

January 2022 AR-VR 1st Edition

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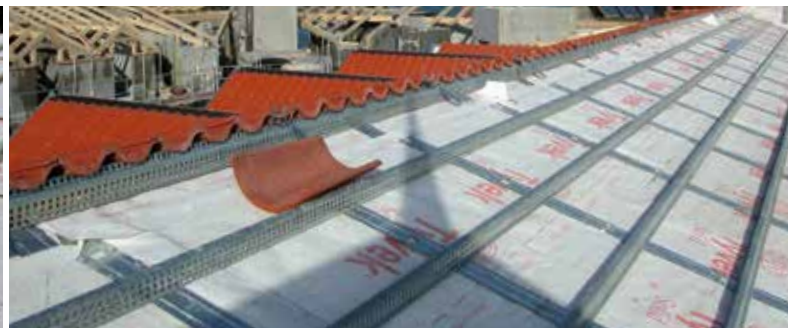
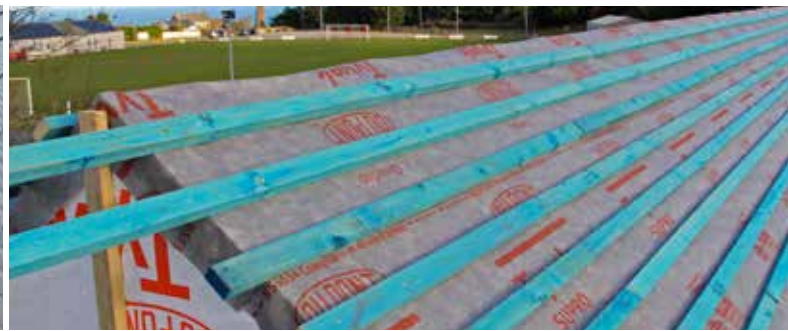
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DUPONT™

Tyvek®

2022 Technical Manual – Roofs

DuPont™ Tyvek® & DuPont™ AirGuard®
Membranes, Tapes and Accessories



What do you want your project to achieve?

| | | Using Tyvek® and AirGuard® |
|---------------------|--|----------------------------|
| Environmental Focus | Reduce waste, increase performance, extend durability | ✓ |
| Energy Efficiency | Save resources, energy and costs | ✓ |
| Air Quality | Reduce ingress of pollution into internal space | ✓ |
| Comfort | Increase internal building occupancy comfort | ✓ |
| Airtightness | Stop or reduce unintentional air leakage | ✓ |
| Durability | Extend life cycle performance of building | ✓ |
| Weather Proofing | Prevent water ingress, weather damage and provide wind tightness | ✓ |

«DUPONT»
Tyvek®

«DUPONT»
AirGuard®

«DUPONT»
Insta Stik™

«DUPONT»
Froth-Pak™

«DUPONT»
Great Stuff™

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Product Portfolio

DuPont Performance Building Solutions

DuPont™ Tyvek® roofing underlays

- Tyvek® Supro / Tyvek® Supro Plus
- Tyvek® Metal



Medium to High Occupancy buildings .e.g. Health, Education, Residential ,Commercial, Leisure...

DuPont™ Tyvek® and DuPont™ AirGuard® accessories

| | | |
|---|------------------------------------|------------------------|
| • Tyvek® Acrylic Tape with split-release liner | • Tyvek® FlexWrap NF Tape | • Tyvek® Primer |
| • Tyvek® Acrylic Tape | • Tyvek® FlexWrap EZ Tape | • DuPont™ Insta Stik™ |
| • Tyvek® Metallised Tape | • DuPont™ AirGuard® Tape | • DuPont™ Great Stuff™ |
| • Tyvek® Double Sided Tape | • DuPont™ AirGuard® Sealant | • DuPont™ Froth-Pak™ |
| • Tyvek® Butyl Tape | • Tyvek® Window/Plastering tape | |
| • Tyvek® UV Façade Tape | • DuPont™ AirGuard® FR System Tape | |

- External application
- Internal application

Products and Technical Support for all Building Types from low occupancy, low level buildings to high occupancy, high rise buildings, on-site and off-site construction

DuPont™ AirGuard® air & vapour control layer (AVCL) and DuPont™ Tyvek® AirGuard® Smart (AVCL) membranes

- DuPont™ AirGuard® Control
- DuPont™ AirGuard® Reflective
- DuPont™ AirGuard® Reflective E
- DuPont™ Tyvek® AirGuard® Smart
- DuPont™ AirGuard® A2 FR fire retardant AVCL
(For use in the internal wall lining)



Low Occupancy buildings .e.g. Detached, Semi-detached, Terraced

DuPont™ Tyvek® breather membranes solutions for wall constructions

- Tyvek® FireCurb® breather membrane
- Tyvek® StructureGuard™
- Tyvek® Housewrap
- Tyvek® Reflex
- Tyvek® UV Façade/Tyvek® UV Façade Plus
(For use in the external wall lining)



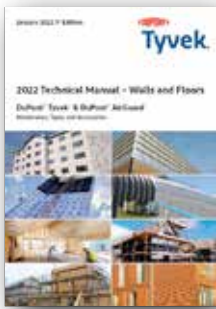
DuPont Tyvek® & DuPont™ AirGuard® - Roof Applications

Introduction

Over 30 years ago , the DuPont™ Tyvek® family of Weather Resistant Barrier (WRB) and superior building performance membranes were introduced into the UK and Ireland construction markets. The inherent qualities of the DuPont™ Tyvek®, range of products, made them an obvious solution in providing protection to buildings against the external elements, offering benefits over traditional materials in terms of water resistance, vapour permeability, flexibility, strength and durability.

The DuPont™ Tyvek® product range was enhanced with the introduction of our internal DuPont™AirGuard® membranes to control internal moisture and enhance energy efficiency. Together with a complete range of adhesive sealing tapes and accessories, the combined product portfolio has evolved to meet the demands of the changing world, providing solutions for the following:

- Weather Protection
- Moisture & Condensation Control
- Energy Efficiency & Airtightness
- Indoor Air Quality
- Thermal Performance
- Fire Safety
- Long Term Durability

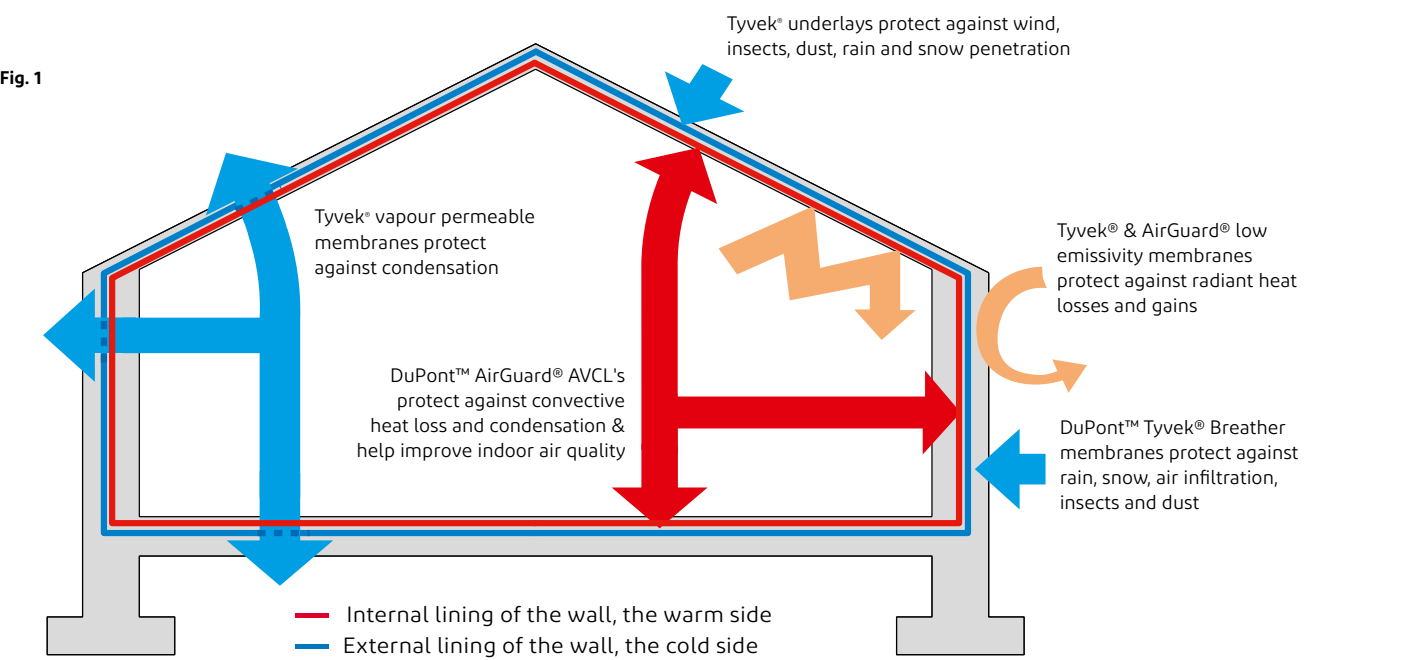


★ Please also see the 2022 Technical Manual - Wall & Floors

Protection in Construction

This technical manual contains detailed information specifically on the use of Tyvek® and AirGuard® membranes in wall and floor construction. By controlling the movements of heat, air and moisture through the building envelope DuPont™Tyvek® and DuPont™ AirGuard® membranes can make a major contribution to protecting the environment by improving the energy efficiency of buildings.

