


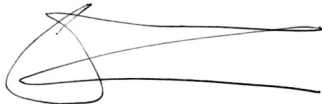


Number BAR 15-044/01/C Replaces: -	  <p style="text-align: center;">BDA Agrément® BAR 15-044/01/C</p> <p style="text-align: center;">Document linked with Kiwa Certificate KGaC 2006 GB, issued by Kiwa Ltd., Cheltenham, UK</p>	Category Pitched roofs
Date 2015.03.25		Phase Assessment
Project number 14-B-0308		Subject Multi-foil reflective thermal insulation
Product Producer (Certificate holder) Description Scope (use) Summary of certificate Major points of assessment Statement	<p>ThermaQuilt</p> <p>Yorkshire Building Services (Whitwell) Ltd. T. : +44 (0) 1909 721662 The Craggs Industrial Park F. : +44 (0) 1909 721442 Morven Street I. : www.ybsinsulation.com Creswell E. : technical@ybsinsulation.com Derbyshire S80 4AJ UK</p> <p>Multi-layered roof insulation material made up of nine layers of metallic foil, flexible wadding. The layers are spot wise connected by double T plastic clips in a regular pattern, avoiding thermal bridging and creating flat and parallel surfaces (Product Type 1 according BS EN 16012¹⁰). The first and outer layer consist of metalized polyethylene foil with backing and reinforcing scrim. The core of the product consists of layers of polyester fibre wadding, separated by metallized film layers. The product is not an underlay.</p> <p>Thermal insulation for use above and/or below rafters in tiled or slated pitched roofs of dwellings and buildings with similar temperature and humidity conditions, designed and constructed in accordance with the relevant clauses of BS 5534².</p> <p>This certificate covers the following:</p> <ul style="list-style-type: none"> • Conditions of use • Frame of reference, including relevant codes of practice and test reports • Independently verified product characteristics • Factory Production Control • Annual verification procedure • Points of attention for the specifier and specific details • Installation procedure • Compliance with Building Regulations and NHBC Standards <p>Thermal performance aspects (sections 1.2, 8.2 & 8.3) The basic property of ThermaQuilt concerns the thermal performance. The thermal performance of the product has been assessed according BS EN ISO 6946 and the principles of BR443. The product can contribute substantially in meeting the U-value requirement for a pitched roof.</p> <p>Condensation and water penetration risk (section 8.4) The performance of ThermaQuilt with regard to interstitial condensation, surface condensation and water penetration has been considered.</p> <p>Behaviour in relation to fire (section 8.5) An insulated pitched roof system using ThermaQuilt can be designed to meet the UK requirements.</p> <p>Durability (section 8.6) ThermaQuilt is stable, rot-proof and durable and will remain effective as an insulant for the life of the building in which they are installed.</p> <p>It is the opinion of the Kiwa BDA Expert Centre Building Envelope (ECBE) that ThermaQuilt is fit for its intended use, provided it is specified, installed and used in accordance with this Certificate.</p> <p>Professor Nico Hendriks, MSc  ECBE Chairman</p> <p>Authorization: Chris van der Meijden, MSc  BDA Group Technical Director</p> <p style="text-align: center;">To check the validity of this document please consult www.bda.nl</p>	
Version 01	Kiwa BDA Expert Centre Building Envelope (ECBE) Department of BDA Group Avelingen West 33 P.O. Box 389 NL - 4200 AJ Gorinchem T : +31(0)183 669690 F : +31(0)183 630630 E : groep@bda.nl W : www.bda.nl Copyright© 2015 BDA	Page 1 of 7 pages

