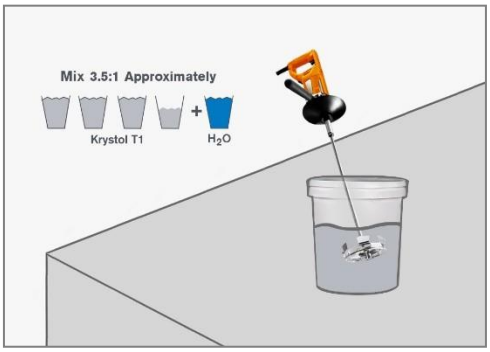
    TIP: High pressure water blasting is effective at cleaning and saturating the concrete in one step.

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STEP 2: MIXING

Krystol T1 can be applied by a concrete brush, broom, texture sprayer or a grout pump/sprayer in either one or two coats. Mix ratios may slightly vary dependent on application method.

Start by mixing approximately 3.5 parts of powder with 1 part clean water by volume and mix until smooth. Adjust as needed based on ambient temperatures to produce a thick, low-sag but spreadable coating. Krystol T1 will thicken in the pail when at rest. Stir as needed to maintain workability (do not add more water). Do not mix more material than can be applied in 20 minutes.



IMPORTANT: Use only as much water as needed to allow you to spray or brush the product evenly. Using too much water will result in low build thickness and make the product weak.

TIP: Krystol T1 will compact in the pail during shipping. Roll the sealed pail on its side to loosen the powder before opening the lid.

STEP 3: APPLICATION

Ensure that Krystol T1 is only applied to saturated-surface-dry (SSD) surface. As you apply the coating, you may need to rewet the concrete ahead of you to maintain a SSD surface. Failure to bring the surface to an SSD condition will result in a weak bond between the Krystol T1 coating and the concrete, and may lead to dusting, flaking and delamination.

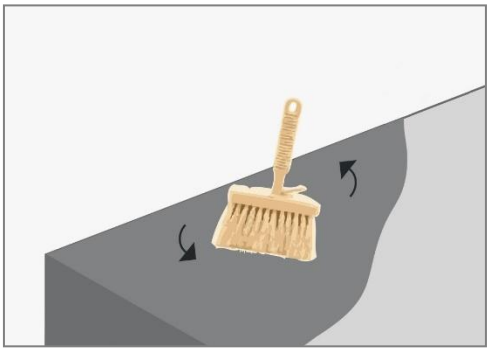
1. Brush or spray Krystol T1 evenly over the concrete at a rate of 1.2 – 1.6 kg/m^2 (2.2 – 3 lb/yd^2) which can be applied in one or two coats.

APPROXIMATE COVERAGE PER 25 KG (55 LB) PAIL

One coat application				Two coat application (per coat)		
1.2 kg/m^2 (2.2 lb/yd^2)	=	20 m^2 (225 ft^2)	=	0.6 kg/m^2 (1.1 lb/yd^2)	=	N/A
1.3 kg/m^2 (2.4 lb/yd^2)	=	19 m^2 (210 ft^2)	=	0.65 kg/m^2 (1.2 lb/yd^2)	=	N/A
1.5 kg/m^2 (2.8 lb/yd^2)	=	N/A	=	0.75kg/m^2 (1.4 lb/yd^2)	=	34 m^2 (360 ft^2)
1.6 kg/m^2 (3 lb/yd^2)	=	N/A	=	0.8 kg/m^2 (1.5 lb/yd^2)	=	32 m^2 (330 ft^2)

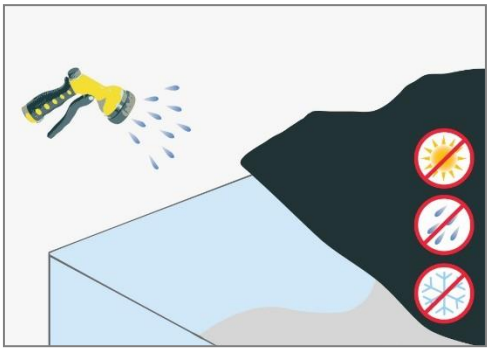
IMPORTANT: Set pails out over the work area in advance to help determine and track coverage.

2. With a concrete brush, scrub and brush the coating to low spots and ensure a good bond.
3. Finish with a lighter pressure to level high spots to ensure a uniform build with no thin spots.
4. If using two coats it is preferable to apply the second coat within 48 hours after the first coat has set hard (usually 6-24 hours depending on temperature). Wash and rinse the hardened Krystol T1 to remove surface bloom before applying the second coat. This may expose some of the aggregate in the first coat. Ensure the hardened Krystol T1 is in an SSD condition.



NOTE: For a smoother, stucco like finish, allow the applied product to set for 5-10 minutes, then smooth the surface with one or two light passes with a trowel.

STEP 4: WATER CURE & PROTECT



Protect the freshly applied Krystol coating with tarps or plastic to prevent water loss due to evaporation while it hardens. Wet curing should begin as soon as the Krystol coating has hardened and will not be damaged by the curing water, usually 6-24 hours depending on temperature. Keep protective coverings in place during the curing period to retain moisture. Apply more curing water if the coating dries out during the curing period. Backfilling may be done after the coating has set hard. If backfilling within 3 days, use damp backfill material.

Wet cure for a minimum of 3 days (7 days for potable water tanks) after Krystol T1 has hardened before water testing treated tanks and reservoirs. Initially, the surface may need to be rinsed with fresh water several times, or water may need pH adjustment using citric acid or similar water treatment chemicals.

IMPORTANT: Freshly applied Krystol T1 must be protected from early drying, rain, frost and traffic. Once hardened it must be kept damp and wet cured for at least 3 days (7 days for potable water) to develop its properties. Longer curing periods are beneficial.

APPLICATION OF PAINTS, COATINGS, GROUTS AND MORTARS OVER KRYSTOL T1

Krystol T1 may develop a surface bloom that may inhibit adhesion of some coatings and finishes. Take care to clean and prepare the surface adequately. Wash and rinse the hardened Krystol T1 to remove surface bloom before applying paints or cementitious products. Roughen Krystol T1 coating to remove loose surface particles.

Paints and coatings must be suitable for use on (new) concrete. Always apply according to the paint manufacturer's instructions, including any recommended primers.

Cementitious products, such as grouts, mortars and plasters can be applied within 48 hours after the Krystol T1 has set hard (6-24 hours depending on conditions) and has developed enough bond strength to support these products. If installing after this time frame use a polymer bonding agent.

IMPORTANT: Always apply a test patch to determine compatibility.

EXISTING CONSTRUCTION OVERVIEW

Waterproofing Existing Parking Garages

SMART CONCRETE®

Kryton's concrete repair products are specially designed to resurface, waterproof and repair leaking cracks, joints, penetrations, tie-holes and defective concrete from the positive or negative side of water pressure. They can be used in concrete that was built yesterday, or structures needing waterproofing repair after decades of service. Kryton's concrete repair products reliably stop high water flow, even under high-hydrostatic pressure, and outperform epoxy or polyurethane injection repair systems.

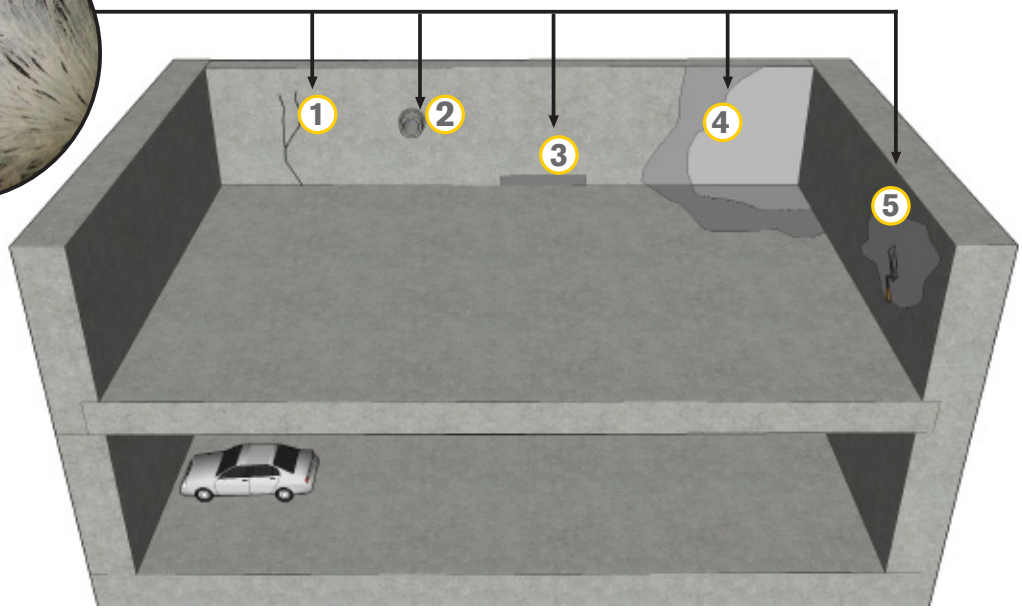
Krystol® Technology

Kryton waterproof repair products contain Krystol technology.

When applied to concrete, Krystol chemically reacts with water and un-hydrated cement particles to form insoluble needle-shaped crystals that fill capillary pores and micro-cracks in the concrete and block the pathways for water and waterborne contaminants.

Any moisture introduced over the lifespan of the concrete will initiate crystallization, ensuring permanent waterproofing protection.





Krystol Leak Repair System

Comprised of Krystol Plug™, Krystol Repair Grout™, and Krystol T1® (recommended), it is primarily used to repair leaking cracks in concrete.

1. Waterproofing cracks, holes and joints.
2. Leaking pipe penetrations.
3. Leaking joints.

Krystol T1 Concrete Waterproofing

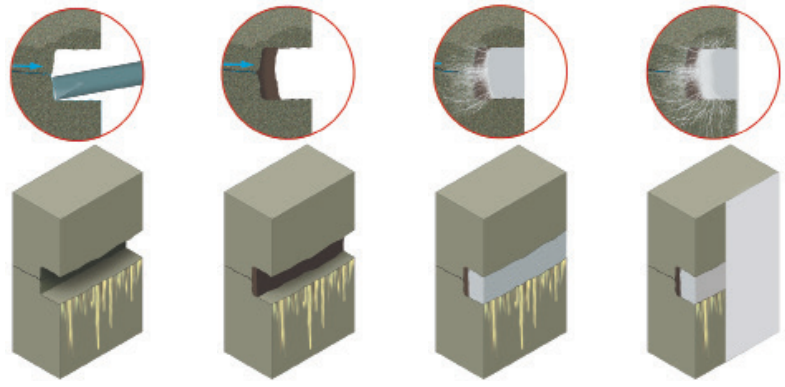
An "in-depth" concrete treatment that is applied as a slurry or spray to the surface of existing concrete structures.

4. Slab and walls to prevent further water ingress.

Krystol Repair Grout or Krystol Bari-Cote

5. Patching and parging defective concrete and masonry.

1 KRYSTOL LEAK REPAIR SYSTEM



Step 1: *Prepare the crack or joint.*

Step 2: *Stop flowing water with Krystol Plug.*

Step 3: *Install Krystol Repair Grout.*

Step 4: *Apply Krystol T1 to the surface.*

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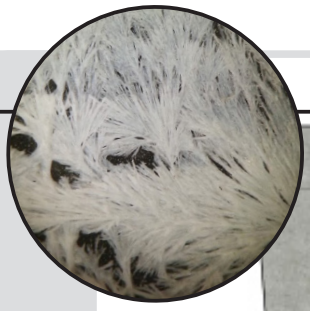
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EXISTING CONSTRUCTION OVERVIEW

Waterproofing Water Tanks / Reservoirs

Kryton's concrete repair products are specially designed to resurface, waterproof and repair leaking cracks, joints, penetrations, tie-holes and defective concrete from the positive or negative side of water pressure. They can be used in concrete that was built yesterday, or structures needing waterproofing repair after decades of service. Kryton's concrete repair products reliably stop high water flow, even under high-hydrostatic pressure, and outperform epoxy or polyurethane injection repair systems.

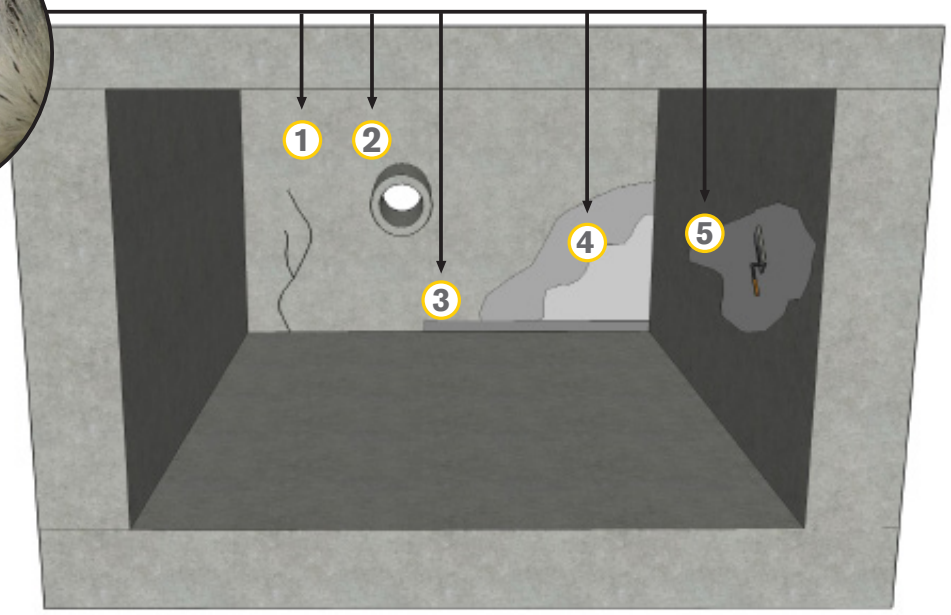
Krystol® Technology



Kryton waterproof repair products contain Krystol technology.

When applied to concrete, Krystol chemically reacts with water and un-hydrated cement particles to form insoluble needle-shaped crystals that fill capillary pores and micro-cracks in the concrete and block the pathways for water and waterborne contaminants.

Any moisture introduced over the lifespan of the concrete will initiate crystallization, ensuring permanent waterproofing protection.



Krystol Leak Repair System

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1. Waterproofing cracks, holes and joints.
2. Leaking pipe penetrations.
3. Leaking joints.

Krystol T1 Concrete Waterproofing

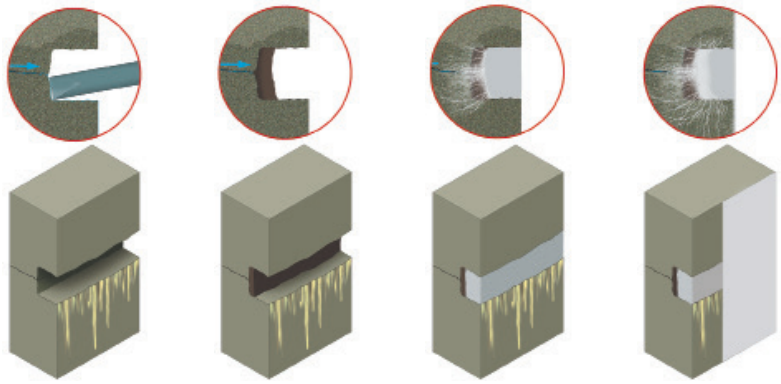
An "in-depth" concrete treatment that is applied as a slurry or spray to the surface of existing concrete structures.

4. Slab and walls to prevent further water ingress.

Krystol Repair Grout or Krystol Bari-Cote

5. Patching and parging defective concrete and masonry.

1 KRYSTOL LEAK REPAIR SYSTEM



Step 1: *Prepare the crack or joint.*

Step 2: *Stop flowing water with Krystol Plug.*

Step 3: *Install Krystol Repair Grout.*

Step 4: *Apply Krystol T1 to the surface.*

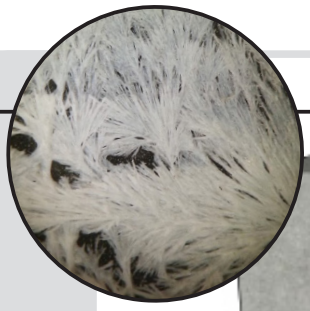
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EXISTING CONSTRUCTION OVERVIEW

Waterproofing Wastewater Treatment Tanks

Kryton's concrete repair products are specially designed to resurface, waterproof and repair leaking cracks, joints, penetrations, tie-holes and defective concrete from the positive or negative side of water pressure. They can be used in concrete that was built yesterday, or structures needing waterproofing repair after decades of service. Kryton's concrete repair products reliably stop high water flow, even under high-hydrostatic pressure, and outperform epoxy or polyurethane injection repair systems.

