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Agrément Certificate

20/5718

Product Sheet 1

XYPEX WATERTIGHT CONCRETE SYSTEM

XYPEX ADMIX C-500 NF

This Agrément Certificate Product Sheet⁽¹⁾ relates to Xypex Admix C-500 NF, an admixture used to provide water retaining 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

Water retaining characteristics — concrete containing the product will have an enhanced capacity to retain water when compared with the equivalent plain concrete (see section 6).

Water penetration and water vapour permeability — 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 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 due 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 First issue: 16 January 2020

Hardy Giesler
Chief Executive Officer

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

Readers MUST check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA directly.

Any photographs are for illustrative purposes only, do not constitute advice and should not be relied upon.

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Regulations

In the opinion of the BBA, the use of Xypex Admix C-500 NF is not subject to the national Building Regulations.

Construction (Design and Management) Regulations 2015 **Construction (Design and Management) Regulations (Northern Ireland) 2016**

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

See section: *3 Delivery and site handling (3.1, 3.3 and 3.4)* of this Certificate.

Additional Information

NHBC Standards 2020

In the opinion of the BBA, Xypex Admix C-500 NF, when incorporated in a suitable concrete mix, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements in relation to *NHBC Standards*, Chapter 5.4 *Waterproofing of basements and other below ground structures*.

Unless it can be demonstrated that the water table is permanently below the underside of the slab, the product should be used in combination with either a Type A or C waterproofing protection where Grade 3 protection is required and the below ground wall retains more than 600 mm (measured from the top of the retained ground to the lowest finished floor level).

CE marking

The Certificate holder has taken the responsibility of CE marking the product, in accordance with harmonised European Standard BS EN 934-2 : 2009, Table 4.

Technical Specification

1 Description

1.1 Xypex Admix C-500 NF is a reactive crystalline admixture for incorporation in concrete to enhance:

- water retaining 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 operated by the manufacturer are being maintained.

3 Delivery and site handling

3.1 The product is supplied in either labelled 20 kg metal pails or labelled 20 kg bags. It can also come in a variety of soluble bag sizes. The label bears the 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 5 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-500 NF.

Design Considerations

4 Use

4.1 Xypex Admix C-500 NF is satisfactory for use in concrete mixes at an addition rate of 1.25 % by weight of cement to provide water retaining properties and watertight concrete for basements, roofs, swimming pools, tunnels and culverts.

4.2 The effect of the product on the properties of concrete designed to BS EN 480-1 : 2014 is shown in Tables 1 and 2 of this Certificate.

Table 1 Effects of the product on the properties of fresh wet concrete, mix A⁽¹⁾

Property (unit)	Control concrete	Xypex Admix C-500 NF (1.25 % wt/wt PC)
Water/cement ratio	0.44	0.43
Slump (mm)		
0 min	75	75
30 min	40	45
Plastic density (kg·m ⁻³)	2396	2423
Air content (%)	1.9	2.3

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

Table 2 Effects of the product on the properties of fresh wet concrete, mix B⁽¹⁾

Property (unit)	Control concrete	Xypex Admix C-500 NF (1.25 % wt/wt PC)
Water/cement ratio	0.51	0.51
Slump (mm)		
0 min	60	65
Plastic density (kg·m ⁻³)	2384	2385
Air content (%)	1.9	2.0

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

4.3 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 concretes. For additional information on the required thickness of concrete for a particular application, advice from the Certificate holder should be sought.

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

4.5 Concrete containing the product is suitable for use in contact with potable water and has been approved by the Drinking Water Inspectorate for this purpose. The user should check the 'List of Approved Products for use in Public Water supply in the United Kingdom.

4.6 The use of the product with an air-entraining agent is outside the scope of this Certificate.

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 Water retaining 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 water retention of concrete mixes containing the product will be greater when compared with equivalent plain concrete. The amount of water retention 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 an equivalent plain concrete.

7.2 Tests conducted on a concrete containing the product in mix B, at an addition rate of 1.25 % by weight of cement, showed a water permeability⁽¹⁾ of $1.81 \times 10^{-13} \text{ m}\cdot\text{s}^{-1}$ compared with $2.77 \times 10^{-13} \text{ m}\cdot\text{s}^{-1}$ for control concrete.

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

8 Water vapour permeability

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

8.2 Test results showed that concrete containing 1.25 % by weight of the total cementitious content in mix A has a water vapour permeability⁽¹⁾ of $794 \times 10^{-12} \text{ g}\cdot\text{m}(\text{N}\cdot\text{s})^{-1}$ compared with $855 \times 10^{-12} \text{ g}\cdot\text{m}(\text{N}\cdot\text{s})^{-1}$ for control concrete.

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

8.3 Concrete made with a high water/cement ratio can have a water vapour permeability above $3000 \times 10^{-12} \text{ g}\cdot\text{m}(\text{N}\cdot\text{s})^{-1}$. The permeability of the concrete is highly dependent on the exact mix design, and the figures given in section 8.2 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 or 550 $\text{MN}\cdot\text{s}\cdot\text{g}^{-1(1)}$ (suitable for grade 3 of BS 8102 : 2009) is given by:

for 200 $\text{MN}\cdot\text{s}\cdot\text{g}^{-1}$, $t = 0.20 \times 10^{12} \times p$

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

where:

t is the concrete thickness in mm

p is the water vapour permeability in $\text{g}\cdot\text{m}(\text{N}\cdot\text{s})^{-1}$ (from BS 3177 : 1959 test).

