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Agrément Certificate

17/5440

Product Sheet 1

Q-BOT INSULATION

Q-BOT UNDERFLOOR INSULATION

This Agrément Certificate Product Sheet⁽¹⁾ relates to Q-Bot Underfloor Insulation, a spray-applied expanded polyurethane foam installed using a remote robotic device (SprayBot) to enter the underfloor void and spray insulation foam to the underside of the floor. The product is for use in timber or suspended concrete ground floors of both new and existing domestic and non-domestic buildings.

(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

Thermal insulation — the insulation has declared thermal conductivities (λ_D) of $0.027 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ for thicknesses less than 80 mm, $0.026 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ for thicknesses ranging from 80 mm to 120 mm, and $0.025 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ for thicknesses greater than 120 mm (see section 6).

Condensation risk — the insulation has a water resistance factor (μ) of 61; however, the risk of interstitial condensation will depend on the floor construction and should, therefore, be assessed for each project (see section 7).

Durability — the insulation will have a life equivalent to that of the structure in which it is incorporated (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

Handwritten signature of John Albon.

Handwritten signature of Claire Curtis-Thomas.

Date of First issue: 11 July 2017

John Albon – Head of Approvals
Construction Products

Claire Curtis-Thomas
Chief Executive

The BBA is a UKAS accredited certification body – Number 113.

The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk
Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

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Regulations

In the opinion of the BBA, Q-Bot Underfloor Insulation, 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 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:	C2(c)	Resistance to moisture
Comment:		The product can contribute to satisfying this Requirement. See sections 7.1 and 7.4 of this Certificate.
Requirement:	L1(a)(i)	Conservation of fuel and power
Comment:		The product can contribute to satisfying this Requirement. See section 6 of this Certificate.
Regulation:	7	Materials and workmanship
Comment:		The product is acceptable. See section 11 and the <i>Installation</i> part of this Certificate.
Regulation:	26	CO₂ emission rates for new buildings
Regulation:	26A	Fabric energy efficiency rates for new dwellings (applicable to England only)
Regulation:	26A	Primary energy consumption rates for new buildings (applicable to Wales only)
Regulation:	26B	Fabric energy consumption rates for new buildings (applicable to Wales only)
Comment:		The product can contribute to satisfying these Regulations. See section 6 of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)	Durability, workmanship and fitness of materials
Comment:		The product is acceptable. See section 11 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	3.15	Condensation
Comment:		The product can contribute to satisfying this Standard, with reference to clauses 3.15.1 ⁽¹⁾⁽²⁾ , 3.15.4 ⁽¹⁾⁽²⁾ and 3.15.5 ⁽¹⁾⁽²⁾ . See sections 7.1 and 7.5 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Standard:	6.2	Building insulation envelope
Comment:		The product can contribute to satisfying these Standards, with reference to clauses, or parts of, 6.1.1 ⁽¹⁾ , 6.1.6 ⁽¹⁾ , 6.2.1 ⁽¹⁾⁽²⁾ , 6.2.3 ⁽¹⁾⁽²⁾ , 6.2.4 ⁽¹⁾⁽²⁾ , 6.2.5 ⁽²⁾ , 6.2.6 ⁽¹⁾⁽²⁾ , 6.2.7 ⁽¹⁾ , 6.2.8 ⁽²⁾ , 6.2.9 ⁽¹⁾⁽²⁾ , 6.2.10 ⁽¹⁾ , 6.2.11 ⁽¹⁾⁽²⁾ , 6.2.12 ⁽²⁾ and 6.2.13 ⁽¹⁾⁽²⁾ . See section 6 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 7.1.4 ⁽¹⁾ [Aspects 1 ⁽¹⁾ and 2 ⁽¹⁾], 7.1.6 ⁽¹⁾⁽²⁾ [Aspects 1 ⁽¹⁾⁽²⁾ and 2 ⁽¹⁾] and 7.1.7 ⁽¹⁾ [Aspect 1 ⁽¹⁾]. See section 6 of this Certificate.
Regulation:	12	Building standards applicable to conversions
Comment:		All comments given for the system 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 (as amended)

Regulation:	23	Fitness of materials and workmanship
Comment:		The product is acceptable. See section 11 and the <i>Installation</i> part of this Certificate.
Regulation:	29	Condensation
Comment:		The product can contribute to satisfying this Regulation. See section 7.1 of this Certificate.
Regulation:	39(a)(i)	Conservation measures
Regulation:	40	Target carbon dioxide emission rate
Comment:		The product can contribute to satisfying these Regulations. See section 6 of this 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.

