

Xypex (UK) LLP
Unit 7
Britannia Business Centre
Britannia Way
Malvern
Worcestershire WR14 1GZ

Tel: 01684 577756 Fax: 01684 897750
e-mail: adamtrow@xypexuk.com
website: www.xypex.com



Agrement Certificate

05/4216

Product Sheet 1

XYPEX WATERTIGHT CONCRETE SYSTEM

XYPEX ADMIX C-1000 NF

This Agrément Certificate Product Sheet⁽¹⁾ relates to Xypex Admix C-1000 NF, an admixture used to provide set-retarding properties and watertight concrete.

(1) Hereinafter referred to as 'Certificate'.

CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.



KEY FACTORS ASSESSED

Setting and hardening characteristics — concrete containing the product will be retarded when compared with the equivalent plain concrete (see section 6).

Resistance to water penetration — concrete containing the product has reduced permeability when compared with the equivalent plain concrete (see sections 7 and 8).

Reinforcement protection — concrete containing the product has enhanced resistance to reinforcement corrosion when compared with the equivalent plain concrete (see section 9).

Mechanical properties — the mechanical properties of the concrete are not adversely affected by the incorporation of the product (see section 10).

Durability — concrete containing the product is more durable than the equivalent plain concrete mix owing to its reduced permeability (see section 18).

The BBA has awarded this Certificate to the company named above for the product described herein. This product has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of Third issue: 26 October 2015

John Albon – Head of Approvals
Construction Products

Originally certificated on 24 March 2005

Claire Curtis-Thomas
Chief Executive

The BBA is a UKAS accredited certification body – Number 113.

The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk

British Board of Agrément
Bucknalls Lane
Watford
Herts WD25 9BA

©2015

tel: 01923 665300
fax: 01923 665301
clientservices@bba.star.co.uk
www.bbacerts.co.uk

Regulations

In the opinion of the BBA, Xypex Admix C-1000 NF is not subject to these Regulations:



The Building Regulations 2010 (England and Wales) (as amended)



The Building (Scotland) Regulations 2004 (as amended)



The Building Regulations (Northern Ireland) 2012 (as amended)

Construction (Design and Management) Regulations 2015

Construction (Design and Management) Regulations (Northern Ireland) 2007

Information in this Certificate may assist the client, Principal Designer/CDM co-ordinator, designer and contractors to address their obligations under these Regulations.

See sections: *3 Delivery and site handling* (3.1, 3.3 and 3.4) and *22 Placing* (22.1) of this Certificate.

Additional Information

NHBC Standards 2014

In the opinion of the BBA, the use of Xypex Admix C-1000 NF in relation to this Certificate is not subject to the requirements of these Standards.

CE marking

The Certificate holder has taken the responsibility of CE marking the product, in accordance with harmonised European Standard BS EN 934-2 (Table 8). An asterisk (*) appearing in this Certificate indicates that data shown are given in the manufacturer's Declaration of Performance.

Technical Specification

1 Description

1.1 Xypex Admix C-1000 NF is a reactive crystalline admixture for incorporation in concrete to enhance:

- set-retarding properties
- the watertightness and durability in its hardened state.

1.2 The product is supplied as a powder consisting of blended Portland cement and proprietary chemicals.

2 Manufacture

2.1 The product is manufactured in a batch blending process.

2.2 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process

- evaluated the process for management of nonconformities
- checked that equipment has been properly tested and calibrated
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control being operated by the manufacturer are being maintained.

3 Delivery and site handling

3.1 The product is supplied in labelled 20 kg metal pails. The label bears company details, mixing instructions and a hazard label.

3.2 The product must be stored in sealed pails in a dry environment at a minimum temperature of 7°C and has a shelf-life of five months from the date of manufacture when stored under these conditions.

