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**Agrément
 Certificate
 No 04/4101**
*Second issue**



Designated by Government
 to issue
 European Technical
 Approvals

TYVEK UNIVERSAL UNDERLAYS IN ENERGY-EFFICIENT NON-VENTILATED PITCHED ROOF SYSTEMS

Système de revêtement
 Dachbelagsystem

Product




• THIS CERTIFICATE RELATES TO THE TYVEK⁽¹⁾ UNIVERSAL UNDERLAYS IN ENERGY-EFFICIENT NON-VENTILATED PITCHED ROOF SYSTEMS, AS ROOF TILE UNDERLAYS IN TILED OR SLATED PITCHED ROOFS.

• The products comprise one part of a sealed, cold pitched or non-ventilated cold pitched roof system and it is important that designers, planners, contractors and/or installers ensure that the roof and ceiling are constructed in accordance with the Certificate holder's instructions and this Certificate.

(1) Tyvek is a registered trademark of DuPont.

Regulations — Detail Sheet 1

1 The Building Regulations 2000 (as amended) (England and Wales)

 The Secretary of State has agreed with the British Board of Agrément the aspects of performance to be used by the BBA in assessing the compliance of roof tile underlay with the Building Regulations. In the opinion of the BBA, TYVEK Universal Underlays in Energy-Efficient Non-Ventilated Pitched Roof Systems, if used in accordance with the provisions of this Certificate, will meet or contribute to meeting the relevant requirements.

Requirement: C4	Resistance to weather and ground moisture
Comment:	The products will contribute to a roof meeting this Requirement. See sections 6.1 and 6.2 of these Front Sheets.
Requirement: F2	Condensation in roofs
Comment:	The products can enable a roof to meet this Requirement. See the tinted areas in the <i>Risk of condensation</i> section of the accompanying Detail Sheets.
Requirement: Regulation 7	Materials and workmanship
Comment:	The products are acceptable materials. See section 9 of these Front Sheets.

continued

continued

- Advice on the use of the products in these applications can be sought from the Certificate holder.
- The products prevent the ingress of wind-blown rain or snow.
- Advantages during installation include resistance to tearing and flexibility at low ambient temperatures.
- The products are permeable to water vapour, but will not allow liquid water to pass through.
- The products are marketed in the UK by the Certificate holder at the address shown on the front page.

These Front Sheets must be read in conjunction with the accompanying Detail Sheets, which provides information on specific systems.

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2 The Building Standards (Scotland) Regulations 1990 (as amended)



In the opinion of the BBA, TYVEK Universal Underlays in Energy-Efficient Non-Ventilated Pitched Roof Systems, if used in accordance with the provisions of this Certificate, will satisfy or contribute to satisfying the various Regulations and related Technical Standards as listed below.

Regulation:	10	Fitness of materials and workmanship
Standard:	B2.1	Selection and use of materials, fittings and components, and workmanship
Comment:		The products can contribute to a construction meeting this Standard. See the <i>Installation</i> part of this Certificate.
Standard:	B2.2	Selection and use of materials, fittings, and components, and workmanship
Comment:		The products are acceptable materials. See section 9 of these Front Sheets.
Regulation:	17	Resistance to moisture
Standard:	G3.1	Resistance to precipitation — Resistance to precipitation
Comment:		The products will contribute to a roof satisfying this Standard. See sections 6.1 and 6.2 of these Front Sheets.
Regulation:	18	Resistance to condensation
Standard:	G4.1	Condensation — Interstitial condensation
Comment:		The products can enable a roof to satisfy this Standard. See the tinted areas in the <i>Risk of condensation</i> section of the accompanying Detail Sheets.

3 The Building Regulations (Northern Ireland) 2000



In the opinion of the BBA, TYVEK Universal Underlays in Energy-Efficient Non-Ventilated Pitched Roof Systems, if used in accordance with the provisions of this Certificate, will satisfy or contribute to satisfying the various Building Regulations as listed below.

Regulation:	B2	Fitness of materials and workmanship
Comment:		The products are acceptable materials. See section 9 of these Front Sheets.
Regulation:	C4	Resistance to ground moisture and weather
Comment:		The products will contribute to a roof satisfying this Regulation. See sections 6.1 and 6.2 of these Front Sheets.
Regulation:	C5	Condensation
Comment:		The products can enable a roof to satisfy this Regulation. See the tinted areas in the <i>Risk of condensation</i> section of the accompanying Detail Sheets.

4 Construction (Design and Management) Regulations 1994 (as amended) Construction (Design and Management) Regulations (Northern Ireland) 1995 (as amended)

Information in this Certificate may assist the client, planning supervisor, designer and contractors to address their obligations under these Regulations.

See sections: 1 *Description* (Table 1) and 5 *Installation, General* (5.3) of the accompanying Detail Sheets.

Technical Specification

5 Delivery and site handling

5.1 Rolls are delivered to site in packages. Each package carries a label bearing the marketing company's name, the grade identification and the BBA identification mark incorporating the number of this Certificate.

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

Design Data

6 Weathertightness



6.1 Tests indicate that the products will resist the passage of water and 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 products resist 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, however, should be kept to a minimum. Advice should be sought from the Certificate holder.

