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Agrément Certificate

23/6775

Product Sheet 1 Issue 2

ADFIL STEEL FIBRE FOR CONCRETE

ADFIL STEEL FIBRE SF86

This Agrément Certificate Product Sheet⁽¹⁾ relates to Adfil Steel Fibre SF86, to reinforce concrete used in the construction of suspended ground floor and ground supported concrete slabs in single-family dwellings. The concrete is outside the scope of this Certificate.

(1) Hereinafter referred to as 'Certificate'.

The assessment includes

Product factors:

- compliance with Building Regulations
- compliance with additional regulatory or non-regulatory information where applicable
- evaluation against technical specifications
- assessment criteria and technical investigations
- uses and design considerations

Process factors:

- compliance with Scheme requirements
- installation, delivery, handling and storage
- production and quality controls
- maintenance and repair

Ongoing contractual Scheme elements†:

- regular assessment of production
- formal 3-yearly review



KEY FACTORS ASSESSED

- Section 1. Mechanical resistance and stability
- Section 2. Safety in case of fire
- Section 3. Hygiene, health and the environment
- Section 4. Safety and accessibility in use
- Section 5. Protection against noise
- Section 6. Energy economy and heat retention
- Section 7. Sustainable use of natural resources
- Section 8. Durability

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 Second issue: 9 April 2024

Originally certified on 21 April 2023

Hardy Giesler
Chief Executive Officer

This BBA Agrément Certificate is issued under the BBA's Inspection Body accreditation to ISO/IEC 17020. Sections marked with † are not issued under accreditation.

The BBA is a UKAS accredited Inspection Body (No. 4345), Certification Body (No. 0113) and Testing Laboratory (No. 0357).

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

The Certificate should be read in full as it may be misleading to read clauses in isolation.

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

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SUMMARY OF ASSESSMENT AND COMPLIANCE

This section provides a summary of the assessment conclusions; readers should refer to the later sections of this Certificate for information about the assessments carried out.

Compliance with Regulations

Having assessed the key factors, the opinion of the BBA is that Adfil Steel Fibre SF86, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations:



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

Requirement:	A1(1)	Loading
Comment:		The product can be designed to contribute to the residual flexural tensile strength of concrete. See section 1 of this Certificate.
Regulation:	7(1)	Materials and workmanship
Comment:		The product is of acceptable materials. See section 8 and 9 of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)	Fitness and durability of materials and workmanship
Comment:		The product can contribute to a construction satisfying this Regulation. See sections 8 and 9 of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	1.1(a)(b)	Structure
Comment:		The product can be designed to contribute to the residual flexural tensile strength of concrete. See section 1 of this Certificate.
(1) Technical Handbook (Domestic).		



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

Regulation:	23(a)(i)	Fitness of materials and workmanship
Comment:	(iii)(b)(i)(ii)	The product is acceptable. See section 8 and 9 of this Certificate.
Regulation:	30	Stability
Comment:		The product can be designed to contribute to the residual flexural tensile strength of concrete. See section 1 of this Certificate.

Additional Information

NHBC Standards 2024

In the opinion of the BBA, Adfil Steel Fibre SF86, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements in relation to *NHBC Standards*, Chapters 3.1 *Concrete and its reinforcement* and 5.2 *Suspended ground floors*.

Fulfilment of Requirements

The BBA has judged Adfil Steel Fibre SF86 to be satisfactory for use in concrete for the construction of suspended ground floor and ground supported concrete slabs in single-family dwellings.