See sections: 3 *Delivery and site handling* (3.1 to 3.3) and 12 *General* (12.6) of this Certificate.

Additional Information

CE marking

The manufacturer of the insulation has taken the responsibility of CE marking the insulation component of the system in accordance with harmonised European Standard BS EN 14315-1: 2013. An asterisk (*) appearing in this Certificate indicates that data shown are given in the manufacturer's Declaration of Performance.

Technical Specification

1 Description

1.1 Q-Bot Underfloor Insulation is a spray-applied closed-cell, hydrofluorocarbon (HFC) blown polyurethane foam insulation suitable for suspended ground floors.

1.2 SprayBot is a robotic device (vehicle) designed to apply spray foam insulation remotely to the underside of suspended timber or concrete floors of both new and existing domestic and non-domestic buildings.

Table 1 Nominal SprayBot technical specification⁽¹⁾

Working dimensions (mm)	350-600 (length) x 350-600 (width) x 175-250 (height)
Weight (kg)	25 (excluding the spray gun)
Max speed (m·s ⁻¹)	0.25

(1) SprayBot may be set up to suit different sized voids and obstacles.

1.3 The device allows a controlled application of the product using remote control and an on-board camera. The manufacture and specification of the vehicle is, however, outside the scope of this Certificate.

1.4 The insulation part of the system is prepared from two liquid components; the insulation is applied with a fixed mixing ratio of 1:1 via a volumetric displacement pump in layers until the final design thickness is achieved.

1.5 Ancillary items for use with the system, but outside the scope of the Certificate, include:

- SprayBot
- computer control interface
- spray gun
- hoses, connections and pumps
- power supply.

2 Manufacture

2.1 The insulation production process involves the addition of raw materials to a mixing vessel according to the determined formulation in a batch process. The batch of material is then stirred, subjected to quality control testing to ensure compliance with the required specification and then filled into the relevant containers.

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 components of the insulation foam are delivered to site in drums (up to 250 kg capacity) bearing the product name and batch number.

3.2 Drums should be stored in a well-ventilated area between 15 and 32°C and away from possible ignition sources. The drums must be protected from frost.

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

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Q-Bot Underfloor Insulation.

Design Considerations

4 General

4.1 Q-Bot Underfloor Insulation is satisfactory for application to the underside of the floor in suspended timber or concrete ground floors of both new and existing domestic and non-domestic buildings.

4.2 Prior to installation, the floor and floor zone of the building are subject to a detailed survey by Q-Bot trained installers to establish suitability.

4.3 The insulation can be installed between the timber joists in suspended timber ground floors provided no direct loading is applied to the insulation.

4.4 Before the application of the insulation, it is essential to ensure that construction elements have been designed, constructed and maintained so as to incorporate the normal precautions against moisture ingress.

4.5 Constructions must be in a good state of repair, with no evidence of damp. Defects must be made good prior to installation (see section 13.1).

4.6 The insulation forms a strong bond with clean, dry substrates. This should be taken into account when specifying the insulation or anticipating future alterations.

4.7 The airspace void under the insulated suspended ground floor must be a minimum of 150 mm deep and must be ventilated (see section 7.3). Care must be taken to ensure that ventilation grilles in the external walls are maintained clear of foam insulation and there are no obstructions to the underfloor ventilation.

5 Practicability of installation

The system must only be installed by installers who have been trained and approved by the Certificate holder (see section 12).

6 Thermal performance



6.1 Calculations of the thermal transmittance (U value) of the floor should be carried out in accordance with BS EN ISO 6946 : 2007 and BRE Report BR 443 : 2006 using the declared thermal conductivity* (λ_D) values in Table 2.

Table 2 Thermal conductivity

Insulation thickness (mm)	Thermal conductivity ($W \cdot m^{-1} \cdot K^{-1}$)
< 80	0.027
80 to 120	0.026
> 120	0.025

6.2 The U value of a completed suspended timber or concrete ground floor will depend on the insulation thickness, the perimeter/area (P/A) ratio, the floor construction and the floor finish. Example U values for floors of various P/A ratios are given in Table 3.