7 Properties in relation to fire

7.1 The products have similar properties in relation to those of traditional polyethylene roof tile

underlays, which are acceptable under BS 5534 : 2003.

7.2 When the products are 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 sarking material, care should be taken during building and maintenance to avoid the material becoming ignited.

8 Maintenance

Damage to the underlay can be repaired easily prior to the installation of slates or tiles by the replacement of the damaged sheet, or for limited areas, by patching and sealing correctly. Care should be taken to ensure that the weathertightness of the roof is maintained.

9 Durability



The products will be virtually unaffected by the normal conditions found in a roof space and will have a life comparable to that of traditional roof tile underlays, provided they are not exposed to sunlight for long periods (see section 5.2 of the relevant Detail Sheet). Advice regarding exposure can be obtained from the Certificate holder.

Bibliography

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

Conditions of Certification

10 Conditions

10.1 This Certificate:

- (a) relates only to the product that is described, installed, used and maintained as set out in this Certificate;
- (b) is granted only to the company, firm or person identified on the front cover — no other company, firm or person may hold or claim any entitlement to this Certificate;
- (c) is valid only within the UK;
- (d) has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective;
- (e) is copyright of the BBA;
- (f) is subject to English law.

10.2 References in this Certificate to any Act of Parliament, Regulation made thereunder, Directive or Regulation of the European Union, Statutory Instrument, Code of Practice, British Standard, manufacturers' instructions or similar publication, are references to such publication in the form in which it was current at the date of this Certificate.

10.3 This Certificate will remain valid for an unlimited period provided that the product and the manufacture and/or fabrication including all related and relevant processes thereof:

- (a) are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA;

(b) continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine; and

(c) are reviewed by the BBA as and when it considers appropriate.

10.4 In granting this Certificate, the BBA is not responsible for:

- (a) the presence or absence of any patent or similar rights subsisting in the product or any other product;
- (b) the right of the Certificate holder to market, supply, install or maintain the product; and
- (c) the nature or standard of individual installations of the product or any maintenance thereto, including methods and workmanship.

10.5 Any recommendations relating to the use or installation of this product which are contained or referred to in this Certificate are the minimum standards required to be met when the product is used. They do not purport in any way to restate the requirements of the Health & Safety at Work etc Act 1974, or of any other statutory, common law or other duty which may exist at the date of this Certificate or in the future; nor is conformity with such recommendations to be taken as satisfying the requirements of the 1974 Act or of any present or future statutory, common law or other duty of care. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the installation and use of this product.



In the opinion of the British Board of Agrément, TYVEK Universal Underlays in Energy-Efficient Non-Ventilated Pitched Roof Systems are fit for their intended use provided they are installed, used and maintained as set out in this Certificate. Certificate No 04/4101 is accordingly awarded to DuPont de Nemours (Luxembourg) s.àr.l.

On behalf of the British Board of Agrément

Date of Second issue: 23rd April 2004


Chief Executive

**Original Certificate issued 15th April 2004. This revised version includes change of product title.*

Product



- THIS DETAIL SHEET RELATES TO TYVEKTM SOLID UNDERLAY IN THE NON-VENTILATED COLD PITCHED ROOF SYSTEM.

(1) Tyvek is a registered trademark of DuPont.

This Detail Sheet must be read in conjunction with the Front Sheets, which give the products' position regarding the Building Regulations and general information relating to the product, and the Conditions of Certification.

Technical Specification

1 Description

1.1 TYVEK Solid Underlay in the Non-Ventilated Cold Pitched Roof System is a high-density polyethylene (HDPE) spunbonded together with heat and pressure to form a flexible sheet for use in fully supported and unsupported specifications.

1.2 The product has the nominal characteristics given in Table 1.

Table 1 Nominal characteristics

Characteristics (units)	TYVEK Solid
Thickness (mm)	0.22
Weight per unit area (gm ⁻²)	82
Roll length (m)	50
Roll width (m)	1.5
Roll weight (kg)	6.2
Minimum elongation at break (%)	
longitudinal	13
transverse	21
Hydrostatic head (cm of H ₂ O)	>200
Colour	white underside/ grey top side (anti-glare) with red logo

1.3 Tyvek Butyl Adhesive Tape is an ancillary item available for use with this system.

2 General

2.1 TYVEK Solid Underlay is satisfactory for use in dwellings with non-ventilated tiled or slated roofs of any conventional plan and of any size. Features⁽¹⁾ successfully assessed include:

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

- (1) For roofs incorporating other features, non-conventional roof geometries or construction materials, the advice of the Certificate holder should be sought.
- (2) As Scottish practice, with slates nailed through the breather membrane directly onto timber planks (nominally 150 mm wide with a 2 mm gap) without battens.

2.2 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.

2.3 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 substantially reduce this mechanism of heat loss (see section 9.4 of this Detail Sheet).

2.4 In non-ventilated roof systems, the risk of condensation is equivalent to, or less than, that attending conventionally-ventilated cold roof systems.

3 Strength

3.1 The product will resist the loads associated with installation.

3.2 The product has adequate resistance to wind uplift forces likely to be experienced in most locations in the United Kingdom and, for design purposes, may be considered at least equal in strength to Types 1F and 5U reinforced bitumen underlay as defined in BS 747 : 2000.

