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BBA APPROVAL INSPECTION TESTING CERTIFICATION
TECHNICAL APPROVALS FOR CONSTRUCTION

Agrément Certificate
07/4474
Product Sheet 1

VIRIDIAN SOLAR PANELS

CLEARLINE RANGE OF ROOF INTEGRATED SOLAR COLLECTORS

This Agrément Certificate Product Sheet(1) relates to the Clearline Range of Roof Integrated Solar Collectors for mounting in tiled or slated roofs pitched between 20° and 60°, on commercial and domestic buildings for the purpose of heating domestic hot water from solar radiation. The collector panel is suitable for installation on new and existing constructions subject to the loadbearing capacity of the roof construction.

(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

Energy performance — when correctly installed, the product will reduce the dependency of the premises to which it is fitted on external energy sources (see section 6).

Structural performance — when installed in accordance with the Certificate holder's instructions, the product will resist the loads likely to be met during installation and service (see section 7).

Weathertightness — the product is resistant to rain penetration and will not adversely affect the resistance of the roof into which it is mounted to by rain, hail or wind-driven snow (see section 8).

Behaviour in relation to fire — the product has been tested for surface spread of flame and penetration performance in accordance with BS 476-3 : 2004 and may be characterised as having an AA rating (see section 9).

Durability — when installed and maintained in accordance with this Certificate, the product will not have an adverse affect on the service life of the roof. The product is considered durable in accordance with BS EN 12975-2 : 2006 (see section 11).

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: 16 January 2013

Originally certificated on 1 November 2007

Sean Moriarty — Head of Approvals
Energy and Ventilation

Greg Cooper
Chief Executive

Certificate amended on 25 January 2013 to change front page picture.

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 Clearline Range of Solar Collectors, if installed, used and maintained in accordance with this Certificate, will meet or contribute to meeting the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):

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

Requirement:	**A1**	**Loading**
Comment:		The product adequately transmits self-weight and wind loads to typical roof structures. See sections 7.1 to 7.5 of this Certificate.
Requirement:	**B4(2)**	**External fire spread**
Comment:		The product does not affect the existing fire rating of a roof structure. The panel has an 'AA' fire rating in accordance with BS 476-3 : 2004. See section 9.1 of this Certificate.
Requirement:	**C2(b)**	**Resistance to moisture**
Comment:		The product does not adversely affect the resistance of a roof to the ingress of precipitation. See sections 8.1 and 8.2 of this Certificate.
Requirement:	**L1(b)(i)**	**Conservation of fuel and power**
Comment:		The product will meet this requirement. See sections 6.1 to 6.8 of this Certificate.
Requirement:	**Regulation 7**	**Materials and workmanship**
Comment:		The product is acceptable. See section 11 and the *Installation* part of this Certificate.

The Building (Scotland) Regulations 2004 (as amended)

Regulation:	**8(1)(2)**	**Fitness and durability of materials and workmanship**
Comment:		The use of the product satisfies the requirements of this Regulation. See sections 10.1 to 10.6 and 11 and the *Installation* part of this Certificate.
Regulation:	**9**	**Building standards applicable to construction**
Standard:	1.1(b)	Structure
Comment:		The product has sufficient strength and stiffness to sustain design loads, with reference to clauses 1.1.2[(1)(2)] and 1.1.3[(1)(2)]. See section 7.1 to 7.5 of this Certificate.
Standard:	2.8	Spread from neighbouring buildings
Comment:		The product does not affect the existing fire rating of a roof structure. The collector panel has an 'AA' fire rating in accordance with BS 476-3 : 2004 and is considered 'low vulnerability', with reference to clause 2.8.1[(1)(2)]. See section 9.1 of this Certificate.
Standard:	3.10	Precipitation
Comment:		The product does not adversely affect the resistance of a roof to the ingress of precipitation, with reference to clause 3.10.8[(1)(2)]. See sections 8.1 and 8.2 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Comment:		The product will contribute to reducing the carbon dioxide emissions and increasing the energy efficiency of the building, with reference to clauses 6.1.1[(1)(2)], 6.1.2[(1)(2)], 6.1.3[(1)(2)] and 6.1.6[(1)(2)]. See sections 6.1 to 6.8 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The product can contribute to meeting the relevant requirements of Regulation 9, Standards 1 to 6 and, therefore, will contribute to a construction meeting a bronze level of sustainability as defined in this Standard. In addition, the product can contribute to a construction meeting a higher level of sustainability as defined in this Standard, with reference to clauses 7.1.3[(1)(2)], 7.1.4[(1)(2)] [Aspect 1[(1)(2)]], 7.1.5[(1)(2)], 7.1.6[(1)(2)] [Aspect 1[(1)(2)]] and 7.1.7[(1)(2)] [Aspect 1[(1)(2)]]. See sections 6.1 to 6.8 of this Certificate.
Regulation:	**12**	**Building standards applicable to conversions**
Comment:		All comments given for these systems under Regulation 9, Standards 1 to 6 also apply to this Regulation, with reference to clause 0.12.1[(1)(2)] and Schedule 6[(1)(2)].