ASSESSMENT

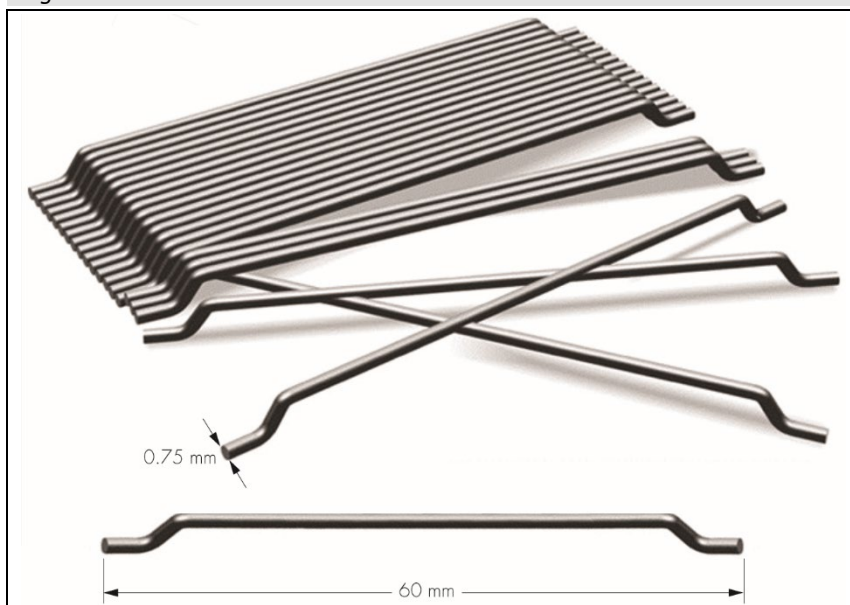
Product description and intended use

The Certificate holder provided the following description for the product under assessment. See Figure 1 for this Certificate. The nominal characteristic properties of the product are given in Table 1 of this Certificate.

Table 1 Nominal properties of Adfil SF86 Steel Fibre

Product	Property	Value
Steel fibre SF86	Shape	Hooked end
	Steel type	Low carbon
	Length (mm)	60 ± 3
	Equivalent diameter (mm)	0.75 ± 0.04
	Aspect ratio	80 ± 8
	Tensile strength ($\text{N}\cdot\text{mm}^{-2}$)	1225 ± 92 (for the mean value)
	Elastic modulus ($\text{N}\cdot\text{mm}^{-2}$)	200000
	Density ($\text{kg}\cdot\text{m}^{-3}$)	7850

Figure 1 Steel Fibre dimensions



Ancillary Items

The Certificate holder recommends the following ancillary items for use with the product, but these materials have not been assessed by the BBA and are outside the scope of this Certificate:

- Standard or self-compacting concrete minimum strength class C28/35 (see Table 2 for the specification of the concrete)
- Fibrin⁽¹⁾ PC-12, length 12 mm, equivalent diameter 40 µm micro-polymer fibres, dosage 0.75 kg·m⁻³
- Fibrin 23, 12 mm length, 18 µm diameter monofilament polypropylene fibres, dosage 0.91 kg·m⁻³ as per BBA Certificate 19/5715 PS1
- Fibrin X-T, 13 and 19 mm length, 22 µm diameter monofilament polypropylene fibres, dosage 0.91 kg·m⁻³ as per BBA Certificate 19/5715 PS2
- Crackstop, 12 and 19 mm length, 18 µm diameter monofilament polypropylene fibres, dosage 0.60 kg·m⁻³ as per BBA Certificate 19/5715 PS3
- Crackstop Ultra, 13 and 19 mm length, 22 µm diameter monofilament polypropylene fibres, dosages 0.91 kg·m⁻³ as per BBA Certificate 19/5715 PS4.

(1) Similar micro polymer fibre with the same specification or better, CE marked to BS EN 14889-2 : 2006, can also be used.