3.3 Tests on the product draped over rafters at 600 mm centres, with batten centres at 300 mm and 350 mm have shown that the product does not extend unduly when subjected to negative pressures of 2 kPa and 1 kPa respectively.

3.4 Where greater wind loads are likely to occur, the batten centres as stated in section 3.3 of this Detail Sheet should be reduced.

3.5 Project design wind speeds should be determined and wind uplift forces calculated, in accordance with BS 6399-2 : 1997.

4 Risk of condensation



4.1 Typical values for water vapour resistance are given in Table 2.

Table 2 Water vapour resistance

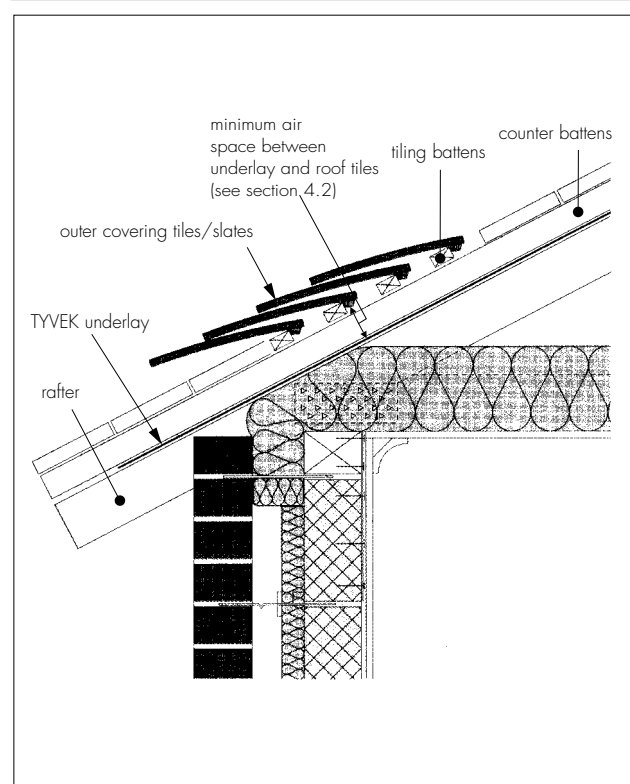
Material	Water vapour resistance (MNsg ⁻¹)
TYVEK Solid	0.24 (nominal)
Traditional felt underlay	570 (maximum)
Polyethylene sheet (0.15 mm)	450

4.2 To allow water vapour dispersal above the product, it must be installed to ensure a minimum air space between it and the roof covering (see Figure 1) when:

- draped between rafters, with loose laps — tiling battens⁽¹⁾ must be used (see also section 3.3 of this Detail Sheet)
- pulled taut and laps sealed — counter battens⁽¹⁾ and tiling battens⁽¹⁾ must be used.

(1) Battens must be of a minimum thickness of 25 mm.

Figure 1 Installation details (condensation risk)



4.3 The complete roof construction, ceiling boards to roof tiles, must be considered as a total system with regard to condensation risk. It is important that the products are laid in accordance with the Certificate holder's instructions and this Certificate to prevent excessive condensation as defined in the national Building Regulations and Standards thus:

England and Wales

Approved Document F

Scotland

Technical Standards, Part G of the *Provisions deemed to satisfy the Standards*

Northern Ireland

Technical Booklet C.

4.4 All penetrations into and out of the roof space must be properly sealed in accordance with the Certificate holder's instructions. Vent stacks, boiler flues, for example, passing through the roof space must additionally be sealed along their length.

4.5 Subsequent penetrations into the roof space must be properly sealed to ensure the integrity of the sealed or non-ventilated cold pitched roof system is maintained. This can be achieved by the use of Tyvek Butyl Adhesive Tape.

4.6 It is essential to limit the rate of water vapour transfer into the loft space from the dwelling below. Appropriate measures include:

- the dwelling below the roof must be ventilated in accordance with national Building Regulations and Standards for the dispersal and rapid dilution of water vapour
- for rooms that may experience high humidity, such as kitchens, utility rooms and bathrooms — the ventilation rates should be in accordance with the guidance documents supporting current national Building Regulations and Standards
- all water tanks in the loft space must be covered and all pipework lagged
- ceiling penetrations must be sealed and loft hatches made convection tight by using a compressible draught seal.

4.7 For additional protection, the use of a vapour control layer/vapour check plasterboard can be considered, such as Tyvek SD2 Air Leakage Barrier/Vapour Control Layer (BBA Certificate No 01/3808)⁽¹⁾.

(1) Users are advised to check the validity of the Certificate (eg by consulting the BBA's website).

5 General

5.1 TYVEK Solid Underlay in the Non-Ventilated Cold Pitched Roof System must be installed and fixed in accordance with the Certificate holder's instructions, 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.

5.2 In open eaves construction, it is recommended to use eaves guards, eg Tyvek Eaves Carrier, to conduct water into the gutter.

Safety

5.3 The products have a smooth surface with a low coefficient of friction and care should be taken when moving or standing on a surface covered by the materials, particularly in cold weather.

6 Procedure

Draped and loose laps

6.1 The underlays should be installed as an unsupported system, and fixed in the traditional method for roof tile underlays, ie draped between the rafters.