(1) Technical Handbook (Domestic).
(2) Technical Handbook (Non-Domestic).

The Building Regulations (Northern Ireland) 2012

Regulation:	**23**	**Fitness of materials and workmanship**
Comment:		The product is acceptable. See section 11 and the *Installation* part of this Certificate.
Regulation:	**28(b)**	**Resistance to ground and weather**
Comment:		The product does not adversely affect the resistance of a roof to the ingress of precipitation. See sections 8.1 and 8.2 of this Certificate.
Regulation:	**30**	**Stability**
Comment:		The product adequately transmits self weight and wind loads to typical roof structures. See sections 7.1 to 7.5 of this Certificate.

Regulation:	36	External fire spread
Comment:		The product does not affect the existing fire rating of a roof structure. The collector panel has an 'AA' fire rating in accordance with BS 476-3 : 2004. See section 9.1 of this Certificate.
Regulation:	39(c)	Conservation measures
Regulation:	40(2)	Target carbon dioxide emission rate
Comment:		The product will contribute to reducing the total carbon dioxide emissions of the building. See sections 6.1 to 6.8 of this Certificate.

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: 1 *Description* (1.4), 3 *Delivery and site handling* (3.3), 10 *Maintenance* (10.1) and 12 *General* (12.2 and 12.4) of this Certificate.

Additional Information

NHBC Standards 2013

NHBC accepts the use of Clearline Range of Roof Integrated Solar Collectors when installed and used in accordance with this Certificate, in relation to NHBC Standards, Chapter 7.2 *Pitched roofs* and *NHBC Standards*, Part 3 *Ancillary Technologies*, Chapter 3.1 *Low or zero carbon technologies*.

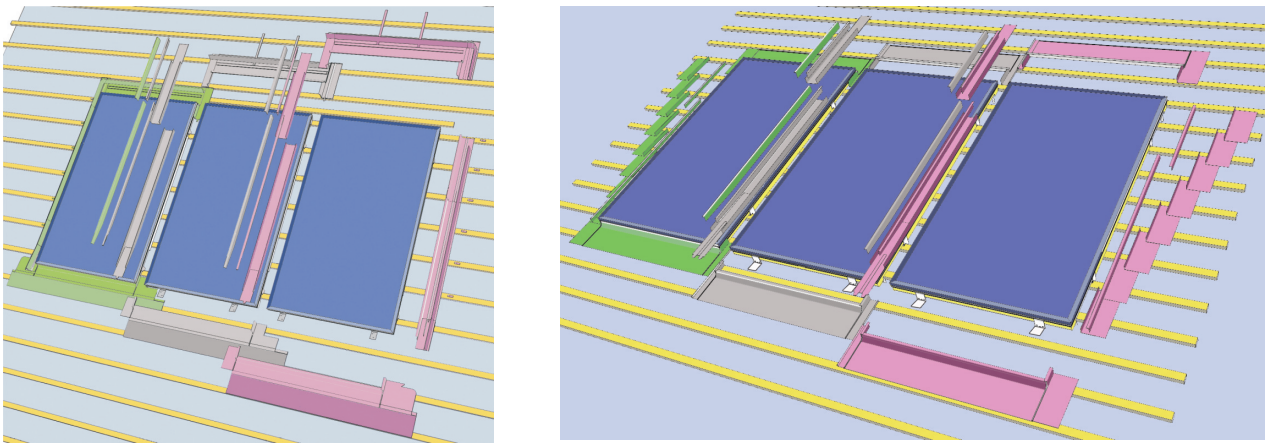
Technical Specification

1 Description

1.1 The Clearline Range of Roof Integrated Solar Collectors comprises flat plate solar collectors with a glass front cover and an aluminium frame (see Figure 1). The collectors are available in three models[1]: V30, V20 and V15.