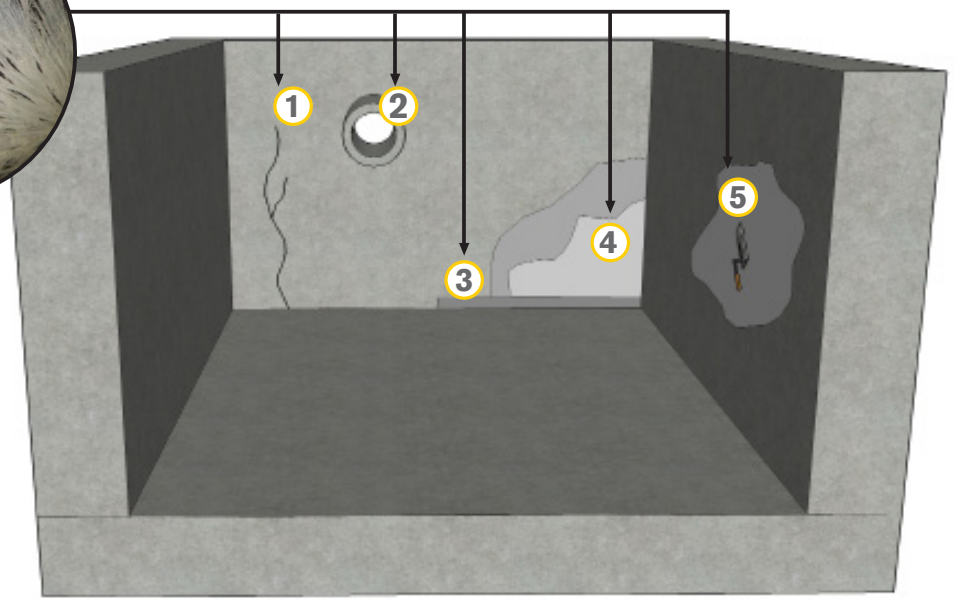
Krystol® Technology



Kryton waterproof repair products contain Krystol technology.

When applied to concrete, Krystol chemically reacts with water and un-hydrated cement particles to form insoluble needle-shaped crystals that fill capillary pores and micro-cracks in the concrete and block the pathways for water and waterborne contaminants.

Any moisture introduced over the lifespan of the concrete will initiate crystallization, ensuring permanent waterproofing protection.



Krystol Leak Repair System

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1. Waterproofing cracks, holes and joints.
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Krystol T1 Concrete Waterproofing

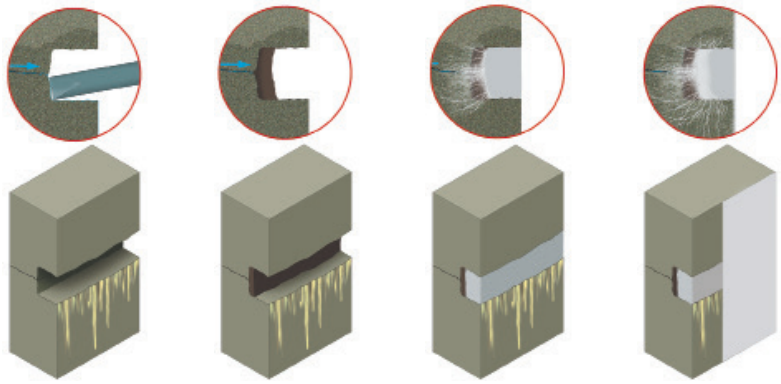
An "in-depth" concrete treatment that is applied as a slurry or spray to the surface of existing concrete structures.

4. Slab and walls to prevent further water ingress.

Krystol Repair Grout or Krystol Bari-Cote

5. Patching and parging defective concrete and masonry.

1 KRYSTOL LEAK REPAIR SYSTEM



Step 1: *Prepare the crack or joint.*

Step 2: *Stop flowing water with Krystol Plug.*

Step 3: *Install Krystol Repair Grout.*

Step 4: *Apply Krystol T1 to the surface.*

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KRYSTOL T1®

Surface Applied Concrete Waterproofing

Frequently Asked Questions (FAQ)

What is the Krystol T1 mixture rate?

Krystol T1 mixture rate is approximately 3.5 parts of the powder to 1 part clean water by volume to produce a thick low sag, but spreadable coating. Mix ratio may slightly vary based on ambient conditions and if the product is being applied to the concrete by sprayer or by brush.

Can I apply Krystol T1 in a single coat?

Yes, Krystol T1 can be installed in either one or two coats. A single thick coat, using a coverage of 1.2 kg/m_2, can be applied to concrete and can save time while delivering a permanent waterproofing solution.

Can I paint over Krystol T1?

Yes, paints and coatings must be suitable for use on (new) concrete and can be applied according to the paint manufacturer's instructions, including any recommended primers. Cementitious products, such as grouts, mortars and plasters can also be applied after Krystol T1 has set hard and has developed enough bond for bon strength to support these products. If installing after this time, use a polymer bonding agent. Always apply a test patch to determine compatibility.

How long should Krystol T1 cure before back filling with soil?

Backfilling may be done after Krystol T1 has set hard, which typically takes 24 hours. Always inspect to ensure adequate strength and a sound bond. If backfilling within 3 days, use damp backfill material so as to not draw moisture out of the coating.

Why is my application of Krystol T1 flaking off?

Krystol T1 requires surface preparation, including the concrete to be in a Surface Saturated Dry (SSD) when it is applied as well as proper application conditions and moist curing. When installed properly (see Application Instruction 2.11 and/or 5.12), Krystol T1 will gain most of its strength and adhesion between 1 and 7 days depending on curing conditions. If early strength and adhesion seems low, continue to moist cure the Krystol T1 application to facilitate further hydration until the desired properties develop.

Why do I need to apply a layer of mortar over the Krystol T1 when installing under tile?

Applying an additional layer of mortar over Krystol T1 prior to installing tile has several advantages; the mortar allows the surface profile to be modified to suit the tile installer's preference, and it also provides a fresh surface for the tile adhesive to bond to.

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What are the minimum and maximum application temperatures for Krystol T1?

Krystol T1 should not be applied below 5 °C (45 °F) to avoid long set times and the risk of freezing.

In hot weather, Krystol T1 should be protected from sources of rapid evaporation such as high temperatures, direct sun exposure, low relative humidity and wind.

Can KIM, Krystol T1 or Krystol Broadcast be substituted for one another?

No.

While each product contains the same Krystol waterproofing technology, each product has been optimized for its intended application method. Always follow the instructions found in Kryton's product data sheets and application instructions.

What effect does KIM and Krystol T1 have on moisture vapour transmission? Does it have a perm rating (g/m2/24hrs)?

Vapour permeability ratings are applicable to membrane systems, not integral materials like KIM or Krystol T1. KIM and Krystol T1 will reduce vapour permeability and moisture vapour transmission through concrete; however, the final performance will depend on many factors, including the basic properties of the concrete.

Testing performed by the British Board of Agrément demonstrated a 20% reduction in moisture vapour permeability for KIM concrete compared to a control. The actual reduction in moisture vapour emission through concrete may be greater because KIM will block liquid water from passing through the concrete, disrupting a significant source of moisture transfer.

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CSI SPECIFICATIONS

Waterproofing and Maintenance of Concrete

Leak Repair, Concrete Repair, Crystalline Waterproofing
Division 3, Division 7

Note to Specifier: *This guide specification includes materials and installation procedures to repair, waterproof and protect concrete with crystalline technology. Successful installation of these systems will restore water tightness, greatly reduce concrete deterioration, prolong service life and reduce future maintenance expenses. The procedures are suitable for the repair of common concrete deficiencies such as leaking or non-leaking cracks, spalls, honeycombs, and restoration and maintenance of concrete cover. The completed system provides protection from the effects of water, chlorides, corrosion, ASR and aggressive chemicals. The guide specification should be adapted to suit the needs and conditions of the project. The content may be included in Division 3 (03 01 00 Maintenance of Concrete) or Division 7 (07 16 16 - crystalline waterproofing) as applicable.*

Part 1 General

1.1 Summary

A. This specification is intended to be read as a whole by all parties involved in the project. The general contractor is responsible to make clear to any subcontractors the scope of their work and coordinate work between different trades.

1.2 System Description

A. This specification describes the patching, repair, surface restoration and protection of exterior horizontal and vertical surfaces of portland cement concrete.

B. The system consists of the following products:

1. Krystol T1 - Penetrating Crystalline Surface Treatment - Resurfaces and waterproofs concrete. Used to ensure low permeability and to seals cracks and microcracks. Provides uniform surface and texture to weathered concrete.
2. Krystol Plug - Used to stop active leaks to allow permanent repairs to be completed.
3. Krystol Repair Grout – Used to make permanent, durable and waterproof repairs to concrete (i.e. cracks and honeycombs). Used as a parge coat to resurface damaged concrete cover or rough, irregular surfaces.

1.3 Related Sections

A. Section 07 16 16 Crystalline Waterproofing

B. Section 03 61 00 Cementitious Grouting

1.4 References

A. The following standards are applicable to this section:

1. ASTC 39 – Compressive strength
2. ASTM C1583 - Bond Strength by direct tension (Pull-off Method).
3. DIN 1048-5 – Water Permeability
4. USACE CRD C48 – Water Permeability
5. CAN/NSF/ANSI No. 61 – Drinking Water System Components

1.5 Quality Assurance

A. Manufacturing Qualifications: The manufacturer of the specified products shall follow a Factory Production Control system certified by agencies accredited to ISO 7065 - Conformity assessment - Requirements for bodies certifying products, processes and services.

B. Contractor Qualifications: The contractor must be qualified in the field of concrete repair with a successful track record of at least 5 years. The contractor will maintain qualified personal trained by a manufacturer's technical representative.

C. Store and apply materials in accordance with the product label and product SDS, or as required by local, state or federal authorities.

1.6 Delivery, Storage and Handling

A. All materials must be delivered in original, unopened containers with the manufacturer's name, label, and batch numbers. Remove damaged material from the site immediately.

B. Store all materials off the ground and protect from rain, freezing or excessive temperature ready to use.

1.7 Job Conditions

A. Do not apply below 4°C (40 °F), or if it is raining or snowing, or if such weather conditions are imminent.

1.8 Submittals

A. Submit copies of the manufacturer's literature, to include: Technical Data Sheet (TDS), Safety Data Sheet (SDS), Application Instructions (AI).

B. Qualification Statements

1. Written notice from installer confirming experience in similar repair work.
2. Submit letter of contractor training by manufacturer.

1.9 Warranty

A. Manufacturer's warranty: Provide written manufacturer's warranty against defects in materials and manufacturing for a period of 10 Years - Concrete Repair Products, beginning with the date of substantial completion of the work.

Part 2 Products

2.1 Manufacturer

A. Basis of Design

Kryton International Inc.
Toll Free: 1.800.268.8280
E-mail: info@kryton.com
Website: www.kryton.com

B. The following products manufactured by Kryton International Inc. conform to the requirements.

1. Krystol T1 (Product Code K-210)
2. Krystol Repair Grout (Product Code K-510)
3. Krystol Plug (Product Code K-620)

C. Substitutions: Not permitted.

2.2 General Requirements:

A. The concrete repair products shall be a blend of portland cement, specially graded, non-reactive aggregates, and additives designed to meet the requirements of this specification.

B. All materials shall be non-combustible, both before and after installation.

C. All materials must be supplied as a sealed, factory blended unit.

2.3 Performance Criteria

Note to Specifier: *Krystol T1 is available in Grey or White.*

A. Crystalline Waterproofing and Protective Coating

1. Appearance <Grey> <White>
2. VOC content – Zero (0 g/L)
3. Working Time – 30 min (20°C / 68°F, 50% RH)
4. Hardening Time – 5 hours (20°C / 68°F, 50% RH)
5. Hydrostatic head resistance – 140 m (460 feet)
6. Crack Sealing – up to 0.5mm (0.02 inches)
7. Pull off strength – (ASTM D4541) – 3.1 MPa (450 psi)
8. Water Permeability – DIN 1048-5 – reduced 75-85%
9. Water Permeability – USACE CRD C48 – reduced 90%
10. Integral Protection:
    1. Crystal growth verified microscopically 100 mm (4 inches) away from the coated surface.
    2. Water penetration - DIN 1048-5 – reduced 51% when tested after removal of the crystalline surface coating.
11. Sulfate Resistance – No loss of strength after 21 cycles in high sulfate solution.
12. Chloride Ion Penetration – reduced 94.6% at a depth of 15 mm (0.5 inches) after 90-day ponding with 10% calcium chloride.
13. Water Absorption – BS 1881: Part 2 – Negligible – “Too impermeable to be sensitive to a longer-term test.”
14. Shape of Crystal - Manufacturer must present independent evidence of waterproofing crystals using both optical imaging and scanning electronic microscope (SEM) to verify waterproofing crystals are needle shaped.
15. Potable Water – Certified to CAN/NSF/ANSI No 61.

B. Fiber-Reinforced Crystalline Concrete Repair Grout

1. Color - Concrete Grey
2. Working time (20°C / 68°F, 50% RH) - 30 minutes
3. Hardening time (20°C / 68°F, 50% RH) - 1 to 1.5 hours.
4. Hydrostatic head resistance - USACE CRD-C48, 140 m (460 feet)
5. Compressive Strength (ASTM C109)
    1. 16 MPa (2300 psi) @ 1 day
    2. 38 MPa (5500psi) @ 3 days
    3. 45 MPa (6500 psi) @ 7 days
    4. 49 MPa (7100psi) @ 28 days
    5. 52 MPa (7500psi) @ 56 days
6. Pull-off Strength (ASTM C1583) - 2.8 MPa (400 psi)

C. Plug Compound

1. Appearance – dark grey powder
2. Working Time – 1 minutes (20°C/ 68°F, 50% RH)
3. Hardening Time – 2 minutes (20°C/ 68°F, 50% RH
4. Compressive strength (ASTM C109)
    1. > 40 MPa (5800 psi) at 7 days.

Part 3 Execution

Note to Specifier: *Detailed installation information is given in Kryton Application Instructions # 5.12 (Leak Repair), 5.22 (general repairs and parge coat) and # 2.11 (Krystol T1). The contractor must read those instructions before performing the work.*

3.1 Surface Preparation

A. Concrete surfaces must be clean and free of paint, sealers, form release agents, curing compounds, dirt, laitance or any other contaminates.

B. Concrete Repair:

1. Cracks and Joints – Chisel or cut the full length of the crack or joint to provide a rectangular-shaped chase that is 40 mm (1.5 inch) deep x 25 mm (1 inch) wide.
    1. Wall-Slab Joints - Angle the chase so it intersects the joint, removing some concrete from both the wall and the slab.
2. Tie holes, rock-pockets, honeycombs - Chisel out defective areas to sound concrete. Rout out the defect to a uniform depth. Leave edges square, do not featheredge.
3. Where reinforcing is encountered, mechanically clean the steel to remove contaminates and rust.

C. Where concrete will receive Krystol T1 coating or Grout Parge Coat, prepare the surface by high pressure water blasting (minimum 3,000 psi), scarifying, shot blasting or sand blasting to remove loose concrete and surface contaminates.

1. For Krystol T1 Coating, prepare to ICRI CSP <1-3>.
2. For parging with Repair Grout, prepare to ICRI CSP <3-5>

D. Thoroughly rinse all surfaces with water to remove all dust and silt.

3.2 Surface Saturation

A. All concrete surfaces that receive repair materials must be Saturated Surface-Dry (SSD). The concrete must be completely saturated with water, but all surface water must be removed before installing repair materials. Rewet the surface as needed to maintain SSD conditions during installation.

3.3 Installation – Concrete Repair - Plug Active Leaks

A. Krystol Plug – Mix to a suitable putty consistency – approximately 4 parts powder to 1 part clean water by volume. Mix only the amount of material that can be installed within one minute.

1. Install 13 mm (0.5 inches) of Krystol Plug and hold in place until it hardens. Do not overfill.
2. Install Krystol Plug along the full length/area of the leaking defect until all leakage has stopped.
3. Wire brush the sides/perimeter of the area to remove excess Plug and rinse with water to expose clean, sound concrete to allow bonding of Krystol Repair Grout.
4. Ensure a minimum depth of 25 mm remains to install Krystol Repair Grout.

3.4 Installation – Concrete Repair – Fill with Grout

A. Krystol Repair Grout - Mix to a non-sag putty consistency (approximately 4.5 parts of powder to 1-part clean water by volume) using a margin trowel or a drill with a grout mixing paddle.