6.2 Overlaps must be provided with the minimum dimensions given in Table 3.

Table 3 Minimum overlaps

Roof pitch	Horizontal lap (mm)	Vertical laps (mm)
12.5° to 14°	225	100
15° to 34°	150	100
35°+	100	100

Taut

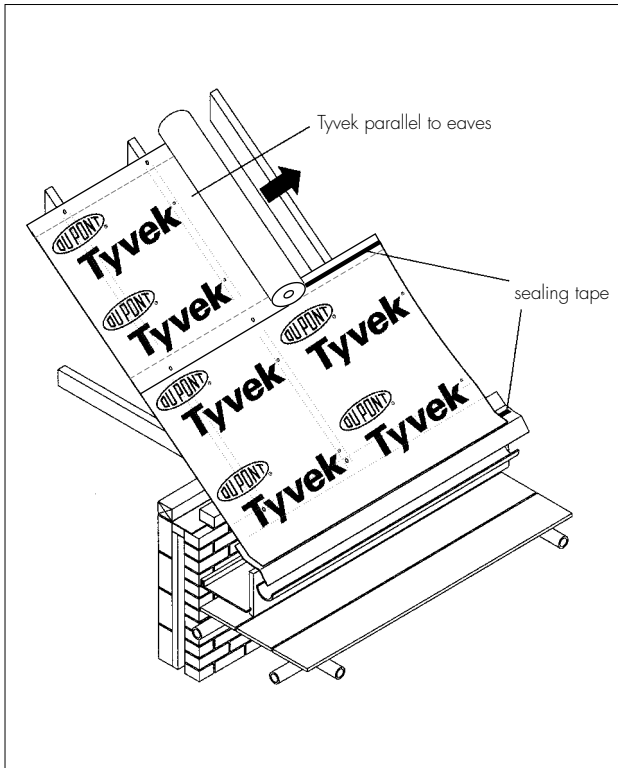
6.3 The underlays should be laid either vertically, eaves to eaves, or horizontally, parallel to the eaves. In both instances the underlay must be pulled taut and not allowed to drape. Each sheet of underlay should be stapled to hold it in position prior to the counter battens being fixed.

Taut — Parallel-to-eaves installation

6.4 When laid horizontally, the products must be pulled taut and not draped from gable to gable and stapled or nailed to hold securely in position. Counter battens (minimum thickness 25 mm) are then fixed to the rafter.

6.5 The edge laps should be sealed using an acrylic adhesive tape (see Figure 2). If required, the edge laps can be supported with cross noggings between rafters. The underlay must be laid with vertical and horizontal laps as defined in Table 13 of BS 5534 : 2003 for unsupported underlays.

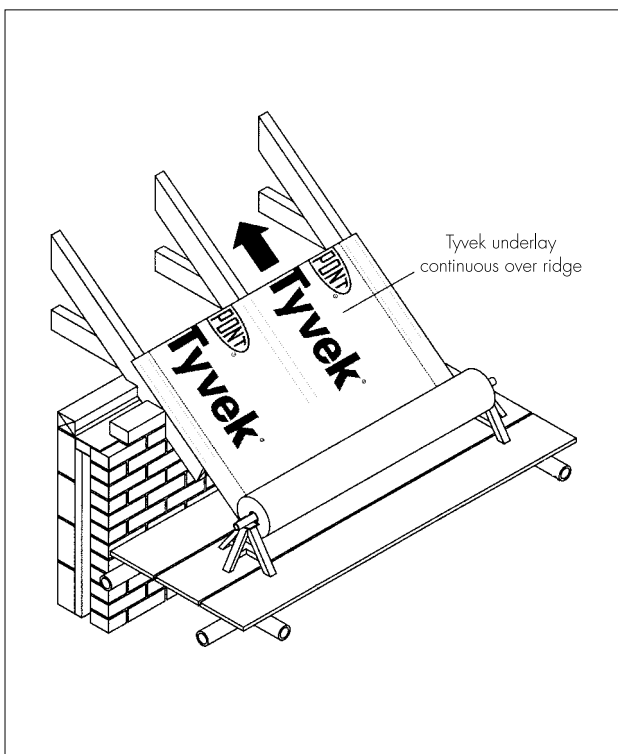
Figure 2 Parallel-to-eaves installation



Taut — Eaves-to-eaves installation

6.6 Using the method shown in Figure 3, the products should be supported by a bar and stand, and the end of the product drawn up and over the ridge and down to the opposite eaves, keeping the product taut (see Figure 3). Each sheet of underlayment is stapled to hold it in position prior to the counter battens being fixed.

Figure 3 Eaves-to-eaves installation



6.7 The underlayment is cut off with a knife, and the supports moved along at each repeat of the procedure.

6.8 The edge laps of the underlayment should be formed on rafters and secured to them by counter battens (minimum thickness 25 mm) fixed at 300 mm centres. The battens for tiling are fixed to the counter battens leaving an air space between the underlayment and the tiles for drainage and natural air movement for moisture dispersal.

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

Timber plank sarking

6.10 For fully supported roofs (traditional Scottish), the slates can be nailed through the underlayment into the timber plank sarking, normally 150 mm wide with a 2 mm gap.