(1) These models are approved under the Microgeneration Certification Scheme as covered by MCS Certificate BBA 0001.

Figure 1 Solar collector with slate and tile flashing kits



1.2 The solar collector system components (see Figure 1) include:

- roof-mounted collector panel
- roof flashing kits — manufactured from coated aluminium alloy including mounting brackets and fixings and the appropriate flashings for the application. For slate roofs, S-series flashing kits: VAS for a single panel, VSL and VSR for a close-coupled pair of panels and VSL, VSC and VSR for a run of panels. For tiled roofs, T-series flashing kits: VAT for a single panel, VTL and VTR for a close-coupled pair of panels and VTL, VTC and VTR for a run of panels.

1.3 Other components used in a typical installation but not covered by this Certificate include:

- pipework, fittings and insulation
- heat transfer fluid (typically 50% propylene glycol)
- system controller and solar pump station
- hot water storage system.

1.4 The product has the nominal characteristics given in Table 1.

Table 1 Characteristics of solar collector range

Characteristic	Collector panel type		
	V30	V20	V15
Panel length (m)	2.895	2.043	1.479
Panel width (m)	1.168	1.168	1.168
Panel weight (empty) (kg)	62	42	31
Heat transfer fluid capacity (litre)	1.4	0.9	0.7

2 Manufacture

2.1 The absorber is mounted in the frame with insulation behind it. Hydraulic connections are made and the glass cover fixed in place.

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 Viridian Solar has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2008 and ISO 14001 : 2004 by ACS Registrars Ltd (Certificate Number 1012789) and BS OHSAS 18001 : 2007 by ACS Registrars Ltd (Certificate Number OHS 1012789).

3 Delivery and site handling

3.1 The product components are delivered to site boxed on a pallet with a label bearing the company name, product type and the BBA identification mark including the number of this Certificate. The Certificate holder's recommendations for installing the panels should be followed at all times.

3.2 The collector panels and flashing kits should be stored on a level, clean dry surface and remain in the packaging until installation.

3.3 Panels should be carried in an upright position and should not be allowed to bend under their own weight nor be subjected to any load on top. Normal precautions for manual handling should be observed. The weights of the panels are given in Table 1.

3.4 Sharp implements or edges should be avoided as they could damage the surface of the panels.

3.5 Site preparations and delivery should be arranged to minimise site storage time prior to installation. Should it be necessary to store the panels temporarily, a dry, ventilated room should be used. The product should be kept away from fire, solvents and paints.

3.6 Damaged collectors must not be used.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on the Clearline Range of Roof Integrated Solar Collectors.

Design Considerations

4 Use

The Clearline Range of Roof Integrated Solar Collectors are satisfactory for installation in tiled or slated roofs with a pitch between 20° and 60°. One or more panels are mounted on a roof elevation depending on the available space and heat generation capacity required. The collectors may be used with vented or unvented hot water systems where a suitable secondary heat exchanger coil is available. Adequate provisions for the control of bacterial growth, including legionella, must be made within the system.

5 Practicability of installation

The product is designed to be installed by a suitably trained and qualified installer, experienced in the installation of solar thermal systems.

6 Energy performance

6.1 The product will reduce the external energy demand of the building in which it is incorporated.

6.2 The performance specification of the panels under standard test conditions is given in Table 2.

Table 2 Performance specifications of Clearline Solar Collectors[1]

Performance characteristic	Collector panel type		
	V15	V20	V30
Aperture area (m^2)	1.55	2.17	3.10
Zero loss efficiency (aperture)		0.788	
Heat loss coefficient ($W \cdot m^{-2} \cdot K^{-1}$)		3.77	
Second order heat loss coefficient ($W \cdot m^{-2} \cdot K^{-1}$)		0.0086	
Incidence angle modifier at 50°		0.94	

(1) Performance data from tests carried out in accordance with BS EN 12975-2 : 2001.

6.3 The performance data given in Table 2 should be used in carbon emissions calculations in accordance with the guidance given in the relevant national Building Regulations.

