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Agrément Certificate
08/4548
Product Sheet 7

TYVEK ROOF LINING SYSTEMS

TYVEK ENERCOR ROOF

PRODUCT SCOPE AND SUMMARY OF CERTIFICATE

This Certificate relates to TYVEK Enercor⁽¹⁾ Roof, a metallised polyolefin laminate for use as a roof tile underlay in warm and cold non-ventilated specifications.

(1) Enercor and TYVEK are registered trademarks of DuPont de Nemours (Luxembourg) S.à r.l.

AGRÉMENT 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

Weathertightness — as part of a complete roof, the product will resist the passage of water and wind-blown snow and dust into the interior of the building (see section 6).

Risk of condensation — the product can be regarded as a low water vapour resistance (Type LR) underlay and can be used as part of a non-ventilated warm and non-ventilated cold, roof system (see section 7).

Thermal insulation — the product can contribute to limiting heat loss through roofs (see section 8).

Wind loading — when installed on appropriately spaced battens and/or rafters the product's physical properties are deemed adequate to resist the wind loads imposed on the underlay. The products will reduce the wind uplift forces acting on the roof covering (see section 9).

Strength — the product has adequate strength to resist the loads associated with the installation of the roof (see section 10).

Durability — under the normal conditions found in a roof space the product will have a service life comparable to a traditional roof tile underlay (see section 13).

The BBA has awarded this Agrément Certificate to the company named above for the product described herein. The product has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Simon Wroe
Head of Approvals — Materials

Greg Cooper
Chief Executive

Date of First issue: 23 February 2012

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, TYVEK Enercor Roof, if used in accordance with the provisions of this Certificate, will meet or contribute to meeting the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or the regions of the UK depicted):



The Building Regulations 2010 (England and Wales)

Requirement: C2(b)	Resistance to moisture
Comment:	The product will contribute to a roof meeting this Requirement. See section 6.1 of this Certificate.
Requirement: C2(c)	Resistance to moisture
Comment:	The product can contribute to limiting the risk of interstitial condensation. See section 7.1 of this Certificate.
Requirement: L1(a)(i)	Conservation of fuel and power
Comment:	See section 8 of this Certificate.
Requirement: Regulation 7	Materials and workmanship
Comment:	The product is acceptable. See section 13 and the <i>Installation</i> part of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation: 8(1)	Fitness and durability of materials and workmanship
Comment:	The product satisfies the requirements of this Regulation. See section 13 and the <i>Installation</i> part of this Certificate.
Regulation: 9	Building standards – construction
Standard: 3.10	Precipitation
Comment:	The product will contribute to a roof satisfying clauses 3.10.1 ⁽¹⁾⁽²⁾ and 3.10.7 ⁽¹⁾⁽²⁾ of this Standard. See section 6.1 of this Certificate.
Standard: 3.15	Condensation
Comment:	The product can contribute to limiting the risk of interstitial condensation, with reference to clauses 3.15 ⁽¹⁾⁽²⁾ and 3.15.5 ⁽¹⁾⁽²⁾ of this Standard. See section 7.1 of this Certificate.
Standard: 6.1(b)	Carbon dioxide emissions
Standard: 6.2	Building insulation envelope
Comment:	See section 8 of this Certificate, with reference to clauses 6.1.6 ⁽¹⁾ , 6.2.1 ⁽¹⁾⁽²⁾ , 6.2.3 ⁽¹⁾ and 6.2.4 ⁽¹⁾⁽²⁾ , 6.2.5 ⁽²⁾ , 6.2.6 ⁽¹⁾⁽²⁾ , 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⁾ .
Standard: 7.1(a)(b)	Statement of sustainability
Comment:	The product can contribute to meeting the relevant requirements of Regulation 9, Standards 1 to 6, and, therefore, will contribute to a construction meeting a bronze level of sustainability as defined in this Standard. In addition, the product can contribute to a construction meeting a higher level of sustainability as defined in this Standard, with reference to clauses 7.1.4 ⁽¹⁾⁽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 8 of this Certificate.
Regulation: 12	Building standards – conversions
Comment:	Comments made in relation to this product 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) 2000 (as amended)

