KRYTON®

شركة المرصد العالمي المتخصص لتشييد المباني

GSO – Global Specialized Observatory

حلول متكاملة لجودة البناء وحماية المنشآت

Krystol Internal Membrane™ (KIM®)

معالجة خرسانية متكاملة ضد الرطـوبـة

Integrated 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

Concrete Waterproofing & Durability Enhancing Admixture

Krystol Internal Membrane™ (KIM®)

DESCRIPTION



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

KIM lowers the permeability of concrete and is used in place of surface applied waterproofing membranes. By stopping the transmission of water through concrete, KIM adds durability and longevity to concrete by protecting it against chemical attack and corrosion of reinforcing steel.

KIM contains Krystol technology. When added 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.

FEATURES & BENEFITS

- The original and unsurpassed Permeability Reducing Admixture for Hydrostatic conditions (PRAH)
  - 35+ years of history
  - Effective against 140 m (460 ft) of hydrostatic head pressure
  - Reliably self-seals hairline cracks up to 0.5 mm (0.02 in)
  - Reduces concrete shrinkage and cracking
- Outperforms other crystalline admixtures on an equal weight basis (kg for kg / lb for lb)
  - Unique chemical reaction
  - Highest level of permeability reduction
  - Most dependable self-sealing performance
  - Best shrinkage and restrained shrinkage cracking reduction
  - Proven to extend life and protect against corrosion
- Easily added directly to ready-mix truck or to a central mixer
- Safe for contact with potable water
  - Certified by NSF to NSF/ANSI Standard 61
- Replaces the need for unreliable membranes, liners and coatings
  - Impervious to physical damage and deterioration
  - Significant reduction to your construction schedule
  - Reduces the cost of maintenance and repairs
  - Increases revenues with a larger building footprint
  - Lowers overall waterproofing costs
- Essential for blind-wall and shotcrete applications
- Extends life of concrete
  - Protects concrete against corrosion of reinforcement
  - Improves resistance to freeze-thaw
  - Improves resistance to waterborne chemicals such as sulfates, chlorides, and acids

RECOMMENDED USES

Use KIM to provide waterproofing protection for any Cast-in-place, Shotcrete or Precast concretes that will be subject to water, such as:

- Below grade parking structures, basements, elevator pits and foundations of high-rise towers
- Recreational facilities such as aquatic centers, aquariums, zoos, water parks and marinas
- Architectural water features such as fountains and waterfalls
- Traffic tunnels, below grade pipelines and subway tunnels
- Water containment reservoirs, water treatment tanks, sewage and manholes
- Bridges, dams and highway infrastructure
- Concrete homes including basements, foundations, swimming pools, decks, bathrooms, garages and exteriors
- Sufficiently designed roof tops and plaza decks
- Any concrete that requires the highest level of protection and durability.

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TECHNICAL DATA SHEET

Concrete Waterproofing & Durability Enhancing Admixture

KRYTON
SMART CONCRETE®

PROPERTIES

PHYSICAL PROPERTIES		
APPEARANCE		Grey Powder
BULK DENSITY		~1.4 g/cm^3 (88 lb/ft^3)
SPECIFIC GRAVITY		~2.8
CHLORIDE ION CONTENT		<0.1%
PLASTIC PROPERTIES (OVER CONTROL)		
SLUMP	ASTM C143 / BS EN 12350-2	No significant change.
PLASTIC DENSITY	ASTM C138 / BS EN 12350-6	No significant change.
AIR CONTENT	ASTM C231 / BS EN 12350-7	No significant change.
HARDENED / PERFORMANCE PROPERTIES[1] (OVER CONTROL)		
PERMEABILITY & RESISTANCE TO WATER UNDER PRESSURE (highest permeability reduction and resistance to water under pressure.)		
	USACE - CRD C48–92 1.38 MPa (200 psi) for 14 days	97% reduction in the coefficient of permeability. - *Nelson Testing Laboratories, USA* No leakage through any of the 7 or 28 day cured KIM treated concrete while control failed at 10 and 45 hours respectively. - *University of British Columbia, Canada*
	DIN 1048-5 0.5 MPa (72.5 psi) for 72 hours	90% reduction in permeability over the same untreated concrete mix design; 3.7 mm (0.15 in) vs 36.7 mm (1.45 in). - *Kuwait University Civil Engineering Testing Center, Kuwait*
	TAYWOOD VALENTA Modified BS 12390-8: 1 MPa (150 psi) for 96 hours	70% reduction in the Coefficient of Permeability over control samples. - *British Board of Agrément (BBA) Certification, UK*
	ICBO/ICC Water Percolation Test	Exceeded ICBO criteria of no water passing and well under the 12.5 mm (0.5 in.) water drop limitation after 48 hours. - *Inspection Concepts, USA*
	NCH 2262.Of 1997 0.5 MPa (72.5 psi) for 72 hours	Average depth of water penetration of 0 mm while control samples were 44 mm (1.73 in). - *Ingeneria Dictuc, Chile*
SELF-SEALING (typically will stop leaks through cracks up to 0.5mm in width. Many factors will influence self-sealing performance. Results may vary.)		
	Self-Sealing Apparatus US Patent 9,038,477	Stopped water flow from crack sizes of 0.6 and 0.7mm (0.028 in). - *British Columbia Institute of Technology, Canada*
	Self-Sealing Apparatus Custom	Self-sealed a 0.6 mm (0.024 in) leaking crack. - *The Cement and Concrete Institute, Sweden*
	Self-Sealing Apparatus US Patent 9,038,477	KIM treated concrete showed self-sealing while controls with the same crack width continued to leak. - *University of Victoria*
CORROSION RESISTANCE: (proven performance in longest real world field study.)		
	10 year field study	Low half-cell readings and no signs of corrosion after 10 years exposure in Honolulu Harbor. KIM was recommended by name to extend life and protect concrete from corrosion of reinforcing steel. - *University of Hawaii at Manoa, USA*

1. Concrete is made of locally sourced materials to achieve different properties like strength, workability and durability. Results of testing will always vary based on the unique mix design. Testing listed is over a control and is a compilation of different tests in which Kryton is best in class.

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PROPERTIES (CONTINUED)

SHRINKAGE & CRACK REDUCTION[2]		
	BS 1881-5	25% reduction in drying shrinkage over control concrete. - *British Board of Agrément (BBA) Certification, UK*
	AS 1012.13-1992	20-25% reduction in drying shrinkage over control. - *Boral Materials Testing & Environmental Services, Australia*
	ASTM C1140 (modified)	80% reduction in restrained shrinkage cracking compared to control. - *AMEC Earth & Environmental Ltd, Canada*
	ASTM C1579 – 06	53% reduction in average crack width over control. - *British Columbia Institute of Technology, Canada*
FREEZE / THAW RESISTANCE		
	BS 5075-2	87% reduction in freeze/thaw expansion compared to control. - *British Board of Agrément (BBA) Certification, UK*
CHEMICAL RESISTANCE		
	US Bureau of Reclamation Sulfate Resistance Test	Outperformed control specimens after 21 cycles of soaking in Na_2SO_4 solution then oven drying. - *R. M. Hardy and Associates, USA*
	British Board of Agrément	The lower permeability of KIM concrete will reduce the ingress of sulfates. - *British Board of Agrément (BBA) Certification, UK*
	AASHTO T277-89	Chloride Ion Resistance (Coulombs) KIM improved resistance over control concrete by 34.5% after 28 days, 36% after 56 days, and 44.8% after 90 days. - *The Port Authority of New York & New Jersey, USA*
	ASTM C1202-97	Reduced Rapid Chloride Permeability over control mix design by 45% after 28 days. - *AMEC Earth and Environmental, Canada*
STRENGTH[3]		
	ASTM C39	Increased compressive strength over control by 5.3% after 7 days and 13.9% after 6 months. - *The Port Authority of New York & New Jersey, USA*
	BS EN 12390-3	Increased compressive strength by 9% after 28 days over the equivalent untreated concrete. - *British Board of Agrément (BBA) Certification, UK*

2. Kryton does not recommend eliminating standard shrinkage control joints. Follow ACI guidelines and Kryton's published literature for waterproofing joints.
3. Do not assume strength increase will occur. Do not reduce strength class or cement, or increase water compared to starting mix. Plan for no changes to strength.

CERTIFICATIONS

KIM is used around the world and has a number of certifications, including:

- NSF to NSF/ANSI Standard 61: Drinking Water System Components
- ASTM 494 Compliant
- Dubai Municipality: Certificate of product conformity
- BRANZ , Appraised No 661
- CE and UKCA Marked to BS EN 934-2
- REACH and UK REACH Compliant
- British Board of Agrément (BBA): Certificate 05/4217
- British Board of Agrément (BBA): Certificate of Conformity of the Factory Production Control 0836-CRP-14/F086
- KIWA GmbH: Certificate of Conformity of the Factory Production Control 0770-CRP-21DE-02410_A
- Singapore Green Label

APPLICATION

Read and distribute Application Instructions 1.11 (Cast-in-place concrete) or 1.21 (Shotcrete) before using this product.

A pre-pour meeting with the general contractor, forming contractor, finisher, concrete supplier and materials testing engineer is strongly recommended. Treat construction joints and penetrations in accordance to Application Instructions 4.11-4.31 (as applicable). Dose KIM at 3-5 kg/m^3 in consultation with an authorized Kryton representative. Depending on project conditions and needs, the dose may be increased up to 8 kg/m^3. Consult with Kryton's Technical Services Department for project specific recommendations. Trial batches are required to determine actual plastic properties. Allow KIM to thoroughly mix at medium/high speed for minimum 1 minute per cubic meter/yard in the batch and a minimum of 3 minutes. Place and finish in accordance with ACI guidelines. Proper placement and curing are essential to achieve the performance and benefits of KIM. Cure in accordance with ACI 308.1 guidelines.

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

KIM is an effective waterproofing system for rigid concrete structures only and may not reliably self-seal dynamic, moving cracks and joints.

SAFETY

Read the Safety Data Sheet (SDS) for this product. For professional use only. Avoid contact with skin or eyes. Avoid breathing dust. Wear a dust mask, long sleeves, safety goggles and impervious gloves.

PACKAGING

KIM is available in 5 kg (11 lb) and 25 kg (55 lb) re-sealable pails as well as pulpable mixer-ready bags in custom sizes to match your mix design.

SHELF LIFE

When stored in a dry enclosed area, KIM has a shelf life of at least 5 years for unopened pails. When packaged in mixer ready bags, KIM has a shelf life of at least 4 years when kept in the original pallet wrapping and must be used within 4 months of opening the original pallet wrapping.

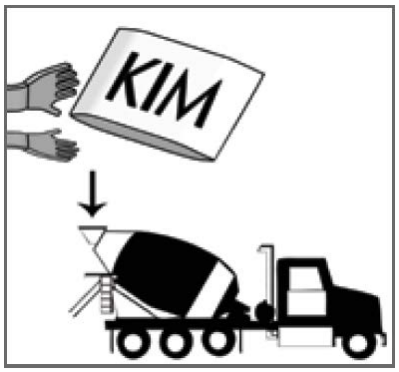
WARRANTY

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.

Krystol Internal Membrane™ (KIM®)

Krystol Internal Membrane™ (KIM®)

DESCRIPTION



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

KIM lowers the permeability of concrete and is used in place of surface applied waterproofing membranes. By stopping the transmission of water through concrete, KIM adds durability and longevity to concrete by protecting it against chemical attack and corrosion of reinforcing steel.

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.

IMPORTANT OVERVIEW

You are making a waterproof membrane out of the concrete. This is different from traditional construction where the concrete just forms the structure. The KIM concrete you are placing will be the only barrier to water penetration. This means that common defects found in typical concrete cannot be tolerated. Poor consolidation, unplanned cold joints, cracks, penetrations, contaminations, etc. will all result in a leaking structure. To avoid leakage and to achieve success, you must follow the critical instructions outlined in this document. Furthermore, you must properly record all relevant data in order for the manufacturer's warranty to be valid.

MIX DESIGN CONSIDERATIONS AND COMPATIBILITY

The properties of concrete materials and admixtures vary from region to region. Trial batches are required to assess the local plastic and hardened properties and determine appropriate mix designs.

- Proportion your mix to minimize shrinkage. Water to cementing materials (w/cm) ratio must follow the guidelines given by ACI 318 (or equivalent code) for the applicable exposure class.
- The w/cm ratio should be 0.45 or lower and must not exceed 0.50.
- The recommended minimum design strength is 28 MPa (4000 psi).
- KIM is compatible with all cement types, supplementary cementing materials (SCMs), blended cements and all common concrete admixtures.
- KIM may delay the setting time of concrete. Normal-Set Type-A (water reducing) and Type-F (high range water reducing) admixtures are preferred with KIM under most conditions. Reduce or remove Type B (set retarding) or Type D (water reducing and set retarding) admixtures unless trial batches show they are beneficial.
- High volumes of fly ash or GGBS (slag) may extend the setting time of concrete. When used with KIM and admixtures that delay the setting time, first test for acceptable setting behavior. After initial trials, some modifications may be made to optimize the setting time.
- Accelerating admixtures are known to increase the risk of cracking and should be avoided when possible. If an accelerating admixture is used, then use only the minimum level necessary.
- KIM will have a minimal effect on air content and will increase air less than 1.0%. Dose air entraining admixtures as normal.
- Admixtures should be added to the concrete separately and must not be mixed together prior to addition. The timing and order of different admixtures may affect the overall slump and setting performance. The properties of concrete containing more than one admixture should be assessed by trial mixes.
- Recycled water should meet the requirements of ASTM C1602 (or equivalent standard) and its performance verified through trial batches.

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APPLICATION INSTRUCTION

Cast-In-Place-Concrete

1.11

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PRE-POUR SITE MEETINGS

The Site Superintendent must arrange and attend a meeting that includes a Kryton representative, the concrete supplier and applicable representatives of the forming, placing and finishing contractors. The meeting needs to be scheduled well in advance of the initial concrete placement in order to communicate any modifications required for a successful concrete project. Discussion will include the following:

- Questions regarding KIM Application Instructions (this document) and the KIM Best Practices Guide.
- Importance of controlling water content and workability of the concrete.
- Importance of proper placement and consolidation of the concrete.
- Importance of proper curing procedures.
- Delayed setting times of KIM concrete, particularly in cold weather.
- Review of how set delay may affect form pressure, stripping schedules and slab finishing.
- Construction joint details using the Krystol Waterstop System.
- Tie hole and penetration details using the Krystol Waterstop System.
- Spacing and treatment of shrinkage control joints.
- Use of Krystol Leak Repair System for repair of deficiencies.
- Review of Krystol Assurance Program documents (if applicable).

CONSTRUCTION JOINTS & DETAILS

Construction Joints and Details need to be treated using the Krystol Waterstop System to create a watertight structure. The following Application Instructions need to be referenced based on the selected detail:

- Cast-in-Place: Application Instruction 4.11, 4.12*, 4.15 or 4.16*.
- Control Joints: Application Instruction 4.14.
- Shrinkage control joints should be spaced to ACI requirements or closer to control random cracking. Typical wall sections should have shrinkage control joints spaced to prevent random cracking, usually every 3-5 m (10-16 feet).
- Suspended Slabs: Application Instruction 4.31.
- Tie holes and penetrations: Application Instruction 4.17*.

*May require minor modifications to concrete forms dependent on waterproofing joint detail selected.

BATCHING AND ON SITE DOSING

- Ensure drum is empty of water prior to batching.
- If adding KIM on-site, premeasure the required KIM material and carry on the truck.
- If possible, add only a portion of the specified high range water reducing admixture when batching and send the rest to the jobsite to be added as needed just prior to unloading.
- KIM is kg-for-kg (lb-for-lb) the best crystalline admixture available and dosage may vary based on mix design, project conditions and risk. Dose at the specified rate of addition to a maximum of 8 kg/m^3 (13.5 lb/yd^3). Consult your Kryton representative for guidance.
- KIM in pulpable bags can be thrown un-opened into the concrete mixer. These bags are designed to disintegrate in the mixer. Before opening KIM pails, loosen compacted material by turning the pail over once or twice. Dispense directly into concrete mixer. Mix concrete at medium to high speed for 1 minute per m^3 (yd^3) in the batch and a minimum of 3 minutes.
- When using pulpable bags, conduct trials to ensure that your mix design produces sufficient shear to pulp the bags. Generally, lower slumps will provide higher shear. If bags do not fully disintegrate, it is recommended to open, empty and discard the pulpable bags.
- KIM may be added at any time during the batching process. Note that adding KIM as your first admixture will tend to minimize any effects on plastic properties.
- The addition of water without supervision and approval may void the manufacturer's warranty.
- Store any unused portions in an airtight container to prevent moisture contamination.

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APPLICATION INSTRUCTION

Cast-In-Place-Concrete

1.11

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HANDLING, PLACEMENT AND FINISHING

- It is very important that there be no water or debris in forms when pouring a joint that must be watertight.
- Under some circumstances, you may observe slump loss at 25 minutes. This is false set and slump will recover with continued mixing. False set normally occurs during transport and is not noticed. Avoid placing concrete during the false set period.
- If the slump is below specification, add a mid or high range water reducer to achieve the required slump. Only add additional water with the approval of the quality control technician (to the maximum of specified w/c ratio). Record all water additions on the batch ticket and do not exceed the specified w/c ratio. The addition of water without supervision and approval may void the manufacturer's warranty.
- Place and finish in accordance with ACI guidelines.
- Proper consolidation of the concrete is essential to achieve the performance and benefits of KIM (see ACI 309R). Ensure walls are vibrated down to the bottom joint. Do not drop concrete through heavily reinforced walls – use a hose or drop chute to deposit concrete in a controlled manner to avoid segregation. Carefully vibrate and level all construction joints that will be treated with a waterstop. Consider using self-consolidating concrete (SCC).
- KIM treated concrete will typically delay the initial and final setting times of the concrete. Adjust your finishing or stripping schedule accordingly. Evaporation retarder may be needed on hot or windy weather.
- Consider monitoring internal temperatures to ensure compliance with specifications.

CONCRETE TESTING

Ensure field sampling and testing is performed by a certified ACI Level 1 Concrete Field Testing Technician or equivalent, and that the testing laboratory is certified to ASTM C1077 or equivalent. All testing procedures should follow ASTM, CAN/CSA, or equivalent. It is recommended to perform field tests at least once for every 115 m^3 (150 yd^3) of concrete placed. The owner, general contractor, or job specifications may require additional testing from what is called for below, but the following data must be recorded to comply with the manufacturer's product warranty requirements:

- Time of batching, testing and placement
- Slump (or Flow)
- Air content
- Temperature of concrete and ambient air
- Compressive strength

Forward all test results to manufacturer or manufacturer's representative. In cases where concrete loads are accepted that do not conform to specifications, record the name of the person authorizing the acceptance and the location of concrete placement.

PROTECTION OF FRESH CONCRETE

Protect freshly placed concrete from rain, excessive wind, and sun.
In cold weather, follow cold weather concrete practices from ACI 306R for batching and placement. An accelerating admixture may be necessary. Dose accelerators according to their instructions.
Although KIM delays the setting time, KIM is not a substitute for hot weather practices and the procedures in ACI 305R must still be followed. In some cases, a set retarder may still be needed.

CURING

Proper curing is essential to minimize cracking and achieve the performance and benefits of KIM. Cure in accordance with ACI 308.1 guidelines. Wet curing the concrete with a fog mist spray, sprinkler or wet coverings (burlap, curing blankets) for 7 days is recommended. Alternatively, immediately apply a curing compound conforming to ASTM C309.
All KIM concrete must be properly cured following the practices in ACI 308.1 regardless of the weather or temperature conditions at the time of placement.

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APPLICATION INSTRUCTION

Concrete Waterproofing Admixture

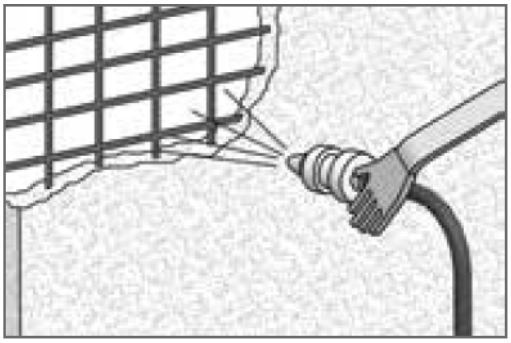
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SMART CONCRETE®

Instructions for Shotcrete Nozzleman & Crew

Krystol Internal Membrane™ (KIM®)

DESCRIPTION



Krystol Internal Membrane (KIM) is a chemical admixture in powder form used to create waterproof concrete. KIM is used in place of externally applied surface membranes to protect against moisture transmission, chemical attack, and corrosion of reinforcing steel.

IMPORTANT: All nozzlemen and crew must be familiar with and follow the guidelines of ACI 506R Guide to Shotcrete. You are making a waterproof membrane out of the concrete. This is different from traditional construction where the concrete just forms the structure. The KIM concrete you are placing will be the only barrier to water penetration. This means that common defects found in typical concrete cannot be tolerated. Poor consolidation, unplanned cold joints, cracks, penetrations, contaminations, etc. will all result in a leaking structure. To avoid leakage and to achieve success, you must follow the critical instructions outlined in this document.

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.

PREPARATION FOR SHOTCRETING

- Ensure all formwork, reinforcing steel and embedded items are braced to avoid vibration and are designed to allow for the escape of compressed air and rebound.
- Ensure sufficient clearance around reinforcement to allow for complete encapsulation.
- Ensure that the Krystol® Waterstop System has been applied to all existing concrete/ shotcrete surfaces (refer to Cold Joints and Construction Joints section below).
- Ensure that all pipes and other penetrations are prepared according to Application Instruction 4.17 — Waterproofing Tie Holes and Pipe Penetrations.
- Ensure there are no unintended penetrations through the shotcrete element such as excess rebar, tie wires, etc. that could provide a migration path for water.
- Ensure that all surfaces to be shot are dampened to a saturated-surface-dry (SSD) condition immediately prior to shotcrete application. Drain free standing water away from shotcrete operations.

SHOTCRETE SUPPLY

- Inspect the ready mix shotcrete batch ticket to verify that the correct shotcrete mixture has been supplied with KIM added at the specified addition rate.

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SHOTCRETE APPLICATION

- Place shotcrete with sufficient velocity and plasticity so material flows around and behind the reinforcement. Follow proper shooting technique as detailed in ACI 506R Guide to Shotcrete.
- Cut out defects while the shotcrete is still plastic and reshoot the affected areas. Defects include:
    - Sloughs, delamination, plastic shrinkage cracks, etc.
    - Entrapped rebound and overspray
    - Voids of incomplete consolidation, including shadows behind rebar
- Have an air lance available at all times to remove excess water and debris just prior to shooting, and to remove rebound and overspray.
- Immediately remove all overspray from exposed reinforcement at construction joints.
- Inform the shotcrete inspector or quality control supervisor of any conditions that prevent the placement of fully consolidated, waterproof shotcrete.

COLD JOINTS AND CONSTRUCTION JOINTS

- Cold joints represent a break in the shotcrete membrane and are vulnerable to water penetration. Whenever possible, build shotcrete elements to their full thickness in one layer to avoid cold joints.
- Apply the Krystol Waterstop System (consisting of Krystol Waterstop Grout™ and Krystol Waterstop Treatment™) to all preplanned construction joints at the end of a shift using one of the following procedures:
    - Application Instruction 4.11 — Waterproofing Horizontal Construction Joints — Internal Grout Method.
    - Application Instruction 4.21 — Waterproofing Horizontal and Vertical Construction Joints for Shotcrete — External Grout Method.
- Prepare pipes and other penetrations to receive the Krystol Waterstop System as described in Application Instruction 4.17 — Waterproofing Tie Holes and Pipe Penetrations.
- All surfaces to receive the Krystol Waterstop System must be free of contaminates and dampened to a saturated- surface-dry (SSD) condition to ensure adequate bonding.

IMPORTANT: Unintended cold joints may develop long lift breaks during bench gunning if the previous layer of shotcrete hardens before the next layer is placed. This is common during hot weather or when using highly accelerated mixes. Inspect all lift breaks as described in Application Instruction 4.22 — Waterproofing Unintended Cold Joints (Shotcrete), and apply a coating of Krystol Waterstop Treatment before shooting the next layer if the previous layer has already hardened.

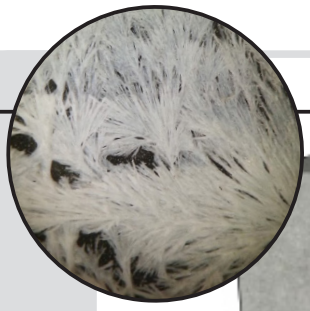
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EXISTING CONSTRUCTION OVERVIEW

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.

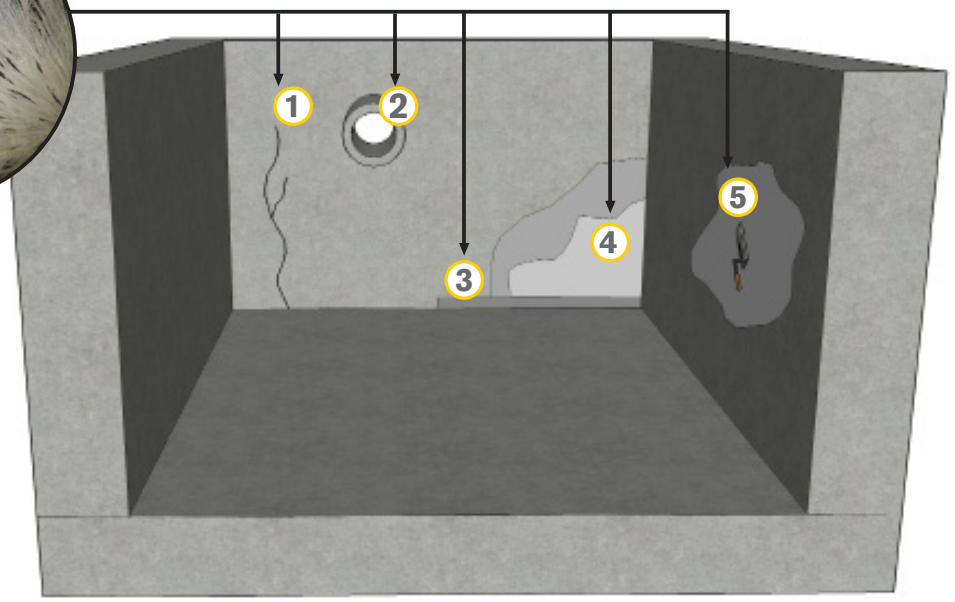
Krystol® Technology



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

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

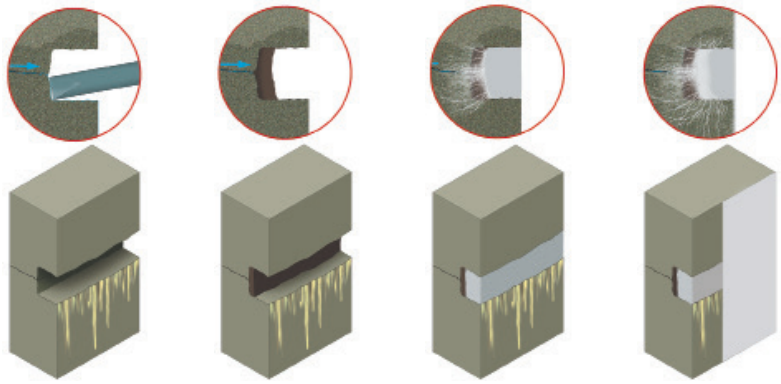
An "in-depth" concrete treatment that is applied as a slurry or spray to the surface of existing concrete structures.

