



At the Lab. In the Field.
By Your Side.

KIM - KRYSTOL INTERNAL MEMBRANE™

Waterproofing Admixture for Concrete

Product Codes: K-300, K-301

September 2006

QUESTIONS: 1-800-267-8280 or www.kryton.com



**CONCRETE
WATERPROOFING**

SHORT PRODUCT DESCRIPTION

Chemical admixture in dry powder form effective in creating waterproof concrete.

WHAT IS KIM?

KIM is the world's only permanent, self-sealing, corrosion-free, concrete waterproofer. KIM is a chemical admixture used for the treatment of concrete and concrete products to protect against water intrusion, leakage, cracking, chemical attack, and corrosion of reinforcing steel. KIM is a more reliable and cost-effective alternative to traditional waterproofing membranes because KIM turns the concrete itself into the membrane.

HOW DOES KIM WORK?

Adding KIM to concrete enhances the concrete's natural hydration process by intensifying and prolonging the hydration of the cementing materials. Capillary pores are reduced in both size and number. The concrete is made dramatically less porous. At the same time, KIM fills all remaining pores and capillaries with millions of long, needle-like crystals throughout the concrete mass. The resulting concrete is impermeable to the migration of water or waterborne chemicals.

When moisture is removed as the concrete dries, the active ingredients of KIM will sit dormant. Sometimes new cracks will form in concrete from drying, settling or some other cause. Water entering through these cracks will come into contact with the dormant chemicals of KIM and cause them to become active again. New crystals form and grow to shut off the water. This ability of the chemicals to sit dormant and then become active again in the presence of water, gives the treated concrete a "self-sealing" ability. The self-sealing ability of KIM is one of its best and most unique features. Self-sealing properties can save enormous repair costs.

PHYSICAL PROPERTIES

Color	Gray
Texture	Powder
Particle size	40-150 microns
Bulk density	~1.4
Water pressure resistance	140m (460ft.) head

BENEFITS

- Eliminates the need for costly waterproofing membranes, liners or coatings.
- Protects reinforcing steel from corrosion
- Reduces shrinkage and cracking
- Self-seals any hairline cracks that may occur from subsequent shrinkage, settling or shifting
- Eliminates the risk of costly repairs and damage from failed membrane systems.
- Provides excellent resistance to waterborne chemicals such as sulphates and chlorides
- Facilitates unique design options and utilization of greater property area
- Facilitates faster backfilling -saving time and money
- Diversifies product line to distinguish the concrete manufacturer from their competition

TYPICAL APPLICATIONS

KIM is recommended for all new above and below grade concrete that will benefit from waterproofing and corrosion protection.

- Foundations and retaining walls
- Potable water and wastewater containment structures
- On ground and suspended slabs, raft slabs
- Bridges and parking structures
- Tunnels and pipelines
- Pools, aquariums and water features
- Marine structures
- Architectural concrete
- Shotcrete
- Pre-cast and tilt-up
- Virtually all concrete requiring crack reduction and durability properties
- Compatible with self consolidating concrete (SCC)
- Compatible with fiber-reinforced concrete

KIM HS

This specialized version of KIM is available with reduced air-entrainment properties. KIM HS is designed for applications where freeze/thaw resistance is not required. Typically, concrete with lower air content will produce higher compressive strength results.

TECHNICAL DATA

APPLICATION INSTRUCTIONS

Kryton representation is available for on site pours and pre-pour consultation. A pre-pour conference with the general contractor, forming contractor, finisher, concrete supplier and materials testing engineer is recommended. Be sure to distribute and follow the instructions contained in Technical Bulletins 301 through 305.

PRECAUTIONS

KIM contains Portland cement and so becomes caustic when mixed with water or perspiration. Avoid contact with eyes and skin. Avoid breathing dust. See the Material Safety Data Sheet for this product. KIM will delay the setting times of concrete under most conditions. This may have an effect on stripping and finishing schedules and form pressure.

MIX DESIGN GUIDELINES

- KIM is a dry powder admixture that is added to the concrete mix at the rate of 2% by weight of the cementitious content including fly ash, to a maximum of 8kg per cubic meter (13.5 lbs / cubic yard).
- Reduce the water content by 5-10% depending on slump requirement. Water to cementitious ratio must be 0.45 or less.
- KIM will typically increase air entrainment by 2 - 6%. Adjust or remove air-entraining admixtures (AEA) accordingly. In most cases KIM eliminates the need for AEA. KIM-HS has only a minimal affect on the air entrainment.
- KIM is compatible with most water reducing admixtures and superplasticizers.
- Trial batches are highly recommended.

