Bauder Ltd
70 Landseer Road
Ipswich
Suffolk IP3 0DH
Tel: 01473 257671 Fax: 01473 230761
e-mail: info@bauder.co.uk
website: www.bauder.co.uk

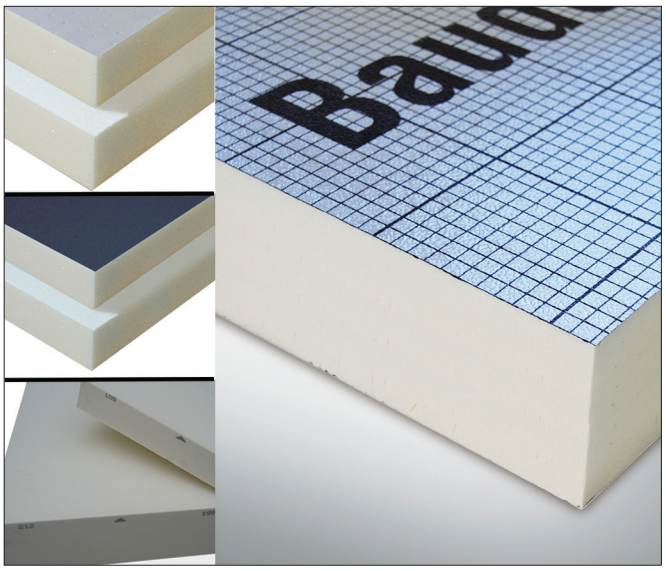
Agrément Certificate
16/5365
Product Sheet 1

BAUDER PIR INSULATION

BAUDER PIR ROOF INSULATION BOARDS

This Agrément Certificate Product Sheet(1) relates to Bauder PIR Roof Insulation Boards, comprising a range of rigid polyisocyanurate (PIR) foam boards with and without foil or glass tissue facings on both sides. The products are for use as a thermal insulation layer on zero fall, flat roofs and pitched roofs, with limited access and finished with roof waterproofing membranes, in 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 performance — the products have a declared thermal conductivity* (λ_D) from 0.022 $W \cdot m^{-1} \cdot K^{-1}$ to 0.027 $W \cdot m^{-1} \cdot K^{-1}$, depending on the thickness and facings (see section 6).

Condensation risk — the products can contribute to limiting the risk of condensation (see section 7).

Strength and stability — when installed on suitable substrates using appropriate fixing methods, the products can adequately transfer maintenance traffic loads and wind loads to the roof deck (see section 8).

Behaviour in relation to fire — the overall fire rating of any roof containing the products will depend on the type of deck and the nature of the roof waterproof covering (see section 9).

Durability — the products, when used as thermal insulation in the roof systems described in this Certificate, will have a life at least as long as that of the roof waterproof covering (see section 11).

The BBA has awarded this Certificate to the company named above for the products described herein. These products have been assessed by the BBA as being fit for their intended use provided they are installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of First issue: 2 February 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.

Regulations

In the opinion of the BBA, Bauder PIR Roof Insulation Boards, 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:	A1	Loading
Comment:		The products can contribute to satisfying this Requirement. See section 8.1 of this Certificate.
Requirement:	B4(2)	External fire spread
Comment:		Roofs incorporating the products can satisfy this Requirement. See sections 9.1 and 9.3 of this Certificate.
Requirement:	C2(c)	Resistance to moisture
Comment:		The products 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 products can contribute to satisfying this Requirement. See section 6 of this Certificate.
Regulation:	7	Materials and workmanship
Comment:		The products are acceptable. See section 11 and the *Installation* part of this Certificate.
Regulation:	26	CO_2 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 efficiency rates for new dwellings (applicable to Wales only)
Comment:		The products can contribute to satisfying these Regulations; however, compensating fabric/services measures may be required. See section 6 of this Certificate.