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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NEW CONSTRUCTION OVERVIEW

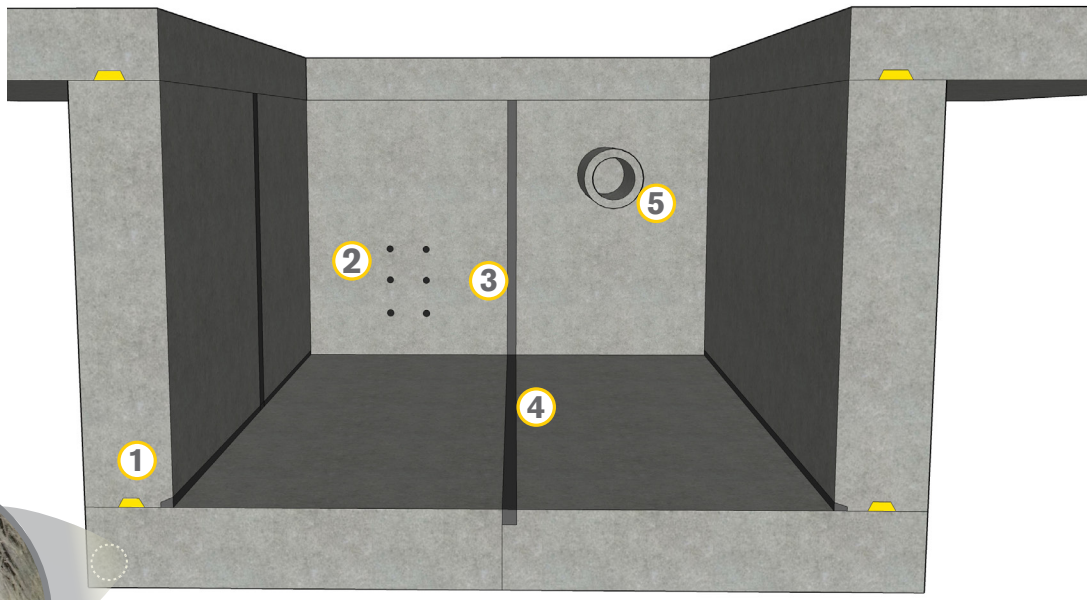
Waterproofing Elevators / Sump Pits

Kryton's **Krystol Internal Membrane™ (KIM®)** Waterproofing System covers every construction detail to create watertight concrete structures that replace the need for traditional surface applied membranes. It is more reliable, lasts longer and saves time over other waterproofing systems. This not only saves money during initial construction but also reduces long term repair and maintenance costs.

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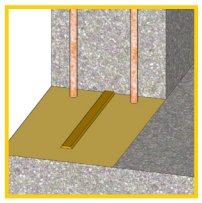
Krystol Waterstop System (KWS)

Use to permanently waterproof every concrete detail including Construction Joints, Penetrations, Tie Holes and Control Joints.

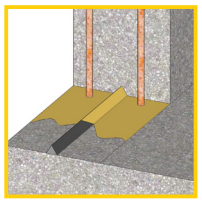
1. **Wall to slab Construction Joints**
2. Tie Holes
3. Wall on wall Construction Joints
4. Slab to slab Construction Joints
5. **Penetrations**

1 WALL TO SLAB CONSTRUCTION JOINTS

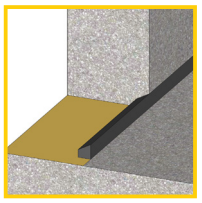
DOUBLE PROTECTION



Internal Swelling Method

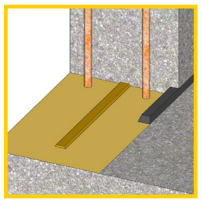


Internal Grout Method

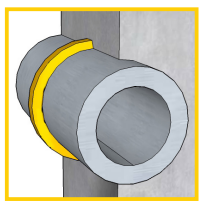


External Grout Method

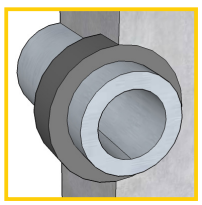
TRIPLE PROTECTION



5 PENETRATIONS



Internal Swelling Method



External Grout Method

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NEW CONSTRUCTION OVERVIEW

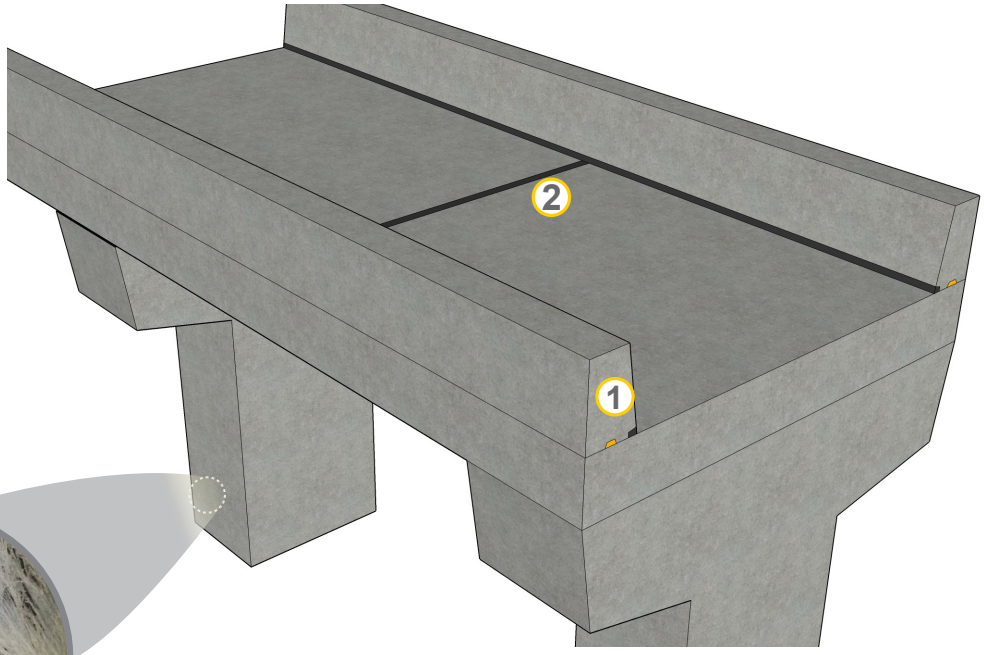
Waterproofing Bridges

Kryton's **Krystol Internal Membrane™ (KIM®)** Waterproofing System covers every construction detail to create watertight concrete structures that prevents corrosion and extends the service life of concrete structures. It is more reliable, lasts longer and saves time over other waterproofing systems. This not only saves money during initial construction but also reduces long term repair and maintenance costs.

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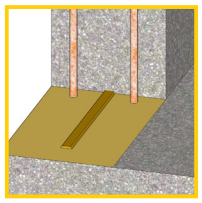
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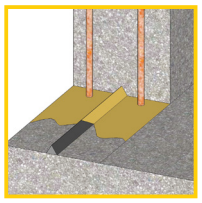
1. Wall to slab Construction Joints
2. Expension Joints

1 WALL TO SLAB CONSTRUCTION JOINTS

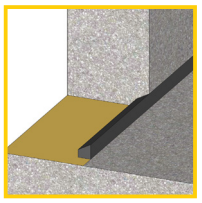
DOUBLE PROTECTION



Internal Swelling Method

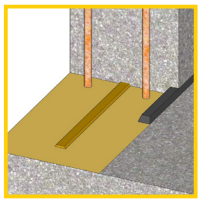


Internal Grout Method



External Grout Method

TRIPLE PROTECTION



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NEW CONSTRUCTION OVERVIEW

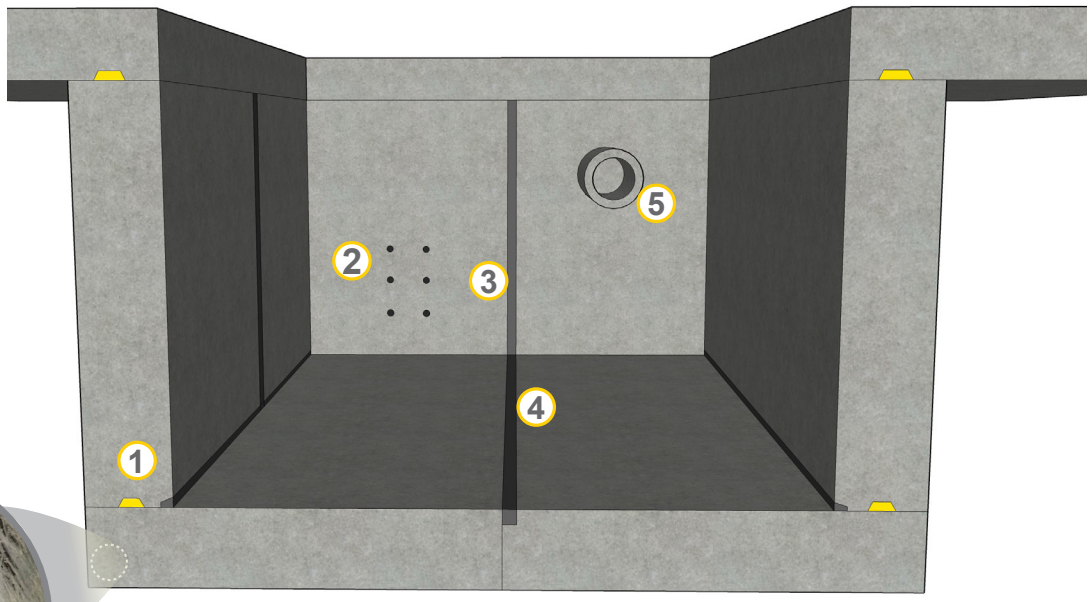
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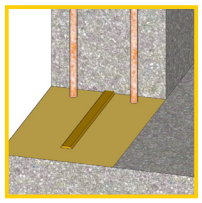
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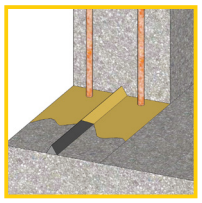
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2. Tie Holes
3. Wall on wall Construction Joints
4. Slab to slab Construction Joints
5. Penetrations

1 WALL TO SLAB CONSTRUCTION JOINTS

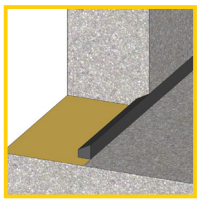
DOUBLE PROTECTION



Internal Swelling Method

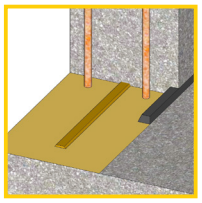


Internal Grout Method

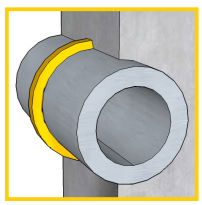


External Grout Method

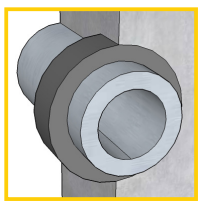
TRIPLE PROTECTION



5 PENETRATIONS



Internal Swelling Method



External Grout Method

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NEW CONSTRUCTION OVERVIEW

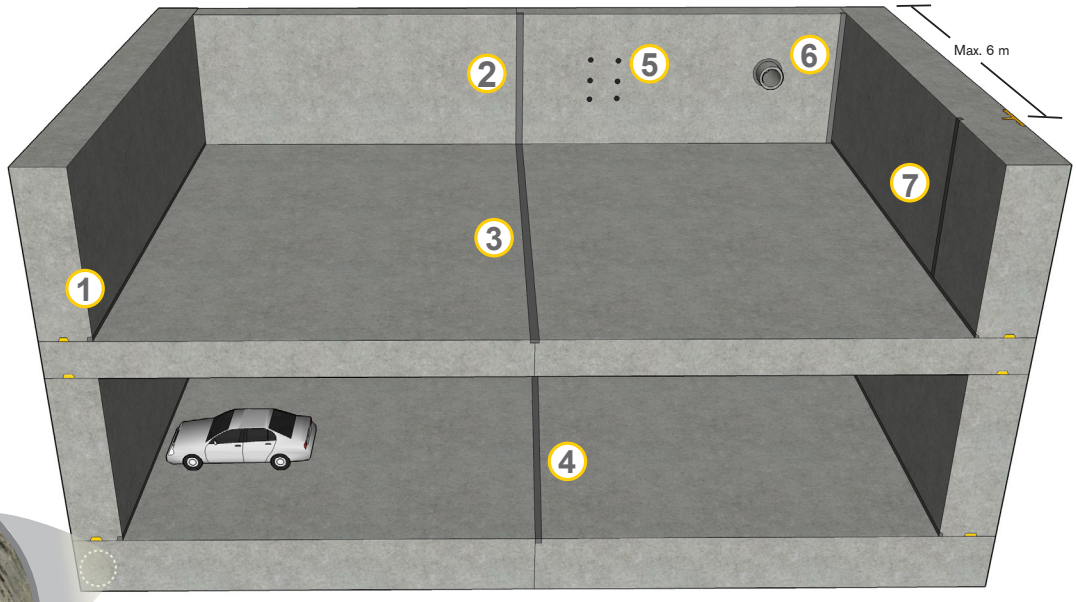
Waterproofing Parking Garages (Cast-in-Place)

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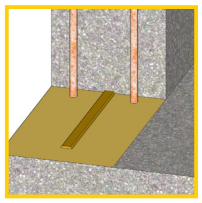
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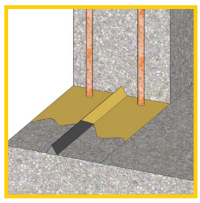
1. Wall to slab Construction Joints
2. Wall on wall Construction Joints
3. Expansion Joints
4. Slab to slab Construction Joints
5. Cold Joints
6. Penetrations
7. Control Joints

1 WALL TO SLAB CONSTRUCTION JOINTS

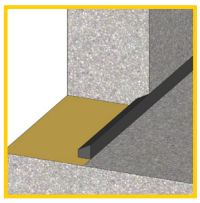
DOUBLE PROTECTION



Internal Swelling Method

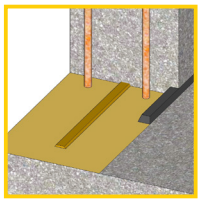


Internal Grout Method

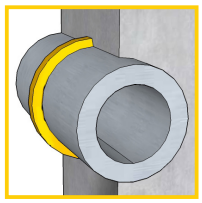


External Grout Method

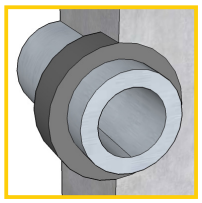
TRIPLE PROTECTION



6 PENETRATIONS

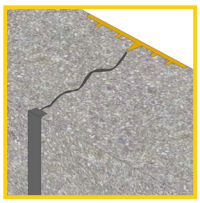


Internal Swelling Method

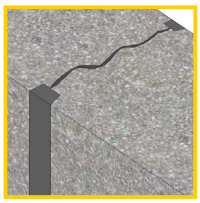


External Grout Method

7 CONTROL JOINTS



Crack Inducing Waterstop Method



External Grout Method

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NEW CONSTRUCTION OVERVIEW

Waterproofing Parking Garages (Shotcrete)

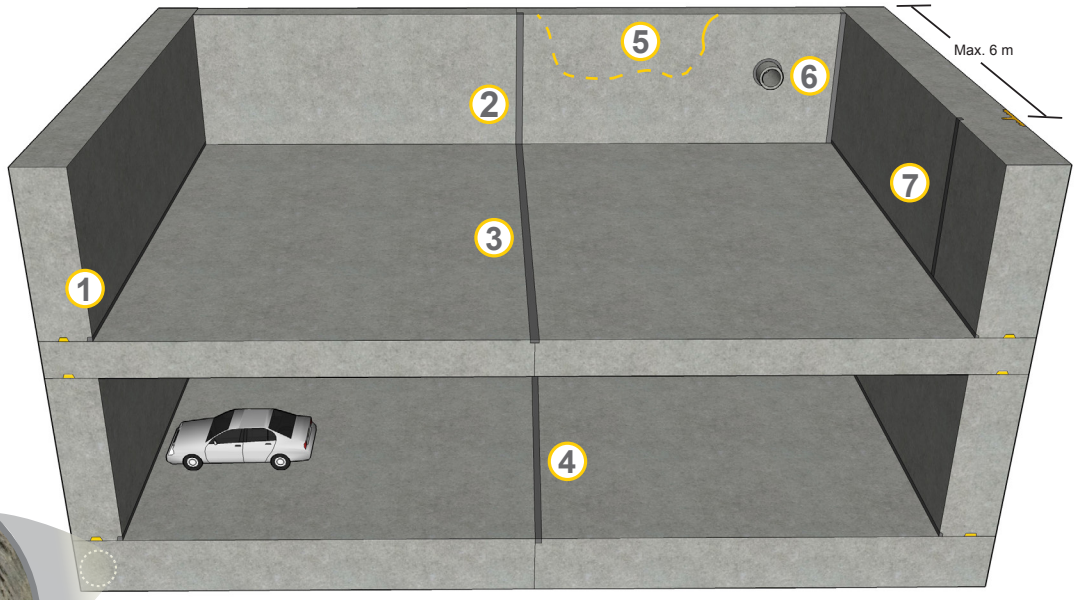
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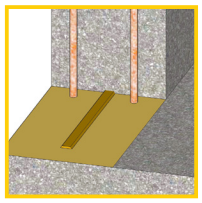
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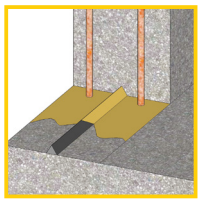
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1 WALL TO SLAB CONSTRUCTION JOINTS

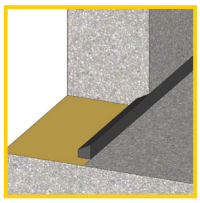
DOUBLE PROTECTION



Internal Swelling Method

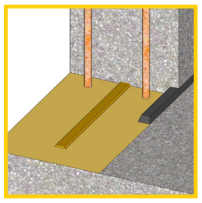


Internal Grout Method

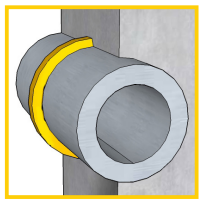


External Grout Method

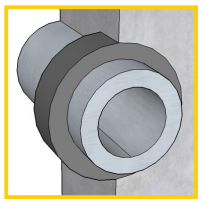
TRIPLE PROTECTION



6 PENETRATIONS



Internal Swelling Method

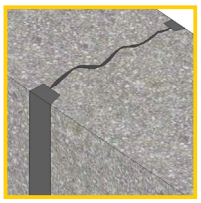


External Grout Method

7 CONTROL JOINTS



Crack Inducing Waterstop Method



External Grout Method

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NEW CONSTRUCTION OVERVIEW

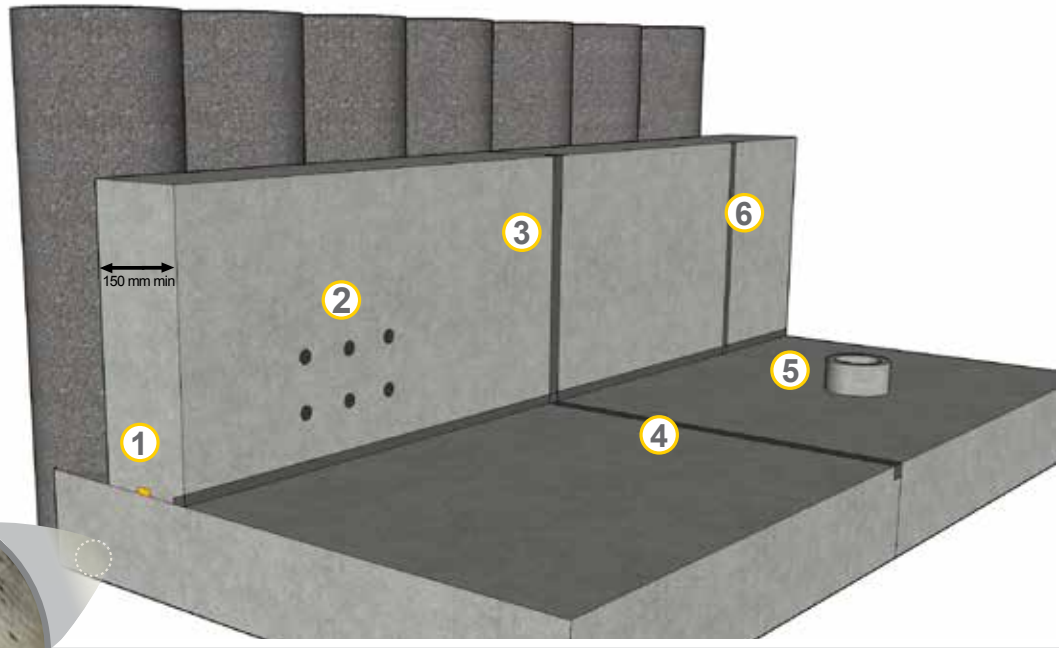
Waterproofing against Secant Pilings

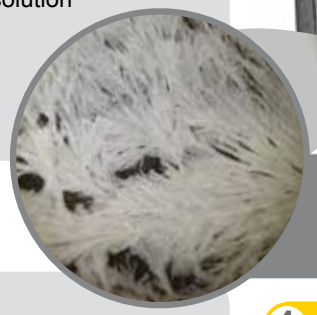
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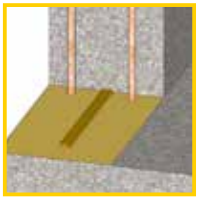
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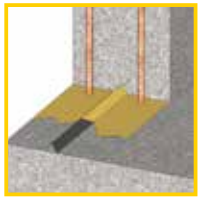
1. Wall to slab Construction Joints
2. Tie Holes
3. Wall on wall Construction Joints
4. Slab to slab Construction Joints
5. Penetrations
6. Control Joints

1 WALL TO SLAB CONSTRUCTION JOINTS

DOUBLE PROTECTION



Internal Swelling Method

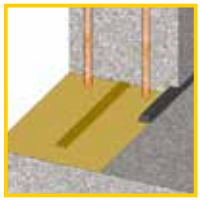


Internal Grout Method



External Grout Method

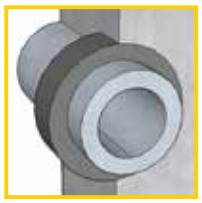
TRIPLE PROTECTION



5 PENETRATIONS

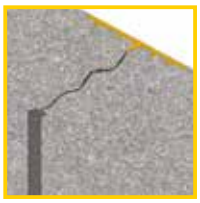


Internal Swelling Method



External Grout Method

6 CONTROL JOINTS



Crack Inducing Waterstop Method

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NEW CONSTRUCTION OVERVIEW

Waterproofing Water Tanks / Reservoirs

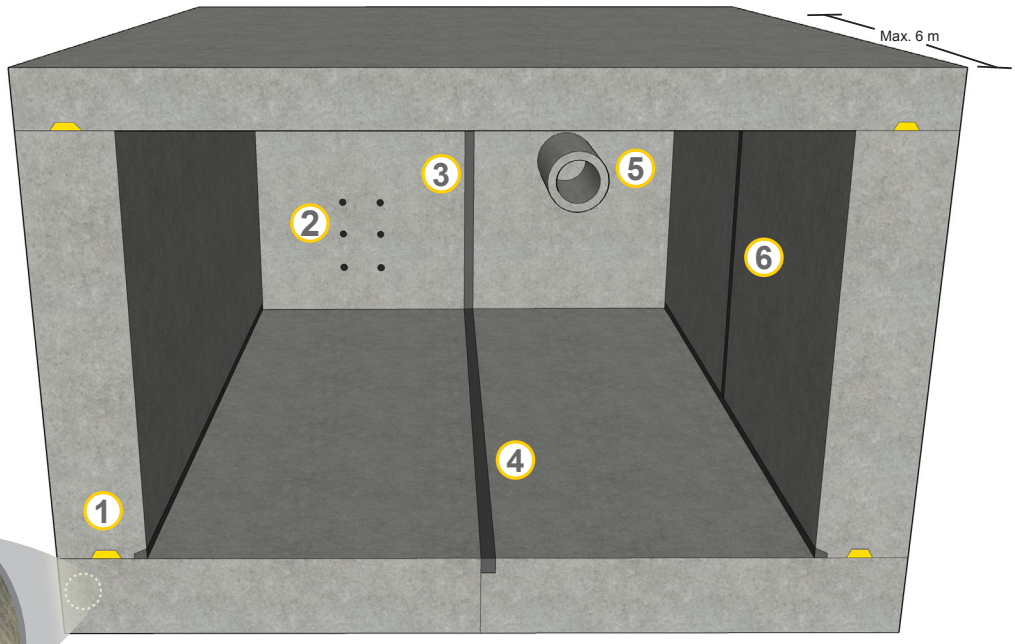
Kryton's **Krystol Internal Membrane™ (KIM®)** Waterproofing System covers every construction detail to create watertight concrete structures that replace the need for traditional surface applied membranes. It is more reliable, lasts longer and saves time over other waterproofing systems. This not only saves money during initial construction but also reduces long term repair and maintenance costs.