<p>1 Conditions of use</p>	<p>1 Application The assessment and certification of ThermaQuilt relates to the use of the product in dwellings and buildings with similar temperature and humidity conditions and correctly detailed tiled or slated pitched roofs with a slope of no less than 20° and no more than 70°, designed and constructed in accordance with the relevant clauses of BS 5534². ThermaQuilt shall not be exposed to organic solvents or plasticisers.</p> <p>2 Assessment Kiwa BDA Testing*) has assessed the thermal performance of the product according BS EN 16012 (BS EN 12667: 2001). The hemispherical emissivity has been assessed according BS EN 16012, Annex D and the characteristic properties according BS EN 823, BS EN 1848-2, BS EN 1602, 1604 and 1608, BS EN 12310-1 and BS EN ISO 12572. *) CPD Notified Laboratory Nr. NB 1640; Testing Accreditation RvA L 447 (acknowledged by UKAS)</p> <p>3 Installation It is recommended that the quality of installation and workmanship is controlled by an independent competent inspector. This inspector can be either a qualified employee of the specifier or a qualified employee of a consulting engineer. The product shall be installed strictly in accordance with the instructions of the Certificate holder and the requirements of this Certificate.</p> <p>4 Geographical scope The validity of this document is limited to England, Wales, Scotland and Northern Ireland, with due regard to section 11. Regulations.</p> <p>5 Validity The purpose of this BDA Agrément® is to provide for well-founded confidence to apply ThermaQuilt in the described applications and according to approved specifications. According to the BDA Guideline – BDA Agrément®¹ the validity of this document is therefore three years after the official date of issue, published on www.bda.nl. After this the validity can be extended every three years after positive review.</p>																																				
<p>2 Frame of reference</p>	<ol style="list-style-type: none"> 1 BDA Guideline – BDA Agrément®, 15th October 2014 2 BS 5534:2003+A1:2010 Code of practice for slating and tiling (including shingles) – Installation 3 BS 5250:2011 Code of practice for control of condensation in buildings 4 BS EN ISO 6946: 2007 Building components and building elements -Thermal resistance and thermal transmittance - Calculation method 5 BR443: Conventions for U-value calculations, 2006 edition, BRE Scotland 6 BDA Report 0156-C-14/4 ThermaQuilt: Determination of product characteristics (initial type testing), 2015.01.29 7 BDA Agrément® + Kiwa Certificate BAR 12-454/01/C, 2012.07.25 8 BDA-Kiwa report: Technical Documentation, containing information to demonstrate the conformity of the product to the applicable requirements of BDA Agrément® + Kiwa Certificate BAR 12-454/01/C 9 BBA Information Bulletin No. 3: Reflective foil Insulation – Conventions for U-value calculations, March 2010 10 BS EN 16012: 2012 Thermal insulation for buildings – Reflective insulation product – Determination of the declared thermal performance 11 NHBC Standards, Chapter 1, Technical Requirement R3 and Chapter 7.2 Pitched Roofs 12 Kiwa Guideline K22005, 15th January 2015 13 Kiwa Certificate KGaC 2006 GB, 2012.07.25, Kiwa Ltd., Cheltenham, UK 14 BDA Report 14-B-0308/3 ThermaQuilt: Calculation of 90/90 values of the emissivity, 2015.02.09 15 Kiwa BDA Report 0156-L-14/1 ThermaQuilt: Determination of thermal resistance, 2014.07.16 16 BDA Report 14-B-0308/1 SuperQuilt 19: Calculation of 90/90 values of the core, 2014.06.30*) 17 BDA Report 15-B-0308/2 ThermaQuilt: Calculation of thermal resistance, pitched roof application, 2015.02.09 <p>*) The core material of ThermaQuilt is identical to the one of SuperQuilt 19</p> <p>Remark: in the text of this document reference is made to these sources by adding the relevant reference number in superscript</p>																																				
<p>3 Independently verified product characteristics related to critical functions*</p>	<p>*) The critical functions which apply to this section are the behaviour in relation to thermal insulation and durability, as mentioned in R3(a) of the NHBC Standards¹¹</p> <table border="0"> <tr> <td>• nominal length</td> <td>: 10.00, 6.667</td> <td>(m)</td> </tr> <tr> <td>• nominal width</td> <td>: 1200</td> <td>(mm)</td> </tr> <tr> <td>• nominal thickness</td> <td>: 35</td> <td>(mm)</td> </tr> <tr> <td>• nominal mass</td> <td>: 0.70</td> <td>(kg.m⁻²)</td> </tr> <tr> <td>• thermal performance core R_{90/90}¹⁶</td> <td>: 0.775</td> <td>(m².K.W⁻¹)</td> </tr> <tr> <td>• emission coefficients of outer surfaces, ε_{90/90}¹⁴</td> <td>: 0.05</td> <td>(-)</td> </tr> <tr> <td>• dimensional stability (length)⁷</td> <td>: 1.5</td> <td>(%)</td> </tr> <tr> <td>• dimensional stability (width)⁷</td> <td>: 2.3</td> <td>(%)</td> </tr> <tr> <td>• tensile strength parallel to faces⁷</td> <td>: 142</td> <td>(kPa)</td> </tr> <tr> <td>• tearing resistance (nail shank)⁶</td> <td>: 408</td> <td>(N)</td> </tr> <tr> <td>• water vapour diffusion factor μ (with seam)⁷</td> <td>: 1700</td> <td>(-)</td> </tr> <tr> <td>• water vapour diffusion factor μ (without seam)⁷</td> <td>: 75000</td> <td>(-)</td> </tr> </table>	• nominal length	: 10.00, 6.667	(m)	• nominal width	: 1200	(mm)	• nominal thickness	: 35	(mm)	• nominal mass	: 0.70	(kg.m ⁻²)	• thermal performance core R _{90/90} ¹⁶	: 0.775	(m ² .K.W ⁻¹)	• emission coefficients of outer surfaces, ε _{90/90} ¹⁴	: 0.05	(-)	• dimensional stability (length) ⁷	: 1.5	(%)	• dimensional stability (width) ⁷	: 2.3	(%)	• tensile strength parallel to faces ⁷	: 142	(kPa)	• tearing resistance (nail shank) ⁶	: 408	(N)	• water vapour diffusion factor μ (with seam) ⁷	: 1700	(-)	• water vapour diffusion factor μ (without seam) ⁷	: 75000	(-)
