ADMIX C-1000/C-1000 NF

CEMENTITIOUS CRYSTALLINE

Concrete Waterproofing

Description

Xypex is a unique chemical treatment for the waterproofing, protection and improvement of concrete. XYPEX ADMIX C-1000/C-1000 NF is added to the concrete mix at the time of batching. Xypex Admix C-1000/C-1000 NF consists of Portland cement, silica sand (excluding the NF grade) 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** 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 0.5mm
- Allows concrete to breathe
- Water retaining abilities
- Non-toxic
- 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

For assistance with project requirements, please contact Xypex Technical Services Department.

Packaging

Xypex Admix is packaged in:

- C-1000 (25kg pails)
- C-1000 NF (20kg pails)
- C-1000 NF (soluble bags available in various weight from 2kg to 8kg)

Storage

Xypex products must be stored dry at a minimum temperature of 7ºC. Shelf life is one year when stored in unopened containers under proper conditions.

Dosage Rates

Xypex Admix C-1000 (Regular Grade):

2 - 3% by weight of cement

Xypex Admix C-1000 NF (No Fines Grade):

1 - 1.5% by weight of cement

NOTE:

1. For determining the appropriate dosage rate and for further information regarding concrete mixes containing fly ash/slag, 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 CE's Technical Services Department.

2. Under certain conditions the dosage rate for the Admix NF (no fines) grade may be as low as 0.8% depending on the quantity and type of total cementitious materials.

Material Properties

Visual Appearance	Light grey powder
pH	12.1 - 12.5
Chloride Content	<0.1%
VOC	none

Test Data

PERMEABILITY

EN 12390-8 "Testing Hardened Concrete. Depth of Penetration of Water under Pressure", Faculty of Civil Engineering, Czech Technical University of Prague, Czech Republic

Regular testing is carried out on concrete specimens collected from project sites to confirm the effectiveness of Xypex Admix C-1000 NF to provide watertight concrete. Specimens are exposed to pressurized water at 0.5MPa for 3 days as per EN 12390-8 and then evaluated for depth of penetration at various ages to determine the extent of crystalline growth and thus enhanced protection over time. One example of this is specimens using a C 30/37-90D XA1 mix design containing Admix C-1000 NF, retrieved from Skanska Transbeton's Riverview project in Prague; testing results recorded a 71% decrease in depth of water penetra-

tion at 150 days compared to the 90 day results. A second example relates to specimens utilizing a C 25/30-90D XA1 mix design with Admix C-1000 NF obtained from Cemex's hospital project in Uherske Hradiste, Czech Republic; testing recorded a 79% decrease in the depth of water penetration at 150 days compared to results obtained at 90 days. The third example is concrete specimens with a C 25/30-90D XA1 mix design dosed with Admix C-1000 NF, supplied by TBG Metrostav of the Heidelberg Group for the Medox II project in Prague; testing results recorded a decrease of 83% in the depth of water penetration at 180 days compared to the measurements at 90 days.

EN 12390-8 "Testing Hardened Concrete. Depth of Penetration of Water under Pressure", TSUS Presov Branch, Bratislava, Slovak Republic

Three sets of samples made from C 25/30 concrete were tested for impermeability. One set contained Xypex Admix C-1000; a second set contained Admix C-1000 NF; the third set was untreated for comparative purposes. Results of the testing recorded an average 85% reduction in the depth of penetration in Admix C-1000 and Admix C-1000 NF samples compared to the untreated reference samples.

EN 12390-8 "Testing Hardened Concrete. Depth of Penetration of Water Under Pressure", Hans Jacobs GmbH, Baustoffprűfung, Hamburg, Germany

Testing is regularly performed to ensure compliance with the requirements of the DIBt. Concrete containing 300kg of cement, with and without Admix C-1000 NF are evaluated at 28 days age and on average the Admix treated specimens record a 50% decrease in the depth of water penetration compared to controls.

EN 12390-8 & JUS.M1.015/78 "Testing Hardened Concrete. Depth of Penetration of Water under Pressure", University of Sarajevo, Faculty of Civil Engineering, IMK, Bosnia and Herzegovina

Several sets of C 30/37 concrete samples with variations in additives including samples with and without Admix C-1000 NF at a 1.2% dosage rate and samples with and without an air-entrainment agent were evaluated. Testing according to EN 12390-8 showed a decrease in the depth of water penetration of Xypex treated samples by 94%, compared to the control samples. Tests done according to national standard JUS.M1.015/78 showed a decrease of 86%. Samples containing an air-entrainer showed a decrease of water penetration by 87%; while confirming that Xypex Admix C-1000 NF does not influence the effect of an air-entrainer.

