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Agrément Certificate
05/4216
Product Sheet 1

XYPEX WATERTIGHT CONCRETE SYSTEM

XYPEX ADMIX C-1000 NF

PRODUCT SCOPE AND SUMMARY OF CERTIFICATE

This Certificate relates to Xypex Admix C-1000 NF, an admixture used to provide watertight concrete.

AGRÉMENT 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

Resistance to water penetration — concrete containing the product has reduced permeability when compared to the equivalent plain concrete (see sections 5 and 6).

Reinforcement protection — concrete containing the product has enhanced resistance to reinforcement corrosion when compared to the equivalent plain concrete (see section 7).

Mechanical properties — the mechanical properties of the concrete are not adversely affected by the incorporation of the product (see section 8).

Durability — concrete containing the product is more durable than the equivalent plain concrete mix due to its reduced permeability (see section 17).

The BBA has awarded this Agrément 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: 8 September 2009

Originally certificated on 24 March 2005

Simon Wroe
Head of Approvals — Materials

Greg Cooper
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

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

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Regulations

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



The Building Regulations 2000 (as amended) (England and Wales)



The Building (Scotland) Regulations 2004 (as amended)



The Building Regulations (Northern Ireland) 2000 (as amended)

Construction (Design and Management) Regulations 2007

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

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

See sections:

2 *Delivery and site handling* (2.1, 2.3 and 2.4) and 21 *Placing* (21.1).

Non-regulatory Information

NHBC Standards 2008

In the opinion of the BBA, there are no requirements in these Standards relating to Xypex Admix C-1000 NF.

Zurich Building Guarantee Technical Manual 2007

In the opinion of the BBA the use of Xypex Admix C-1000 NF when installed and used in accordance with this Certificate is capable of satisfying the requirements of the *Zurich Building Guarantee Technical Manual* Section 5 *Internal/external works, services & finishes*, Sub-sections *External works*, and *Concrete mixes — General*.

Technical Specification

1 Description

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

1.3 The product is manufactured by a blending process. Quality control is exercised over raw materials, during production and on the final product.

2 Delivery and site handling

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

2.2 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.

2.3 The product is classified as 'irritant' under *The Chemicals (Hazard Information and Packaging for Supply) Regulations 2002* (CHIP3).

2.4 When handling, the normal health and safety procedures associated with cementitious materials should 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.

3 Use

3.1 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 watertight concrete for basements, swimming pools, tunnels, and culverts, without the requirement for additional applied protection.

3.2 Concrete containing the product should be designed in accordance with BS EN 206-1 : 2000 and BS 8500-2 : 2006 for use as all normal types, including precast, pre-stressed, post-tensioned, ready-mixed, reinforced, slip formed, sprayed and pumped concrete.

3.3 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 : 2000.

3.4 The product is suitable for use in contact with potable water.

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

4 Practicability of installation

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

5 Water penetration

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

6 Water vapour permeability

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

6.2 Concrete made with a high water/cement ratio can have a water vapour permeability above $3000 \times 10^{-12} \text{ gm(Ns)}^{-1}$. The permeability of concrete is strongly dependent on the exact mix design and the figure given in Table 2 indicates the levels that can be obtained using the product.

6.3 The appropriate thickness for concrete with a specific permeability to achieve a water vapour resistance of 200 MNsg^{-1} or 550 MNsg^{-1} (suitable for grades 3 and 4 respectively of BS 8102 : 1990) is given by:

For 200 MNsg^{-1} , $t = 0.2 \times 10^{12} \times p$

For 550 MNsg^{-1} , $t = 0.55 \times 10^{12} \times p$

where t = concrete thickness, mm and p = water vapour permeability in gm(Ns)^{-1} (from BS 3177 : 1959 test).

7 Reinforcement protection

7.1 The high alkalinity ($\text{pH} > 13$) of concrete necessary to prevent corrosion of the reinforcement is not adversely affected by the incorporation of the product.

7.2 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.

8 Mechanical properties

8.1 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 : 2001, Tables 3.1 and 3.2.

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

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

9 Drying shrinkage and wetting expansion

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

10 Setting and hardening characteristics

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

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

11 Carbonation resistance

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

12 Frost resistance

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

13 Sulfate resistance

The lower permeability of the 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.

