



# Krytol Internal Membrane™ (KIM®)

(Waterproofing Admixture for Concrete)

## DESCRIPTION

Krytol Internal Membrane (KIM) is a hydrophilic crystalline waterproofing admixture in dry powder form. KIM is used in place of externally applied surface membranes to protect concrete structures against moisture transmission, chemical attack and corrosion of reinforcing steel.

When combined with fresh concrete, Kryton's unique and proven Krytol® technology reacts with un-hydrated cement particles to form millions of needle-like crystals. Over a period of weeks and months, these crystals grow, filling the naturally occurring pores and micro-cracks in concrete, and permanently blocking the pathways for water and waterborne contaminants. Later, if cracks form due to settling or shrinkage, incoming water triggers the crystallization process and additional crystals form, filling cracks and ensuring that the structure's waterproofing barrier is maintained and protected.

In addition to filling the pores and capillaries of the concrete matrix with crystals, KIM enhances the natural hydration process by intensifying and prolonging the hydration of the cementing materials. This reduces the size and number of cracks and capillary pores within the concrete matrix, making it dramatically less porous, and improving strength and durability characteristics.

## FEATURES

- KIM is a permeability reducing admixture for hydrostatic conditions (PRAH)
- Replaces unreliable exterior membranes, liners and coatings
- Easily added directly to ready-mix truck or at batch plant
- Self-seals hairline cracks up to 0.5 mm (0.02 in.)
- Reactivates in the presence of moisture
- Effective against hydrostatic pressure up to 140 m (460 ft.) of head
- Waterproofs from any direction (i.e. positive or negative side)
- Impervious to physical damage and deterioration
- Safe for contact with potable water, certified by NSF to NSF/ANSI Standard 61
- Reduces concrete shrinkage and cracking
- Provides excellent resistance to waterborne chemicals such as sulfates, chlorides, and acids
- Compatible with self-compacting concrete (SCC)

## KEY BENEFITS

- Permanently waterproofs concrete
- Protects concrete and reinforcement from harsh environments
- Increases the durability and lifespan of concrete
- Lowers the cost of waterproofing by up to 40%
- Significant reduction to your construction schedule
- Reduces the cost of maintenance and repairs
- Increases revenues with a larger building footprint
- Essential for blind-wall and shotcrete applications
- Concrete Waterproofing Admixture



### RECOMMENDED USES

Use KIM to provide permanent protection for all concrete that will be subject to water pressure, 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
- Water containment reservoirs, water treatment tanks, sewage and manholes
- Traffic tunnels, below grade pipelines and subway tunnels
- Bridges, dams and highway infrastructure
- Concrete homes including basements, foundations, swimming pools, decks, bathrooms, garages and exteriors
- Properly designed roof tops and plaza decks

### PHYSICAL PROPERTIES

Appearance	Light gray powder
Particle size (μ)	40-150
Bulk density g/cm <sup>3</sup> (lb./cu. ft)	~1.4 (88)
Specific gravity	~2.8
Compressive Strength	No change or slight increase

### PLASTIC PROPERTIES

Plastic Properties	Test Reference	Control Concrete	KIM-HS Concrete (2% wt/wt Cement)
Water/Cement Ratio		0.49	0.47
Slump (mm) - 0 min	BS 12350-2	70	65
Slump (mm) - 30 min	BS 12350-2	40	45
Plastic Density (kg/m <sup>3</sup> )	BS EN 12350-6	2410	2420
Air Content (%)	BS EN 12350-7	1.0	0.9

*British Board of Agrément (2005), Certificate No 05/4217*

### WORKABILITY

#### ASTM C143 – Standard Test Method for Slump of Hydraulic Cement Concrete

KIM enhances the workability and plastic properties of concrete in many ways. KIM provides plasticizing effects at low and high slump requirements and provides better flow and consolidation even at low slumps. KIM works very well with superplasticizers to achieve high slumps for long pumping distances and unique applications without segregation.

*HBT Agra Ltd., 1993*



### HARDENED PROPERTIES

Hardened Properties	Test Reference	KIM-HS Performance
Coefficient of Water Permeability	Taywood/ Valenta	Reduced 70%
Drying Shrinkage	BS 1881-5	Reduced 25%
Freeze/Thaw Expansion	BS 5075-2	Reduced 87%
Compressive Strength (28 Days)	BS EN 12390-3	Increased 8%
Flexural Strength (28 Days)	BS EN 12390-5	Increased 7%
Modulus of Elasticity	BS 1881-122	Increased 16%

*British Board of Agrément (2005), Certificate No 05/4217*

### PERMEABILITY

#### **DIN 1048: Part 5 - Permeability of Hardened Concrete**

Concrete specimens containing KIM (@ 2% cementing materials) were cast and aged for 28 days. The specimens were then subjected to hydrostatic pressure of 500 KPa (72.5 psi) for a period of 72 hours. This pressure is equal to 51 m (167 ft.) of water head pressure. Maximum penetration of less than 3 mm (0.125 in.). The specimens exhibited no leakage or dampness. *Al-Fattaim Tarmac Laboratories, 2002*

Concrete specimens containing KIM (@ 2% cementing materials) and a 0.40 water to cement ratio were cast and aged for 28 days. The specimens were then subjected to hydrostatic pressure of 500 KPa (72.5 psi) for a period of 72 hours. This pressure is equal to 51 m (167 ft.) of water head pressure. KIM performed 10x better than the control, allowing only 3.7 mm (0.146 inches) of water to penetrate the sample.

