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Agrément Certificate
17/5467
Product Sheet 1

IKO ENERTHERM XPS

IKO ENERTHERM INVERTED ROOF SYSTEM

This Agrément Certificate Product Sheet(1) relates to the IKO enertherm Inverted Roof System, extruded polystyrene (XPS) boards used in conjunction with a water-control membrane in inverted flat untrafficked roofs, balconies and terraced roofs subject to pedestrian access only, with either zero pitch roofs or slopes between 1:80 and 1:6.

(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 system can contribute towards the thermal performance of a roof. The design thermal conductivity (λ_U), including moisture correction factor, of the boards is 0.034 $W \cdot m^{-1} \cdot K^{-1}$ for XPS thicknesses greater than or equal to 100 mm, and 0.035 $W \cdot m^{-1} \cdot K^{-1}$ for XPS thicknesses less than 100 mm (see section 6).

Condensation risk — the system can contribute to limiting the risk of surface and interstitial condensation (see section 7).

Resistance to foot traffic — the system, when installed on appropriate decks finished with a gravel ballast layer or paving slabs, can be used on untrafficked roofs with limited pedestrian access associated with maintenance operations, and pedestrian access roofs (on balconies and roof terraces) subject to foot traffic only (see section 8).

Durability — the sytem will remain effective as an insulant for at least 25 years, as long as the IKO enertherm WCL (water-reducing layer) is in place (see section 12).

The BBA has awarded this Certificate to the company named above for the system described herein. This system 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 First issue: 4 December 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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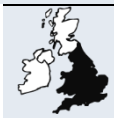
Regulations

In the opinion of the BBA, the IKO enertherm Inverted Roof System, 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 system can contribute to satisfying this Requirement. See sections 7.4 and 7.5 of this Certificate.
Requirement:	**L1(a)(i)**	**Conservation of fuel and power**
Comment:		The system can contribute to satisfying this Requirement. See sections 6.1 and 6.4 of this Certificate.
Regulation:	**7**	**Materials and workmanship**
Comment:		The system is acceptable. See section 12.1 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 performance values for new dwellings (applicable to Wales only)**
Comment:		The system can contribute to satisfying these Regulations. See sections 6.1 and 6.4 of this Certificate.

The Building (Scotland) Regulations 2004 (as amended)

Regulation:	**8(1)(2)**	**Durability, workmanship and fitness of materials**
Comment:		The system is acceptable. See sections 11.1 and 12.1 and the *Installation* part of this Certificate.
Regulation:	**9**	**Building standards applicable to construction**
Standard:	3.15	Condensation
Comment:		The system 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 7.4 and 7.6 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Standard:	6.2	Building insulation envelope
Comment:		The system can contribute to satisfying these Standards, with reference to clauses, or parts of, 6.1.1(1), 6.1.2(1)(2), 6.1.4(1)(2), 6.1.5(1), 6.1.6(1)(2), 6.1.7(2), 6.1.8(2) to 6.1.10(2), 6.2.1(1)(2), 6.2.2(1), 6.2.3(1)(2), 6.2.4(1)(2), 6.2.5(2), 6.2.6(1)(2) to 6.2.11(1)(2), 6.2.12(2) and 6.2.13(1)(2). See sections 6.1 and 6.4 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The system 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 system 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 6.1 of this Certificate.

Regulation:	**12**	**Building standards applicable to conversions**
Comment:		All Comments in relation to 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 system is acceptable. See section 12.1 and the *Installation* part of this Certificate.
Regulation:	**29**	**Condensation**
Comment:		The system can contribute to satisfying this Regulation. See section 7.4 of this Certificate.
Regulation:	**39(a)(i)**	**Conservation measures**
Comment:		The system can contribute to satisfying this Regulation. See sections 6.1 and 6.4 of this Certificate.
Regulation:	**40(2)**	**Target carbon dioxide emission rate**
Comment:		The system can contribute to satisfying this Regulation. See sections 6.1 and 6.4 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: 1 *Description* (1.2 and 1.3) and 3 *Delivery and site handling* (3.4) of this Certificate.

Additional Information

NHBC Standards 2017

In the opinion of the BBA, the IKO enertherm Inverted Roof System, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements 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 system in accordance with harmonised European Standard BS EN 13164 : 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 The IKO enertherm Inverted Roof System consists of IKO enertherm XPS, extruded polystyrene (XPS) boards rebated for lap jointing (see Figure 1), and IKO enertherm WCL, a water-control membrane.