To achieve the required internal conditions with optimum efficiency it is essential to consider air flow and moisture movement together with all aspects of heat transfer, not only by conduction, but also by convection and radiation. The reduction of air leakage, the avoidance of damaging condensation and the provision of thermal insulation must all be considered together to ensure the protection and well-being of the occupants and the long-term protection of the building fabric.



For information on Tyvek® & AirGuard® membranes for protection against external moisture please contact the DuPont™ Tyvek® Building Knowledge Centre. Details on back page.

DuPont™ Tyvek® membranes: pitched roof applications

Roofing underlay

Tyvek® Supro and Tyvek® Supro Plus are extremely durable flexible sheet materials for use as roofing underlays in pitched roof construction. They can be incorporated into all tiled or slated pitched roofs, whether they be new-build or refurbishment projects. As a secondary water shedding layer a Tyvek® membrane will provide a barrier to minimize the wind load acting on the slates and tiles and will adequately resist wind blown snow and dust from entering the roof construction. Tyvek® membranes are suitable for use as roofing underlays as defined in BS5534:2014 and A2.2018. Tyvek® membranes are also suitable for use in metal clad industrial roofs.

Insulation - Condensation

Tyvek® membranes offer benefits over traditional impermeable roofing underlays by minimising the risk of interstitial condensation occurring within roof constructions: Over the last 30 years or so, as we have become more aware of the need to conserve energy, the required levels of insulation within roofs have become greater. This has had the effect of increasing the likelihood of condensation forming on the underside of the roofing felt. Prior to the introduction of modern vapour permeable membranes, the only way of reducing this risk was to introduce ventilation openings in the roof to effectively “change the air”. In order to ensure that a sufficient amount of ventilation was provided to prevent condensation, Building Regulations and Standards were amended.

Satisfying the Building Regulations

Standards across the UK require that the building and the people who use the building are protected from the harmful effects of moisture in all its forms. In England and Wales, the requirements of Approved Document C apply.

In Scotland, The Building Standards section 3.15 provide guidance and in Northern Ireland, Technical Booklet C is used to demonstrate compliance. In Ireland, Technical Guidance C provides examples on how to meet the requirements for all buildings.

Approved Documents contain practical guidance on how to meet the requirements of the Building Regulations. Part C covers Resistance to moisture under C2. The requirement is as follows:

Resistance to moisture

C2. The floors, walls and roof of the building shall be designed and constructed as to prevent the passage of moisture to the inside of the building or damage to the fabric of the building.

b) precipitation and wind driven spray.

c) interstitial and surface condensation; and,

d) spillage of water from or associated with sanitary fittings or fixed appliances.

Protection from external moisture and condensation will ensure the structural performance of a roof construction and thermal performance of the insulation will not be compromised.

DuPont™ Tyvek® Solution

Tyvek® is a vapour permeable material which, as a Type LR roofing underlay (BS5250), will offer a low resistance to the passage of vapour. During the winter, when a building is heated and the internal vapour pressure is high, a Tyvek® underlay will, by diffusion, allow water vapour within the roof space to permeate through to the batten space. Natural air movement through the joints of the roof covering will subsequently allow any moisture laden air to escape to atmosphere.

The ability of a Tyvek® underlay to provide this function of condensation control eliminates the need to ventilate any roof voids between the underlay and the insulation.

In every case during the design stage it is important to consider the entire roof element, from the interior dry-lining to the outer roof covering, to assess the capacity of the system to control condensation. This is dependant on a number of factors, but from a fabric point of view efficient external vapour release and internal vapour control must be established. In accordance with Section 6 of Approved Document C, moisture transfer through penetrations and gaps in the internal lining should be avoided. This requirement encourages us to address the airtightness of the ceiling and its ability to reduce convective vapour and heat transfer. Methods for which are described in BS 9250:2007 (Code of practice for design of the airtightness of ceilings in pitched roofs).

Using a Tyvek® underlay in conjunction with a suitable air & vapour control layer (AVCL) will fulfil all the requirements for weather protection, condensation control and convective heat loss (airtightness), across the UK and Ireland, meeting the requirement of Approved Document C2.

Further information on internal air & vapour control can be found on page 11. Please refer to page 37 for the DuPont™ AirGuard® range of AVCL's



BBA Approvals

In order to determine the risk of condensation in non-ventilated pitched roof constructions using Tyvek® as the roofing underlay, the British Board of Agrément (BBA) conducted a long term research programme. The exhaustive research covered a wide range of pitched roofs, typical to the UK, varying in pitch from 12.5° to 70°, in different locations throughout the country, using various roof coverings. The tests were conducted over two winter periods and data collated and assessed using sophisticated computer modelling. More than 100 cases were analysed using readings taken from sites in Wiltshire and Glasgow, which were selected to reflect the prevailing weather patterns in these regions.

The results from the research were very successful, with insignificant amounts of condensation recorded, especially in the sealed roof systems. The results were further verified by additional measured data that had been gathered from other previous site monitoring.

Not surprisingly, the BBA granted approval in the form of certificate 08/4548 for the use of Tyvek® membranes in non - ventilated and sealed cold pitched roofs.

Together with the warm roof approvals granted originally in 1991 and most significantly in 1994 and 2004, DuPont now have universal approval for the use of Tyvek® membranes in pitched roof constructions.

NHBC

For sites covered by an NHBC warranty, Tyvek® Supro is classed as an LR (vapour permeable) underlay and is fully compliant with NHBC requirement 7.2, which states:

Ridge or high-level ventilation equivalent to a continuous opening of 5mm should be provided at the highest point of each roof slope in accordance with BS 5250.

As BS5534 requires a dry fix ridge system, this ventilation is easily accommodated into normal site practice, regardless of underlay type.

Non-ventilated vs ventilated

BBA certificate 08/4548 states that with Tyvek®, “the risk of condensation is equivalent to, or less than, that attending current conventionally ventilated cold roof systems.” The certificate also states that Tyvek® membranes may be used in “dwellings of any conventional plan and of any size.” This documentation is sufficient to satisfy current legislative requirements across the UK and Ireland: Building Regulations Approved Document C2.

The solution of ventilating roof constructions in order to prevent excessive condensation beneath impermeable underlays is often regarded as “the traditional way” of meeting the regulations. However, traditional methods of construction and practices are often superceded by more efficient and effective solutions. From an energy conservation perspective, introducing cold external air into roofs can be to the detriment of the construction by:

- reducing the effectiveness of fibrous insulation.
- promoting warm air leakage from the building into the roof space.
- Increasing air infiltration into the heated building.
- Introducing dirt, dust and insects into the roof construction.
- Introducing external moisture laden air into the construction.

A non-ventilated Tyvek® system will not only prevent excessive condensation, as required, but will also offer substantial gains in energy efficiency by reducing these factors

Agrément certificate coverage

Agrément certificate coverage

BBA certificate 08/4548 state that Tyvek® underlays are suitable for use in dwellings. Due to the wide range of conditions that they offer, dwellings are used by the BBA for the purposes of assessing product performance. The test environments include appropriate temperature and humidity levels which prevail within bathrooms and kitchens. It is generally accepted that the majority of commercial and industrial buildings will present safer conditions within which the membrane is to perform. An office for instance will generally have lower temperature and humidity levels than a domestic dwelling. Tyvek® membranes can therefore be incorporated into domestic, industrial and commercial specifications. Previous certification was restricted, in that the BBA approved the use of Tyvek® membranes only in roofs of simple plan rectangular shapes. Certification now allows for typical roof detailing such as lean-to roofs, valleys, dormers and Scottish boarded roofs. Certificate 08/4548 approves the use of Tyvek® membranes in both **warm and cold** pitched roof construction. These are categorised according to the positioning of the insulation:

Cold roofs (Fig. 5)

This is where the insulation is installed at joist level with a cold loft - space (attic) between the insulation and roofing underlay. In the main, quilt insulation is laid between and over ceiling joists.

Warm roofs (Fig. 6)

This is where the insulation is installed at rafter level using rigid and/or semi rigid insulation. The insulation would ideally be positioned in a continuous layer above the rafters so that the roof structure is situated in a “warm” environment. However, certain roof specifications can result in the insulation being installed over rafters, between rafters or under rafters. With increasing thermal requirements it is quite common for a combination of these options to be employed.