Regulation: B2	Fitness of materials and workmanship
Comment:	The product is acceptable. See section 13 and the <i>Installation</i> part of this Certificate.
Regulation: C4(b)	Resistance to ground moisture and weather
Comment:	The product will contribute to a roof satisfying this Regulation. See section 6.1 of this Certificate.
Regulation: C5	Condensation
Comment:	The product can contribute to limiting the risk of interstitial condensation. See section 7.1 of this Certificate.
Regulation: F2(a)(i)	Conservation measures
Regulation: F3(2)	Target carbon dioxide Emission Rate
Comment:	See section 8 of this Certificate.

Construction (Design and Management) Regulations 2007

Construction (Design and Management) Regulations (Northern Ireland) 2007

Information in this Certificate may assist the client, CDM co-ordinator, designer and contractors to address their obligations under these Regulations.

See section: 1 *Description* (1.2) of this Certificate.

Additional Information

NHBC Standards 2011

NHBC accepts the use of TYVEK Enercor Roof, when installed in a warm roof specification and used in accordance with this Certificate, in relation to *NHBC Standards*, Chapter 7.2 *Pitched roofs*.

CE marking

The Certificate holder has taken the responsibility of CE marking the product in accordance with harmonised Standard reference EN 13859-1 : 2010. An asterisk (*) appearing in this Certificate indicates that data shown is given in the manufacturer's Declaration of Performance.

Technical Specification

1 Description

1.1 TYVEK Enercor Roof is a laminate made from polyolefins and metallised on one side with aluminium which is protected with a lacquer. The product has characteristics of:

Length (m)	50
Width (m)	1 or 1.5
Mass per unit area* ($\text{g}\cdot\text{m}^{-2}$)	148 (nominal)
Water resistance*	Class W1
Water vapour transmission – S_d^* (m)	0.025 (nominal)
Water vapour resistance ($\text{MN}\cdot\text{s}\cdot\text{g}^{-1}$)	0.13
Reaction to fire*	Class E
Maximum tensile force* (N per 50 mm)	
longitudinal	245 (nominal)
transverse	205 (nominal)
Elongation at maximum tensile force* (%)	
longitudinal	7 to 30
transverse	10 to 40
Tear resistance* – nail shank (N)	
longitudinal	175 (nominal)
transverse	195 (nominal)
Resistance to air penetration* [$\text{m}^3\cdot\text{m}^{-2}\cdot\text{hr}^{-1}$ (50 Pa) $^{-1}$]	0.15 (max)
Dimensional stability* (%)	1 (max)
Low temperature flexibility* ($^{\circ}\text{C}$)	-40 (max)
Water column (m)	1.5 (nominal)
Emissivity	0.15 (nominal)

1.2 TYVEK AirGuard Reflective can be used in conjunction with TYVEK Enercor Roof as a vapour control layer. See Product Sheet 4.

1.3 The following products are used in conjunction with TYVEK Enercor Roof to minimise air infiltration:

- TYVEK Tape — a TYVEK single-sided tape with an acrylic adhesive to close laps between the membrane
- TYVEK Metallised Tape — to close laps between the membrane
- TYVEK Double-sided Tape — an acrylic tape for sealing overlaps and bonding membrane to smooth surfaces
- TYVEK Butyl Tape — a double-sided tape used for; sealing membrane joints, between the membrane and common building materials at detailing and at nail penetrations.

1.4 TYVEK Eaves Carrier is an eaves guard used to protect the exposed underlay edge.

2 Manufacture

2.1 The membrane is manufactured by laminating a water vapour permeable, lacquered, metallised, spunbonded polyethylene and a non-woven, spunbonded polypropylene to form a flexible sheet.