1.2 Characteristics of IKO enertherm XPS boards are given in Table 1.

Table 1 Nominal characteristics - IKO enertherm XPS

Characteristic (unit)	**Value**
Work size (mm)	1250 x 600
Overall size (mm)	1265 x 615
Standard thicknesses (mm)(1)	50, 70, 100, 130, 160, 180, 200, 220 and 230
Water vapour permeability ($MN \cdot s \cdot g^{-1} \cdot m^{-1}$)	625
Minimum compressive strength* at 10% compression (kPa)	300
Edge profile (see Figure 1)	15 mm rebated

(1) Thicknesses >80 mm are achieved by combining up to three insulation boards.

1.3 IKO enertherm WCL is used as a filter layer and water-control layer between the insulation and the roof ballast layer. The nominal properties are given in Table 2.

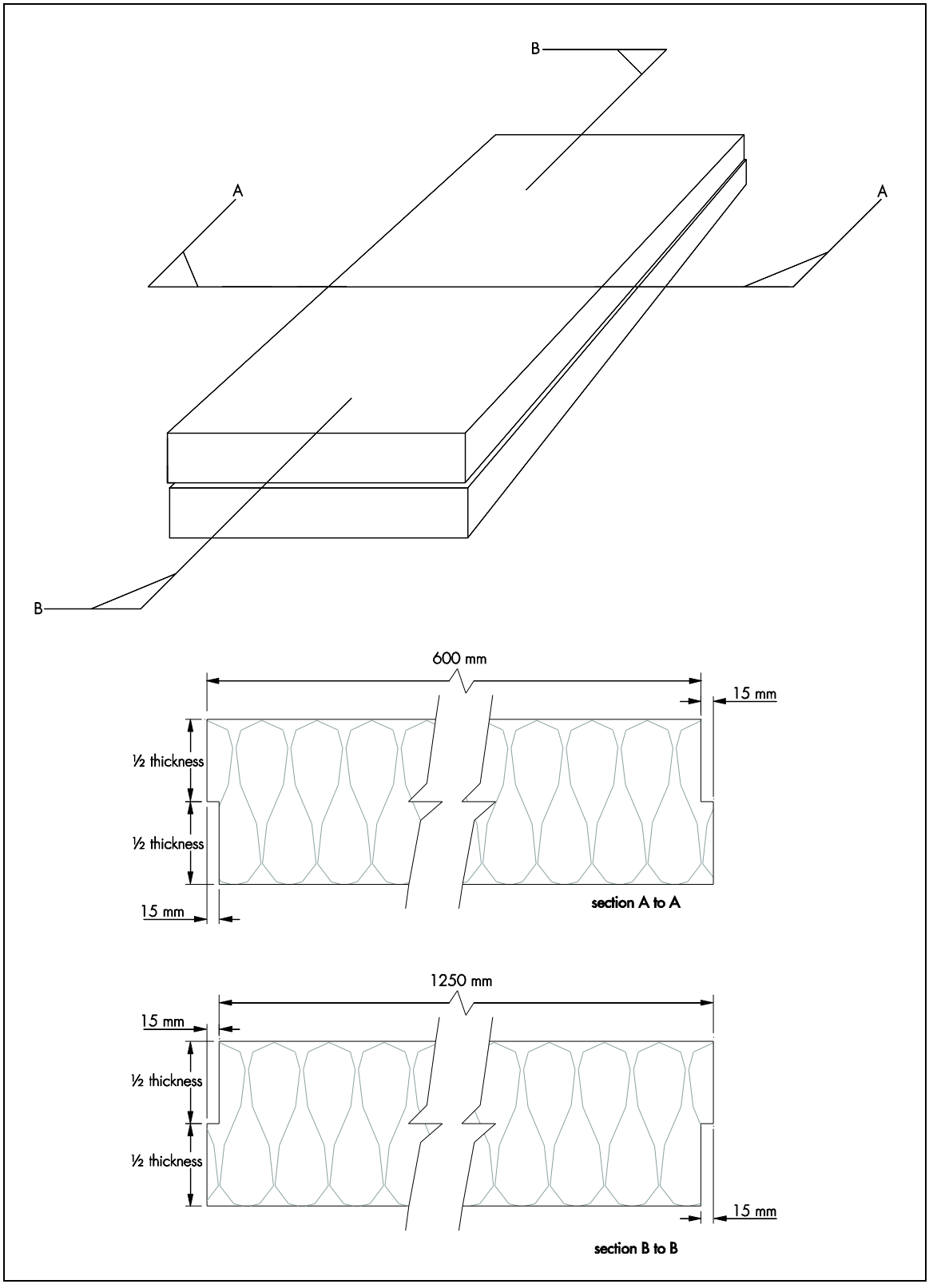
Table 2 Nominal characteristics — IKO enertherm WCL