The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)	Durability, workmanship and fitness of materials
Comment:		The products are acceptable. See section 11 and the *Installation* part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	1.1	Structure
Comment:		The products can contribute to satisfying this Standard, with reference to clauses 1.1.1[(1)(2)], 1.1.2[(1)(2)] and 1.1.3[(1)(2)]. See section 8.1 of this Certificate.
Standard:	2.8	Spread from neighbouring buildings
Comment:		Roofs incorporating the products can satisfy this Standard, with reference to clause 2.8.1[(1)(2)]. See sections 9.1 and 9.3 of this Certificate.
Standard:	3.15	Condensation
Comment:		The products can contribute to satisfying this Standard, with reference to clauses 3.15.1[(1)(2)], 3.15.3[(1)(2)], 3.15.4[(1)(2)], 3.15.5[(1)(2)] and 3.15.6[(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 products can contribute to satisfying these Standards, with reference to clauses, or parts of, 6.1.1[(1)], 6.1.2[(2)], 6.1.6[(1)], 6.2.1[(1)(2)], 6.2.3[(1)], 6.2.4[(2)], 6.2.5[(2)], 6.2.6[(1)], 6.2.7[(1)], 6.2.8[(1)(2)], 6.2.9[(1)(2)], 6.2.10[(1)(2)], 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 products can contribute to satisfying 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 products can contribute to a construction meeting a higher level of sustainability as defined in this Standard, with reference to clauses 7.1.4[(1)(2)] [Aspects 1[(1)(2)] and 2[(1)]], 7.1.6[(1)(2)] [Aspects 1[(1)(2)] and 2[(1)]] and 7.1.7[(1)(2)] [Aspect 1[(1)(2)]]. See section 6.2 of this Certificate.
Regulation:	12	Building standards applicable to conversions
Comment:		Comments made in relation to the products 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 products are acceptable. See section 11 and the *Installation* section of this Certificate.
Regulation:	29	Condensation
Comment:		The products can contribute to satisfying this Regulation. See section 7.1 of this Certificate.
Regulation:	30	Stability
Comment:		The products can contribute to satisfying this Regulation. See section 8.1 of this Certificate.
Regulation:	36(b)	External fire spread
Comment:		Roofs incorporating the products can satisfy this Regulation. See sections 9.1 and 9.3 of this Certificate.

Regulation:	39(a)(i)	Conservation measures
Regulation:	40(2)	Target carbon dioxide emission rate
Comment:		Roofs incorporating the products can satisfy 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 section: 3 *Delivery and site handling* (3.3) of this Certificate.

Additional Information

NHBC Standards 2017

NHBC accepts the use of Bauder PIR Roof Insulation Boards, provided they are installed, used and maintained in accordance with this Certificate, in relation to *NHBC Standards*, Chapter 7.1 *Flat roofs and balconies*.

CE marking

The Certificate holder has taken the responsibility of CE marking the products in accordance with harmonised European Standard BS EN 13165 : 2012. 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 Bauder PIR Roof Insulation Boards comprise a range of rigid polyisocyanurate (PIR) foam boards with and without foil or glass tissue facings on both sides, to suit various applications (see section 4). The range of products and their nominal characteristics are given in Table 1.

Table 1 Nominal characteristics

Product	Core/Facings	Edge detail	Length* x width* (mm)	Thickness* (mm)	Compressive strength at 10% compression *(kPa)
BauderPIR FA-TE	PIR core with printed aluminium foil facings both sides	Straight	1200 x 600	20 to 240	≥120
BauderPIR FA	PIR core with black coloured aluminium foil facings both sides	Rebated 15 mm all sides	1200 x 2400 nominal (1185 x 2385 installed)	60 to 240	≥120
BauderPIR Flatboard	PIR core with glass tissue facings both sides	Straight or Rebated 15 mm all sides	1200 x 600 1200 x 600 nominal (1185 x 585 installed)	20 to 240	≥120
BauderPIR Tapered	PIR block tapered board with no facings	Straight	1200 x 800	20 to 400	≥120

1.2 The products are installed as part of a roof system in conjunction with the following items (which are outside of the scope of this Certificate):

- waterproofing membrane(s)
- vapour control layer (VCL)
- adhesives and/or mechanical fixings.

2 Manufacture

2.1 BauderPIR FA-TE, BauderPIR FA and BauderPIR Flatboard insulation boards are manufactured by blending together polyol and MDI in a continuous foaming process aided by a blowing agent, and sandwiched between two facings on a lamination production line. After formation, the boards are left to cure and are cut to size. BauderPIR Tapered insulation boards are manufactured as a foam block material on a separate production line using the same core constituents. After curing, tapered boards are cut from block to the required finished sizes.

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 the manufacturer Bauder GmbH has been assessed and registered as meeting the requirements of DIN EN ISO 9001 : 2008 (Certificate 70499/03-15_d) and DIN EN ISO 14001 : 2004 (Certificate 70499/03-15_e) by ESC Cert GmbH.

3 Delivery and site handling

3.1 The products are delivered to site in shrink-wrapped packs, containing a label with the product description and characteristics, along with the manufacturer's name.

3.2 It is essential that the products are stored off the ground, inside or under cover on a flat, dry, level surface in a well-ventilated area, and with nothing stored on top of it. The products must be protected from rain, snow and prolonged exposure to sunlight. Boards that have been allowed to get wet or that are damaged must not be used.

3.3 The products must not be exposed to a direct naked flame or other ignition sources, or to solvents or other chemicals.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Bauder PIR Roof Insulation Boards.

Design Considerations

4 Use

4.1 Bauder PIR Roof Insulation Boards are suitable for use as a fully supported thermal insulation layer on zero fall, flat roofs and pitched roofs (see section 4.6) with concrete, timber and profiled metal roof decks, in conjunction with suitable roof waterproofing membrane systems (see section 4.4), with limited access only (see section 4.5).