2.2 To ensure product quality is consistently maintained to the required specification, the BBA has:

- agreed with the Certificate holder 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 as part of a surveillance process to ensure that standards are maintained and that the product remains as Certificated.

2.3 The management system of DuPont de Nemours (Luxembourg) S.à r.l. has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2008 by DQS GmbH (Certificate 463950 QM08).

3 Delivery and site handling

3.1 Rolls are delivered to site in packages that carry a label bearing the grade identification, the CE marking and the BBA identification mark including the number of this Certificate.

3.2 The rolls should be stored flat on their sides, on a smooth, clean, dry surface, under cover and protected from sunlight.

Assessment and Technical Investigations

The following part of the Certificate gives a summary of the assessment and technical investigations carried out on TYVEK Enercor Roof.

Design Considerations

4 General

4.1 TYVEK Enercor Roof is satisfactory for use as an underlay in warm roof specifications, with a minimum air space of 25 mm between the membrane and insulation, in tiled and slated pitched roofs constructed in accordance with the relevant Clauses of BS 5534 : 2003.

4.2 The product when used unsupported is also satisfactory for use in cold non-ventilated tiled or slated roofs, for dwellings, of any conventional roof plan and of any size. Features⁽¹⁾ successfully assessed include:

- duo pitched
- gable ends
- room-in-roof⁽²⁾
- mono-pitched
- verges
- dormer
- hipped
- abutments
- mansard
- valleys.

(1) For roofs incorporating other features, non-conventional roof geometries or construction materials, the advice of the Certificate holder should be sought.

(2) Where a room-in-roof results in part of a pitch being insulated (ie a warm roof) a minimum air space of 25 mm between the underlay and the insulation must be maintained.

4.3 The product can be installed by draping over rafters and securing with tiling battens, or installed taut over rafters and secured with counter battens and tiling battens.

4.4 In conventionally-ventilated roof constructions, energy loss by ventilation can account for up to 25% of the total heat lost through the roof. The non-ventilated system will significantly reduce this mechanism of heat loss.

5 Practicability of installation

The product can be installed readily by operatives experienced with this type of product.

6 Weathertightness



6.1 Results of tests indicate that the product will resist the passage of water, wind-blown snow and dust into the interior of a building, under all conditions to be found in a roof constructed in accordance with the relevant Clauses of BS 5534 : 2003.

6.2 The product resists penetration of liquid water and consequently may be used as temporary waterproofing prior to the installation of slates or tiles. The period of such use should, however, be kept to a minimum. In cases of doubt advice should be sought from the Certificate holder.

7 Risk of condensation



7.1 For design purposes, the product's water vapour resistance may be taken as not more than $0.25 \text{ MN}\cdot\text{s}\cdot\text{g}^{-1}$ and for roofs designed in accordance with BS 5534 : 2003 or BS 5250 : 2011, Section H, it may be regarded as a Type LR membrane.

7.2 In common with all roofs, care must be taken in the overall design and installation to minimise the risk of water vapour coming into contact with cold parts of the construction. Factors to be considered and minimised include, moisture diffusion through the ceiling, infiltration through unsealed openings/penetrations in the ceiling and services evaporating or venting moisture into cold spaces.

7.3 The risk of condensation is highest in new-build construction during the first heating period, where there is high moisture loading due to wet trades, such as in-situ cast concrete slabs or plaster. The risk of condensation diminishes as the building naturally dries out. See *BBA Information Bulletin No 1 — Roof Tile Underlays in Cold Roofs during the Drying-out Period*.

Ceiling and insulation inclined (warm roof)

7.4 For roofs with an insulated inclined ceiling, ventilation above or below the underlay will not be required provided that the passage of moisture by diffusion and by convection is controlled, for eg, by a vapour control layer such as DuPont AirGuard Reflective, the subject of Product Sheet 4, or a continuous envelope of insulation with a high vapour resistance.

Ceiling and insulation partially inclined (warm roof and cold roof)

7.5 Where an insulated ceiling only spans part of the roofline, resulting cold roof spaces should be installed in accordance with the requirements for a cold non-ventilated roof.