Characteristic (unit)	**Value**
Length (m)	100
Width (m)	1.5
Weight ($g \cdot m^{-2}$)	100
Water vapour resistance ($MN \cdot s \cdot g^{-1}$)	0.1
Lap joints (mm) — unsealed	300

1.4 Ancillary items outside the scope of this Certificate include:

- gravel ballast — comprising a washed, low-fines aggregate, rounded and 16 to 32 mm in size (nominal), and laid to a minimum depth of 50 mm, or
- paving ballast of minimum 40 mm thickness and paving support spacers (see section 9.2)
- separating or cushion layers (if required, see section 4.15)
- rainwater outlet grilles
- dual level rainwater outlets
- flashings and skirtings.

Figure 1 Rebate detail



2 Manufacture

2.1 Raw materials are heated to form a molten plastic mix, which is injected with blowing agent. The foam is extruded and shaped in a die. An automated process cures and cuts the product to the required size.

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 being operated by the manufacturer are being maintained.

2.3 The management system of the manufacturer has been assessed and registered as meeting the requirements of BS EN 9001 : 2015 and BS EN 14001 : 2015 by Bureau Veritas Certification (Certificates UK008727 and UK009333 respectively).

3 Delivery and site handling

3.1 The boards are shrink wrapped in polythene and delivered to site on pallets or bearers. Each pack shows the manufacturer's name, grade, type marking and the BBA logo incorporating the number of this Certificate.

3.2 Boards must be protected from prolonged exposure to sunlight and should be stored under cover or protected with light-coloured opaque polythene sheets.

3.3 Care must be taken to avoid contact with solvents and materials containing organic components.

3.4 Boards must be stored flat, off the ground on a clean, level surface and under cover to protect them from high winds. They must not be exposed to open flame or other ignition sources.

3.5 Damaged boards must not be used.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on the IKO enertherm Inverted Roof System.

Design Considerations

4 Use

4.1 The IKO enertherm Inverted Roof System is suitable for use in new and existing domestic and non-domestic buildings as a fully supported thermal insulation layer on inverted flat or zero pitch untrafficked roofs, and balconies and terraced roofs subject to pedestrian access only, with a gravel or paving ballast and a suitably designed timber, concrete or metal structural deck.

4.2 For the purposes of this Certificate:

- flat roofs are defined as those having either a minimum finished fall between 1:80 and 1:6, or zero pitch with finished falls from 0 to 1:80. For design purposes, on sloping flat roofs, twice the minimum finished fall should be assumed, unless a detailed analysis of the roof is available, including overall and local deflection, direction of falls etc. See also *BBA Information Bulletin No 4*
- untrafficked roofs are defined as those subject only to pedestrian traffic during installation of the system and to carry out maintenance of the roof covering and cleaning of gutters. Traffic in excess of the above criteria is outside the scope of this Certificate and special precautions, such as the use of higher compressive-strength-grade insulation and additional protection to the waterproofing membrane, will be necessary
- pedestrian access roofs are defined as those consisting of the structural deck and all the layers on it, including waterproofing, thermal insulation and a surface protective layer designed for foot traffic and gathering of people greater than that required for maintenance.

4.3 A roof ballast layer must be installed as work progresses to protect the insulation boards and the IKO enertherm WCL from the effects of wind uplift and UV degradation. The ballasted roof finish may be gravel or paving ballast, which must be assessed by a specialist for its suitability according to region exposure and building height. In addition, the dead load imposed by the finish must be allowed for in calculating the total acceptable load on the deck. Care must be taken to ensure that upgraded roofs are capable of carrying the increased load and depth of the installed system. Ballast must not be stacked in one place on the roof unless the roof is capable of supporting it.

4.4 Gravel ballast should be as described in section 1.4 of this Certficate. The minimum size of ballast depends on the wind loads and parapet height to prevent wind scour of the ballast. The ballast should be installed in accordance with BS EN 1991-1-4 : 2005 and its UK National Annex.

