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Agrément Certificate

14/5129

Product Sheet 1

TRITON WATERTIGHT CONCRETE SYSTEMS

TRITON TT ADMIX

This Agrément Certificate Product Sheet⁽¹⁾ relates to Triton TT Admix, a crystalline waterproofing admixture powder, for use in concrete mixes to provide watertight concrete 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 — concrete containing the product has reduced permeability when compared with an equivalent plain concrete (see section 6).

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

Mechanical properties — the flexural and compressive strengths of concrete are not adversely affected by the incorporation of the product (see section 9).

Durability — concrete containing the product is more durable than an equivalent plain concrete mix, owing to its reduced capillary absorption (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: 3 January 2018

John Albon — Head of Approvals
Construction Products

Claire Curtis-Thomas
Chief Executive

Originally certificated on 16 June 2014

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, the use of Triton TT Admix 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, 3.4 and 3.5) and 22 *Placing* (22.1) of this Certificate.

Additional Information

NHBC Standards 2018

In the opinion of the BBA, Triton TT Admix, 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).

Technical Specification

1 Description

Triton TT Admix is a crystalline waterproofing admixture powder, consisting of blended Portland cement and proprietary chemicals. When incorporated in concrete mixes it enhances the water resistance and durability properties of the hardened concrete.

2 Manufacture

2.1 The product is manufactured 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.

3 Delivery and site handling

3.1 The product is supplied in 4.1 kg water-soluble bags, heat sealed, packed 6 bags per plastic pail, 8 pails per layer and 2 layers high, shrink-wrapped on a wooden pallet (ie 96 bags per pallet).

3.2 Each container bears the Certificate holder's name, product name, batch number, health and safety information and the BBA logo incorporating the number of this Certificate.

3.3 The product must be stored in sealed original containers in a dry environment indoors, undercover and out of direct sunlight, at temperatures between 10°C and 38°C. When stored under these conditions, the product has a shelf-life of 6 months.

3.4 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).

3.5 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 Triton TT Admix.

4 Use

4.1 The product is satisfactory for use in concrete mixes at an addition rate of 1.17% by weight of cement in the mixture with a maximum water/cement of 0.45, to provide watertight concrete for basements, roofs, swimming pools, tunnels, and culverts, without the requirement for additional applied protection.

4.2 The effect of the product on the properties of concrete designed to BS EN 480-1 : 2014 is shown in Table 1.

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

Property (unit)	Control concrete	Triton TT Admix (1.17% wt/wt PC)
Water/cement ratio	0.43	0.42
Slump (mm)		
0 minimum	60	60
30 minimum	60	50
Plastic density (kg·m ⁻³)	2398	2417
Air content (%)	1.5	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.

4.3 Concrete containing the product should be designed in accordance with BS EN 206-1 : 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.

4.4 The product 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 The 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 clause 9.2.1.4.

5 Practicability of installation

The product can be placed, compacted and cured by operatives with experience of conventional concreting methods and equipment.

6 Water penetration

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

6.2 Tests conducted on a concrete containing the product at an addition rate of 1.17% by weight of cement in the mixture with a maximum water/cement ratio of 0.45 showed a water permeability⁽¹⁾ of $3.35 \times 10^{-13} \text{ m} \cdot \text{s}^{-1}$ compared with $3.74 \times 10^{-13} \text{ m} \cdot \text{s}^{-1}$ 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.

7 Water vapour permeability

7.1 Concrete containing the product has a lower permeability by water vapour than that of an equivalent plain concrete. For specific cases, advice should be sought from the Certificate holder.

7.2 Tests conducted on concrete containing the product at an addition rate of 1.17% by weight of cement showed a water vapour permeability⁽¹⁾ of $667 \times 10^{-12} \text{ g} \cdot \text{m} (\text{N} \cdot \text{s})^{-1}$ compared with $774 \times 10^{-12} \text{ g} \cdot \text{m} (\text{N} \cdot \text{s})^{-1}$ 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.

7.3 Concrete made with a high water/cement ratio can have a water vapour permeability greater than $3000 \times 10^{-12} \text{ g} \cdot \text{m} (\text{N} \cdot \text{s})^{-1}$. 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 product.

7.4 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 BS 8102 : 2009, Grade 3) is given by:

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

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

where: t = concrete thickness (mm)

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

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

8 Reinforcement protection

8.1 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 concrete.

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

9 Mechanical properties

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

9.2 The flexural strength of concrete containing the product is similar to that of an equivalent plain concrete. For specific cases, advice should be sought from the Certificate holder.

9.3 The static modulus of elasticity of concrete containing the product is similar to that of an equivalent plain concrete.

9.4 The effect of the product on the mechanical properties of concrete designed to BS EN 480-1 : 2014 is shown in Table 2.