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

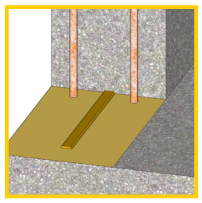
Krystol Waterstop System (KWS)

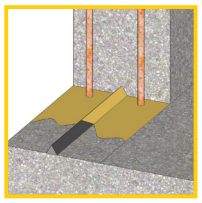
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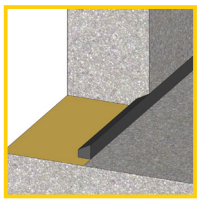
1. Wall to slab Construction Joints
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6. Control Joints

1 WALL TO SLAB CONSTRUCTION JOINTS

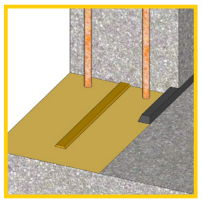
DOUBLE PROTECTION


Internal Swelling Method

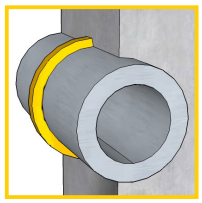

Internal Grout Method

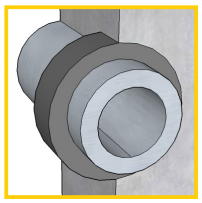

External Grout Method

TRIPLE PROTECTION



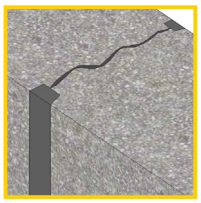
5 PENETRATIONS


Internal Swelling Method


External Grout Method

6 CONTROL JOINTS


Crack Inducing Waterstop Method


External Grout Method

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NEW CONSTRUCTION OVERVIEW

Waterproofing Swimming Pools

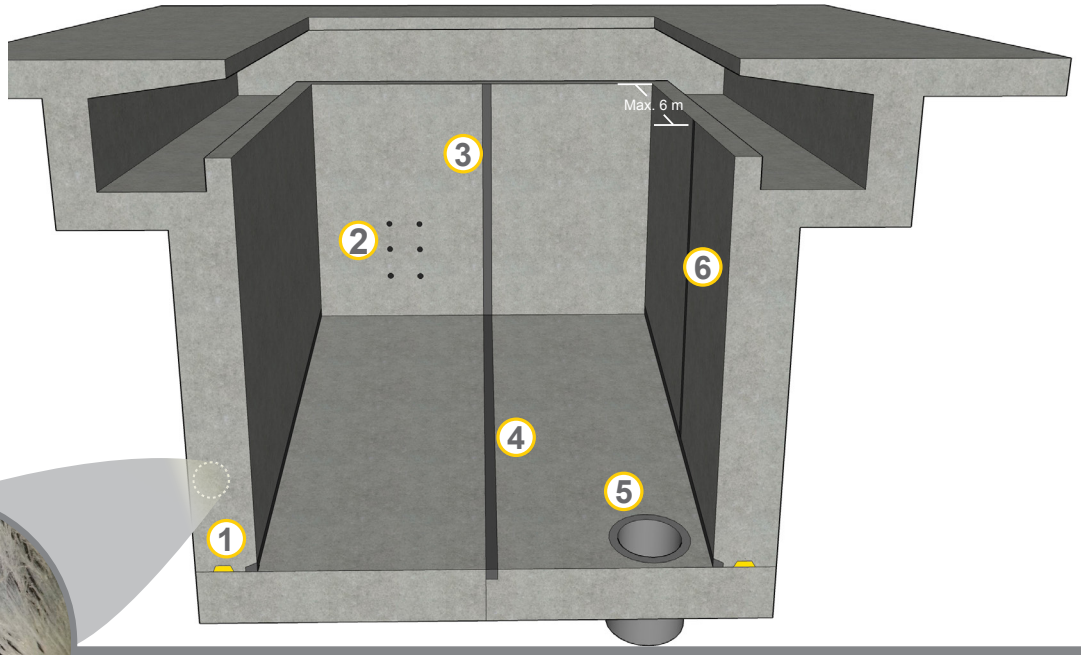
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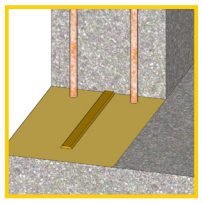
Krystol Waterstop System (KWS)

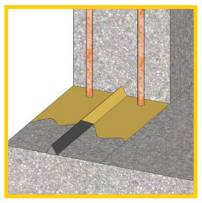
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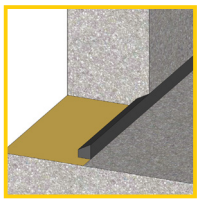
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1 WALL TO SLAB CONSTRUCTION JOINTS

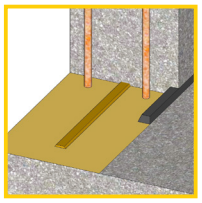
DOUBLE PROTECTION


Internal Swelling Method

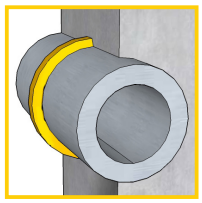

Internal Grout Method

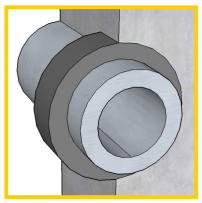

External Grout Method

TRIPLE PROTECTION



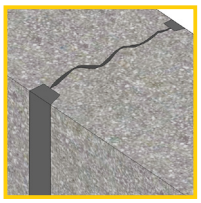
5 PENETRATIONS


Internal Swelling Method


External Grout Method

6 CONTROL JOINTS


Crack Inducing Waterstop Method


External Grout Method

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NEW CONSTRUCTION OVERVIEW

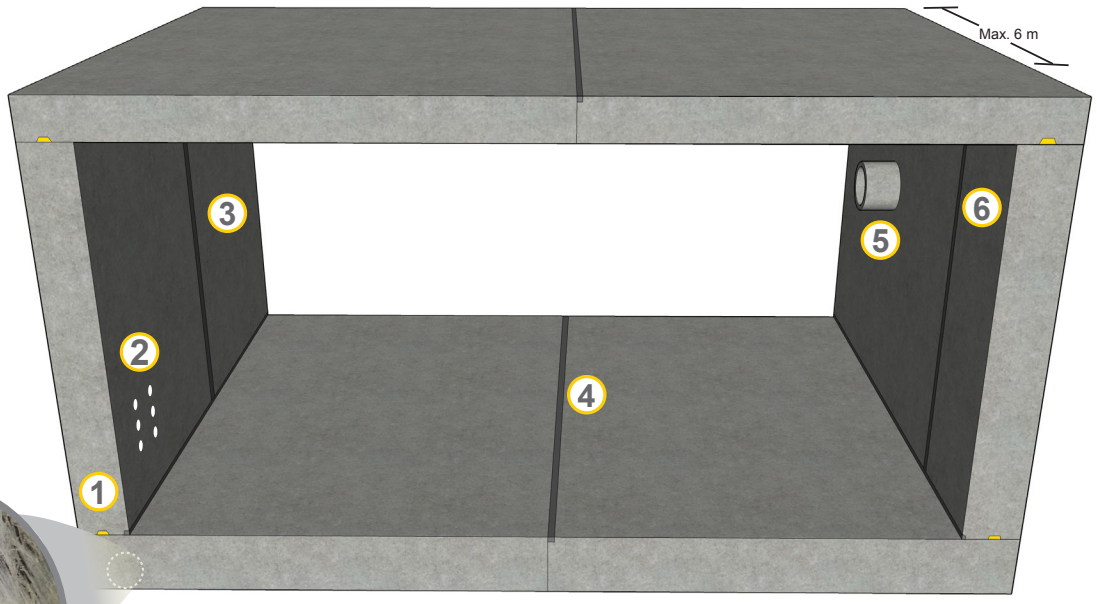
Waterproofing Tunnels

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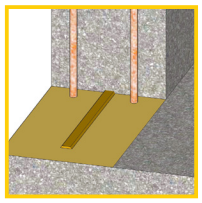
Krystol Waterstop System (KWS)

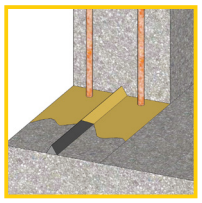
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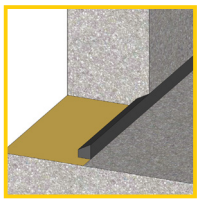
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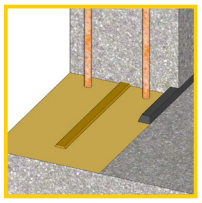
DOUBLE PROTECTION


Internal Swelling Method

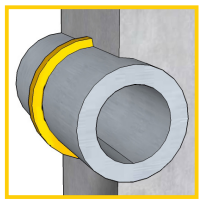

Internal Grout Method

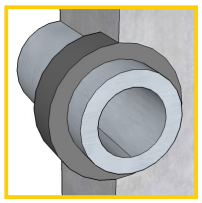

External Grout Method

TRIPLE PROTECTION



5 PENETRATIONS


Internal Swelling Method


External Grout Method

6 CONTROL JOINTS


Crack Inducing Waterstop Method

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KRYSTOL INTERNAL MEMBRANE™ (KIM®)

Concrete Waterproofing

Frequently Asked Questions (FAQ)

What is KIM?

Krystol Internal Membrane (KIM) is a hydrophilic crystalline admixture used to create permanently waterproof concrete. KIM lowers the permeability of concrete, and is used in place of surface applied waterproofing membrane. By stopping the transmission of water through concrete, KIM adds durability and longevity to concrete by protecting it against chemical attack and corrosion of reinforcing steel.

Is KIM compatible with Superplasticizers, Air Entrainers and Accelerators?

KIM is compatible with normal concrete admixtures and is regularly used with water reducers, superplasticizers, air entrainers and accelerators with excellent results.

The exact performance of any two admixtures will depend on numerous factors, including the mix design, order of addition, mixing conditions and environmental conditions.

KIM will delay the setting time of most mixes, so it is often possible to reduce the amount of set retarders or low range water reducers normally used. Your Kryton representative can offer mix specific advice. Test pours are always recommended when using KIM in a new mix design.

Is KIM harmful to concrete in anyway? Does KIM contain chlorides?

KIM is not harmful to concrete in any way. KIM has been tested to the equality standards in ASTM C494 and BS EN 934, and is certified as building code compliant and safe for concrete by the International Code Council Evaluation Services (ICC-ES). KIM contains no chlorides and is regularly tested to ensure no chloride contamination.

Is KIM compatible with concrete made with SCM's such as Fly Ash, Silica Fume and Slag?

Yes – KIM is routinely used in concrete mixes containing fly ash, silica fume and slag cement with excellent results. In ddition to further reducing permeability, KIM provides self-sealing which is a property not provided by SCM's.

How long does KIM need to self-seal crack?

Crack sealing will depend on many factors including the depth and width of the crack and the amount of water flowing through the crack. Cracks in KIM concrete have been observed to self-seal after anywhere from a few days to several months.

Cracks that are too large to self-seal, or that will not seal fast enough due to tight construction schedules should be repaired using the Krystol Leak Repair System (Application Instruction 5.12).

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Does KIM have LEED certification?

Not directly. LEED (Leadership in Energy and Environmental Design) is a program designed to promote and reward the construction of energy efficient, sustainable buildings. LEED certification applies to whole buildings, not specific products.

KIM helps to earn LEED points by replacing solvent based waterproofing membranes and reducing construction waste when packaged in dissolvable bags (no empty pails to dispose of).
Visit www.usgbc.org/ to learn more about the LEED program.

Does KIM allow for other waterproofing and drainage systems to be modified or replaced?

KIM can replace traditional waterproofing membranes for below grade concrete subject to hydrostatic pressure. The use of dimpled drain board, granular fill or other drainage systems may still be needed depending on the landscaping and structural capacity of the building. Drainage requirements for the site should be determined by the project's engineer.

What are the minimum and maximum application temperatures for KIM?

The waterproofing performance of KIM will not be affected by temperature as long as the concrete is placed and cured using appropriate methods. Installation temperatures for KIM concrete should be determined following regular ACI guidelines:

For cold weather, reference ACI 306R-88.
For hot weather, reference ACI 305R-99.

Can I paint KIM concrete?

Painting KIM treated concrete is no different than painting regular concrete. Select a paint that is suitable for the required service conditions, and follow the paint manufacturer's instructions regarding surface preparation and application.

Note that as a general rule of thumb, new concrete should not be painted for at least 28 days to allow the concrete to dry and undergo its initial shrinkage before paint is applied.

What effect does KIM 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 T1/T2. KIM and T1/T2 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.

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 isntructions found in Kryton's Technical Data Sheets and Application Instructions.

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Frequently Asked Questions (FAQ)

What is Krystol?

Krystol is a chemical that reacts with water and un-hydrated cement particles to form insoluble needle-shaped crystals. These crystals fill capillary pores and micro-cracks in the concrete to block pathways for water and waterborne contaminates.

Krystol will continue to give the concrete structure a self-sealing ability. If water is re-introduced through a rise in hydrostatic pressure or through hairline cracks, Krystol will initiate further crystallization to ensure permanent waterproof protection. Krystol works for the life of the concrete.

Are Krystol Products Toxic?

No. All Krystol based products are approved under NSF/ANSI-61 for contact with potable water. When handled and applied according to each products literature, all Krystol products are safe.

Just because a product is not toxic does not mean it is harmless. Any product containing portland cement will become caustic when mixed with water and cause skin and eye burns if not handled properly. Always read and follow the label and read each products safety data sheet (SDS).

How deep will Krystol penetrate? How long will it take?

The development and penetration of Krystol will depend on numerous factors, particularly the density of the concrete and the amount of available free water. In damp or leaking concrete, Krystol will penetrate along the path of water until the concrete is dry.

Independent testing has found that under typical conditions, Krystol will take approximately 7-14 days to stop water at the surface, and several months to penetrate deep into the concrete.

Is Krystol damaged by UV radiation?

No.

Krystol becomes an integral component of the concrete and will not deteriorate due to UV radiation like membrane systems.

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CSI SPECIFICATIONS

CRYSTALLINE WATERPROOFING ADMIXTURE

Section 03 30 00

Note to Specifier: Krystol Internal Membrane (KIM) is a chemical admixture used to create waterproof concrete. KIM is used in place of externally applied surface membranes for water containment or waterproofing protection of structures exposed to hydrostatic conditions. KIM is also used to add durability as it protects against moisture transmission, chemical attack, and corrosion of reinforcing steel. This section is intended to be used in conjunction with applicable Division 03 - Concrete technical specifications for cast-in-place concrete to suit project requirements. Edit this section as required to suit concreting procedures.

Part 1 General

1.1 SUMMARY

A. Hydrophilic crystalline concrete admixture to provide durable, permanently waterproof concrete. The admixture reacts chemically with water and un-hydrated cement particles to form insoluble microscopic needle-shaped crystals that fill capillary pores and self-seal micro-cracks in the concrete and block the pathways for water and waterborne contaminants. The admixture significantly lowers the permeability of concrete, adds durability and longevity to concrete by protecting against chemical attack and corrosion of reinforcing steel and is used as a more reliable and long-term waterproofing solution compared to surface applied waterproofing membranes and coatings.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-In-Place Concrete

B. Section 03 15 16 - Concrete Construction Joints

C. Section 033713- Shotcrete

D. Section 03 40 00- Precast Concrete Section

E. Section 03 01 30 - Maintenance of Cast-in-Place Concrete

1.3 REFERENCES

A. The following agencies and standards are applicable to this section.

1. American Concrete Institute (ACI)
2. American Society for Testing and Materials (ASTM)
3. British Board of Agrément (BBA)
4. British Standard Institution (BSI)
5. Canadian Standards Association (CSA)
6. German Institute for Standardization (DIN)
7. NSF International
8. U.S. Army Corps of Engineers (USACE)
9. United Facilities Guide Specification (UFGS)–Marine Concrete-Supplemental Corrosion Protection.

1.4 PERFORMANCE REQUIREMENTS

A. Permeability:

1. Permeability reduced minimum 70% over untreated concrete tested to BS EN 12390-8 or DIN 1048-5 at <0.5 MPa><<72.5 psi>> for 72 hours.
2. Permeability reduced 70% over untreated concrete tested to Taywood / Valenta method (BS EN 12390-8 modified to <1 MPa><<150 psi>> for 96 hours.

3. No leakage from samples tested to USACE CRD C48 at 200 psi (460-feet of head) for 14 days.
4. Permeability reduced 97% tested to USACE CRD C48 at 200 psi (460 feet of head) for 14 days.

B. **Compressive Strength**: Treated concrete must have compressive strength equal or higher than plain concrete when tested to ASTM C39/C39M at 28 days.

C. **Drying Shrinkage:** Minimum 20% reduced drying shrinkage for treated concrete tested to ASTM C157.

D. **Self-Sealing:** Autogenous crack sealing of treated concrete for cracks with width of <0.5mm><<0.02 inches>> or greater; verified by independent testing.

E. **ASR Protection:** Reduce ASR kinetics and reduced ASR damage due to microcrack sealing, verified by independent testing.

F. **Chemical Resistance:** The waterproofing admixture shall improve sulphuric acid resistance of cement-based materials by blocking capillary pores to reduce acid penetration.

G. Corrosion of Reinforcing Steel:

1. Field Performance - The admixture must provide enhanced corrosion resistance to embedded steel such that low half-cell readings and no noticeable signs of corrosion are evident after 10 years exposure directly in the corrosive marine tidal zone; untreated panels show evidence of corrosion.
2. Testing following ASTM G109 and ASTM C876, and assessed using half-cell measurements, macro cell corrosion rate, and lineral polarization resistance (LPR) after exposure to severe corrosive conditions, must demonstrate that the waterproofing admixture significantly delays the onset of corrosive conditions and reduces corrosion rates.

H. Evidence of Crystallization:

1. Manufacturer must present independent evidence of waterproofing crystals using both optical and scanning electronic microscope (SEM) to verify waterproofing crystals are needle shaped.
2. Manufacturer must present independent evidence using Energy Dispersive X-Ray Spectroscopy (EDS) that waterproofing crystals are distinct from ettringite crystals.

I. **Bonding of coatings and finishes** – Manufacturer must present tensile pull-off testing showing that the waterproofing admixture does not reduce the bond strength of subsequent coatings or finishes, with examples of using four different coatings (acrylic coating, rubber coating, epoxy coating, and tile thin-set).

1.5 ADMINISTRATIVE REQUIREMENTS

A. A meeting shall be held prior to placement of waterproof concrete with the Contractor, forming contractor, [finisher], concrete supplier and Owner's testing agency and the Consultant in attendance.

B. Review schedule for testing, batching, construction methods, jointing, placement, finishing and curing.

1.6 SUBMITTALS FOR REVIEW

A. Product Data: Provide technical data on waterproofing admixture certifying compliance with specified performance requirements, storage and handling recommendations and application instruction method.

B. Independent Test Reports:

1. Provide reports certifying compliance of waterproofing admixtures with performance requirements.
2. Reports shall include dosage rate for admixtures.

C. Batching Test Reports:

1. Provide reports from testing; identify admixture dosage rate, air content, plastic and hardened properties, slump and other properties as requested by Consultant.

1.7 SUBMITTALS FOR INFORMATION

A. Installation Data: Manufacturer's installation requirements and best practices recommendations.

B. Qualification Statements:

1. [Written notice from manufacturer confirming applicator is qualified and approved to install the materials.]
2. Written notice from manufacturer confirming manufacturing and project experience.

1.8 CLOSEOUT SUBMITTALS

A. Warranty Documents: Manufacturer's warranty documentation executed in the Owner's name.

1.9 QUALITY ASSURANCE

A. Perform Work in accordance with [ACI 301][CSA-A23.1/A23.2].

B. Source Quality Control: Obtain all crystalline integral waterproofing products from a single manufacturer, including jointing and repair products.

C. Product Certifications:

1. NSF/ANSI Standard 61 certified for use with potable water.
2. CE and UKCA mark certifying compliance with EN 934-2:2009 A1:2012.
3. BBA Certified 05/4217

D. Manufacturer:

1. Manufacturer shall have a minimum 25 years' experience in supplying crystalline admixtures.

E. Admixture Dosage Rate:

1. Dose at the rate recommended by the manufacturer to meet specified performance requirements.

F. Test Batches:

1. Provide test batches as recommended by the waterproofing admixture manufacturer to determine air content, plastic and hardened properties, and slump.
2. Include admixture manufacturer's lot number for products used in test mix.
3. Provide test results to the Consultant.

G. Testing: The following data must be recorded to comply with the manufacturer's warranty requirements:

1. Slump using CAN/CSA A23.3-5C or ASTM C143.
2. Air content using CAN/CSA A23.2-4C or ASTM C231.
3. Temperature of concrete and of ambient air.
4. Time of batching, testing and placement.
5. Cylinders: Take compressive test cylinders from each load tested or as per the job specifications.

1.10 DELIVERY, STORAGE, AND PROTECTION

A. Deliver packaged waterproofing admixture materials in original undamaged containers, with manufacturer's labels and seals intact.

B. Store materials in dry environment at a temperature above 7 degrees C (45 degrees F).

1.11 PROJECT CONDITIONS

A. Structural Design: The concrete structure shall be designed to meet local building codes and in addition shall be designed to minimize and control any occurrence of cracks within the concrete mass. Follow ACI 224R and ACI 301 regarding the placement of reinforcement and crack control joints.

B. Weather Conditions:

1. For mixing, transporting and placing concrete under conditions of high temperature or low temperature, follow ACI 305R (Hot Weather Concreting) and ACI 306R (Cold Weather Concreting).
2. For flatwork placed in hot, dry or windy conditions, surface humidity must be maintained by fogging or use of monomolecular film (evaporation retardant).

1.12 WARRANTY

A. Provide 25-year manufacturer's standard limited product warranty for the waterproofing admixture.

Part 2 Products

2.1 ADMIXTURES

Note to Specifier: KIM is compatible with other concrete admixtures, such as accelerators, air-entrainers and plasticizers. However, care must be taken when using water reducers or plasticizers that may delay the setting time.

- *Type B admixtures (set retarding) and Type D admixtures (water reducing and set retarding) - these should be removed when using KIM unless they are needed due to high ambient temperatures or mass concrete. Accelerating admixtures may be used in cold weather to maintain normal setting times. Field trials are recommended to assess setting performance.*
- *Type A (water reducing) and Type F (water reducing, high range) admixtures are preferred for most conditions.*

A. Crystalline Waterproofing Admixture: Permeability-reducing admixture for hydrostatic conditions (PRAH) as defined by ACI 212.3R-10 Chapter 15; Provide as a powdered waterproofing admixture for use in ready-mix concrete.

1. 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 end evidence using Energy Dispersive X-Ray Spectroscopy (EDS) that waterproofing crystals are distinct from ettringite crystals.
2. Certifications:
    1. NSF/ANSI/CAN Standard 61 certified for use with potable water.
    2. [CE][BBA][UKCA] certifying compliance with EN 934-2:2009 A1:2012.
    3. BBA 05/4217
3. Product: Krystol Internal Membrane (KIM).
4. Manufacturer - Basis of Design:
    1. Kryton International Inc.
        Toll Free: 1.800.267.8280
        E-mail: info@kryton.com
        Website: www.kryton.com

B. Substitutions: Not permitted.

2.2 ACCESSORIES

A. Joints and Penetrations: Admixture manufacturer's recommended products for waterproofing construction joints, control joints and penetrations.

1. Acceptable Products: Krystol Waterstop System.

B. Leak Repair: Admixture manufacturer's recommended products for leaking and defective concrete.

1. Acceptable Products: Krystol Leak Repair System.

Part 3 Execution

3.1 EXAMINATION

A. Verify the joints are treated according to the requirements of the waterproofing manufacturer's instructions prior to placing concrete.

3.2 PREPARATION

A. Coordinate the placement of joint devices with erection of concrete formwork and form accessories.

3.3 APPLICATION

A. Apply crystalline waterproofing admixture to concrete mix at ready-mix plant in accordance with manufacturer's written instructions and approved test batches.

1. Batching and mixing of materials shall be in accordance with ASTM C94/C94M
2. Mix at least 5 minutes after the addition of crystalline waterproofing admixture.

B. Placing Concrete: Refer to Section 03 30 00, supplemented as follows:

1. Notify Consultant minimum twenty-four (24) hours prior to commencement of operations.
2. Ensure reinforcement, [embedded parts] [formed expansion/contraction joints] [inserts] are not disturbed during concrete placement.
3. Concrete Placement Records: Record date, location, quantity, air temperature, and samples taken.
4. Place concrete continuously between predetermined expansion, control, and construction joints.
5. Do not interrupt successive placement; do not permit cold joints to occur.
6. Consolidate concrete in accordance with ACI 309R with special attention given to joint locations.

C. Curing: Cure in accordance with Section 03 30 00, supplemented as follows:

1. Wet cure waterproof concrete [to ACI 308.1] using fog mist spray, sprinkler or wet burlap for 7 days. Alternatively; use curing compound conforming to ASTM C309.

3.4 FIELD QUALITY CONTROL

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

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

B. Submit proposed mix design [of each class of concrete] to [inspection] [testing] firm for review prior to commencement of Work.

C. Site Tests and Inspections:

Note to Specifier: The following paragraphs describe flood testing of water containment structures. Revise to describe testing for other types of structures as applicable. Consult with manufacturer for specific testing.

1. Perform flood test on completed waterproofing installation before placement of other adjacent construction.
2. Plug or dam drains and fill area with water to a depth of [<50 mm><<2 inches>>] or to within [<13 mm><<1/2 inches>>] of top of waterproofing treatment.
3. Let water stand for twenty-four (24) hours.

Note to Specifier: Due to the self-sealing properties of the admixture, leaks that occur may self-seal within a few days or weeks. Consult with manufacturer whenever leaks are discovered for recommended remedial course of action.

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

3.5 PATCHING

A. Repair leaking cracks or joints having width greater than <0.5 mm><<0.02 inch>> in accordance with waterproofing admixture manufacturer's written instructions and as follows:

1. Chase the length of joints and cracks to a minimum depth of <40 mm><<1.5 inch>>. Provide rectangular-shaped chase that is deeper than wide.
2. Use waterproofing admixture manufacturer's recommended water stop plug to stop water leakage.
3. Use waterproofing admixture manufacturer's recommended repair grout to completely fill the chase flush with adjacent surfaces.

3.6 DEFECTIVE CONCRETE

A. Repair or replacement of defective concrete will be determined by the Consultant.

B. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Consultant for each individual area.

3.7 PROTECTION OF FINISHED WORK

A. Protect completed waterproof assemblies from damage after application.

3.8 SCHEDULES

Note to Specifier: Prepare a schedule for crystalline waterproofing locations. The following schedule includes are EXAMPLES only. Edit the paragraphs below to create a project specific schedule.

A. Provide crystalline waterproofing in the following locations:

1. Below grade parking.
2. Elevator pits, [sump pits].
3. Tunnels, underground vaults, dry wells, and manholes.
4. Water tanks, flumes, clarifier tanks, digester sections, reservoirs and wet wells.
5. Planters and swimming pools.

END OF SECTION

The preceding specifications are provided by Kryton International Inc. as a guide and are not intended to replace sound engineering practice and judgment and should not be relied upon for that purpose. Kryton makes no warranty of any kind, either express or implied, as to the accuracy, completeness or the contents of these guide specifications. Kryton assumes no liability with respect to the provision or use of these guide specifications, nor shall any legal relationship be created by, or arise from, the provision of such specifications. KRYTON SHALL NOT BE RESPONSIBLE UNDER ANY LEGAL THEORY TO ANY THIRD PARTY FOR ANY DIRECT OR CONSEQUENTIAL DAMAGES OF ANY KIND ARISING FROM THE USE OF THESE GUIDE SPECIFICATIONS. The specifier, architect, engineer or design professional or contractor for any particular project bears the sole responsibility for the preparation and approval of the specifications and determining their suitability for a particular project or application. Prior to each use of any Kryton product, the user must always read and follow the warnings and instructions on the product's most current Technical Data Sheet, Application Instruction, product label and Safety Data Sheet which are available online at http://www.kryton.com or by contacting an authorized Kryton Representative. Nothing contained in any Kryton document relieves the user of the obligation to read and follow the warnings and instruction for each Kryton product as set forth in the current literature prior to use.

CSI SPECIFICATIONS

CRYSTALLINE WATERPROOFING ADMIXTURE FOR SHOTCRETE

Section 03 37 00

Note to Specifier: Krystol Internal Membrane (KIM) is a chemical admixture used to create waterproof concrete. KIM is used in place of externally applied surface membranes for water containment or waterproofing protection of structures exposed to hydrostatic conditions. KIM is also used to add durability as it protects against moisture transmission, chemical attack, and corrosion of reinforcing steel. This section is intended to be used in conjunction with applicable Division 03 - Concrete technical specifications for shotcrete to suit project requirements. Edit this section as required to suit concreting procedures.

Part 1 General

1.1 SUMMARY

A. Hydrophilic crystalline concrete admixture to provide permanently waterproof concrete. The admixture reacts chemically with water and un-hydrated cement particles to form insoluble microscopic needle-shaped crystals that fill capillary pores and self-seal micro-cracks in the concrete and block the pathways for water and waterborne contaminants. The admixture significantly lowers the permeability of concrete, adds durability and longevity to concrete by protecting against chemical attack and corrosion of reinforcing steel and is used as a more reliable and long-term waterproofing solution compared to surface applied waterproofing membranes and coatings.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-In-Place Concrete

B. Section 03 15 16 - Concrete Construction Joints

C. Section 03 37 13- Shotcrete

D. Section 03 40 00- Precast Concrete Section

E. Section 03 01 30 - Maintenance of Cast-in-Place Concrete

1.3 REFERENCES

A. The following agencies and standards are applicable to this section.

1. American Concrete Institute (ACI)
2. American Society for Testing and Materials (ASTM)
3. British Board of Agrément (BBA)
4. British Standard Institution (BSI)
5. Canadian Standards Association (CSA)
6. German Institute for Standardization (DIN)
7. NSF International
8. U.S. Army Corps of Engineers (USACE)
9. United Facilities Guide Specification (UFGS)–Marine Concrete-Supplemental Corrosion Protection.

1.4 PERFORMANCE REQUIREMENTS

A. Permeability:

1. Permeability reduced minimum 70% over untreated concrete tested to BS EN 12390-8 or DIN 1048-5 at <0.5 MPa><<72.5 psi>> for 72 hours.
2. Permeability reduced 70% over untreated concrete tested to Taywood / Valenta method (BS EN 12390-8 modified to <1 MPa><<150 psi>> for 96 hours.

3. No leakage from samples tested to USACE CRD C48 at 200 psi (460-feet of head) for 14 days.
4. Permeability reduced 97% tested to USACE CRD C48 at 200 psi (460 feet of head) for 14 days.

B. **Compressive Strength**: Treated concrete must have compressive strength equal or higher than plain concrete when tested to ASTM C39/C39M at 28 days.

C. **Drying Shrinkage:** Minimum 20% reduced drying shrinkage for treated concrete tested to ASTM C157.

D. **Self-Sealing:** Autogenous crack sealing of treated concrete for cracks with width of <0.5mm><<0.02 inches>> or greater; verified by independent testing.

E. **ASR Protection:** Reduce ASR kinetics and reduced ASR damage due to microcrack sealing, verified by independent testing.

F. **Chemical Resistance:** The waterproofing admixture shall improve sulphuric acid resistance of cement-based materials by blocking capillary pores to reduce acid penetration.

G. Corrosion of Reinforcing Steel:

1. Field Performance - The admixture must provide enhanced corrosion resistance to embedded steel such that low half-cell readings and no noticeable signs of corrosion are evident after 10 years exposure directly in the corrosive marine tidal zone; untreated panels show evidence of corrosion.
2. Testing following ASTM G109 and ASTM C876, and assessed using half-cell measurements, macro cell corrosion rate, and lineral polarization resistance (LPR) after exposure to severe corrosive conditions, must demonstrate that the waterproofing admixture significantly delays the onset of corrosive conditions and reduces corrosion rates.

H. Evidence of Crystallization:

1. Manufacturer must present independent evidence of waterproofing crystals using both optical and scanning electronic microscope (SEM) to verify waterproofing crystals are needle shaped.
2. Manufacturer must present independent evidence using Energy Dispersive X-Ray Spectroscopy (EDS) that waterproofing crystals are distinct from ettringite crystals.

I. **Bonding of coatings and finishes** – Manufacturer must present tensile pull-off testing showing that the waterproofing admixture does not reduce the bond strength of subsequent coatings or finishes, with examples of using four different coatings (acrylic coating, rubber coating, epoxy coating, and tile thin-set).