7 Finishing

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

7.2 To achieve a convection-tight loft space, it is important that the following details are maintained (see also section 4.6 of this Detail Sheet):

- all penetrations, eg pipework, electrical fittings to the loft space, must be sealed
- the loft hatch must be securely sealed to ensure a draught-free fit
- the insulation must be pushed into the eaves and against the underlayment to avoid gaps.

7.3 The tiling and slating must be carried out in accordance with the relevant clauses of BS 5534 : 2003, BS 8000-6 : 1990 and the Certificate holder's instructions, especially when using tightly-jointed slates or tiles.

Technical Investigations

The following is a summary of the technical investigations carried out on TYVEK Solid Underlayment in the Non-Ventilated Pitched Roof System.

8 Tests

8.1 Samples of TYVEK Solid were obtained from the Certificate holder for testing. The results of the tests carried out by, or on behalf of, the BBA, which show typical results for the material are summarised in Table 4.

Table 4 Test results

Test (units)	Method ⁽¹⁾	Mean result
Mullen burst strength (kNm ⁻²)	BS 3137	870
1 metre head of water for 24 hours	BBA ⁽²⁾	no penetration
Hydrostatic pressure (m)	BS EN 20811	>2.0 (mean) 1.9 (minimum)
Water vapour permeability (gm ⁻² day ⁻¹)	BS 3177	874
Water vapour resistance (MNs ^g -1)	BS 3177 (25°C/75% RH)	0.23
Resistance to water spray	T1/15 ⁽³⁾	pass
Coefficient of friction	T1/10 ⁽³⁾	0.45 0.19

(1) The test documents are detailed in the *Bibliography*. Numbers in the table refer to sections/parts of the various documents.

(2) Based on MOAT No 27 : Method 5.1.4.

(3) BBA test methods.

8.2 Data from previous tests on Tyvek membrane assessments were used to assess the following properties:

- change in properties after heat ageing
- change in properties after water soak
- wet strength
- resistance to tear
- low temperature flexibility.

9 Investigations

9.1 Using computer modelling, roofs described in section 2.1 of this Detail Sheet were analysed for the risk of condensation.

9.2 An assessment of practicability of installation was made from site visits and data gathered during previous assessments of Tyvek Underlay Systems.

9.3 An evaluation was made of monitored data covering internal loft space temperature and relative humidity, plus moisture content of the rafters. The data were collected over winter and summer periods.

9.4 An evaluation was also made of data relating to reduction in unwanted energy loss from roofs incorporating the Tyvek non-ventilated system.

9.5 An examination was made of quality control data relating to:

- physical properties
- thickness
- roll weight.

Bibliography

BS 747 : 2000 Reinforced bitumen sheets for roofing — Specification

BS 3137 : 1972 Methods for determining the bursting strength of paper and board

BS 3177 : 1959 Method for determining the permeability to water vapour of flexible sheet materials used for packaging

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

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

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

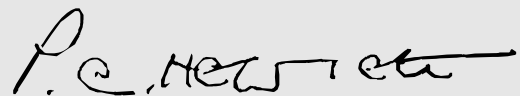
BS EN 20811 : 1992 Textiles — Determination of resistance to water penetration — Hydrostatic pressure test

MOAT No 27 : 1983 General Directive for the Assessment of Roof Waterproofing Systems



On behalf of the British Board of Agrément

Date of issue: 15th April 2004



Chief Executive

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British Board of Agrément

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For technical or additional information,
contact the Certificate holder (see
front page).
For information about the Agrément
Certificate, including validity and
scope, tel: Hotline 01923 665400,
or check the BBA website.



DuPont de Nemours (Luxembourg) s.à.r.l.

Certificate No 04/4101

TYVEK SUPRO UNDERLAY IN THE NON-VENTILATED COLD PITCHED ROOF SYSTEM

DETAIL SHEET 3

Product



• THIS DETAIL SHEET RELATES TO TYVEK⁽¹⁾ SUPRO UNDERLAY IN THE NON-VENTILATED COLD PITCHED ROOF SYSTEM.

(1) Tyvek is a registered trademark of DuPont.

This Detail Sheet must be read in conjunction with the Front Sheets, which give the products' position regarding the Building Regulations and general information relating to the product, and the Conditions of Certification.

Technical Specification

1 Description

1.1 TYVEK Supro is a vapour permeable roof tile underlay available with (known as TYVEK Supro Plus) or without an integral adhesive tape.

1.2 The product is manufactured by spinning strands of high density polyethylene (PE-HD) and bonding them together with heat and pressure. To this a polypropylene non-woven sheet is laminated using an adhesive and heat bonding to form a

flexible sheet for use in unsupported and fully supported specifications.

1.3 The product has the nominal characteristics given in Table 1.

Table 1 Nominal characteristics

Characteristics (units)	TYVEK Supro
Thickness (mm)	0.45
Weight per unit area (gm ⁻²)	145
Roll length (m)	50
Roll width (m)	1.0, 1.5
Roll weight (kg)	7.4, 11.0
Nail tear strength (N)	
longitudinal	180
transverse	200
Elongation at break (%)	
longitudinal	14
transverse	24
Hydrostatic head (cm of H ₂ O)	>200
Colour	white underside/ grey top side with red logo

1.4 Tyvek Butyl Adhesive Tape is an ancillary item available for use with this system.

Design Data

2 General

2.1 TYVEK Supro Underlay is satisfactory for use in dwellings with non-ventilated tiled or slated roofs of any conventional plan and of any size. Features⁽¹⁾ successfully assessed include:

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

- (1) For roofs incorporating other features, non-conventional roof geometries or construction materials, the advice of the Certificate holder should be sought.
- (2) As Scottish practice, with slates nailed through the breather membrane directly onto timber planks (nominally 150 mm wide with a 2 mm gap) without battens.