4.2 Decks should be designed in accordance with the relevant clauses of BS 6229 : 2003, BS 8217 : 2005 or BS EN 13956 : 2012 and, where appropriate, the *NHBC Standards* 2017, Chapter 7.1.

4.3 Roofs should incorporate a VCL below the products which is compatible with the products and the waterproofing system. Advice should be sought from the Certificate holder.

4.4 The products must be either adhesively bonded to the VCL or mechanically fixed to the roof deck (see section 8), and are for use in conjunction with a suitable roof waterproofing system (as given in Table 2).

Table 2 Application

Insulation	Reinforced bitumen membrane (torch-on)[1]	Reinforced bitumen membrane (self-adhered)[1]	Single-ply fleece-backed membrane (adhered)[2]	Single-ply membrane (mechanically fixed)[2]	Cold applied liquid waterproofing[3]
BauderPIR FA-TE	X	✓	✓	✓	✓
BauderPIR FA	X	✓	✓	✓	✓
BauderPIR Flatboard	✓	✓	✓	✓	✓
BauderPIR Tapered	✓	✓	✓	✓	✓

(1) Reinforced bitumen membranes to BS 8747 : 2007 in accordance with the recommendations of Table 5, and installed to the relevant clauses of BS 8217 : 2005, including the following:
- Bauder Total Roof Waterproofing Systems (Agrément Certificate 10/4744, PS1)
- Bauderflex Roof Waterproofing Systems (Agrément Certificate 10/4744, PS3).

(2) Single-ply roof waterproofing systems (adhesively bonded or mechanically fixed), such as PVC, CSM, CPE, FPO (including TPO), VET, PIB or EPDM, which are the subject of a current Agrément Certificate and laid in accordance with the requirements of that Certificate and the manufacturer's recommendations, including the following:
- Thermoplan T (Agrément Certificate 04/4120, PS1)
- Thermofol U (Agrément Certificate 06/4354, PS1).

(3) Liquid-applied waterproofing systems with a current Agrément Certificate and laid in accordance with the requirements of that Certificate and the manufacturer's recommendations, including the following:
- Bauder LiquiTEC Roof System (Agrément Certificate 14/5152, PS1).

4.5 Limited access roofs are defined for the purpose of this Certificate as those roofs subject only to pedestrian traffic for maintenance of the roof covering, cleaning of gutters, etc.

4.6 For the purposes of this Certificate: flat roofs are defined as those roofs having a minimum finished fall of 1:80 and a maximum of 1:6, as defined in BS 6229 : 2003; zero fall roofs are defined as those roofs having a finished fall of less than 1:80; and pitched roofs are defined as sloping roofs with a fall greater than 1:6.

4.7 For design purposes on flat roofs, twice the minimum finished fall should be assumed, unless a detailed analysis of the roof is available, including overall and local deflections, direction of falls etc.

4.8 BauderPIR Tapered insulation boards may be used where appropriate, to achieve the minimum finished falls between 1:80 and 1:6.

4.9 On zero fall flat roofs it is particularly important to identify the correct drainage points to ensure that drainage provided is effective. Reference should be made to the appropriate clauses of the LRWA Guidance Note No 7 – *Specifier guidance for flat roof falls*, which generally requires surface drainage falls in most situations.

5 Practicability of installation

Installation of the products must be carried out only by installers trained and approved by the Certificate holder.

6 Thermal performance

6.1 Calculations of thermal transmittance (U value) 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 given in Table 3.

*Table 3 Declared thermal conductivity (λ_D)**

Product	PIR Insulation core Declared thermal conductivity (λ_D)* $W \cdot m^{-1} \cdot K^{-1}$
BauderPIR FA-TE BauderPIR FA	0.022
BauderPIR Flatboard	20 to 79 mm thick – 0.027 80 to 119 mm thick – 0.026 ≥ 120 mm thick – 0.025
BauderPIR Tapered	20 to 79 mm thick – 0.027 80 to 119 mm thick – 0.026 ≥ 120 mm thick – 0.025

6.2 The U value of a completed roof will depend on the thickness of insulation used, the type of fixing and the insulating value of other roof components/layers. Example U values of roofs incorporating the products are given in Table 4.

Table 4 Example U values

	BauderPIR FA-TE and BauderPIR FA		
U value ($W \cdot m^{-2} \cdot K^{-1}$)	Insulation thickness[1] (mm)		
	Concrete deck[2]	Timber deck[3]	Metal deck[4]
0.13	160	160	160
0.15	140	140	140
0.16	140	140	140
0.18	120	120	120
0.20	120	100	120
0.25	100	80	100
	BauderPIR Flatboard		
U value ($W \cdot m^{-2} \cdot K^{-1}$)	Insulation thickness[1] (mm)		
	Concrete deck[2]	Timber deck[3]	Metal deck[4]
0.13	180	180	200
0.15	160	160	160
0.16	160	140	160
0.18	140	140	140
0.20	120	120	120
0.25	100	100	100
	BauderPIR Tapered[5]		
U value ($W \cdot m^{-2} \cdot K^{-1}$)	Insulation thickness[1] (mm)		
	Concrete deck[2]	Timber deck[3]	Metal deck[4]
0.13	180	180	200
0.15	160	160	160
0.16	160	140	160
0.18	140	140	140
0.20	120	120	120
0.25	100	100	100

(1) Nearest available thickness.