1.5 ADMINISTRATIVE REQUIREMENTS

A. A meeting shall be held prior to placement of waterproof shotcrete with the Contractor, shotcrete subcontractor [finisher,] concrete supplier and Owner's testing agency and the Consultant.

B. Review schedule for testing, batching, construction methods, jointing, placement, finishing and curing.

1.6 SUBMITTALS FOR REVIEW

A. Product Data: Provide technical data on waterproofing admixtures certifying compliance with specified performance requirements, storage and handling recommendations and application instruction method.

B. Independent Test Reports:

1. Provide reports certifying compliance of waterproofing admixtures with performance requirements.
2. Reports shall include dosage rate for admixtures.

C. Batching Test Reports:

1. Provide reports from testing; identify admixture dosage rate, air content, plastic and hardened properties, slump and other properties as requested by Consultant.

1.7 SUBMITTALS FOR INFORMATION

A. Installation Data: Manufacturer's special installation requirements and best practices recommendations.

B. Qualification Statements:

1. Written notice from shotcrete subcontractor confirming project experience and qualifications of nozzlemen.
2. [Written notice from manufacturer confirming applicator is qualified and approved to install the materials.]
3. Written notice from manufacturer confirming manufacturing and project experience.

1.8 CLOSEOUT SUBMITTALS

A. Warranty Documents: Manufacturer's warranty documentation executed in the Owner's name.

1.9 QUALITY ASSURANCE

A. Perform Work in accordance with [ACI 506R][CSA-A23.1/A23.2].

B. Source Quality Control: Obtain all crystalline integral waterproofing products from a single manufacturer, including jointing and leak repair products.

C. Product Certifications:

1. NSF/ANSI/CAN Standard 61 certified for use with potable water.
2. CE and UKCA mark certifying compliance with EN 934-2:2009 A1:2012.
3. BBA Certified 05/4217.

D. Shotcrete Subcontractor:

1. Nozzlemen must be ACI certified in category specific to the installation method to be used, including; wet-mix vertical, wet-mix overhead, dry-mix vertical or dry-mix overhead.
2. Nozzlemen shall be prequalified based on assessment of job-specific mock-up.

E. Manufacturer:

1. Manufacturer shall have a minimum 25 years' experience in supplying crystalline admixtures.

F. Admixture Dosage Rate:

1. Dose at the rate recommended by the manufacturer to meet specified performance requirements.

G. Test Batches:

1. Provide test batches as recommended by the waterproofing admixture manufacturer to determine air content, plastic and hardened properties, and slump.
2. Include admixture manufacturer's lot number for products used in test mix.
3. Provide test results to the Consultant.

H. Testing: The following data must be recorded to comply with the manufacturer's warranty requirements:

1. Slump using CAN/CSA A23.3-5C or ASTM C143.
2. Air content using CAN/CSA A23.2-4C or ASTM C231.
3. Temperature of concrete and of ambient air.
4. Time of batching, testing and placement.
5. Cylinders: Take compressive test cylinders from each load tested or as per job specifications.

1.10 MOCK-UP

Note to Specifier: Use this article for assessing abilities of shotcrete nozzlemen, for review of construction, coordination of work of several sections, testing, or observation of operation.

A. Provide [<[_____] m><<[_____] ft>>] long by [<[_____] m><<[_____] ft>>] wide mock-up area under conditions similar to those which will exist during actual placing.

B. Locate [where directed by Consultant].

C. Mock-up will be used to assess the abilities of the shotcrete subcontractor to perform the Work.

D. Approved mock-up [may] [may not] remain as part of the Work.

1.11 DELIVERY, STORAGE, AND PROTECTION

A. Deliver packaged waterproofing admixture materials in original undamaged containers, with manufacturer's labels and seals intact.

B. Store materials in dry environment at a temperature above 7 degrees C (45 degrees F).

1.12 PROJECT CONDITIONS

A. Structural Design: The concrete structure shall be designed to meet local building codes and in addition shall be designed to minimize and control any occurrence of cracks within the concrete mass. Follow ACI 224R, ACI 301 and ACI 506R regarding the placement of reinforcement and crack control joints.

B. Weather Conditions:

1. For mixing, transporting and placing shotcrete under conditions of high temperature or low temperature, follow ACI 305R (Hot Weather Concreting) and ACI 306R (Cold Weather Concreting).
2. For flatwork being placed in hot, dry or windy conditions, surface humidity must be maintained by fogging or use of monomolecular film (evaporation retardant).

1.13 WARRANTY

A. Provide 25-year manufacturer’s standard limited product warranty for the waterproofing admixture.

Part 2 Products

2.1 ADMIXTURES

Note to Specifier: KIM is compatible with other concrete admixtures, such as accelerators, air-entrainers and plasticizers. However, care must be taken when using water reducers or plasticizers that may delay the setting time.

- *Type B admixtures (set retarding) and Type D admixtures (water reducing and set retarding) - these should be removed when using KIM unless they are needed due to high ambient temperatures or mass concrete. Accelerating admixtures may be used in cold weather to maintain normal setting times. Field trials are recommended to assess setting performance.*
- *Type A (water reducing) and Type F (water reducing, high range) admixtures are preferred for most conditions. .*

A. Crystalline Waterproofing Admixture: Permeability-reducing admixture for hydrostatic conditions (PRAH) as defined by ACI 212.3R-10 Chapter 15; Provide as a powdered waterproofing admixture for use in ready-mix concrete.

1. 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 end evidence using Energy Dispersive X-Ray Spectroscopy (EDS) that waterproofing crystals are distinct from ettringite crystals.
2. Certifications:
    1. NSF/ANSI/CAN Standard 61 certified for use with potable water.
    2. [CE][,BBA][UKCA] certifying compliance with EN 934-2:2009 A1:2012.
    3. BBA 05/4217
3. Product: Krystol Internal Membrane (KIM).

4. Manufacturer - Basis of Design:
    1. Kryton International Inc.
        Toll Free: 1.800.267.8280
        E-mail: info@kryton.com
        Website: www.kryton.com

B. Substitutions: Not permitted.

2.2 ACCESSORIES

A. Joints and Penetrations: Admixture manufacturer's recommended products for waterproofing construction joints, control joints and penetrations.

1. Acceptable Products: Krystol Waterstop System

B. Repair Products: Admixture manufacturer's recommended products for leaking and defective concrete.

1. Acceptable Products: Krystol Leak Repair System.

Part 3 Execution

3.1 EXAMINATION

A. Verify the joints are treated according to the requirements of the waterproofing manufacturer's instructions prior to placing shotcrete.

B. Verify that existing concrete surfaces, lift breaks and unintended cold joints are treated according to the requirements of the waterproofing manufacturer's instructions.

3.2 PREPARATION

A. Coordinate the placement of joint devices with erection of concrete formwork and form accessories.

B. Verify that formwork, reinforcing steel and embedded items are braced to avoid vibration, resist rebound and designed to allow compressed air to escape.

C. Verify that earth, rock, concrete and masonry surfaces are prepared in accordance with ACI 506.2.

D. Verify that surfaces to be shot are dampened to a saturated-surface-dry (SSD) condition immediately prior to shotcrete application.

E. Verify that groundwater leaking through shoring will not interfere with shotcrete placement. Plug or redirect groundwater as necessary.

3.3 APPLICATION

A. Apply crystalline waterproofing admixture to concrete mix at ready-mix plant in accordance with manufacturer's written instructions and approved test batches.

1. Batching and mixing of materials shall be in accordance with ASTM C94/C94M
2. Mix at least 5 minutes after the addition of crystalline waterproofing admixture.

B. Placing Shotcrete: Refer to Section 03 37 13, supplemented as follows:

1. Place shotcrete in accordance with [CSA-A23.1/A23.2 and] ACI 506R.
2. Notify Consultant minimum twenty-four (24) hours prior to commencement of operations.
3. Ensure reinforcement, [embedded parts] [formed expansion/contraction joints] [inserts] are not disturbed during concrete placement.
4. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

5. Place concrete continuously between predetermined expansion, control, and construction joints.
6. Do not interrupt successive placement; do not permit cold joints to occur.
7. Cut out defects while the shotcrete is still plastic and reshoot the affected areas. Defects include:
    1. Sloughs, delamination, plastic shrinkage cracks.
    2. Entrapped rebound and overspray
    3. Voids of incomplete consolidation, including shadows behind rebar.
8. Remove excess water and debris, and rebound and overspray using air lance.
9. Remove all overspray from exposed reinforcement at construction joints.

C. Curing: Cure in accordance with Section 03 37 13, supplemented as follows:

1. Wet cure waterproof concrete [to ACI 308.1] using fog mist spray, sprinkler or wet burlap for 5 to 7 days. Alternatively; use curing compound conforming to ASTM C309.

3.4 FIELD QUALITY CONTROL

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

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

B. Submit proposed mix design [of each class of concrete] to [inspection] [testing] firm for review prior to commencement of Work.

C. Site Tests and Inspections:

Note to Specifier: The following paragraphs describe flood testing of water containment structures. Revise to describe testing for other types of structures as applicable. Consult with manufacturer for specific testing.

1. Perform flood test on completed waterproofing installation before placement of other adjacent construction.
2. Plug or dam drains and fill area with water to a depth of [<50 mm><<2 inches>>] or to within [<13 mm><<1/2 inches>>] of top of waterproofing treatment.
3. Let water stand for twenty-four (24) hours.

Note to Specifier: Due to the self-sealing properties of the admixture, leaks that occur may self-seal within a few days or weeks. Consult with manufacturer whenever leaks are discovered for recommended remedial course of action.

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

3.5 PATCHING

A. Repair leaking cracks or joints having width greater than <0.5 mm><<0.02 inch>> in accordance with waterproofing admixture manufacturer's written instructions and as follows:

1. Chase the length of joints and cracks to a minimum depth of <40 mm><<1.5 inch>>. Provide rectangular-shaped chase that is deeper than wide.
2. Use waterproofing admixture manufacturer's recommended water stop plug to stop water leakage.
3. Use waterproofing admixture manufacturer's recommended repair grout to completely fill the chase flush with adjacent surfaces.

3.6 DEFECTIVE CONCRETE

A. Repair or replacement of defective concrete will be determined by the Consultant.

B. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Consultant for each individual area.

3.7 PROTECTION OF FINISHED WORK

A. Protect completed waterproof assemblies from damage after application.

3.8 SCHEDULES

Note to Specifier: The following article will assist in preparing a schedule for crystalline waterproofing locations for the project. The following schedule includes are EXAMPLES only. Edit the paragraphs below to create a project specific schedule. Do not repeat statements that may exist on drawings.

A. Provide crystalline waterproofing in the following locations:

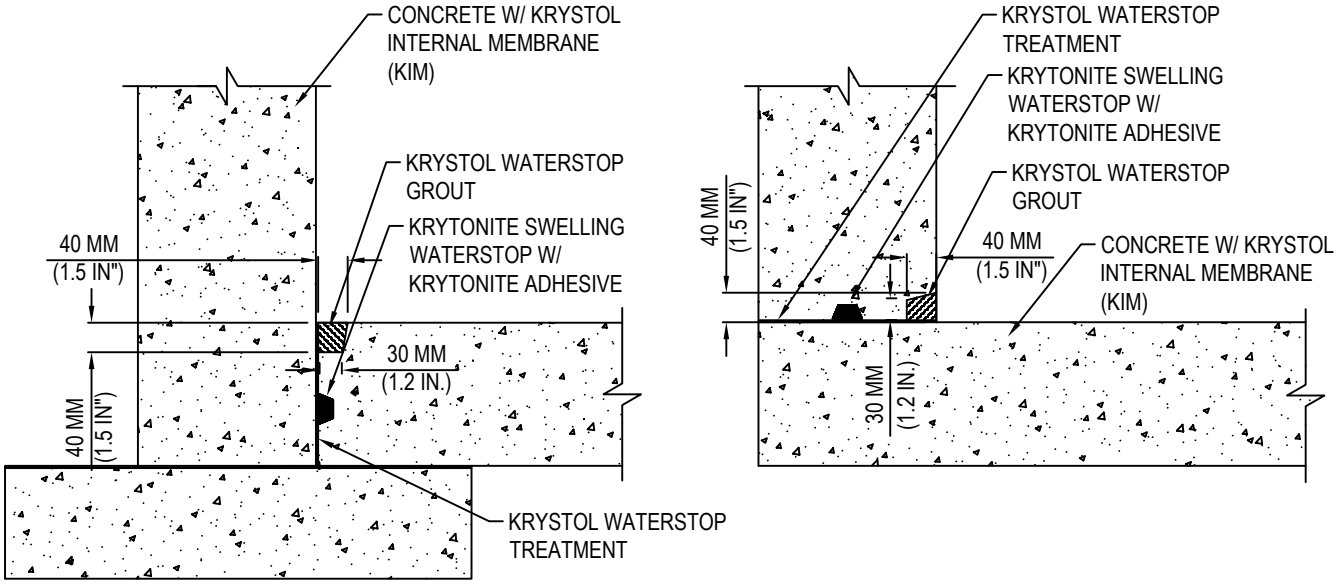
1. Below grade parking.
2. Elevator pits, [sump pits].
3. Tunnels, underground vaults, dry wells and manholes.
4. Water tanks, flumes, clarifier tanks, digester sections, reservoirs and wet wells.
5. Planters and swimming pools.

END OF SECTION

The preceding specifications are provided by Kryton International Inc. as a guide and are not intended to replace sound engineering practice and judgment and should not be relied upon for that purpose. Kryton makes no warranty of any kind, either express or implied, as to the accuracy, completeness or the contents of these guide specifications. Kryton assumes no liability with respect to the provision or use of these guide specifications, nor shall any legal relationship be created by, or arise from, the provision of such specifications. KRYTON SHALL NOT BE RESPONSIBLE UNDER ANY LEGAL THEORY TO ANY THIRD PARTY FOR ANY DIRECT OR CONSEQUENTIAL DAMAGES OF ANY KIND ARISING FROM THE USE OF THESE GUIDE SPECIFICATIONS. The specifier, architect, engineer or design professional or contractor for any particular project bears the sole responsibility for the preparation and approval of the specifications and determining their suitability for a particular project or application. Prior to each use of any Kryton product, the user must always read and follow the warnings and instructions on the product's most current Technical Data Sheet, Application Instruction, product label and Safety Data Sheet which are available online at http://www.kryton.com or by contacting an authorized Kryton Representative. Nothing contained in any Kryton document relieves the user of the obligation to read and follow the warnings and instruction for each Kryton product as set forth in the current literature prior to use.

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SMART CONCRETE®



INBOARD

WALL ON TOP

WALL TO SLAB CONSTRUCTION JOINTS
TRIPLE PROTECTION

MANUFACTURER'S NOTES:

1. PLACE CONCRETE TREATED WITH KRYSTOL INTERNAL MEMBRANE (KIM).
2. COAT SURFACE AREA OF THE JOINT WITH KRYSTOL WATERSTOP TREATMENT AT A SPREAD RATE OF 1 KG/M2 (0.2 LB./SQ. FT.).
3. INSTALL KRYTONITE SWELLING WATERSTOP IN CENTER OF SLAB, USING KRYTONITE ADHESIVE AT A COVERAGE RATE OF 8-10 METERS (26-32 FT) PER CARTRIDGE.
4. CREATE A 40 MM X 40 MM (1.5 IN. X 1.5 IN.), TAPERING TO 30 MM (1.2 IN.), KEYWAY AT THE INTERSECTION WHERE THE TWO CONCRETE SECTIONS MEET, THROUGH FORMING, OR WHILE THE CONCRETE IS IN A MOLDABLE PLASTIC STATE.
5. TIGHTLY PACK PREFORMED KEYWAY FLUSH TO THE SURFACE WITH KRYSTOL WATERSTOP GROUT AT A RATE OF 3.33 KG/M (2.23 LB./FT.)

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.
5. CONTRACTOR'S NOTE: FOR PRODUCT AND COMPANY INFORMATION VISIT www.CADdetails.com/info AND ENTER REFERENCE NUMBER 5104-016

KRYSTOL WATERSTOP SYSTEM

WALL TO SLAB – TRIPLE PROTECTION

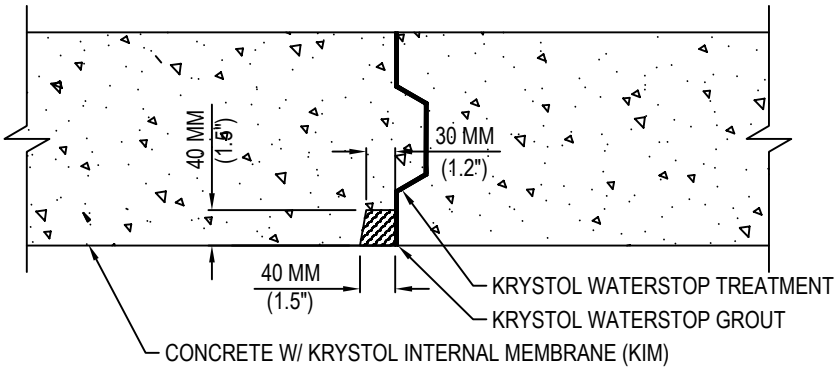
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REVISION DATE 11/05/2020

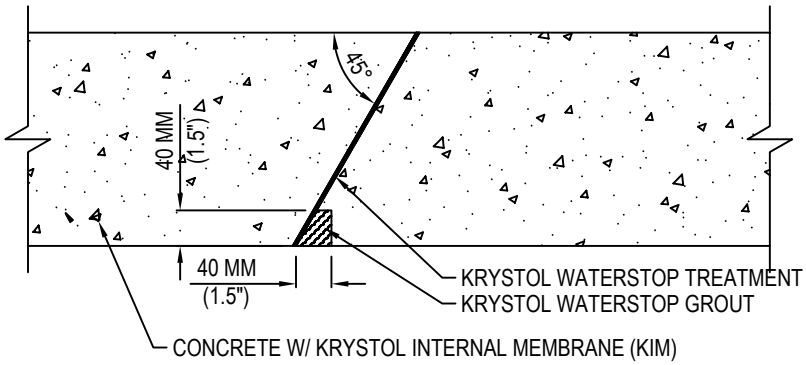
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www.kryton.com

SMART CONCRETE®



FORMED WALL



SHOTCRETE WALL

WALL TO WALL (VERTICAL) CONSTRUCTION JOINTS
DOUBLE PROTECTION; EXTERNAL GROUT METHOD

MANUFACTURER'S NOTES:

1. PLACE CONCRETE TREATED WITH KRYSTOL INTERNAL MEMBRANE (KIM).
2. COAT SURFACE AREA OF THE JOINT WITH KRYSTOL WATERSTOP TREATMENT AT A SPREAD RATE OF 1 KG/M2 (0.2 LB./SQ. FT.).
3. CREATE A 40 MM X 40 MM, TAPERING TO 30 MM, KEYWAY AT THE INTERSECTION WHERE THE TWO CONCRETE SECTIONS MEET WHILE THE CONCRETE IS IN A MOLDABLE PLASTIC STATE.
4. TIGHTLY PACK PREFORMED KEYWAY FLUSH TO THE SURFACE WITH KRYSTOL WATERSTOP GROUT AT A RATE OF 3.33 KG/M (2.23 LB./FT.).

NOTES:

1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
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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.
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5. CONTRACTOR'S NOTE: FOR PRODUCT AND COMPANY INFORMATION VISIT www.CADdetails.com/info AND ENTER REFERENCE NUMBER 5104-018

KRYSTOL WATERSTOP SYSTEM (KWS)

WALL TO WALL – DOUBLE PROTECTION – EXT GROUT METHOD

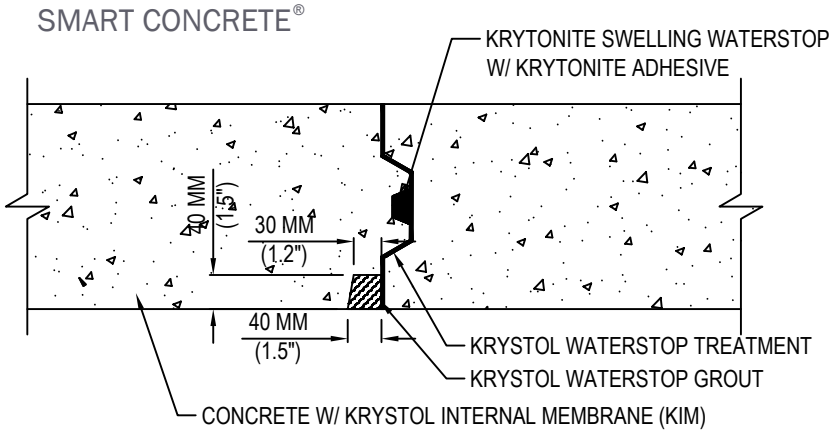
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REVISION DATE 11/05/2020

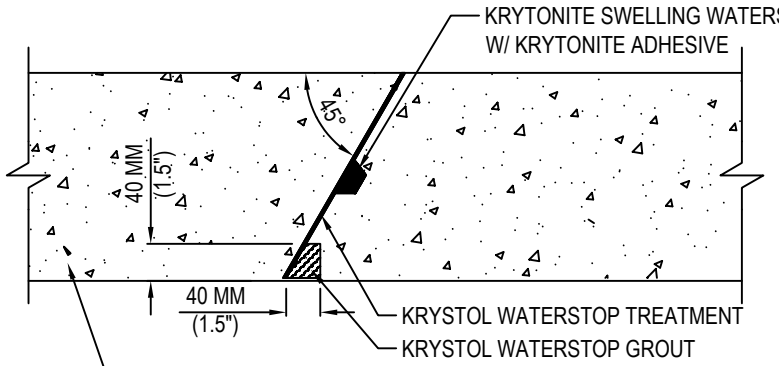
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SHOTCRETE WALL

WALL TO WALL (VERTICAL) CONSTRUCTION JOINTS
TRIPLE PROTECTION

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3. INSTALL KRYTONITE SWELLING WATERSTOP IN CENTER OF SLAB, USING KRYTONITE ADHESIVE AT A COVERAGE RATE OF 8-10 METERS (26-32 FT) PER CARTRIDGE.
4. CREATE A 40 MM X 40 MM (1.5 IN. X 1.5 IN.), TAPERING TO 30 MM (1.2 IN.), KEYWAY AT THE INTERSECTION WHERE THE TWO CONCRETE SECTIONS MEET WHILE THE CONCRETE IS IN A MOLDABLE PLASTIC STATE.
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5. CONTRACTOR'S NOTE: FOR PRODUCT AND COMPANY INFORMATION VISIT www.CADdetails.com/info AND ENTER REFERENCE NUMBER 5104-020

KRYSTOL WATERSTOP SYSTEM

WALL TO WALL – TRIPLE PROTECTION

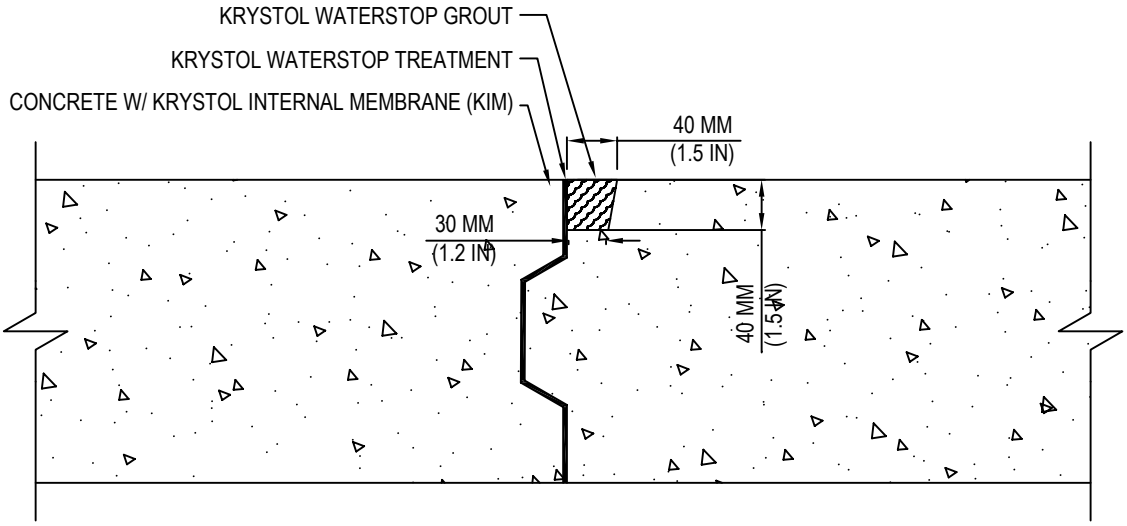
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SMART CONCRETE®



SLAB TO SLAB CONSTRUCTION JOINTS
DOUBLE PROTECTION; EXTERNAL METHOD

MANUFACTURER'S NOTES:
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KRYSTOL WATERSTOP SYSTEM

SLAB TO SLAB – DOUBLE PROTECTION – EXT GROUT METHOD

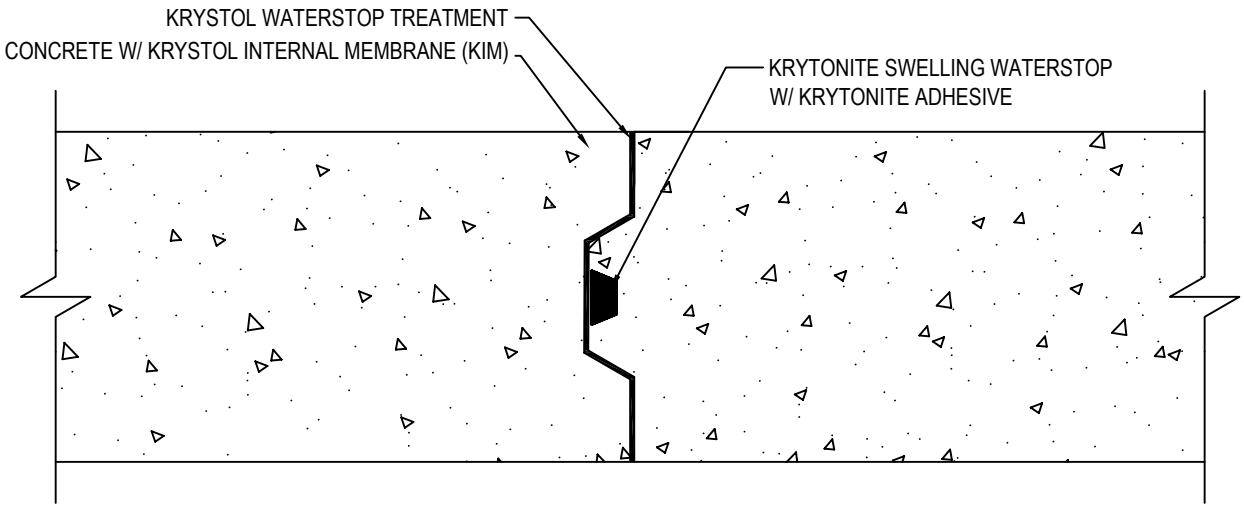
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SMART CONCRETE®



SLAB TO SLAB CONSTRUCTION JOINTS
DOUBLE PROTECTION; INTERNAL SWELLING METHOD

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3. INSTALL KRYTONITE SWELLING WATERSTOP IN CENTER OF SLAB, USING KRYTONITE ADHESIVE AT A COVERAGE RATE OF 8-10 METERS (26-32 FT) PER CARTRIDGE