1. Firmly install Krystol Repair Grout into the prepared repair area so that it is flush with the surface. Do not leave any voids.
2. For repairs with minimum width and depth of 50 mm (2 in.) or larger, Krystol Repair Grout may be extended with 10 mm (3/8 in.) pea gravel. Use clean, non-reactive, well-graded gravel complying with ASTM C33. Mix 4 parts grout powder: 2 parts gravel, and up to 1 part water to make a low-slump, cohesive mix. Perform trial batches to confirm workability, as aggregate properties can vary.

3.5 Installation – Resurfacing with Grout Parge Coat:

***Note to Specifier:**. A Parge Coat of Repair Grout is normally only needed for porous surfaces (like concrete block/CMU), or restoring very rough or low concrete cover. If the concrete surface is in acceptable condition, use Krystol T1. When a Grout parge coat is used, Krystol T1 may be applied as the final step.*

A. Krystol Repair Grout

1. Mix approximately 4 parts powder to 1-part clean water by volume using a margin trowel or a drill with a grout mixing paddle.
2. Bonding Slurry for Parge Coat – Mix 3 parts powder to 1-part clean water by volume.

B. Scrub the bonding slurry over the prepared surface to fill voids, then immediately trowel the Parge Coat over the repair area to a thickness of <3 mm (1/8 inch)> <6 mm (1/4 inch)> <specify thickness mm (inch)>

3.6 Installation - Concrete Protection and Waterproofing – Krystol T1:

A. Krystol T1 – Mix to a thick but spreadable consistency (approximately 3.5 parts powder to 1-part clean water by volume) using a margin trowel or a drill with a grout mixing paddle.

1. Verify surface is Saturated Surface Dry (SSD).
2. Brush or spray Krystol T1 evenly over the concrete to achieve a typical coating thickness of 1-1.5 mm <0.04-0.06 inches>. As supplied, the consumption rate of Krystol T1 powder will be <1.2 – 1.6> kg/m^2 (<2.2 – 3.0 lb/yd^2>).
    1. Brush Application - Apply by with a masonry brush using a circular motion to press the coating into low spots. Finish with a lighter pressure to achieve the target coverage and a uniform finish.
    2. Spray Application – Spray evenly over the surface at the specified coverage. Low impact spray equipment will require back brushing to ensure adequate contact between the coating and the concrete. Consult spray equipment manufacturer regarding methods and attachments.

3.7 Protection and Curing

A. Krystol Repair Grout - Protect fresh grout from rapid drying or freezing for at least 24 hours. Cover with tarps or poly if necessary. Protect the fresh grout from rain until it has fully hardened, and do not apply curing water if the grout has not hardened. Begin wet curing once Krystol Repair Grout has hardened (1-2 hours under most conditions). Wet cure by ensuring the grout remains saturated with water by using hoses and sprinklers, saturated coverings or impermeable coverings. Maintain these curing conditions for at least 72 hours or until Krystol T1 is applied.

B. Krystol T1 - Protect the freshly applied Krystol coating with tarps or plastic to prevent water loss due to evaporation while it hardens. Leave an air space between freshly applied coating and the protective covering until the coating has set to the touch. Wet curing should begin as soon as the Krystol coating has hardened and will not be damaged by the curing water, usually 6-24 hours depending on temperature. Keep protective coverings in place during the curing period to retain moisture. Apply more curing water if the coating dries out during the curing period. Wet cure for a minimum of 72 hours.

3.8 Clean Up

A. Concrete repair materials - Uncured repair materials can be cleaned from tools with water. Cured repair materials must be removed mechanically.

B. Leave finished work area in a neat, orderly and clean condition.

3.9 Field Quality Control

Note to Specifier: *Only include this section if special field inspection services are required.*

A. Provide free access to Work and cooperate with appointed firm.

B. Do not conceal installed waterproofing treatment before review by Consultant [and waterproofing manufacturer's representative].

C. If leaks are discovered, verify with manufacturer whether time period for self-sealing properties of the treated concrete has been exceeded. Make repairs as recommended by the manufacturer and repeat test until no leaks are observed.

3.10 Protection of Finished Work

A. Protect completed work from damage after application.

B. Do not backfill for at least thirty six hours (36) after completion of repairs.

C. If backfilling within 7 days, use damp backfill material.

3.11 Schedules

Note to Specifier: *Specify products, location and colour to suite project.*

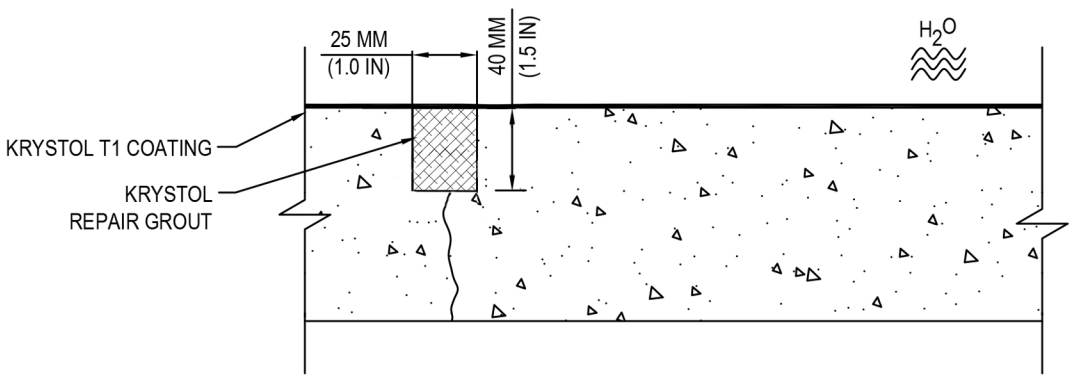
A. Provide crystalline waterproofing in the following locations

Location	Repair Cracks and Joints	Parge Coat, Resurface	Krystol T1 <Grey><White>
Elevator pits [sump pits, escalator pits]			
Tunnels, underground vaults, dry wells and manholes			
Water tanks, clarifier tanks, digester sections, reservoirs and wet wells			
Planters, fountains, pools			
Retaining walls, sea walls.			
<specify area>			

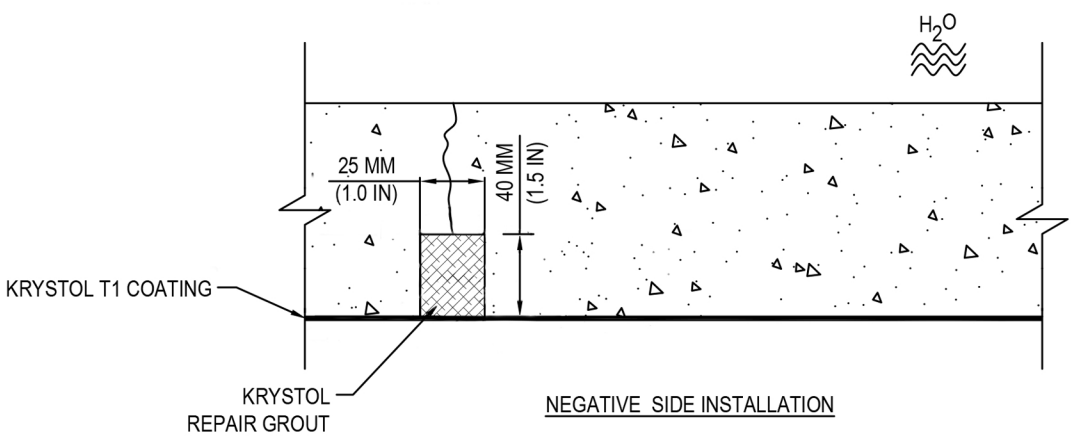
END OF SECTION

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POSITIVE SIDE INSTALLATION



NEGATIVE SIDE INSTALLATION

MANUFACTURER'S NOTES:

1. SAW CUT AND OR CHISEL ANY CRACKS OVER 0.5 MM TO THE REQUIRED DEPTH OF 40 MM X 25 MM (1.5" X 1")
2. PACK WITH KRYSTOL REPAIR GROUT AT A RATE OF APPROPRIATELY 2.5 KG PER LINEAL METER (1.6 LB PER LINEAL FOOT)
3. APPLY KRYSTOL T1 AT A RATE OF 1.2 KG PER M^2 (2.2 LBS PER YD^2)

NOTES:

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5. CONTRACTOR'S NOTE: FOR PRODUCT AND COMPANY INFORMATION VISIT www.CADdetails.com/info AND ENTER REFERENCE NUMBER 5104-062

KRYSTOL T1 SURFACE APPLIED CRYSTALLINE WATERPROOFING

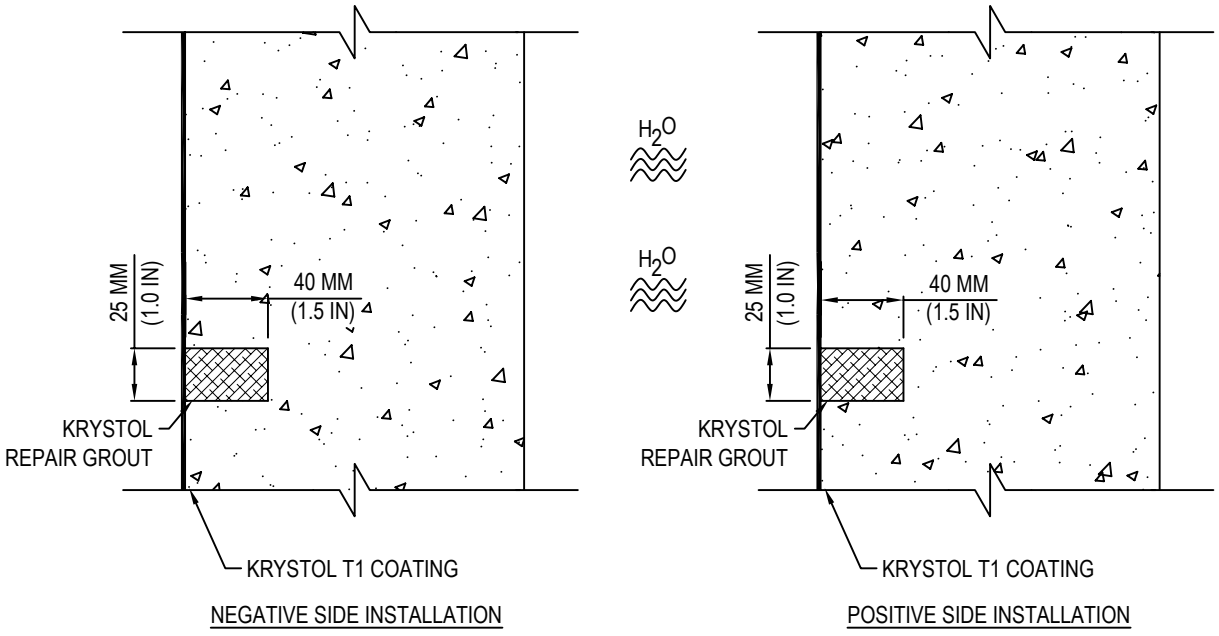
HORIZONTAL SURFACES

5104-062

REVISION DATE 07/01/2019

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NEGATIVE SIDE INSTALLATION

POSITIVE SIDE INSTALLATION

MANUFACTURER'S NOTES:

1. SAW CUT AND OR CHISEL ANY CRACKS OVER 0.5 MM TO THE REQUIRED DEPTH OF 40 MM X 25 MM (1.5" X 1")
2. PACK WITH KRYSTOL REPAIR GROUT AT A RATE OF APPROPRIATELY 2.5 KG PER LINEAL METER (1.6 LB PER LINEAL FOOT)
3. APPLY KRYSTOL T1 AT A RATE OF 1.2 KG PER M² (2.2 LBS PER YD²).

NOTES:

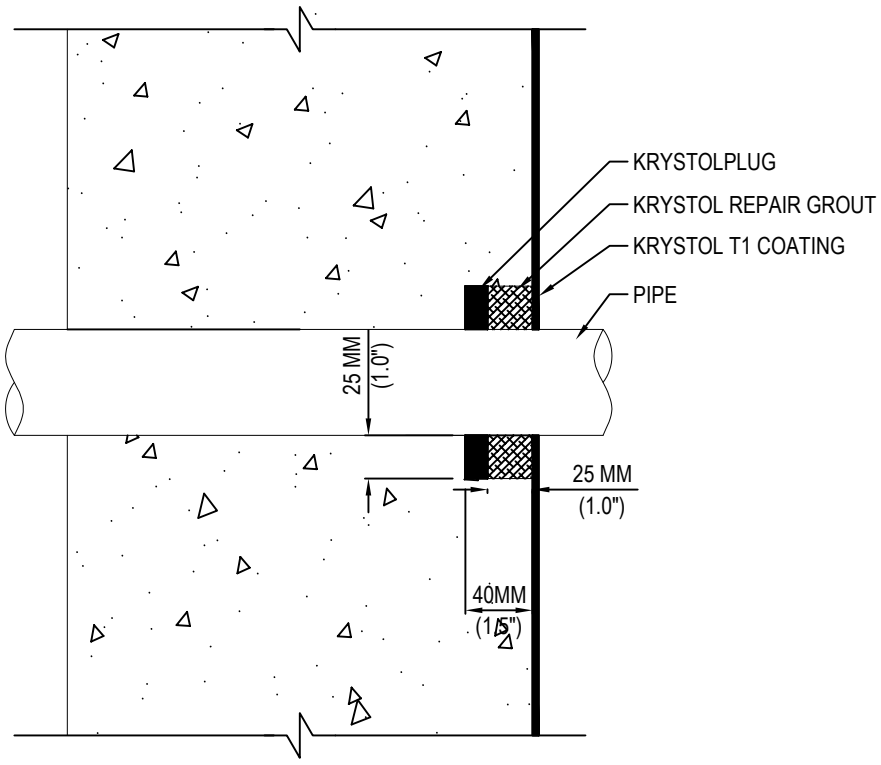
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5. CONTRACTOR'S NOTE: FOR PRODUCT AND COMPANY INFORMATION VISIT www.CADdetails.com/info AND ENTER REFERENCE NUMBER 5104-061

KRYSTOL T1 SURFACE APPLIED CRYSTALLINE WATERPROOFING

VERTICAL SURFACES

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MANUFACTURER'S NOTES:
- CHISEL TO CREATE A CHASE AROUND THE PIPE TO THE REQUIRED 25 MM X 40 MM (1 X 1.5)
1. APPLY KRYSTOL PLUG TO PREPARED CHASE TO STOP FLOWING WATER.
2. TIGHTLY PACK REMAINING CHASE WITH KRYSTOL REPAIR GROUT AT A RATE OF APPROXIMATELY 1.6 KG PER LINEAL METER (1 LB. PER LINEAL FOOT).
3. WATERPROOF ENTIRE WALL OR SLAB WITH KRYSTOL T1 AT A RATE OF 1.2 KG/M2.

