Krystol Internal Membrane™ (KIM®)

(Waterproofing Admixture for Concrete)
Product Code: K-300 (KIM-AE), K-301 (KIM-HS), K-302 (KIM-ES)

DESCRIPTION

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

When combined with fresh concrete, Kryton's unique and proven Krystol® 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 voids 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 capillary pores within the concrete matrix, making it dramatically less porous, and improving strength and durability characteristics.

FEATURES

- 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 pressure
- 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 Drinking Water System Components – Health Effects
- 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
- Increases reliability and quality control
- Lowers the cost of waterproofing by up to 40%
- Shaves weeks off the construction schedule
- Reduces the cost of maintenance and repairs
- Increases revenues with a larger building footprint

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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 rooftopps and plaza decks

PHYSICAL PROPERTIES

Appearance	Light gray powder
Particle size (µ)	40-150
Bulk density g/cm^3 (lb./cu. ft)	~1.4 (88)
Specific gravity	~2.8

PLASTIC PROPERTIES

The KIM admixture has been further optimized to meet the requirements of projects in various climate conditions. The three types of KIM include:

- **KIM-HS**: This version of KIM is used for most common applications. KIM-HS is compatible with common admixtures, such as plasticizers, accelerators, retarders and air-entrainers.
- **KIM-AE**: This version of KIM is specially designed for concrete requiring air-entrainment to resist freezing and thawing cycles. KIM-AE will increase air content by 3-5%. Adjust or remove any air-entraining admixtures accordingly.
- **KIM-ES**: This version of KIM is specially designed for use in hot climates and mass concrete. KIM-ES will prolong the slump retention of the concrete and delay the initial setting time. Adjust or remove set retarding admixtures accordingly.

All versions will typically delay the setting times of the concrete. Consult with a Kryton Technical Services Representative for the most appropriate KIM admixture for your project.

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^3)	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

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Plastic Properties	Test Reference		Control Concrete *AEA added	KIM-AE Concrete (2% wt/wt Cement)
	CAN/CSA	ASTM		
Water Demand (kg/m^3)			153	143
Slump (mm)	A23.2-5C	C143	75	80
Air Content (%)	A23.2-4C	C231	6.6	6.2
Plastic Density (kg/m^3)	A23.2-6C	C138	2312	2328
Total Bleeding (kg/m^2)		C232	0.21	0.48
Bleeding Rate (kg/m^2/hr)		C232	0.060	0.044

* Water Reducer and Air Entraining Admixture added to control.
HBT Agra Ltd., 1993

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%

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Hardened Property	Test Reference		Control Concrete *AEA added	KIM-AE Concrete
	CAN/CSA	ASTM		
Compressive Strength (MPa)	A23.2-9C	C39		
@ 24 hrs			8.4	8.0
@ 3 days			20.6	23.7
@ 7 days			28.1	33.4
@ 28 days			35.7	41.0
@ 56 days			41.6	46.7
Boiled Absorption @ 7 days (%)		C642	5.3	4.7
Permeable Void @ 7 days (%)		C642	11.7	10.7
Hardened Air Void Parameters	A23.2-17C	C457		
Air Content (%)			5.6	6.5
Specific Surface (mm^2/mm^3)			30.9	22.8
Spacing factor (µm)**			150.0	180.0

* Water Reducer and Air Entraining Admixture added to control
** Meet CAN/CSA A23.1-M90: Clause 14.3 Requirements for Spacing Factor Not exceeding 230 µm

HBT Agra Ltd., 1993

PERMEABILITY

DIN 1048: Part 5 - Permeability of Hardened Concrete

Concrete specimens containing KIM (@ 2% cmts) 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% cmts) 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% cmts) 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% cmts) 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

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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% cmts) 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

SULFATE RESISTANCE

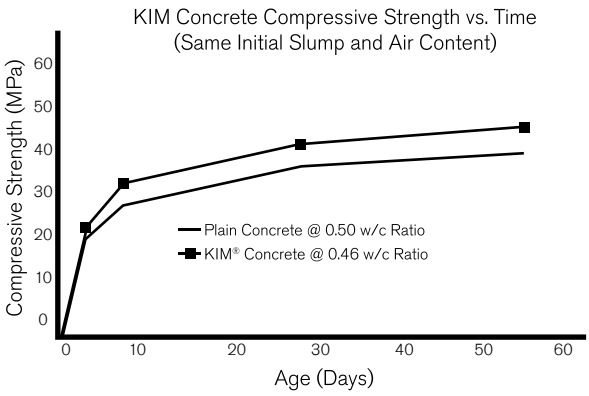
Krystol treated concrete specimens exhibited excellent sulfate resistance when tested in accordance with US Bureau of Reclamation guidelines. Specimens were alternately soaked in sodium sulfate solution and oven dried. The specimens were tested for strength loss and weight change. The Krystol treated 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% cmts) 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



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.

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

FREEZE/THAW DURABILITY

ASTM C233, CAN/CSA A266.1-M – Air Entraining Admixtures for Concrete
KIM-AE acts as an effective air-entraining admixture when evaluated against the requirements. Both plastic and hardened air contents and spacing factors allow KIM-AE concrete to maintain excellent freeze/thaw durability.
HBT Agra Ltd., 1993

New York DOT Test Method 503-3P
Concrete specimens containing KIM (@ 2% cmts) were cast and aged 28 days. The specimens were then subjected to freezing and thawing cycles in a saturated condition. No loss of weight.
Future Tech Consultants New York, 2000

POTABLE WATER CONTAINMENT

NSF/ANSI Standard 61: Drinking Water System Components – Health Effects
KIM has been tested extensively and certified 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% cmts) were tested for water soluable 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 is dosed at 2% by weight of cementitious materials (including fly ash and other supplementary cementing materials) to a maximum dosage of 8 kg/m^3 (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.

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

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. warrants that its products are free from manufacturer's defects and, when applied in accordance with the current specification and application instructions will perform as so stated in its product literature. Because methods and conditions of use are beyond the control of Kryton, no guarantee, expressed or implied can be given as to the results of application. Liability of Kryton shall be limited to replacement of materials proved defective or, at its option, refund of the purchase price of the product.

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