



## CONCENTRATE

CEMENTITIOUS CRYSTALLINE

Concrete Waterproofing

### Description

Xypex is a unique chemical treatment for the waterproofing, protection and repair of concrete. XYPEX CONCENTRATE consists of Portland cement, finely graded sand and active proprietary chemicals; it is applied as a cementitious slurry to the pre-saturated surface of existing above and below-grade structures. The active chemicals diffuse into the substrate and react with moisture and the constituents of hardened concrete to cause a catalytic reaction. This reaction generates a non-soluble crystalline formation throughout the pores and capillary tracts of the concrete, as well as cracks, permanently sealing the concrete and preventing the penetration of water and other liquids from any direction, even under high hydrostatic pressure. Xypex Concentrate is also mixed in a Dry-Pac form for sealing strips at construction joints, or for the repairing of leaking cracks, faulty construction joints and other defects.

### Recommended for:

- Reservoirs
- Sewage and Water Treatment Plants
- Underground Vaults
- Secondary Containment Structures
- Foundations
- Tunnels and Subway Systems
- Swimming Pools
- Parking Structures

### Advantages

- Resists extreme hydrostatic pressure
- Becomes an integral part of the substrate
- Can seal static hairline cracks up to 0.4 mm
- Can be applied to the positive or the negative side of the concrete surface
- Allows concrete to breathe
- Highly resistant to aggressive chemicals
- Non-toxic / no VOCs
- Does not require a dry surface
- Cannot puncture, tear or come apart at the seams
- No costly surface priming or leveling prior to application
- Does not require sealing, lapping and finishing of seams at corners, edges or between membranes
- Does not require protection during backfilling or during placement of steel, wire mesh or other materials
- Less costly to apply than most other methods
- Not subject to deterioration
- Permanent
- Available in white for enhanced illumination

### Packaging

Xypex Concentrate is available in 9.1 kg pails, 27.2 kg pails and 22.7 kg bags.

### Storage

Xypex products must be stored dry at a minimum temperature of 7°C. Shelf life is one year when stored under proper conditions.

### Coverage

For normal surface conditions, the coverage rate for each Xypex coat is 0.65 - 0.8 kg/m<sup>2</sup>.

### Test Data

#### PERMEABILITY

**U.S. Army Corps of Engineers (USACE) CRD C48, "Permeability of Concrete", Pacific Testing Labs, Seattle, USA**

Two in. (51 mm) thick, 2000 psi (13.8 MPa) Xypex-treated concrete samples were pressure tested up to a 405 ft. (124 m) water head (175 psi/1.2 MPa), the limit of the testing apparatus. While untreated samples showed marked leakage, the Xypex-treated samples (as a result of the crystallization process) became totally sealed and exhibited no measurable leakage.

**DIN 1048 (equivalent to EN 12390-8), "Water Impermeability of Concrete", Bautest – Corporation for Research & Testing of Building Materials, Augsburg, Germany**

Twenty cm thick Xypex-treated concrete samples were pressure tested up to 7 bars (230 ft./70 m water head) for 24 hours to determine water impermeability. While the reference specimens measured water penetration up to a depth of 92 mm, Xypex-treated samples measured water penetration of zero to an average of 4 mm.

**EN 12390-8, "Depth of Water Penetration on Samples Treated with Concentrate Coating", OL-123, Czech Technical University, Prague, Czech Republic**

Three replicate 150 mm concrete cubes from four different mix designs (strength classes) were coated with Xypex Concentrate at a thickness of 0.8 mm to 1 mm. Controls for each of the different mix designs were also cast for comparison purposes. All samples were exposed to 0.5 MPa (73 psi) of water pressure for 72 hours from the opposite side of the treated surface. Specimens from each set were split transversely from the treated surface at 28 and 91 days to measure depth of water penetration from the exposed surface. After 28 days, the Xypex coating reduced the depth of water penetration by 90 to 94% compared to the control mixes for the four mix types. At 91 days all Xypex-treated samples measured <1 mm of water penetration.