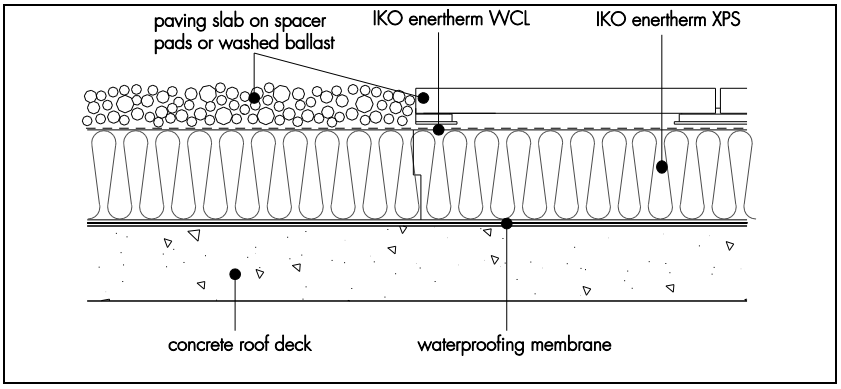
4.5 The gravel ballast specification given in section 1.4 is suitable in sheltered regions, or buildings up to 10 storeys. On buildings up to 15 storeys, this specification may be used, but the perimeter must be loaded with paving determined by reference to BS EN 1991-1-2 : 2002. For other exposure conditions or tall buildings, specialist advice should be sought.

4.6 A paving finish ballast, comprising a minimum 40 mm of standard pressed concrete paving slabs, is suitable in sheltered regions and in buildings up to 15 storeys. For other exposure conditions or tall buildings, specialist advice should be sought. Paving should be supported using proprietary spacer pads in accordance with the Certificate holder's recommendations.

4.7 IKO enertherm XPS must always be overlaid with IKO enertherm WCL, which acts as a filter layer preventing fines and other debris from passing through, and also as a water-flow reducing layer minimising cold rainwater flowing between the insulation and the roof waterproofing with consequent heat loss. The membrane may be covered with either a gravel ballast or paving finish (see Figure 2).

4.8 IKO enertherm WCL must be laid with 300 mm laps, overlapping in the downward direction of the flat roof slope. At upstands and penetrations, the membrane must be turned up to finish above the surface of the ballast layer; at drainage outlets, the membrane must be turned down.

Figure 2 Typical installation detail — gravel/paving ballast finish



4.9 Concrete, metal or timber roofs should be designed in accordance with the relevant provisions of BS 6229 : 2003, BS 8217 : 2005 and BS 8218 : 1998, in particular to accommodate the weight of the ballast layer.

4.10 Decks should be covered with one or more of the following roof waterproofing specifications:

- built-up specifications using 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
- mastic asphalt laid in accordance with BS 8218 : 1998
- other waterproofing systems which are the subject of a current BBA Certificate and laid in accordance with, and within the limitations imposed by, that Certificate.

4.11 The roof must be designed with adequate falls unless the roof waterproofing system has been specifically designed and covered by a valid BBA Certificate for use in a zero pitch roof application. For zero pitch roofs, it is particularly important to identify the correct drainage points, to ensure that drainage is sufficient and 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.

4.12 It is essential that roof falls and drainage paths are correctly designed to avoid ponding and subsequent risk of silt build up, stresses in freezing conditions and to reduce water entry in the event of a failure in the waterproofing layer.

4.13 Dual-level roof drainage should be provided in accordance with BS 6229 : 2003 and BS EN 12056-3 : 2000 to drain water off at the level of the IKO enertherm WCL and also at the level of the roof waterproofing. See Figures 4 and 5 of this Certificate.

4.14 Drainage points need to be located at the lowest point of the roof, to facilitate the effective removal of rainwater. Care is needed to identify these locations. For example, precast concrete decks will deflect between spans, and mid-span may be the lowest point of the roof rather than roof edges or column supports.

4.15 Where there is a risk from plasticiser migration or other contaminants from the roof waterproofing (such as PVC single-ply membranes), a suitable plastic fibre or similar isolating sheet must be interposed between the roof waterproofing and the insulation boards. For loose-laid, single-layer roof waterproofing membranes, a cushion layer should be interposed. For mastic asphalt waterproofing membranes, a non-woven polyester fleece isolating membrane must be interposed in accordance with BS 8218 : 1998.

4.16 Care must be taken to ensure that upgraded roofs are capable of carrying the increased load and depth of the installed system.

5 Practicability of installation

The system is designed to be installed by a competent general builder or contractor experienced with this type of system.

6 Thermal performance

6.1 Calculations of the thermal transmittance (U value) of a specific roof construction should be carried out in accordance with BS EN ISO 6946 : 2007 and BRE Report BR 443 : 2006, using the design thermal conductivity (λ_U) (including moisture correction factor) and f_x drainage factor for the system as given below (see also BBA Information Bulletin No 4):

- 0.035 $W \cdot m^{-1} \cdot K^{-1}$ — design thermal conductivity (λ_U), which is the declared lambda λ_D* with addition of moisture-correction factor for XPS thicknesses less than 100 mm
- 0.034 $W \cdot m^{-1} \cdot K^{-1}$ — design thermal conductivity (λ_U), which is the declared lambda λ_D* with addition of moisture-correction factor for XPS thicknessess greater than or equal to 100 mm
- f_x = 0.001 — drainage factor for systems incorporating the IKO enertherm WCL.