2.2 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.

2.3 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 substantially reduce this mechanism of heat loss (see section 9.4 of this Detail Sheet).

2.4 In non-ventilated roof systems, the risk of condensation is equivalent to, or less than, that attending conventionally-ventilated cold roof systems.

3 Strength

3.1 The product will resist the loads associated with installation.

3.2 Batten spaces for fixing the tiles or slates should be calculated in accordance with BS 5534 : 2003, Section 5.5.2.

3.3 The product has adequate resistance to wind uplift forces likely to be experienced in most locations in the United Kingdom and, for design purposes, may be considered at least equal in strength to Types 1F and 5U reinforced bitumen underlay as defined in BS 747 : 2000.

3.4 Project design wind speeds should be determined and wind uplift forces calculated, in accordance with BS 6399-2 : 1997.

4 Risk of condensation



4.1 Typical values for water vapour resistance are given in Table 2.

Table 2 Water vapour resistance

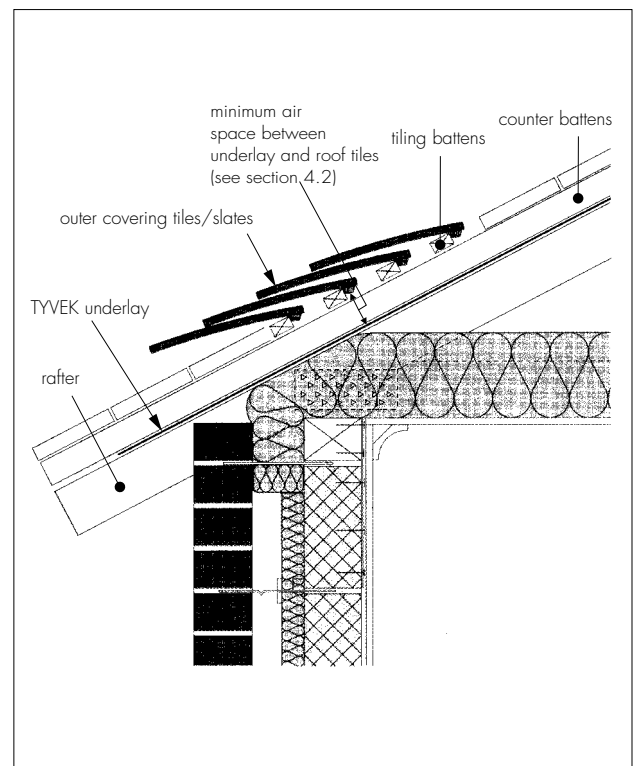
Material	Water vapour resistance (MNsg ⁻¹)
TYVEK Supro	0.21 (nominal)
Traditional felt underlay	570 (maximum)
Polyethylene sheet (0.15 mm)	450

4.2 To allow water vapour dispersal above the product, it must be installed to ensure a minimum air space between it and the roof covering (see Figure 1) when:

- draped between rafters, with loose laps — tiling battens⁽¹⁾ must be used (see also section 3.3 of this Detail Sheet)
- pulled taut and laps sealed — counter battens⁽¹⁾ and tiling battens⁽¹⁾ must be used.

- (1) Battens must be of a minimum thickness of 25 mm.

Figure 1 Installation details (condensation risk)



4.3 The complete roof construction, ceiling boards to roof tiles, must be considered as a total system with regard to condensation risk. It is important that

the products are laid in accordance with the Certificate holder's instructions and this Certificate to prevent excessive condensation as defined in the national Building Regulations and Standards thus:

England and Wales

Approved Document F

Scotland

Technical Standards, Part G of the *Provisions deemed to satisfy the Standards*

Northern Ireland

Technical Booklet C.

4.4 All penetrations into and out of the roof space must be properly sealed in accordance with the Certificate holder's instructions. Vent stacks, boiler flues, for example, passing through the roof space must additionally be sealed along their length.

4.5 Subsequent penetrations into the roof space must be properly sealed to ensure the integrity of the sealed or non-ventilated cold pitched roof system is maintained. This can be achieved by the use of Tyvek Butyl Adhesive Tape.

4.6 It is essential to limit the rate of water vapour transfer into the loft space from the dwelling below. Appropriate measures include:

- the dwelling below the roof must be ventilated in accordance with national Building Regulations and Standards for the dispersal and rapid dilution of water vapour
- for rooms that may experience high humidity, such as kitchens, utility rooms and bathrooms — the ventilation rates should be in accordance with the guidance documents supporting current national Building Regulations and Standards
- all water tanks in the loft space must be covered and all pipework lagged
- ceiling penetrations must be sealed and loft hatches made convection tight by using a compressible draught seal.

4.7 For additional protection, the use of a vapour control layer/vapour check plasterboard can be considered, such as Tyvek SD2 Air Leakage Barrier/Vapour Control Layer (BBA Certificate No 01/3808)⁽¹⁾.