NOTES:
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KRYSTOL LEAK REPAIR SYSTEM

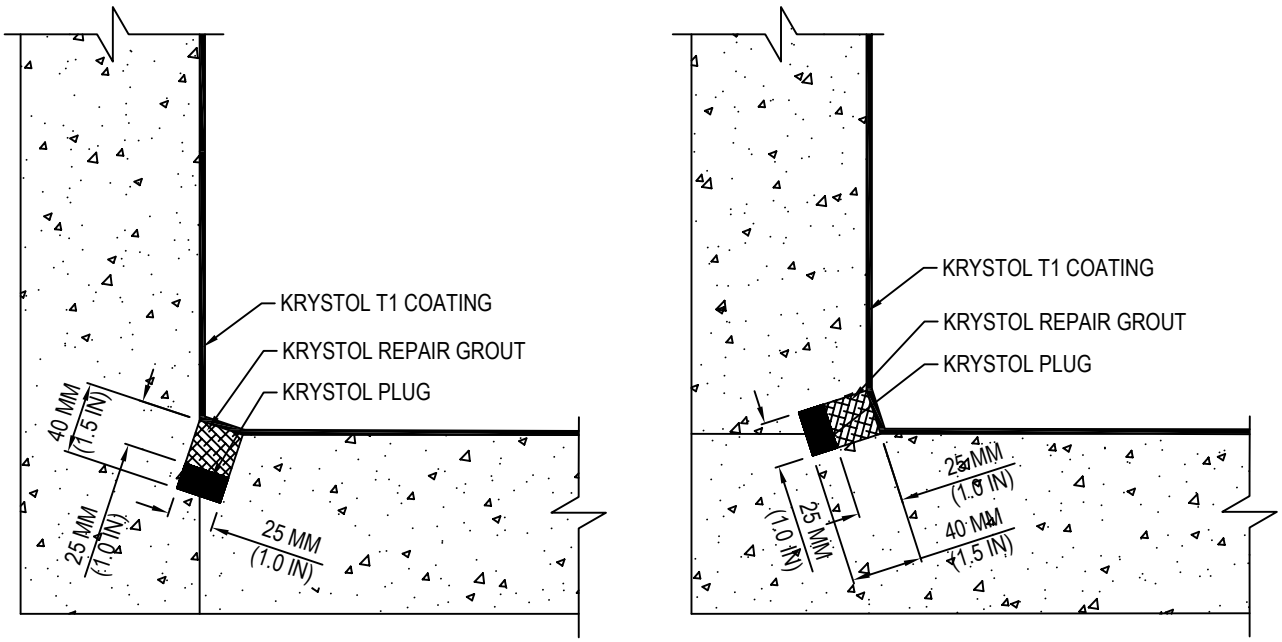
PIPE PENETRATION - LEAK REPAIR

5104-052

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WALL TO SLAB JOINT REPAIR

MANUFACTURER'S NOTES:

CHISEL TO CREATE A CHASE ALONG THE ENTIRE LENGTH OF THE LEAKING CRACK OR JOINT TO THE REQUIRED 25 MM X 40 MM (1" X 1.5")

1. APPLY KRYSTOL PLUG TO PREPARED CHASE TO STOP FLOWING WATER.
2. TIGHTLY PACK REMAINING CHASE WITH KRYSTOL REPAIR GROUT AT A RATE OF APPROXIMATELY 1.6 KG PER LINEAL METER (1 LB. PER LINEAL FOOT).
3. WATERPROOF ENTIRE WALL OR SLAB WITH KRYSTOL T1 AT A RATE OF 1.2 KG/M2

NOTES:

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KRYSTOL LEAK REPAIR SYSTEM

WALL TO SLAB – LEAK REPAIR

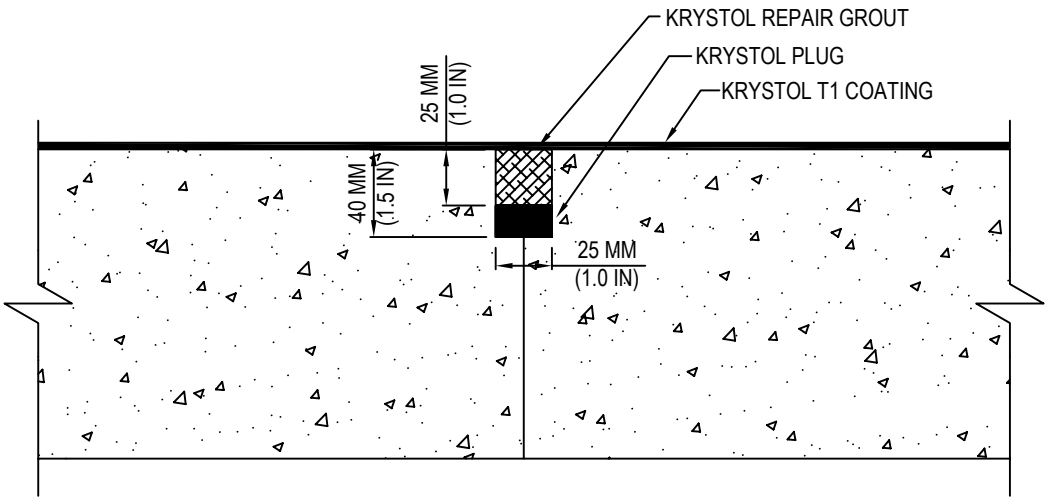
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SMART CONCRETE®

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SLAB TO SLAB/WALL TO WALL JOINT REPAIR

MANUFACTURER'S NOTES:

CHISEL TO CREATE A CHASE ALONG THE ENTIRE LENGTH OF THE LEAKING CRACK OR JOINT TO THE REQUIRED 25 MM X 40 MM (1" X 1.5")

1. APPLY KRYSTOL PLUG TO PREPARED CHASE TO STOP FLOWING WATER.
2. TIGHTLY PACK REMAINING CHASE WITH KRYSTOL REPAIR GROUT AT A RATE OF APPROXIMATELY 1.6 KG PER LINEAL METER (1 LB. PER LINEAL FOOT).
3. WATERPROOF ENTIRE WALL OR SLAB WITH KRYSTOL T1 AT A RATE OF 1.2 KG/M2

NOTES:

1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
2. DO NOT SCALE DRAWING.
3. THIS DRAWING IS INTENDED FOR USE BY ARCHITECTS, ENGINEERS, CONTRACTORS, CONSULTANTS AND DESIGN PROFESSIONALS FOR PLANNING PURPOSES ONLY. THIS DRAWING MAY NOT BE USED FOR CONSTRUCTION.
4. ALL INFORMATION CONTAINED HEREIN WAS CURRENT AT THE TIME OF DEVELOPMENT BUT MUST BE REVIEWED AND APPROVED BY THE PRODUCT MANUFACTURER TO BE CONSIDERED ACCURATE.
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KRYSTOL LEAK REPAIR SYSTEM

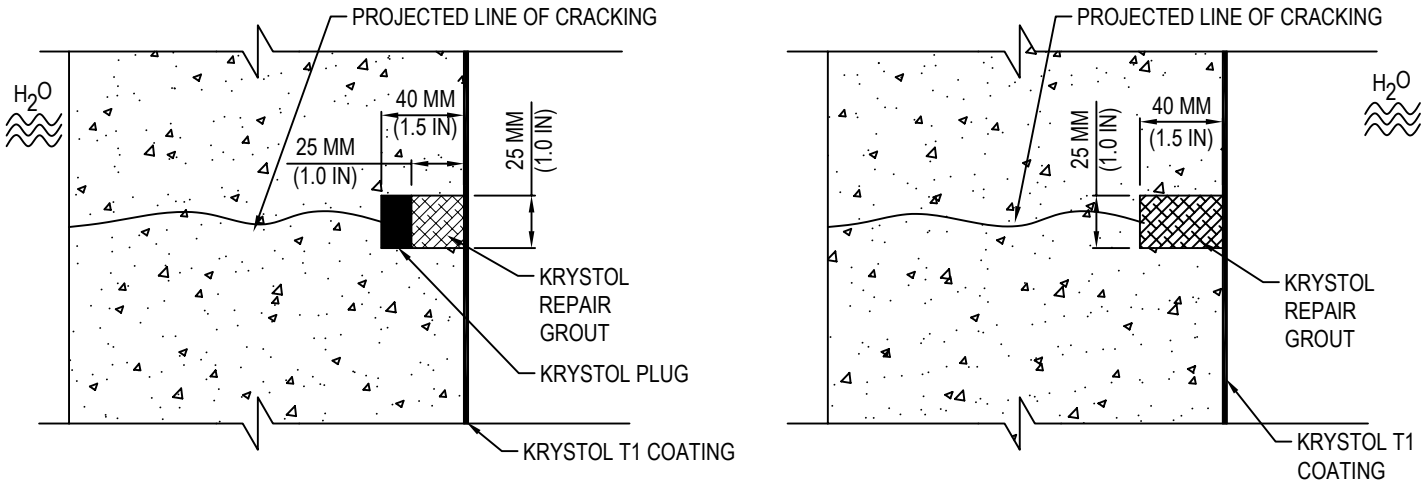
SLAB TO SLAB – LEAK REPAIR

5104-034

REVISION DATE 28/11/2019

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NEGATIVE SIDE LEAK REPAIR

POSITIVE SIDE LEAK REPAIR

LEAKING CRACK REPAIR

MANUFACTURER'S NOTES:
CHISEL TO CREATE A CHASE ALONG THE ENTIRE LENGTH OF THE LEAKING CRACK OR JOINT TO THE REQUIRED 25 MM X 40 MM (1" X 1.5")

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KRYSTOL LEAK REPAIR SYSTEM

POSITIVE NEGATIVE – LEAK REPAIR

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SMART CONCRETE®

Waterproof from + / - Side

Repair Faster

Increase Your Profits

Use for New & Existing Structures

A SINGLE COAT

will transform your concrete into a permanent waterproof barrier.

KRYSTOL T1®

CRYSTALLINE WATERPROOFING TREATMENT

AVAILABLE IN WHITE & GRAY



- ✓ Self-seals cracks reliably up to 0.02 in / 0.5 mm
- ✓ Works effectively against up to 460 ft / 140 m of head pressure
- ✓ Fixes membrane failures without excavation

MORE RELIABLE

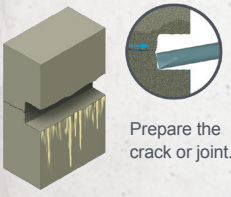
than injection systems at a fraction of the cost.

KRYSTOL® LEAK REPAIR SYSTEM

- ✓ Stops water permanently
- ✓ Simplifies the application process
- ✓ Negates the risk of costly call-backs

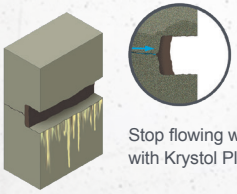


STEP 1



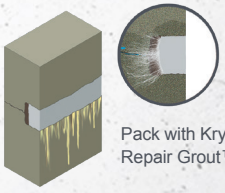
Prepare the crack or joint.

STEP 2



Stop flowing water with Krystol Plug™.

STEP 3



Pack with Krystol Repair Grout™.

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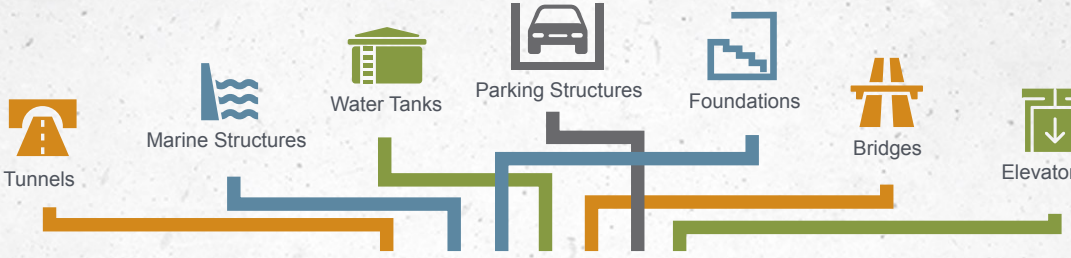
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INTEGRAL WATERPROOFING & DURABILITY SOLUTIONS

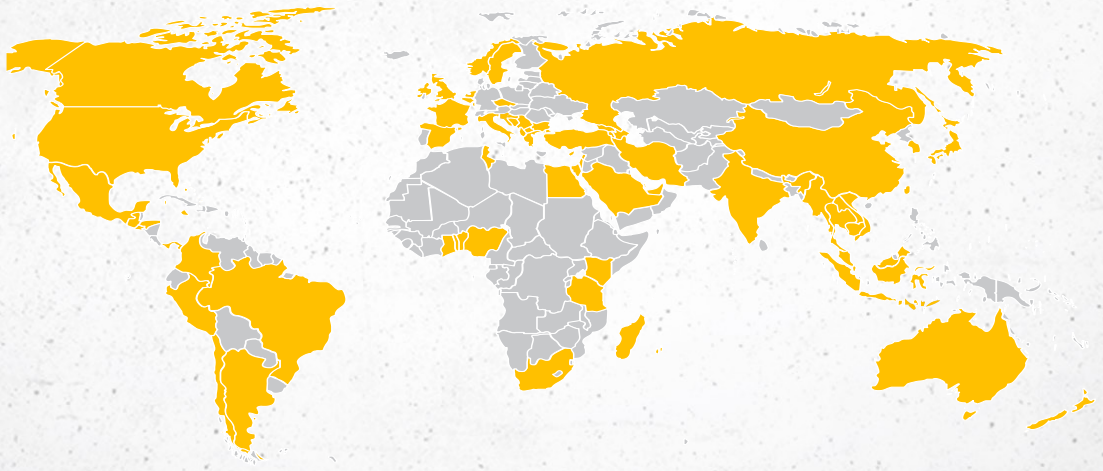
Krystol® Technology

Krystol is Kryton's proprietary crystalline technology. When added or applied to concrete, Krystol chemically reacts with water and unhydrated cement particles to form insoluble needle-shaped crystals that fill capillary pores and micro-cracks in the concrete to block the pathways for water and waterborne contaminants.

Any moisture introduced over the life span of the concrete will initiate crystallization, ensuring permanent waterproofing protection.



PROTECTING CONCRETE STRUCTURES AROUND THE WORLD FOR **OVER 45 YEARS**



SMART CONCRETE®

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THREE OF MANY SUCCESSFUL PROJECTS



VanDusen Botanical Gardens Visitor Centre, Vancouver, B.C, Canada

The visitor center was built to exceed LEED (Leadership in Energy and Environmental Design) Platinum status and pursue the Living Building Challenge, which defines the highest measure of sustainability for built environments. Kryton's Krystol Internal Membrane (KIM) concrete waterproofing admixture was used to waterproof the site's water cistern as well as the wall behind the rammed earth wall. Kryton's Krystol Waterstop System for joints was also used to fully tank the site's water cistern.

Winner of the 2012 Outstanding Shotcrete Project
Project of the Year for Infrastructure from the American Shotcrete Association

AMERICAN SHOTCRETE ASSOCIATION



Knight Theater Pedestrian Tunnel, Charlotte, NC, USA

Several waterproofing systems were considered for the new pedestrian tunnel, including HDPE membrane, PVC membrane, double-bonded spray-applied cementitious membrane and cementitious concrete admixtures. After evaluating the cost and constructability issues of these methods, a combination of two systems were selected to achieve the specified and desired results. It was decided to use Kryton's Krystol Internal Membrane (KIM) in the structural shotcrete walls and invert concrete slab of the tunnels and then apply a double-bonded spray-applied membrane to the walls.



The Carlyle Residences, Los Angeles, CA, USA

Home to Bruce Willis and Larry King among others, the 24-story Carlyle Residences features price points from $2.9 million to $15 million. The four level parking structure is equipped with a modern elevator system that leads owners to their respective suites without so much as a single hallway. The building's placement above an active aquifer challenged the architects and their design concept. The project stakeholders chose to waterproof every portion of the below grade areas with Kryton's waterproofing systems. The parking structure was constructed by KIM-treated shotcrete eliminating the need for conventional membranes. Control cracks were intentionally implemented, and those were addressed using Kryton's Crack Repair System and all joints were treated with Kryton's Krystol Waterstop System. When addressing all tie-holes and beam pockets, Kryton's detailed application instructions were helpful in safeguarding those areas.



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WATERPROOFING STRUCTURAL SHOTCRETE WITH AN INTERNAL MEMBRANE

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THE PROBLEM:
Why is waterproofing structural shotcrete so difficult?

1. Shotcrete is commonly applied to a blind-wall form and there is no access to apply a membrane
2. Membranes that are hung on the form and shot against risk damage and/or torn seams
3. Membrane installation adds time and money
4. It is difficult to reliably waterproof around pipes and other penetrations
5. Shotcrete is known to shrink and crack more than cast-in-place

THE SOLUTION:
Using Krystol Internal Membrane (KIM) to waterproof structural shotcrete instead of a membrane

1. **Reduce Risk**: KIM is mixed into and becomes a permanent part of the shotcrete and so there is no risk of damage to waterproofing system
2. **Build Faster**: KIM allows for faster construction as there is no need to schedule installation or wait during delays
3. **More Practical**: KIM is an integral waterproofer and so there is no need to access the blind side of the shotcrete
4. **Reduces Cracking**: KIM treated shotcrete is proven to reduce cracking due to shrinkage
5. **Reliably Waterproofs Around Pipes and Penetrations**: The KIM waterproofing system can reliably waterproof around pipes and other penetrations
6. **Protects Against Corrosion**: KIM is proven to protect steel reinforcement from corrosion
7. **Enhances Durability**: KIM will enhance the durability of the shotcrete by protecting it from deleterious chemicals
8. **Kryton Offers the Industry-Leading 25-year Manufacturer's Warranty**



DID YOU KNOW?

Structural shotcrete is becoming a preferred concreting method in foundation construction, building tanks, parking garages and many other structures because it's up to 50% faster than conventional cast in place.