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<p>4 Assessed ancillary items and associated products used for critical functions^{*)} *) See section 3</p>	<ul style="list-style-type: none"> • YBS Insulation foil-backed tape with acrylic adhesive, width 75 mm • 14 mm staples or nails • vapour control layer • breather membrane • pre-treated counter battens, softwood battens and tiling laths • roofing slates or tiles • additional insulation where required 	
<p>5 Factory Production Control (FPC)</p>	<p>Kiwa N.V., Approval Body, has determined that Yorkshire Building Services (Whitwell) Ltd. (YBS), with respect to the product ThermaQuilt fulfills all provisions concerning the specifications described in this Certificate. The Factory Production Control has been found to comply with the Kiwa Guideline K22005¹² and this Certificate. The Factory Production Control system of YBS is in line with the Technical Documentation from the producer⁸. Kiwa Ltd. has performed the initial inspection of the factory and of the Factory Production Control and performs the continuous surveillance of the Factory Production Control¹³.</p>	
<p>6 Quality control</p>	<p>ThermaQuilt is produced under a Quality Management System, which is deemed to satisfy the requirement concerning the FPC. The quality system enables the Certificate holder to demonstrate that the product fulfil the requirements of this Certificate. This means that the following aspects are covered:</p> <ul style="list-style-type: none"> • the quality objectives, quality planning, quality manual and control of documents must fully take on board the objective of delivering a product that conforms to the specifications in this Certificate; • the manufacturer must identify and document the essential requirements that are relevant for the product and the harmonised standards to be used or other technical solutions that will ensure fulfilment of the specifications in this Certificate; • the identified standards or other technical solutions must be used as design input and as verification that design output as given in a continuous technical consulting service ensures that the specifications in this Certificate will be met; • the measures taken by the Certificate holder to control production must ensure that the product conform to the identified safety requirements; • the Certificate holder in its measurement and control of the production process and finished product must identify and use methods which are identified in standards or other appropriate methods to ensure that the specifications in this Certificate are met; • quality records, such as inspection reports and test data, calibration data, qualification reports of the personnel concerned, must be suitable to ensure the fulfilment of the applicable specifications in this Certificate. 	
<p>7 Annual verification procedure</p>	<p>In order to demonstrate that the FPC is in conformity with the requirements of the technical specification described in this Certificate the continuous surveillance, assessment and approval of the FPC will be done in a frequency of not less than 1 time per year by Kiwa Ltd. For the purpose of the annual assessment a sample of the product (1 roll) will be independently taken at the production site. The annual assessment will concern the following product characteristics, which will be determined and assessed by BDA and Kiwa Ltd.:</p> <ul style="list-style-type: none"> • Thickness BS EN 823:1995 • Width BS EN 1848-2:2001 • Length BS EN 1848-2:2001 • Mass BS EN 1602:1997 • Thermal resistance of core BS EN 16012:2012, method B (BS EN 12667: 2001) • Hemispherical emissivity of foil faces BS EN 16012:2012, Annex D <p>Remark: If at the time of the verification testing a new version of a mentioned Test Standard has been issued, this new version shall prevail</p>	
<p>8 Points of attention for the specifier</p>	<p>1 Delivery</p> <ul style="list-style-type: none"> - The product are delivered in rolls packed in a protective sealed bag and should include product name, dimensions, the BDA identification mark and the number of this Certificate. <p>2 Roof insulation</p> <ul style="list-style-type: none"> - special attention should be given to the air tightness of the ceiling, being the most important measure to avoid excessive condensation in the space above the insulation; if ventilation has been provided above the ThermaQuilt layer, there is no requirement for a vapour control layer above the (plasterboard) ceiling, provided that the ThermaQuilt layer is thoroughly sealed at all joints, resulting in an airtight layer; - the building physical behaviour of roof structures incorporating the insulation must be analyzed by a specialist; The specialist can be either a qualified employee of the specifier or a qualified consultant or a qualified employee of the Certificate holder. He will check the building physical behaviour of the designed roof construction and if need be, advice about improvement to achieve final specification; - if ventilation openings are used they should be positioned along two opposite sides of the roof at eaves level in accordance with BS 5250³; - ventilation openings should be arranged in such a way that blockage is prevented and also the ingress of rain, snow, birds and small mammals. 	
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8 Points of attention for the specifier
(continued)