Table 2 Specification of concrete reinforced with Adfil Steel Fibre SF86

Characteristic	Value
Compressive strength class	C28/35
Minimum cement content	400 kg·m ⁻³
Aggregate for concrete	The aggregate for concrete must comply with BS EN 12620 : 2002. The maximum aggregate size is 10 mm
Cement types designation (BS EN 197-1 : 2011/2:2023 BS 8500-2 : 2023)	CEM IIA-L / CIIA-L CEM IIB-S / CIIB-S CEM IIIA / CIIIA
Maximum water ⁽¹⁾ /cement ratio	0.46
Consistency class	SF2 (660 to 750) - refer to BS EN 206 : 2013, Table 6
Admixture/superplasticiser	Per manufacturer's instructions and BS EN 934-2 : 2009

(1) The water used in the concrete must comply with the requirements of BS EN 1008 : 2002

Product assessment – key factors

The product was assessed for the following key factors, and the outcome of the assessments is shown below. Conclusions apply to the whole of the UK unless otherwise stated.

1 Mechanical resistance and stability

1.1 Residual flexural tensile strength of concrete

1.1.1 Results of assessments of concrete reinforced with the product, based on fR1 (residual flexural tensile strength at CMOD⁽¹⁾ of 0.5 mm), fR3 (residual flexural tensile strength at CMOD of 2.5 mm) and fR4 (residual flexural tensile strength at CMOD of 3.5 mm), in accordance with the principle of BS EN 14651 : 2005, for the concrete specification as indicated in the Table below, are shown in Table 3 of this Certificate.

(1) CMOD stands for Crack Mouth Opening Displacement.

Table 3 Residual flexural tensile strength of concrete

Product assessed	Assessment method	Requirement	Result (N·mm ⁻²)
Ready mix concrete reinforced with Adfil SF86 steel fibre, with dosage of 20 ⁽¹⁾ kg·m ⁻³ , for concrete C28/35	BS EN 14651 : 2005	Value achieved	fR1= 2.76 fR3= 2.73 fR4=2.27
Ready mix concrete reinforced with Adfil SF86 steel fibre, with dosage of 30 ⁽¹⁾ kg·m ⁻³ , for concrete C28/35			fR1= 2.86 fR3= 3.62 fR4=3.32
Ready mix concrete reinforced with Adfil SF86 steel fibre, with dosage of 45 ⁽¹⁾ kg·m ⁻³ , for concrete C28/35			fR1= 4.90 fR3= 5.60 fR4=5.20

(1) The dosage rates of steel fibre SF86 in this Table include 15% additional fibre to give the minimum required residual flexural tensile strength of concrete, including a tolerance for batching and fibre distribution.

1.1.2 On the basis of the testing undertaken, the concrete strength C28/35 will have a residual flexural tensile strength at CMOD of 0.5, 2.5 and 3.5 mm for the fibre dosages as shown in Table 3 of this Certificate and may be incorporated in a suitably designed concrete slab.

2 Safety in case of fire

Not applicable.

3 Hygiene, health and the environment

Not applicable.

4 Safety and accessibility in use

Not applicable.

5 Protection against noise

Not applicable.

6 Energy economy and heat retention

Not applicable.

7 Sustainable use of natural resources

7.1 Environmental information

The concrete including steel fibre can be readily recycled.

8 Durability

8.1 The potential mechanisms for degradation and the known performance characteristics of the materials in this product were assessed.

8.2 Service life

Under normal service conditions, the product will have a life of at least 60 years provided it is designed, installed and maintained in accordance with this Certificate and the Certificate holder's instructions.

Information provided by the Certificate holder was assessed for the following factors:

9 Design, installation, workmanship and maintenance

9.1 Design

9.1.1 A suitably experienced and competent individual must ensure that the floor system is suitable for the intended application, as defined below:

9.1.2 A site-specific assessment and design method must be performed, using the appropriate structural design codes including BS EN 1990 : 2002, BS EN 1992-1-1 : 2004' BS EN 1997-1 : 2004 and their UK National Annexes taking into account the following:

9.1.2.1 Variable actions – imposed, snow and wind load in accordance with the principles of BS EN 1991-1-1 : 2002, BS EN 1991-1-3 : 2003 and BS EN 1991-1-4 : 2005, and their UK National Annexes.