## DEPTH OF PENETRATION

### ***“Measurement of Mass Concrete Humidity”, Czech Technical University, (CVUT) Faculty of Civil Engineering, Prague, Czech Republic***

A coating of Xypex Concentrate was applied to one face of a 300 mm x 300 mm x 220 mm set of concrete blocks; two replicate sets of blocks were left untreated. Water filled containers were tightly sealed onto the opposite face of the treated blocks and one set of the untreated blocks while the third untreated block set was kept in the laboratory as a control. Humidity probes were installed in 6 mm diameter holes that were drilled to within 30 - 40 mm of the water exposed surface. Mass humidity was recorded at intervals of 28, 45, 90, 125 and 132 days. Final results showed that the Xypex-treated specimens had an average humidity reading of 4.6%, the untreated sample measured 7.9% and the control block with no water exposure was 4.4%, essentially equivalent to the Xypex specimens' results. The Xypex reactive chemicals had diffused at least 190 mm in 132 days.

### ***“An Enhancement in the Nature of Concrete with a Multiplicative Cement Crystal-Type Concrete Material”, Central Research Laboratory of Nikki Shoji in Association with Hosei University, Japan***



A 60 cm x 70 cm x 40 cm concrete block was cast and a Concentrate coating was applied to the surface and cured. The block was left outdoors for approximately 1 year.

Subsequently, a 40 cm (15.75 in.) long cylinder was then cored perpendicular to the Xypex treatment and cut into 18 slices of equal length. SEM photographs utilizing a 1000x magnification were taken of slices from various depths from the treated surface to determine the extent of crystalline growth. While the crystalline structure was most dense in specimens located closest to the treated surface, there was evidence of the crystalline structure at 30 cm (12 inches) from the treated surface.

## CRACK SEALING

### ***ASTM C856 “Standard Practice for Petrographic Examination of Hardened Concrete”, Setsco Services Pte, Ltd., Singapore***

A coat of Xypex Concentrate was applied to a slab that had developed numerous hairline cracks. To determine the crack sealing ability of the Xypex treatment, cores were extracted from a slab at 3, 10, 14 and 20 days following application. Thin sections were taken from each core in order to examine hairline cracks utilizing a polarizing and fluorescent microscope (PFM). In each case, there was evidence of the Xypex crystalline structure in the cracks to a depth of about 20 mm. Photographs taken this depth at

100x magnification showed the Xypex crystalline structure had reduced the width of the cracks dramatically.

## TENSILE BOND STRENGTH

### ***EN 1542 “Products and Systems for the Protection and Repair of Concrete Structures – Test Methods – Measurement by Pull-off”, Trow Associates Inc., Burnaby, B.C., Canada***

Two coats of Xypex Concentrate were applied at 0.8 kg per m<sup>2</sup> with a total cured thickness of 0.9 mm to a standard concrete substrate meeting EN 1766 MC (0,40) (meeting ICRI CSP-4). The coating was applied and cured to the manufacturer's technical specifications and tested at 30 days age for bond strength. The average tensile bond strength of five replicates was 1.23 MPa.

## CHEMICAL RESISTANCE

### ***ASTM C 267, “Chemical Resistance to Mortars”, Pacific Testing Labs, Seattle, USA***

Xypex-treated cylinders and untreated cylinders were exposed to hydrochloric acid, caustic soda, toluene, mineral oil, ethylene glycol, pool chlorine, brake fluid and other chemicals. Results indicated that chemical exposure did not have any detrimental effects on the Xypex coating. Tests following chemical exposure measured an average 17% higher compressive strength in the Xypex-treated specimens over the untreated control samples.

### ***IWATE University Technical Report, “Resistance to Acid Attack”, Tokyo, Japan***



Xypex-treated mortar and untreated mortar were measured for acid resistance after exposure to a 5% H<sub>2</sub>SO<sub>4</sub> solution for 100 days. Xypex suppressed concrete erosion to 1/8 of the reference samples.

### ***ASTM C876 “Influence of Xypex Coating System on Residual Service Life of Concrete Structures” Durability Assessment Section, Xypex Australia***

A bridge pier exposed to seawater in a tidal splash zone for over 40 years experienced different types of deterioration mechanisms including surface abrasion (skin loss), cracking, and corrosion of steel reinforcement. Corrosion monitoring was conducted before and six months after application of Xypex Concentrate. This non-destructive testing (NDT) included a measurement of the corrosion rate, corrosion potential, and concrete resistivity. Results indicated a reduction of corrosion rate and corrosion potential up to 50% and 40% respectively, and significant enhancement of the concrete resistivity.

