Sika Limited
Watchmead
Welwyn Garden City
Hertfordshire AL7 1BQ

Tel: +44 (0)1707 394444
e-mail: technical@uk.sika.com
website: www.sika.co.uk

Agrément Certificate
19/5643
Product Sheet 1

SIKA WATERTIGHT CONCRETE SYSTEM

SIKA 1+ SYSTEM

This Agrément Certificate Product Sheet(1) relates to the Sika 1+ System, a two-component system compromising a water resisting admixture and a high range water-reducing/superplasticising admixture, used to provide watertight concrete. The system is suitable for basements, roofs, swimming pools, tunnels and culverts, without the requirement for additional applied protection.

(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 penetration and absorption — concrete containing the system has reduced permeability when compared with the equivalent plain concrete (see section 6).

Reinforcement protection — concrete containing the system has enhanced resistance to reinforcement corrosion when compared with the equivalent plain concrete (see section 8).

Mechanical properties — the mechanical properties of the concrete are not adversely affected by the incorporation of the system (see section 9).

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

The BBA has awarded this Certificate to the company named above for the system described herein. This system 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: 24 April 2019

John Albon
Chief Scientific Officer

Claire Curtis-Thomas
Chief Executive

Certificate amended on 6 August 2019 to update section 6.
Certificate amended on 28 October 2019 to update section 20.

Regulations

In the opinion of the BBA, the use of the Sika 1+ System 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 sections: 3 *Delivery and site handling* (3.1, 3.2, 3.4 and 3.5) and 22 *Placing* (22.1) of this Certificate.

Additional Information

NHBC Standards 2019

In the opinion of the BBA, the Sika 1+ System, 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 system 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 system is not covered by a harmonised European Standard under the construction Products Regulation. However, the Certificate holder has taken the responsibility of CE marking both components of the system individually, in accordance with harmonised European Standard BS EN 934-2 : 2009. An asterisk (*) appearing in this Certificate indicates that the data shown are given in the manufacturer's Declaration of Performance.

Technical Specification

1 Description

The Sika 1+ System comprises two components:

- Sika 1+ — a liquid admixture
- Sika ViscoFlow/ViscoCrete — a range of liquid admixtures designed as a high range water reducer or superplasticiser.

2 Manufacture

2.1 The system components are produced by a 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.

2.3 The management system of Sika Limited has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 by BSI (Certificate FM 12504).

3 Delivery and site handling

3.1 The system components are supplied in 20 or 200 litre drums, and 1000 litre intermediate bulk containers (IBC).

3.2 Each drum or IBC bares the manufacturer's name, product name, batch number, Health and Safety information and the BBA logo incorporating the number of this Certificate.

3.3 The system components must be stored in sealed original containers in a dry environment at temperatures between 5 and 25°C. The components have a shelf-life of 12 months when stored under these conditions.

3.4 The Certificate holder has taken the responsibility of classifying and labelling the system 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).

3.5 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 the Sika 1+ System.

Design Considerations

4 Use

4.1 The system is satisfactory for use in concrete mixes at the addition rates shown in Table 1, to provide watertight concrete for basements, roofs, swimming pools, tunnels and culverts, without the requirement for additional applied protection.

Table 1 Mix designs

Component	Control concrete	Concrete containing the Sika 1+ System
Water/cement ratio	0.42	0.39
Sika 1+ (% wt/wt PC)	—	1.5
Sika ViscoFlow 1000 (% wt/wt PC)	—	0.5

4.2 The effects of the admixture on the properties of the concrete designed to BS EN 480-1 : 2014 are shown in Table 2 of this Certificate.

Table 2 Effects of the system on the properties of fresh wet concrete(1)

Property (unit)	Control concrete	Concrete containing the Sika 1+ System
Slump (mm)		
0 min	70	120
30 min	40	115
Plastic Density ($kg \cdot m^{-3}$)	2414	2389
Air Content (%)	2.1	3.6

(1) The specific effect of the system 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 system 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 pump concretes.

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

4.5 Sika Limited have self-certified Sika 1+ for use in contact with potable water. This aspect is outside the scope of this Certificate.

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

4.7 Sika 1+ provides water resistance, pore blocking and enhanced durability when incorporated in concrete complying with BS EN 934-2 : 2009, Table 9.