(2) 150 mm concrete deck — 1.33 $W \cdot m^{-1} \cdot K^{-1}$, VCL, mechanically-fixed single-ply waterproofing membrane.

(3) 12.5 mm plasterboard, 150 mm timber joists (12.5%)/air cavity (87.5%), 18 mm plywood decking, VCL, mechanically-fixed single-ply waterproofing membrane.

(4) Metal deck (not included in calculation), VCL, mechanically-fixed single-ply waterproofing membrane.

(5) Thicknesses shown for BauderPIR Tapered insulation are for illustrative purposes, as each tapered insulation project will be designed to suit the building and U values calculated accordingly.

Junctions

6.3 Care must be taken in the overall design and construction of junctions with other elements and openings to 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 Roofs will adequately limit the risk of interstitial condensation when they are designed and constructed in accordance with BS 5250 : 2011, Annexes D and H and the relevant guidance.

7.2 For the purposes of calculations, the following vapour resistivity/resistance values of the individual components may be used:

- BauderPIR FA-TE, BauderPIR FA and BauderPIR Flatboard insulation core — 390 $MN \cdot s \cdot g^{-1} \cdot m^{-1}$
- BauderPIR Tapered insulation core — 705 $MN \cdot s \cdot g^{-1} \cdot m^{-1}$
- Aluminium foil-facing for BauderPIR FA-TE and BauderPIR FA — 1000 $MN \cdot s \cdot g^{-1}$
- Glass tissue-facing for BauderPIR Flatboard — 375 $MN \cdot s \cdot g^{-1}$.

7.3 To minimise moisture entering the roof, a VCL should be used; joints must be sealed and lapped and it should be turned up around the insulation and bonded to the waterproofing finish. In the case of single-ply roofing membranes, the recommendations of the SPRA Design guide should be followed.

Surface condensation

7.4 Roofs will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed 0.35 $W \cdot m^{-2} \cdot K^{-1}$ at any point, and the junctions with other elements are designed in accordance with the guidance referred to in section 6.3 of this Certificate.

7.5 For buildings in Scotland, constructions will be acceptable where the thermal transmittance (U value) does not exceed 1.2 $W \cdot m^{-2} \cdot K^{-1}$ at any point, and the junctions with other elements are designed in accordance with the guidance referred to in BS 5250 : 2011, Annex H. Further guidance may be obtained from BRE Report BR 262 : 2002 and section 6.3 of this Certificate.

8 Strength and stability

8.1 When installed on suitable flat roof decks, using appropriate adhesive and/or mechanical fixing methods, the products can adequately transfer maintenance traffic loads and negative and positive (suction and pressure) wind loads to the roof deck.

8.2 For adhesive application of the insulation product, the substrate must be dry and free from dust, and installation should be in accordance with the instructions of the adhesive manufacturer. The surface of the substrate must have sufficient cohesive strength to resist the calculated wind load acting upon the structure.

8.3 When adhering is the chosen method for the insulation or waterproofing, adhesion between the insulation product and VCL and between the product and overlay must be adequate to resist the effects of wind suction and thermal cycling likely to be experienced under normal conditions. In areas where high wind speeds can be expected, additional mechanical fixings should be considered; the advice of a suitably qualified and experienced individual should be sought as to the method of fixing as defined in the relevant clauses of BS EN 1991-1-4 : 2005 and its UK National Annex.

8.4 The roof construction must be structurally sound and have sufficient strength and stability to resist all dead, imposed and wind loads. It must also have adequate resistance to the pull-out forces created by the wind forces acting on the specified fixings used.

8.5 The suitability of the substrate to accept the adhesive bond or mechanical fixings must be established before installation. Mechanical fixings must be checked before installation by carrying out in-situ pull-out or pull-through testing to determine the maximum safe working load the fixings can resist. The advice of the Certificate holder should be sought in respect of suitable mechanical fixings.

8.6 All design analysis must be in accordance with British or European Standards relevant to the construction. All calculations should be carried out by a suitably qualified and experienced individual.

8.7 The fixing method and, if necessary, the number and type of mechanical fixings required will vary depending on the geographical location of the building, the topographical data, and height and width of the roof concerned, etc; the Certificate holder's advice should be sought in this respect. The Certificate holder recommends a minimum number of fixings per board (see sections 13.3 and 13.4).

8.8 Roof waterproofing systems (see section 4.4 for suitable types) must be applied in accordance with the relevant Agrément Certificates and Certificate holder's instructions.

8.9 For design purposes, the products may be assumed to have an allowable compressive strength at 10% compression* of ≥120 kPa.