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KRYSTOL WATERSTOP SYSTEM

SLAB TO SLAB – DOUBLE PROTECTION – INT SWELLING METHOD

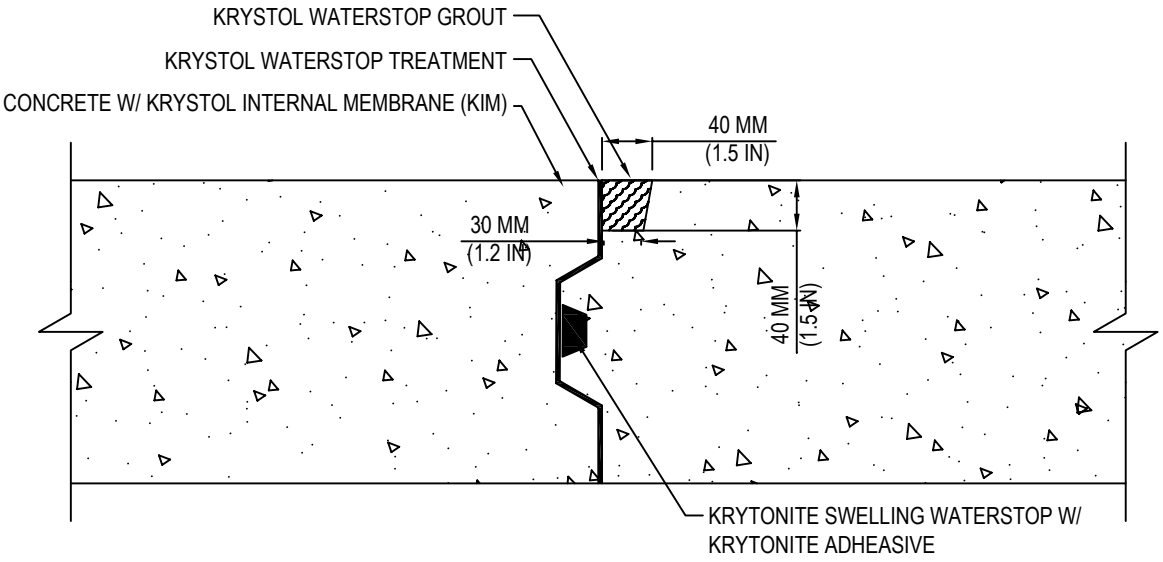
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SLAB TO SLAB CONSTRUCTION JOINTS
TRIPLE PROTECTION

MANUFACTURER'S NOTES:

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5. CONTRACTOR'S NOTE: FOR PRODUCT AND COMPANY INFORMATION VISIT www.CADdetails.com/info AND ENTER REFERENCE NUMBER 5104-024

KRYSTOL WATERSTOP SYSTEM

SLAB TO SLAB – TRIPLE PROTECTION

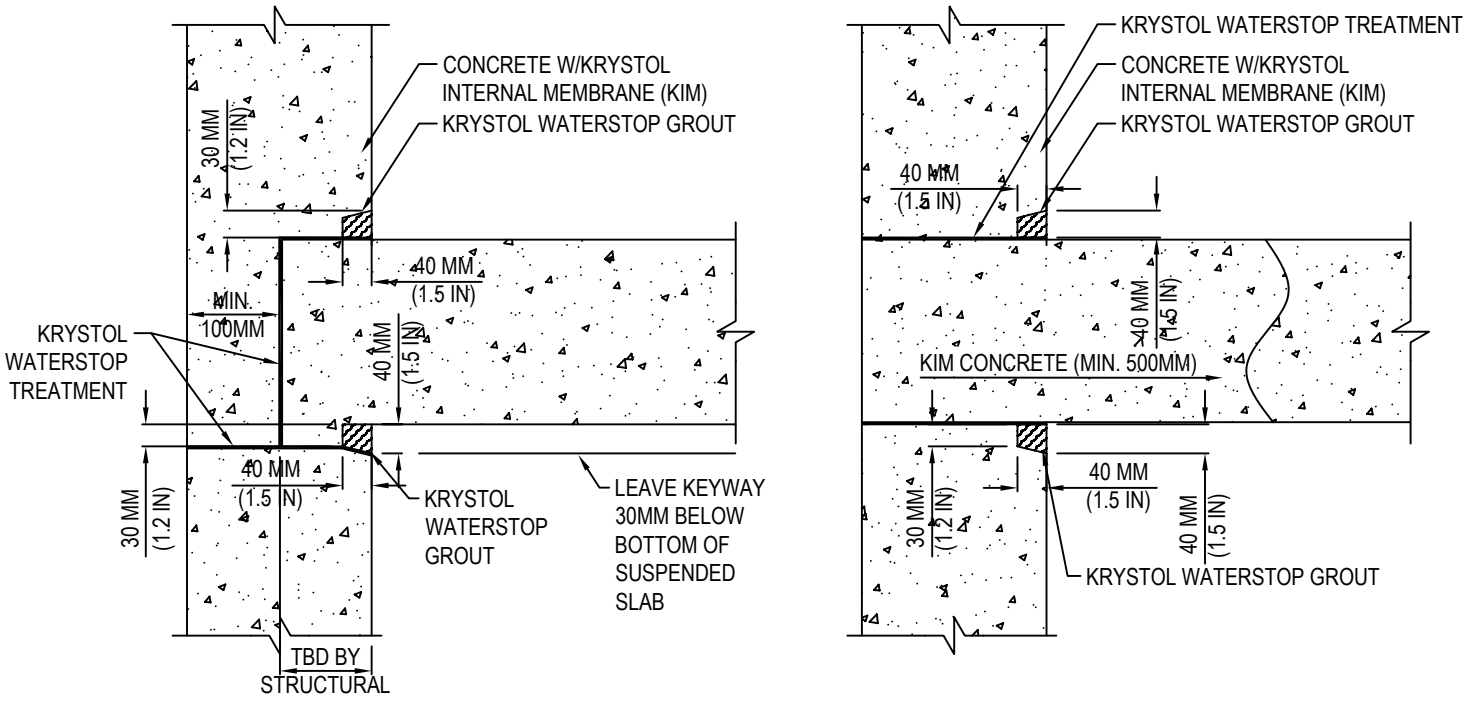
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SMART CONCRETE®



WALL TO ELEVATED SLAB CONTRUCTION JOINTS
DOUBLE PROTECTION; EXTERNAL GROUT METHOD

MANUFACTURER'S NOTES:

1. PLACE CONCRETE TREATED WITH KRYSTOL INTERNAL MEMBRANE (KIM).
2. COAT SURFACE AREA OF THE JOINT WITH KRYSTOL WATERSTOP TREATMENT AT A SPREAD RATE OF 1 KG/M2 (0.2 LB./SQ. FT.).
3. CREATE A 40 MM X 40 MM (1.5 IN. X 1.5 IN.), TAPERING TO 30 MM (1.2 IN.), KEYWAY AT THE INTERSECTION WHERE THE TWO CONCRETE SECTIONS MEET, THROUGH FORMING, OR WHILE THE CONCRETE IS IN A MOLDABLE PLASTIC STATE.
4. TIGHTLY PACK PREFORMED KEYWAY FLUSH TO THE SURFACE WITH KRYSTOL WATERSTOP GROUT AT A RATE OF 3.33 KG/M (2.23 LB./FT.)

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KRYSTOL WATERSTOP SYSTEM

WALL TO ELEVATED SLAB – DOUBLE PROTECTION – EXT GROUT METHOD

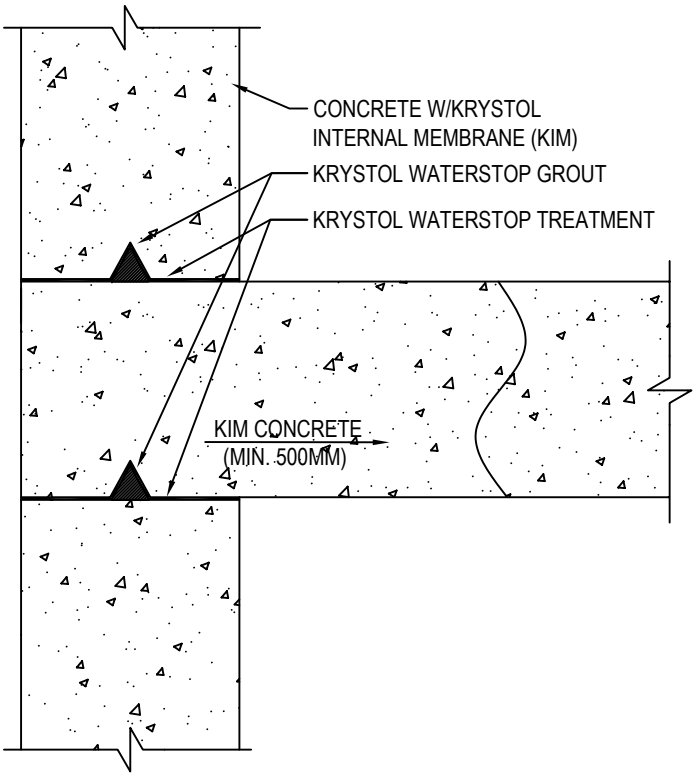
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SMART CONCRETE®



WALL TO ELEVATED SLAB
DOUBLE PROTECTION; INTERNAL GROUT METHOD

MANUFACTURER'S NOTES:

1. PLACE CONCRETE TREATED WITH KRYSTOL INTERNAL MEMBRANE (KIM).
2. PLACE KRYSTOL WATERSTOP GROUT IN A 50 MM (2 IN.) WIDE BY 30 MM (1.2 IN.) HIGH TRIANGULAR SHAPE AT A COVERAGE RATE OF 1.67 KG/M (1.12 LB. /FT.)
   NOTE: ENSURE A MINIMUM OF 25 MM (1 IN.) BETWEEN GROUT AND REBAR, AND 50 MM (2 IN.) BETWEEN GROUT AND THE EDGE OF THE POUR.
3. COAT SURFACE AREA OF THE JOINT, AND CURED KRYSTOL WATERSTOP GROUT, WITH KRYSTOL WATERSTOP TREATMENT AT A SPREAD RATE OF 1 KG/M2 (0.2 LB./SQ. FT.).

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KRYSTOL WATERSTOP SYSTEM

WALL TO ELEVATED SLAB – DOUBLE PROTECTION – INT GROUT METHOD

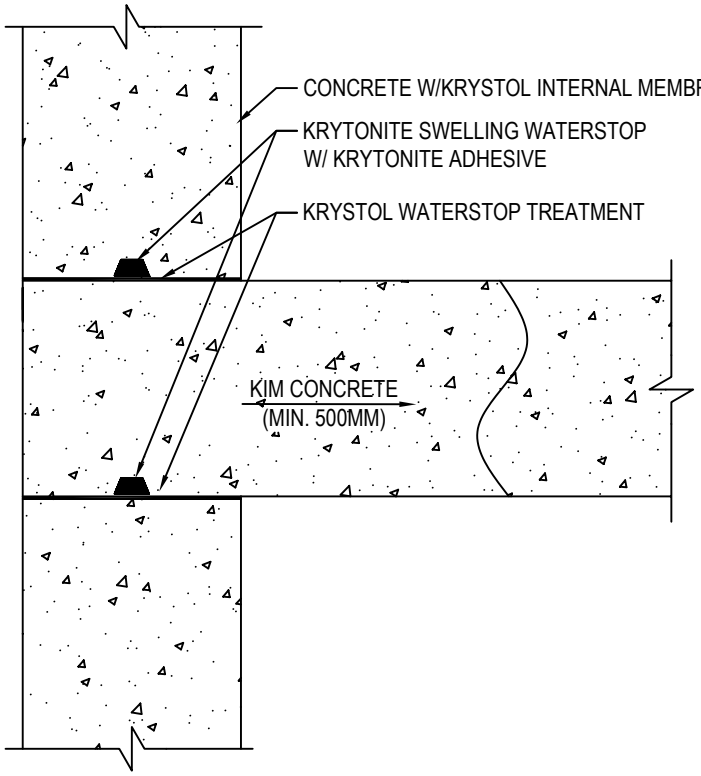
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SMART CONCRETE®



WALL TO ELEVATED SLAB
DOUBLE PROTECTION; INTERNAL SWELLING METHOD

MANUFACTURER'S NOTES

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3. INSTALL KRYTONITE SWELLING WATERSTOP IN CENTER OF SLAB, USING KRYTONITE ADHESIVE AT A COVERAGE RATE OF 8-10 METERS (26-32 FT) PER CARTRIDGE.

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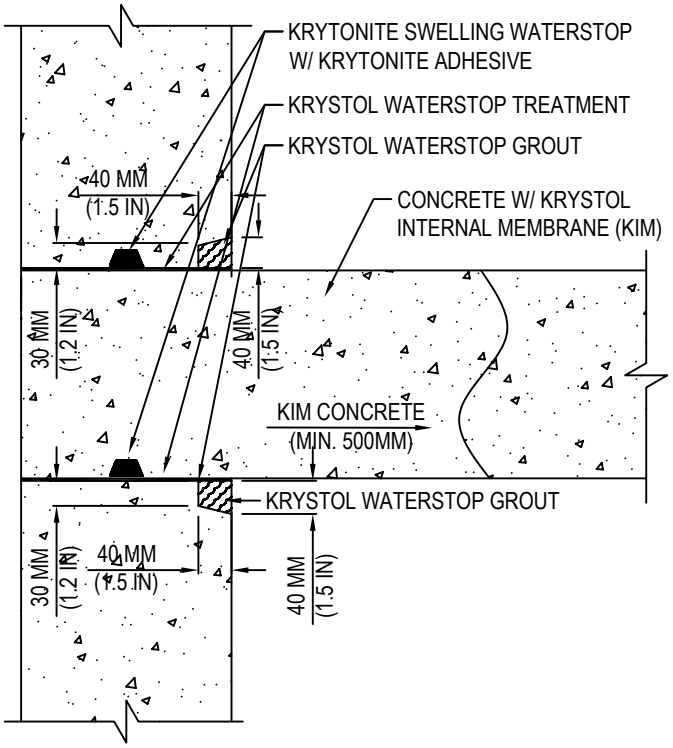
KRYSTOL WATERSTOP SYSTEM

WALL TO ELEVATED SLAB – DOUBLE PROTECTION – INT SWELLING METHOD

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WALL TO ELEVATED SLAB
TRIPLE PROTECTION

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KRYSTOL WATERSTOP SYSTEM

WALL TO ELEVATED SLAB – TRIPLE PROTECTION

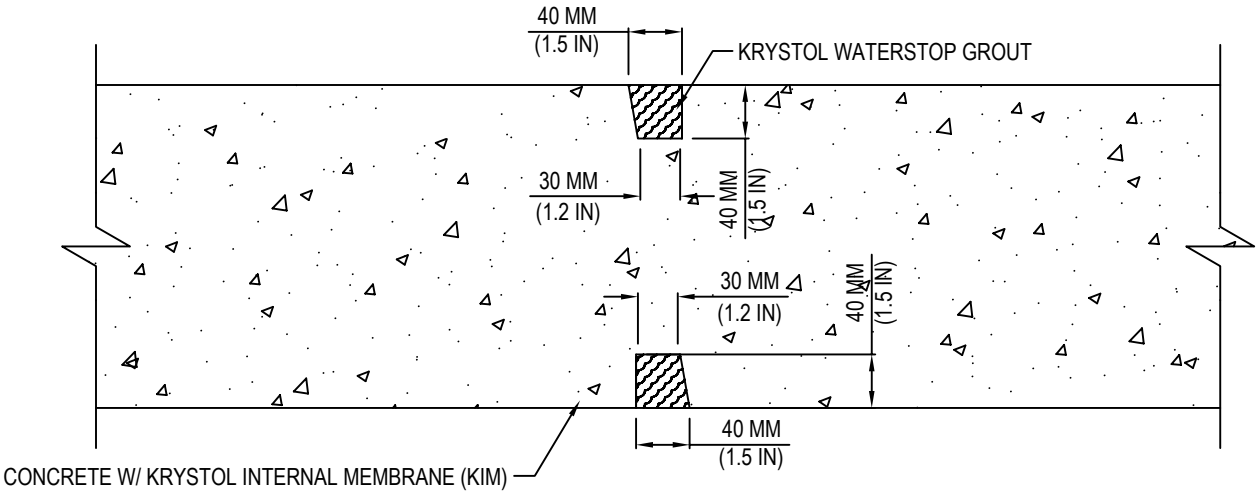
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CONTROL JOINTS
BACK FILLED WALL

MANUFACTURER'S NOTES:

1. CREATE 40 MM X 40 MM (1.5 IN. X 1.5 IN.), TAPERING TO 30 MM (1.2 IN.), KEYWAYS ON EITHER SIDE WHERE THE CONTROL JOINT IS TO BE LOCATED.
2. PLACE CONCRETE TREATED WITH KRYSTOL INTERNAL MEMBRANE (KIM).
3. TIGHTLY PACK PREFORMED KEYWAY FLUSH TO THE SURFACE WITH KRYSTOL WATERSTOP GROUT AT A RATE OF 3.33 KG/M (2.23 LB./FT.)

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KRYSTOL WATERSTOP SYSTEM

CONTROL JOINT – BACK FILLED WALL – EXT GROUT METHOD

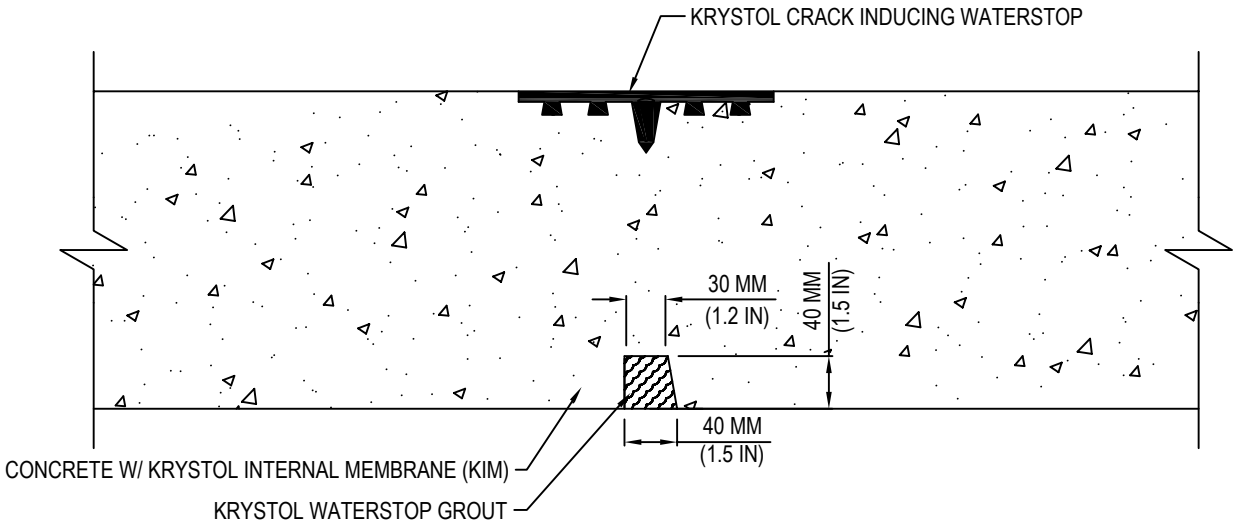
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REVISION DATE 25/06/2020

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SMART CONCRETE®



CONTROL JOINTS
BLIND, SHORING WALL

MANUFACTURER'S NOTES:
1. SECURE THE KRYTON CRACK INDUCING WATERSTOP TO SHORING WALL WHERE THE CONTROL JOINT IS TO BE LOCATED.
2. CREATE A 40 MM X 40 MM (1.5 IN. X 1.5 IN.), TAPERING TO 30 MM (1.2 IN.) KEYWAY IN-LINE WITH CENTER OF THE KRYSTOL CRACK INDUCING WATERSTOP
3. PLACE CONCRETE TREATED WITH KRYSTOL INTERNAL MEMBRANE (KIM).
4. TIGHTLY PACK PREFORMED KEYWAY FLUSH TO THE SURFACE WITH KRYSTOL WATERSTOP GROUT AT A RATE OF 3.33 KG/M (2.23 LB./FT.)

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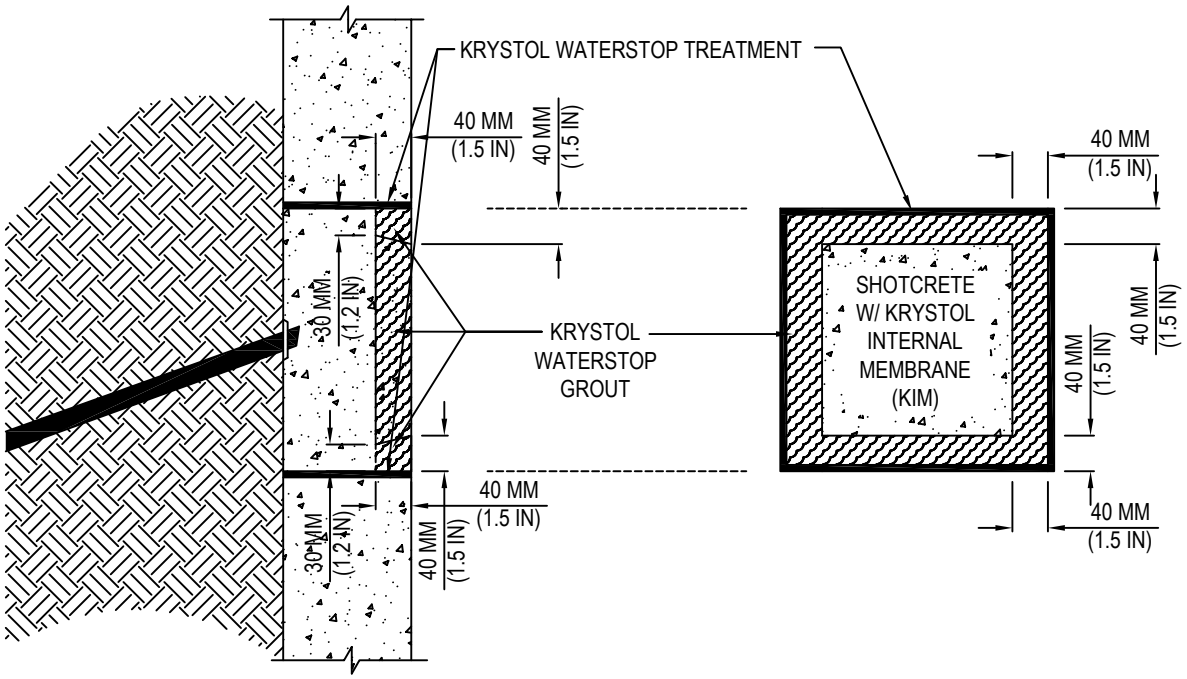
KRYSTOL WATERSTOP SYSTEM

CONTROL JOINT – BACK FILLED WALL – EXT GROUT METHOD

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SMART CONCRETE®



SHOTCRETE: TIE BACK BLOCKOUT
DOUBLE PROTECTION; EXTERNAL GROUT METHOD

MANUFACTURER'S NOTES:
1. PLACE CONCRETE TREATED WITH KRYSTOL INTERNAL MEMBRANE (KIM).
2. COAT SURFACE AREA OF THE JOINT WITH KRYSTOL WATERSTOP TREATMENT AT A SPREAD RATE OF 1 KG/M2 (0.2 LB./SQ. FT.).
3. CREATE A 40 MM X 40 MM (1.5 IN. X 1.5 IN.), TAPERING TO 30 MM (1.2 IN.), KEYWAY AT THE INTERSECTION WHERE THE TWO CONCRETE SECTIONS MEET, THROUGH FORMING, OR WHILE THE CONCRETE IS IN A MOLDABLE PLASTIC STATE.
4. TIGHTLY PACK PREFORMED KEYWAY FLUSH TO THE SURFACE WITH KRYSTOL WATERSTOP GROUT AT A RATE OF 3.33 KG/M (2.23 LB./FT.)

NOTES:
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KRYSTOL WATERSTOP SYSTEM

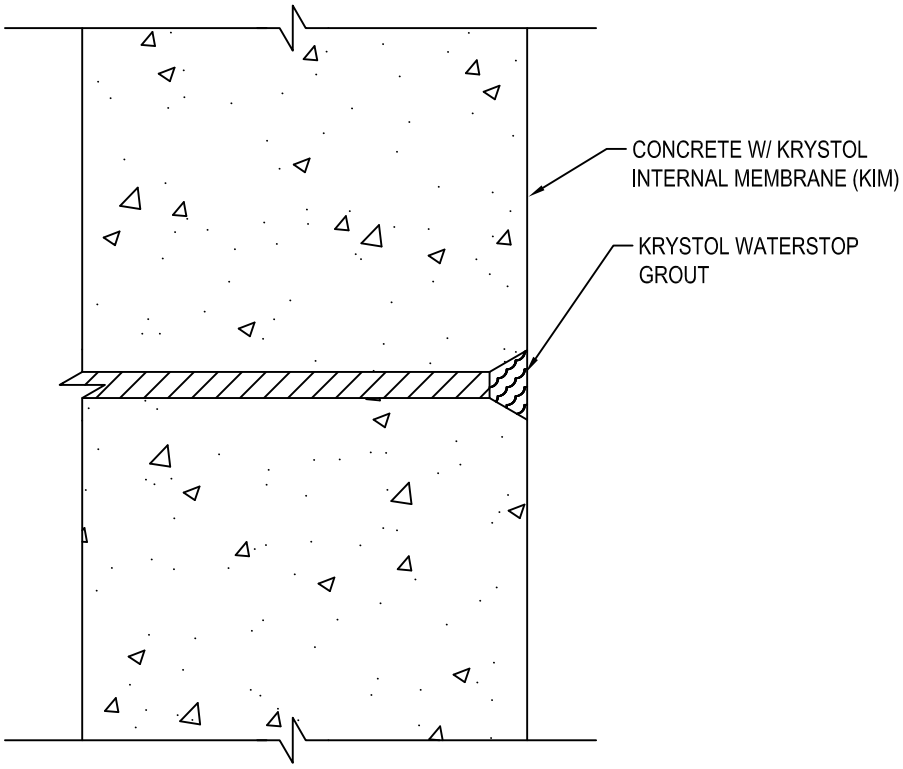
TIE BACK BLOCKOUT – DOUBLE PROTECTION – EXT GROUT METHOD

5104-032

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TIE HOLES

MANUFACTURER'S NOTES:
1. FILL TIE HOLES FLUSH TO THE SURFACE WITH KRYSTOL WATERSTOP GROUT.