4.8 Sika ViscoFlow/ViscoCrete admixtures comply with BS EN 934-2 : 2009, Tables 3.1 and 3.2, enabling a significant reduction in water/cement ratio of the mix, while enhancing workability of the concrete during placement.

5 Practicability of installation

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

6 Water penetration and absorption

6.1 Concrete containing the system has greater resistance to water penetration and water absorption than an equivalent plain concrete.

6.2 Tests on concrete containing the system (as per Table 1), showed a water permeability(1) of 5.60 x 10^{-14} m·s^{-1}, compared with 9.48 x 10^{-14} m·s^{-1} for control concrete.

6.3 Tests on concrete containing the system (as per Table 1), showed a capillary absorption(1) of 47% by mass of the control concrete at 7 days, and 45% by mass of the control concrete at 90 days.

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

7 Water vapour permeability

7.1 Concrete containing the system has a lower permeability to water vapour as that of an equivalent plain concrete.

7.2 Tests on concrete containing the system (as per Table 1), showed a water vapour permeability(1) of 467 x 10^{-12} g·m(N·s)$^{-1}$ compared with 560 x 10^{-12} g·m(N·s)$^{-1}$ for control concrete.

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

7.3 Concrete made with a high water/cement ratio can have a water vapour permeability greater than 3000 x 10^{-12} g·m(N·s)$^{-1}$. The permeability of concrete is strongly dependent on the exact mix design, and the figures given in section 7.2 indicate the levels that can be obtained using the admixture.

7.4 The appropriate thickness for concrete with a specific permeability to achieve a water vapour resistance of 200 or 500 MN·sg^{-1}(1) (suitable for grade 3 of BS 8102 : 2009) is given by:

For 200 MN·sg^{-1}(1), t=0.2 x 10^{12} x p
For 500 MN·sg^{-1}(1), t=0.55 x 10^{12} x p

Where:

t is the concrete thickness in mm
p is the water vapour permeability in g·m(N·s)$^{-1}$ (from tests to BS 3177 : 1959).

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

8 Reinforcement protection

8.1 The high level of alkalinity required to prevent corrosion of the reinforcement (pH > 13) will not be adversely affected by the incorporation of the admixture in the concrete.

8.2 Corrosion of the 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 system will slow down diffusion of aggressive agents into the concrete and so provide improved protection against reinforcement corrosion.

8.3 The Certificate holder has declared the chloride ion content* of the admixtures contained in the system as < 0.1%.

8.4 The Certificate holder has declared that the admixtures contained in the system comply with the corrosion behaviour requirements given in BS EN 934-1 : 2008, Clause 5.1, and is labelled accordingly.

9 Mechanical properties

9.1 The compressive strength of concrete containing the system is higher than that of an equivalent plain concrete.

9.2 Test conducted on concrete containing the system showed a compressive strength of 20.5 $N \cdot mm^{-2}$ after 24 hrs compared to 22.5 $N \cdot mm^{-2}$ for control concrete(1), and 66.5 $N \cdot mm^{-2}$ after 28 days compared with 57.3 $N \cdot mm^{-2}$ for control concrete.

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

9.4 Tests conducted on concrete containing the system showed a flexural strength(2) of 2.2 $N \cdot mm^{-2}$ after 24 hrs, compared with 2.5 $N \cdot mm^{-2}$ for control concrete(1), and of 6.4 $N \cdot mm^{-2}$ after 28 days compared with 5.6 $N \cdot mm^{-2}$ for control concrete.

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

10 Drying shrinkage and wetting expansion

10.1 The drying shrinkage and wetting expansion of concrete containing the system is similar to that of an equivalent plain concrete.

10.2 Tests conducted on concrete containing the system showed a drying shrinkage(1) of 0.035% compared to 0.033% for the control concrete, and a wetting expansion(1) 0.018% compared to 0.014% for control concrete.

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

11 Setting characteristics and hardening

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

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

11.3 Tests conducted on concrete containing the system showed an initial set of 510 minutes compared to 155 minutes for the control and a final set of 875 minutes compared to 250 minutes for the control.