9.1.2.2 The permanent actions in accordance with the principles of BS EN 1991-1-1 : 2002 and its UK National Annexes.

9.1.2.3 Site conditions, shape, size and construction to evaluate the variable actions (imposed, snow, wind), permanent actions (self-weight) and total loads applied to the floor slab.

9.1.2.4 The maximum bending moment resistance of the floor must be calculated, using Equation 6 of TR34 (4th edition) or Swedish Standard SS 812310 : 2014 based on the f_{R1} , f_{R3} and f_{R4} values in accordance with BS EN 14651 : 2005 (see Table 3 of this Certificate).

9.1.2.5 The maximum effective span of the concrete floor slab must be calculated, using the maximum ultimate bending moment applied on the floor and the maximum ultimate bending moment resistance of the floor.

9.1.2.6 The maximum design shear resistance and punching shear resistance of the floor must be calculated in accordance with TR34 (4th edition), to resist the load defined in Table 4 of this Certificate.

9.1.2.7 The serviceability deflection limit under the quasi-permanent loads must be calculated and must not exceed span/500 in accordance with BS EN 1992-1-1 : 2004, section 7.4. For quasi-permanent load combination ($E_{c,eff}$), refer to BS EN 1990 : 2002, equation 6.16a. The effective modulus of elasticity of concrete is obtained from equation $E_{c,eff} = E_{cm}^{(1)} / (1 + \Psi)$, where Ψ is the long-term creep coefficient of the concrete and is equal to 2.

(1) E_{cm} is the modulus of elasticity of concrete for quartzite aggregates. For limestone and sandstone aggregates, the value of E_{cm} must be reduced by 10 and 30% respectively.

9.1.2.8 The characteristic values of imposed concentrated load and uniformly distributed load (UDL) for single-family dwellings in accordance with the provisions of BS EN 1991-1-1 : 2002 and its UK National Annex, must not exceed the values given in Table 4 of this Certificate.

Table 4 Maximum characteristic imposed and partition loads and weight of finishes for concrete floors reinforced with Adfil SF86 steel fibre

Description	Characteristic value of loads for single-family dwellings
Imposed UDL ($\text{kN}\cdot\text{m}^{-2}$)	1.5 ⁽¹⁾
Imposed concentrated load (kN)	2.0 ⁽¹⁾⁽²⁾
Line load partitions ($\text{kN}\cdot\text{m}^{-1}$)	1.0 ⁽³⁾
Allowance for moveable partition ($\text{kN}\cdot\text{m}^{-2}$)	0.5 ⁽³⁾
Finishes ($\text{kN}\cdot\text{m}^{-2}$)	0.25

(1) Imposed concentrated load must not be combined with UDL, or other variable actions.

(2) Imposed concentrated load for residential buildings is assumed to be applied over a square plate (at least 50 by 50 mm).

(3) Either the line load or allowance for moveable partitions must be accounted for.

9.1.2.9 The concrete mix design documents must be provided, incorporating the specification of the required concrete and the suitability of a proposed mix design, including an evaluation of the aggregate grading.

9.1.2.10 One of the microfibers mentioned in the ancillary items of this Certificate must be utilised to reduce the occurrence of plastic shrinkage cracking and plastic settlement, and to enhance the properties of the hardened concrete.

9.1.2.11 If the void below the slab is to be ventilated, a minimum void depth of 150 mm must be provided. Where the potential for clay heave has been identified, the void depth must be increased accordingly to maintain the minimum required for ventilation and to accommodate potential heave, which are specified according to the volume change potential of the soil as follows:

- high volume change – 300 mm total void (150 mm for ventilation + 150 mm for clay heave)
- medium volume change potential – 250 mm total void (150 mm for ventilation + 100 mm for clay heave)
- low volume change potential – 200 mm total void (150 mm for ventilation + 50 mm for clay heave).