3.3 The Certificate holder has taken the responsibility of classifying and labelling the product under the *CLP Regulation (EC) No. 1272 / 2008 on the classification, labelling and packaging of substances and mixtures*. Users must refer to the relevant Safety Data Sheet(s).

3.4 When handling, the normal health and safety procedures associated with cementitious materials must be observed.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Xypex Admix C-1000 NF.

Design Considerations

4 General

4.1 Xypex Admix C-1000 NF is satisfactory for use in concrete mixes at an addition rate of between 1.0 and 1.5% by weight of cement to provide set-retarding properties and watertight concrete for basements, swimming pools, tunnels and culverts, without the requirement for additional applied protection.

4.2 Concrete containing the product should be designed in accordance with BS EN 206 : 2013 and BS 8500-2 : 2015 for use as all normal types, including precast, pre-stressed, post-tensioned, ready-mixed, reinforced, slip formed, sprayed and pumped concrete. For additional information on required thickness of concrete, advice from the Certificate holder can be sought.

4.3 The product is compatible with cement blends containing pulverized-fuel ash, ground granulated blast furnace slag and silica fume blends as defined in BS EN 197-1 : 2011.

4.4 The product is suitable for use in contact with potable water. Confirmation from the Drinking Water Inspectorate (DWI) website should be sought.

4.5 Use of the product with an air-entraining agent is not covered by this Certificate.

4.6 Joints should be designed with waterstops as recommended by BS 8102 : 2009, in particular Section 9.2.1.4. Only waterstops that have been independently assessed as capable of meeting the correct grade of waterproofing protection must be considered.

4.7 Penetrations of concrete, such as pipe entries or formwork ties, must be securely sealed to maintain watertightness. The advice of the Certificate holder should be sought on suitable systems.

5 Practicability of installation

Concrete containing the product can be placed, compacted and cured by operatives with experience of using conventional concreting methods and equipment.

6 Setting and hardening characteristics

6.1 The effect of the product for a specific mix and site conditions should be evaluated through site trials prior to use.

6.2 The setting time of concrete mixes containing the product will be retarded when compared with equivalent plain concrete. The amount of retardation will depend on the concrete mix design used and ambient temperature during placing and curing.

7 Water penetration

7.1 Concrete containing the product has greater resistance to water penetration than equivalent plain concrete.

7.2 Tests showed that concrete containing the product (1.25% wt/wt PC) showed a water permeability⁽¹⁾ of $1.99 \times 10^{-13} \text{ m} \cdot \text{s}^{-1}$ compared with $3.26 \times 10^{-13} \text{ m} \cdot \text{s}^{-1}$ for the control concrete.

(1) The specific effect of the product on water penetration for a particular mix and site conditions should be evaluated through site trials prior to use.

8 Water vapour permeability

8.1 Concrete containing the product has a lower permeability to water vapour than equivalent plain concrete.

8.2 Test results for concrete containing the product (1.25% wt/wt PC) showed a water vapour permeability⁽¹⁾ of $440 \times 10^{-12} \text{ [g} \cdot \text{m (Ns)}^{-1}]$ compared with $690 \times 10^{-12} \text{ [g} \cdot \text{m (Ns)}^{-1}]$ for the control concrete.

(1) The specific effect of the product on these properties for a particular mix and site conditions should be evaluated through site trials prior to use.

8.3 Concrete made with a high water/cement ratio can have a water vapour permeability above $3000 \times 10^{-12} \text{ [g} \cdot \text{m (Ns)}^{-1}]$. The permeability of concrete is strongly dependent on the exact mix design, and the figures given in this Certificate indicate the levels that can be obtained using the product.