6.2 The value of a completed roof will depend on the insulation thickness, and type of substrate and internal finish. When considering insulation requirements, designers should refer to the detailed guidance contained in the documents supporting the national Building Regulations. The U values shown in Table 3, indicate that the system can contribute to a roof achieving the typical U values referred to in those supporting documents.

Table 3 Example U value for flat roof and zero pitch applications (incorporating IKO enertherm WCL)(1)

Required U value ($W \cdot m^{-2} \cdot K^{-1}$)	**IKO enertherm XPS insulation thickness**(2) **(mm)**	
	p(3) **≤ 3**	***p***(3) **= 8**
0.10	160 + 160	180 + 180
0.13	180 + 70	130 + 130
0.15	220	230
0.16	200	220
0.18	180	200
0.20	160	180
0.25	130	130

(1) 200 mm dense concrete deck (2.5 $W \cdot m^{-1} \cdot K^{-1}$).
(2) Thickest board as bottom layer, when double/triple layer used.
(3) Values for *p* taken as examples of best to worst case for all UK locations.

6.3 Rainfall reaching the roof waterproofing membrane will temporarily affect the rate of heat loss from the roof and should be accounted for by adding a correction (ΔU_r) to the calculated roof U value in accordance with Annex D.4 of BS EN ISO 6946 : 2007, as follows:

$\Delta U_r = p f_x (R_1/R_T)^2$

where:

ΔU_r = correction to the calculated thermal transmittance of the roof element ($W \cdot m^{-2} \cdot K^{-1}$)
p = average rate of precipitation during the heating season(1) ($mm \cdot day^{-1}$)
f = drainage factor giving the fraction of p reaching the waterproof membrane
x = factor for increased heat loss caused by rainwater flowing on the membrane ($W \cdot day \cdot m^{-2} \cdot K^{-1} \cdot mm^{-1}$)
R_1 = thermal resistance of the layer of the insulation above the waterproofing membrane ($m^2 \cdot K \cdot W^{-1}$)
R_T = total thermal resistance of the construction before application of the correction ($m^2 \cdot K \cdot W^{-1}$)
f_x = 0.001 for the system incorporating IKO enertherm WCL (water-control membrane).

(1) Values for average rainfall during the heating season for different UK locations can be found at www.metoffice.gov.uk/climate/uk/averages/19812010/. The values for October to March should be summed and divided by 182 to obtain an average 'p' in $mm \cdot day^{-1}$ for the heating season.

Junctions

6.4 The system 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

7.1 Warm water trapped under the boards is likely to be replaced by colder water during rainfall. Therefore, during heavy or continuous rainfall, the roof waterproofing and the deck will be cooled. If condensation does occur it will be short-term, disappearing when the rain stops.

7.2 Risk of interstitial condensation will be minimal with concrete decks but metal and timber decks will be subjected to short periods of moisture; therefore timber must be treated with a suitable preservative in accordance with BS 8417 : 2011.

7.3 For systems using paving, a condensation risk analysis may be necessary using dynamic software in accordance with BS EN 15026 : 2007, depending on the climatic conditions existing in the location where it is installed.

Interstitial condensation

7.4 Roofs will adequately limit the risk of interstitial condensation when they are designed and constructed in accordance with BS 5250 : 2011, Section 4 and Annex D and H. Further guidance may be obtained from BRE Report BR 262 : 2002.

Surface condensation

7.5 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 walls are designed in accordance with section 6.4 of this Certificate.

7.6 In Scotland, roofs will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed 1.2 $W \cdot m^{-2} \cdot K^{-1}$ at any point. Guidance may be obtained from BS 5250 : 2011, Section 4 and Annex H. Further guidance may be obtained from BRE Report BR 262 : 2002 and section 6.4 of this Certificate.

8 Resistance to foot traffic

When covered with a ballast layer, as specified in section 4, the system can accept the limited pedestrian foot traffic and light concentrated loads associated with installation and maintenance operations.

9 Behaviour in relation to fire

9.1 IKO enertherm XPS has a reaction to fire classification* of Class F to BS EN 13501-1 : 2007.

9.2 The IKO enertherm Inverted Roof System, when used with an inorganic covering listed in Commission Decision 2000/553/EC, is considered to be unrestricted. The listed coverings include:

- loose-laid gravel to a minimum thickness of 50 mm
- cast stone or mineral slabs of at least 40 mm thickness.