9.1.2.12 Where heave precaution solutions are to be employed, allowance for their depth, hydration, or collapse/failure loads as appropriate must be allowed for in the design and detailing.

9.2 Installation

9.2.1 Installation instructions provided by the Certificate holder were assessed and judged to be appropriate and adequate.

9.2.2 Installation must be carried out in accordance with this Certificate and the Certificate holder's instructions. A summary of instructions and guidance is provided in Annex A.

9.2.3 The quality of work must comply with the relevant requirements BS EN 13670 : 2009, BS 8000-0 : 2014 and BS 8000 : Section 2.1 : 1990 and Section 2.2 : 1990, with regard to the placing of the concrete.

9.2.4 Fresh, fibre-reinforced concrete must be placed in situ via pumping or direct discharge without segregation.

9.2.5 During installation, the free flowing and stable self-compacting mix must not be mechanically vibrated.

9.2.6 Tests to confirm the dosage rate of steel fibres in a spot sample of the concrete, must be carried out in accordance with BS EN 14721 : 2005. For steel fibres, the maximum allowed deviation of single test results from the limit values, from tolerance on a target value or from the limits of the specified class, must be in accordance with BS EN 206 : 2013, Table 22.

9.2.7 The tolerance for the batching process and criteria for acceptability of steel fibre content must be in accordance with BS EN 206 : 2013, Tables 27 and B.2.

9.2.8 The product must be manufactured in accordance with BS 8500-1 : 2023, BS 8500-2 : 2023 and BS EN 206 : 2013 in plants covered by the QSRMC (Quality Scheme for Ready Mixed Concrete) or the BSI quality scheme.

9.3 Workmanship

Practicability of installation was assessed by the BBA on the basis of the Certificate holder's information. To achieve the performance described in this Certificate, installation of the product must be carried out by a competent general builder or contractor experienced with this type of product.

9.4 Maintenance and repair

As the product is installed within the floor structure and has suitable durability, maintenance is not required.

10 Manufacture

10.1 The production processes for the product have been assessed, and provide assurance that the quality controls are satisfactory according to the factors below:

10.1.1 The manufacturer has provided documented information on the materials, processes, testing and control factors.

10.1.2 The quality control operated over batches of incoming materials has been assessed and deemed appropriate and adequate.

10.1.3 The quality control procedures and product testing to be undertaken have been assessed and deemed appropriate and adequate.

10.1.4 The process for management of non-conformities has been assessed and deemed appropriate and adequate.

10.1.5 An audit of each production location was undertaken, and it was confirmed that the production process was in accordance with the documented process, and that equipment has been properly tested and calibrated.

† 10.2 The BBA has 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.

11 Delivery and site handling

11.1 The Certificate holder stated that the product is delivered to site in packaging bearing the product name, company name, CE marking and the mass of each bag/box in kilograms.

11.2 Delivery and site handling must be performed in accordance with the Certificate holder's instructions and this Certificate, including:

- all trained operatives involved with placing, compacting and finishing the concrete should wear appropriate personal protective equipment, eg goggles, impermeable gloves, long-sleeved jackets, full length trousers and boots, to avoid direct eye and skin contact with fresh concrete
- care must be taken when unloading, stacking and storing the fibres to prevent damage. They must be stored in a cool, dry environment and must be protected from exposure to direct sunlight
- the product is packaged in measured quantities of 7.5 and 20 kg in bags, which are supplied on pallets of 997.5 and 1000 kg respectively.

ANNEX A – SUPPLEMENTARY INFORMATION †

Supporting information in this Annex is relevant to the product but has not formed part of the material assessed for the Certificate.

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.

CE marking

The Certificate holder has taken the responsibility of CE marking the product in accordance with EN 14889-1 : 2006.