8.4 The appropriate thickness for concrete with a specific permeability to achieve a water vapour resistance of $200 \text{ MN} \cdot \text{s} \cdot \text{g}^{-1}$ or $550 \text{ MN} \cdot \text{s} \cdot \text{g}^{-1}$ (suitable for grade 3 of BS 8102 : 2009) is given by:

for $200 \text{ MN} \cdot \text{s} \cdot \text{g}^{-1}$, $t = 0.2 \times 10^{12} \times p$

for $550 \text{ MN} \cdot \text{s} \cdot \text{g}^{-1}$, $t = 0.55 \times 10^{12} \times p$

where t = concrete thickness, mm and p = water vapour permeability in $\text{g} \cdot \text{m (Ns)}^{-1}$.

9 Reinforcement protection

9.1 The high alkalinity (pH>13) of concrete necessary to prevent corrosion of the reinforcement is not adversely affected by the incorporation of the product.

9.2 Corrosion of reinforcement is normally caused by the ingress of chloride to the steel or by the reduction in alkalinity of the concrete by the diffusion of carbon dioxide. The reduced permeability of concrete containing the product will slow down diffusion of aggressive agents into the concrete and so provide improved protection against reinforcement corrosion.

10 Mechanical properties

10.1 The compressive strength of concrete containing the product will typically be higher than the equivalent plain concrete with the same slump. Higher compressive strength may be obtained with the use of a high range water-reducing or superplasticising admixture complying with BS EN 934-2 : 2009, Tables 3.1 and 3.2.

10.2 The flexural strength of concrete containing the product is similar to that of an equivalent plain concrete.

10.3 The static modulus of elasticity of concrete containing the product is higher than that of an equivalent plain concrete.

11 Drying shrinkage and wetting expansion

The drying shrinkage and wetting expansion of concrete containing the product is reduced compared with that of equivalent plain concrete.

12 Carbonation resistance

Concrete containing the product has a greater resistance to carbon dioxide diffusion than equivalent plain concrete.

13 Frost resistance

13.1 Concrete containing the product has a greater freeze/thaw resistance than equivalent plain concrete owing to its reduced permeability.

13.2 Tests results for concrete containing the product (1.25 % wt/wt PC) showed a freeze/thaw expansion of 0.001% compared with 0.009% for the control concrete.

14 Sulfate resistance

The lower permeability of concrete containing the product will reduce the ingress of sulfates. However, if sulfate-resistant concrete is required, the advice of the Certificate holder should be sought.

15 Alkali silica reaction (ASR)

15.1 Concrete containing the product should be designed according to BS EN 206 : 2013, Section 5.2.3.5 and BS 8500-2 : 2006, Section 5.2.

15.2 The sodium oxide equivalent of the product when measured in accordance with BS EN 480-12 : 2005 was 6.81% by mass of admixture. The Certificate holder should be consulted for current typical values and maximum declared values of the sodium oxide equivalent of the product.

16 Resistance to leaching

Use of the product reduces the leaching of lime from the hydrated cement in the concrete.

17 Maintenance

The product does not impose additional maintenance requirements on the concrete to which it is added. For a specific installation, the maintenance regime should be considered to ensure that the required design life of the concrete is achieved.

18 Durability

18.1 Under normal conditions of service, concrete containing the product is more durable than equivalent plain concrete owing to its reduced permeability.

18.2 Where exposure to aggressive soil conditions or chemicals is anticipated, a full assessment of the site must be made. In these situations the Certificate holder should be consulted on the suitability of the concrete.

Installation

19 General

19.1 Structures built incorporating the product should be designed to the relevant Sections of BS EN 1992-3 : 2006, BS 8102 : 2009, BS EN 1992-1-1 : 2004, BS EN 1992-1-2 : 2004 and their relevant UK National Annexes.

19.2 Concrete containing the product is suitable for Type B constructions as described in BS 8102 : 2009, and can meet the requirements for all grades defined in Table 1 of this Standard. For Grade 3 (where control of water vapour is required), it will be necessary to provide a mix with a sufficiently low vapour permeability in combination with an adequate section thickness (see sections 8.2 and 8.3).

19.3 Basements for dwellings should be designed in accordance with the guidance given in the *Approved Document — Basements for Dwellings*⁽¹⁾.