9.3 The designation of other specifications should be confirmed by test or assessment as required by the national Building Regulations.

9.4 The system should not be laid over compartment walls.

10 Effect on roof coverings

10.1 The protected inverted roof system will provide solar protection and also limit the range of temperatures to which the waterproofing membrane will be subjected. Placing the insulation on top of the roof covering will normally lead to an extended life of the waterproofing membrane.

10.2 Separation or cushion layers between the insulation boards and the roof waterproofing may be needed in some circumstances (see section 4.15 of this Certificate).

11 Maintenance

11.1 The inverted roof concept should require little or no maintenance, other than annual removal of any plants (in the case of gravel/paving finish), cleaning/checking of water outlets and gutters if necessary and checking that the gravel ballast is still in place and not interfering with or blocking gullies or outlets. Any displaced ballast, for example by wind scouring, should be promptly returned to its original state.

11.2 The use of chemicals (eg weed killers) should be checked for compatibility with the insulation, water-control membrane and the deck waterproofing layer. The Certificate holder can advise on the suitability of a particular system.

11.3 Should a leak occur in the waterproof membrane, it must be repaired following removal of the gravel ballast or paving ballast layer, water-control membrane and the insulation boards. Correct reinstatement of these layers must be carried out, taking care not to damage the water-control membrane.

12 Durability

12.1 IKO enertherm XPS board is rot resistant and, as long as IKO enertherm WCL remains undamaged, will have a life of at least 25 years under normal circumstances.

12.2 Care must be taken to ensure that the gravel or paving ballast roof covering, once installed, provides cover to the insulation and the water-control membrane at all times, to avoid the risk of UV degradation.

13 General

13.1 IKO enertherm XPS board should be installed in accordance with the relevant guidance in section 4 of this Certificate, providing adequate load-bearing capacity, falls, drainage, sound roof waterproofing and limited risk of condensation.

13.2 The insulation product is laid in accordance with the Certificate holder's instructions. The product is light and may be installed in any weather but, due to its size, care will be needed in high winds. Installers must not carry it near parapets or apertures in the deck and, once placed, the product must be covered with IKO enertherm WCL (water-control membrane) and ballasted as soon as possible.

13.3 Boards are laid in a brick bond pattern, and it is essential that all joints between the boards are tight and that no gaps exist where they meet rooflights, edge details and other services which perforate the roof deck. The boards can be cut easily using a fine tooth saw, sharp knife or a hot wire cutter.

13.4 IKO enertherm WCL should be loose laid over the insulation, at right angles to the slope, with 300 mm unsealed lap joints running down the slope. At upstands and penetrations, IKO enertherm WCL should be turned up to finish above the surface of the ballast later and turned down at drainage outlets. See Figures 3 to 5.

13.5 The ballast loading layer should be installed in accordance with BS 6399-2 : 1997, BS EN 1991-1-4 : 2005, BRE Digest 295 : 1985 and BRE Digest 311 : 1986.

13.6 The ballast loading layer must be applied as work progresses to protect the insulation and the filter/water-control layer from the effects of wind uplift and solar degradation. The ballast must not be stacked in one place on the roof unless the roof is strong enough to support it.

Upgrading roofs

13.7 In existing roofs, all requirements of sections 13.1 to 13.6 apply and, in addition, the existing roofing and substructure must be examined for degradation and, where necessary, repairs effected. Particular consideration should be given to the condensation risk that the existing roof structure may present. See section 7 of this Certificate.

13.8 Where, for example, parapets, details and services have insufficient height to accommodate the increased depth of insulation/protection, due provision needs to be made (ie a minimum of 150 mm from the top of the gravel to the top of the skirtings). If upgrading involves laying the product on existing inverted roof insulation, the advice of the Certificate holder should be sought.

