



## ADMIX C-500 NF

CEMENTITIOUS CRYSTALLINE

Concrete Waterproofing

### Description

Xypex is a unique chemical treatment for the waterproofing, protection and improvement of concrete. XYPEX C-500 NF is added to the concrete mix at the time of batching. Xypex Admix C-500 NF consists of Portland cement and various active, proprietary chemicals. These active chemicals react with the moisture in fresh concrete and with the by-products of cement hydration to cause a catalytic reaction. This reaction generates a non-soluble crystalline formation throughout the pores and capillary tracts of the concrete that permanently seals the concrete and prevents the penetration of water and other liquids from any direction.

### Xypex Admix C-Series

All variations of the Admix C-Series contain the same amount of reactive chemicals at their prescribed dosage rates and provide the same waterproofing and durability performance characteristics. Xypex Admix C-Series is available in regular or no-fines grades (NF). **Xypex Admix C-500/C-500 NF** is formulated to have minimal or no effect on setting time. **Xypex Admix C-1000/C-1000 NF** is formulated for concrete mix designs where a normal or mildly delayed set is desired. **Xypex Admix C-2000/C-2000 NF** is designed for warmer climates and projects where a slower hydration rate is typically required. See Setting Time and Strength for more details. Consult with a Xypex Technical Services Representative for the most appropriate Xypex Admix for your project.

### Recommended for:

- Reservoirs
- Sewage and Water Treatment Plants
- Secondary Containment Structures
- Tunnels and Subway Systems
- Underground Vaults
- Foundations / Basements
- Parking Structures
- Swimming Pools
- Precast Components
- Bridge Structures

### Advantages

- Resists extreme hydrostatic pressure
- Becomes an integral part of the substrate
- Highly resistant to aggressive and chemical environments
- Can seal static hairline cracks up to 0.4mm
- Allows concrete to breathe
- Non-toxic

- No VOCs
- Less costly to apply than most other methods
- Permanent
- Added to the concrete at time of batching and therefore is not subject to climatic restraints
- Increases flexibility in construction scheduling

### Packaging

Xypex Admix C-500 NF is available in 20kg pails or in a variety of soluble bag sizes to meet your specific batching requirements. For specific projects, contact the manufacturer for availability of customized packaging.

### Storage

Xypex products must be stored dry at a minimum temperature of 7°C. The product should be used within its shelf life for optimum technical performance, which is one year when stored under proper conditions.

### Dosage Rates

#### Xypex Admix C-500 NF (No Fines Grade):

Typically 1 - 1.5% by weight of cement

#### NOTE:

1. For determining the appropriate dosage rate and for further information regarding concrete mixes containing supplementary cementitious materials (SCM's), enhanced chemical resistance, optimum concrete performance, or meeting the specific requirements and conditions of your project, consult with the local Xypex Technical Services Representative or Xypex UK's Technical Services Department.
2. The recommended minimum dosage for Admix C-500 NF (No Fines Grade) is 3kg per m<sup>3</sup>; the maximum dosage is 6kg per m<sup>3</sup>.
3. Under certain conditions the dosage rate for the Admix C-500 NF (No Fines Grade) may be as low as 0.8% depending on the quantity and type of total cementitious materials.
4. Trial mixes and appropriate testing should be carried out, under project conditions, to determine the optimum dosage rate for the mix design of the project.

### Test Data

#### PERMEABILITY

**U.S. Army Corps of Engineers CRD C48-73, "Permeability of Concrete", Aviles Engineering Corp., Houston, USA**

Two concrete samples containing Xypex Admix and an untreated control sample were tested for water permeability. Both the treated and untreated samples were subjected to a pressure of 150psi / 1.04MPa (350ft.

/ 106.7m water head). Results showed moisture and permeated water throughout the untreated sample after 24 hours. However, the Xypex Admix samples showed no leakage, and water penetration of only 1.5mm / 0.06 inches after 120 hours (5 days).

***U.S. Army Corps of Engineers CRD C48-73, "Permeability of Concrete", Setco Services, Pte., Ltd., Singapore***

Six Xypex Admix-treated and six untreated concrete samples were tested for water permeability. Pressure was gradually increased over five days and then maintained at 7 bars (224ft. / 68.3m water head) for 10 days. While the six reference samples showed water leakage beginning on the fifth day and increasing throughout the test period, the Xypex Admix samples showed no water leakage at any time during the test.