14 Alkali silica reaction (ASR)

14.1 Concrete containing the product should be designed according to BS EN 206-1 : 2000, Section 5.2.3.4 and BS 8500-2 : 2006, Section 5.2.

14.2 The sodium oxide equivalent of the product when measured in accordance with BS EN 480-12 : 1998 was 6.81% by mass of admixture.

15 Resistance to leaching

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

16 Maintenance

For a specific installation, the maintenance regime should be considered to ensure that the required design life of the concrete is achieved.

17 Durability

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

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

Installation

18 General

18.1 Structures built incorporating the product should be designed to the relevant Sections of BS 8007 : 1987, BS 8102 : 1990, BS 8110-1 : 1997, BS EN 1992-1-1 : 2004 and BS EN 1992-1-2 : 2004.

18.2 Concrete containing the product is suitable for Type B constructions as described in BS 8102 : 1990, and can meet the requirements for all grades defined in Table 1 of this Standard. For Grades 3 and 4 (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 6.2 and 6.3).

18.3 Basements for dwellings should be designed in accordance with the guidance given in the Approved Document Basement for dwellings⁽¹⁾.

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

19 Mix design

19.1 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.

19.2 The concrete must have a minimum cement content of 325 kgm⁻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.

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

19.4 Once mixed, further materials must not be added to the fresh concrete.

19.5 The consistency of the concrete can be adjusted using a suitable⁽¹⁾ water reducing or superplasticising admixture complying with BS EN 934-2 : 2001, Tables 3.1 and 3.2 to ensure the maximum water/cement ratio given in section 19.2 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 should be carried out to establish the appropriate dose required.

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

20 Site mixing

20.1 The product is added at the correct dose (see section 3.1) to the aggregate and sand, then mixed thoroughly for two to three minutes⁽¹⁾ before adding the cement and water.

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

20.3 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.

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

21 Placing

21.1 Concrete containing the product should be placed in the same way as normal concrete, in accordance with BS 8000-2.2 : 1990, ENV 13670-1 : 2000, the Certificate holder's health and safety guidance and the normal routine precautions for handling concrete.

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

21.3 Concrete containing the product should be fully compacted.

22 Curing

The concrete should be cured strictly in accordance with BS 8110-1 : 1997, ENV 13670-1 : 2000 and the Certificate holder's recommendations where site specific information exists.

23 Joints

23.1 Joints should be designed with waterstops as recommended in BS 8102 : 1990, to maintain watertightness of the whole structure. The advice of the Certificate holder should be sought for a particular construction.

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

24 Finishes

When water-based products are used to coat the Xypex Admix C-1000 NF concrete, a bonding agent may be needed. For specific cases, advice should be sought from the Certificate holder.

Technical Investigations

25 Tests

25.1 The results of tests were evaluated to determine the effect of the product on the properties of concrete designed to BS EN 480-1 : 1998, Reference concrete 1, see Tables 1 and 2 of this Certificate.

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

Property	Control concrete	Xypex Admix C-1000 NF	Test reference
Xypex Admix C-1000 NF (% wt/wt PC)	–	1.25	
Water/cement ratio	0.47	0.45	
Slump (mm)			BS EN 12350-2
0 min	65	60	
30 min	30	35	
Plastic density (kgm ⁻³)	2415	2420	BS EN 12350-6
Air content (%)	0.7	0.8	BS EN 12350-7
Setting time (min)			BS 5075-1
initial set	170	315	
final set	235	490	

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

Property	Control concrete	Xypex Admix C-1000 NF	Test reference
Xypex Admix C-1000 NF (% wt/wt PC)	–	1.25	
Water permeability (ms ⁻¹)	3.26 x 10 ⁻¹³	1.99 x 10 ⁻¹³	Taywood/Valenta
Drying shrinkage (%)	0.030	0.023	BS 1881-5
Wetting expansion (%)	0.019	0.013	
Freeze/thaw expansion (%)	0.009	0.001	BS 5075-2
Compressive strength (Nmm ⁻²)			BS EN 12390-3
24 hours	18.0	19.0	
28 days	57.8	64.2	
Flexural strength (Nmm ⁻²)			BS EN 12390-5
24 hours	2.5	2.4	
28 days	6.0	6.4	
Modulus of elasticity (Nmm ⁻²)			BS 1881-122
28 days	38500	42000	
Water vapour permeability [gm(Ns) ⁻¹]	690 x 10 ⁻¹²	440 x 10 ⁻¹²	BS 3177

(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.