(1) Users are advised to check the validity of the Certificate (eg by consulting the BBA's website).

5 General

5.1 TYVEK Supro Underlay in the Non-Ventilated Cold Pitched Roof System must be installed and fixed in accordance with the Certificate holder's instructions, 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.

5.2 In open eaves construction, it is recommended to use eaves guards, eg Tyvek Eaves Carrier, to conduct water into the gutter.

Safety

5.3 The products have a smooth surface with a low coefficient of friction and care should be taken when moving or standing on a surface covered by the materials, particularly in cold weather.

6 Procedure

Draped and loose laps

6.1 The lining, when installed as an unsupported system, is fixed in the traditional method for roof tile underlays, ie draped between the rafters. Batten spacings should not exceed 250 mm in areas of high wind loading and 350 mm in areas of normal wind loading.

6.2 Overlaps must be provided with the minimum dimensions given in Table 3.

Table 3 Minimum overlaps

Roof pitch	Horizontal lap (mm)	Vertical laps (mm)
12.5° to 14°	225	100
15° to 34°	150	100
35°+	100	100

Taut

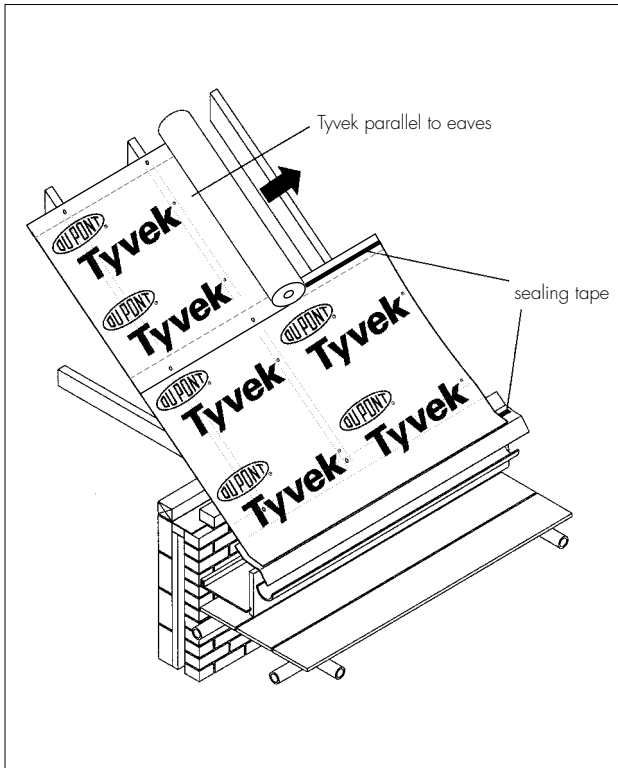
6.3 The underlays should be laid either vertically, eaves to eaves, or horizontally, parallel to the eaves. In both instances the underlay must be pulled taut and not allowed to drape. Each sheet of underlay should be stapled to hold it in position prior to the counter battens being fixed.

Taut — Parallel-to-eaves installation

6.4 When laid horizontally, the products must be pulled taut and not draped from gable to gable and stapled or nailed to hold securely in position. Counter battens (minimum thickness 25 mm) are then fixed to the rafter.

6.5 The edge laps should be sealed using an acrylic adhesive tape (see Figure 2). If required, the edge laps can be supported with cross noggings between rafters. The underlay must be laid with vertical and horizontal laps as defined in Table 13 of BS 5534 : 2003 for unsupported underlays.

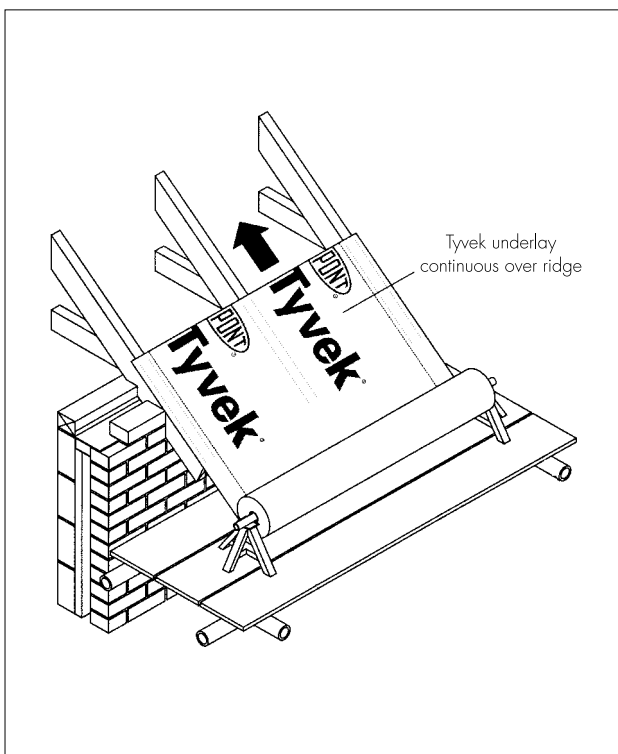
Figure 2 Parallel-to-eaves installation



Taut — Eaves-to-eaves installation

6.6 Using the method shown in Figure 3, the products should be supported by a bar and stand, and the end of the product drawn up and over the ridge and down to the opposite eaves, keeping the product taut (see Figure 3). Each sheet of underlay is stapled to hold it in position prior to the counter battens being fixed.