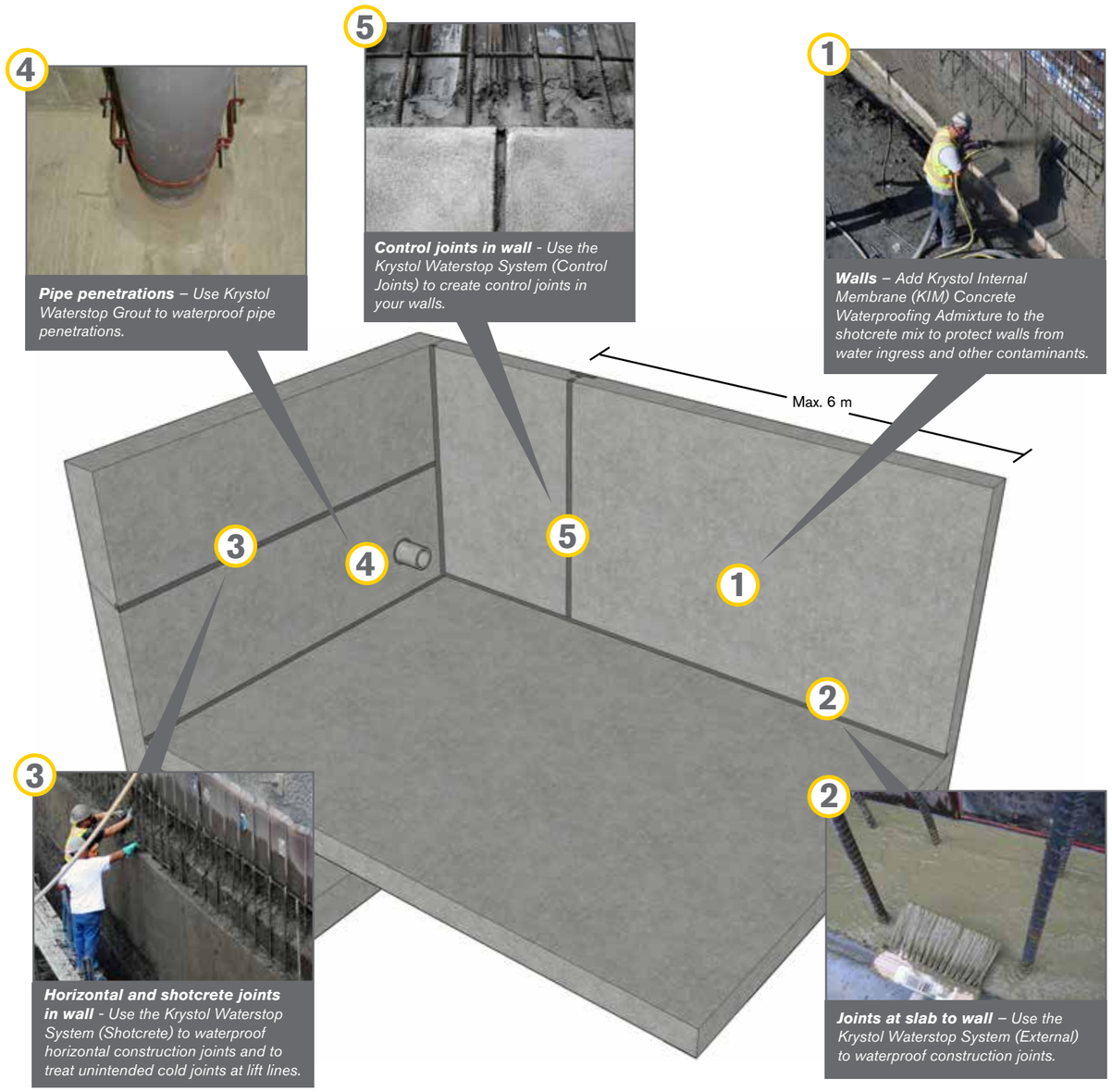
ADDITIONAL BENEFITS OF USING KRYTON'S SHOTCRETE CONCRETE WATERPROOFING SYSTEM

- **Increases your Profitability**: No need to go back and repair leaks that are common with shotcrete structures waterproofed by membranes.
- **Peace of mind**: Kryton's Dedicated One-Stop-Shop Expertise mitigates risk. Kryton's knowledge and expertise of specific shotcrete details including waterproofing construction joints, penetrations and other tricky details ensure the delivery of a completely tanked and waterproofed concrete structure from a single partner. Kryton Takes the Risk Out of Concrete Waterproofing.

> *"…compared to membranes or other admixtures, Kryton's KIM offers superior performance due to its unique crystal self-sealing technology being able to both reduce shrinkage during the curing process combined with reduced cracking. This has enabled us to build watertight structures with greater confidence and time savings."*
>
> - Gary Hawkins, Torrent Shotcrete Structures Ltd.

BUILD BETTER WITH KRYTON WATERPROOFING

Although, shotcrete structures can be challenging to waterproof, Kryton's experience and systemic approach has all the details covered. There are many considerations to take into account that are different from waterproofing structures that are built using cast in place concrete. Rebar stabilization, shadowing, experienced and attentive nozzlemen, proper concrete mix designs, climate, construction joint details, penetrations, and cracking, are just a few items that need to be addressed differently when dealing with shotcrete compared to cast in place. Most membrane waterproofing systems do not address the differences in concrete placement and the result or doing it wrong can lead to costly repairs.



Pipe penetrations *– Use Krystol Waterstop Grout to waterproof pipe penetrations.*

Control joints in wall *- Use the Krystol Waterstop System (Control Joints) to create control joints in your walls.*

Walls *– Add Krystol Internal Membrane (KIM) Concrete Waterproofing Admixture to the shotcrete mix to protect walls from water ingress and other contaminants.*

Horizontal and shotcrete joints in wall *- Use the Krystol Waterstop System (Shotcrete) to waterproof horizontal construction joints and to treat unintended cold joints at lift lines.*

Joints at slab to wall *– Use the Krystol Waterstop System (External) to waterproof construction joints.*

Kryton has all these details covered. Kryton International Inc. provides the most effective concrete waterproofing systems in the world. With over 40 years of experience, and more than 10,000 successful waterproofing projects, Kryton is recognized and acknowledged as the leader in taking the risk out of concrete waterproofing.

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PROTECT
MARINE STRUCTURES
WITH CRYSTALLINE WATERPROOFING

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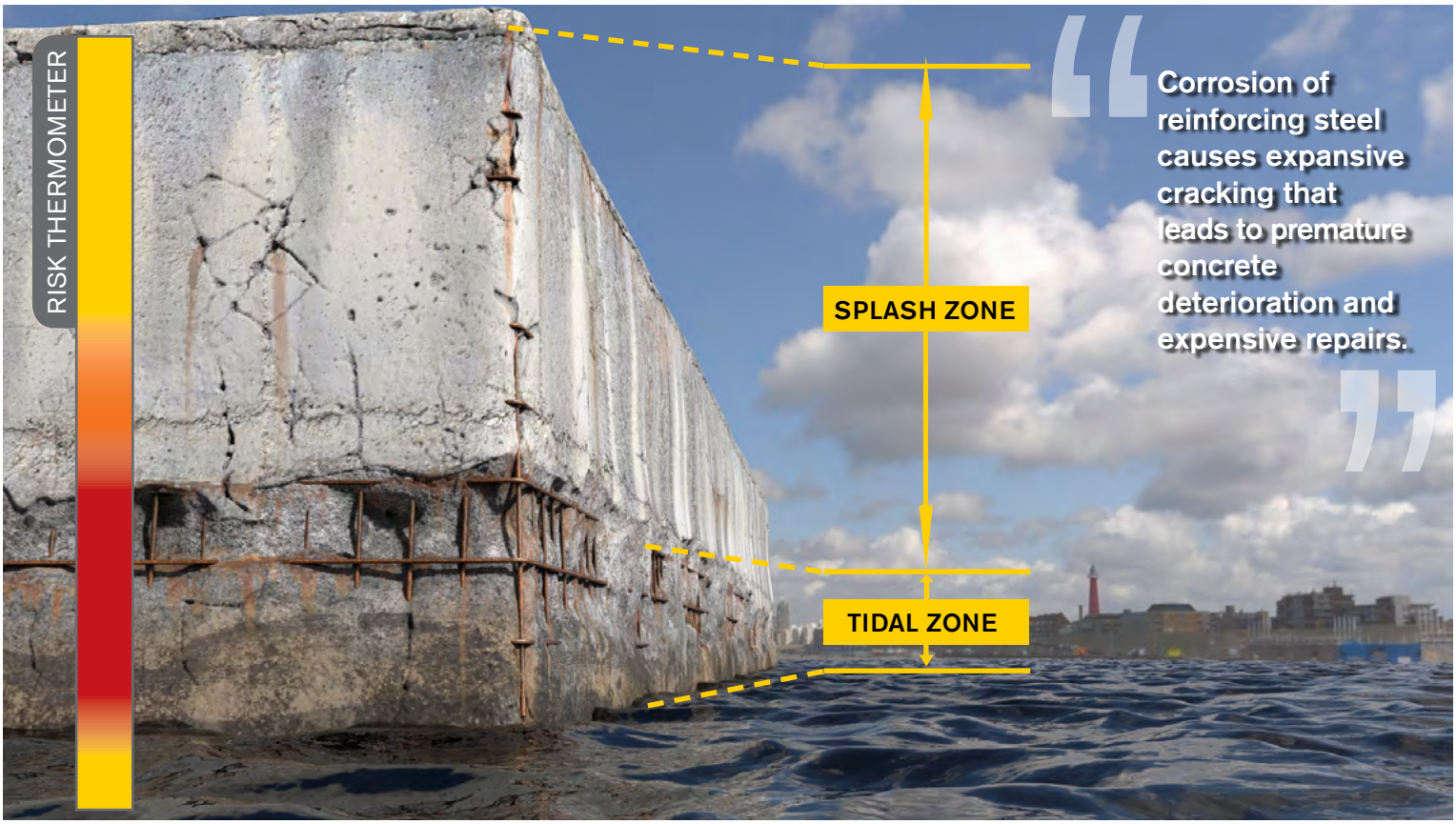


INCREASE THE LIFESPAN OF MARINE CONCRETE:

- Sea Walls
- Piers
- Waterside Buildings / Infrastructure
- Breakwaters
- Docks
- Concrete Pilings
- Dams
- Bridges
- Jetties
- Groynes
- Bulkheads
- Ports

USE THE RIGHT PRODUCTS TO PROTECT AND INCREASE

THE LIFESPAN OF INFRASTRUCTURE IN HARSH MARINE ENVIRONMENTS



THE PROBLEM:

Concrete located in or near marine environments have a higher risk of chloride attack and corrosion due to constant wet-dry cycles that force water through the capillary tracts and micro-pores found in concrete.

Water movement through the concrete allows waterborne chlorides to penetrate to the reinforcing steel and causes corrosion resulting in expansive pressure and cracking. These factors lead to rapid deterioration of concrete and a drastically shortened lifespan.

THE SOLUTION:

Krystol Internal Membrane™ (KIM®) is a hydrophilic crystalline admixture used to create permanently waterproof concrete.

KIM effectively and reliably lowers the permeability of concrete and self-seals micro-cracks for the life of the structure. By preventing the transmission of water through concrete, KIM eliminates the factors that cause early concrete destruction such as chemical attack and corrosion of reinforcing steel. Instead, KIM is a permanent waterproofing solution that ensures durability and longevity for a concrete structure.



KRYSTOL® TECHNOLOGY TURNS THE CONCRETE INTO A PERMANENT
WATERPROOF BARRIER BY LOWERING PERMEABILITY AND INCREASING DURABILITY

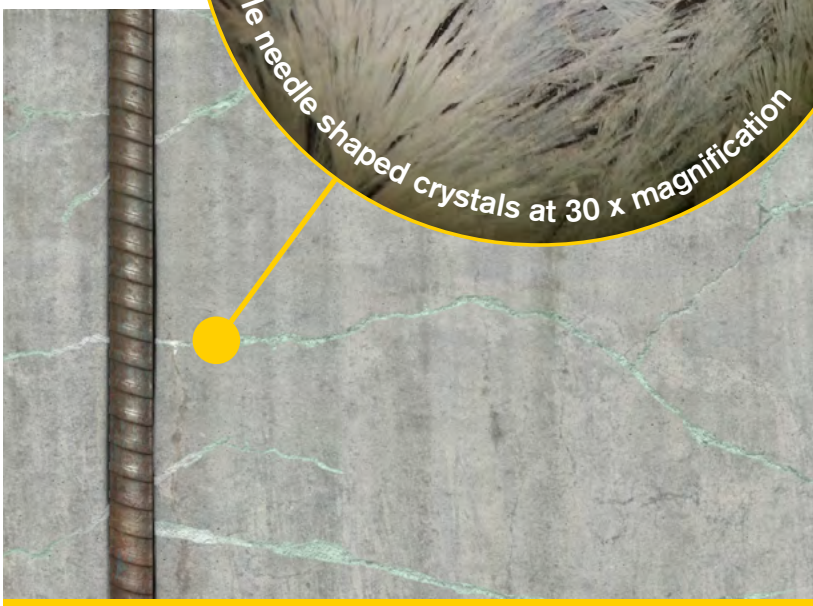
HOW IT WORKS:

KIM is a crystalline waterproofing admixture that uses Krystol® technology to waterproof concrete. When added to concrete, Krystol chemical reacts with water and un-hydrated cement particles to form insoluble needle-shaped crystals that fill capillary pores and micro-cracks in the concrete and block the pathways for water and waterborne contaminants.

Any moisture introduced over the lifespan of the concrete will initiate crystallization, ensuring permanent waterproofing protection.



A cross section of unprotected concrete



A cross section of KIM protected concrete

Krystol Internal Membrane™ (KIM®):

Permanently waterproofs concrete to protect against:
- Corrosion of steel reinforcement
- Chloride attack
- Sulfate attack
- Carbonation
- Alkali Aggregate reaction (AAR)
- Freeze/thaw damage

Reduces plastic and drying shrinkage of concrete, preventing:
- Cracks in concrete
- Direct exposure of reinforcement to water and chlorides
- Early onset of corrosion

Provides life-long 'self-sealing' of static cracks
- Certified up to 0.5 mm – tested to 0.77 mm
- Permanent solution, no need to reapply



KIM is added to the concrete before placement

10-year Corrosion Study by University of Hawaii Recommends KIM

A long-term corrosion study was conducted to evaluate the durability of 22 reinforced concrete specimens, all containing various pozzolans and chemical admixtures. Test panels were exposed to a marine environment, in the tidal zone in Honolulu Harbor from 2002-2012. Panels were monitored for half-cell potential, chloride concentrations, cracking and visible signs of corrosion.



After 10 years marine exposure; Control concrete / KIM treated concrete.

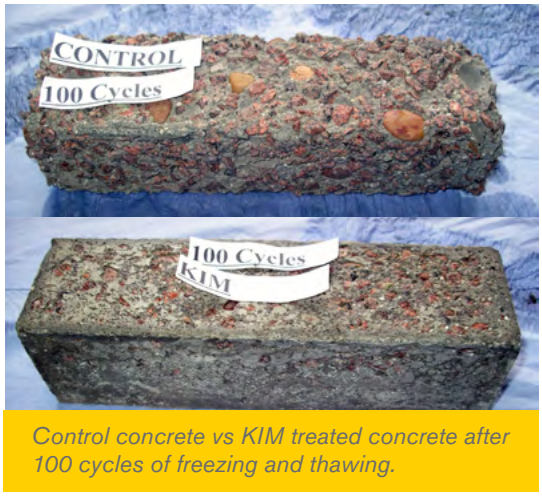
KEY FINDINGS

- The panel using Krystol Internal Membrane (KIM) at a dosage of 2% had low half-cell readings and no visible signs of corrosion
- KIM significantly outperformed other permeability reducing admixtures & corrosion inhibitors

BBA BRITISH BOARD OF AGRÉMENT
CERTIFICATE No 05/4217

Independent testing by the British Board of Agrément (BBA) confirms that Krystol Internal Membrane (KIM) has superior waterproofing properties. KIM's ability to stop water increases concrete durability as freeze thaw expansion and corrosion expansion cracking are virtually eliminated.

Water Permeability	Reduced 70%
Drying Shrinkage	Reduced 25%
Wetting Expansion	Reduced 33%
Freeze Thaw Expansion	**Reduced 86%**
Compressive Strength (28 Day)	Improved 11%
Flexural Strength	Improved 7%
Water Vapor Permeability	Reduced 17%



Control concrete vs KIM treated concrete after 100 cycles of freezing and thawing.

No other company has more experience at keeping water out of concrete than Kryton International Inc.

Kryton has been an innovator of crystalline waterproofing technology throughout the world for more than 40 years and is the inventor of the crystalline waterproofing admixture. Kryton offers a full line of waterproofing products for new and existing construction, including admixtures, surface-applied coatings, construction joints and details, as well as repair systems.

Kryton's Krystol Technology has been used to successfully waterproof high-risk projects throughout the world and has been proven to extend the life of a structure by creating durable, long-lasting concrete.