3 Thermal performance aspects

- for the purpose of U-value calculations to determine if the requirements of the Building (or other statutory) Regulations are met, the thermal resistance of the product in combination with a non-ventilated air cavity on both sides of the ThermaQuilt layer of 25 mm (nominal value) is to be calculated according to BS EN ISO 6946⁴ and/or BR443⁵, the thermal bridging effect has to be assessed according to BBA Information Bulletin No. 3: Reflective foil insulation – Conventions for U-value calculations, March 2010⁹;
- to minimize the effect of thermal bridging cross-battening is advised;
- the requirement for limiting the heat loss through the building fabric, including the effect of thermal bridging can be satisfied if the U-values of the building elements do not exceed the maximum values in the relevant Elemental Methods given in the National Building Regulations of England and Wales (Approved Documents L), Scotland (Technical Standards Regulations 9) and Northern Ireland (Technical Booklet F); further information on regulations is given in section 11 of this Certificate.

4 Condensation risk

- roofs incorporating the product will adequately limit the risk of interstitial condensation when designed in accordance with BS 5250³;
- roofs with insulation at rafter level should be ventilated along the eaves and the ridge in accordance with BS 5250³;
- when installed in accordance with this Certificate the product will provide a convection-free envelope of high vapour resistance;
- when installed against the external side of the rafters or battens a vapour control layer is required, unless a specialist advises otherwise (see section 8.2);
- when installed against the internal side of the rafters or battens the product will perform as a vapour barrier and should be used in conjunction with a suitable breather membrane against the sheathing on the external side of the studs or battens, see also section 10.