*Kuwait University, Civil Engineering Testing Center, 2004*

#### **ICBO/ICC Water Percolation Test (Modified ASTM D4068 annex A2)**

Concrete specimens containing KIM (@ 2% cementing materials) were cast and aged for 28 days. The specimens were then subjected to hydrostatic pressure imposed by water columns 1.22 m (48 in.) in height. The specimens met the acceptance criteria, which is no water passing through the specimens and maximum 12.5 mm (0.5 in.) of water drop in the columns after 48 hours.

*Inspection Concepts California, 1993*

#### **CRD C48 - 92 – USACE Standard Test Method for Water Permeability of Concrete**

Six concrete specimens containing KIM (@ 2% cementing materials) were cast and aged for 28 days. The specimens were then subjected on one side to hydrostatic pressure of 1.38 MPa (200 psi) for a period of 14 days. This pressure is equal to 140 m (460 ft.) of water head pressure. There was no leakage through any of the specimens.

*UBC/Kryton, 2003*

A similar test was conducted by AGRA Earth and Environmental in 1995, which compared reference concrete mixes of high strength concrete (50-60 MPa) with and without the addition of KIM. Results of permeability testing show that even for these mixes, KIM achieved 57% and 75% reductions in permeability over the reference mixes.

*AGRA Earth & Environmental Ltd., 1995*



### RAPID CHLORIDE PERMEABILITY

#### **ASTM C1202-97 – Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration & AASHTO T277-89 – Rapid Determination of the Chloride Permeability of Concrete**

Commonly referred to as the Rapid Chloride Permeability (RCP) test, the test determines the penetration of chloride-laden water into concrete by measuring the electrical conductance (in coulombs) of the specimens. The RCP test is widely accepted as a test for concrete permeability. Lower values reveal less chloride penetration and thus lower permeability. Concrete specimens containing KIM (@ 2% cementing materials) were tested on separate occasions by The Port Authority of New York & New Jersey and by AMEC Earth and Environmental. Chloride permeability was shown to be reduced by 45% in both tests.

*The Port Authority of New York & New Jersey, 1998*

*AMEC Earth and Environmental, 2000*

### CORROSION RESISTANCE

A long-term corrosion study was conducted to evaluate the durability of reinforced concrete specimens containing various pozzolans and chemical admixtures exposed to a marine environment. Test panels were exposed in the tidal zone in Honolulu Harbor for a period of 9-10 years from 2002 to 2012. During exposure, the panels were monitored for half-cell potential, chloride concentrations, cracking and visible signs of corrosion.

Kryton KIM performed well during the field exposure, with low half-cell readings and no visible signs of corrosion after 10 years exposure. This report proves that KIM is effective at preventing corrosion over the long term under real world conditions.

*University of Hawaii at Manoa, 2012*

### SELF SEALING PERFORMANCE

The addition of KIM will result in a considerably higher degree of automatic correction (self-sealing). Without the addition of KIM a crack in the concrete =0.3mm has automatically healed itself after 1200 hours in actual test situations. With the addition of KIM, even a crack width of 0.6 mm is automatically corrected.

*The Cement and Concrete Institute, Sweden, 2003*

The addition of Krystol Internal Membrane (KIM) indicates an enhancement in the concrete's natural ability to self-seal

*British Columbia Institute of Technology, 2012*

### SULFATE RESISTANCE

Krystol treated concrete specimens exhibited excellent sulfate resistance when tested in accordance with US Bureau of Reclamation guidelines. Specimens were alternately soaked in sodium sulfate solution and oven dried. The specimens were tested for strength loss and weight change. The Krystol treated specimens dramatically outperformed both the control specimens and the competitor's specimens.

*R. M. Hardy and Associates, 1976*

The lower permeability of KIM-HS concrete will reduce the ingress of sulfates.