**RILEM CPC-18 “Carbonation Resistance of Samples Treated with a Xypex Concentrate Coating”, Construction and Maintenance Technology Research Center (CONTEC), Sirindhorn International Institute of Technology (SIIT) – Thammasat University, Bangkok, Thailand**

Control and Xypex Concentrate coated samples were carbonated in an accelerated carbonation chamber. The average depths of carbonation were measured at 28, 56, 77 and 91 days. The depth of carbonation of these Xypex Concentrate coated samples was reduced by 35 - 40% compared to the controls. Following initial carbonation, one set of samples was coated with Xypex Concentrate to model old concrete already damaged by carbonation. For these specimens, testing indicated that carbonation was arrested and in one specimen reduced.

#### **FREEZE/THAW DURABILITY**

**ASTM C 672, “Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to De-Icing Chemicals”, Twin City Testing Lab, St. Paul, USA**

Xypex-treated samples restricted chloride ion concentration to below the level necessary to promote electrolytic corrosion of reinforcing steel. Visual examination of untreated panels after 50 freeze/thaw cycles showed a marked increase in surface deterioration compared to Xypex-treated samples.

#### **POTABLE WATER EXPOSURE**

**NSF 61, “Drinking Water System Component-Health Effects”, NSF International, Ann Arbor, USA**

Exposure testing of potable water in contact with Xypex-treated samples indicated no harmful effects.

#### **RADIATION RESISTANCE**

**U.S.A. Standard No. N69, “Protective Coatings for the Nuclear Industry”, Pacific Testing Labs, Seattle, USA**

After exposure to  $5.76 \times 10^4$  rads of gamma radiation, the Xypex treated specimens displayed no ill effects or damage.

## **Application Procedures**

**1. SURFACE PREPARATION** Concrete surfaces to be treated must be clean and free of laitance, dirt, film, paint, coating or other foreign matter. Surfaces must also have an open capillary system to provide “tooth and suction” for the Xypex treatment. A CSP-3 per the International Concrete Repair Institute Guidelines and Surface Profile Chips is recommended. If surface is too smooth (e.g. where steel forms are used) or covered with excess form oil or other foreign matter, the concrete should be lightly sandblasted, waterblasted, or etched with muriatic (HCL) acid.

**2. STRUCTURAL REPAIRS – PRIOR TO COATING APPLICATION** For cracks larger than 0.4 mm or for actively leaking cracks the following repair procedures are recommended. Chip out cracks, faulty construction joints and other structural defects to a depth of 37 mm and a width of 25 mm. A “V” shaped slot is not acceptable. The slot may be saw cut instead of chipped but ensure that the slot is dovetailed or otherwise shaped such that there will be mechanical interlock of materials placed into the slot at a later stage. Clean and wet the slot and apply a brush coat of Xypex Concentrate as described in steps 5 & 6 and allow to dry for 10 minutes. Fill cavity by tightly compressing Dry-Pac into the groove with pneumatic packing tool or with hammer and wood block.

#### **NOTE:**

- i. Areas of poor concrete consolidation that show evidence of leakage should also be repaired.
- ii. Against a direct flow of water (leakage) or where there is excess moisture due to seepage, use Xypex Patch'n Plug, then Xypex Dry-Pac followed by a brush coat of Xypex Concentrate.
- iii. For expansion joints or chronic moving cracks, flexible materials such as expansion joint sealants should be used.

**3. WETTING CONCRETE** Xypex requires a saturated surface dry (SSD) condition. Concrete surfaces must be thoroughly saturated with clean water prior to the application so as to aid the diffusion of the Xypex chemistry and to ensure growth of the crystalline formation deep within the pores of the concrete. Remove excess water before the application such that there is no glistening water on the surface. If concrete dries out before application, it must be re-wetted.

**4. MIXING FOR SLURRY COAT** Mix Xypex powder with clean water to a creamy consistency in the following proportions:

#### **For Brush Application**

0.65 - 0.8 kg/m<sup>2</sup>

5 parts powder to 2 parts water

1.0 kg/m<sup>2</sup>

3 parts powder to 1 part water

#### **For Spray Application**

0.65 - 0.8 kg/m<sup>2</sup>

5 parts powder to 3 parts water

(ratio may vary with equipment type)

Do not mix more Xypex material than can be applied in 20 minutes. As the mixture thickens, stir briefly to ensure mixture remains fluid; but do not add water.