Room in the roof applications (Fig. 7)

The BBA have assessed room in the roof applications as included in Agrément certificate 08/4548. Tyvek® membranes may therefore be installed into this form of construction without ventilation at eaves or ridge. Room in the roof constructions very often incorporate a combination of both warm and cold roof constructions, employing varying types of insulation. Cold roof areas usually include “vapour open” fibrous insulation such as mineral wool quilt, whereas the sloping ceiling areas include closed cell or foil backed rigid board insulants, of which the majority are highly vapour resistant. This variation in vapour resistance can result in an imbalance in vapour drive. To equalise the internal vapour resistances throughout the construction it is recommended that a AVCL such as DuPont™ AirGuard® Control, DuPont™ AirGuard® Reflective, DuPont™ AirGuard® A2 FR and DuPont™ Tyvek® AirGuard® Smart be installed beneath the “vapour open” quilt insulation.

Air & Vapour Control Layers (AVCL's).

As the regulations of all UK and Ireland authorities tighten and fabric thermal performance levels increase, heat transmission into a cold roof space by conduction will be reduced. In a cold pitched roof this will result in a lower operating temperature within the loft space, which could potentially increase the probability of interstitial condensation occurring. However, in a normal domestic environment of 20°C at 60% RH the expected quantity of vapour should egress the building safely and efficiently via trickle vents and other internal ventilation measures. The Tyvek® underlay can be relied upon to diffuse any normal levels of vapour that migrates into the roof construction to outside atmosphere.

There may however be circumstances where the internal air will contain a higher level of moisture than the system can efficiently manage. Excessive humidity levels can be generated by swimming pools for example or when a new building is undergoing a period of drying-out during a winter season. As heat will displace air in an upwards trend, the majority of vapour will migrate into the roof void. Cold vapour resistant surfaces such as structural steelwork and vapour impermeable (Type HR) underlays are at great risk from a build-up of condensate even when properly ventilated. Similarly, vapour can also potentially condense on vapour permeable (Type LR) underlays (such as Tyvek® Supro) if moisture in the air is excessive. This is most likely to happen whilst the building is drying out.

Once the moisture levels within the building have decreased, so too will the risk of condensation. The relative humidity will balance out and the building will operate within the expected comfort levels. In some cases, the drying out phase may need some assistance with apparatus such as de-humidifiers. This would be particular to buildings which have extreme levels of trapped moisture due to construction processes as described above, or from exposure to precipitation during construction. Specifying an air & vapour control layer (AVCL) such as DuPont™ Airguard will in every case help to safeguard against large volumes of moisture laden air infiltrating the roof construction, resulting in a reduced condensation risk. Coupled with the layer’s airtight function and obvious energy saving benefits, it is generally accepted as good practice for an AVCL to be installed into roof systems, regardless of whether they are ventilated or not (Please see following note on Ventilated systems).

Ventilated systems

Due to the detrimental effects that cold air infiltration can have on the thermal performance of insulated systems, windwashing, convective heat loss, etc. an AVCL is of particular importance where the roof system is to be ventilated. Please refer to page 34 for the DuPont™ Airguard range of AVCL's.

Non-ventilated or Sealed roofs?

DuPont promote two methods of application for Tyvek® membranes in pitched roof construction. This reflects the in-depth research that DuPont has undertaken to ascertain the most effective ways of not only controlling condensation, but also improving energy efficiency in roof construction. Extensive monitoring of test houses incorporating Tyvek® membranes at the BRE's test facilities also confirm the benefits of using Tyvek® non-ventilated and sealed roof systems.

Non-ventilated roofs

Roofs with no provision for airflow beneath the underlay will be more energy efficient than conventional, ventilated roofs.

Sealed roofs

Roofs with no airflow beneath the underlay and with all air leakage paths sealed will be more energy-efficient than non-ventilated roofs and will provide a higher degree of comfort.

Results from tests carried out on the non-ventilated systems showed this to be an efficient form of construction. However, further improvements were indicated in tests carried out on the sealed roofs.

Non-ventilated systems

This is where a Tyvek® membrane is laid over the roof, parallel to the eaves, as in traditional practice. A horizontal lap of 150mm minimum is maintained between each consecutive Tyvek® run. No ventilation is incorporated at eaves or ridge.

Sealed roof systems

A Tyvek® membrane is laid over the roof in a taut condition, parallel to the eaves and counter battened. A horizontal lap of 150mm minimum is maintained between each consecutive Tyvek® run. All membrane laps, junctions, pipe penetrations, rooflights and perimeters are sealed with an appropriate sealing tape. No ventilation is incorporated at eaves or ridge.

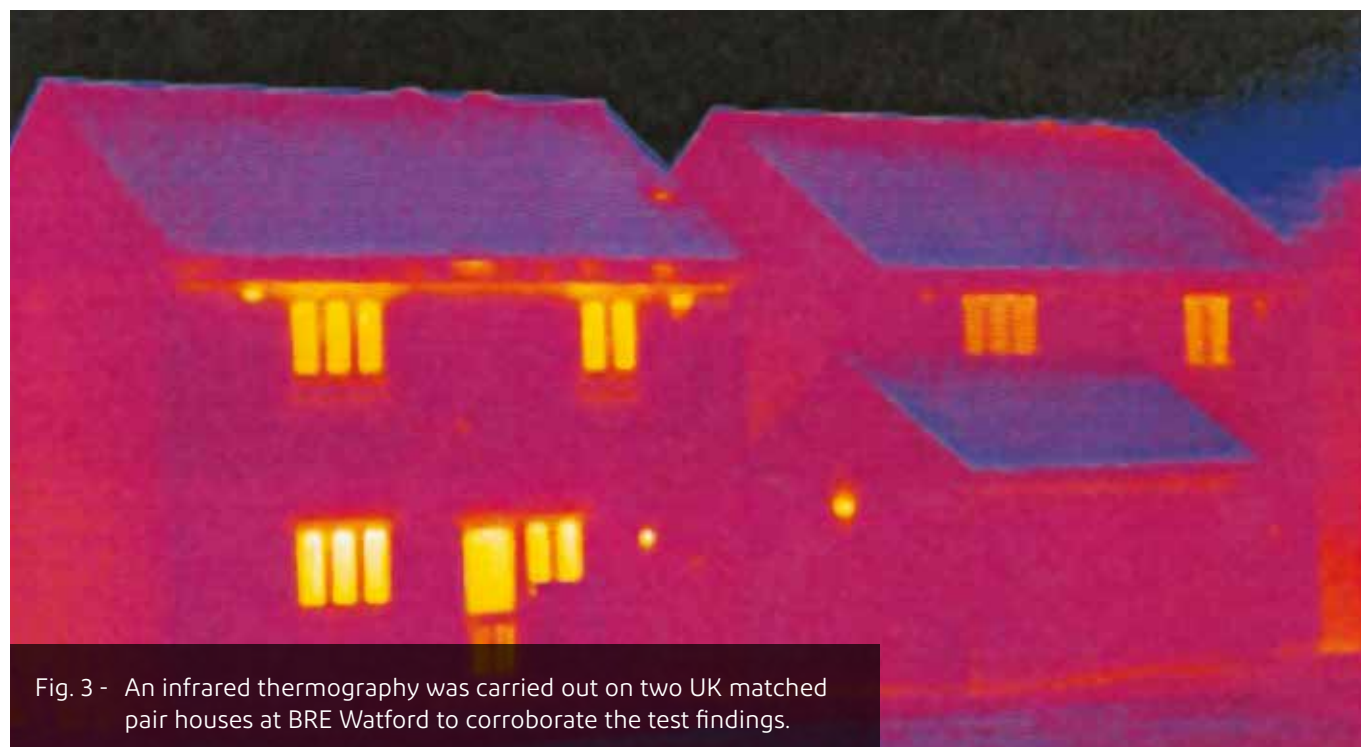
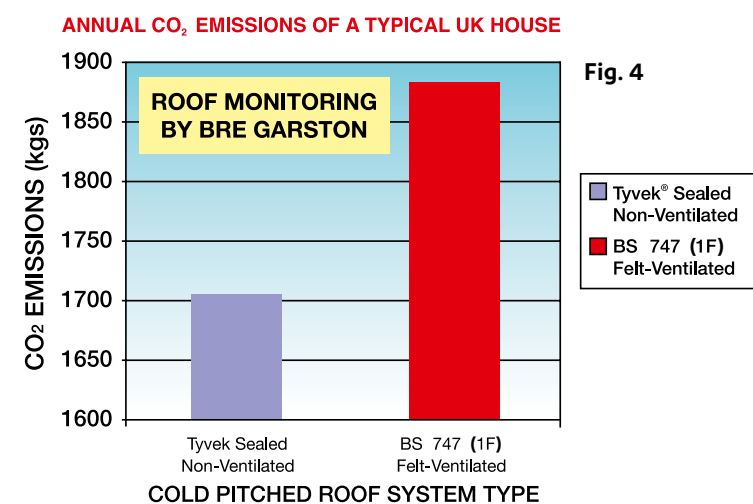


Fig. 3 - An infrared thermography was carried out on two UK matched pair houses at BRE Watford to corroborate the test findings.