*British Board of Agreement (BBA) Agrément certificate No 05/4217, 2005*

### COMPRESSIVE STRENGTH

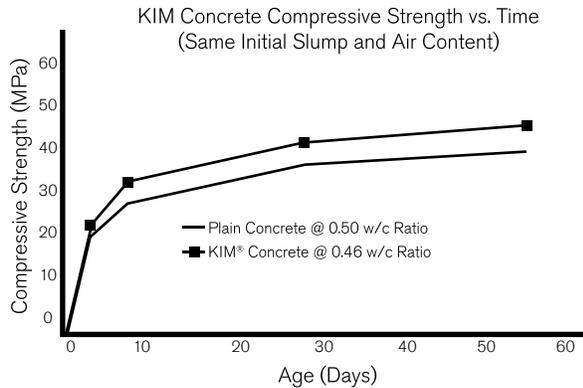
#### **ASTM C494: Type D, CAN/CSA A266.2-M: Type WR – Chemical Admixtures for Concrete**

Concrete specimens containing KIM (@ 2% cementing materials) displayed increases in compressive strength of 12% to 19% at ages 3, 7, 28 and 56 days compared to control specimens of equal slump and air. This exceeds the CAN/CSA A266.2-M requirements for a Type WR water reducing set-retarding admixture.

*HBT Agra Ltd., 1993*



BE SURE, BE KRYTON.



Note: Do not assume strength increase will occur. Plan for no change to strength

## SHRINKAGE AND CRACK REDUCTION

### AS 1012.13-1992 – Determination of the drying shrinkage of concrete for samples prepared in the field or in the laboratory

Results have clearly shown drying shrinkage reduction and resulting crack reduction in KIM modified concrete. Evaluation of KIM concrete showed a reduction in drying shrinkage of 20-25%.

*Materials Testing & Environmental Services of Boral Resources (NSW) Pty. Ltd.*

### ASTM C341/C341M-06 – Standard Practice for Length Change of Cast, Drilled, or Sawed Specimens of Hydraulic-Cement Mortar and Concrete

Restrained shrinkage cracking in KIM concrete with similar slump, air content and cement content is less than plain concrete by 80%.

*AMEC Earth & Environmental Ltd.*

### ASTM C1579 – 06 Standard – Restrained Shrinkage Cracking Study

The shrinkage cracking test results indicate that Krystol Internal Membrane (KIM) admixtures can reduce plastic shrinkage cracks in younger concrete. Evaluation of KIM concrete demonstrate 53% crack reduction over control.

*British Columbia Institute of Technology, 2012*

NOTE: Kryton does not recommend eliminating standard shrinkage control joints. Follow ACI guidelines and Kryton's published literature for waterproofing joints

## POTABLE WATER CONTAINMENT

### NSF/ANSI Standard 61: Drinking Water System Components – Health Effects

KIM has been tested and certified safe for concrete drinking water containment by NSF International.

## CHLORIDE ION CONTENT

### DIN EN 480-10: Determination of Water Soluble Chloride Content

Concrete specimens containing KIM (@ 2% cementing materials) were tested for water soluble chlorides. KIM contains only negligible levels of chlorides (0.01 % wt/wt) and is therefore not harmful to steel reinforcement.

*Kirton Concrete Services Ltd (United Kingdom), 2010*



## APPLICATION

### **Read and distribute Application Instruction 1.11 — Instructions for Mix Design & Batch Plant through 1.22 — Instructions for Shotcrete Inspector (as applicable) before using this product.**

A pre-pour conference with the general contractor, forming contractor, finisher, concrete supplier and materials testing engineer is strongly recommended. Joints should be treated according to Application Instructions 4.11 — Waterproofing Horizontal Construction Joints (Internal Method) through 4.31 — Waterproofing Suspended Slab Joints (as applicable)— consult a Kryton Representative for help with selecting the appropriate joint detail. KIM dosed at 2% of cementing materials by weight, to a maximum dosage of 8 kg/m<sup>3</sup> (13.5 lb./cu. yd.). Dosage may be varied for specific projects in consultation with Kryton's Technical Services Department. Trial batches are required to determine actual plastic properties. Allow KIM to thoroughly mix at medium/high speed for 1 minute per cubic meter/yard in the batch and a minimum of 3 minutes. Place and finish in accordance with ACI guidelines. Proper curing is essential to achieve the performance and benefits of KIM. Cure in accordance with ACI 308.1 guidelines. Tie holes and penetrations should be treated as per Application Instruction 5.31 — Waterproofing Cracks, Holes & Joints and 5.33 — Waterproofing Pipe Penetrations (New Construction), respectively.

## LIMITATIONS

KIM is an effective waterproofing system for rigid concrete structures only and may not reliably seal cracks and joints that experience variable loading or repeated movement. Consult a Kryton representative for project specific recommendations.

## SAFETY

Read the Material Safety Data Sheet (MSDS) before using this product. For professional use only.

## PACKAGING

- 5 kg (11 lb.) resealable pails
- 25 kg (55 lb.) resealable pails
- Mixer Ready bags in custom sizes to match your mix design

## SHELF LIFE

KIM has a shelf life of 24 months for unopened pails, and 4 months for properly re-sealed pails. Mixer Ready bags have a minimum shelf life of 12 months for wrapped skids or 4 months for open skids.

## 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.