BATCHING AND MIXING

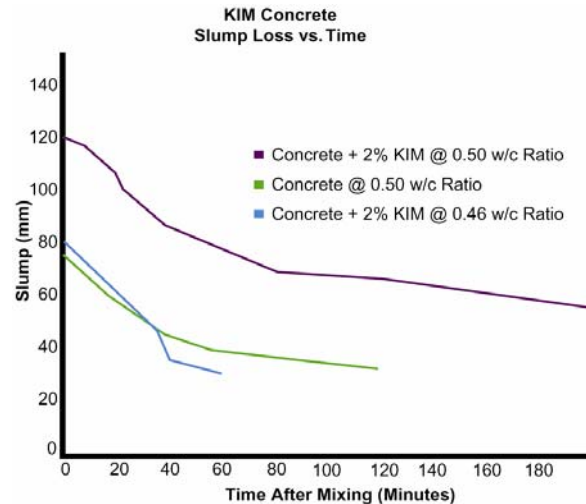
- Simply add KIM directly to the concrete mixer during batching.
- KIM can be added at any time during the batching process. However, the addition time may affect plastic properties. Trial batches are recommended.
- Allow KIM to thoroughly mix at medium/high speed for ten minutes prior to placing.
- Should superplasticizers be used, they are normally added after the addition of KIM.

PLACING AND FINISHING

- Place and finish in accordance with ACI guidelines.
- KIM improves flow, pumpability and placement properties of plastic concrete. Maximum values are achieved if the concrete mix is placed within 45 minutes from time of batching.
- After 45 minutes, concrete may experience slump loss. Adjust slump with superplasticizer following manufacturers instructions.
- Do not add water to increase slump.
- KIM treated concrete may delay the initial and final setting times of the concrete. Adjust your finishing or stripping schedule accordingly.

WORKABILITY

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. Best results within 45 minutes. *HBT Agra Ltd., 1993*

**JOINTS**

Construction joints and penetrations should be treated as described in Krystol Specification #3 *KIM Waterstop Joint Design*. This may require minor modifications to concrete forms. Shrinkage control joints should be installed to standard locations and spacing. Expansion joints should be installed following the expansion joint manufacturer's instructions.

CURING

- Cure in accordance with ACI 308.1 specifications.
- KIM greatly improves internal curing and helps reduce drying shrinkage and mass cracking. However, KIM is not a replacement for proper curing procedures. Wet cure the concrete with a fog mist spray, sprinkler or wet burlap for at least five days. Protect from rain, direct sunlight or excessive wind.

PROPERTIES OF FRESH KIM CONCRETE

Tested under auspices of HBT Agra Ltd.

Fresh Property	Test	Method	Control Concrete	Concrete with 2% KIM addition by mass of cement
	CAN/CSA	ASTM	*AEA added	
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.

Testing Services Test	Days	Result of Control Mix (Coulombs)	Result of Same Mix with KIM (coulombs)	% Reduction in Permeability
Port Authority of New York & New Jersey- Nov.9,'98 Coulomb test AASHTO T277	28 days	5358	3509	35%
	56 days	4072	2608	36%
	90 days	3048	1681	45%
AMEC Earth & Environmental Ltd. - Sep.21,'00 Shotcrete Mix Coulomb test ASTM C1202-97	28 days	1176	650	45%
	90 days	493	327	34%

Summary Reports from Independent Testing Services

TEST DATA

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 72.5 psi (500KPa) for a period of 72 hours. This pressure is equal to 167 vertical feet (51m) of water head pressure. Maximum penetration: less than 1/8th inch (<3mm). The specimens exhibited no leakage or dampness.

Al-Fattaim Tarmac Laboratories, 2002

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.

RAPID CHLORIDE PERMEABILITY

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 48 inches in height. The specimens met the acceptance criteria, which is no water passing through the specimens and maximum 0.5 inches 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 200 psi (1.38MPa) for a period of 10 days. This pressure is equal to 460 vertical feet (140m) of water head pressure. There was no leakage through any of the specimens.