Table 3 U values – suspended timber ground floors: thickness required (mm)

P/A ratio	Design U value ($W \cdot m^{-2} \cdot K^{-1}$) ⁽¹⁾⁽²⁾				
	0.13	0.15	0.20	0.22	0.25
0.2	150 between and 10 under	130 between	80 between	70 between	50 between
0.4	150 between and 30 under	150 between and 10 under	110 between	95 between	80 between
0.6	150 between and 40 under	150 between and 15 under	120 between	105 between	90 between
0.8	150 between and 45 under	150 between and 20 under	125 between	110 between	95 between
1.0	150 between and 45 under	150 between and 20 under	125 between	115 between	100 between

(1) Suspended timber ground-floor construction: floor deck thermal resistance $0.138 \text{ m}^2 \cdot \text{K} \cdot \text{W}^{-1}$, based on 18 mm timber ($\lambda = 0.13 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$), spray foam insulation (91.67%) between 50-mm-wide, 150-mm-deep timber floor joists ($\lambda = 0.13 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$) at 600 mm centres (8.33%). No bridging assumed for insulation under the timber floor joists.

(2) Where an area of the floor is uninsulated (see sections 12.7 and 12.8), an area-weighted U value calculation should be performed.



6.3 The product can contribute to maintaining continuity of thermal insulation at junctions with other elements and minimise thermal bridges and air infiltration. Detailed guidance can be found in the documents supporting the national Building Regulations.

7 Condensation risk

Interstitial condensation



7.1 Floors will limit the risk of interstitial condensation adequately when they are designed and constructed in accordance with the relevant parts of BS 5250 : 2011, Annexes D and F. Further guidance may be obtained from BRE Report BR 262 : 2002.

7.2 For the purposes of assessing the risk of interstitial condensation, a water vapour resistance factor (μ) of 61 should be used for the insulation.

7.3 Voids below suspended concrete or timber ground floors should be ventilated. Ventilation may be achieved by installing vents not less than 1500 mm²/m run of external wall or 500 mm²/m² of floor area, whichever is the greater. Ventilation openings should be arranged to prevent the ingress of rain, snow, birds and small mammals and the risk of subsequent blockage by other building operations.

Surface condensation



7.4 Floors will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed 0.7 W·m⁻²·K⁻¹ at any point and the junctions with walls are designed in accordance with the guidance referred to in section 6.3 of this Certificate.



7.5 Floors will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed 1.2 W·m⁻²·K⁻¹ at any point. Guidance may be obtained from BS 5250 : 2011, Annexes D and F. Additional guidance can be found in BRE Report BR 262 : 2002 and section 6.3 of this Certificate.

8 Behaviour in relation to fire

8.1 The product has a NPD reaction to fire classification (No Performance Determined).

8.2 When properly installed, the insulation will not add significantly to any existing fire hazard until the floor is destroyed. Therefore, the insulation will not contribute to the development stages of a fire or present a smoke or toxic hazard.

9 Materials in contact – electrical wiring installations

9.1 Insulation must not be sprayed directly onto electric cables.

9.2 Where electric cables have been identified in the survey, they should be re-routed accordingly where possible.

9.3 Any minor overspray of the foam insulation will be compatible with the PVC materials of the cables.

9.4 De-rating of electric cables should be considered in areas where the insulation restricts the flow of air. The advice of a qualified electrician should be sought.

10 Maintenance

The insulation, once installed, does not require any regular maintenance and has suitable durability.

11 Durability



The durability of the insulation is satisfactory and will have a service life equivalent to that of the structure in which it is incorporated.

12 General

12.1 A detailed pre-installation survey and checks of the site must be carried out and documented in accordance with the Certificate holder's instructions.

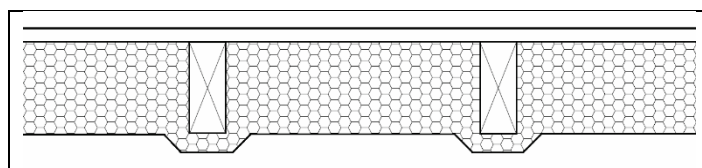
12.2 This detailed pre-install survey covers (*but is not limited to*):

- void access
- joist condition and dimensions
- moisture readings of the timber
- void dimensions and subsequent clearance
- condition of ground
- location and identification of any pipes, cables and wires
- sleeper/support walls
- number, location, condition and area of air vents.

12.3 The insulation should be evenly sprayed to all exposed timber joists to the design thickness.

12.4 The application profile should be controlled to provide an even covering of insulation between the timber joists and 25 mm minimum below the underside of the timber joists. See Figure 1.

Figure 1 Ideal profile of installation



12.5 The depth of insulation must be regularly checked when spraying to ensure that it meets the minimum level required.

12.6 During spraying, the void below the suspended timber or ground floors must be extracted using a fume extractor approved by the Certificate holder which creates a negative pressure inside the void to remove any airborne fumes and dust particles.