8.10 The products have not been assessed for use with permanent distributed or concentrated loads, such as air conditioning units, mechanical plants, water tanks, etc. Such loads should be supported directly on the roof construction. The products are not suitable when permanent roof access is required.

8.11 When profiled decking is used, the products will need to span across the ribs. Maximum permissible spans between ribs for the different product thicknesses are given in Table B.1 of BS 4841-4 : 2006 (reproduced in Table 5 of this Certificate). For the minimum adhesive bonding area, see section 8.3 of this Certificate.

Table 5 Maximum clear span

Maximum clear span (mm)		Minimum roofboard thickness (mm)
< 75		25
> 75	≤ 100	30
> 100	≤ 125	35
> 125	≤ 150	40
> 150	≤ 175	45
> 175	≤ 200	50
> 200	≤ 225	55
> 225	≤ 250	60

8.12 When maintenance is required to the roof waterproofing, protective boarding should be laid over the roof surface to avoid concentrations of load.

9 Behaviour in relation to fire

9.1 The products have a reaction to fire classification* of Class E to BS EN 13501-1 : 2007.

9.2 The fire rating of any roof containing the products will depend on the type of deck and the nature of the roof waterproofing.

9.3 The following systems will be unrestricted by the national Building Regulations:

- a system comprising a 19 mm exterior plywood substrate, a fully bonded layer of BauderTHERM DS1 DUO, a 30 mm thick BauderPIR FA-TE insulation board bitumen bonded, a fully bonded layer of BauderTEC KSA DUO and a fully bonded layer of Bauder K5K
- a system comprising an 18 mm OSB timber board substrate, a fully bonded layer of BauderTHERM DS1 DUO, a 100 mm thick BauderPIR Flatboard insulation bitumen bonded, and a fully bonded layer of Bauder PRO F
- a system comprising an 18 mm OSB timber board substrate, a fully bonded layer of BauderTEC KSD DUO, a 147 mm average thickness BauderPIR T insulation board bonded, a fully bonded layer of BauderTEC KSD Duo and a Bauder LiquiDEK cold applied liquid waterproofing membrane with 110 g polyester reinforcement fleece.

9.4 The designation of other specifications should be confirmed by:

England and Wales — test or assessment in accordance with Approved Document B, Volumes 1 and 2, Appendix A, Clause 6

Scotland — test to conform to clauses 2.C[1] and 2.F[2]

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).

Northern Ireland — test to conform to clauses 5.21 and 5.22.

10 Maintenance

The products, once installed, do not require any maintenance and have suitable durability provided the roof waterproofing is inspected and maintained at regular intervals (see section 11).

11 Durability

The products are rot-resistant and durable, and will have a life at least as long as that of the roof waterproofing.

Installation

12 General

12.1 Bauder PIR Roof Insulation Boards must be installed in accordance with the Certificate holder's instructions, BS 6229 : 2003, BS 8217 : 2005 and BS EN 13956 : 2012.

12.2 Care should be taken to ensure the deck is graded to the correct fall, is dry, clean and free from any projections or gaps.

12.3 Any hollows, depressions or backfalls found in the roof deck must be rectified prior to laying the insulation.

12.4 The suitability of the substrate deck to accept an adhesive bond or mechanical fixings must be checked prior to the work commencing.

12.5 The deck to which the VCL is to be applied must be even, dry, sound, free from dust and grease and other defects which may impair the bond. All deck joints should be taped.

12.6 To prevent moisture being trapped on, or in, the insulation it is essential to:

- protect the products during laying, before the application of the roof waterproofing, or to lay the roof covering at the same time as laying the product. If the products are accidentally wetted, they must be replaced
- install the products only when the ambient temperature is above 5°C, to prevent condensation.

12.7 The products can be cut with a sharp knife or fine-toothed saw, to fit around projections through the roof.

12.8 The products are for use with the waterproofing systems specified in section 4.4, laid in accordance with the relevant British Standard and current Agrément Certificate.

12.9 Once installed, access to the roof should be restricted in accordance with section 4.5.

13 Procedure

Timber decks (eg tongue-and-groove boards, plywood, OSB)