(1) Published by the British Cement Association, Document No 48.062.

20 Mix design

20.1 Concrete containing the product is normally supplied as 'ready-mixed concrete' but may also be prepared on sites where there is adequate mix control. Concrete prepared on site should be carried out in accordance with BS 8000-2.1 : 1990, the Certificate holder's instructions and this Certificate.

20.2 The concrete must have a minimum cement content of 325 kg·m⁻³ and be batched with a maximum water/cement ratio of 0.5. Further details of suitable mixes can be obtained from the Certificate holder or their approved representatives.

20.3 The product must not be added to wet mixed concrete as this may cause clumping, and thorough dispersion will not occur.

20.4 The product must be thoroughly dispersed in the mix so that a homogeneous mixture is achieved.

20.5 The consistency of the concrete can be adjusted using a suitable⁽¹⁾ water-reducing or superplasticising admixture complying with BS EN 934-2 : 2009, Tables 3.1 and 3.2 to ensure that the maximum water/cement ratio given in section 20.2 is not exceeded.

(1) The Certificate holder's advice should be sought regarding the suitability and compatibility of water-reducing or superplasticising admixtures. Admixtures should be evaluated before use and site trials carried out to establish the appropriate dose required.

20.6 The addition of the product does not have a detrimental effect on the properties of the concrete.

21 Site mixing

21.1 The product is added at the correct dose (see section 4.1) to the aggregate and sand, and mixed thoroughly for two to three minutes⁽¹⁾ before adding the cement and water.

21.2 When an additional superplasticiser is required, it should be added in accordance with the superplasticiser manufacturer's instructions.

21.3 The resulting concrete should be mixed for a further five minutes⁽¹⁾ to ensure even distribution of the product throughout the concrete.

(1) It should be noted that mixing times may vary depending on the mixing equipment used.

21.4 Where the product is to be added to concrete on site, care must be taken to ensure that adequate mix control is available.

22 Placing

22.1 Concrete containing the product is placed in the same way as normal concrete, in accordance with BS 8000-2.2 : 1990, BS EN 13670 : 2009, the Certificate holder's health and safety guidance and the normal routine precautions for handling concrete.

22.2 Concrete containing the product must not be placed at temperatures of 5°C or below.

22.3 Concrete containing the product must be fully compacted.

23 Curing

The concrete should be cured strictly in accordance with BS EN 1992-1-1 : 2004 and its UK National Annex, BS EN 13670 : 2009, and the Certificate holder's recommendations where site-specific information exists.

Technical Investigations

24 Tests

24.1 Tests were conducted to determine the effect of the Xypex Admix C-1000 NF admixture (1.25 % wt/wt PC) on the properties of concrete designed to BS EN 480-1 : 2014, as shown in Tables 1 to 4.

Table 1 Effects of Xypex Admix C-1000 NF on the properties⁽¹⁾ of fresh wet concrete

Property	Control concrete	Concrete containing Xypex Admix C-1000 NF
Xypex Admix C-1000 NF	–	1.25
Water/cement ratio	0.47	0.45
Slump (mm)		
0 min	65	60
30 min	30	35
Plastic density (Kg·m ⁻³)	2415	2420
Air content (%)*	0.7	0.8

(1) The specific effect of the product on these properties for a particular mix and site conditions should be evaluated through site trials prior to use.

Table 2 Effects of Xypex Admix C-1000 NF on the mechanical properties⁽¹⁾ of hardened concrete

Property	Control concrete	Concrete containing Xypex Admix C-1000 NF
Compressive strength (N·mm ⁻²)		
24 hrs	18.0	19.0
28 days*	57.8	64.2
Flexural strength (N·mm ⁻²)		
24 hrs	2.5	2.4
28 days	6.0	6.4
Modulus of elasticity (N·mm ⁻²)		
28 days	38500	42000

(1) The specific effect of the product on these properties for a particular mix and site conditions should be evaluated through site trials prior to use.