Ceiling and insulation horizontal (cold non-ventilated roof)

7.6 All penetrations into and out of the roof space must be properly sealed in accordance with the Certificate holder's instructions which includes the use of the Certificate holder's recommended sealing tape. In addition, such features as vent stacks and boiler flues, passing through the roof space must be sealed.

7.7 It is essential to minimise water vapour transfer into the loft space from the dwelling below. Appropriate measures include:

- ventilating the dwelling below in accordance with national Building Regulations and Standards for the dispersal and rapid dilution of water vapour, particularly from rooms that may experience high humidity (such as kitchens, utility rooms and bathrooms)
- covering all water tanks in the loft space and lagging pipework
- sealing penetrations in the ceiling and making loft hatches convection-tight by using a compressible draught seal
- ensuring that there is continuity of jointing with walls (and behind wall linings) at ceiling perimeters
- ensuring that masonry wall cavities do not interconnect with roof cavities.

7.8 For additional protection, the use of a vapour control layer/vapour check plasterboard can be considered.

7.9 Convective water vapour transfer into the roof construction can be reduced by installing a vapour control layer/air barrier such as DuPont AirGuard Reflective behind the internal lining, (see Product Sheet 4).

8 Thermal insulation



Calculations of thermal transmittance (U value) should be carried out in accordance with BS EN ISO 6946 : 2007 and BRE⁽¹⁾ report (BR 443 : 2006) *Conventions for U-value calculations*, using an emissivity value of 0.15 for the metallised surface of the product. Where this faces into a sloping unventilated air space the following cavity thermal resistance values can be used:

- resistance of an unventilated cavity of greater than 25 mm and a slope less than 60° is a nominal 0.37 m²·K·W⁻¹
- resistance of an unventilated cavity of greater than 25 mm and a slope greater than 60° is a nominal 0.50 m²·K·W⁻¹
- resistance of an unventilated roof space resistance (R_v) with a horizontal ceiling is a nominal 0.30 m²·K·W⁻¹.

(1) Building Research Establishment.

9 Wind loading

9.1 Project design wind speeds should be determined and wind uplift forces calculated, in accordance with BS EN 1991-1-4 : 2005 and the UK National Annex.

9.2 Wind loading on the underlay, when unsupported, should be calculated in accordance with BS 5534 : 2003, Section 5.5.2.7. Acceptable wind loads with specific batten spacings for the draped product, using a 25 mm deep teiling batten and a 600 mm rafter spacing, are given in Table 1.

Table 1 Resistance to wind loads

Batten spacing (mm)	Maximum pressure (kPa)
350	1.0
330	1.5
300	2.5

10 Strength

The product will resist the normal loads associated with installation of battens and roof tiles.

11 Properties in relation to fire

11.1 The product will melt and shrink away from heat, but will burn in the presence of a naked flame. The product is classified in accordance with BS EN 13501-1 : 2007 as a Class E* material.

11.2 When the product is used unsupported, there is a risk that fire can spread if the materials are accidentally ignited during maintenance works, eg by a roofer's or plumber's torch. As with all types of underlay, care should be taken during building and maintenance to avoid the material becoming ignited.

12 Maintenance

As the product is confined within a roof structure and has suitable durability (see section 13), maintenance is not required.

13 Durability



The product will be virtually unaffected by the normal conditions found in a roof space and will have a life comparable with that of traditional roof tile underlays, provided they are not exposed to sunlight for long periods (see section 14.4). Advice regarding exposure can be obtained from the Certificate holder.

Installation

14 General

14.1 TYVEK Enercor Roof must be installed and fixed in accordance with the Certificate holder's instructions, provisions of this Certificate and the relevant recommendations of BS 5534 : 2003 and BS 8000-6 : 1990. Installation can be carried out under all conditions normal to roofing work.