Benefits of DuPont™ Tyvek® sealed roof system

Tyvek® non-ventilated roofs will significantly reduce the likelihood of condensation, have less air leakage and are more energy efficient than conventionally ventilated roofs. However, they are still subject to air infiltration at laps, perimeters and penetrations. Air movement through those gaps can result in significant heat losses. Adopting the Tyvek® sealed roof system will not only reduce the risk of condensation, but will also minimise the heat losses caused by air infiltration.



Eliminating air movement substantially improves energy efficiency

DuPont™ Tyvek® Sealed Roof System was extensively researched during early studies by the BRE and VTT. Further tests were carried out by the BBA for the purposes of independent accreditation. The following results and conclusions were achieved:

- a significant reduction in air leakage
- a 7.1% reduction in overall energy consumption
- 25% saving in heat lost through the roof when compared to a typical ventilated system
- an air leakage rate as low as 2ach.

These test results are indicative of the following energy savings:

- a 3.2kWh saving in energy consumption per day
- a 700kWh saving in energy consumption over a full heating season
- a 135kg reduction in CO₂ emissions over a full heating season If correct and thorough sealing work is carried out to the roof construction further improvements in energy savings can be made:
- 4.2kWh saving in energy consumption per day*
- 927kWh saving in energy consumption over a full heating season*
- 79kg reduction in CO₂ emissions over a full heating season*
- Air leakage rate as low as 1.7ach*.

* Data obtained from additional tests after extensive sealing work was carried out.

Please note: It is of benefit to recognise the importance of making internal linings convection tight when considering the need to reduce uncontrolled air leakage. This is particularly relevant for the purposes of complying with the air permeability requirements of all UK and Ireland regulations, including Approved Document L.

The requirements of regulatory bodies and the BBA certificate 08/4548 should be referred to when sealing work is to be carried out.

With a lower risk of condensation in comparison with a standard roof using a traditional felt underlay and a ventilated loft space. In addition to this the BBA have concluded: "In conventionally ventilated roof constructions energy loss by ventilation can account for up to 25% of the total heat lost through the roof. The Tyvek® non-ventilated roof system will substantially reduce this mechanism of heat loss."

To gain maximum benefit an air & vapour control layer (AVCL) should be installed above the ceiling. DuPont™ AirGuard® Control, AirGuard® Reflective, AirGuard® A2FR and Tyvek® AirGuard® Smart are available for this purpose.

Refurbishment work to existing buildings

In addition to new build projects, a non-ventilated roof system using Tyvek Supro can also be adopted in refurbishment/ re-roofing work. Before such work is undertaken however, it is important to consider the notes below to ensure efficient performance in terms of heat, air and moisture management.

Existing ceiling and thermal efficiency

At the design stage of a new build domestic construction the recommendations of BS 9250:2007 to establish airtightness at the ceiling line can be followed and an AVCL can be specified. As a continuous airtight and vapour-tight layer this important component can greatly reduce condensation within the loft space which can sometimes occur when the building is undergoing a drying-out phase. This is not normally possible in a refurbishment project as there will typically be an existing ceiling already in place. The existing ceiling will very often provide a sufficient level of vapour control as they invariably include layers of paint or textured finishes which will help to diffuse internally generated vapour. In this case the system should perform satisfactorily and ventilation to the loft space will not be necessary. When considering airtightness and thermal efficiency, the integrity of the existing ceiling, whether plasterboard or lathe & plaster is a factor, as any breach in these layers will allow water vapour to infiltrate the construction. Existing loft access hatches should be checked to ensure they are up to current standards and if in doubt, should be replaced with a modern insulated unit that incorporates compressible draught seals. If new light fittings are to be installed within the ceiling line any penetrations made should be formed so as to present minimal disruption to the ceiling's airtightness and vapour controlling abilities. The holes created by light fittings can be made good by sealing the wiring penetration with a suitable sealing tape. The retrospective installation of downlights can present noticeable disruptions in the ceiling, which will allow high levels of internal heat and

vapour to flow freely into the roof space. Special care and attention should be paid to fitments of this kind to reduce the detrimental effect that they can have on condensation control and energy efficiency. Where possible, low energy, fire rated and sealed units that are IP65 rated should be considered as best practice.

Insulation

During refurbishment projects, particularly with cold pitched roofs, it is common for the existing insulation to be upgraded or added to with extra thermal layers. The benefits in terms of energy consumption and subsequent lowered heating costs are well known, but a negative effect of this will be lower loft space temperatures. High humidity within the building and/or insufficient air/vapour control at ceiling level could potentially increase the condensation risk within the roof construction. Other updating measures, such as installing double glazing will further improve the building's thermal performance, but will also alter the internal air quality. It is important therefore to ensure that adequate indoor ventilation is achieved, in line with current building regulations.

Note: A Tyvek non-ventilated pitched roof system will efficiently deal with the humidity/moisture levels associated with normal domestic building use.



Insulation
Tyvek® underlay
DuPont™AirGuard® AVCL

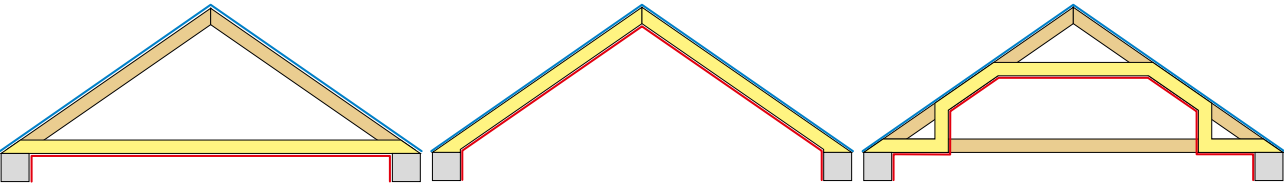


Fig. 5 - Cold roof

Fig. 6 - Warm roof

Fig. 7 - Room in the roof

Tyvek® roofing applications can be broken down into two main categories:

- 1. UNSUPPORTED APPLICATIONS
- 2. SUPPORTED APPLICATIONS

The application category will determine which membrane is suitable and how it is to be installed.

1. SUPPORTED APPLICATIONS

DuPont™ Tyvek® Supro - DuPont™ Tyvek® Supro Plus

This is where the Tyvek® membrane is laid directly over a supporting layer such as timber boarding or flexible/rigid insulation. In this condition counter battens over the membrane will be required to lift the tiling battens off the membrane and create an effective drainage path to the eaves.

Fig. 8 *

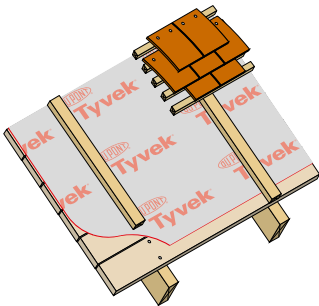


Fig. 9 *

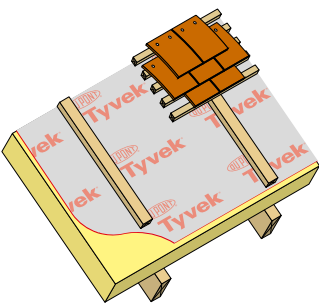
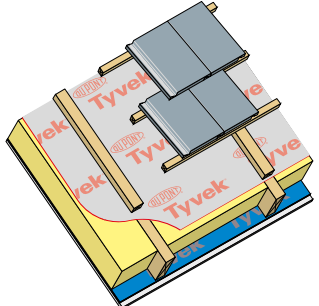


Fig. 10 *



Scottish boarded roofs are also categorized as supported applications but battens are normally omitted and the slates are nailed directly through the membrane and into the boarding. Recommended grade: Tyvek® Supro.

Fig. 11 *

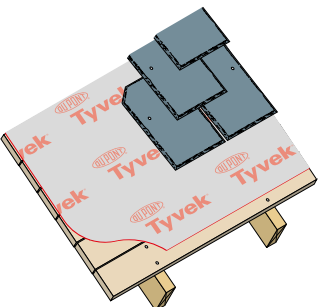
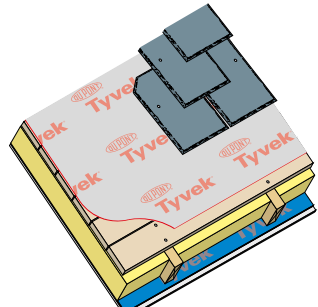


Fig. 12 *



Sealed Roof System - The supported application gives the end-user the option to upgrade the system to a sealed roof by taping all laps and penetrations in the membrane. Tyvek® Supro Plus is most suitable for this purpose as an integral sealing tape is provided.