Table 3 Effects of Xypex Admix C-1000 NF on the properties⁽¹⁾ of hardened concrete

Property	Control concrete	Concrete containing Xypex Admix C-1000 NF
Drying shrinkage (%)	0.030	0.023
Wetting expansion (%)	0.019	0.013

(1) The specific effect of the product on these properties for a particular mix and site conditions should be evaluated through site trials prior to use.

Table 4 Setting times⁽¹⁾ for Xypex Admix C-1000 NF

Property	Control concrete	Concrete containing Xypex Admix C-1000 NF
Setting time (min)*		
initial set	170	315
final set	235	490

(1) The specific effect of the product on setting times for a particular mix and site conditions should be evaluated through site trials prior to use.

24.2 Tests were conducted and the results evaluated, with additional workability and durability tests required by the BBA, as follows:

for concrete in its mixed state

- water cement ratio
- slump
- slump retention⁽¹⁾
- plastic density
- air content
- setting time

for concrete in its hardened state

- water permeability
- drying shrinkage
- wetting expansion
- freeze/thaw expansion
- compressive strength
- flexural strength
- modulus of elasticity
- water vapour permeability
- resistance to liquid water pressure⁽¹⁾
- bond to reinforcement⁽¹⁾
- efflorescence⁽¹⁾

characterisation of the admixture

- alkali content
- total chlorine
- water soluble chlorine
- pH
- IR trace
- conventional dry material content
- effect on setting time in different cement types⁽¹⁾.

(1) Denotes BBA-appointed test.

25 Investigations

25.1 The manufacturing process was evaluated, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

25.2 User surveys of specifiers and contractors were conducted to establish the product's performance in use and in service.

Bibliography

BS 8000-2.1 : 1990 *Workmanship on building sites — Code of practice for concrete work — Mixing and transporting concrete*

BS 8000-2.2 : 1990 *Workmanship on building sites — Code of practice for concrete work — Sitework with in-situ and precast concrete*

BS 8102 : 2009 *Code of practice for protection of below ground structures against water from the ground*

BS 8500-2 : 2015 *Concrete — Complementary British Standard to BS EN 206 — Specification for constituent materials and concrete*

BS EN 197-1 : 2011 *Cement — Composition, specifications and conformity criteria for common cements*

BS EN 206 : 2013 *Concrete — Specification, performance, production and conformity*

BS EN 480-1 : 2014 *Admixtures for concrete, mortar and grout — Test methods — Reference concrete and reference mortar for testing*

BS EN 480-12 : 2005 *Admixtures for concrete, mortar and grout — Test methods — Determination of the alkali content of admixtures*

BS EN 934-2 : 2009 *Admixtures for concrete, mortar and grout — Concrete admixtures — Definitions and requirements, conformity, marking and labelling*

BS EN 1992-1-1 : 2004 *Eurocode 2 : Design of concrete structures — General rules and rules for buildings*

NA to BS EN 1992-1-1 : 2004 UK National Annex to *Eurocode 2 : Design of concrete structures — General rules and rules for buildings*

BS EN 1992-1-2 : 2004 *Eurocode 2 : Design of concrete structures — General rules — Structural fire design*

NA to BS EN 1992-1-2 : 2004 UK National Annex to *Eurocode 2 : Design of concrete structures — Structural fire design*

BS EN 1992-3 : 2006 *Eurocode 2 : Design of concrete structures — Liquid retaining and containing structures*

NA to BS EN 1992-3 : 2006 UK National Annex to *Eurocode 2 : Design of concrete structures — Liquid retaining and containing structures*

BS EN 13670 : 2009 *Execution of concrete structures*

26 Conditions

26.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page – no other company, firm, organisation or person may hold claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document – it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

26.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

26.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

26.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

26.5 In issuing this Certificate the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

26.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.