25.2 Tests were carried out by the BBA to determine:

- characteristics of the admixture including:
 - alkali content
 - setting time in cement-blended mortars
 - pH
 - total chlorine
 - water soluble chloride
 - IR trace
 - conventional dry material content
- fresh concrete
 - setting time
 - workability
- hardened concrete
 - liquid water permeability
 - water vapour permeability
 - compressive strength
 - flexural strength
 - modulus of elasticity
 - bond to steel
 - drying shrinkage
 - wetting expansion
 - freeze/thaw resistance
 - efflorescence.

26 Investigations

26.1 The manufacturing process was examined including methods for quality control, details of quality and composition of the materials used.

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

Bibliography

- BS 1881-5 : 1970 *Testing concrete — Methods of testing hardened concrete for other than strength*
- BS 1881-122 : 1983 *Testing concrete — Method for determination of water absorption*
- BS 3177 : 1959 *Method for determining the permeability to water vapour of flexible sheet materials used for packaging*
- BS 5075-1 : 1982 *Concrete admixtures — Specification for accelerating and retarding water reducing admixtures*
- BS 5075-2 : 1982 *Concrete admixtures — Specification for air-entraining admixtures*
- 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 8007 : 1987 *Code of practice for design of concrete structures for retaining aqueous liquids*
- BS 8102 : 1990 *Code of practice for protection of structures against water from the ground*
- BS 8110-1 : 1997 *Structural use of concrete — Code of practice for design and construction*
- BS 8500-2 : 2006 *Concrete — Complementary British Standard to BS EN 206-1 — Specification for constituent materials and concrete*
- BS EN 197-1 : 2000 *Cement — Composition, specifications and conformity criteria for common cements*
- BS EN 206-1 : 2000 *Concrete — Specification, performance, production and conformity*
- BS EN 480-1 : 1998 *Admixtures for concrete, mortar and grout — Test methods — Reference concrete and reference mortar for testing*
- BS EN 480-12 : 1998 *Admixtures for concrete, mortar and grout — Test methods — Determination of the alkali content of admixtures*
- BS EN 934-2 : 2001 *Admixtures for concrete, mortar and grout — Concrete admixtures — Definitions, requirements, conformity, marking and labelling*
- BS EN 1992-1-1 : 2004 *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 and rules for buildings. General rules. Structural fire design*
- BS EN 12350-2 : 2000 *Testing fresh concrete — Slump test*
- BS EN 12350-6 : 2000 *Testing fresh concrete — Density*
- BS EN 12350-7 : 2000 *Testing fresh concrete — Air content — Pressure methods*
- BS EN 12390-3 : 2002 *Testing hardened concrete — Compressive strength of test specimens*
- BS EN 12390-5 : 2002 *Testing hardened concrete — Flexural strength of test specimens*
- ENV 13670-1 : 2000 *Execution of concrete structures — Common*

27 Conditions

27.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is granted only to the company, firm or person named on the front page — no other company, firm or person may hold or claim any entitlement to this Certificate
- 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.

27.2 Publications and documents referred to in this Certificate are those that the BBA deems to be relevant at the date of issue or re-issue of this Certificate and include any: Act of Parliament; Statutory Instrument; Directive; Regulation; British, European or International Standard; Code of Practice; manufacturers' instructions; or any other publication or document similar or related to the aforementioned.

27.3 This Certificate will remain valid for an unlimited period provided that the product/system and the manufacture and/or fabrication including all related and relevant 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.

27.4 In granting this Certificate, the BBA is not responsible for:

- 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
- individual installations of the product/system, including the nature, design, methods and workmanship of or related to the installation
- the actual works in which the product/system is installed, used and maintained, including the nature, design, methods and workmanship of such works.

27.5 Any information relating to the manufacture, supply, installation, use and maintenance 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 and maintained. It does not purport in any way to restate the requirements of the Health & Safety at Work etc Act 1974, or of any other statutory, common law or other duty which may exist at the date 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. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the manufacture, supply, installation, use and maintenance of this product/system.