(1) This figure may be used where a high resistance to water vapour is required.

9 Reinforcement protection

9.1 The high alkalinity required to prevent corrosion of the reinforcement ($\text{pH}>13$) will not be adversely affected by the incorporation of the product into the concrete.

9.2 Corrosion of reinforcement is normally caused by the ingress of chloride to the steel and/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 confer improved protection against reinforcement corrosion.

9.3 The Certificate holder has declared the chloride ion content of the product as $<0.1\%$.

10 Mechanical properties

10.1 The compressive strength of concrete containing the product is similar to that of an equivalent plain concrete with the same consistency.

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

11 Drying shrinkage and wetting expansion

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

11.2 Tests conducted on concrete containing the product in mix A showed a drying shrinkage⁽¹⁾ of 0.036% compared with 0.039% for control concrete, and a wetting expansion⁽¹⁾ of 0.023% compared with 0.026% for control concrete.

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

12 Carbonation resistance

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

13 Frost resistance

Concrete containing the product has a similar resistance to freeze/thaw to that of an equivalent plain concrete.

14 Sulfate resistance

The lower permeability of concrete containing the product reduces 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 in accordance with BS EN 206 : 2013 Section 5.2.3.5, and BS 8500-2 : 2015 Clause 5.2.

15.2 The sodium oxide equivalent of the product when measured in accordance with BS EN 480-12 : 2005 was 7.5% 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, a 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 8102 : 2009 and BS EN 1992-1-1 : 2004, BS EN 1992-1-2 : 2004 and BS EN 1992-3 : 2006, and their UK National Annexes.

19.2 Concrete mixes containing the product are suitable for Type B protection as described in BS 8102 : 2009, Table 1, and can satisfy the requirements for all grades defined in Table 2 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 8.3 and 8.4 of this Certificate). The use of suitable ventilation, dehumidification or air-conditioning, appropriate to the intended use, must also be considered.

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

(1) Published by Basement Information Centre, Product code: TBIC/007.

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⁽¹⁾. Concrete prepared on site should be carried out in accordance with BS 8000-0 : 2014, the Certificate holder's instructions and this Certificate.

(1) NHBC will only accept use of the admixture where included at the concrete batching plant which must also be either QSRMC or BSI Kitemark registered.

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 of this Certificate 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 1.25 % by weight of cement, a dosage within the product parameter range of 1.0 and 1.5% by weight of cement to the aggregate and sand, and mixed thoroughly for two to three minutes⁽¹⁾ before adding the cement and water. The advice of the Certificate holder should be sought on dosage rates for particular applications.

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 concrete is batched 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 8000-0 : 2014, 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 concrete 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.

24 Joints

24.1 Joints must be designed with waterstops as recommended in BS 8102 : 2009, to maintain the watertightness of the whole structure (see section 4.7 of this Certificate). The advice of the Certificate holder should be sought for particular applications. Only waterstops that have been BBA-approved as being capable of satisfying the necessary grade of waterproofing protection should be used.

24.2 Penetrations of the concrete, such as pipe entries or formwork ties, must also be securely sealed to maintain watertightness. The Certificate holder can advise on suitable systems.

25 Finishes

When water-based products are used to coat the hardened concrete, a bonding agent may be required. For specific cases, advice should be sought from the Certificate holder.

Technical Investigations

26 Tests

26.1 Tests were conducted to determine the effect of Xypex Admix C-500 NF (1.25 % by weight of cement) on the properties of concrete designed to BS EN 480-1 : 2014.

26.2 Tests were carried out and the results assessed to determine the characteristics of fresh concrete, including:

- setting time
- workability

- air content
- slump
- density.

26.3 Tests were carried out and the results assessed to determine the characteristics of the hardened concrete, including:

- flexural strength
- compressive strength
- bond to steel
- wetting expansion
- efflorescence
- freeze/thaw resistance
- water vapour permeability
- modulus of elasticity
- drying shrinkage
- liquid water permeability.

27 Investigations

27.1 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.

27.2 A user survey was conducted to investigate the performance of the product in service.

27.3 An assessment of the test data supplied by the Certificate holder was made to determine characteristics of the admixture including:

- homogeneity and colour
- conventional dry material content
- water soluble chloride
- pH
- alkali content (sodium oxide equivalent)
- bleeding
- IR spectroscopy.

Bibliography

- BS 3177 : 1959 *Method of determining the permeability to water vapour of flexible sheet materials used for packaging*
- BS 8000-0 : 2014 *Workmanship on construction sites. Introduction and general principles*
- BS 8500-2 : 2015 + A2 : 2019 *Concrete. Complementary British Standard to BS EN 206. Specification for constituent materials and concrete*
- BS 8102 : 2009 *Code of practice for protection of below ground structures against water from the ground*
- BS EN 197-1 : 2011 *Cement. Composition, specifications and conformity criteria for common cements*
- BS EN 206 : 2013 + A1 : 2016 *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 + A1 : 2012 *Admixtures for concrete, mortar and grout. Concrete admixtures. Definitions, requirements, conformity, marking and labelling*
- BS EN 1992-1-1 : 2004 + A1 : 2014 *Eurocode 2: Design of concrete structures. General rules and rules for buildings*
NA + A2 : 14 to BS EN 1992-1-1 : 2004 + A1 : 2014 *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. General rules. 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 containment structures*
- BS EN 13670 : 2009 *Execution of concrete structures*

28 Conditions

28.1 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 or 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.

28.2 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.

28.3 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.

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

28.5 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.

28.6 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.