Fig. 13 *

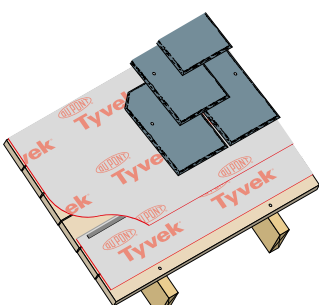


Fig. 14 *

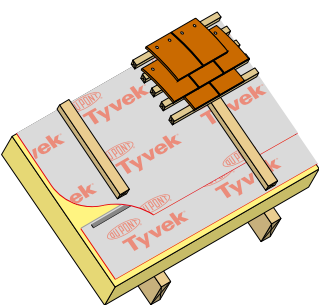
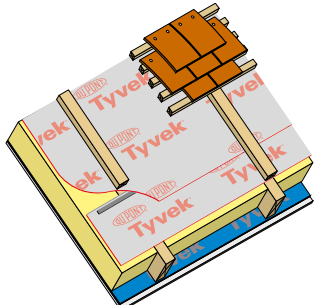


Fig. 15 *



2. UNSUPPORTED APPLICATIONS
DuPont™ Tyvek® Supro - DuPont™ Tyvek® Supro Plus

Over rafters (the traditional method) - The Tyvek® membrane is laid over rafters and allowed to drape slightly for drainage beneath tiling battens. To accommodate the drape an airspace of approx 10mm beneath the membrane will be required. In order to prevent the risk of wind uplift a maximum drape of 10mm in the membrane is recommended. No counter battens will be required over the membrane in this application. Recommended grade: Tyvek® Supro.

Fig. 16 *

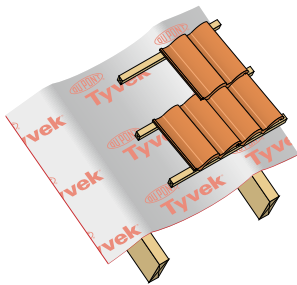


Fig. 17 *

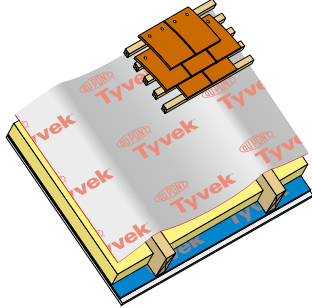
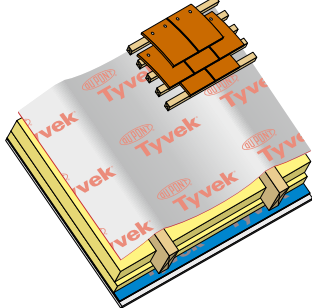


Fig. 18 *



Over counter battens - Tyvek® can also be draped over counter battens that are installed over timber boarding or rigid insulation. This represents the most practicable approach to on-site membrane installation and corresponds with the majority of rigid insulation manufacturers recommendations. Recommended grade: Tyvek® Supro.

Fig. 19 *

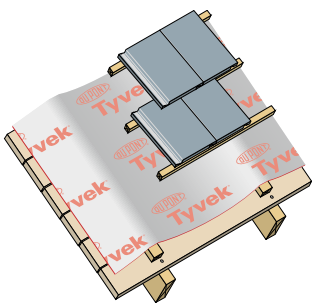


Fig. 20 *

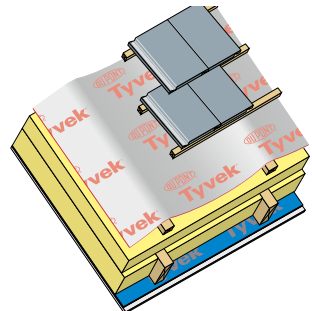
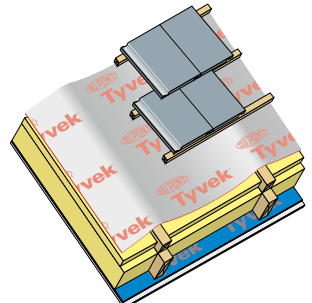


Fig. 21 *



Sealed Roof System - Tyvek® can also be installed over rafters in a taut condition with counter battens fixed over. This method is normally adopted when a sealed system is specified. Tyvek® Supro Plus is most suitable for this purpose as an integral sealing tape is provided.

Fig. 22 *

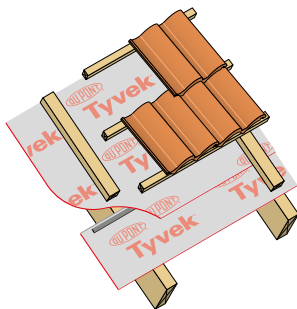


Fig. 23 *

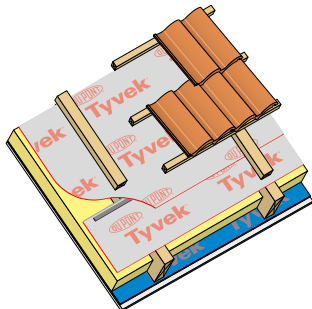
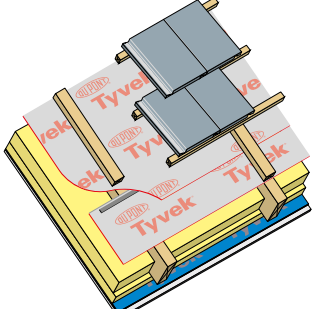


Fig. 24 *



Agrément certificate 08/4548 covers the use of Tyvek® membranes in non-ventilated and sealed pitched roofs.

Note: Please refer to the wind uplift information on pages 12 & 13 for further guidance on unsupported applications.

DuPont™ Tyvek® roofing underlays - Wind uplift resistance

BS5534:2014 +A2 2018

In the UK, most homeowners at some time will have experienced some sort of damage resulting from extreme weather conditions. In addition to the odd garden fence blowing over, the roof is particularly susceptible to wind damage - the hazards associated with dislodged tiles being very real. Limiting this risk and thus making our roofs safer is the responsibility of BS5534.

For nearly 40 years, anyone engaged in the construction of a pitched roof in the UK has been able to draw upon the recommendations within BS5534. Whilst this document forms the Code of Practice for slating and tiling, its guidance covers many other aspects of pitched roofing, the materials used and the methods employed. The standard does not take the form of a legal document, but for many it could be regarded as 'the roofers bible.'

The latest revision to BS5534, introduced in 2018 was a radical update to the standard with a realistic and future- proof emphasis on roof security and overall safety. The document addresses in detail the specification of mortar bedding, battens, flashings, structural sheathing and underlays as well as a specific focus on fixings.

BS5534: 2018 also includes guidance associated with UK meteorological data, such as exposure to driving rain and a noticeable concentration on the effect of wind pressures on roofing components. Roofing underlays have not been left out and now after many years of debate specific limits on wind uplift resistance have been imposed. By following the guidance and advice given in the standard we can now realistically design and build our homes in a way to better prepare them for high winds and stormy conditions. This is very relevant as the majority of damage reports come from domestic dwellings, where the average cost of damage is at least £300 million per year.

Extreme wind conditions have in the past resulted in entire roofs being lifted off a building. New building codes will have reduced the risk, but these roof failures demonstrate the strong lifting forces that can be exerted upon a roof when wind passes overhead. The suction effect of negative wind pressure, such as on the leeward side of a building can result in tiles or slates being dislodged. BS5534: 2018 has gone some way to safeguard against this risk with its recommendations, not just with more stringent fixing requirements for slates and tiles, but also for the underlay.

The emphasis on underlays

The benefits of a roof underlay positioned beneath a primary water shedding layer have been realised for many years. Even before a pitched roof is completed, a quickly installed underlay will keep the construction dry before the outer layers are in place. Once the roof is completed, the underlay will act as a back-up to the tile or slate covering by providing a secondary water shedding function. The underlay is also expected to resist a significant proportion of wind load

imposed on the outer covering and it is this function that is now being addressed.

The potential effect of an underlay subjected to excessive wind loading is for it to balloon upwards, toward the tile or slate covering. If the wind resistance of the underlay is inadequately low or it has been installed with excessive drape, it could balloon to such an extent that it impacts upon the tiles or slates, causing them to dislodge. The tiling batten will help to restrain the underlay to an extent, but in the case of large format tiles where the batten gauge is sizeable the underlay deflection would be more significant.

A greater responsibility has therefore been placed on the underlay to cope with these wind forces and it is appropriate for BS5534: 2018 to set the parameters. The Code of Practice now also includes a new annex which describes the procedure for assessing an underlays' wind uplift resistance to a more stringent level than was previously required. When tested to the new standard the recorded values will determine the product's suitability for use in certain areas of the country. The document consequently includes a UK wind zone map, derived from a map of wind velocities, which correlates with EN 1991-1, the relevant Eurocode concerning Wind Actions.

Wind zones according to Annex A

These minimum wind resistance requirements are applicable for building projects where positive wind pressure from beneath is limited by a continuous internal lining. The ceiling in this case will consequently be considered continuous, which for today's energy efficient modern buildings should be regarded as standard practice. The figures are for an underlay laid with a drape of 10mm and a batten gauge of 345mm.