12 Carbonation resistance

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

13 Frost resistance

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

14 Sulfate resistance

The lower permeability of concrete containing the system 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 system 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 Sika 1+ System, when measured in accordance with BS EN 480-12 : 2014, was 0.01% by mass of admixture. The Certificate holder's declared value* of <0.1% should be used when calculating the contribution of the admixture to the total alkali content of a given concrete mix. In turn, this can be used to assess the susceptibility of that concrete to alkali-silica reaction.

16 Resistance to leaching

Use of the system will reduce the leaching of lime from the hydrated cement in concrete.

17 Maintenance

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 system is more durable than an 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 should be made. In these situations, the Certificate holder should be consulted on the suitability of the system.

Installation

19 General

19.1 When used in concrete mixes, the system enhances durability and improves protection against reinforcement corrosion by providing the concrete with reduced permeability that protects against water ingress via absorption and hydrostatic pressure.

19.2 The use of the system will produce a concrete with the following properties relative to a control:

- reduced porosity
- reduced permeability
- increased water resistance
- increased corrosion resistance.

19.3 The system has no known detrimental effect on the properties of concrete.

19.4 Structures built incorporating the system should be designed to the relevant clauses 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.

19.5 The system is suitable for Type B constructions as defined in BS 8102 : 2009, 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 the mix with a sufficiently low vapour permeability in combination with an adequate section thickness (see sections 7.2 and 7.3). The use of suitable ventilation, dehumidification or air conditioning, appropriate to the intended use, must also be considered.

19.6 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 system is normally supplied as ready-mixed concrete but may be prepared on sites where there is adequate mix control(1). Preparation of concrete 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.

20.2 The system components should be added to the concrete mix at the rate of:

- Sika 1+ 1.5 % by weight of cement
- Sika ViscoFlow/ViscoCrete(1) 0.5 % by weight of cement.

(1) The Sika ViscoFlow/ViscoCrete dosage may be varied with the Certificate holder's agreement to obtain the appropriate slump and workability and ensuring the maximum water/cement ratio given in section 20.3 is not exceeded.

20.3 The concrete must have a minimum cement content of 350 $kg \cdot m^{-3}$ and be batched with a maximum water/cement ratio of 0.45 to achieve a minimum consistence of S3. Further details of suitable mixes can be obtained from the Certificate holder.

21 Site mixing

21.1 The system components are added to the concrete at the dosages given in section 20 by automatic dispensing equipment. Between 50 and 75% of the total water is added first, followed by Sika 1+, and finally Sika ViscoFlow/ViscoCreteand the remaining amount of water. The system components must always be added separately and should never be mixed together prior to addition.

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

21.3 Where the system 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 system should be 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 system should not be placed at temperatures of 5°C or below.

22.3 Concrete containing the system mix should be fully compacted.

23 Curing

The concrete must be cured strictly in accordance with BS EN 13670 : 2009, and BS EN 1992-1-1 : 2004 and its UK National Annex, 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. The advice of the Certificate holder should be sought on particular applications.

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 carried out and the results assessed to determine the effect of the system on the properties of concrete designed in accordance with BS EN 480-1 : 2014.

26.2 Test 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 hardened concrete, including:

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

26.4 Tests carried out for the characterisation of Sika 1+ admixture included:

- homogeneity and colour
- water soluble chloride
- alkali content (Na_2O equivalent)
- IR spectroscopy.

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 system in service.

Bibliography

BS 3177 : 1959 *Method for determining the permeability to water vapour of flexible sheet materials used for packaging*

BS 8000-0 : 2014 *Workmanship on construction site — Introduction and general principles*

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

BS 8500-2 : 2015 + A1 : 2016 *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 + 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 : 1998 *Admixtures for concrete, mortar and grout — Test methods — Determination of alkali content of admixtures*

BS EN 934-1 : 2008 *Admixtures for concrete, mortar and grout — Common requirements*
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*

BS EN ISO 9001 : 2015 *Quality m*anagement systems — *Requirements*

28 Conditions

28.1 This Certificate:

- relates only to the product 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 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 or any other product
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product
- actual installations of the product, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product, 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 which is contained or referred to in this Certificate is the minimum required to be met when the product 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.

British Board of Agrément
Bucknalls Lane
Watford
Herts WD25 9BA

tel: 01923 665300
clientservices@bbacerts.co.uk
www.bbacerts.co.uk