14.2 The membrane may be laid with the silver reflective side facing either inwards or outwards. However to gain maximum thermal benefit the reflective faces inwards into either a non-ventilated air space or a cavity (nominal 25 mm). The membrane may be installed either taut or draped a maximum of 10 mm to allow drainage.

14.3 The membrane is lapped to shed water out and down the slope.

14.4 Overlaps are sealed and must be provided with the dimensions given in Table 2.

Table 2 Minimum overlaps

Roof pitch (°)	Horizontal lap (mm)	Vertical laps (mm)
12.5 to 14	150	300
15 to 34	150	300
35+	150	300

14.5 In closed eaves constructions, eaves guards should be used to protect the product from sunlight, and to direct water into the gutter. TYVEK Eaves Carrier is recommended for this purpose.

14.6 Hips should be covered with a 600 mm wide strip of the product.

14.7 To assist in achieving the design air permeability, the lap joints and penetrations through the underlay can be sealed with TYVEK Butyl Tape or TYVEK Tape. When installed supported with the reflective facing outward the lap joints are sealed using TYVEK Metallised Tape.

15 Procedure

Draped and loose laps

15.1 The product should be installed as an unsupported system, and fixed in the traditional method for roof tile underlays, ie draped between the rafters, with the coloured printed side uppermost. The underlay should not drape more than 10 mm.

Taut

15.2 The product should be laid horizontally and must be pulled taut and not allowed to drape. Each sheet should be fixed to hold it in position prior to the counter battens being fixed. Counter battens (minimum thickness 25 mm) are then fixed to the rafter.

Warm roof

15.3 When installed in a warm roof specification an unvented air space of a minimum 25 mm must be provided between the membrane and the insulation when the reflective face is facing inwards.

16 Finishing

16.1 Detailing of abutments, verges and hips must be in accordance with the Certificate holder's instructions.

16.2 The tiling and slating must be carried out in accordance with the relevant Clauses of BS 5534 : 2003, BS 8000-6 : 1990 and the tile/slate manufacturer's instructions, especially when using tightly-jointed slates or tiles.

17 Repair

Damage to the product can be repaired easily prior to the installation of slates or tiles by replacing the damaged areas, by patching and sealing correctly. Care should be taken to ensure that the watertightness of the roof is maintained.

18 Tests

18.1 An assessment was made on data to EN 13859-1 : 2010 in relation to:

- thickness*
- mass per unit area*
- tensile strength and elongation*
- resistance to tear*
- dimensional stability*
- resistance to water penetration*
- resistance to artificial ageing*
- reaction to fire*.

18.2 Tests were carried out on samples of TYVEK Enercor roof and the results assessed:

- to determine:
 - resistance to slip
 - Mullen burst strength
 - resistance to wind loads
 - water vapour transmission for control and combined UV, heat and humidity aged samples
 - indicative emissivity for control, UV aged and combined UV, heat and humidity aged samples.
- to assess:
 - safety during installation
 - robustness during installation
 - properties when installed
 - the effect of service conditions on breathability
 - the effect of installation and service conditions on thermal performance.

19 Investigations

19.1 The risk of interstitial condensation in a range of typical constructions was evaluated.

19.2 An evaluation of the thermal performance of the product in typical constructions was made.

19.3 An re-evaluation of the assessment leading to Prototype Product Assessment 08/P002 for DuPont Climate System was carried out.

19.4 An assessment of independent data for joint tests on other DuPont membranes, using tapes detailed in section 1.3, was carried out.

Bibliography

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

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

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

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

NA to BS EN 1991-1-4 : 2005 *UK National Annex to Eurocode 1 : Actions on structures — General actions — Wind actions*

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

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

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

EN 13859-1 : 2010 *Flexible sheets for waterproofing — Definitions and characteristics of underlays — Underlays for discontinuous roofing*

20 Conditions

20.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page — no other company, firm, organisation or person may hold or claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

20.2 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.

20.3 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.

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

20.5 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
- individual 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.

20.6 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.