NOTES:
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KRYSTOL WATERSTOP SYSTEM (KWS)

PIPE PENETRATION - EXT GROUT METHOD

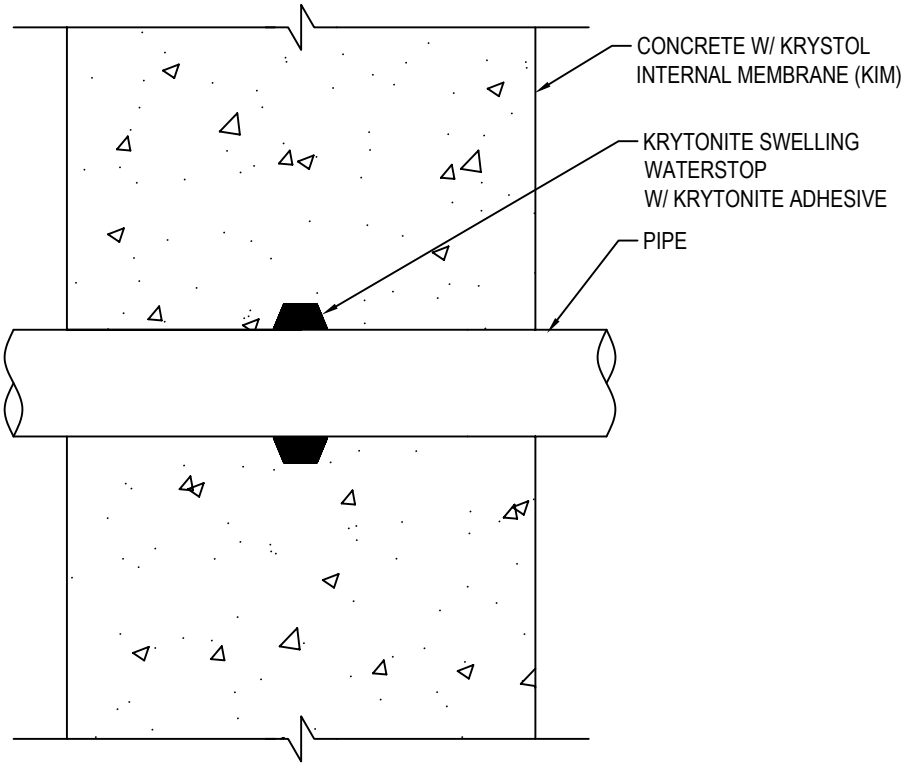
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SMART CONCRETE®



PIPE PENETRATIONS
INTERNAL SWELLING METHOD

MANUFACTURER'S NOTES:
1. PLACE CONCRETE TREATED WITH KRYSTOL INTERNAL MEMBRANE (KIM).
2. INSTALL KRYTONITE SWELLING WATERSTOP IN CENTER OF PIPE, USING KRYTONITE ADHESIVE AT A COVERAGE RATE OF 8-10 METERS (26-32 FT) PER CARTRIDGE

NOTES:
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KRYSTOL WATERSTOP SYSTEM (KWS)

PIPE PENETRATION - INT SWELLING METHOD

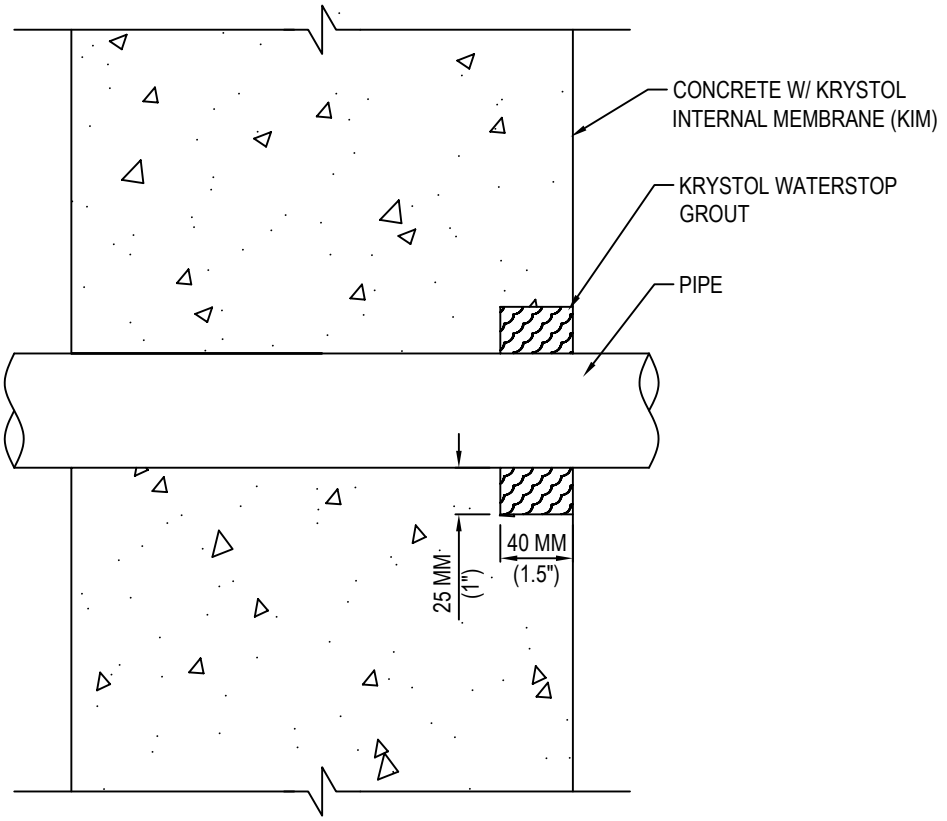
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PIPE PENETRATIONS
EXTERNAL GROUT METHOD

MANUFACTURER'S NOTES:
1. PLACE CONCRETE TREATED WITH KRYSTOL INTERNAL MEMBRANE (KIM).
2. FORM A 25MM X 40MM (1" X 1.5") CHASE AROUND THE PIPE PENETRATION
3. TIGHTLY PACK PREFORMED KEYWAY FLUSH TO THE SURFACE WITH KRYSTOL WATERSTOP GROUT AT A RATE OF 3.33 KG/M (2.23 LB./FT.).

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PIPE PENETRATION - EXT GROUT METHOD

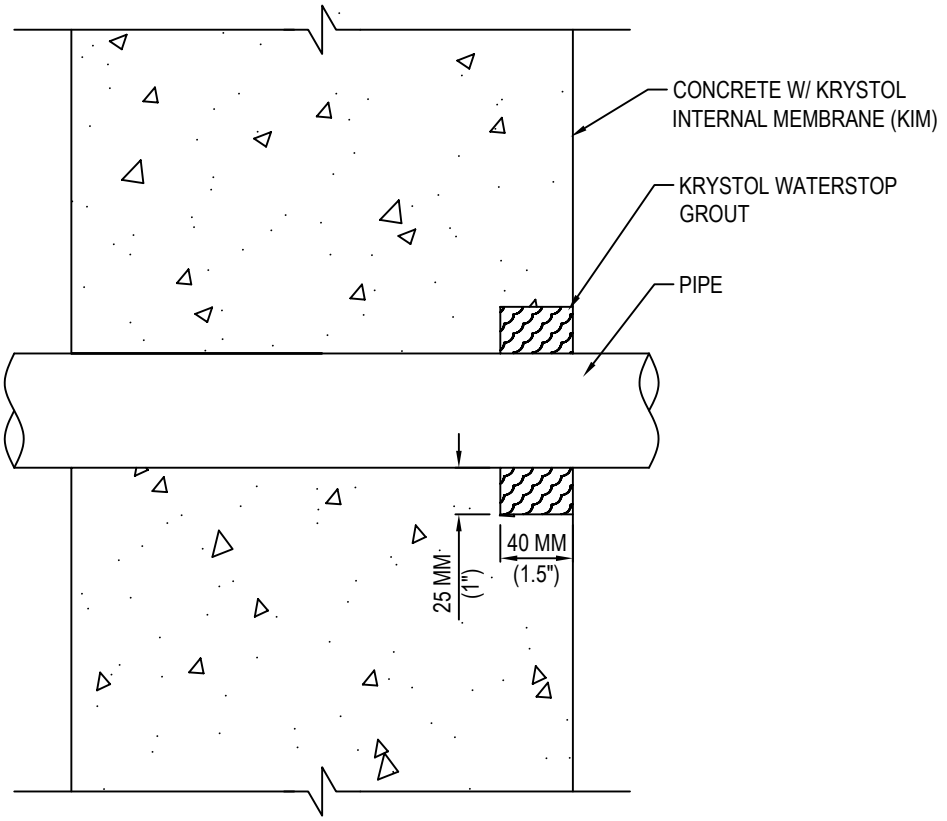
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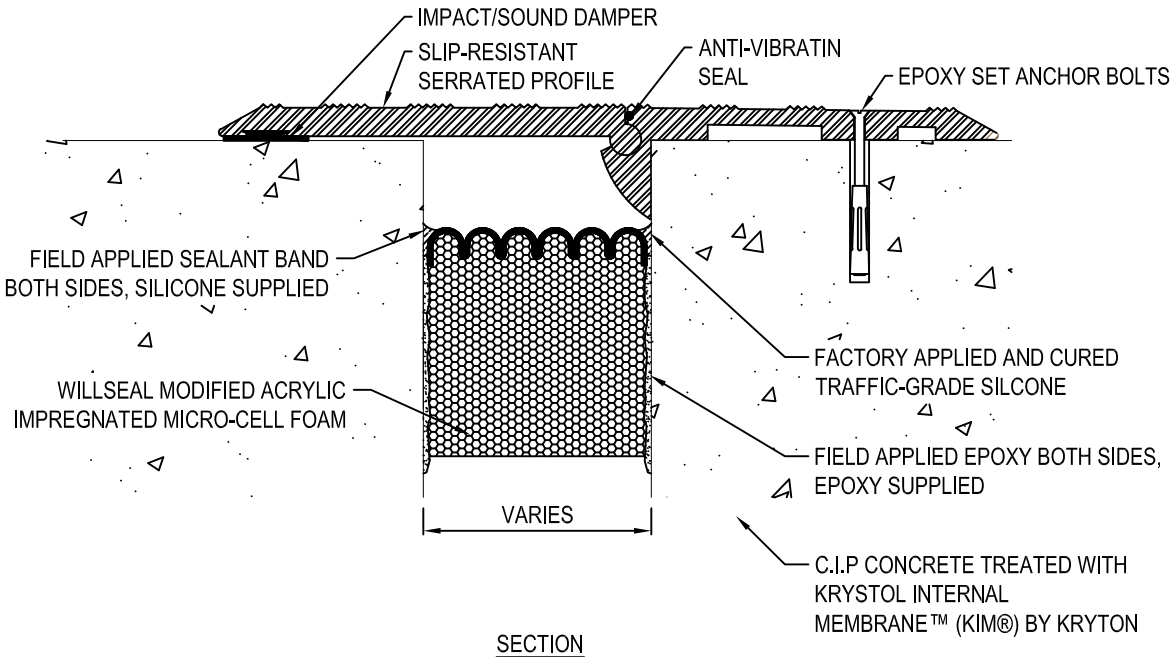
PIPE PENETRATION - EXT GROUT METHOD

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SECTION

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2. APPLY DUCT TAPE ALONG JOINT EDGE.
3. MIX THE SUPPLIED EPOXY IN A SEPARATE CONTAINER AT A 1:1 RATIO, MIX UNTIL UNIFORM IN COLOR, EPOXY MUST BE USED WITHIN A 30 MINUTE TIME FRAME.
4. APPLY EPOXY ALONG THE VERTICAL FACE WITHIN IN THE JOINT SUBSTRATE AT A 60 LFT PER GALLON YIELD.
5. REMOVE PACKAGING MATERIAL, BEING SURE NOT TO PULL OR TWIST, USE MARGIN TROWELS TO INSTALL THE MATERIAL.
6. OVERLAP EACH PROGRESSIVE SUPPLIED SPLICE ADHESIVE AT THE END OF EACH STICK, THE END OF EACH STICK SHOULD BE INSTALLED IN COMPRESSION.
7. USING THE SUPPLIED SILICONE APPLY A FILLET BEAD, AT A RATE OF 80 LFT PER SAUSAGE, ALONG THE MATERIAL AND THE SUBSTRATE AS WELL AS THE SILICONE SPLICE SEAMS.
8. REMOVE THE DUCT TAPE AND REMOVE ANY EXCESS EPOXY OR SILICONE LEFT ON THE SURFACE OF THE MATERIAL OR SUBSTRATE.
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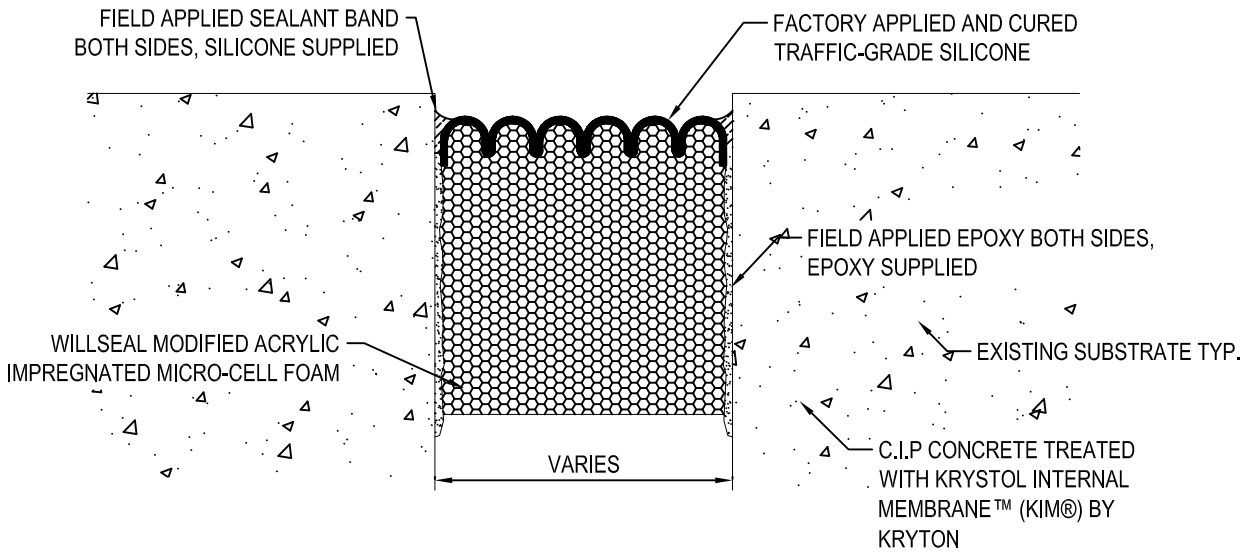
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WILLSEAL 250 - KIM CONCRETE

EXPANSION JOINTS - HEAVY DUTY COVER PLATE APPLICATION

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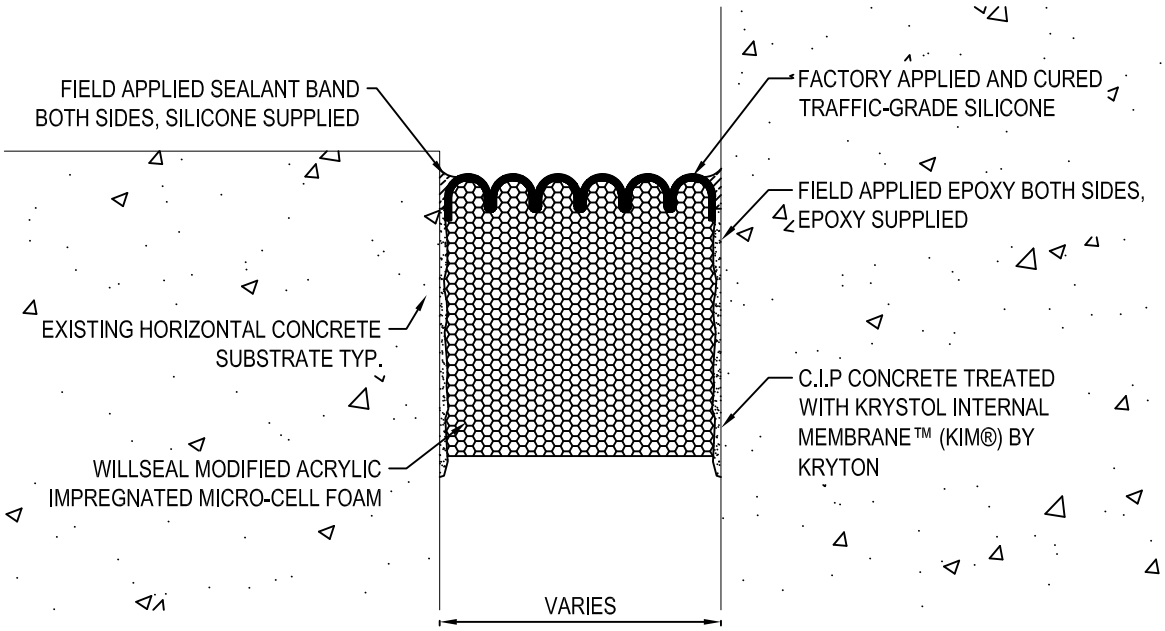
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WILLSEAL 250 - KIM CONCRETE

EXPANSION JOINTS - JOINT APPLICATION

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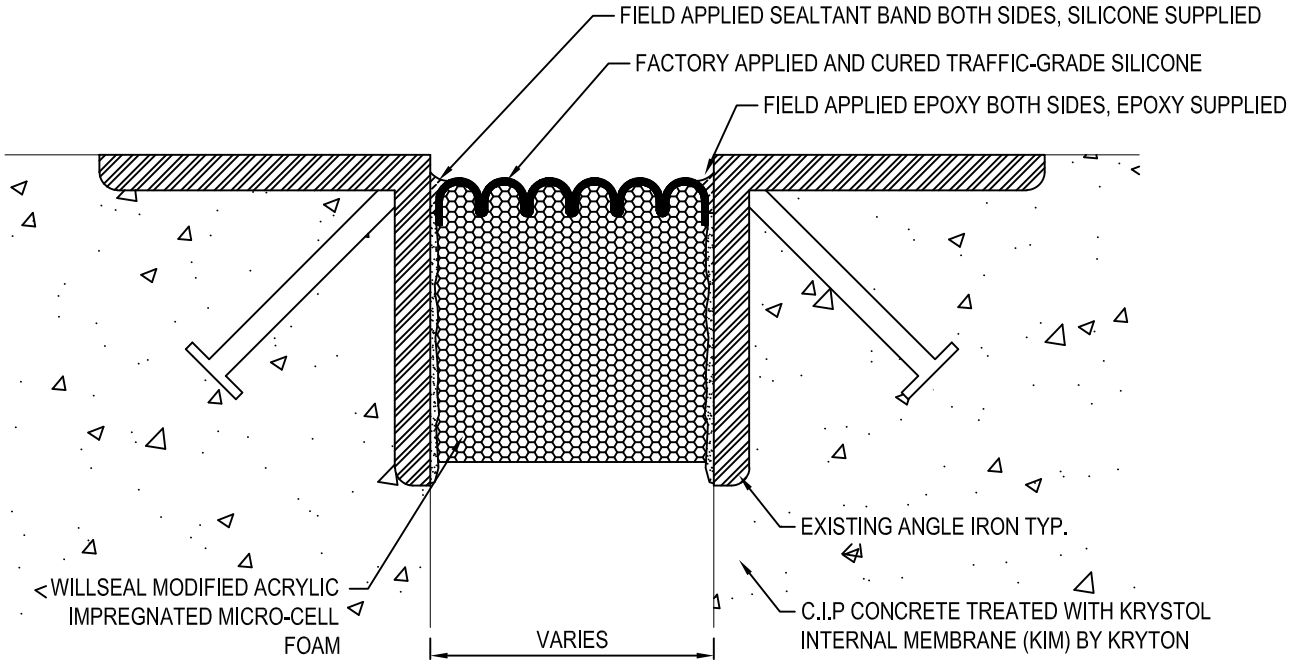
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WILLSEAL 250 - KIM CONCRETE

EXPANSION JOINTS - DECK TO WALL APPLICATION

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WILLSEAL 250 - KIM CONCRETE

EXPANSION JOINTS - ANGLE IRON APPLICATION

5104-053

REVISION DATE 13/04/2018

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KRYSTOL INTERNAL MEMBRANE™ (KIM®)

THE MOST TRUSTED WATERPROOFING ADMIXTURE

KRYTON®

SMART CONCRETE®

TELUS Garden, Vancouver, Canada

KIM



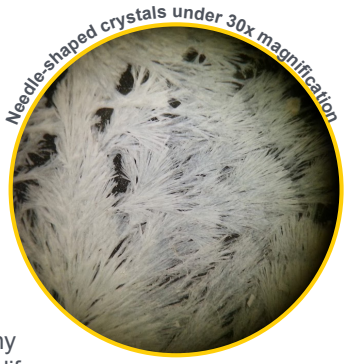
KIM is a hydrophilic crystalline admixture used to create permanently waterproof concrete.

KIM lowers the permeability of concrete and is used in place of surface-applied waterproofing membranes. By stopping the transmission of water through concrete, KIM adds durability and longevity to concrete as it protects the concrete from chemical attack and its reinforcing steel from corrosion.

- **Waterproofs concrete** – Lowers water penetration by reducing permeability of the concrete by 50-90%, even under extreme hydrostatic pressure
- **Self-seals cracks** – Activates in the presence of moisture to seal micro-cracks that develop over the life span of the structure
- **Is environmentally friendly** – Remains safe for potable water (certified to NSF/ANSI 61) and non-toxic
- **Protects reinforcing steel** – Prevents the penetration of waterborne contaminants and chloride-laden water that cause reinforcing steel to corrode
- **Reduces shrinkage and cracking** – Increases quality and longevity of concrete during the plastic and curing stages
- **Resists freeze-thaw damage** – Mitigates the effect of expansion and contraction of freezing and thawing within concrete

HOW IT WORKS

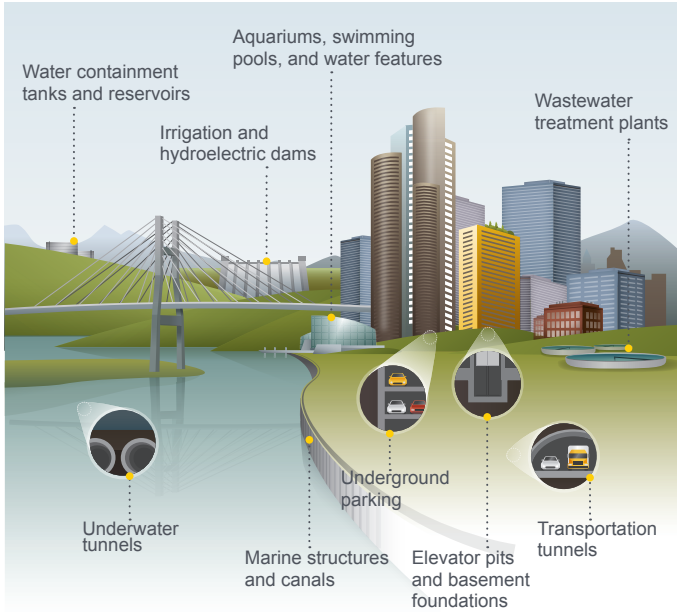
KIM contains Krystol® technology. When added to concrete, Krystol chemically reacts with water and unhydrated cement particles to form insoluble needle-shaped crystals that fill capillary pores and micro-cracks in the concrete, which blocks the pathways for water and waterborne contaminants. Any moisture introduced over the life span of the concrete will initiate crystallization, ensuring permanent waterproofing protection.



Kryton has over 250 project profiles available at ***www.kryton.com***

A WORLD OF **APPLICATIONS**

KIM is recommended for all concrete that will be subject to water pressure and can be used in cast-in-place, precast, and shotcrete applications.



KIM IN THE FIELD

VANCOUVER, BC, CANADA
700 WEST 8TH



KIM was added to the shotcrete mix used to waterproof the concrete perimeter walls.

"Using Kryton's KIM in the shotcrete as the concrete waterproofer helped us complete the project on time with a fast-paced schedule. Due to our success on 700 West 8th, we have been using Kryton's Krystol Waterproofing System on a variety of other projects in different parts of the Lower Mainland of BC."

- Bryan Tucker, VP of Construction for ICON Pacific

KIM VS TRADITIONAL WATERPROOFING:

- Replaces the need for surface-applied waterproofing membranes
- Cannot be punctured
- Shortens construction schedules
- Lowers maintenance and repair costs
- Improves reliability and quality control
- Allows for a larger building footprint

KIM VS COMPETITORS:

- Krystol technology is chemically different from its competitors
- Only KIM is the best-performing crystalline admixture with the:
  - Highest level of permeability reduction
  - Most dependable self-sealing performance
  - Best shrinkage and restrained shrinkage cracking reduction
  - Proven ability to protect against corrosion
- Only Kryton offers a complete waterproofing system that covers every construction detail
- Kryton is the inventor of the crystalline waterproofing admixture, and we have the most experience

ATLANTA, GA, USA
55 ALLEN PLAZA



The below grade walls were built from the top down, using single-sided forming against the dirt. The developer used KIM to waterproof because the shoring wall did not leave room for installing conventional membranes.

"Kryton is a great team to work with, and we are extremely impressed with their waterproofing products. Their products do what they promise to do. Even though there's water behind the walls, it's not leaking through the concrete because of Kryton's crystalline technology."

- Rick Anderson, President of ABE Enterprises

WHY **KRYTON**:

THE MOST EFFECTIVE CONCRETE WATERPROOFING AND DURABILITY-ENHANCING SOLUTIONS IN THE WORLD

- Proven Krystol technology that ensures waterproofing for the life of the structure
- Well-defined, step-by-step installation process that ensures success
- Comprehensive support and consultation resources available to provide answers and guidance
- Assurance from the leading warranty in the industry
- Independently accredited proof of performance as Kryton works with industry, academic, and governmental bodies around the world to develop certification standards and testing methodologies

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Toll-free (in Canada/USA): 1.800.267.8280
Email: info@kryton.com

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.



Offices in Canada, USA, UK, Singapore, China, India, and Dubai. Plus, over 50 distributors worldwide, there is a Kryton distributor near you.

See how much you'll save!
Visit **www.kryton.com**
and try our cost comparison tool!

BBA BRITISH BOARD OF AGREMENT · CE · ES · NSF Certified to NSF/ANSI 61

WATERPROOFING STRUCTURAL SHOTCRETE WITH AN INTERNAL MEMBRANE

KRYTON®
SMART CONCRETE®

AUTHORIZED DISTRIBUTOR

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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.

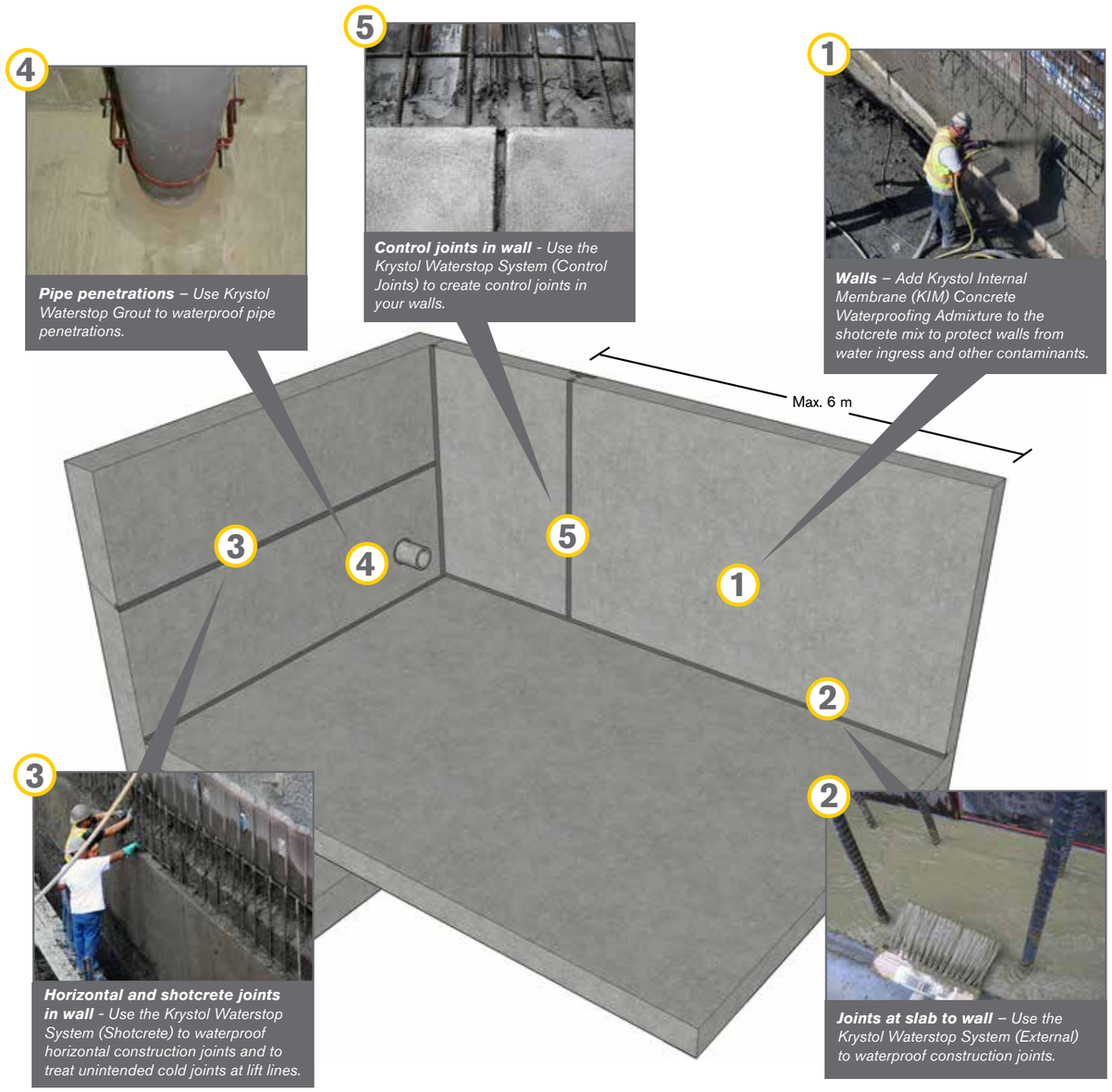
ADDITIONAL BENEFITS OF USING KRYTON'S SHOTCRETE CONCRETE WATERPROOFING SYSTEM

- **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

KRYTON®
SMART CONCRETE®

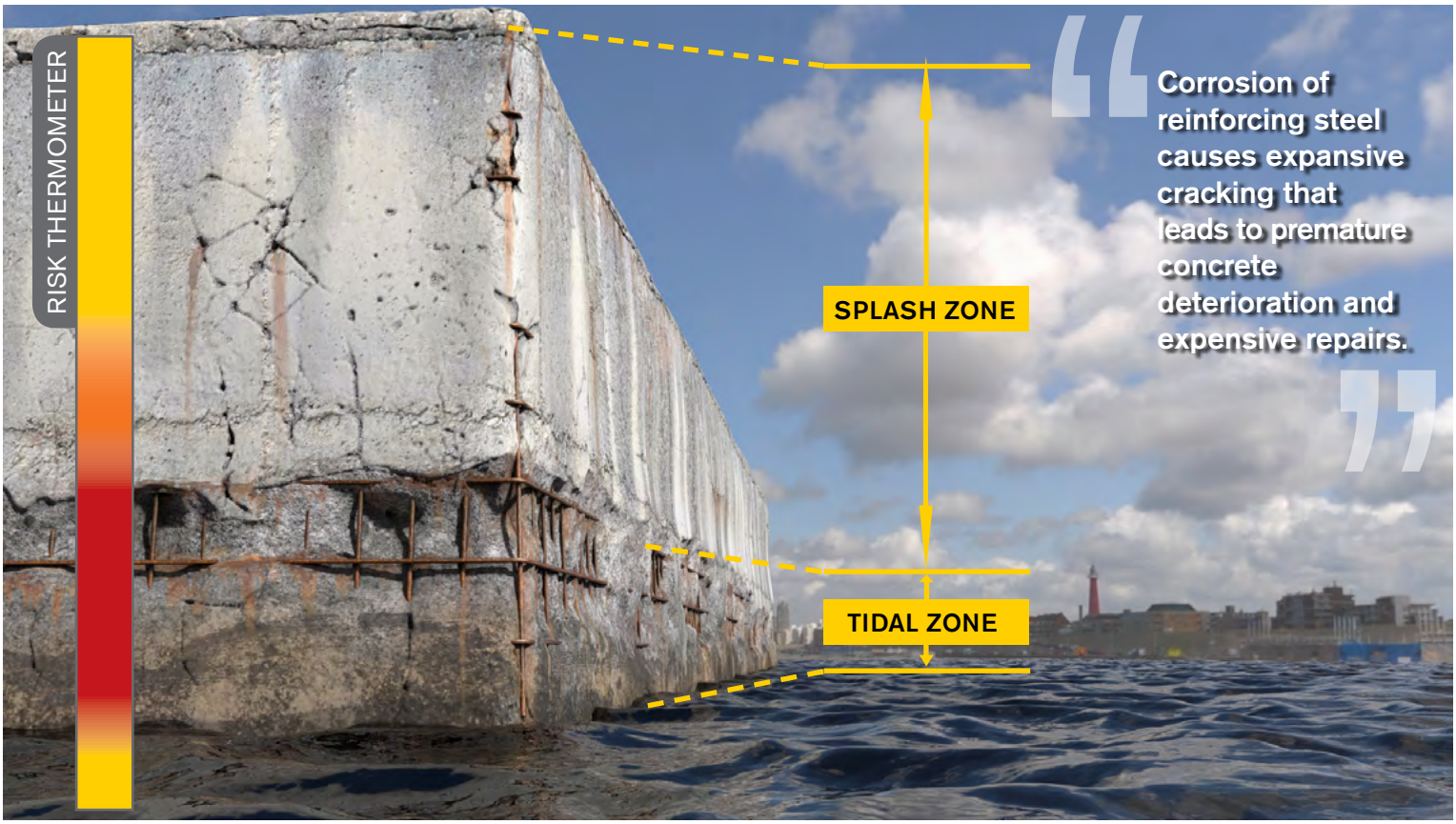


INCREASE THE LIFESPAN OF MARINE CONCRETE:

- 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

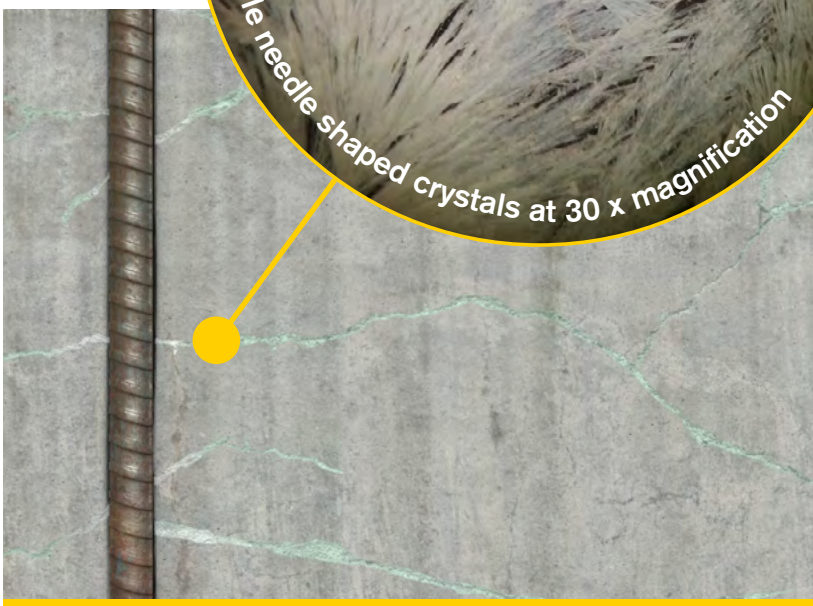
HOW IT WORKS:

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.

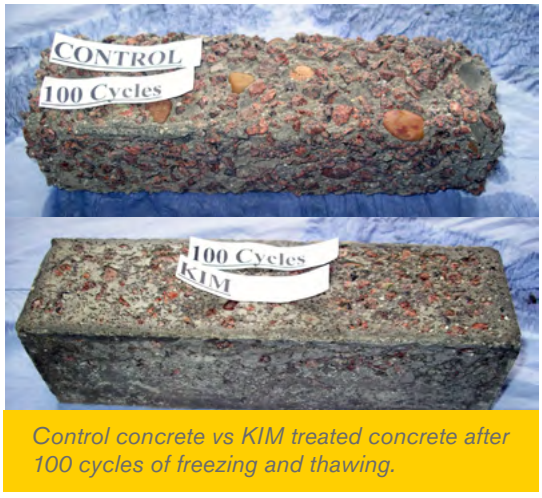
KEY FINDINGS

- 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

BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No 05/4217 · CE · ES · NSF Certified to NSF/ANSI 61

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SMART CONCRETE®

SMART CONCRETE®

INTEGRAL WATERPROOFING & DURABILITY SOLUTIONS



Marina Bay Sands, Singapore



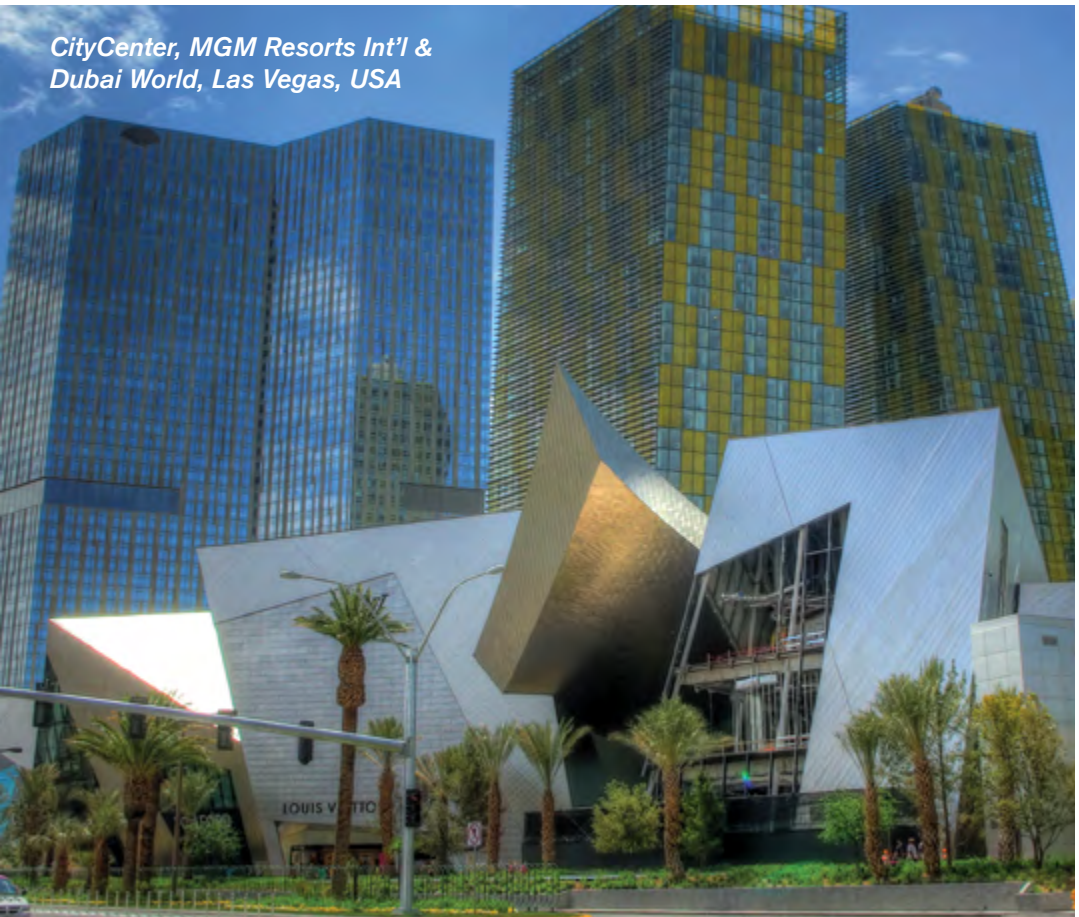
Vancouver Convention Centre, Vancouver, Canada



Canal Santa Lucia, Monterrey, Mexico

THE MOST EFFECTIVE CONCRETE WATERPROOFING AND HARDENING SYSTEMS IN THE WORLD.

Kryton's Smart Concrete® solutions contain proprietary technologies that allow concrete to respond to its environment to protect itself against water penetration and corrosion, or erosion and abrasion. Since Kryton products waterproof and harden from the inside out, they create either a permanent waterproof barrier stopping the transmission of water or increase concrete hardness to dramatically extend the structure's service life. Kryton also works from the outside in, it waterproofs cracks and improves the durability of concrete structures. Our products are demanded in over 50 countries, from Canada to China, India to Indonesia, the UAE to the USA.



CityCenter, MGM Resorts Int'l & Dubai World, Las Vegas, USA



Bintulu Paragon, Bintulu, Malaysia



TELUS Garden, Vancouver, Canada

PROTECT YOUR INVESTMENT WITH SMART CONCRETE:

TECHNOLOGICALLY ADVANCED CONCRETE THAT AUTOMATICALLY RESPONDS TO ITS ENVIRONMENT

Kryton's Smart Concrete® solutions are used by the construction industry because of our time-tested and proven superior performance, extensive warranties and technical support. A building. A hydroelectric facility. A bridge. All are more than concrete and steel, brick and glass. They're investments of time, money and talent that convert visions into reality. These investments deserve to be protected with Kryton's Smart Concrete solutions that provide concrete with permanent waterproofing, increased durability and a substantially increased wear life. That's why world-class builders protect with Kryton.

SMART WATERPROOFING

Only Kryton permanently protects concrete through integral waterproofing using proprietary Krystol® technology. Krystol Internal Membrane™ (KIM®) lowers the permeability of concrete, and is used in place of surface applied waterproofing membranes. Our revolutionary self-sealing technology and comprehensive support system transforms concrete into an ever-vigilant, waterproof barrier. Short term, you'll shave weeks off construction schedules, cut waterproofing costs and maximize your building footprint. Long term, you'll avoid leaks and costly callbacks. All of which explain how we can offer an industry-leading 25-year warranty, and how 40-year-old Kryton projects are as dry today as when they were first built.

SMART HARDENING

Kryton solutions harden concrete permanently ensuring structures have significantly extended service lives. Our integral hardening admixture, Hard-Cem®, is used to increase abrasion and erosion resistance of concrete. Its unique technology extends concrete wear life up to 6 times, overcomes deficiencies of surface-applied hardeners and allows usage in horizontal, vertical or inclined concrete and shotcrete surfaces. Hard-Cem reduces maintenance costs, improves concrete sustainability, expedites construction schedules and can be used with air-entrained concrete.

SMART PROTECTION FOR THE JOB YOU DO.

OWNER
- Shorten construction schedules
- Build right to the property line **
- Reduce costly repairs
- Extend concrete service life

APPLICATOR
- Step-by-step application instructions
- Work under any jobsite condition
- Eliminate stress and cost of callbacks
- Eliminate exposure to harmful dust *

GENERAL CONTRACTOR
- Enhance jobsite productivity
- Save time, build faster
- Reduce labor and workmanship issues

ENGINEER
- Time-proven technology
- Independent testing and certification
- Extensive technical support
- Remove installation risks and concerns *

ARCHITECT
- Achieve greater design flexibility
- Build to LEED standards
- Keep your project on time and on budget

CONCRETE PRODUCER
- Technical support is tailored to your needs
- Add value and margin to your concrete
- Create co-branded waterproof or hardened concrete mix designs

** Applies to KIM only

* Applies to Hard-Cem compared to surface applied (dry-shake) hardeners

KRYSTOL INTERNAL MEMBRANE™ (KIM®) WATERPROOFING ADMIXTURE: NO ONE COMES CLOSE.



1 PROVEN CRYSTALLINE TECHNOLOGY

WATERPROOFING FOR THE LIFE OF YOUR STRUCTURE.

Kryton's proprietary crystalline technology reacts with water and un-hydrated cement particles to form insoluble needle-shaped crystals. Kryton products have been waterproofing concrete since 1973. In 1983, Kryton invented KIM, the original crystalline waterproofing admixture, and revolutionized the way we build today. Independent testing, combined with the ultimate test of time, have proven that Kryton waterproofing can protect your structure throughout its service life.

2 STEP-BY-STEP INSTALLATION

ENSURE YOUR SUCCESS WITH OUR WELL-DEFINED PROCESS.

Kryton helps you save both time and money by eliminating risks associated with waterproofing. You get expert help—before, during and after construction—with instructions, technical materials and videos that make it easy to use our products to create watertight structures that last. We also provide full specifications and training for architects, engineers, general contractors, sub-trades and concrete producers.



3 EXTENSIVE FIELD-LEVEL SUPPORT

GET TECHNICAL ANSWERS WHEN YOU NEED THEM.

No other waterproofing company matches Kryton's level of integrated support. Kryton Authorized Distributors around the world have received extensive training on the use of Kryton products and have decades of experience. Have a specific question? You'll always be able to contact a Kryton technical support person no matter where you are in the world.

4 INDUSTRY EXPERTISE

THE MOST TRUSTED NAME IN WATERPROOFING

Kryton has independent accreditation from construction authorities around the world such as the International Code Council Evaluation Service (ICC-ES), NSF International and British Board of Agrement (BBA). Kryton is a proud contributing member of industry and academic guiding bodies such as American Concrete Institute (ACI) and the International Concrete Repair Institute (ICRI) and are known as the most trusted name in waterproofing.

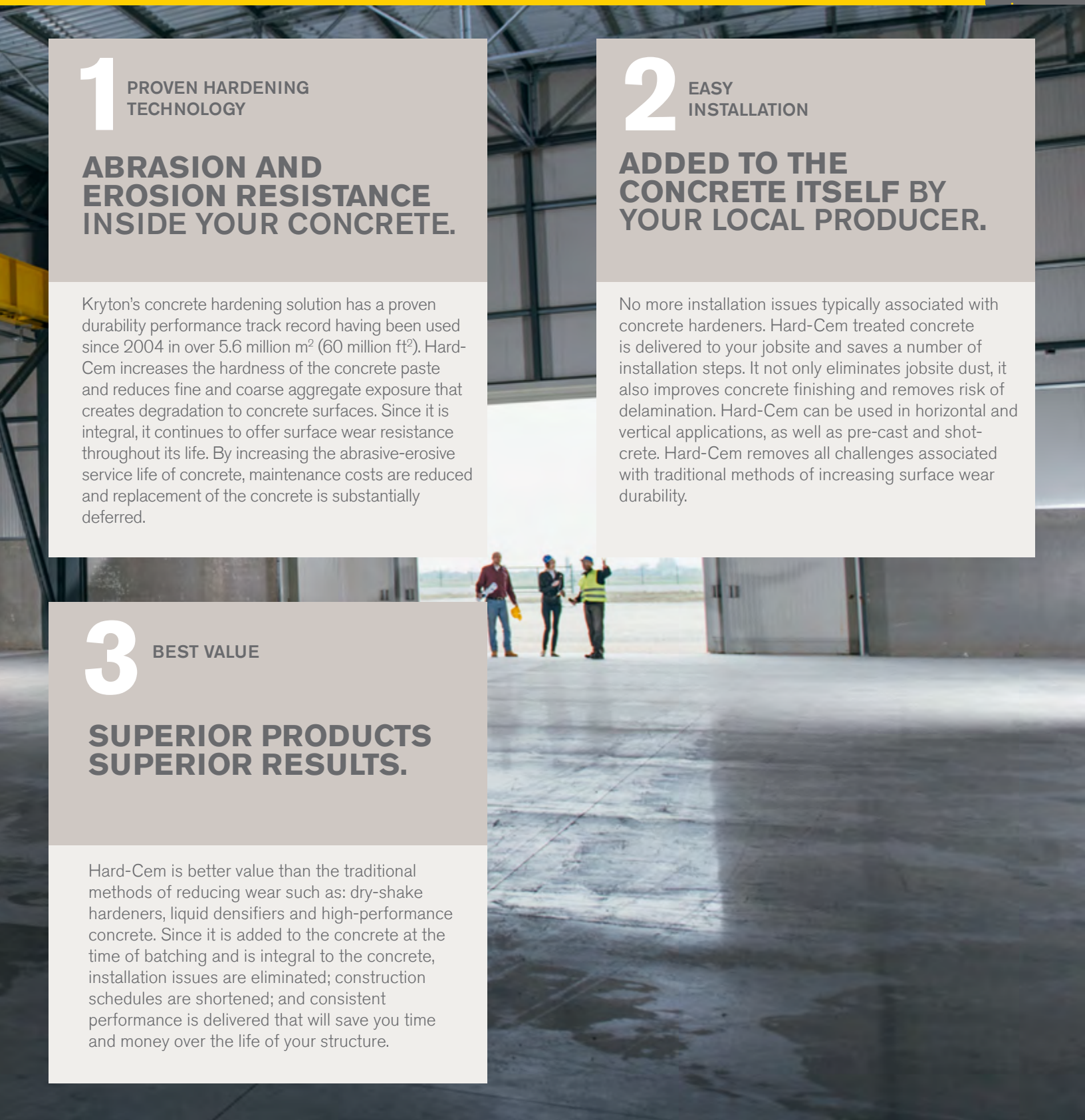
5 BEST-IN-INDUSTRY WARRANTY

BUILD CONFIDENTLY WITH KRYTON.

We offer the industry-leading 25-year warranty for our Krystol Internal Membrane™ (KIM®) admixture. Want further assurance? Kryton has the only crystalline waterproofing admixture associated with projects that have outlasted their warranties.

Coopers Quay, Vancouver, Canada

HARD-CEM®
INTEGRAL HARDENING ADMIXTURE:
MAKES CONCRETE SURFACES LAST LONGER.



1 PROVEN HARDENING TECHNOLOGY

ABRASION AND EROSION RESISTANCE INSIDE YOUR CONCRETE.

Kryton's concrete hardening solution has a proven durability performance track record having been used since 2004 in over 5.6 million m^2 (60 million ft^2). Hard-Cem increases the hardness of the concrete paste and reduces fine and coarse aggregate exposure that creates degradation to concrete surfaces. Since it is integral, it continues to offer surface wear resistance throughout its life. By increasing the abrasive-erosive service life of concrete, maintenance costs are reduced and replacement of the concrete is substantially deferred.

2 EASY INSTALLATION

ADDED TO THE CONCRETE ITSELF BY YOUR LOCAL PRODUCER.

No more installation issues typically associated with concrete hardeners. Hard-Cem treated concrete is delivered to your jobsite and saves a number of installation steps. It not only eliminates jobsite dust, it also improves concrete finishing and removes risk of delamination. Hard-Cem can be used in horizontal and vertical applications, as well as pre-cast and shot-crete. Hard-Cem removes all challenges associated with traditional methods of increasing surface wear durability.

3 BEST VALUE

SUPERIOR PRODUCTS SUPERIOR RESULTS.

Hard-Cem is better value than the traditional methods of reducing wear such as: dry-shake hardeners, liquid densifiers and high-performance concrete. Since it is added to the concrete at the time of batching and is integral to the concrete, installation issues are eliminated; construction schedules are shortened; and consistent performance is delivered that will save you time and money over the life of your structure.

KRYTON HAS YOUR SOLUTION.



1	2	3	4	5	6
Runways, highway pavements and intersections	Hydro dams, irrigation, sluiceways, spillways and drainage conduits	Bridge decks	Fire suspension reservoirs	Wastewater treatment plants, water reservoirs and tanks	Manufacturing and warehouse floors

7	8	9	10	11	12
Service and repair bays; utility and maintenance buildings	Marine structures: sea walls, dry docks and jetties	Underground parking, parking structures, ramps and aprons	Basement foundations and elevator pits	Culverts, underwater tunnels and precast pipes	Transportation tunnels

PRODUCTS THAT PERMANENTLY PROTECT

Admixtures & Additives

Kryton's admixtures and additives include solutions that provide concrete waterproofing and durability. Kryton's Waterproofing Admixtures are added to concrete or mortars at time of batching and include Krystol Internal Membrane™ (KIM®) and Krystol Mortar Admixture™ (KMA). They provide waterproofing protection that replaces the need for traditional surface-applied waterproofing treatments and add long-term durability to your structure.

Kryton's Hard-Cem® is an integral hardening admixture used to increase abrasion and erosion resistance of concrete, extending wear life up to 6 times. Hard-Cem is added to the concrete at the time of batching to increase the hardness of the concrete and expand concrete wear life in both vertical and horizontal applications.

Kryton's Con-Fume® silica fume is an industry standard, pozzolanic, supplementary cementing material used to produce high performance concrete or shotcrete, mortar or cementitious grouts requiring increased strength and/or reduced permeability of the hardened cement matrix.

Surface-Applied Waterproofing

Kryton's Surface-Applied Waterproofing treatments are applied to concrete to protect against the ingress of water and include the Krystol T1® & T2® Waterproofing System, Krystol Broadcast™ and Hydrostop™ Sealer. They provide waterproofing protection that adds long-term durability to your structure.

Construction Joints & Details

The Krystol Waterstop System is used to permanently waterproof concrete construction joints, penetrations, tie-holes and control joints. The Krystol Waterstop System has been tested and proven to outperform other waterstops. Kryton is the only integral waterproofing company that offers fully integrated concrete waterproofing solutions.

The Krystol Waterstop System is comprised of Krystol Waterstop Grout™, Krystol Waterstop Treatment™, Krytonite™ Swelling Waterstop and Kryton's Crack Inducing Waterstop. These products are used in a variety of ways to waterproof all construction joints and details found in concrete construction.

Concrete Repair

Kryton's Concrete Repair products are specially designed to resurface, waterproof and repair leaking cracks, penetrations, tie-holes and defective concrete from the positive or negative side of the water pressure. The product line includes Krystol Plug™, Krystol Repair Grout™ and Krystol T1®, which can be used together to form the Krystol Leak Repair System, as well as Krystol Bari-Cote™.

Kryton's Concrete Repair products are 100% compatible with the entire line of Krystol products. They can be used in concrete that was built yesterday or structures needing waterproofing repair after decades of service.

THE MOST EFFECTIVE CONCRETE WATERPROOFING AND DURABILITY ENHANCING SOLUTIONS IN THE WORLD.

Kryton International Inc. is the inventor of the crystalline waterproofing admixture and has been waterproofing concrete structures with its proprietary Krystol® technology since 1973. It has won awards for innovation, manufacturing, best place to work and entrepreneurial awards. In 2017, Kryton acquired Cementec Industries and is now distributing Hard-Cem®, an integral (not surface-applied) concrete hardener for increased abrasive and erosive wear resistance of ready-mix concrete, precast concrete and shotcrete. Kryton is now the only manufacturer of Silica Fume products in Western Canada. It is an active member of the American Concrete Institute, International Concrete Repair Institute, American Shotcrete Association and many other thought-leading organizations. Kryton exports its products to over 50 countries.

Kryton headquarters are in Canada with 7 regional offices in China, India, Mexico, Singapore, UAE, USA and UK. Our solutions are sold by over 50 distributors worldwide. To find the Kryton distributor nearest you, visit: **www.kryton.com**

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Email: info@kryton.com

KRYTON®

SMART CONCRETE®

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INCREASE THE VALUE OF YOUR PRECAST CONCRETE

With Krystol Internal Membrane™ (KIM®) Concrete Waterproofing Admixture

SMART CONCRETE®

WATERPROOFING SOLUTIONS FOR PRECAST CONCRETE

KRYSTOL INTERNAL MEMBRANE™ (**KIM®**)



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

KIM lowers the permeability of concrete and gives it an ability to self-seal. By stopping the transmission of water through concrete, the admixture protects against chemical attack and corrosion of reinforcing steel, which enhances durability and longevity of concrete.

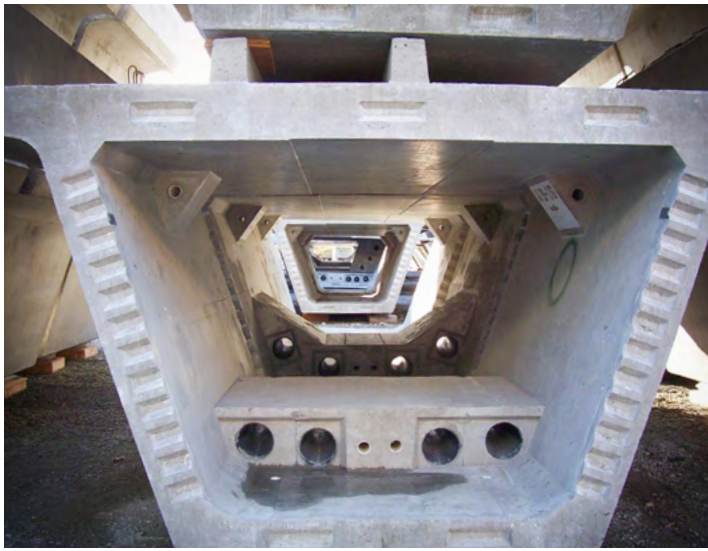
Adding KIM to precast concrete adds value by permanently waterproofing the concrete - even after cracks develop - and by increasing longevity of the precast components.

HOW KIM WORKS

KIM contains self-sealing Krystol® technology. When added to concrete, Krystol chemically reacts with water and un-hydrated cement particles. This reaction forms 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 WORLD OF **APPLICATIONS**



KIM is recommended for all precast concrete structures where long-term waterproofing and water containment is needed. It is also used to protect concrete from chemical attack and prevent corrosion of reinforcing steel. KIM can add value to:

- Box culverts
- Cable and drain trenches
- Catch basins
- Concrete pipes
- Highway barriers & parking curbs
- Headwalls
- Lawn basins
- Oil interceptor chambers
- Perimeter drains
- Vaults & chambers

MANUKAU POLICE HUB TUNNEL, NEW ZEALAND

New Zealand's Manukau Police Hub needed an underground tunnel to connect to the adjacent courthouse. The new tunnel would also include a full basement development with cells to hold the overflow prisoners. It was determined that the tunnel would be built out of fifty precast box culverts with the most sound structural integrity in mind. The construction team recommended that Kryton's Krystol Internal Membrane (KIM) was the best waterproofing choice based on performance and pricing. All fifty of the precast box culvert segments contain KIM, ensuring that they are permanently protected from water ingress from the inside out.



ADDED VALUE TO PRECAST CONCRETE

1. **Reduces permeability** – Lowers water penetration by reducing permeability of the concrete by 50-90%, even under extreme hydrostatic pressure.
2. **Self-seals cracks** – KIM activates in the presence of moisture to seal micro-cracks that develop over the life-span of the structure.
3. **Environment-friendly** - Safe for potable water (certified to NSF/ANSI std. 61) and non-toxic.
4. **Protects reinforcing steel** – Prevents the penetration of waterborne contaminants and chloride-laden liquids that cause the corrosion of reinforcing steel.
5. **Reduces shrinkage and cracking** during the plastic and curing stages, increasing quality and longevity of concrete.
6. **Resists freeze-thaw** – Mitigates the effect of expansion and contraction of freezing and thawing within concrete.



KIM IN THE FIELD



"The KIM system is easy to use, requires very little labor and we are responding to municipal requirements that won't allow tar based systems to be put below ground."