***ACCI Water Permeability Test, "Water Permeability of Concrete", Australia Centre of Construction and Innovation, University of New South Wales, Sydney, Australia***

Concrete samples containing Xypex Admix NF at a dosage rate of 0.8% and 1.2% were tested for water permeability against control samples. All the samples were subjected to a pressure of 10 bars (100m / 328ft. water head) for 2 weeks. Water permeability coefficients were calculated and the Xypex Admix treated concrete showed significant reduction in water permeability by up to 93% at a dosage rate of 1.2%.

***STN EN 12390-8 "Testing of Hardened Concrete; Depth of Water Penetration Under Pressure", Technical and Testing Construction Institute, Bratislava, Slovakia***

Concrete cubes were prepared with Admix C-1000 at 2% and Admix C-1000 NF at 1% along with control cubes. A water pressure of 0.5MPa was applied for 72 hrs and specimens were subsequently split transversely to measure depth of water penetration. Depth results for C-1000/C-1000 NF were 10.3mm and 25mm respectively, whereas penetration on control samples was 113 mm. Using the Valenta equation to calculate the water permeability coefficient showed 20 to 120x reduction for C-1000/C-1000 NF treated concrete compared to control concrete.

## **COMPRESSIVE STRENGTH**

***ASTM C 39, "Compressive Strength of Cylindrical Concrete Specimens", Kleinfelder Laboratories, San Francisco, USA***

At 28 days, the compressive strength test of the concrete containing Xypex Admix measured 7160psi / 49.5MPa as compared to the reference sample at 6460psi / 44.5MPa (a 10% increase).

## **CHEMICAL RESISTANCE**

***CSN 73 1326 "Measuring Loss of Surface Due to Sulphate Attack of Concrete Treated with Admix C-1000/Admix C-1000 NF", Betonconsult, Building Materials Testing Laboratory, Prague, Czech Republic***

Concrete specimens treated with Admix C-1000 at 1% and 2%, and Admix C-1000 NF at 0.5% and 1% were cast along with non-treated concrete specimens. The specimens were exposed to a highly concentrated sulphate solution (i.e. 36,000mg/l) for 4 months and samples were weighed to determine mass loss periodically. The Admix treated samples recorded a mass loss between 5 and 50g/m<sup>2</sup> and showed no surface deterioration, while the non-treated specimens measured an average mass loss of 4,860g/m<sup>2</sup> with significant surface deterioration.

***HB 84-2006 "Durability Assessment of Reinforced Concrete Structure Containing Xypex Admix Exposed to 19 Years of Severe Marine Environment", Sharp and Howells Pty. Ltd., Chemical Laboratories, Victoria, Australia***

Lascelles Wharf serves as a bulk chemical and grain dock. In 1995, as part of an extensive maintenance program and to protect new precast concrete panels from the extremely harsh and aggressive marine environment, the concrete was dosed with Xypex Admix C-2000 NF at 1%. Recently tests were conducted to predict "initiation time to corrosion". Extracted cores were tested for chloride content at incremental depths into the concrete. Chloride content profiles, concrete cover (51mm), surface chloride content, and chloride corrosion threshold were used in a model based on Fick's 2nd law to predict the residual service life of this structure. The average initiation time to corrosion was estimated at 164 years; whereas, the structure had been designed for 50 years of service life.

***NT BUILD 443, "Chloride Diffusion by NordTest with 16.5% NaCl Solution of 40 MPa Concrete Containing Admix C-1000 NF", Australia Centre for Construction Innovation, University of New South Wales, Sydney, Australia***

The NordTest NT BUILD 443 is a standard accelerated method for evaluation of the chloride diffusion coefficient of concrete. In this test program, concrete mixes with 25% fly ash, 38% slag, and 60% slag were cast (total cementitious content = 435kg, 0.4w/c). Xypex Admix C-1000 NF at 0.8% and 1.2% by weight of cementitious materials were compared to control mixes (for each cement system). All specimens were immersed in a 16.5% NaCl solution for 35 days. Chloride diffusion coefficient was calculated based on the chloride profile, utilising Fick's 2nd law. Admix treated fly ash concrete showed 25% reduced chloride diffusion coefficient for both 0.8% and 1.2% addition. The Admix treated 38% slag concrete had 67% lower chloride diffusion coefficient at 0.8% addition and 75% lower at 1.2% addition. The reduction of chloride diffusion coefficient was 42% and 53% for high slag mixes for 0.8% and 1.2% addition respectively.