12.7 Where joists are parallel to the external wall, the void next to the wall should be sprayed (see Figure 2). Where this is not possible, it should be left clear (see Figure 3) and indicated on the floor spray plan. This uninsulated area must be accounted for via an area-weighted U value calculation to determine the overall floor U value.

Figure 2 Joists parallel to the external wall

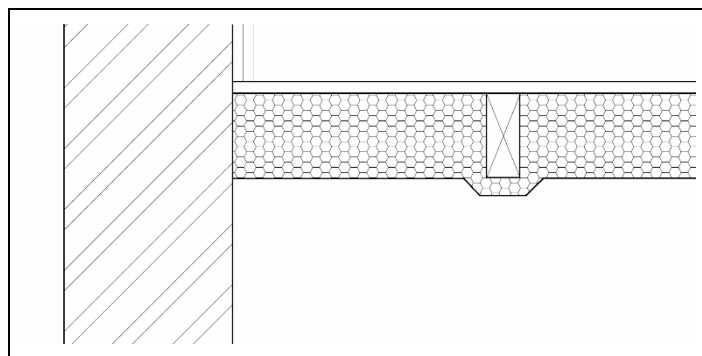
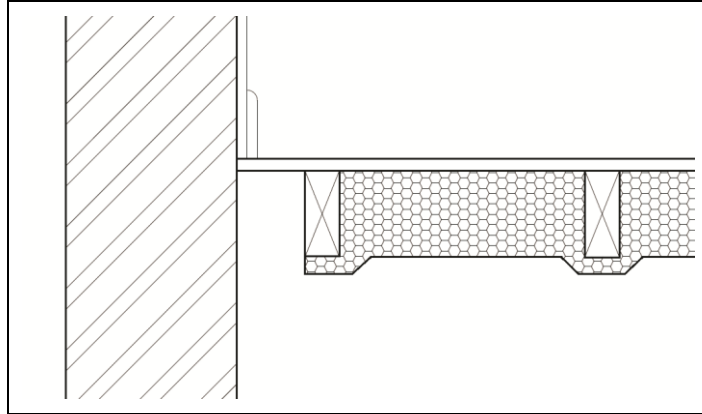
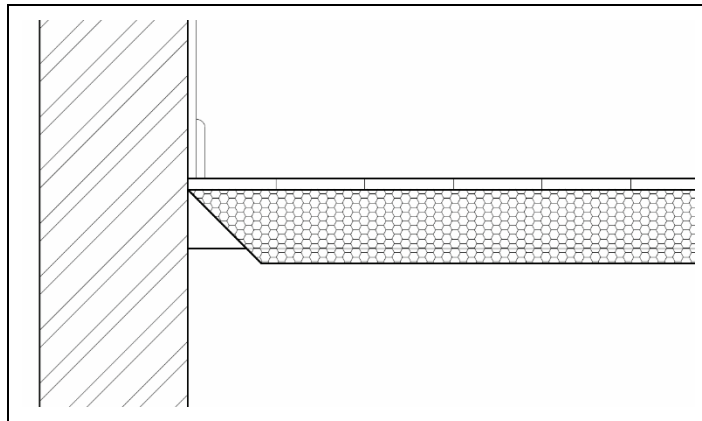


Figure 3 Joists parallel to the external wall



12.8 Where joists are perpendicular to the wall, the insulation should taper away from the external wall where the joist butts up to it (see Figure 4). If the tapered profile cannot be achieved, a small length of joist next to the wall (~50 mm) must be left uninsulated.

Figure 4 Joists perpendicular to the wall



12.9 Insulation must not be sprayed on any pipes containing gas. They must be accessible at all times and must not be encased along any of their length. This includes any areas where they penetrate the floorboards. The location of gas pipes must be marked on the void map so they can be easily identified if work needs to be carried out in the future.

12.10 Air vents must not be sprayed, to allow proper ventilation throughout the void. They must be checked regularly to ensure they are clear on both the outside and inside.

12.11 The insulation may be sprayed over secured water pipes; however, it must not cover any water pipe joints or valves.

12.12 Once the SprayBot has been removed from the void, any internal access hatches should be insulated to ensure uniform coverage.