6.4 The building's location and orientation of the collectors will have a significant effect on the heat generated by the system. A south facing elevation at 30° pitch is ideal (south-east or south-west elevations can also achieve favourable results). Installers should provide an estimate of annual heat production for individual sites based on a site survey. Annual solar radiation for different roof pitch and orientation is given in Table 3 for UK locations based on typical values given in SAP 2009.

Table 3 Annual solar radiation ($kW \cdot h \cdot m^{-2}$)

Pitch of roof	Orientation				
	South	SE/SW	E/W	NE/NW	North
30°	1073	1027	913	785	730
45°	1054	997	854	686	640
60°	989	927	776	597	500

(1) Taken from SAP 2009, Table H2.

6.5 Shade, such as that cast from trees or neighbouring buildings, can reduce the performance of a system and should be considered when deciding the suitability of a particular site.

6.6 The annual solar energy input to the cylinder will depend on a number of factors including hot water demand of the property, timing of back-up heating and the size and configuration of the hot water cylinder.

6.7 Reasonable provision should be made to ensure that the owner/occupier of the building is provided with sufficient information about the product so that it can be operated and maintained to maximise its potential for the conservation of fuel and power.

6.8 The pipework associated with the product must be insulated as outlined in the Certificate holder's installation manual and in accordance with the relevant national Building Regulations and Standards.

7 Structural performance

7.1 The condition and structural adequacy of the roof into which the panels are to be mounted, must be evaluated by site survey and assessed by a suitably qualified and experienced individual. The roof must be sufficiently robust to resist the additional loads resulting from the installation of the panels. The maximum rafter spacing is 600 mm (between centres) and minimum batten size is 50 mm by 25 mm. For buildings in Scotland, the guidance given in Mandatory Standard 1.1, clauses 1.1.2[1][2] and 1.1.3[1][2], must be followed when assessing the suitability of the roof structure.

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).

7.2 Imposed loads due to wind and snow must be determined for each project in accordance with BS EN 1991-1-3 : 2003 and BS EN 1991-1-4 : 2005. Further guidance is given in BRE Digest 489 *Wind loads on roof-based photovoltaic systems*. The derived loads should be multiplied by an appropriate partial load factor.

7.3 It is the responsibility of the installation designer to ensure that the installed system is able to resist the anticipated loads for each project.

7.4 Tests in accordance with MCS 012 *Product Certification Scheme Requirements: Pitched Roof Installation Kits*, (version 1.0) *Appendix A* on installed panels indicate that the system has a characteristic value of resistance to wind uplift of 3.4 kPa. For design purposes this value should be divided by a partial material factor of 1.44 to give a design resistance to ultimate loads of 2.4 kPa.

7.5 The installed panels remain serviceable when subjected to imposed loads due to snow up to 2.4 kPa.

8 Weathertightness

8.1 The product is fixed to tiling battens above the roof tile underlay. Completed roofs will provide adequate resistance to weather ingress.

8.2 Particular attention must be paid to correct fitting of all components and to the detailing and positioning of gaskets and areas where pipework enters the building.

9 Behaviour in relation to fire

9.1 The collector panel (including flashings) may be classified as 'AA' or 'low vulnerability' in accordance with national Building Regulations and, therefore, is unrestricted under the following guidance:

England and Wales — Approved Document B, Section 10.4

Scotland — Mandatory Standard 2.8, clause 2.8.1(1)

(1) Technical Handbook (Domestic).

Northern Ireland — Technical Booklet E, Section 4.19.

9.2 The collector panel components (including flashings) outside of the building envelope have been tested in accordance with BS 476-3 : 2004 to obtain the classification 'AA'.

10 Maintenance

10.1 Appropriate safety precautions in relation to working at height and risk of burns should be taken when carrying out maintenance on the panels.

10.2 The panels should be inspected for damage at regular intervals. The Certificate holder should be consulted if damaged panels are discovered, to decide on the most appropriate method of repair.

10.3 It is important that the panels are clean to maintain maximum efficiency. It is not normally necessary to clean the collectors as rainfall generally has a cleansing effect. Where heavy soiling occurs, the collectors may be cleaned by hosing down with plain water (ie without cleaning agents) and gently wiping with a sponge. Abrasives must not be used and dirt should never be scraped or scrubbed away when dry as this may cause scratching.

10.4 The security of mountings, pipe connections and other components should be checked regularly.

10.5 Annual and five-yearly maintenance schedules are supplied by the Certificate holder and allow for fluid level checks and replacement.