***"Sulfuric Acid Resistance Test", Aviles Engineering Corporation, Houston, USA***

Concrete containing Xypex Admix at different dosage rates including 3% specimens were tested against untreated control samples for sulfuric acid resistance. After

immersion in the sulfuric acid, each sample was tested for weight loss on a daily basis until a weight loss of 50% or a definite response trend was obtained. The percentage weight loss of the samples containing Xypex Admix tested significantly lower than the control samples.

***“Acid Resistance of Mortar Coated with Xypex Concentrate or Containing Xypex Admix C-1000 NF”, Construction and Maintenance Technology Research Center (CONTEC), Sirindhorn International Institute of Technology (SIIT) - Thammasat University, Bangkok, Thailand***

An acid testing regime was part of an extensive program to determine the benefit of the Xypex Admix C-1000 NF dosed at 1% to improve the durability of concrete. Several comparative mixes were utilized in this evaluation, including: a plain Portland cement and a 30% fly ash mix. Cured samples were exposed to 5% H<sub>2</sub>SO<sub>4</sub>; the pH value of this acid solution was 0.25 and never greater than 0.54pH. In this extremely acidic, corrosive environment, at 12 weeks the Admix samples reduced the weight loss by 48% compared to controls of the cement-only mortar, and 53% in the fly ash specimens.

## **CRACK SEALING**

***ASTM C1585 and ASTM C1202 “Evaluation of Self-healing Capability of Self-compacting Concrete Made with Blast-furnace Slag Cements Activated by the Xypex Crystalline Catalyst”, Instituto Tecnológico de Aeronautica, Sao Jose dos Campos, Brazil***

Portland, blast furnace slag and slag-modified Portland concrete samples, treated with 2.5% Admix C-500, were evaluated for self-healing capabilities. Microcracks were induced by loading to 90% of ultimate compressive strength. Cracked samples were then immersed in water to trigger self-healing after 28, 56 and 84 days. Strength and ultrasonic pulse velocity tests were used to determine mechanical recovery; sorptivity and rapid chloride permeability were used to evaluate watertightness recovery. Results substantiated the ability of Xypex Admix to provide self-healing of cracked concrete.

***“Testing of Xypex Admix C-1000 NF Crack Healing Capabilities” CH Karnchang (Lao) Company Ltd., Xayaburi Laboratory, Ban Xieng Yeun, Vientiane, Laos***

Prior to construction of a Mekong River dam, testing was undertaken to substantiate the ability of Xypex Admix to self-heal static cracks up to 0.4mm. Three large concrete slabs treated with Admix C-1000 NF at 0.8% were cast along with three control slabs. Following curing, a force was applied at the mid-point of each slab to create cracks; on average measuring 0.4mm width. Water was ponded above the cracked area. Initially all cracks leaked; at 4 days all dripping had ceased from the cracks of the Xypex treated panels, while leaking continued through the cracks of the control slab until the end of the test period (25 days). SEM photographs showed sig-

nificant crystalline growth throughout the cracks of the Admix treated slab.

## **SCANNING ELECTRON MICROSCOPY**

***SEM “Microscopic Examination of Crystalline Products in Three Xypex Admix Modified Concrete and Mortar”, Australian Centre for Construction Innovation, University of New South Wales, Sydney, Australia***

Slag and fly ash blended cement samples were treated with Xypex Admix and examined for evidence of crystalline growth at ages ranging from 8 months to 2 years. Samples were sliced and/or split and examined at magnifications between 500x and 5000x. Characteristic Xypex crystalline growth was observable on all Xypex treated samples, providing evidence of Xypex crystalline reactions with fly ash and slag blended cements.

## **FREEZE/THAW DURABILITY**

***ASTM C 666 “Freeze/Thaw Durability” Independent Laboratory, Cleveland, USA***

After 300 freeze/thaw cycles, the Xypex Admix-treated samples indicated 94% relative durability.

## **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.

Various other national or local potable water approvals are available: please contact your local distributor or representative.

## **Directions for Use**

Xypex Admix C-500 NF is added to the concrete at the time of batching. It is important to obtain a homogeneous mixture of Xypex Admix within the concrete. Do not add dry Admix powder directly to wet mixed concrete as this could cause clumping and thorough dispersion will not occur. The sequence and timing of procedures for addition will vary according to the type of batch plant operation and equipment. The following methods have been used successfully in the past and it is recommended that the local Xypex Technical Services Representative be consulted about the best method to use.