Additional information on installation

A.1 Before installation of the product can take place, a suitably experienced and competent engineer should check:

- the layout of the floor is in accordance with the design drawings
- appropriate formwork, if required, is provided and installed to the correct level and alignment
- any membranes or insulation are correctly positioned and installed
- the pour area is clean and free from debris and standing water.

A.2 The concrete mix design should contain at least 45% of fine aggregate (0 to 4 mm). For concrete which will be power floated, the fine aggregate ratio must be at least 47.5%.

A.3 Fibres are added at the batching plant, with care taken to ensure that adequate mix control and supervision is available.

A.4 Fibre concrete mixes will flow around reinforcement, into restricted areas and against mould faces, as for plain concrete of similar mix proportions:-

Bibliography

- BS 8000-0 : 2014 *Workmanship on construction sites – Part 0: Introduction and general principles*
BS 8000 : Section 2.1 : 1990 *Workmanship on building sites Part 2 – Code of practice for concrete work (Sections 2.1 Mixing and transporting concrete and 2.2 Sitework with in situ and precast concrete)*
- BS 8500-1:2023 *Concrete Complementary British Standard to BS EN 206 - Method of specifying and guidance for the specifier*
BS 8500-2:2023 *Concrete Complementary guidance to BS EN 206 - Specification for constituent materials and concrete*
- BS EN 197-1 : 2011 *Cement Part 1: Composition, specifications and conformity criteria for common cements*
- BS EN 206 : 2013 + A1 : 2016 *Concrete — Specification, performance, production and conformity*
- BS EN 934-2 : 2009 + A1 : 2012 *Admixtures for concrete, mortar and grout – Concrete admixtures – Definitions, requirements, conformity, marking and labelling*
- BS EN 1008 : 2002 *Mixing water for concrete — Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete*
- BS EN 13670 : 2009 *Execution of concrete structures*
- BS EN 1990 : 2002 + A1 : 2005 *Eurocode : Basis of structural design*
NA to BS EN 1990 : 2002 + A1 : 2005 *UK National Annex to Eurocode : Basis of structural design*
- BS EN 1991-1-1 : 2002 *Eurocode 1 : Actions on structures — General Actions — Densities, self-weight, imposed loads for buildings*
NA to BS EN 1991-1-1 : 2002 *UK National Annex to Eurocode 1 : Actions on structures — General Actions — Densities, self-weight, imposed loads for buildings*
BS EN 1991-1-3:2003+A1:2015 *Eurocode 1. Actions on structures. General actions. Snow loads*
BS EN 1991-1-4:2005+A1:2010 *Eurocode 1. Actions on structures. General actions. Wind actions*
- BS EN 1992-1-1 : 2004 + A1 : 2014 *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 1997-1:2004+A1:2013 *Eurocode 7. Geotechnical design. General rules*
NA+A2:2022 TO BS EN 1997-1:2004+A1:2013 *UK National Annex to Eurocode 7. Geotechnical design. General rules*
- BS EN 12620 : 2002 + A1 : 2008 *Aggregates for concrete*
- BS EN 14651 : 2005 + A1 : 2007 *Test method for metallic fibre concrete — Measuring the flexural tensile strength (limit of proportionality (LOP), residual)*
- BS EN 14721 : 2005 + A1 : 2007 *Test method for metallic fibre concrete — Measuring the fibre content in fresh and hardened concrete*
- BS EN 14889-1 : 2006 *Fibres for concrete — Steel fibres — Definitions, specifications and conformity*
BS EN 14889-2 : 2006 *Fibres for concrete — Polymer fibres — Definitions, specifications and conformity*
- TR34 (4th edition), March 2016 *Concrete industrial ground floors — A guide to design and construction*
- Swedish Standard SS 812310 : 2014 *Fibre Concrete – Design of Fibre Concrete Structures*

Conditions of Certificate

Conditions

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.

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.

3 This Certificate will be displayed on the BBA website, and the Certificate Holder is entitled to use the Certificate and Certificate logo, 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.

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

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.

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.

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