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 113mm. 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

EN 12390-8 "Testing hardened Concrete. Compressive Strength of Test Specimens", Hans Jacobs GmbH, Baustoffprűfung, Hamburg, Germany

Concrete specimens containing 300kg of cement is the standard mix design utilized by the DIBt in Germany to determine the effect an additive has on compressive strength. Repeated testing of samples containing Admix C-1000 NF dosed at 1.5% performed at 28 days age recorded an increase of compressive strength from 5% to 17%, compared to control samples.

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 th 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^2 and show no surface deterioration, while the non-treated specimens measured an average mass loss of 4,860g/m^2 with significant surface deterioration.

"Testing Hardened Concrete. Depth of Penetration Exposed to Transformer Oil, Diesel Fuel, Crude Oil and Silage Fluid Under Pressure", TSUS Presov Branch, Bratislava, Slovak Republic

C 25/30 concrete samples dosed with Xypex Admix C-1000 at 2% were cast along with controls and tested for resistance to various aggressive liquids at a pressure of 0.5m. Samples exposed to transformer oil for 24 hours treated with Admix C-1000 recorded a 59% reduction in the depth of penetration compared to the controls; Admix C-1000 NF samples dosed at 1% reduced the penetration by 48%. After 48 hours of exposure to 0.5m pressure of diesel fuel, Xypex Admix C-1000 samples showed a 33% reduction in penetration compared to controls; the Admix C-1000 NF by 26%. In evaluating the exposure of samples for 48 hours at 0.5m pressure to crude oil, Xypex Admix C-1000 samples showed a reduction in penetration depth compared to control samples by 44%. Xypex Admix C-1000 samples exposed to silage fluid for 72 hours at 0.5m of pressure recorded 67%

less depth of penetration; Admix C-1000 NF by 56%.

NT BUILD 443, "Chloride Diffusion by NordTest with 16.5% NaCl Solution of 40MPa 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.

"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_2SO_4; 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 Tecnologico 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. 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 with widths from 0.2 to 0.5mm on the surface. 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 significant 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.

EN 12390-8 & JUS.M1.015/78 "Testing Hardened Concrete. The Effect of Freeze / Thaw Cycling", University of Sarajevo, Faculty of Civil Engineering, IMK, Sarajevo, Bosnia and Herzegovina

Samples cast utilizing air entrained C 30/37 concrete, with and without Xypex Admix C-1000 NF dosed at 1.2% were evaluated following exposure to 200 and 250 freeze / thaw cycles for resistance to damage. This effect of this exposure was determined by measuring and comparing the compressive strength following exposure. The Xypex treated samples recorded a decreased strength of 10.1% after 200 cycles and 11.2% following 250 cycles; the untreated specimens results were 13.6% and 18.2% respectively.

"Testing Hardened Concrete. The Effect of Freeze / Thaw Cycling by Mass Loss", University of Sarajevo, Faculty of Civil Engineering, IMK, Bosnia and Herzegovina

Xypex Admix C-1000 NF samples dosed at 1.2% and controls were cast utilizing air entrained C 30/37 concrete. The samples were subsequently evaluated by measuring mass loss for resistance to freeze / thaw damage and exposure to a 3% NaCl solution. After 30 freeze / thaw cycles, the average weight loss of the samples without Xypex was 0.2mg/mm^2, while the Admix treated samples had no measurable weight loss.

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.

Directions for Use

Xypex Admix C-1000/C-1000 NF is added to the concrete at the time of batching. It is important to obtain a homogeneous mixture of Xypex Admix with the concrete. Do not add dry Admix powder directly to wet mixed concrete as this could cause clumping and thorough dispersion may not occur. The sequence 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 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 drum 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 along with 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-1000/C-1000 NF is formulated for concrete mix designs where a normal or mildly delayed set is desired. Concrete containing the Xypex Admix C-1000/C-1000 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-1000/C-1000 NF. Consult with a Xypex Technical Services Representative for the most appropriate Xypex Admix for your project.

Limitations

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

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 CE or Xypex Chemical Corporation.

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 CE or your local Xypex Technical Services Representative to obtain copies of the latest Safety Data Sheets prior to product storage or use.

Certification

Xypex Admix C-1000/C-1000 NF satisfies the requirements of EN 934-2. BSI, as the notified certification body (No. 0086), performed the initial inspection of the manufacturing plant and Factory Production Control and performs the continuous surveillance, assessment and evaluation of the FPC.

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.

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