- Zone 1: 820Pa
- Zone 2: 975Pa
- Zone 3: 1150Pa
- Zone 4: 1330Pa
- Zone 5: 1600Pa

The following conditions apply:

- ridge height not greater than 15 m;
- roof pitch between 12.5° and 75°;
- site altitude not greater than 100 m;
- no significant site topography;

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www.windpressure-calculator.tyvek.co.uk

Additional values according to specification of internal linings and fenestration:

- 1 600 N/m² when a continuous ceiling is present;
- 1 900 N/m² when no ceiling or non-continuous ceiling is present: continuous and non-continuous.
- 2 350 N/m² when no ceiling or no continuous ceiling is present and a permanent dominant opening is present on an external face of the building.

Minimum underlay requirements:

There will undoubtedly be many building projects in the UK where the conditions above do not apply. In these instances the standard requires that additional calculations will need to be taken to determine the values that are required. The values conveyed in the document are indeed minimum standards and careful selection of the underlay will be needed to ensure that the recorded wind resistance values are suitable for the job. Ideally the underlay would be capable of tolerating all the conditions that would be encountered in all 5 wind zones.

The Tyvek® solution

As set out within BS5534: 2018 underlay manufacturers are required to clearly indicate the suitability of their product in accordance with the standard. The tables below indicate zonal suitability for the Tyvek roof underlays currently available in the UK.

| Tyvek® Supro | | | |
|--------------|-----------------------------|------------|------------------|
| BATTEN GAUGE | WIND UPLIFT RESISTANCE (Pa) | | ZONE SUITABILITY |
| | Battened lap | Taped lap* | |
| ≤ 345 mm | 1643Pa | 3371Pa | 1 to 5 |
| ≤ 250 mm | 3272Pa | 3371Pa | 1 to 5 |
| ≤ 100 mm | 3272Pa | 3371Pa | 1 to 5 |

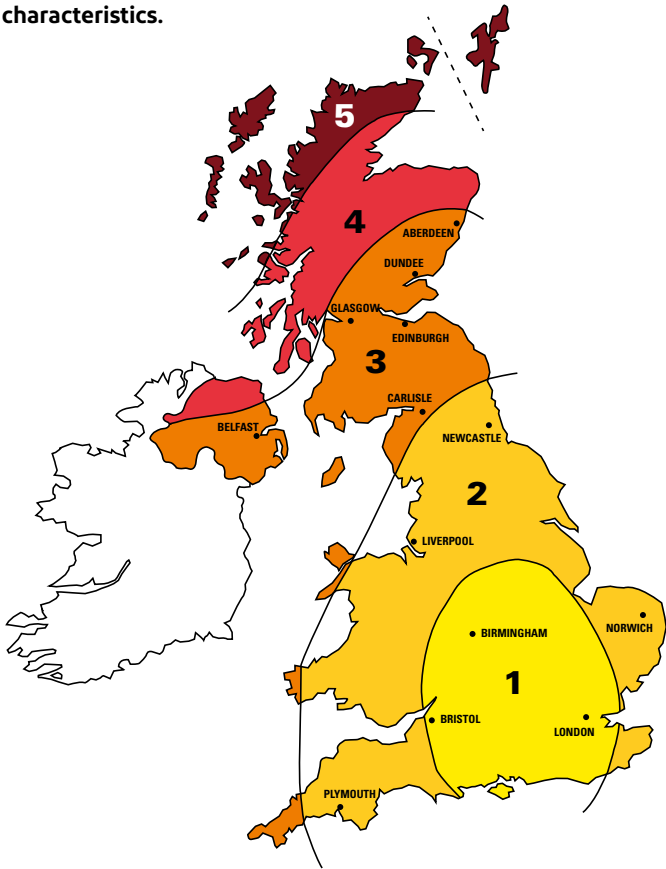
| Tyvek® Supro Plus | | | |
|-------------------|-----------------------------|------------|------------------|
| BATTEN GAUGE | WIND UPLIFT RESISTANCE (Pa) | | ZONE SUITABILITY |
| | Battened lap | Taped lap* | |
| ≤ 345 mm | 1750Pa | 3204Pa | 1 to 5 |
| ≤ 250 mm | 1750Pa | 3204Pa | 1 to 5 |
| ≤ 100 mm | 1750Pa | 3204Pa | 1 to 5 |

Zone Suitability:

The wind uplift resistance figures for the Tyvek® underlays in the tables apply to applications where a well-sealed ceiling is present, ridge height is not greater than 15 m, roof pitch is between 12.5° and 75°, site altitude is not greater than 100 m, and no significant site topography is present. Projects outside of these parameters may require a greater wind uplift resistance. If in doubt please contact the DuPont™ Tyvek® Building Knowledge Centre (details on back page) where specific wind uplift calculation can be carried out.

Tyvek® - unrestricted use:

A Tyvek® underlay with a taped lap will satisfy all geographical locations, all site conditions and all building characteristics.



The designated wind zones range from Zone 1 with moderate conditions to Zone 5 that typically encounter higher wind speeds.

Please note: Ireland is classed as zones 3 and 4.



The suitability of underlays in respect to wind uplift is defined by BS5534 (The code of Practice for slating and tiling,) using the zonal method as described previously. Annex A of the standard describes five geographical wind zones within the United Kingdom with ascending design wind pressures allocated to each zone.

However, these design wind pressures for each zone are only applicable if the site of the construction falls within the following parameters:

- ridge height not greater than 15 m;
- roof pitch between 12.5° and 75°;
- site altitude not greater than 100 m;
- no significant site topography;

Where a construction site falls outside of these parameters the standard suggest that a further calculation be undertaken (as defined by Annex H of BS5534,) to give a revised Design wind pressure.

To ensure full compliance with the standard the Tyvek® Building Knowledge Centre have created a user friendly, BRE calibrated calculation tool to quickly ensure the suitability of Tyvek® roofing products in all locations across the United Kingdom. This tool is free to use at the following link:

www.windpressure-calculator.tyvek.co.uk

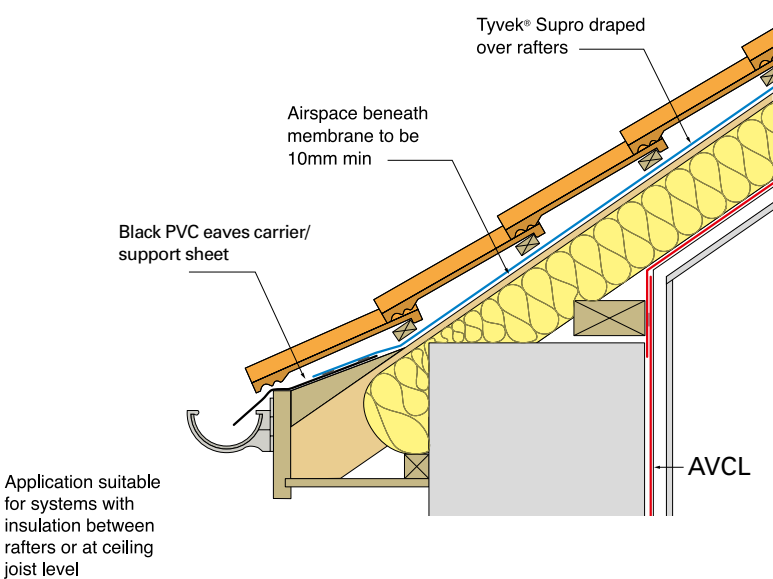
Alternatively, our Building Knowledge Centre can be contacted on +44 (0) 117 452 9050 or the numbers on the back of this manual.

DuPont™ Tyvek® membranes Installation in pitched roofs

Eaves Detailing

The following pages contain information on how best to install Tyvek® membranes in pitched roof constructions. No provision for ventilation at eaves or ridge is included in these recommendations. BBA references are included where appropriate.

Fig. 25 - Membrane unsupported over rafters



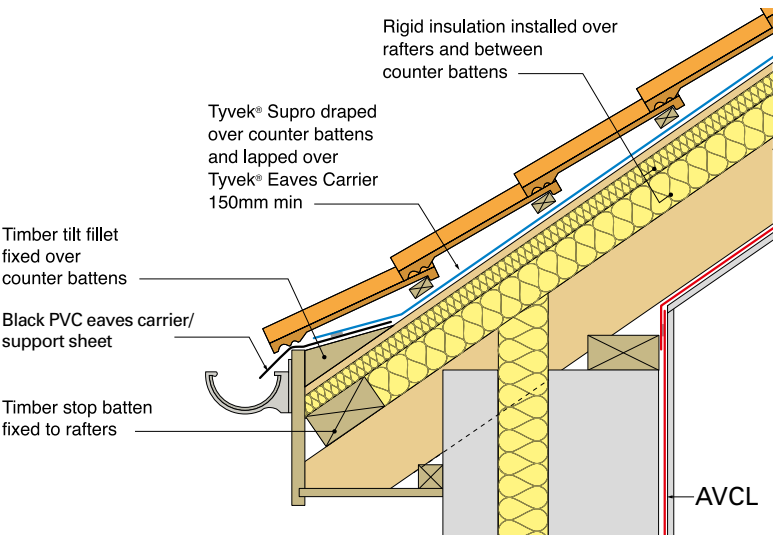
In both of these details, Tyvek® Supro is installed in a draped condition over rafters or counter battens.