**1. ADDITION TO COARSE AGGREGATE BELT** Add Xypex Admix powder directly to the coarse aggregate conveyor belt manually or through a computer controlled mass batching system. Account for worker health and safety issues with moving belts and wind-blown dust issues.

**2. TRUCK ADDITION (AT PLANT)** Add Xypex Admix in bulk powder or soluble bag form to the drum of the ready-mix truck immediately prior to driving the truck under the batch plant and adding the balance of the materials or the premixed concrete in accordance with

standard concrete batching practices. Measures to ensure soluble bags are dispersed include adding the bags as far forward in the drum as possible, adding a small amount of batch water with the bags, and spinning the drum prior to adding remaining ingredients. Avoid delays in adding other components and utilize high speed mixing to ensure homogeneity of mix. Where there may be insufficient water for thorough dispersion of the bulk powder, a water slurry can be made with the Admix and added to the truck mixer prior to batching. Account for added water in the mix design and slump.

**3. ADDITION TO CENTRAL MIXER** Load the Admix in bulk powder form or in soluble bags to the drum of the central mixer prior to adding the other components. Mix as per standard batching practices to ensure thorough dispersal of the Admix resulting in a homogeneous mixture. Account for worker safety issues when accessing the equipment.

**NOTE:**

- i. Although addition on site in powder form is not normally recommended, it may be necessary. In such a case, add Xypex Admix to truck in slurry form (e.g. 3 parts powder to 2 parts water by volume). Mix concrete for a minimum of 5 minutes on high speed or until thoroughly dispersed. Account for added water in the mix design and slump.
- ii. Concrete containing the Xypex Admix does not preclude the requirement for design of crack control, construction joint detailing, proper placement, consolidation and curing of the concrete and measures for repairing defects such as honeycombing, tie holes, cracks beyond specified limits.
- iii. Further guidelines are available that address the use of Xypex Admix for a specific situation, (e.g. dry mixes, use of ice in hot ambient conditions, cold-weather concreting, etc.). Consult with a local Xypex Technical Services Representative or Xypex's Technical Services Department for further information.

### Setting Time and Strength

The setting time of concrete is affected by the chemical and physical composition of ingredients, temperature of the concrete and climatic conditions. Xypex Admix C-500 NF (No Fines Grade) is formulated to have minimal or no effect on setting time. Concrete containing the Xypex Admix C-500 NF may develop higher ultimate strengths than plain concrete. Trial mixes should be carried out under project conditions to determine the setting time and strength of the concrete dosed with Xypex Admix C-500 NF. Consult with the local Xypex Technical Services Representative or Xypex UK's Technical Services Department for the most appropriate Xypex Admix for your project.

### Limitations

When incorporating Xypex Admix, the temperature of the concrete mix should be above 4°C.

### Technical Services

For more instructions, alternative installation methods, or information concerning the compatibility of the Xypex treatment with other products or technologies, contact the Technical Services Department of XYPEX (UK) LLP or your local Xypex Technical Services Representative.

### 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 (UK) LLP or your local Xypex Technical Services Representative to obtain the latest copies of Safety Data Sheets prior to product storage or use.

### Certification

Xypex Admix C-500 NF satisfies the requirements of EN 934-2; Initial Type Testing (ITT) according to EN 934-2 was certified by BSI as the Notifying Body.

### Warranty

XYPEX (UK) LLP (Registration No. OC315394) warrants to the purchaser that the products supplied by it shall be free from material defect. Should any of the products be proven defective, the liability to XYPEX (UK) LLP shall be limited to (at the choice of XYPEX (UK) LLP) either replacement of the proven defective products ex-factory with Xypex products, or refund of the NETT ex-factory purchase price at the date the proven defective products were supplied. XYPEX (UK) LLP will not be liable or responsible, to such an extent as permitted by law, for any consequential or direct damages, compensation, costs, expenses, losses or other liabilities that may occur as a result of the defective products. XYPEX (UK) LLP makes no warranty as to the merchantability or fitness for a particular purpose and the terms of this warranty are in lieu of all other warranties expressed or implied by law. The purchaser should consult with Xypex UK LLP for further details in relation to the Warranty.