5 Behaviour in relation to fire

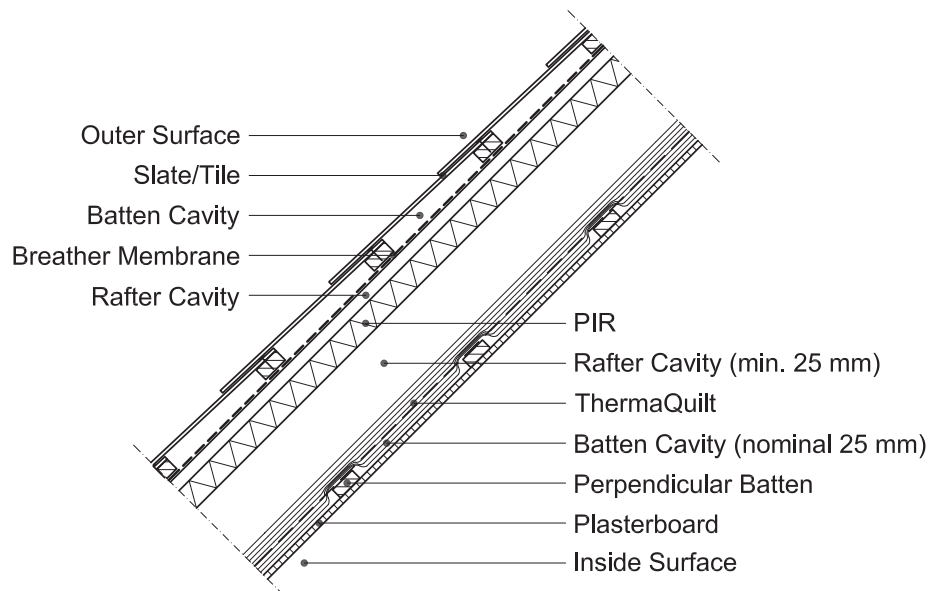
- when installed with an internal lining board, e.g. 12.5 mm thick plasterboard, the insulation will be contained between the external part of the roof and internal lining board, until one is destroyed. Therefore, the insulation will not contribute to the development stages of a fire or present a smoke or toxic hazard;
- the insulation must not be carried over junctions between roofs and roofs required to provide a minimum period of fire resistance;
- the continuity of fire resistance must be maintained, for example as described in: England and Wales- Approved Document B, Volume 1, Sections 5.11 to 5.12; Scotland-Mandatory Standard 2.2, clause 2.2.10; Northern Ireland-Technical Booklet E, paragraph 3.21;
- the use of the product will not affect the fire rating obtained by tiled or slated roofs when evaluated by assessment or test to BS 476-3:2004.

6 Durability

The product is stable, rot-proof and durable and will remain effective as an insulant for the life of the building in which it is installed. There is no risk for moth or beetle infestation.

9 Specific details

Figure 1 – Typical under rafter application of ThermaQuilt in combination with PIR insulation