13.9 Rainwater outlets will need to be modified or replaced to suit, eg by the installation of gravel guards.

Figure 3 Parapet upstand detail — gravel/paving finish

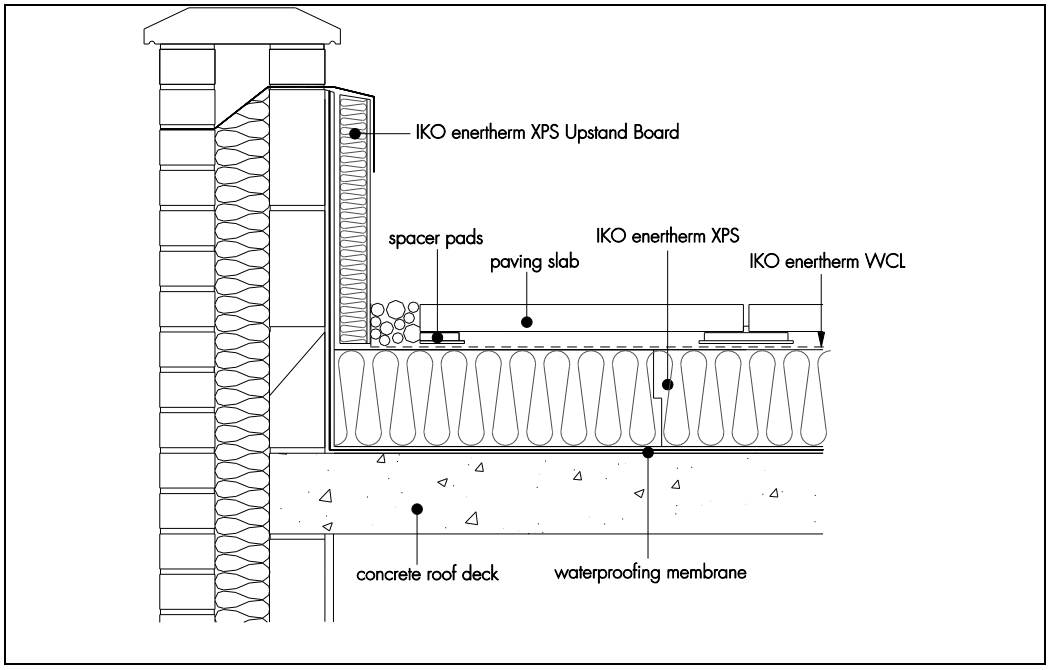


Figure 4 Water outlet detail — gravel finish

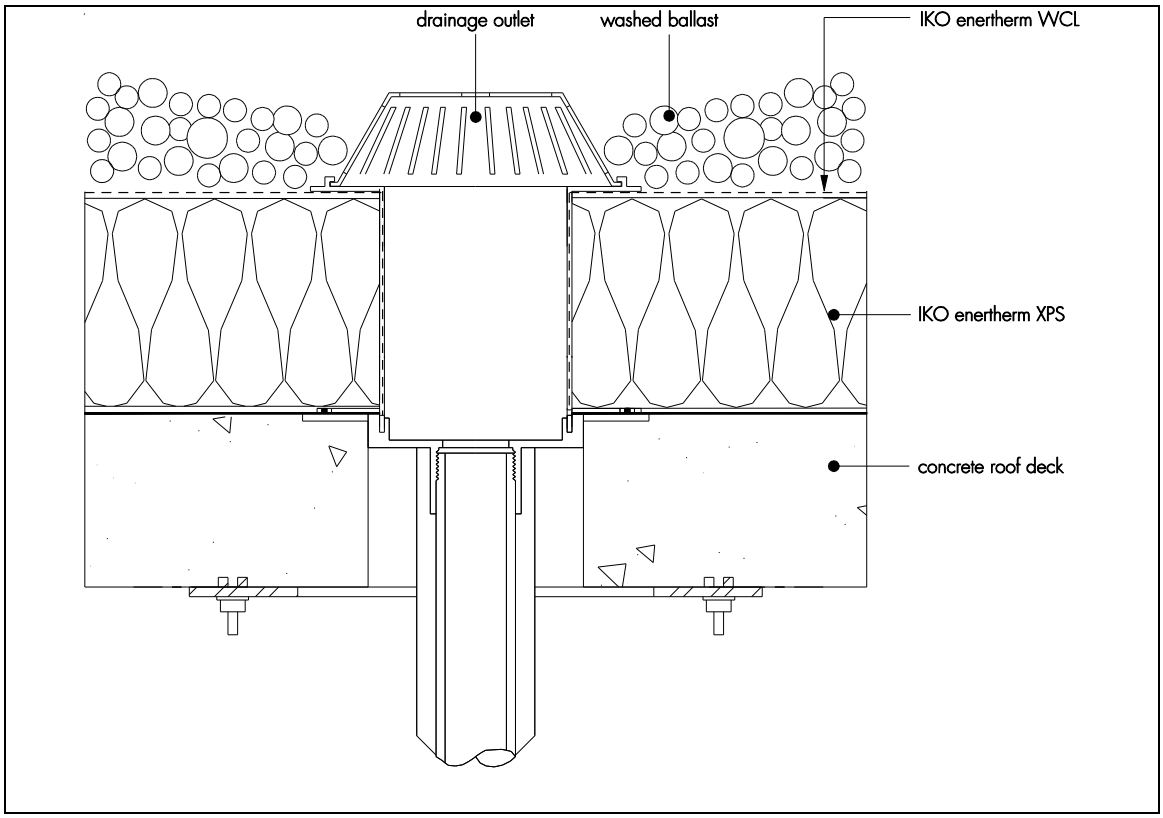
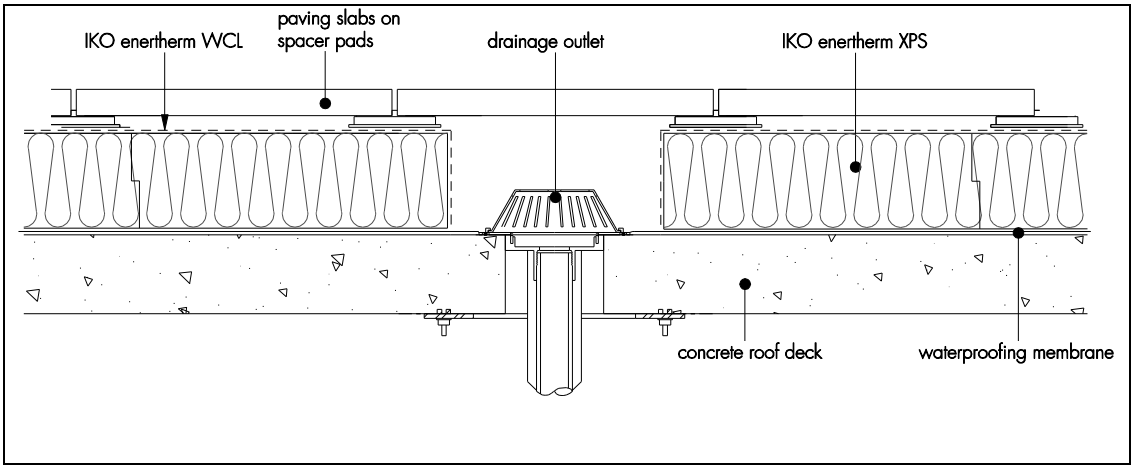