### Mixing Dry-Pac

Using a trowel, mix 6 parts Xypex Concentrate powder by volume to 1 part clean water for 10 to 15 seconds. Lumps should be present in this mixture. Do not mix more than can be applied in 20 minutes.

**5. APPLYING XYPEX** Apply Xypex with a semi-stiff nylon bristle brush, push broom (for large horizontal surfaces) or specialized spray equipment. The coating must be uniformly applied and should be just under 1.25 mm. When a second coat (Xypex Concentrate or Xypex Modified) is required, it should be applied after the first coat has reached an initial set but while it is still “green” (less than 48 hours). Curing by misting the coating with water should be done between coats. Ensure first coat is in SSD condition before application of the second coat. The Xypex treatment must not be applied under rainy conditions or when ambient temperature is below 4°C. Avoid application of the Xypex coating in hot and windy conditions as the coating may dry out prematurely. For recommended equipment, contact Xypex’s Technical Services Department or your local Xypex Technical Services Representative.

**6. CURING** Generally a misty fog spray of clean water is used for curing the Xypex treatment. Curing should begin as soon as the Xypex has set to the point where it will not be damaged by a fine spray of water. Under normal conditions, it is sufficient to spray Xypex-treated surfaces three times per day for two to three days. In hot or arid climates, spraying may be required more frequently. Wet burlap and some specialty curing blankets are also effective for curing. During the curing period, the coating must be protected from rainfall, frost, wind, the puddling of water and temperatures below 2°C for a period of not less than 48 hours after application. If plastic sheeting is used as protection, it must be raised off the Xypex to allow the coating to breathe. Xypex Gamma Cure may be used in lieu of water curing for certain applications, consult with Xypex’s Technical Services Department or your local Xypex Technical Services Representative.

#### NOTE:

- i. For concrete structures that hold liquids (e.g. reservoirs, swimming pools, tanks, etc.), Xypex should be cured for three days and allowed to set for 12 days (18 days for waste water or corrosive solutions) before filling the structure with liquid.
- ii. For Xypex coated slabs that will be a wearing surface, an application of Xypex Quickset after the coating has been cured and dried is recommended. Contact your local Xypex Technical Services Representative for assistance.

iii. If any other cementitious system is applied over the Xypex coating, it should be after the coating has completely set but while it is still green (12 to 48 hours); the 12 to 24 hour window is considered ideal. For installations onto a Xypex coating older than 48 hours contact your local Xypex Technical Service Representative regarding surface preparation and application recommendations. Xypex Chemical Corporation makes no representations or warranties regarding the compatibility of Xypex products with plasters, stuccos, tiles and other surface-applied materials. Prior to the installation, it is recommended that a test section be completed under anticipated ambient and project conditions to demonstrate acceptable bond.

### Technical Services

For more instructions, alternative application methods, or information concerning the compatibility of the Xypex treatment with other products or technologies, contact the Technical Services Department of Xypex Chemical Corporation or your local Xypex Technical Services Representative.

### Certification

Xypex Concentrate satisfies the requirements of EN 1504-2; Initial Type Testing (ITT) according to EN 1504-2 was certified by BSI as the Notifying Body.

### Safe Handling Information

Xypex is alkaline. As a cementitious powder or mixture, Xypex may cause significant skin and eye irritation. Directions for treating these problems are clearly detailed on all Xypex pails and packaging. The Manufacturer also maintains comprehensive and up-to-date Safety Data Sheets on all its products. Each sheet contains health and safety information for the protection of workers and customers. The Manufacturer recommends you contact Xypex Chemical Corporation or your local Xypex Technical Services Representative to obtain copies of Safety Data Sheets prior to product storage or use.

### Warranty

The Manufacturer warrants that the products manufactured by it shall be free from material defects and will be consistent with its normal high quality. Should any of the products be proven defective, the liability to the Manufacturer shall be limited to replacement of the product ex factory. The Manufacturer makes no warranty as to merchantability or fitness for a particular purpose and this warranty is in lieu of all other warranties expressed or implied. The user shall determine the suitability of the product for his intended use and assume all risks and liability in connection therewith.