Kryton's global network includes staff in Canada, USA, UK, UAE, India, China, Singapore, as well as Distributors in over 50 countries. To find a Kryton office near you please visit: www.kryton.com

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CONSTRUCTION & REPAIR OF CONCRETE TUNNELS

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CONSTRUCT WATERTIGHT

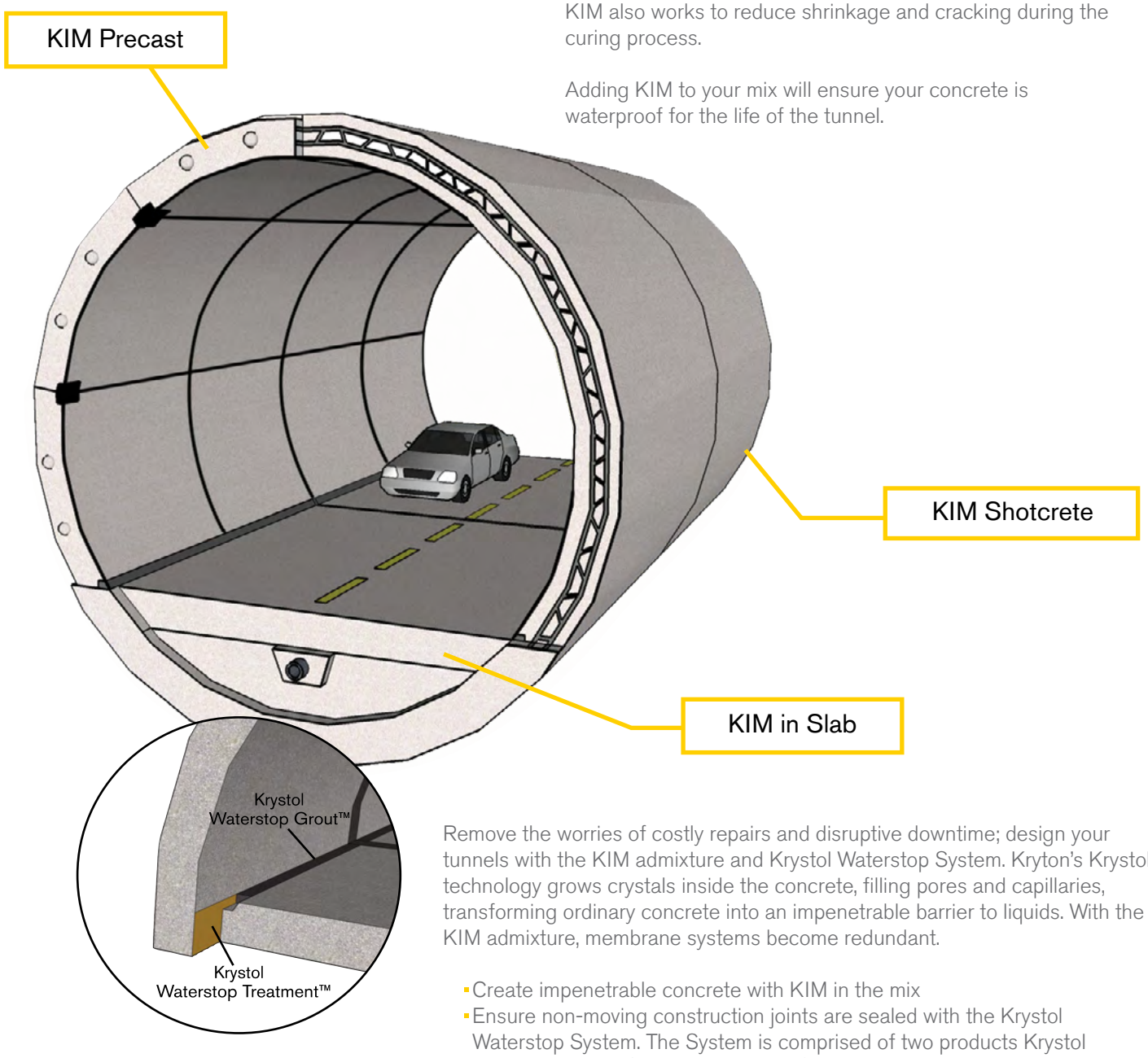
TUNNELS THAT LAST

Tunnels can be subjected to heavy traffic and vibration, temperature changes, corrosion damage and freeze thaw cycles which affect the tunnel's durability.

Proper waterproofing prevents the penetration of moisture and chemicals into the concrete and steel components of the tunnel. Ultimately protecting the durability and structural integrity of the concrete; overall, prolonging the life of the tunnel. Kryton's Krystol® Waterproofing System protects the structural rebar from corrosion and provides a durable, leak-free solution that will last for the life of the tunnel.

Whether using cast-in-place, shotcrete and/or precast to construct your tunnel, Krystol Internal Membrane™ or KIM® can be added to the concrete at the plant, or on-site to the mixer truck to make your concrete watertight. KIM turns the concrete itself into the waterproofing membrane – eliminating the need for any surface-applied membrane to be applied. KIM and the Krystol Waterproofing System reduce labor, construction schedules and costs for concrete waterproofing. KIM also works to reduce shrinkage and cracking during the curing process.

Adding KIM to your mix will ensure your concrete is waterproof for the life of the tunnel.



Remove the worries of costly repairs and disruptive downtime; design your tunnels with the KIM admixture and Krystol Waterstop System. Kryton's Krystol technology grows crystals inside the concrete, filling pores and capillaries, transforming ordinary concrete into an impenetrable barrier to liquids. With the KIM admixture, membrane systems become redundant.

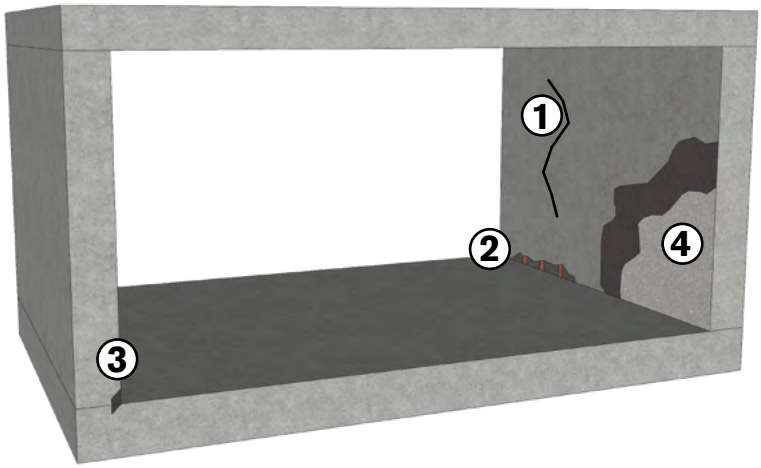
- Create impenetrable concrete with KIM in the mix
- Ensure non-moving construction joints are sealed with the Krystol Waterstop System. The System is comprised of two products Krystol Waterstop Grout (Internal or External) and Krystol Waterstop Treatment.

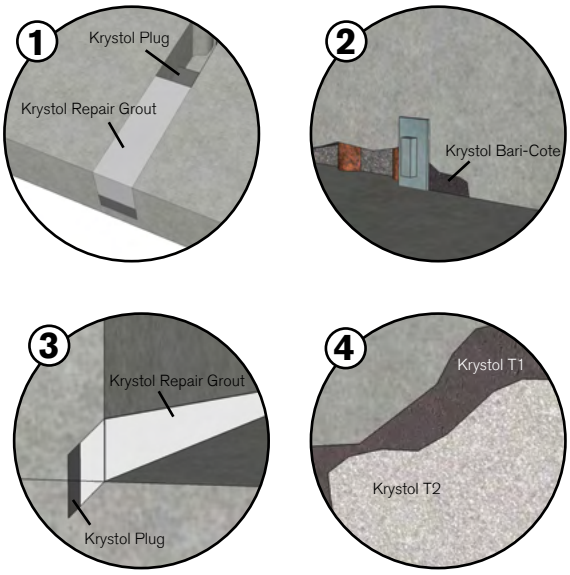
REPAIR AND WATERPROOF

EXISTING TUNNELS

Wherever previous waterproofing systems have failed, Kryton has a solution; the only solution that is as strong as concrete and works 100% of the time.

- Seal cracks and stop leaks with the Krystol Leak Repair System
- Resurface honeycombing and spalling, and waterproof with Krystol Bari-Cote™
- Repair leaking cold joints using the Krystol Leak Repair System
- Prevent water ingress by applying Krystol T1® and Krystol T2® to the concrete on the inside of the tunnel





REPAIRING THE **YUNNAN SHUIMA TUNNELS**



Repair work on the Yunnan Shuima Tunnels

BACKGROUND

In 2007, construction was completed on a 180 km (112 mi.) superhighway that included five pairs of tunnels through the mountains of the Sichuan Province of China.

Shortly after completion the tunnels needed to be repaired; the soil and rock conditions paired with heavy seasonal rainfall quickly contributed to cracking and water leakage within the newly completed tunnels. With approximately 125,000 sq m (150,000 sq. y.) of surface area throughout the tunnels, the waterproofing repair work was a significant undertaking.

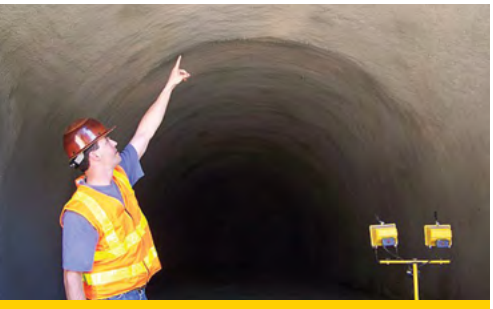
SOLUTION

Because the leaking tunnels had already been built using cast-in-place concrete, Kryton's team recommended using Krystol T1 & T2 surface-applied crystalline slurry coat system. Krystol T1 & T2 is a two-step, brush-applied system that prevents water intrusion, repairs cracking and maintains existing concrete structures. T1 seals the concrete against permeating water and T2 protects the surface of the structure from moisture. Once applied, the chemicals are absorbed into the concrete creating a strong barrier to water.

25,000 kg (55,000 lb.) of T1 & T2 were used to waterproof the 125,000 sq m (150,000 sq. y.) of tunnel walls and about 2,000 kg (4,400 lb.) of Kryton's Krystol Leak Repair System material were also used to mend the 1,200 m (3,937 ft.) of cracked and leaking concrete.

Less than a year later, a massive earthquake struck Sichuan killing more than 68,000 people. It destroyed communities and cost the government 1 trillion Yuan ($146.5 billion USD) to rebuild. Despite the quake's wholesale destruction the waterproofed tunnels of the Sichuan Mountains remained unaffected.

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Knight Theater Pedestrian Tunnel, Charlotte, North Carolina, USA

Shotcrete Construction

Several waterproofing systems were considered for the new pedestrian tunnel, including HDPE membrane, PVC membrane, double-bonded spray-applied cementitious membrane and cementitious concrete admixtures. After evaluating the cost and constructability issues of these methods, a combination of two systems were selected to achieve the specified and desired results. It was decided to use Kryton's Krystol Internal Membrane (KIM) in the structural shotcrete walls and invert concrete slab of the tunnels and then apply a double-bonded spray-applied membrane to the walls.



Ensenada International Terminal Grain Tunnel, Ensenada, Baja California, Mexico

Cast-in-Place Construction

A below grade concrete tunnel to house a belt transportation system and grain silo were constructed using Kryton's Krystol Internal Membrane (KIM) admixture, Krystol Waterstop System for joints and Krystol Leak Repair System. The port location meant that the tunnel would be in constant contact with sea water and it was essential the tunnel remained water free. Water in the transport tunnel could ruin entire containers worth of valuable grain. Further, salt water and its ability to corrode the steel and structure was also a key factor in the waterproofing design.



Manukau Police Hub Tunnel, Manukau City, New Zealand

Precast Construction

The new Manukau Police Hub built an underground tunnel between the police hub and the adjacent courthouse. The tunnel was constructed out of fifty precast box culverts with the most sound structural integrity in mind. The contractor selected Kryton's Krystol Internal Membrane (KIM) as the waterproofing choice based on performance and pricing. All fifty of the precast box culvert segments contained KIM, ensuring that they would be permanently protected from water ingress from the inside out.

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CONSTRUCTION & REPAIR OF CONCRETE PARKING STRUCTURES

KRYTON®

SMART CONCRETE®

CONSTRUCT WATERTIGHT

PARKING STRUCTURES THAT LAST

Kryton takes the risk out creating durable waterproof concrete parking structures.

Parking structures are different from other concrete buildings due to:

- Reduced roofing, cladding, and climate control that result in a more severe direct or indirect exposure to rain, snow, sunlight, temperature variations and airborne chlorides;
- Water and waterborne contaminates can cause corrosion of reinforcing steel and compromise the structural integrity of the structure;
- Vehicular occupancy that imposes heavy moving loads and deposits deicing salts;
- Large plan size that magnifies the potential for damage caused by restraint of movements and forces associated with volumetric changes.

All of these factors influence the durability of parking structures and require consideration in their design. Kryton's Concrete Waterproofing System reduces risk by transforming concrete into a powerful water resistant barrier which extends the durability of your new parking structure.

1



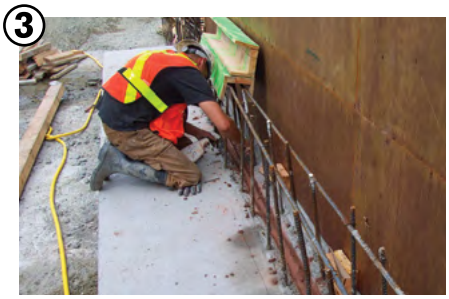
Create a watertight structure by using Krystol Internal Membrane™ (KIM®) in precast, cast-in-place or shotcrete walls and slabs. KIM builds the waterproofing right in to the concrete, eliminating the need for unreliable membranes.

2



Waterproof pipe penetrations and tie-holes with Krystol Waterstop Grout™.

3

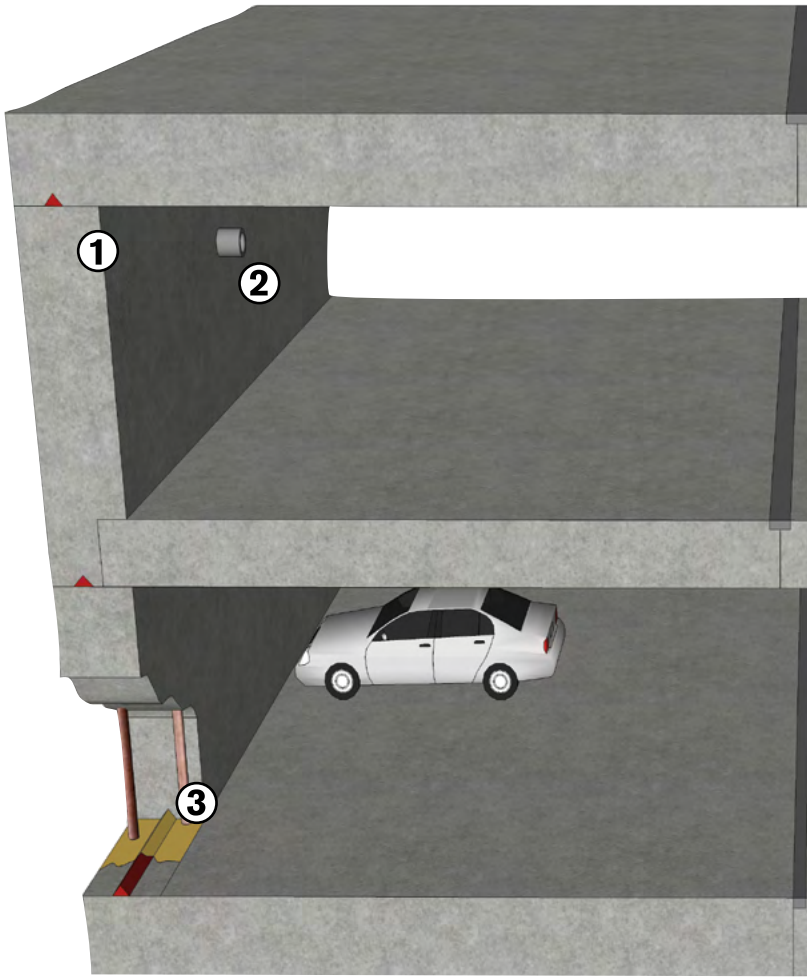


Create two levels of construction joint protection with both a physical and crystalline chemical barrier by using the Krystol® Waterstop System.

4



Construct a water resistant seal at suspended slab control joints.