13 Procedure

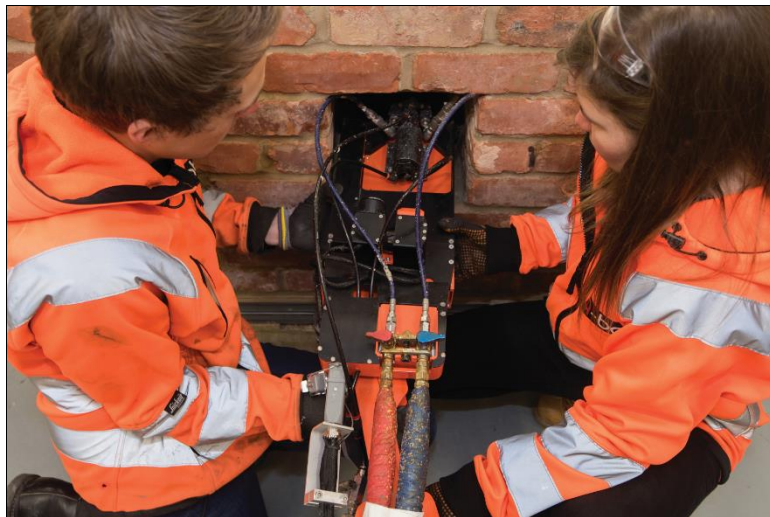
13.1 An initial survey is carried out by Q-Bot trained installers on the property to ensure that it is suitable. A small access hatch to the void beneath the floor may be required in order to measure the height between the ground and the floor, and to assess whether any existing services need to be treated or repaired (eg mains, waste and central heating pipes, electrical cables, damp, rot, infestation or structural issues).

13.2 Access to installation is gained through various methods, for instance removal of an air vent and some local bricks on the outside of the property, or through access points from within the property, eg by lifting floorboards, etc. See Figures 5 and 6.

Figure 5 SprayBot installation through an access hatch within the property



Figure 6 SprayBot installation through an air vent on the outside of the property



13.3 The operator visually inspects the area being installed via the camera feed and checks the spray plan, modifying as required prior to spraying.

13.4 The moisture content of any timber floor boards and joists must be below 20% before spraying.

13.5 One operator controls and monitors the SprayBot; the other monitors the spray equipment, including the hose routing. Both operators should be outside the void and able to communicate.

13.6 Once the SprayBot is inside the void, insulation is applied in controlled multiple layers to a typical depth of 100 mm to 125 mm. Each single layer must not exceed 50 mm in depth. The operator must wait a minimum of 60 seconds between each layer application.

13.7 After spraying, there must be a gap greater than 150 mm between the lowest part of the insulation and the ground to ensure adequate ventilation of the void.

13.8 The insulation should have a fine, uniform cell structure and colour with minimal voids. There should be no visible peeling or blistering between layers. The operator is required to constantly monitor the quality of the spray foam and, if required, adjust the equipment accordingly.

13.9 Any internal access hatches need to be insulated in a similar manner and must be level to ensure a uniform coverage.

Post installation survey

13.10 A detailed post-installation survey and checks of the site are then carried out and documented in accordance with the Certificate holder's instructions. This survey must confirm, amongst other things, that:

- a minimum void of at least 150 mm has been maintained between the lowest aspect of the insulation and the highest aspect of the ground
- the foam spray insulation has a fine, uniform cell structure and light cream colour with minimal voids
- all gas pipes, water pipe joints and valves, together with electricity cables, are free from foam, other than a slight over spray
- there is no peeling or delamination of the spray foam.

13.11 The SprayBot carries out a 360° scan of the total insulated area to verify that all aspects of the spraying process have been carried out.

13.12 If any aspect of the process does not meet the requirements, remedial action is taken to rectify the issue and a further scan is taken.

13.13 The scans, images and survey reports are sent back to Q-Bot for verification prior to a Declaration of Conformity being signed and issued for each property insulated.

Technical Investigations

14 Tests

14.1 Results of tests were assessed to determine:

- Spray foam density
- Practicability of installation
- Consistency of applied foam
- Reaction to fire
- Thermal conductivity
- U value calculations and condensation risk analysis (CRA) calculations

14.2 Tests to determine the methodology and the practicability of installation were also carried out.

15 Investigations

15.1 The insulation manufacturing process was evaluated, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

15.2 Site visits were carried out to establish the adequacy of surveys and the practicability of installation.

15.3 A detailed user survey was carried out and evaluated.

15.4 The insulation characteristics were evaluated.

Bibliography

BS 5250 : 2011 *Code of practice for control of condensation in buildings*

BS EN 14315-1 : 2013 *Thermal insulating products for buildings. In-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam products. Specification for the rigid foam spray system before installation*

BS EN 1995-1-1 : 2004 *Eurocode 5: Design of timber structures — General — Common rules and rules for buildings*

BS EN ISO 6946 : 2007 *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method*

BRE Report BR 443 : 2006 *Conventions for U-value calculations*

BRE Report BR 262 : 2002 *Thermal insulation — Avoiding risks*

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 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.