SPS Septic,
Georgia, United States



"We use it (KIM) in our septic tanks as a precaution to prevent water from penetrating or escaping the tank through any cracks that may occur during the manufacture process or in the future while in the ground from any settling."

Bode's Precast Septic Tanks,
Washington, United States

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CONSTRUCTION & REPAIR OF CONCRETE TUNNELS

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CONSTRUCT WATERTIGHT

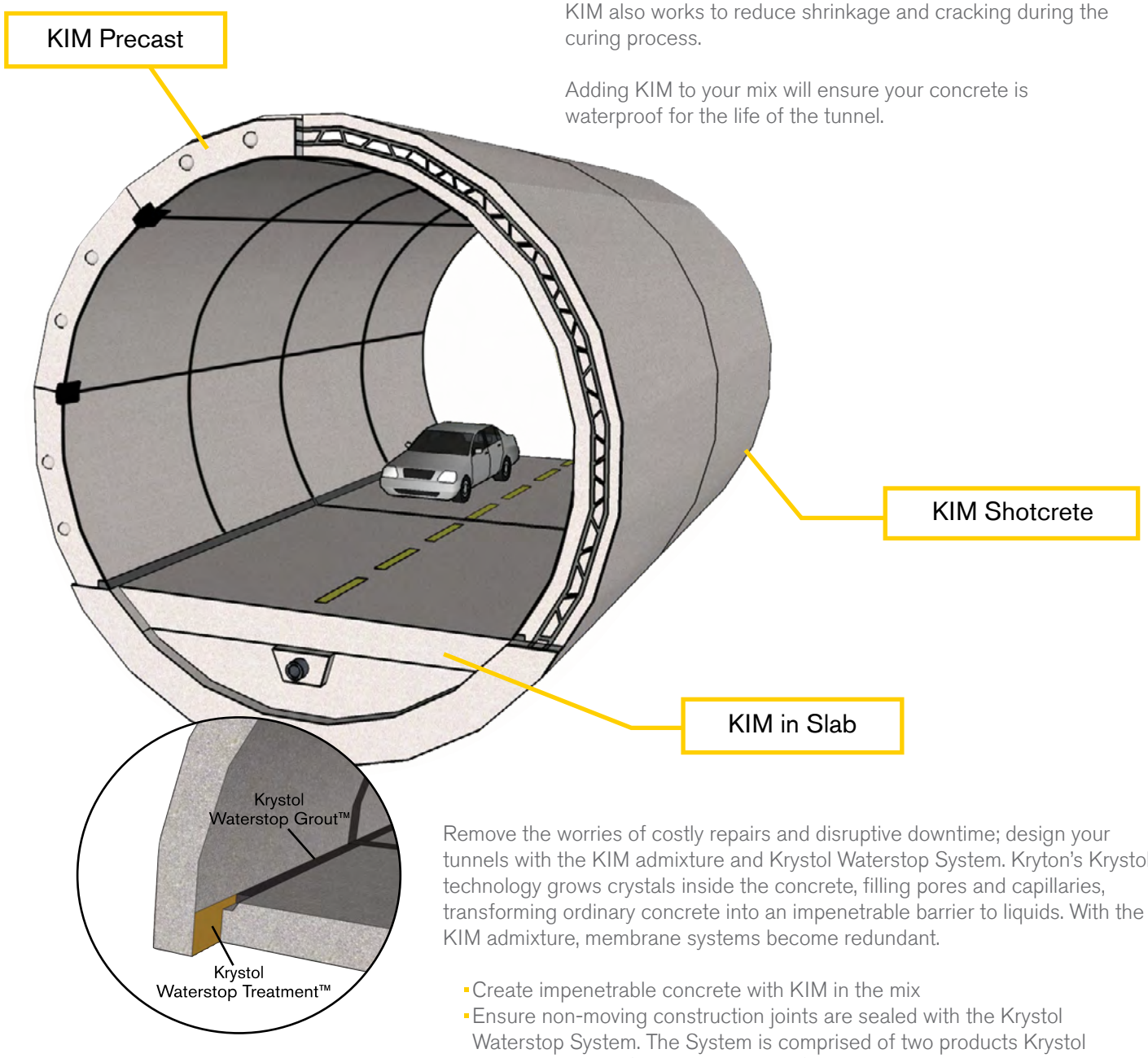
TUNNELS THAT LAST

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.

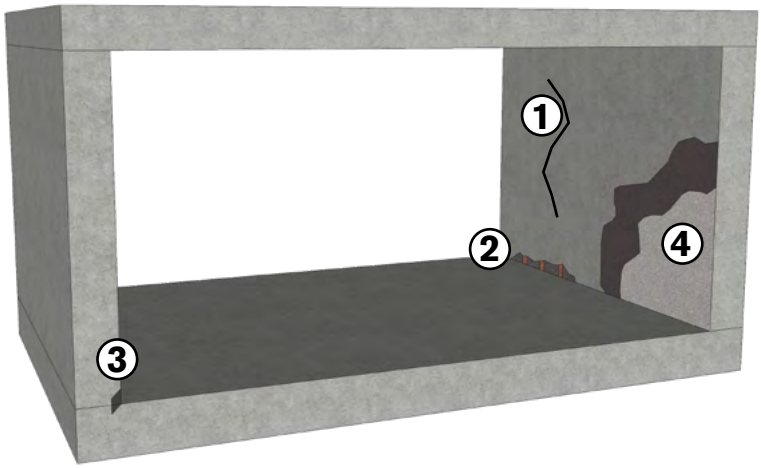
- Create impenetrable concrete with KIM in the mix
- Ensure non-moving construction joints are sealed with the Krystol Waterstop System. The System is comprised of two products Krystol Waterstop Grout (Internal or External) and Krystol Waterstop Treatment.

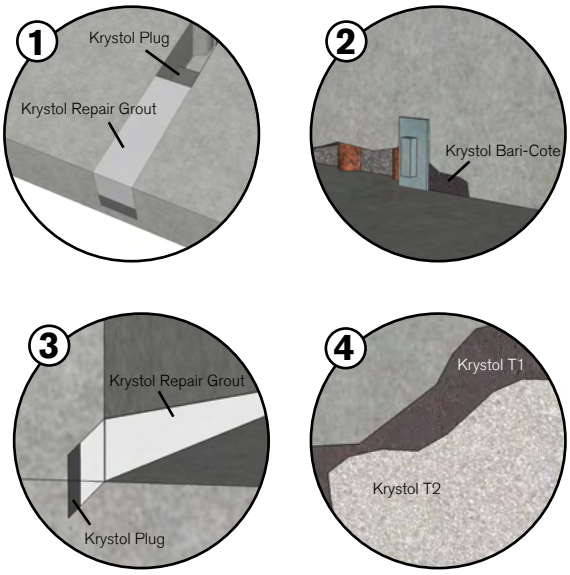
REPAIR AND WATERPROOF

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.

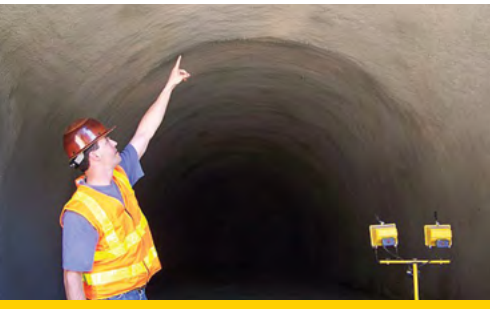
SOLUTION

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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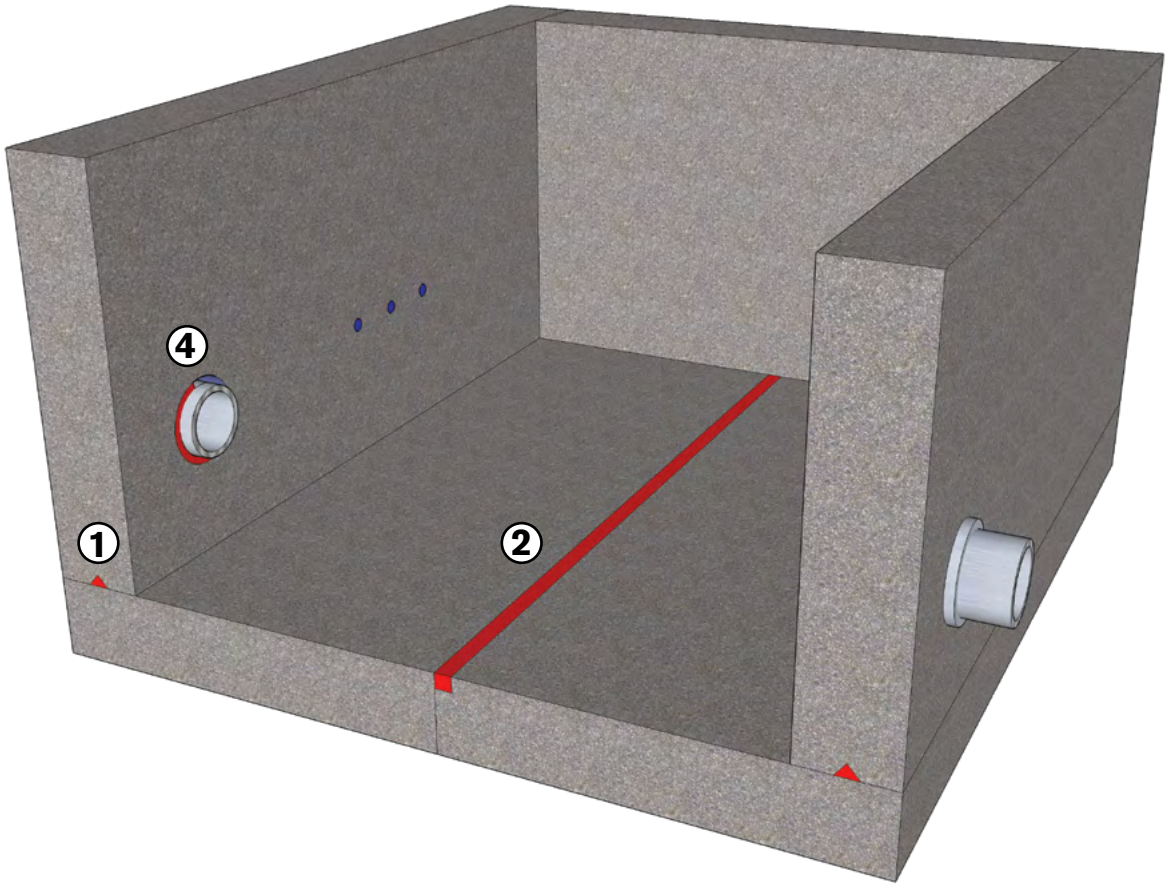
CONSTRUCT WATERTIGHT

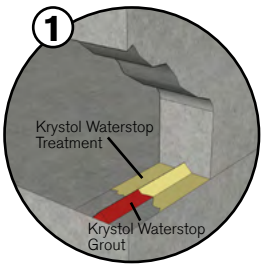
STRUCTURES

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.

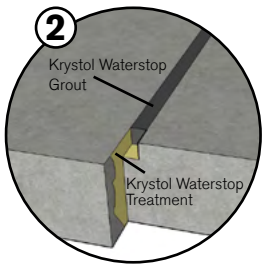
Waterproofing is built right into the concrete, eliminating the need for membranes. Kryton's Krystol® technology provides excellent resistance to harmful caustic effects of contact with sewage, wastewater and waterborne chemicals such as sulphates, chlorides and acids.

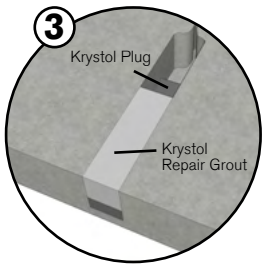
- Transform walls and slabs into impenetrable barriers using KIM or Krystol Broadcast™
- Create watertight construction joints and pipe penetrations using the Krystol Waterstop System



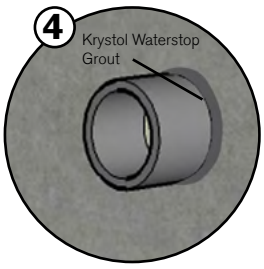


Ensure watertight construction joints with the Krystol Waterstop System





Repair leaking cracks with the Krystol Leak Repair System



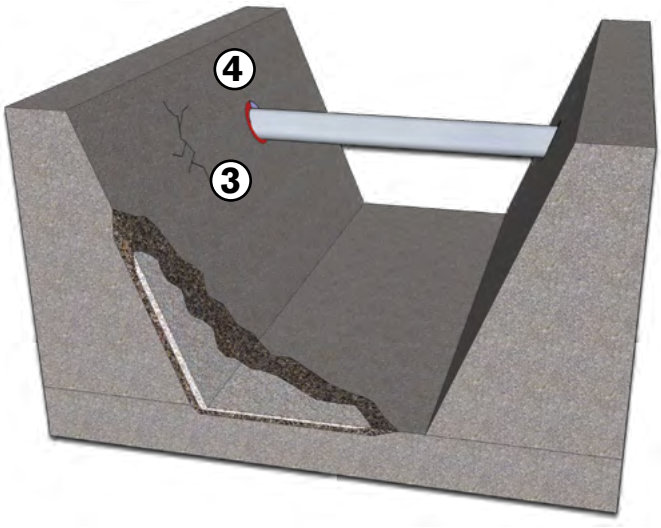
Prevent leaks at pipe penetrations with Krystol products

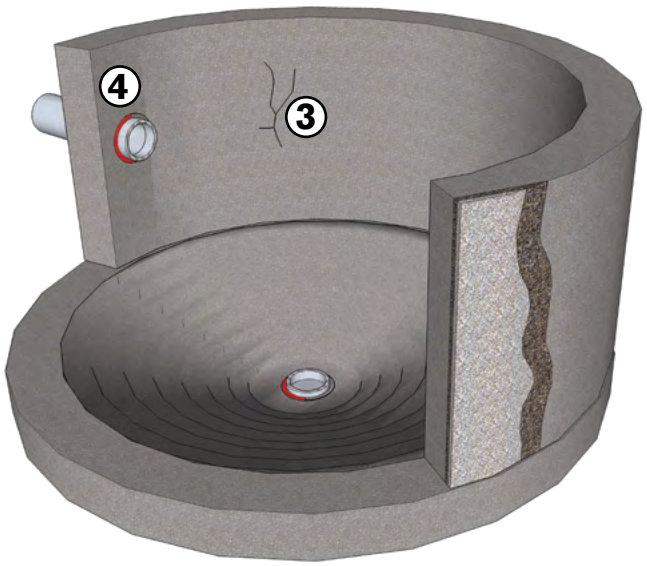
REPAIR AND WATERPROOF

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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The Science of Krystol® Technology

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The Science of Krystol Technology

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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.

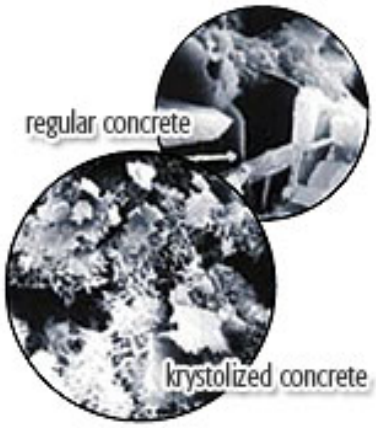
This is significantly different from silicate-based products that react with compounds in the concrete such as calcium hydroxide or free lime. The reaction binds such a treatment into an insoluble solid and hopefully blocks the pores. These products quickly become completely bound in place and therefore 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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Silica Fume and KIM®

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Silica Fume and KIM

When concrete producers want to modify the properties of concrete, supplemental cementing materials (SCM'S) can be used to achieve the intended goal. These materials are added to the concrete at the time of batching and are typically a replacement for a portion of the Portland cement. Silica Fume is a very common SCM that is frequently used to increase the strength and durability of a concrete structure. Used in the right proportion it can also reduce the overall cost of the concrete.

Even though silica fume densifies concrete, it is not a waterproofer. Under hydro-static pressure, other forms of waterproofing are required. This article explains the technical nature of silica fume and its compatibility with Kryton's KIM admixture for completely waterproof concrete.

Silica Fume (Micro Silica) is a by-product from the manufacture of ferro-silicon alloys and silicon metal. It results from the reduction of high purity quartz with coal in electric arc furnaces. Silica Fume contains 85% to 98% silicon dioxide and has an average particles size that is 100 times smaller than cement particles. They are extremely fine spherical glassy particles.

Owing to the fineness and the high glass content, concentrated silica fume makes an efficient pozzolanic material[1]. The high specific surface of condensed silica fume results in increased water demand when the material is incorporated into concrete. Silica Fume, used as a supplementary cementitious material, increases compressive strength and densifies concrete.

Despite low initial permeability, silica fume is not without limitations. The use of silica fume in concrete shows a tendency for plastic shrinkage[2], drying shrinkage[3] and cracking resulting in water penetration and corrosion of reinforcing steel. This increased densification of the concrete often creates an illusion of waterproofing capability. In actuality the use of silica fume will accelerate the deterioration process when cracking occurs.

KIM admixture relies on Kryton's Krystol® technology to waterproof concrete. Krystol is a blend of proprietary chemicals containing hydration promoting materials that create vast amounts of crystals within the pores and capillaries of the concrete matrix. KIM decreases water demand, increases compressive strength, mitigates shrinkage cracking and provides permanent waterproofing.



KIM reduces the common cracking effect of Silica Fume concrete

- KIM reduces volume of bleeding per hour while increasing the hours in which bleeding occurs without allowing the surface area to dry prematurely due to evaporation.
- KIM lowers the heat of hydration resulting in a lower temperature during the concrete's natural hydration process.

The above factors allow for a reduction in shrinkage of the concrete during the hydration process. This reduction is a direct contribution to reduced cracking within the concrete structure.

Due to the inherent nature of concrete, cracking can also be expected after the initial shrinkage has become irrelevant. In denser silica fume, concrete the amount of cracking over a period of time is often greater. Water then penetrates through the cracks. This in turn leads to the corrosion of reinforcing steel and an accelerated deterioration of the concrete. KIM admixture's ability to self-seal micro cracking is a distinct advantage. Even the most dense silica fume concrete cannot stop water penetration through micro-cracks.
When a micro-crack occurs in a Silica Fume/KIM mix concrete, and water begins to penetrate the structure, KIM will immediately react with the un-hydrated cement particles and the water – causing crystals to grow throughout the crack. This will effectively seal the cracked area and protect the reinforcing steel from the corrosion process.



Silica Fume Powder.

The use of KIM has been proven in many countries to be the most effective method of waterproofing and protecting reinforcing steel against

- Embedded Metal Corrosion
- Corrosion-Induced Cracking And Spalling
- Dissimilar Metal Corrosion
- Post-Tension Strand Corrosion
- Structural Steel Corrosion

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As an added advantage the use of KIM provides protection against

- Reductions in Structural Capacity
- Chloride Penetration
- Cast-In Chlorides
- Carbonization
- Exposure to Aggressive Chemicals
- Freeze-Thaw Disintegration
- Alkali-Aggregate Reactions
- Sulfate Attack
- Problems Resulting From Drying Shrinkage
- Moisture Transmission
- Moisture Content Volume Change
- Damage Caused by Thermal Movement Cracks
- Hydrostatic Pressure

In instances where Silica Fume is required, KIM may be used to provide an excellent method of increasing concrete density, quality, compressive strength, appearance and structural life, while effectively reducing the limitations of Silica Fume.

[1] A Pozzolanic Material is a material that doesn't have cementitious capabilities by itself but will form cementing compounds together with water and calcium hydroxide.

[2] Plastic shrinkage is a result of the rate of evaporation exceeding the bleed rate causing the surface area to crack.

[3] Drying shrinkage is a result of contraction of the concrete as it dries. An increased water content of the freshly mixed concrete will increase drying shrinkage.

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10 Reasons to Choose KIM Admixture Over Waterproofing Membrane Systems

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10 Reasons to Choose KIM Admixture Over Waterproofing Membrane Systems

Concrete is a porous material which has the ability to absorb water and water-borne contaminants. Leaving the concrete exposed to the elements causes deterioration, and reduces the durability and lifetime of the structure.

So, to protect your structure and ensure it has a long, serviceable life, you have to waterproof the concrete. The question is how?

There are two main ways to classify concrete waterproofing systems based on their application method: surface-applied concrete waterproofing systems (i.e. coatings, sheet membranes, expanding clays) and integral systems (from within the concrete itself). Although advancements have been made in surface-applied systems such as sheet membranes, the failures and limitations of these systems are still all too common and costly.

It's becoming clear to many leaders involved in the construction industry that waterproofing concrete from the inside out is the best choice. Commonly called integral systems, these are densifiers, water repellents and reactive/crystalline products that are added to new concrete at the batching plant or on-site and react chemically within the concrete.

Some integral systems simply increase the density of the concrete or increase its ability to repel water. These admixtures only "dampproof" the concrete, rather than waterproof it. But resisting liquid under hydrostatic pressure calls for a crystalline admixture made up of a distinctive blend of cementitious and proprietary chemicals – specially formulated by Kryton.

Kryton's KIM® – Krystol Internal Membrane™ – actually uses available water in a chemical reaction within the concrete to form crystals until all pores are blocked and no water can penetrate the concrete.



Here are 10 reasons why Kryton's KIM admixture should be your number one choice:

1. KIM eliminates the complications of blindsided waterproofing applications. KIM works within the concrete matrix so you do not have to over-excavate for membrane placement or risk membrane debonding from opposite-side water pressure.

2. Membranes are usually inaccessible for repairs after installation, but KIM-treated concrete contains chemicals that lie dormant within the concrete structure. If a concrete crack forms, the influx of water causes more crystals to grow, re-blocking the passage against water and water-borne contaminants.
3. Using the KIM admixture system speeds up the construction schedule and decreases labour costs. KIM combines the waterproofing step with the placing of concrete which means there is no labor-intensive, costly and time-consuming surface preparation, installation, sealing and protecting.

4. KIM will decrease your maintenance costs and increase the durability of your building. Because the crystals grow throughout the concrete, the waterproofing is impervious to physical damage and deterioration. It is permanent.



5. Placing KIM-treated concrete is as easy as placing regular concrete. Unlike installing membranes – which calls for careful finishing, temperature control, clean and dry concrete, and dependable surface adhesion – good quality placing, finishing and curing are all that is needed.

6. Avoid costly application mistakes. Even the simplest membrane systems require some level of skilled application…and even the most dedicated tradesperson can make mistakes when it comes to applying them. KIM is not subject to stringent workmanship requirements. In fact, it requires no application labor at all.

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7. KIM-treated concrete lasts, unlike membranes, which are at their best the day they are applied. It will not debond or wear away. In fact, in the presence of moisture, KIM concrete becomes stronger over time, protecting reinforcing steel from corrosion and preventing spalling, cracking and deterioration.

8. KIM concrete is great for complex architectural designs. Without concern for the limitations of membrane application, you are free to be creative – unencumbered by traditional limitations of curved surfaces, corners and concrete finishing.

9. KIM admixture requires no surface preparation. It does not require adhesives or smooth surfaces and can be placed in damp/wet conditions. In fact, a saturated surface is one of the few preparation requirements of the surface applied system.

And the number 10 reason to use Krystol Internal Membrane (KIM)? It's a green solution! Not only is it best for your job site, it's best for the earth.

10. KIM-treated concrete is environmentally friendly and sustainable, unlike membranes that are made from petroleum or other environmentally harmful materials. KIM concrete is LEED friendly, contains no volatile organic compounds (VOCs) and when the time comes for demolition, KIM concrete can be completely recycled.

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Do Blind-Sided Applications Have Your Back To The Wall?

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Do Blind-Sided Applications Have Your Back To The Wall?

Traditional waterproofing methods encourage the use of positive-side waterproofing during construction. However, this requires access to the outside wall of the concrete structure. When access is restricted, blind or negative-side applications are often necessary. Unlike old-fashioned external membranes, which rely on an additional hurdle to shield the concrete from moisture, Krystol® actually transforms the concrete into a water-resistant barrier.

That's because Krystol becomes an integral part of the concrete matrix when applied to existing concrete or added to the mix at time of batching.



Krystol waterproofing technology eliminates the need to access the exterior surface of the structure.

Don't Get Blind-Sided By Space Limitations – Avoid Applications Altogether

An innovative technology is changing the way concrete structures are waterproofed and repaired. Whether your foundation needs to be damp proof or all out water proofed against hydrostatic pressure, "Integral Crystalline Waterproofing (ICW)" provides a quick and cost-saving alternative to traditional membranes. Now you can eliminate the challenges associated with blind-walls and avoid application techniques altogether during the planning stages and during construction – whether positive-side or negative-side.

Challenged For Space And Time?

At any time before, during or after the construction of a below-grade concrete foundation, "Integral Crystalline Waterproofing (ICW)" can solve the problem quickly and easily. Manufacturers such as Kryton International Inc, in B.C. Canada have developed concrete admixtures and cementitious surface treatments that stop water intrusion from any direction. Simply add a crystalline waterproofing admixture at the batch plant or on site – no installation is required. With the waterproofing admixture mixed right in with the concrete, a larger building footprint can also be achieved.

Unlike traditional membranes, which are subject to deterioration and abrasion from the day they are applied, integral crystalline waterproofing systems permanently become a part of the concrete matrix by reacting with water to grow long, narrow crystals to fill the pores and capillaries of the concrete mass. Crystalline surface treatments can also be brush-applied on the inside wall after the concrete pour to solve your waterproofing challenge.

Build All The Way To The Property Line

External waterproofing membranes require room to make the application on the outside of a structure. Replace external membranes with a crystalline waterproofing admixture, such as KIM® (Krystol Internal Membrane™) and you have the flexibility to design a larger footprint – maximizing space and getting the most out of your property.

Backfill Sooner

Don't waste time standing around while contractors apply external membranes. Crystalline technology allows you to expedite construction schedules by backfilling sooner. In addition, the best manufacturer's crystalline products are impervious to surface abrasion, wear and tear so there is no risk of tearing and puncturing a membrane system when it comes time to backfill.



Kryton's KIM admixture can be added at the job site

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Lower The Cost Of Labor And Materials

By eliminating external membranes you also save on the cost of labor and materials that would normally be involved with such a system. In addition, even the best applicators make mistakes when they are tired, overworked or underpaid. Reduce the risk of human error by eliminating the need for application. Avoid the headaches and wasted time & money caused by insufficient seam coverage, poor surface preparation and inadequate adhesion.

Reduce Future Maintenance And Water Problems

The best crystalline products become part of the concrete matrix. Unlike traditional external membranes, true crystalline waterproofing systems are permanent and do not require replacement. In addition, the leading systems have the unique ability to self-seal hairline cracks that inevitably occur over the life of a structure - saving time, money and aggravation years into the future.

HOW DO I KNOW WHICH BRAND IS BEST?

Once you have decided to go with crystalline waterproofing, you are faced with a choice of products from competing manufacturers. Choosing the best one can be problematic.

The literature of one product reads very much the same as another. One must be careful not to confuse crystalline waterproofing products with products that are simply concrete densifiers or pore blockers. Watch also for products that claim to grow crystals but really only crystallize as they dry. Such products do not grow through the concrete, nor do they reactivate in the presence of water to fill cracks.

Choosing a hydrophilic waterproofing system rather than a hydrophobic system is critical to the quality of crystalline-treated concrete. Hydrophilic chemicals absorb water to create crystals that serve to block the pores and capillaries of concrete – more water equals more crystals, until no additional water can penetrate.

Silicate-based materials on the other hand form a type of hydrophobic viscous gel that repels water. They are unable to penetrate past the surface and are prone to wear and eventual deterioration. Products that contain silicates, stearates, or talc are temporary waterproofers at best, so manufacturers should offer long-term warranties and they should be able to state that their products are not based on these chemicals.

With all systems in construction, good communication and co-ordination between the manufacturer, specifier and contractor are paramount for total success.



Integral crystalline waterproofing also withstands high hydrostatic pressure.

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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.

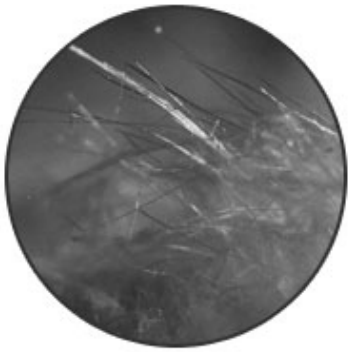
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Krystol® VS Silicate-based Technology

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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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