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

SHRINKAGE AND CRACK REDUCTION

Results have clearly shown drying shrinkage reduction and resulting crack reduction in KIM modified concrete. Evaluation of KIM concrete against test method AS1012.13-1992 by *Materials Testing & Environmental Services of Boral Resources (NSW) Pty. Ltd.* showed a reduction in drying shrinkage of 20-25%. Restrained shrinkage cracking in KIM concrete is 80% less than plain concrete with similar slump, air content and cement content based on testing to ASTM C341 by *AMEC Earth & Environmental Ltd.*

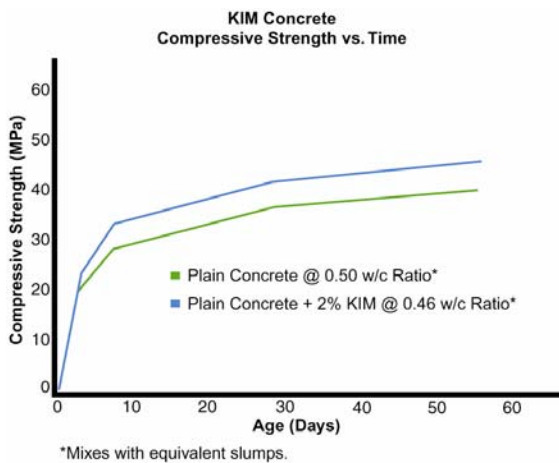
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NOTE: Kryton does not recommend eliminating standard shrinkage control joints. Follow ACI guidelines.

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*



SULPHATE & CHLORIDE RESISTANCE

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

R. M. Hardy and Associates, 1976

KIM modified concrete has been shown in coulomb testing (ASTM C1202-97 & AASHTO T277) to reduce chloride permeability by 45% compared to control specimens of equal slump and air.

*Port Authority of New York & New Jersey, 1998
AMEC Earth and Environmental, 2000*

FREEZE/THAW DURABILITY

ASTM C233, CAN/CSA A266.1-M – Air Entraining Admixtures for Concrete *HBT Agra Ltd., 1993*

KIM acts as an effective air-entraining admixture when evaluated against the requirements. Both plastic and hardened air contents and spacing factors allow KIM concrete to maintain excellent freeze/thaw durability.

New York DOT Test Method 503-3P

Concrete specimens containing KIM (@ 2% cmts) were cast and aged for 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

PROPERTIES OF HARDENED KIM CONCRETE

Tested under auspices of HBT Agra Ltd.

Hardened Property	Test	Method	Control Concrete	Concrete with 2% KIM addition by mass of cement
	CAN/CSA	ASTM	*AEA added	
Comparative Strength, MPa @ 24 hrs @ 3 days @ 7 days @ 28 days @ 56 days	A23.2-9C	C39		
			8.4	8.0
			20.6	23.7
			28.1	33.4
			35.7	41.0
			41.6	46.7
Boiled Absorption % @ 7 days		C642	5.3	4.7
Permeable Void % @ 7 days		C642	11.7	10.7
Hardened Air Voids Parameters Air Content % Specific Surface mm ² /mm ³ Spacing factor, um**	A23.2-17C	C457	5.6	6.5
			30.9	22.8
			150.0	180.0

*Water Reducer and Air Entraining Admixture added to control.

**Meets CAN/CSA A23.1-M90: Clause 14.3 Requirements for Spacing Factor Not exceeding 230 um.

POTABLE WATER CONTAINMENT

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

KIM has been tested extensively and approved for waterproofing concrete drinking water containment by NSF International, US Environmental Protection Agency, US Department of Agriculture, Health and Welfare Canada, and Bureau de Normalisation du Quebec.

PACKAGING

KIM is packaged ready-to-use in the following sizes:

- 5kg and 25kg pails
 - 10kg and 15kg mixer-ready bags
- See Technical Bulletin 310 for more information about using mixer-ready bags.

SPECIFYING

Detailed CSC and CSI formatted specifications are available on disk or by download from our website: <http://www.kryton.com>.

MATERIALS

- Permanent, self-sealing, corrosion-free, concrete waterproofing admixture in dry powder

form, which intensifies and prolongs hydration of cementing materials in concrete.

- B. Admixture shall provide air-entrainment conforming to CAN/CSA A266.1 (ASTM C233) - "Air-entraining Admixtures for Concrete."
- C. Admixture shall provide water reduction and set-retardation conforming to CAN/CSA A266.2 Type WR (ASTM C494 Type D) "Chemical admixtures for concrete."
- D. Admixture must not contain silicates, oils, chlorides, or sodium.

WARRANTY

Kryton International Inc. warrants that its products are free from manufacturers defects and, when applied in accordance with the current specification and application instructions will perform as so stated in its product literature. Waterproofing performance of the KIM Admixture System can be expected to last the lifetime of the concrete. Kryton will replace any product shown to be defective.

In addition to our standard product warranty, performance warranties are available for individual projects. Specific warranty time periods and inclusive details are provided based on project requirements and geographic region. Please refer to your Kryton representative for project specific performance warranty information.