9 Specific details
(continued)

Figure 2 - Typical double layer application, under and over rafters

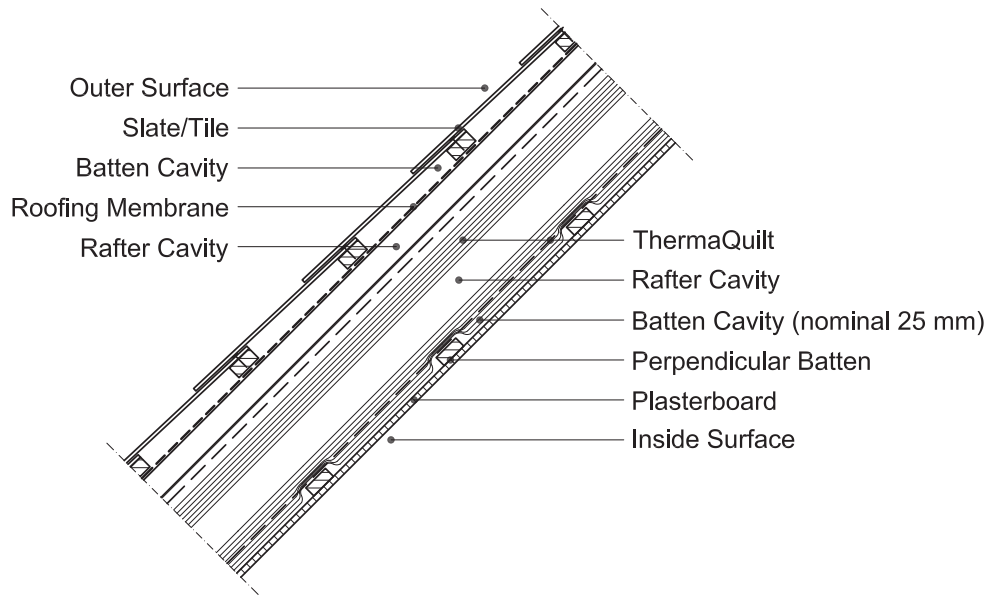


Figure 3 - Typical over rafter application in combination with PIR insulation

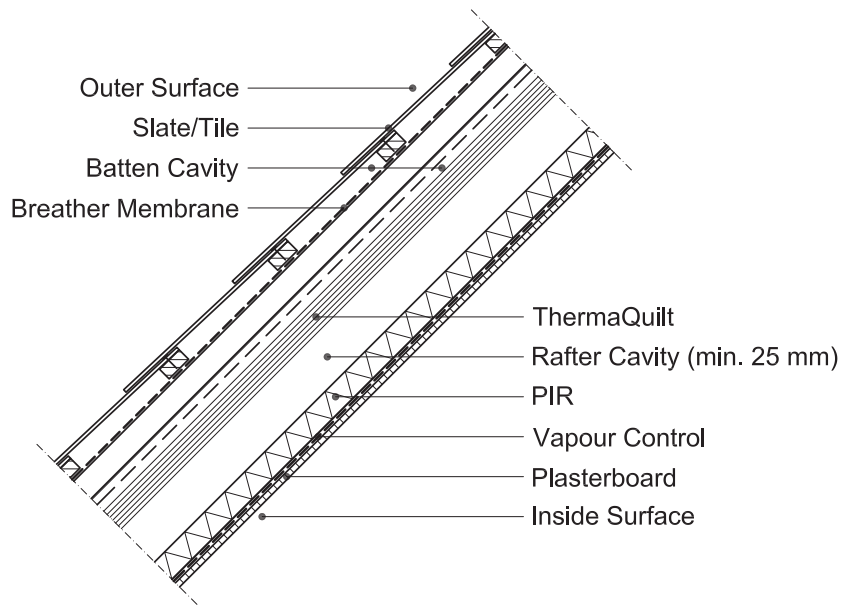
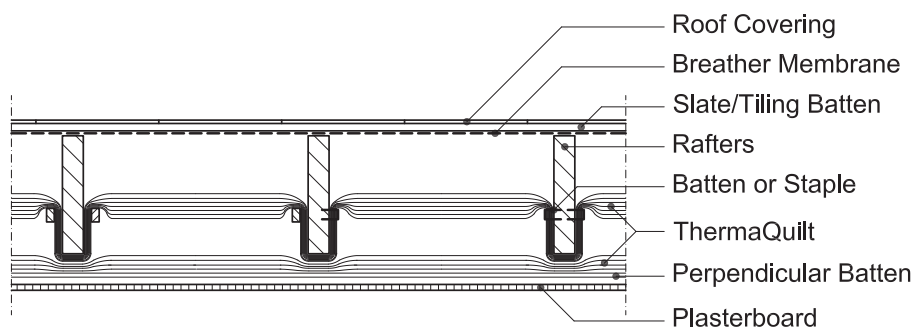