Table 2 Effects of the product on the mechanical properties of hardened concrete⁽¹⁾

Property (unit)	Control concrete	Triton TT Admix (1.17% wt/wt PC)
Compressive strength ($\text{N}\cdot\text{mm}^{-2}$)		
24 hours	19.7	16.5
28 days	60.8	55.0
Flexural strength ($\text{N}\cdot\text{mm}^{-2}$)		
24 hours	2.7	2.6
28 days	5.8	5.5
Modulus of elasticity ($\text{N}\cdot\text{mm}^{-2}$)		
28 days	37500	38000

(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.

10 Drying shrinkage and wetting expansion

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

10.2 The effect of the product on the shrinkage and expansion properties of concrete designed to BS EN 480-1 : 2014 is shown in Table 3.

Table 3 Effects of the product on the shrinkage and expansion properties of hardened concrete⁽¹⁾

Property (unit)	Control concrete	Triton TT Admix (1.17% wt/wt PC)
Water/cement ratio	0.43	0.42
Drying shrinkage (%)	0.038	0.027
Wetting expansion (%)	0.021	0.016

(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.

11 Setting and hardening characteristics

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

11.2 The setting time of concrete mixes containing the product will be higher than that of an equivalent plain concrete.

11.3 The effect of the product on the setting properties of concrete designed to BS EN 480-1 : 2014 is shown in Table 4.

Table 4 Effects of the product on the setting properties of fresh wet concrete⁽¹⁾

Property (unit)	Control concrete	Triton TT Admix (1.17% wt/wt PC)
Water/cement ratio	0.43	0.42
Setting time (minutes)		
initial set	150	205
final set	245	285

(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.

12 Carbonation resistance

Concrete containing the product has a similar resistance to carbon dioxide diffusion to that of an equivalent plain concrete.

13 Frost resistance

Concrete containing the product has a similar freeze/thaw resistance 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 206-1 : 2013, clause 5.2.3.4, 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 9.51% by mass of admixture. The Certificate holder's declared value of <10.4% should be used when calculating the contribution of the product 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 product reduces the leaching of lime from the hydrated cement in the concrete.

17 Maintenance

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

18 Durability

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

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 concrete.

Installation

19 General

19.1 When used in concrete, Triton TT Admix enhances durability and improves protection against reinforcement corrosion, by providing a concrete with reduced permeability that protects it against water ingress via hydrostatic pressure.

19.2 Use of the product will produce a concrete with properties relative to a control of:

- reduced porosity
- reduced capillary absorption
- increased water resistance
- increased corrosion resistance.

19.3 Structures built incorporating the product should be designed to the relevant sections of BS 8102 : 2009, BS EN 1992-1-1 : 2004, BS EN 1992-1-2 : 2004 and BS EN 1992-3 : 2006.

19.4 Concrete containing the product is 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 that 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 7.2 and 7.3).

19.5 Basements for dwellings should be designed in accordance with the guidance given in *Approved document — basement for dwellings (revised edition)*⁽¹⁾.

(1) Published by the British Cement Association, Product code: 48.062.

20 Mix design

20.1 Concrete containing the product is normally supplied as ready-mixed concrete but may be prepared on sites where there is adequate mix control. Concrete preparation 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 350 kg·m⁻³, be batched with a maximum water/cement ratio of 0.45 and have a minimum consistency of S3. Further details of suitable mixes can be obtained from the Certificate holder.

20.3 Once the fresh concrete is mixed, further materials must not be added.

20.4 The consistency of the concrete can be adjusted using a suitable⁽¹⁾ water reducing or superplasticising admixture complying with BS EN 934-2 : 2009 to ensure that the maximum water/cement ratio given in section 20.2 is not exceeded. Specific admixtures have not been considered and are outside the scope of this Certificate.

(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.

21 Site mixing

21.1 The product is added to the mixer at the correct dose (see section 4.1) prior to batching the concrete constituents.

21.2 Any additional superplasticiser should only be added once the product has been incorporated.

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

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 should not be placed at temperatures of 5°C or below.

22.3 Concrete containing the product should be fully compacted.

23 Curing

The concrete should be cured strictly in accordance with BS EN 13670 : 2009, 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 should be designed with waterstops as recommended in BS 8102 : 2009, to maintain 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 advice of the Certificate holder should be sought on suitable systems.

25 Finishes

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

Technical Investigations

26 Tests

26.1 Tests were conducted on concrete designed to BS EN 480-1 : 2014 both with and without Triton TT Admix and the results assessed to determine:

- water/cement ratio
- slump
- plastic density
- air content
- setting time
- water permeability
- capillary absorption
- drying shrinkage
- wetting expansion
- freeze/thaw
- compressive strength
- flexural strength
- modulus of elasticity.

26.2 Tests were carried out on the characteristics of the admixture and the results assessed to determine:

- conventional dry material content
- pH
- total chloride content
- water soluble chloride ion content
- alkali content
- corrosion behaviour.

26.3 Tests were carried out on the fresh concrete and the results assessed to determine:

- setting time
- workability
- air content
- slump
- density.

26.4 Tests were carried out on the hardened concrete and the results assessed to determine:

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

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.

Bibliography

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

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 206-1 : 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 + 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 to BS EN 1992-1-1 : 2004 + A1 : 2014 *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*

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