A nominal drape in the membrane is required to allow sufficient drainage beneath the tiling/slating battens.

The membrane may come into contact with the insulation with no risk of tenting (capillary action).

Air infiltration beneath the membrane should be prevented by ensuring air-tightness at the fascia and soffit locations. Insulation pushed up to the underside of the membrane will also be effective, but may obstruct the drainage of moisture over the membrane.

Fig. 26 - Membrane unsupported over counter battens

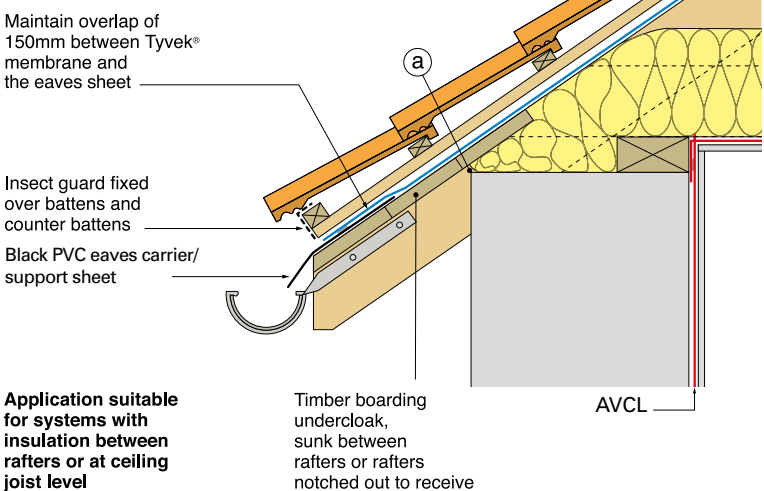


Note:
Please refer to the wind uplift information on pages 15 & 17 for further guidance on unsupported applications.

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Eaves Detailing

Fig. 27 - Membrane unsupported over rafters (sealed)



Both of these details show Tyvek® Supro or Tyvek® Supro Plus installed unsupported over rafters. The membrane is laid in a taut condition with counter battens fixed over. Sealing the system is easily achieved by taping the laps.

An insect mesh should be fixed at the eaves to prevent intrusion into the batten zone.

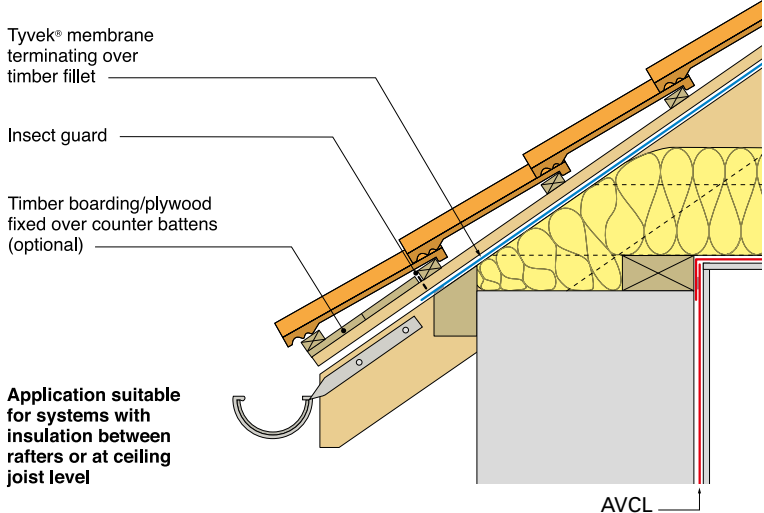
Both details include no fascia board or soffit:

Fig. 27 includes a timber undercloak at the overhang with the membrane unsupported over rafters (sealed) membrane dressed onto an eaves sheet.

Fig. 28 is an alternative arrangement showing the Tyvek® membrane terminating before the gutter.

Air infiltration beneath the membrane should be prevented by ensuring air-tightness at **a**.

Fig. 28 - Membrane unsupported over rafters (sealed)

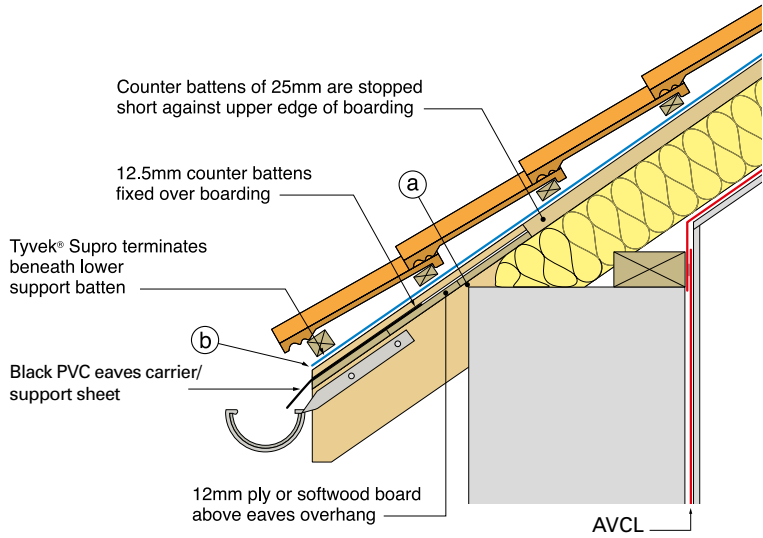


Note:
Please refer to the wind uplift information on pages 15 to 17 for further guidance on unsupported applications.

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Eaves Detailing

Fig. 29 - Membrane unsupported over counter battens



These details illustrate Tyvek® Supro installed in a draped condition and are suggested in order to overcome detailing of the timber undercloak. Once again, both details include no fascia board or soffit:

Fig. 29 includes a timber undercloak fixed over rafters.

Fig. 30 shows the timber undercloak notched into the rafter.

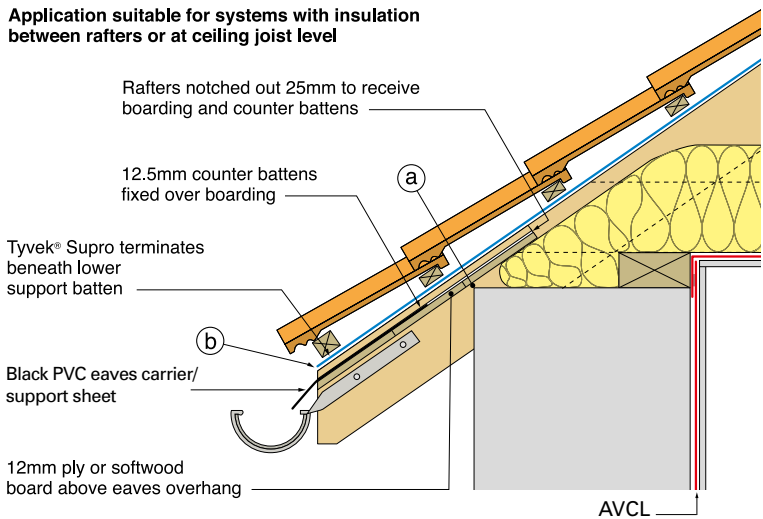
In both instances a small counter batten or lathe is fixed over the boarding to ensure continuous drainage to the eaves is maintained.

Air infiltration beneath the membrane should be prevented by ensuring air-tightness at (a).

Preventing air infiltration beneath the membrane at (b) may be difficult to achieve. Attention at these locations should therefore be paid to minimise air ingress.

Fig. 30 - Membrane unsupported over rafters

Application suitable for systems with insulation between rafters or at ceiling joist level

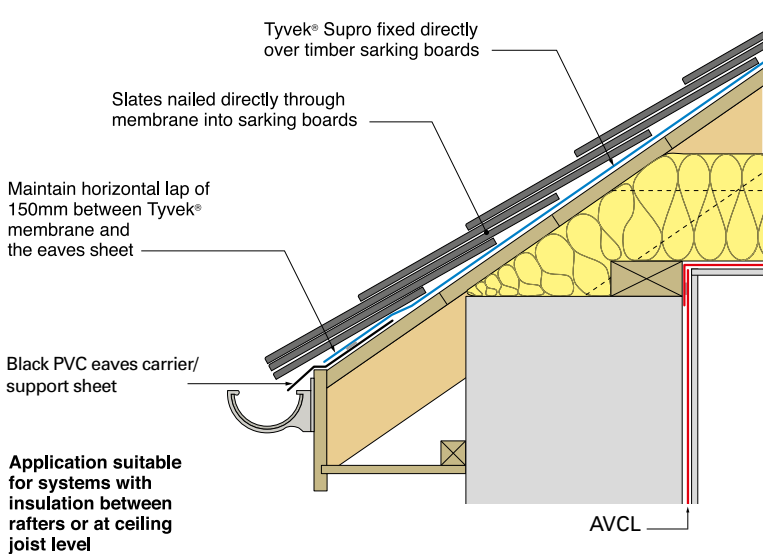


Note:
Please refer to the wind uplift information on pages 15 & 17 for further guidance on unsupported applications.