Figure 4 - Typical double layer application, under and between rafters



<p>10 Installation procedure</p>	<p>1 General</p> <ul style="list-style-type: none"> - installation of ThermaQuilt and additional product should be in accordance with the Certificate holder's instructions and current good building practice; - during installation care must be taken to avoid damaging of the product; should damage occur, holes in the product should be repaired with suitable tape, as provided by the Certificate holder; - the product should be attached to the rafters or battens by using staples or nails of at least 14 mm length; - the width of overlap joints must be at least 50 mm; the joints must be taped over the full length with suitable tape, as provided by the Certificate holder; - when the product is cut to fit around openings or connections, gaps must be minimized; any exposed cut edges should be sealed with suitable tape, as provided by the Certificate holder. <p>2 Delivery and site handling</p> <ul style="list-style-type: none"> - the product is delivered to site in rolls packed in a protective bag sealed with a plastic tie; fitting instructions are placed in the bag; - the rolls should be stored in clean, dry conditions, not exposed to sunlight; - the product shall be protected from being dropped or crushed by objects. Care must be exercised when storing large quantities on site; - the product shall not be exposed to open flame or other ignition sources and must be stored away from flammable material such as paint and solvents; - to ensure maximum performance of the product when installed, on site precautions must be taken to protect it from mud and dirt; - the product shall not be exposed to open flame or other ignition sources and must be stored away from flammable material such as paint and solvents; - to ensure maximum performance of the product when installed, on site precautions must be taken to protect it from mud and dirt. <p>3 Roof insulation</p> <ul style="list-style-type: none"> - the product shall be cut equal to the width of the sloping section plus 100 mm; - installation should start from the ridge with the product being unrolled parallel to the eaves across the rafters, after which it is fixed using staples or nails; in certain cases it also possible to start at the eaves and install the product, counter battens, breather membrane and tile battens and then work off the tile battens to install the next layer; - the product should be held in place using timber battens in such a way that there is a nominal 25 mm air cavity above the product and a nominal 25 mm air cavity below the product, resulting in an effectively minimal cavity thickness of 13 mm; - to minimize the effect of thermal bridging cross-battening is advised; - when installed above rafters a vapour barrier should be installed in conjunction with a suitable breather membrane under the tiles, without a ventilated air space; - when installed below rafters the product will perform as a vapour barrier and should be used in conjunction with a suitable breather membrane under the tiles, without a ventilated air space; - the breather membrane should be installed on the counter battens and tiling battens attached perpendicular to the rafters; - roof tiles or slates shall be installed in accordance with BS 5534² and the recommendations of the tile/slate manufacturer should be followed; - typical examples of applications are given in figures 1 through 4 (see section 9). <p>4 Ceiling</p> <ul style="list-style-type: none"> - the layer of plasterboard should be fixed to the battens in case of the roof insulation installed below the rafters. The batten size should be sufficient to ensure a nominal 25 mm gap between the product and the plasterboard; - in case of the roof insulation installed above the rafters the foil-backed layer of plasterboard can be fixed directly to the rafters; - further details are given in section 9 of this Certificate. <p>5 Maintenance and repair</p> <ul style="list-style-type: none"> - once installed, the product do not require any maintenance, provided that it remains installed strictly in accordance with the requirements of this Certificate and of the Certificate holder; - the Certificate holder must continue to provide a technical consulting service. 	