Figure 3 Eaves-to-eaves installation



6.7 The underlay is cut off with a knife, and the supports moved along at each repeat of the procedure.

6.8 The edge laps of the underlay should be formed on rafters and secured to them by counter battens (minimum thickness 25 mm) fixed at 300 mm centres. The battens for tiling are fixed to the counter battens leaving an air space between the underlay and the tiles for drainage and natural air movement for moisture dispersal.

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

Timber plank sarking

6.10 For fully supported roofs (traditional Scottish), the slates can be nailed through the underlay into the timber plank sarking, normally 150 mm wide with a 2 mm gap.

7 Finishing

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

7.2 To achieve a convection-tight loft space, it is important that the following details are maintained (see also section 4.6 of this Detail Sheet):

- all penetrations, eg pipework, electrical fittings to the loft space, must be sealed
- the loft hatch must be securely sealed to ensure a draught-free fit
- the insulation must be pushed into the eaves and against the underlay to avoid gaps.

7.3 The tiling and slating must be carried out in accordance with the relevant clauses of BS 5534 : 2003, BS 8000-6 : 1990 and the Certificate holder's instructions, especially when using tightly-jointed slates or tiles.

Technical Investigations

The following is a summary of the technical investigations carried out on TYVEK Supro Underlay in the Non-Ventilated Pitched Roof System.

8 Tests

8.1 Samples of TYVEK Supro were obtained from the Certificate holder for testing. The results of the tests carried out by, or on behalf of, the BBA, which show typical results for the material are summarised in Tables 4 and 5.

Table 4 Physical properties — directional

Test (units)	Method ⁽¹⁾	Mean result	
		Long ⁽²⁾	Trans ⁽³⁾
Tensile strength (N per 50 mm) unaged	BS EN 12311-1 ⁽⁴⁾	310	241
Elongation at break (%)	BS EN 12311-1 ⁽⁴⁾	16	26
Resistance to tear (nail) (N)	MOAT 27 : 5.4.1	129	121

(1) The test documents are detailed in the *Bibliography*. Numbers in the table refer to sections/parts of the various documents.

(2) Longitudinal direction.

(3) Transverse direction.

(4) Sample modified in accordance with prEN 13859-1.

Table 5 Service performance

Test (units)	Method ⁽¹⁾	Mean result
Mullen burst strength (kNm ⁻²)	BS 3137	724
Water vapour permeability at 25°C/75% RH (gm ⁻² day ⁻¹)	BS 3177	935
Vapour resistance 25°C/75% RH (MNsg ⁻¹)	BS 3177	0.22
Hydrostatic head (cm)	BS EN 20811	
mean		237
minimum		189
Wind loading (kPa)	UEAtc Guideline 4.2.1	
batten spacing 350 mm		1.0 ⁽²⁾
batten spacing 330 mm		1.5 ⁽²⁾
batten spacing 300 mm		2.0 ⁽²⁾
batten spacing 250 mm		2.5 ⁽²⁾

(1) The test documents are detailed in the *Bibliography*. Numbers in the table refer to sections/parts of the various documents.

(2) Maximum pressure achieved.

8.2 Data from previous tests on Tyvek membrane assessments were used to assess the following properties:

- change in properties after heat ageing
- change in properties after water soak
- change in properties after UV ageing
- wet strength
- resistance to tear
- low temperature flexibility
- coefficient of dynamic friction
- resistance to water pressure.

9 Investigations

9.1 Using computer modelling, roofs described in section 2.1 of this Detail Sheet were analysed for the risk of condensation.

9.2 An assessment of practicability of installation was made from site visits and data gathered during previous assessments of Tyvek Underlay Systems.

9.3 An evaluation was made of monitored data covering internal loft space temperature and relative humidity, plus moisture content of the rafters. The data were collected over winter and summer periods.

9.4 An evaluation was also made of data relating to reduction in unwanted energy loss from roofs incorporating the Tyvek non-ventilated system.

9.5 An examination was made of quality control data relating to:

- physical properties
- thickness
- roll weight.

Bibliography

BS 747 : 2000 Reinforced bitumen sheets for roofing — Specification

BS 3137 : 1972 Methods for determining the bursting strength of paper and board

BS 3177 : 1959 Method for determining the permeability to water vapour of flexible sheet materials used for packaging

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

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

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

BS EN 12311-1 : 2000 Flexible sheets for waterproofing — Determination of tensile properties — Part 1 — Bitumen sheets for roof waterproofing

BS EN 20811 : 1992 Textiles — Determination of resistance to water penetration — Hydrostatic pressure test

MOAT No 27 : 1983 General Directive for the Assessment of Roof Waterproofing Systems

prEN 13859-1 Flexible sheets for waterproofing — Definitions and characteristics of underlays — Part 1 Underlays for discontinuous roofing

UEAtc Technical Report for the Assessment of Discontinuous Roofing Underlay Systems : February 2004



On behalf of the British Board of Agrément

Date of issue: 23rd April 2004

A handwritten signature in black ink, appearing to read 'P. C. Newson', is written over a light grey background.

Chief Executive

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