10.6 Fault diagnosis is described in the product literature. Faults not covered within the literature may be resolved by contacting the Certificate holder.

11 Durability

The product will have a life equivalent to that of the roof into which it is incorporated. The product has been assessed for durability in accordance with BS EN 12975-2 : 2006 and is considered durable in accordance with this test method.

Installation

12 General

12.1 The Clearline Range of Solar Collectors must be installed and fixed in accordance with the Certificate holder's instructions and provisions of this Certificate. Installation can be carried out under all conditions normal to roofing work and within the building under all conditions normal to plumbing work.

12.2 Prior to commencement of work, all necessary precautions with regard to manual handling and working at height must be taken. The panels can get very hot when exposed to sunlight and precautions must be taken to avoid burns.

12.3 The collectors should be protected from damage during installation.

12.4 Installation of the panels in windy or wet conditions should be avoided.

13 Procedure

Roofing works

13.1 The collector panel must be fitted to the roof structure only when roof tile underlay and tile battens are secured in place. The collector panels must be secured to the battens using the fixing components provided. Tile battens should be secured to the roof structure following the relevant recommendations of BS 5534 : 2003 and BS 8000-6 : 1990. If there is any doubt about the condition or security of the battens, they must be replaced with suitably treated battens.

13.2 The panels should be fixed into position with rafter brackets at the top and bottom. Where the panel is located above two rafters, four brackets should be used and where it is located above one rafter, two brackets should be used. Each bracket is secured on to the rafter using two 4 mm by 50 mm screws supplied with the fixing kit.

13.3 Adjacent panels are positioned with a gap of 94 mm between panels.

13.4 The panels are attached to the battens using side brackets with three each side for V30 panels and two each side for V20 and V15 panels. Each bracket is secured to the batten using two 4 mm by 25 mm screws supplied with the fixing kit. Adjacent panels should be secured to alternate battens.

13.5 The pipes from the panels are passed through the underlay using a solar outlet sealing collar and carefully secured to the roof structure.

13.6 Once the panels are secured to the roof structure, the appropriate flashing kits are installed. This commences with the sill flashings starting from the left-hand panel. This is followed by the gutters between panels, side flashings or soakers at the sides and the top flashings.

13.7 The slating or tiling is completed, overlapping the flashings.

Plumbing works

13.8 The system controller, pipework, hot water stores and pressure relief systems are not included within the scope of this Certificate, but they should be installed by a competent plumber experienced in the installation of solar systems. Connection to the collectors must be made after they are secured to the roof structure; adequate access must be provided for maintenance of the system.

Technical Investigations

14 Tests

Tests carried out by the BBA included:

- thermal cycling performance
- wind-driven rain test to BS 6375-1 : 2004
- effect of heat ageing on elastomeric components
- weathertightness in accordance with MCS 012 *Product Certification Scheme Requirements: Pitched Roof Installation Kits,* (version 1.0), *Appendix A*
- wind uplift resistance in accordance with MCS 012.

15 Investigations

An examination was made of existing data relating to:

- the adequacy of installation instructions
- the practicability of installation
- performance and durability in accordance with BS EN 12975-2 : 2006
- the properties in relation to fire in accordance with BS 476-3 : 2004
- the practicability and adequacy of maintenance requirements
- the durability of materials used.

Bibliography

BS 476-3 : 2004 *Fire tests on building materials and structures — Classification and method of test for external fire exposure to roofs*

BS 5534 : 2003 *Code of practice for slating and tiling (including shingles)*

BS 6375-1 : 2004 *Performance of windows and doors — Classification of weathertightness and guidance on selection and specification*

BS 8000-6 : 1990 *Workmanship on building sites — Code of practice for slating and tiling of roofs and claddings*

BS EN 1991-1-3 : 2003 *Eurocode 1 : Actions on structures — General actions — Snow loads*
BS EN 1991-1-4 : 2005 *Eurocode 1 : Actions on structures — General actions — Wind actions*

BS EN 12975-2 : 2006 *Thermal solar systems and components — Solar collectors — Test methods*

BS EN ISO 9001 : 2008 *Quality management systems — Requirements*

ISO 14001 : 2004 *Environmental management systems— Specification with guidance for use*

BS OHSAS 18001 : 2007 *Occupational health and safety management systems — Requirements*

16 Conditions

16.1 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.

16.2 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.

16.3 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.

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

16.5 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.

16.6 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.

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