Kryton's complete waterproofing system makes concrete more durable:

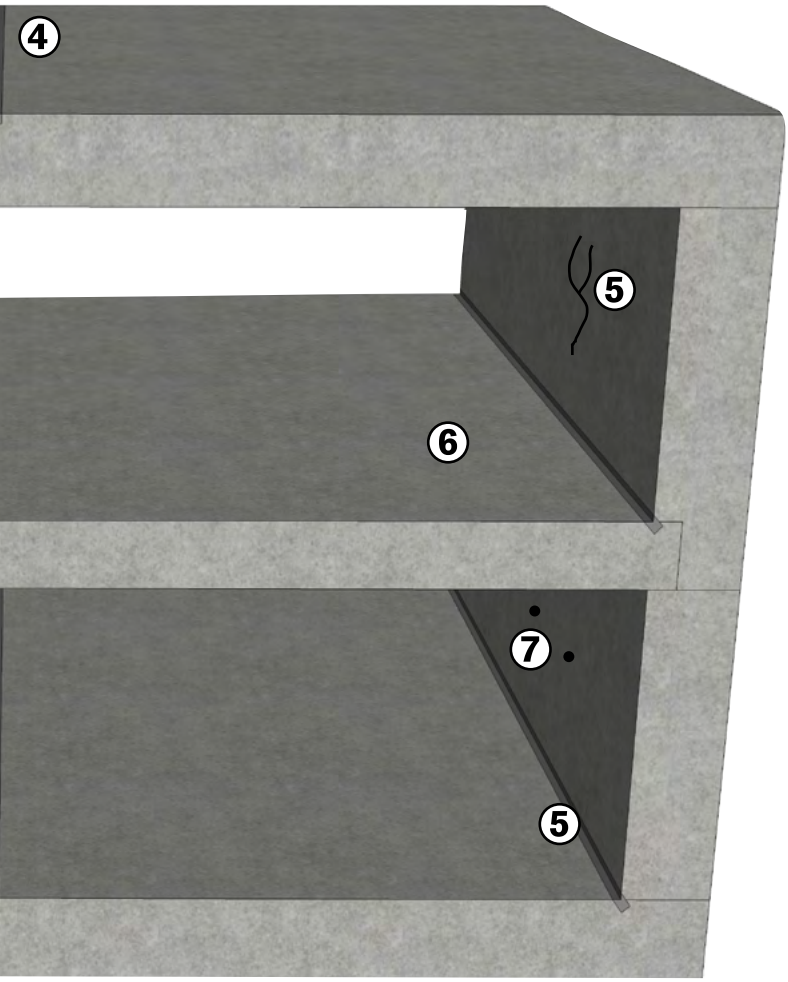
- Kryton's Waterproofing System self-seals leaks and protects rebar from corrosion
- Promotes more efficient use of time and money
- Replaces leak prone membranes

REPAIR AND EXTEND THE LIFE

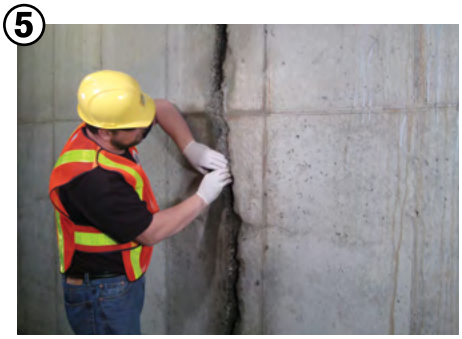
OF EXISTING PARKING STRUCTURES

Extend the life of your parking structure with the use of Kryton's complete Waterproofing System.

- Repair of parking structures damaged by ground water penetration and leaks
- Stops water and waterborne contaminates entering the structure
- Avoids premature deterioration of structural components
- Extends the durability of your parking structure

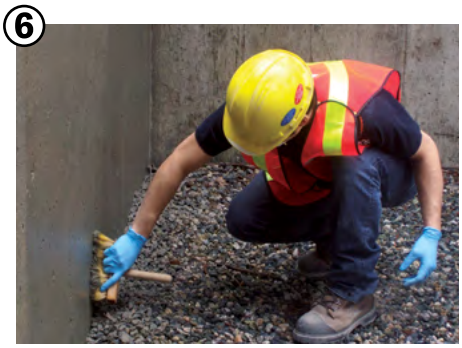


5



Waterproof leaking cracks and joints using the Krystol Leak Repair System.

6



Waterproof where existing membranes have failed or where there was no initial waterproofing with Krystol T1 & T2®; a cementitious slurry system that becomes an integral part of the concrete to prevent water ingress.

7



Repair leaking pipe penetrations and tie holes with Krystol Leak Repair System.

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The Erickson Underground Parking
Vancouver, B.C, Canada

The Erickson is a luxury, 20-story concrete and steel-trussed building with glass on all sides and an undulating shape that rises from the edge of False Creek in downtown Vancouver, surrounded by water on three sides.

They chose Kryton's Krystol Internal Membrane (KIM) admixture in all below grade concrete. KIM was used for all below grade perimeter walls. In addition to the waterproof concrete, the builder also applied thousands of lineal feet of Kryton's Krystol Waterstop System to seal the below grade construction joints, giving the joints the same level of crystalline protection that is in the concrete.

The Krystol Waterproofing System eliminated any need for exterior waterproof membranes, saved time and labour costs, and ensured a guaranteed leak-free building that can proudly bear the Arthur Erickson name.



Al Mashfa Private Hospital
Underground Parking, Jeddah, Saudi Arabia

Kryton's Krystol Internal Membrane (KIM) admixture was used to waterproof the base slab and perimeter walls and the Krystol Waterstop System was used for all the cold joints in the slabs and walls. The Krystol Waterproofing System saved the team thousands of dollars and shaved 48 days off their construction schedule.

"The implementation of all typical waterproofing methods would have been near impossible for our project. Particularly given the challenges we incurred during excavation: the 12-meter (39.4 feet) cutoff wall and extreme head pressure. We required an advanced waterproofing system that could withstand all of these obstacles especially during the casting of the matt slab."
– Mr. A. Hamis Elmas, Project Manager & Architectural Consultant, Al Mashfa Group



KK Times Square Underground Parking
Kota Kinabalu, Malaysia

For KK Times Square the developers used Kryton's Krystol Internal Membrane (KIM) admixture, surface-applied Krystol T1 & T2, Krystol Waterstop Joint System and Krystol Leak Repair system. The Krystol line of products met the developer's requirements for:

- affordability and ease of application
- a system that would be long lasting, minimizing future repair costs and inconveniences
- a waterproofing system that could withstand significant hydrostatic pressure and protect against the corrosion of steel reinforcements

Kryton is headquartered in Canada and has 7 regional offices in China, India, Mexico, SIngapore UAE, UK and the USA.

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CONSTRUCTION & REPAIR OF CONCRETE WATER CONTAINMENT STRUCTURES

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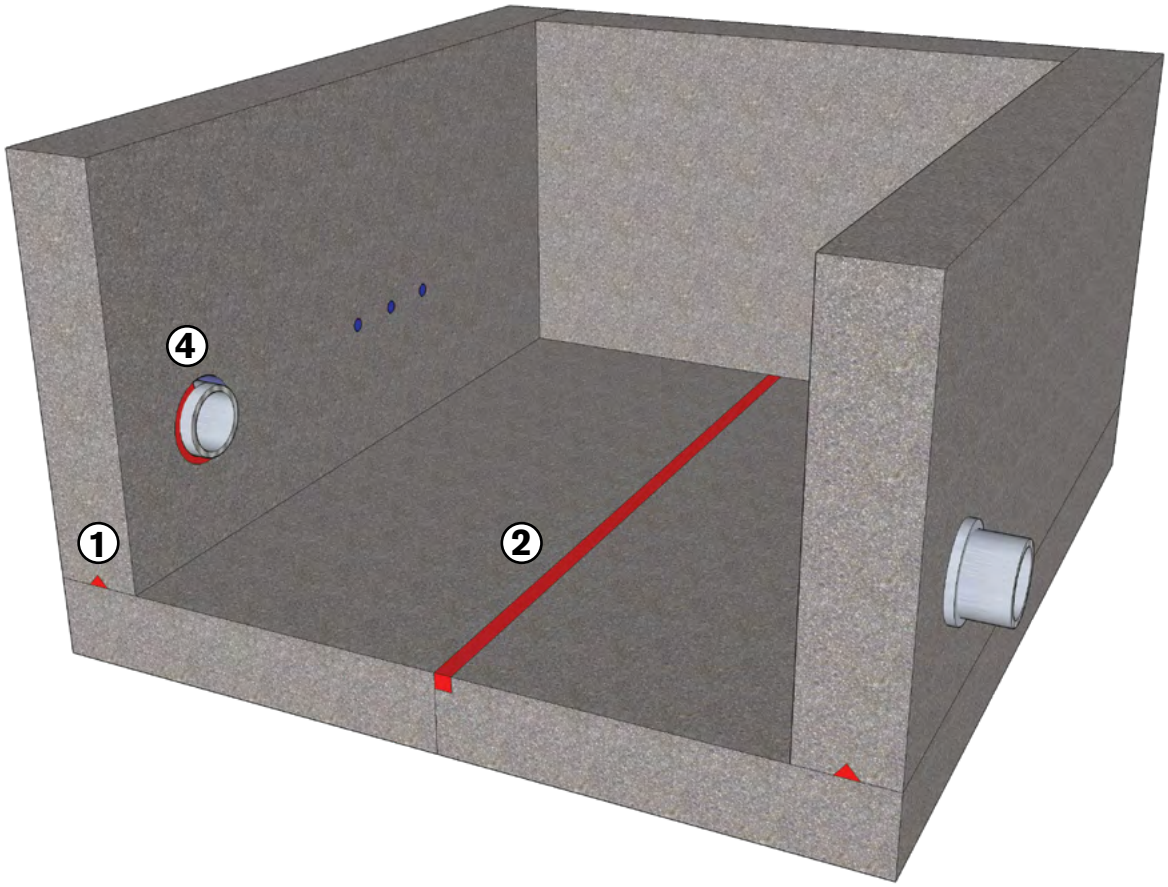
CONSTRUCT WATERTIGHT

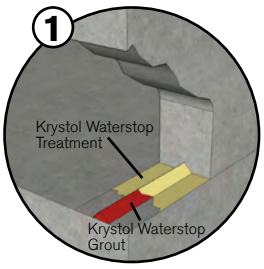
STRUCTURES

Take the risk out of creating watertight tanks from the begining by using Kryton's Krystol Internal Membrane™ (KIM®) admixture and Krystol Waterstop Joint System.

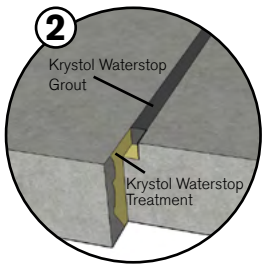
Waterproofing is built right into the concrete, eliminating the need for membranes. Kryton's Krystol® technology provides excellent resistance to harmful caustic effects of contact with sewage, wastewater and waterborne chemicals such as sulphates, chlorides and acids.

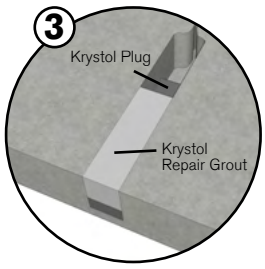
- Transform walls and slabs into impenetrable barriers using KIM or Krystol Broadcast™
- Create watertight construction joints and pipe penetrations using the Krystol Waterstop System



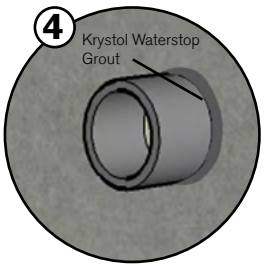


Ensure watertight construction joints with the Krystol Waterstop System





Repair leaking cracks with the Krystol Leak Repair System



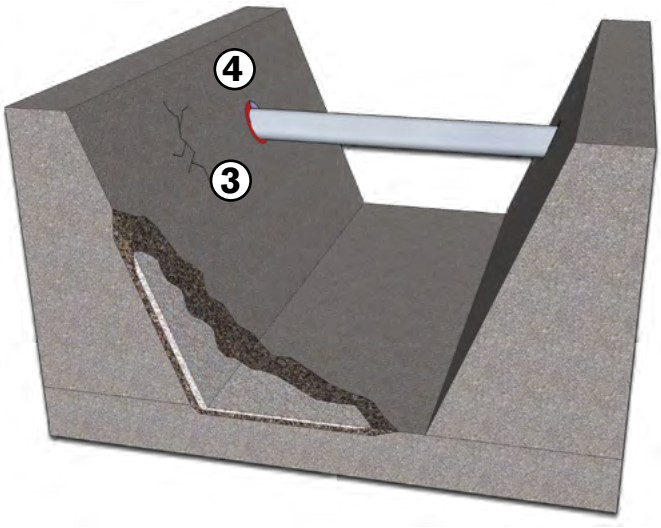
Prevent leaks at pipe penetrations with Krystol products

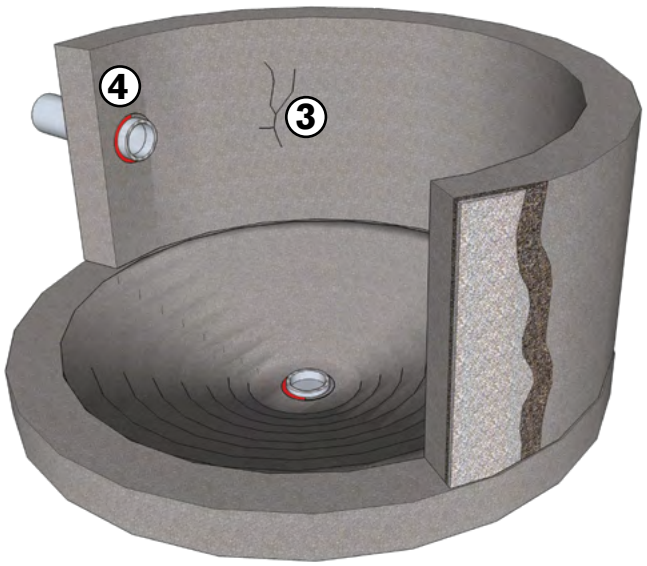
REPAIR AND WATERPROOF

EXISTING STRUCTURES

Extend the life of your existing structures by waterproofing where existing membranes have failed or where there was no initial waterproofing. Kryton's waterproofing and repair system is the only system that is as strong as concrete and works 100% of the time.

- Seal cracks and stop leaks using the Krystol Leak Repair System
- Use Krystol Plug™ and Krystol Repair Grout to treat leaking pipe penetrations
- Prevent further water ingress by applying Krystol T1 & T2 to walls and slabs subject to hydrostatic pressure





REPAIRING THE **BELENES WATER TANK**



Repair work on the Belenes water tank, Guadalajara, Mexico

The Belenes water containment tank was built 10 years ago, but had never been put into use. It needed a major re-surface treatment. There were cracks in the walls and in the slab. The tie holes needed waterproofing treatment. Major repair was needed to ensure a dependable and safe source of drinking water was available.

The government body charged with supplying potable water and sewer services to the Jalisco region, SIAPA, had previous experience with an innovative product manufactured by Kryton which was used for waterproofing concrete. Two years previously, SIAPA's technical director gave Kryton a real-life trial by seeing if their integral crystalline waterproofing could repair SIAPA's water tank in nearby Mesa Colorada. Delighted with the outcome, SIAPA included Kryton's integral crystalline admixture and repair system in its specifications for all future concrete repair and construction projects.

The project used Kryton's Krystol Leak Repair System, followed by a coating of Krystol T1 over the entire tank. Not only does the Krystol system ensure that the Belenes water tank will be waterproof, the Krystol line of products are also certified safe for contact with potable water by NSF International (certified to NSF/ANSI std. 61) and have zero volatile organic compounds (VOCs).

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TreePeople Center Underground Cistern, Los Angeles, Cailfornia, USA

TreePeople, is a non-profit organization that provides sustainable solutions to urban ecosystem problems. The center features a 216,000-gallon underground concrete cistern designed to achieve the US Green Building Council's Leadership in Energy and Environmental Design (LEED) Platinum Rating. Because conventional waterproofing membranes deteriorate over time the center's owners opted to use Kryton's Krystol Internal Membrane (KIM) and the Krystol Waterstop System for joints. By eliminating costly repairs and maintenance, KIM provides worry-free waterproofing for the life of the cistern.

In 2011 Kryton was awarded Project of the Year in the GreenSite Awards for their work on the TreePeople cistern.