<p>11 Regulations</p>	<p>1 Requirements: The Building Regulations (England and Wales) (as amended)</p> <ul style="list-style-type: none"> - B3(4) Internal fire spread (structure) – Junctions between roofs and compartment walls must be fire stopped. The insulation must not be carried over junctions between roofs and walls required to provide a minimum period of fire resistance; - C4 Resistance to weather and moisture – ThermaQuilt can adequately resist the passage of moisture to the underlying structure, provided the roof is constructed in accordance with BS 5534² and the requirements of this Certificate; - J3 Protection of the building from heat-producing appliances – in order to comply with this Regulation ThermaQuilt shall be adequately separated or shielded from a chimney, flue, fireplace recess, heat-producing appliance or hearth. The separations recommended, where appropriate, are detailed in Approved Document J supporting these Regulations, to which reference must be made; - L1 Conservation of fuel and power – roofs constructed using ThermaQuilt can be designed and constructed to provide a U-value of no greater than 0.20 W.m⁻².K⁻¹; - Regulation 7 Materials and workmanship – ThermaQuilt is manufactured from suitably safe and durable materials for their application and can be installed to give a satisfactory performance. 	
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<p>11 Regulations (continued)</p>	<p>Requirements: The Building (Scotland) Regulations (as amended)</p> <p>2.1 Regulations 8 (1) Durability of materials and workmanship</p> <ul style="list-style-type: none"> - ThermaQuilt is manufactured from acceptable materials and are considered to be adequately resistant to deterioration and wear under normal service conditions, provided they are installed in accordance with the requirements of this Certificate. <p>2.2 Regulation 9 Building Standards Construction</p> <p>Section 2 Fire</p> <ul style="list-style-type: none"> - 2.4 Cavity barriers - combustible materials are permitted in the roof cavity but require any opening to be sealed. The insulation must not be carried over junctions between roofs and walls required to provide a minimum period of fire resistance; - 2.5 Heat-producing, solid fuel burning or oil- or gas-fired installations - a roof, incorporating ThermaQuilt can be designed and constructed to comply with these Standards, provided that they are isolated from the flue of a gas-fired, or solid fuel, or oil-fired heat-producing appliance by a separation. The insulation shall be adequately separated from a fire place opening, recess, hearth or flue pipe, or from any heat-producing appliance. <p>Section 3 Environment</p> <ul style="list-style-type: none"> - 3.10 Precipitation - ThermaQuilt can adequately resist the passage of moisture to the underlying structure provided the roof is constructed in accordance with BS 5534² and the requirements of this Certificate; - 3.15 Condensation - a roof formed using ThermaQuilt in accordance with the requirements of this Certificate and of BS 5250³, can be designed and constructed to comply with these Standards. <p>Section 6 Energy</p> <ul style="list-style-type: none"> - 6.1(b) Where a proposed roof U-value is not better than (or is greater than in Scotland) the relevant 'notional' value, additional energy saving measures will be required in the building envelope and/or services to achieve the required overall carbon dioxide emission rate reduction of about 20% in dwellings (18% to 25% in Scotland) and 23% to 28% in buildings other than dwellings; - 6.2.1. Conservation of fuel and power: the building fabric - pitched roofs can be designed and constructed with ThermaQuilt to provide a U-value of no greater than 0.35 W.m⁻².K⁻¹. <p>3 Requirements: The Building Regulations (Northern Ireland) (as amended)</p> <ul style="list-style-type: none"> - B2 Fitness of materials and workmanship - ThermaQuilt is manufactured from materials which are considered to be suitably safe and acceptable for use as vapour open roof cavity rain barrier; - C5 Resistance to moisture and weather - where ThermaQuilt is installed within a timber frame roof, that roof can be designed and constructed so as to prevent the passage of moisture or water vapour through it. Advice is given in section 10 of this Certificate; - C7 Condensation - a roof incorporating ThermaQuilt can be designed and constructed to prevent any harmful effect from moisture in the form of interstitial condensation; - E5(b) The product will not affect the external fire rating of a tiled or slated roof in which it is installed; - F2 Conservation of fuel and power - pitched roofs, incorporating ThermaQuilt, between the roof insulation and tiles, can be designed and constructed to provide a U-value of no greater than 0.35 W.m⁻².K⁻¹; - F3(2) The product can contribute to a building satisfying its Target Emission Rate; - L2 Heat-producing appliances and associated constructions - a roof, incorporating ThermaQuilt can be designed and constructed to comply with these Regulations, provided that the insulation is isolated from the flue of a gas-fired, or solid fuel or oil-fired heat-producing appliance or an incinerator. It shall be adequately separated from a chimney or fireplace recess, from a flue pipe, from a hearth or from the appliance. 	
<p>12 NHBC Standards</p>	<p>NHBC accepts the use of ThermaQuilt, provided they are specified, installed and used in accordance with this Certificate, as meeting Technical Requirement R3 in relation to the NHBC Standards, Chapter 7.2 Pitched Roofs¹¹.</p>	
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