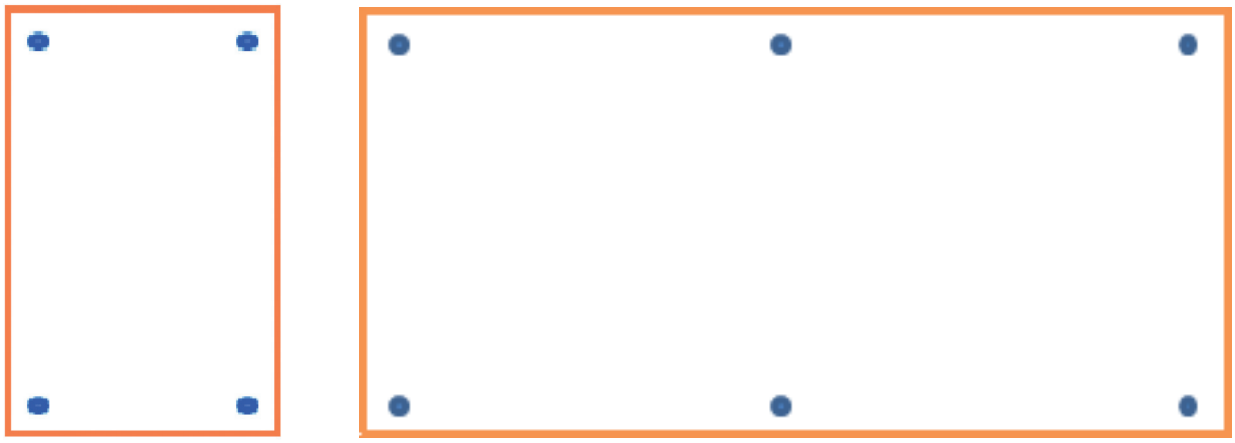
13.1 A VCL is applied in accordance with the manufacturer's instructions.

13.2 The VCL should be laid with sealed laps, turned up around the insulation and sealed to the waterproof finish at all edges and penetrations such as roof lights, with detailing in accordance with the standards and guidance in sections 7.1 and 12.1. See section 7.3 in relation to single-ply roofing membranes.

13.3 The insulation boards are adhesively or mechanically fixed to the VCL and deck below in a brick-bonded pattern with the minimum number of mechanical fixings placed within the individual board area as shown in Figure 1. The actual number of mechanical fixings required to fix the board must be determined by a suitably qualified and experienced individual to suit the wind uplift requirements for the particular site.

13.4 Each fixing should incorporate a head or washer which is a maximum of 50 mm diameter if round, or 50 mm by 50 mm if square. For adhered single-ply roofing membranes, the SPRA Design Guide recommends a 75 mm dia round head or a 70 x 70 mm washer. Fixings located along the edge or at corners of the boards should be situated no less than 50 mm and no more than 150 mm from the board edge. For non-bituminous VCLs, the fixings penetrating the VCL should be self-sealing. For bituminous VCLs, the nail heads should be blanked out with hot bitumen.

Figure 1 Minimum fixing pattern



600 x 1200 board — BauderPIR FA-TE and BauderPIR Flatboard
800 x 1200 board — BauderPIR Tapered

2400 x 1200 board — BauderPIR FA

13.5 The single-ply roof waterproofing membrane is mechanically fixed, in accordance with the manufacturer's instructions.

Concrete decks

13.6 Before applying the VCL, an appropriate levelling screed should be applied where necessary. The whole deck should be primed, if necessary, in accordance with the manufacturer's instructions. The advice of the Certificate holder should be sought in respect of a suitable primer.

13.7 The VCL is fully bonded and the laps are sealed. The insulation boards and roof waterproofing membrane are then applied in the manner described for timber decks (see sections 13.3 and 13.4).

Metal decks

13.8 Before applying the VCL, the deck should be primed, if necessary, in accordance with the manufacturer's instructions. The advice of the Certificate holder should be sought in respect of a suitable primer.

13.9 A reinforced VCL is fully bonded to the metal deck and the laps are sealed. The insulation boards and roof waterproofing membrane are then applied in the manner described for timber decks (see sections 13.3 and 13.4).

13.10 The insulation boards are laid with the long edges at right angles to the ribs and all board ends must be fully supported on a rib.

13.11 The thickness of the roofboard used depends on the width of the rib openings of the metal deck, as indicated in section 8, Table 5.