Figure 5 Water outlet detail — paving finish



14 Procedure

Gravel ballast finish

14.1 In order to prevent flotation, wind uplift and UV degradation, the system must be covered with gravel ballast as the work proceeds, to a minimum thickness of 50 mm.

14.2 It is essential that the ballast is carefully placed directly over IKO enertherm WCL (laid with 300 mm unsealed lap joints), and that complete depth and cover is achieved over the entire surface of the system.

14.3 Gravel must not contain excessive fines, in order to prevent clogging of gullies and outlets and to discourage organic growth.

Paving slabs finish

14.4 Cast stone or mineral slab paving of at least 40 mm thickness must satisfy the requirements of sections 7.3 and 9 of this Certificate. Paving slabs can be laid either fully supported, or supported using proprietary spacer pads in accordance with the manufacturer's instructions.

14.5 The paving slab finish is laid directly over IKO enertherm WCL (laid with 300 mm unsealed lap joints).

Technical Investigations

15 Tests

Results of tests were assessed to determine:

XPS insulation

- compressive strength
- compressive creep
- deformation under specified compressive load and temperature
- dimensional stability
- water vapour transmission
- water flow through an inverted roof
- long-term water absorption by diffusion
- resistance to freeze-thaw
- thermal conductivity
- bowing under a thermal gradient

Water-reducing layer

- tensile strength
- resistance to static loading (point loading)
- resistance to water penetration
- hydrostatic head
- water vapour transmission.

16 Investigations

16.1 A calculation was undertaken to confirm the declared and design thermal conductivity.

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

16.3 A series of U value calculations was carried out.

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

Bibliography

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BS 6399-2 : 1997 *Loading for buildings — Code of practice for wind loads*

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BS EN 1991-1-2 : 2002 *Eurocode 2 : Design of concrete structures — General rules — Structural fire design*
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BS EN 12056-3 : 2000 *Gravity drainage systems inside buildings — Roof drainage, layout and calculation*

BS EN 13164 : 2012 *Thermal insulation products for buildings — Factory made extruded polystyrene foam (XPS) products*

BS EN 13501-1 : 2007 *Fire classification of construction products and building elements — Classification using test data from reaction to fire tests*

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BRE Digest 311 : 1986 *Wind scour of gravel ballast on roofs*

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

BRE Report BR 262 : 2002 *Thermal Insulation: avoiding risks*

LRWA Guidance Note No.7 : 2012 — *Specifier Guidance for Flat Roof Falls*

17 Conditions

17.1 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.

17.2 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.

17.3 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.

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

17.5 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.

17.6 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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