Annacis Island Wastewater Treatment Plant, Vancouver, British Columbia, Canada

Annacis Island Wastewater Treatment Plant (WWTP) is the largest WWTP in the Greater Vancouver area and provides secondary wastewater treatment to approximately 1 million people. Four huge DAFT tanks, several meters in height and 400 mm (15 in.) thick were cracking and leaking. Kryton-approved applicators were contracted to provide repairs to leaking tanks and other walls at the facility. Krystol Bari-Cote, Krystol T1 & T2 were used to repair and waterproof the tanks.

When Annacis Island expanded their facilities, the Krystol Internal Membrane (KIM) admixture was used for waterproofing base slabs and walls in place of a membrane and bentonite at the deepest locations on-site – three stories below the water table.



Batu Kitang Water Treatment Facility Complex, Batu Kitang , Kuching, Malaysia

Due to the growing population the Kuching Water Board needed to expand their fresh water and they needed to do it quickly. The board elected to add to the complex by building an eighth module, which would increase the facility's fresh water producing capacity by 100 million liters per day. With a timeline projected of a year and a half, speed and efficiency of construction were critical. Another important factor in construction was waterproofing as the structure would be exposed to high water pressure being constantly pumped in and out of the plant. The team used Kryton's Krystol Internal Membrane (KIM), Krystol Waterstop System and Krystol T1 to keep the structure leak-free and meet their tight construction schedule.

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Replace Unreliable Waterproofing Membranes. Build The Waterproofing In With Krystol® Technology!

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Replace Unreliable Waterproofing Membranes. Build The Waterproofing In With Krystol Technology!

BE SURE. BE KRYTON.

Build The Waterproofing In With Krystol Technology

It's the intelligent, self-sealing water-protection system that transforms concrete into a powerful water-resistant barrier. Krystol relies on a revolutionary crystalline technology that turns porous concrete into an impermeable barrier. The result is a structure with reduced cracking, self-sealing and waterproofing abilities that provide a powerful defense against water damage and corrosion of reinforcing steel.

So whether it's new construction, upgrading an existing structure or repairing cracks, Krystol will help you build the quality, reliability and cost-effectiveness into the concrete.

Key Benefits of The Krystol Concrete Waterproofing System

- Lower the cost of waterproofing by up to 40%
- Shave weeks off the construction schedule
- Reduce the cost of maintenance and repairs
- Increase revenues with a larger building footprint

The Krystol Advantage

Replaces unreliable exterior membrane systems

- Penetrates deep into concrete—many inches over time
- Self-seals hairline cracks—minimum .02 in. (.5mm)
- Reactivates in the presence of moisture—even years later
- Effective against hydrostatic pressure—up to 460 ft (140m) of head pressure
- Waterproof from any direction (i.e. positive or negative side)
- Impervious to physical damage and deterioration
- Certified non-toxic and safe for potable water—NSF approved
- Easy to apply and reduces potential for human error
- Works where other systems fail to eliminate leaks and water damage

How Does Integral Crystalline Waterproofing Work?

When added or applied to concrete, crystalline chemicals create a reaction that causes long, narrow crystals to form, filling the pores, capillaries and hairline cracks of the concrete mass. As long as moisture remains present, crystals continue to grow throughout the concrete, reaching lengths of many inches over time. Once the concrete has cured, the crystalline chemicals sit dormant until another dose of water (such as through a new crack) causes the chemical reaction to begin again.

The ability to reactivate in the presence of water gives crystalline-treated concrete the ability to "self-seal". When cracks form due to curing shrinkage, settling, seismic activity, etc., water entering through them causes new crystals to form and grow, blocking and filling the cracks. Its ability to self-seal cracks is one of crystalline technology's most unique and useful features, and can help to dramatically reduce the long-term maintenance and repair costs of a concrete structure.



Other Benefits of Integral Crystalline Technology

Along with superior waterproofing and self-sealing properties, integral crystalline waterproofing technology offers a number of key benefits:

- **Permanent Solution** – becomes a part of the concrete matrix so it will not crack, peel, tear or wear-away. Even against high hydrostatic pressure. Unlike externally applied membranes, which are best on the day they are applied, crystalline applications become more effective with time.
- **Perfect for Blind-Wall Applications** – can be added to the concrete mix or applied to the negative side of the structure (against the water pressure). There's no need to save room outside the structure for membrane application. Project teams can design a larger structural footprint and build right to the property line.
- **Protect Reinforcing Steel** – adds to the longevity of concrete structures by preventing the penetration of waterborne contaminants and chloride-laden liquids that cause the corrosion of reinforcing steel.
- **Save Weeks on Construction Schedules** – can be applied to green concrete, or even added to the ready-mix truck. There is no need to wait for membrane application and backfilling can begin right-away.

In hot or tropical climates, integral crystalline waterproofing offers several key advantages. Hot weather can dramatically shorten concrete's setting time, resulting in weaker concrete and enhancing the likelihood of shrinkage and cracking. Adding crystalline chemicals to the concrete mix reduces premature moisture loss, creating a more durable structure and reducing shrinkage and cracking. Unlike membrane systems that become brittle and deteriorate when exposed to prolonged heat,

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crystalline waterproofing is unaffected by climate and remains effective for the life of the structure.

The soil in many hot or tropical climates can contain high levels of sulphates, chlorides and other chemicals that decrease concrete's integrity and corrode steel reinforcement. By blocking the penetration of water that can carry these contaminants and safeguarding concrete and reinforcements against corrosion, crystalline technology helps to prolong a structure's useful life.

How is Integral Crystalline Waterproofing Applied?



In the case of new concrete construction, crystalline chemicals are supplied as a dry powder comprised of Portland cement, silica sand and special chemicals. This powder can simply be added to the concrete mixture at the plant to create a powerful moisture barrier in slabs, walls and construction joints. There is no need for any sort of surface application at the construction site.

Can Integral Crystalline Waterproofing Be Used in Existing Concrete Structures?



Absolutely. A number of manufacturers produce surface-applied formulas that can be brushed onto existing concrete structures to repair existing cracks, fortify and waterproof concrete and protect against contamination and steel reinforcement corrosion. The best systems may be applied on the negative side of the concrete against the water pressure where access to outside walls may be difficult or impossible. This allows concrete to be repaired without digging up the perimeter, destroying landscaping and incurring extra cost.

When applied to existing concrete, crystalline chemicals are absorbed into the concrete by capillary action (the natural wicking movement of liquids through a porous structure) and diffusion (the natural movement of chemical molecules.) Once inside the concrete, crystalline chemicals begin growing crystals and filling the spaces between concrete particles. The majority of active crystalline chemicals migrate into the concrete within the first 28 days, meaning the surface-applied system can be completely removed from the surface after this time without impacting its waterproofing properties.

What About Concrete Joints?

In building a concrete structure, extra care must be taken when waterproofing construction joints, since these areas are most vulnerable to cracks and leakage. Historically, the best option for waterproofing joints was to place a PVC barrier or bentonite strip into the joint before an adjoining wall was poured. However, this method is unpredictable at best because physical barriers easily become dislodged or damaged during subsequent concrete pours, rendering them ineffective and leaving joints susceptible to leakage.

Some manufacturers offer special crystalline waterstop systems that replace conventional waterstops, cost less and are easier to install. When used with the appropriate crystalline waterproofing system for new or existing concrete, crystalline waterstop systems help ensure that a structure is truly watertight. And crystalline waterstops are one of the few systems that can be retrofitted into existing joints should the original waterstop method fail or deteriorate.

Selecting a Quality Integral Crystalline Waterproofing System

A number of companies, including Kryton International, offer integral crystalline waterproofing systems, featuring products for new and existing concrete structures and joints. When selecting an Integral Crystalline Waterproofing system, it's important not to confuse true crystalline products with those that are simply concrete densifiers or pore blockers. Be wary also of products that claim to grow crystals but really only crystallize as they dry – these products will not permeate the concrete, nor will they reactivate in the presence of water to fill cracks. Ask whether the product you are considering contains silicates, stearates, or talc – these offer temporary waterproofing at best. And be sure your manufacturer offers a long-term warranty on all crystalline products.

Though originally received with skepticism, integral crystalline waterproofing has been repeatedly and successfully tested and used in virtually every country around the world. Over the past few decades, crystalline technology has been embraced by the construction industry as a superior replacement for conventional membranes, offering time and cost savings and flexibility that are simply unmatched by traditional waterproofing methods.

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SMART CONCRETE®

The Science of Krystol® Technology

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The Science of Krystol Technology

SMART CONCRETE®

Krystol technology is based on principles that are very similar to the processes that occur during the hydration and hardening of concrete. Cement is mainly made up of several calcium silicates. When cement particles are mixed with water, a chemical reaction occurs whereby these calcium silicates combine with the water to form new compounds. The new compounds are calcium silicate hydrate (CSH) and calcium hydroxide.



Microscopic, needle-like crystals fill the naturally occurring pores and capillary tracts of concrete for guaranteed waterproof structures.

The CSH forms as an amorphous microcrystalline structure, extending outward from the individual cement particles and eventually filling the space between them. The CSH crystal formation is the mechanism by which the concrete stiffens and gains strength. It is most dramatic in the first hours after the concrete is placed, but actually continues for weeks, months and even years into the life of the concrete.

The reason that hydration can continue, seemingly indefinitely, is because only a portion of the cement has reacted during the initial hydration and hardening of the concrete. A significant portion of each cement particle remains un-reacted long after the concrete has reached its design strength. It is the un-reacted particles that allow the Krystol chemicals to perform their function. Krystol acts as a catalyst to a larger reaction within the concrete mass.

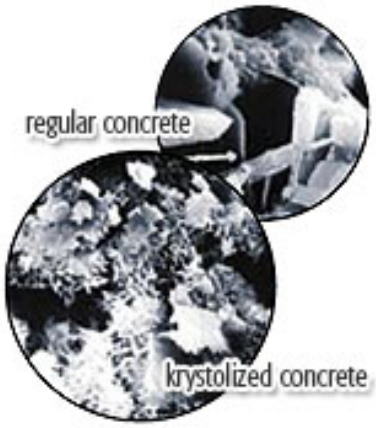
This is significantly different from silicate-based products that react with compounds in the concrete such as calcium hydroxide or free lime. The reaction binds such a treatment into an insoluble solid and hopefully blocks the pores. These products quickly become completely bound in place and therefore do not penetrate more than a few millimeters into the concrete. For the same reason, these products will not reactivate to self-seal new cracks that may form. In fact, they are insoluble and the presence of water in the future has no effect on them.

Krystol, on the other hand, works quite differently. The crystals that are formed are hydration crystals, but they are not amorphous like cement hydration crystals. Instead, they form into a crystalline structure of long hexagonal prisms that extend through and fill the capillary voids and micro-cracks of the concrete. The crystals themselves are not made up solely of the Krystol material, but grow from the partially reacted cement particles. This is why the crystals can travel many inches through the concrete.

Krystol treatments that have been applied to one side of a concrete wall have been observed to cause crystal growth to occur on the other side of several inches of “solid” concrete. The Krystol chemical is never used-up during the crystallization process. As a catalyst, only a very small amount of Krystol is required to grow a very large quantity of crystals. Within the tight confines of the concrete, crystals can easily grow to fill and block the microscopic capillary pores and micro-cracks without using more than a small fraction of the available Krystol chemical. The remaining chemical lies dormant within the concrete waiting for a crack to develop that will provide the necessary space and water source to allow the crystallization process to continue.

When added or applied to concrete, crystalline chemicals create a reaction that causes long, narrow crystals to form, filling the pores, capillaries and hairline cracks of the concrete mass. As long as moisture remains present, crystals continue to grow throughout the concrete, reaching lengths of many inches over time. Once the concrete has cured, the crystalline chemicals sit dormant until another dose of water (such as through a new crack) causes the chemical reaction to begin again.

The ability to reactivate in the presence of water gives crystalline-treated concrete the ability to “self-seal”. When cracks form due to curing shrinkage, settling, seismic activity, etc., water entering through them causes new crystals to form and grow, blocking and filling the cracks. Its ability to self-seal cracks is one of crystalline technology’s most unique and useful features, and can help to dramatically reduce the long-term maintenance and repair costs of a concrete structure.



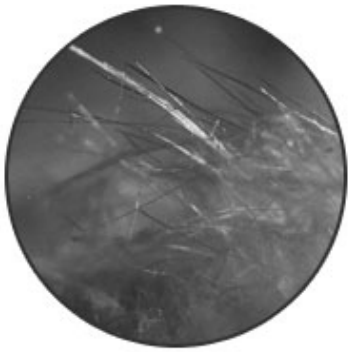
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Krystol® VS Silicate-based Technology

KRYTON | OCTOBER 2008

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Krystol VS Silicate-Based Technology



Krystol is a mixture of cement and waterproofing ingredients that work as a catalyst to further react un-hydrated cement particles and promote the hydration process - growing more and longer crystals that penetrate deeply into the pores and capillaries of the concrete, rendering it waterproof - permanently.

By contrast, silicates react with free lime in concrete to produce an insoluble Calcium Silicate Hydrate gel within the pores near surface. As the surface wears or is otherwise removed/damaged, the concrete will be unable to withstand even low hydrostatic pressure.

Self-Sealing

In the absence of water, Krystol chemicals remain dormant within the concrete matrix. Subsequent water intrusion, typically from cracks, will trigger the chemical reaction to cause additional crystals to grow and seal the crack and surrounding capillaries.

Silicate-based materials will not reactivate to produce additional gel and protect against future water intrusion.

	Silicate	Krystol
Self-sealing	No	Yes
Set time of green concrete	Accelerates	Retards
Hydrophilic vs. Hydrophobic	Hydrophobic	Hydrophilic
Strength	Decreases	Increases
Cracking	Increase	Decrease
Penetration	1/8—1/4”	inches
Reacts with free-lime	Yes	No
Improves with age	No	Yes
Helps reduce corrosion	No	Yes

Set Time of Green Concrete (Newly Poured Concrete)

Krystol retards the set time of the concrete to allow more time for un-hydrated cement particles to react with water and produce a stronger bond. This leads to higher compressive strength. Also, since the hydration process is extended, the hydration heat and peak heat are both decreased, which reduces the potential for shrinkage cracking.

Silicate-based material accelerates the set time. This leads to weaker strength and more potential for cracking during curing.

Hydrophilic vs. Hydrophobic

Krystol chemicals absorb water to create the unique crystals that serve to block the pores and capillaries of concrete - more water equals more crystals, until no additional water can penetrate. The hydrophilic nature of the Krystol system gives it the ability to resist unmatched levels of hydrostatic pressure, to grow deep into (and even throughout) the concrete matrix and to reactivate in the presence of moisture.

Silicate-based materials form a type of viscous, colloidal gel that repels water. They are unable to penetrate past the surface and are prone to wear and eventual deterioration. Negative-side water pressure will cause the surface treatment to “delaminate” while positive side pressure will wear the coating away.

Penetration

Krystol reacts with moisture and travels as far as water will carry it into the concrete matrix. Depending on porosity of concrete, humidity and water pressure, Krystol will penetrate many inches into concrete over time.

Silicate-based materials only produce a kind of viscous colloidal gel near the concrete surface during the initial hydration process. After that, it will not react to create additional gel and therefore won’t penetrate any further.

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Waterproof

By penetrating deeply into the concrete and becoming a permanent part of the concrete matrix, Krystol is effective against hydrostatic pressure from both the positive and negative side. In fact, once the Krystol chemicals are drawn into the concrete the initial surface treatment can be removed without affecting permeability of the concrete.

Because silicate-based materials form a high viscosity colloidal gel near the concrete surface, such systems rely on the surface layer to maintain effectiveness. Once the surface is compromised, the concrete will be unable to withstand hydrostatic pressure. In addition, since it doesn't penetrate deeply into the concrete, it cannot waterproof on the negative side.

Reacts with Free-Lime

Silicate-based materials require free-lime to form the surface gel that blocks water intrusion. Because Krystol does not require free-lime to grow millions of needle-like crystals throughout the concrete it is unaffected by the availability of this material.

Additives such as silica fume and fly-ash reduce the amount of free-lime that is available in the concrete. In addition, aged concrete that has undergone weathering and carbonation may not have enough free-lime left at the surface for silicate-based materials to be effective.

Improves with Age

In moist environments, when it matters most, Krystol will continue to grow into the concrete, even and especially under high water presence. The concrete will increase in compressive strength and reduce potential cracking. This is a permanent solution.

Reduces Corrosion

Krystol blocks the water from entering the concrete, reducing the potential for corrosion of steel reinforcements. As Krystol is a permanent treatment it offers protection against corrosion over the long-term.

Silicate-based materials are not permanent. They are subject to wear and deterioration and are unable to withstand hydrostatic pressure. Over time, water will penetrate the concrete and cause the corrosion of the steel.

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