Figure 2 Reinforced bitumen membrane, adhesively fixed on timber deck

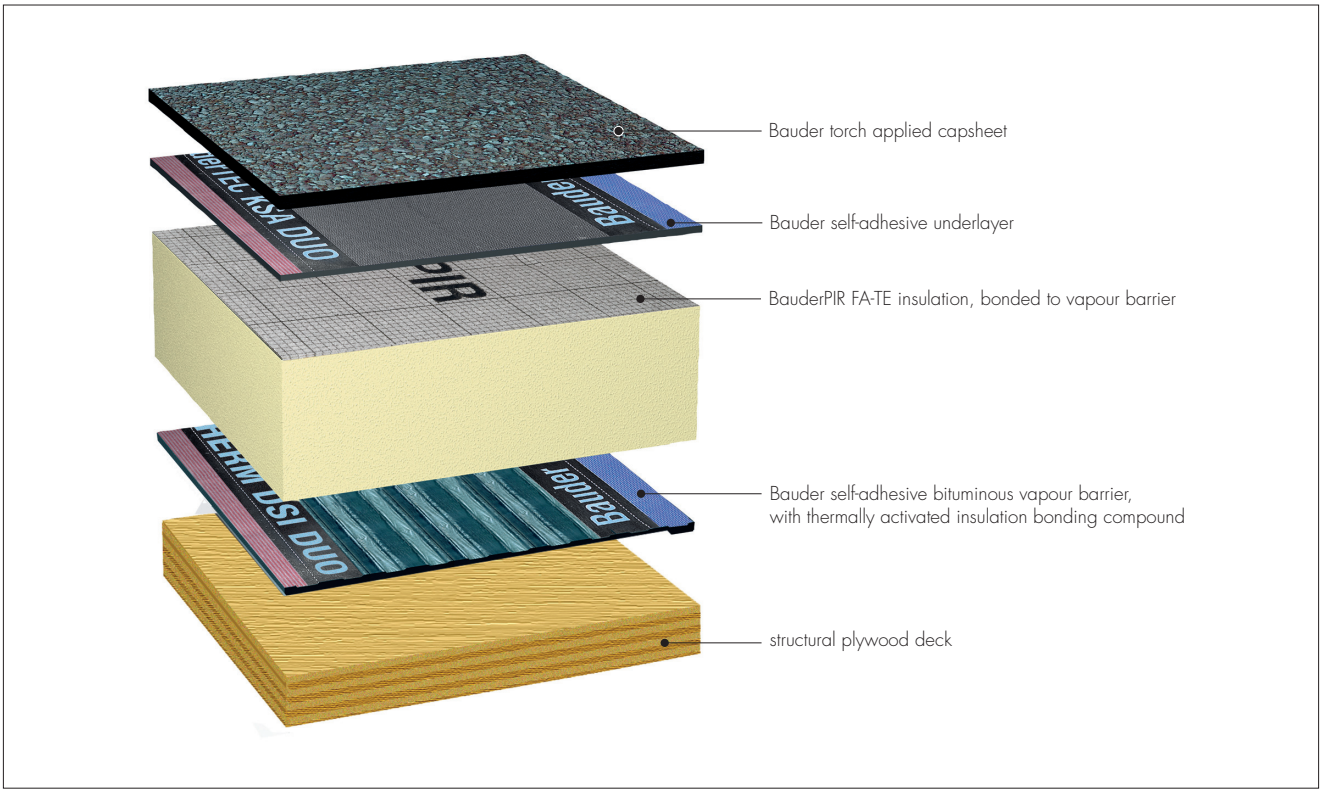


Figure 3 Single-ply waterproofing mechanically fixed on metal deck

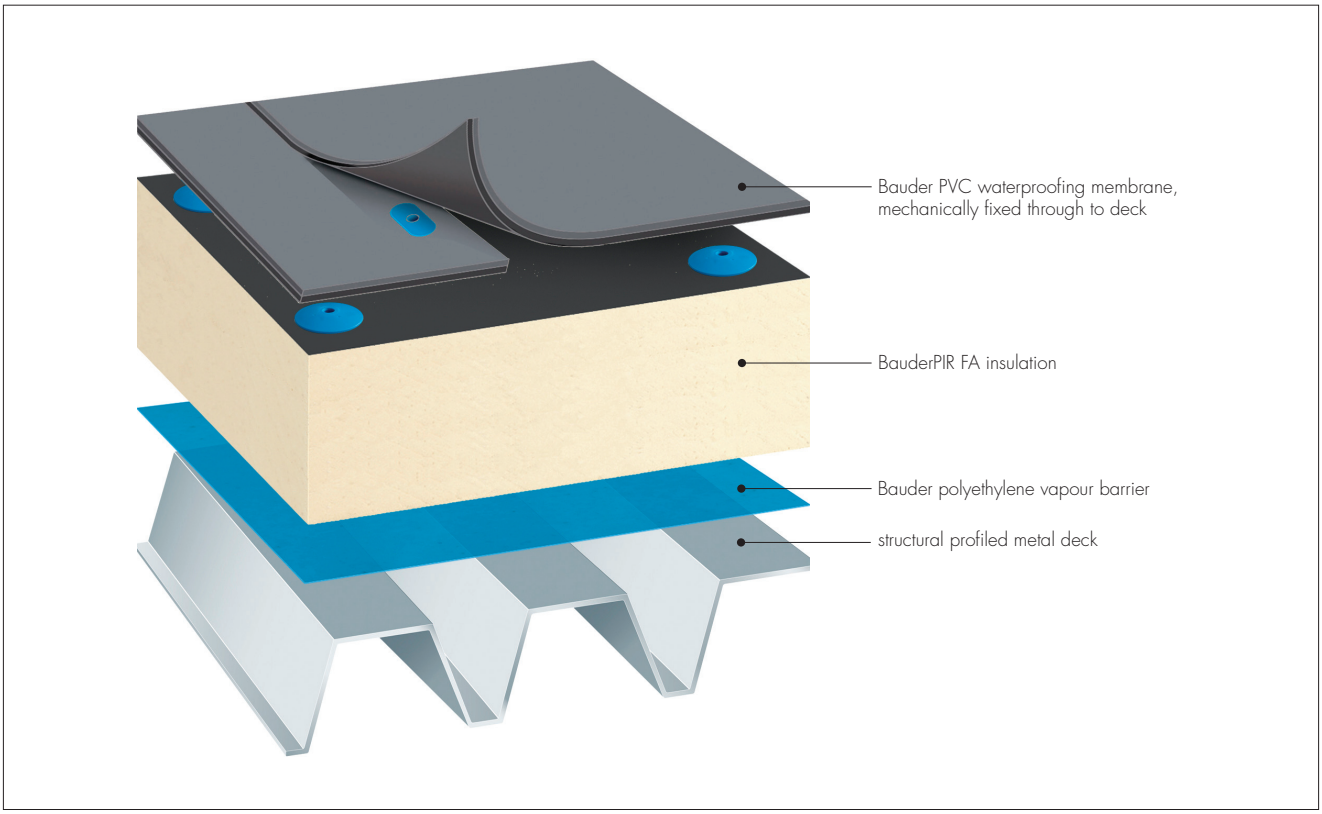
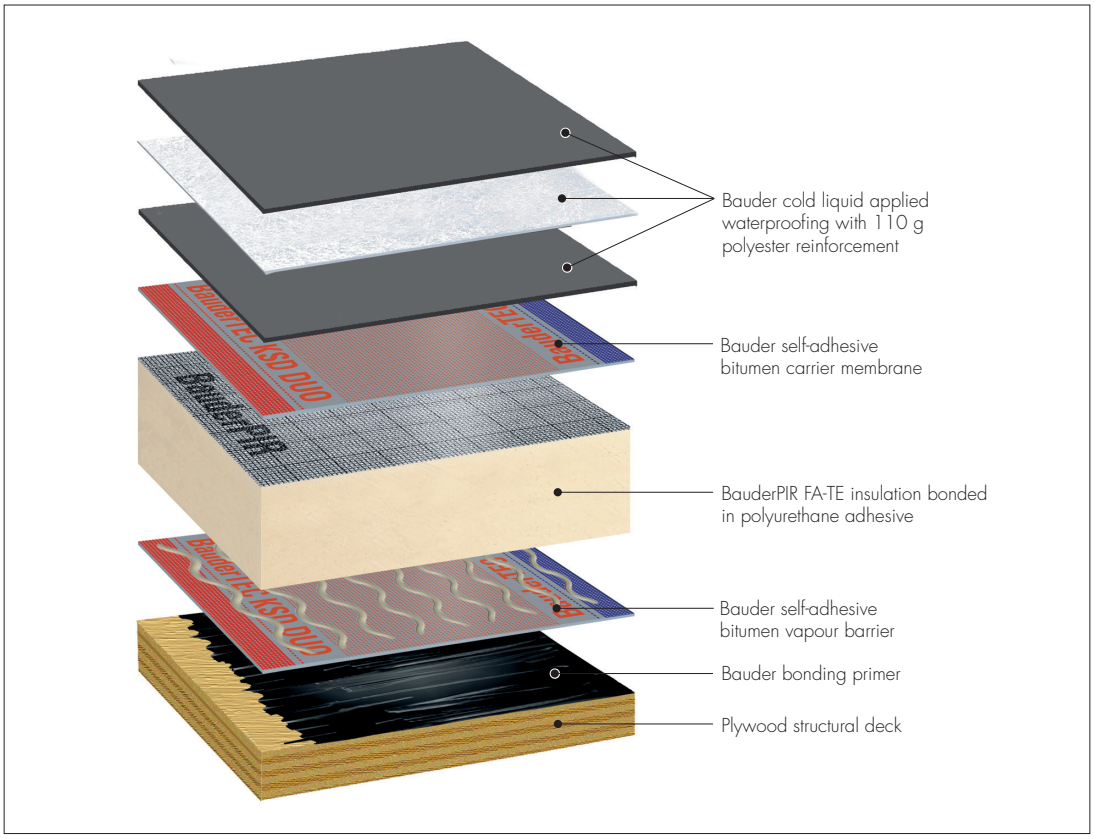


Figure 4 Cold Liquid Applied Waterproofing, adhesively fixed on timber deck



Technical Investigations

14 Investigations

14.1 An assessment was made of the results of test data relating to:

- reaction to fire
- thermal conductivity
- compressive strength
- dimensional stability
- wind uplift
- tensile strength perpendicular to faces
- water vapour transmission.

14.2 An assessment of the risk of interstitial condensation was made.

14.3 An assessment was made of typical constructions which achieve the design U values.

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

Bibliography

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LRWA Guidance Note No 7 — *Specifier Guidance for Flat Roof Falls*

SPRA Design Guide 2013 — *Design Guide to Single Ply Roofing*

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British Board of Agrément
Bucknalls Lane
Watford
Herts WD25 9BA

tel: 01923 665300
fax: 01923 665301
clientservices@bba.star.co.uk
www.bbacerts.co.uk