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Eaves Detailing

Fig. 31 - Membrane supported over timber sarking



Boarded roofs are common to geographical locations that experience high exposure to driving rain, typically Scotland.

Tyvek® Supro should be laid directly onto the boarding or draped over a counter batten.

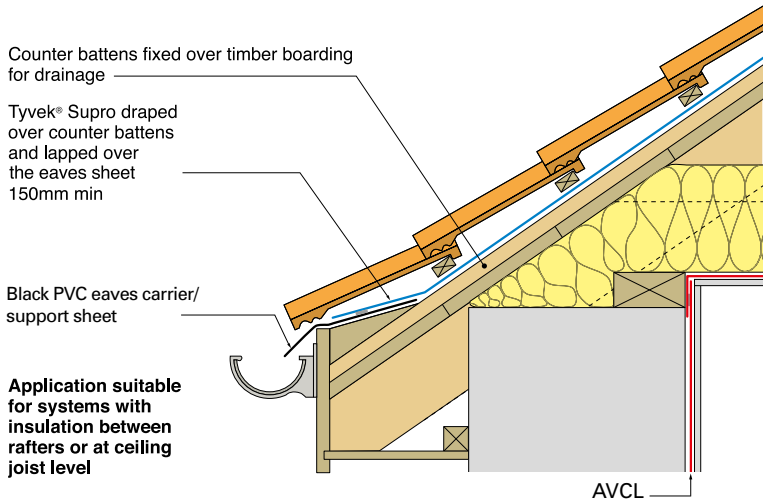
Fig. 31 illustrates typical Scottish practice where the roofing underlay is laid over the sarking board. Slates are then secured directly over the membrane with no battens or counter battens included.

Fig. 32 incorporates battens and counter battens and is applicable to systems with slates or tiles.

A sealed roof system can be achieved with both methods of application by specifying Tyvek® Supro Plus and taping all laps in the membrane. This is feasible only when the membrane is laid in direct contact with the boarding.

Air infiltration beneath the membrane should be prevented by ensuring air-tightness at the fascia and soffit locations. Insulation pushed up to the underside of the sarking board will also be effective.

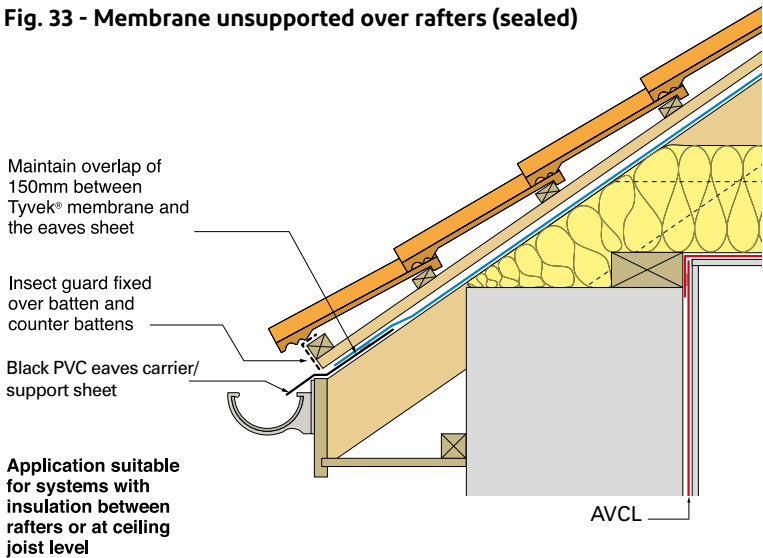
Fig. 32 - Membrane unsupported over timber sarking



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Eaves Detailing

Fig. 33 - Membrane unsupported over rafters (sealed)



Both of these details are suitable if a sealed system is required, as the membrane is laid in a taut condition with counter battens fixed over. Sealing the system is achieved by taping all horizontal laps.

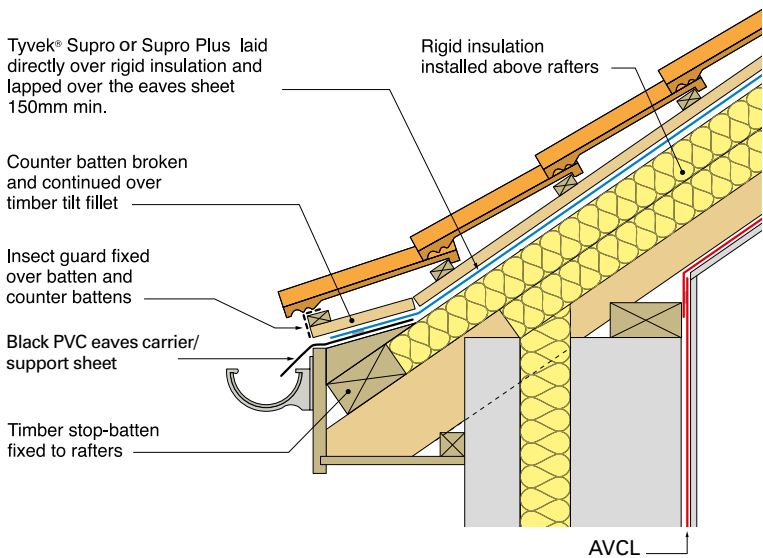
An insect mesh should be fixed at the eaves to prevent intrusion into the batten zone.

Fig. 33 illustrates Tyvek® Supro or Tyvek® Supro Plus laid taut over rafters with counter battens fixed over. The membrane runs down the full length of the rafter and is dressed onto a Tyvek® membrane supported over insulation (sealed) eaves carrier.

Air infiltration beneath the membrane should be prevented by ensuring air-tightness at the fascia and soffit locations. Insulation pushed up to the underside of the membrane will also be effective, but may obstruct the drainage of moisture over the membrane.

Fig. 34 is an alternative arrangement showing Tyvek® Supro or Supro Plus dressed over a timber tilt fillet. In this case a warm roof with insulation over the rafters is shown.

Fig. 34 - Membrane supported over insulation (sealed)

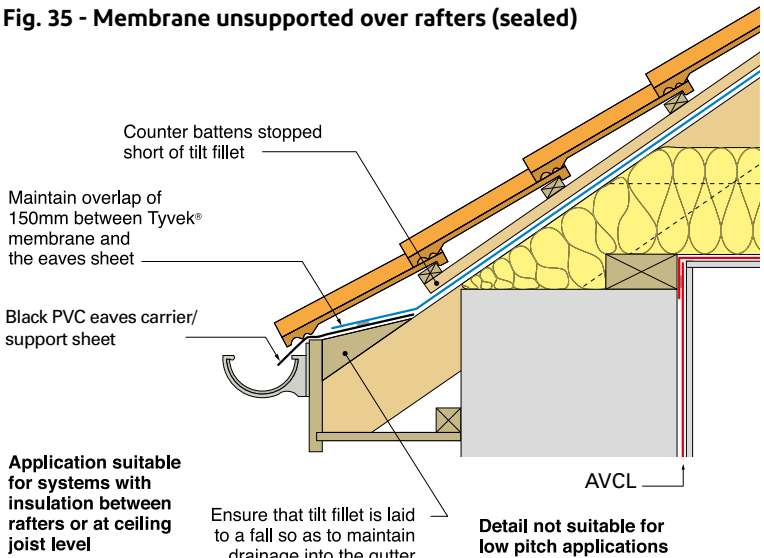


Note:
Please refer to the wind uplift information on pages 15 & 17 for further guidance on unsupported applications.

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Detailing

Fig. 35 - Membrane unsupported over rafters (sealed)



This is a slight variation on the sealed roof details illustrated on page 17 Again Tyvek® Supro or Supro Plus is laid in a taut condition with counter battens fixed over. The laps can then be sealed using adhesive tape.

In this detail the counter batten is stopped short of an enlarged tilt fillet which supports the tiles/slates.

Air infiltration beneath the membrane should be prevented by ensuring airtightness at the fascia and soffit locations. Insulation pushed up to the underside of the membrane will also be effective, but may obstruct the drainage of moisture over the membrane.

EAVES DETAILING - GENERAL COMMENTS

We have tried to be thorough with the eaves details illustrated in this technical guide in an attempt to match a variety of individual roof specifications. However, it will not always be possible to achieve complete coverage of all roof designs. Care should therefore be taken if adapting a detail to suit certain design parameters. It is most important to ensure that the Tyvek® membrane can adequately shed any water to the eaves efficiently and without risk of penetration into the structure and is not exposed to UV for a period exceeding 4 months.

Note:
Please refer to the wind uplift information on pages 15 & 17 for further guidance on unsupported applications.

Ponding of water on the membrane and back-falls on timber tilt fillets should be avoided.



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Detailing

Fig. 36 - Membrane unsupported over rafters

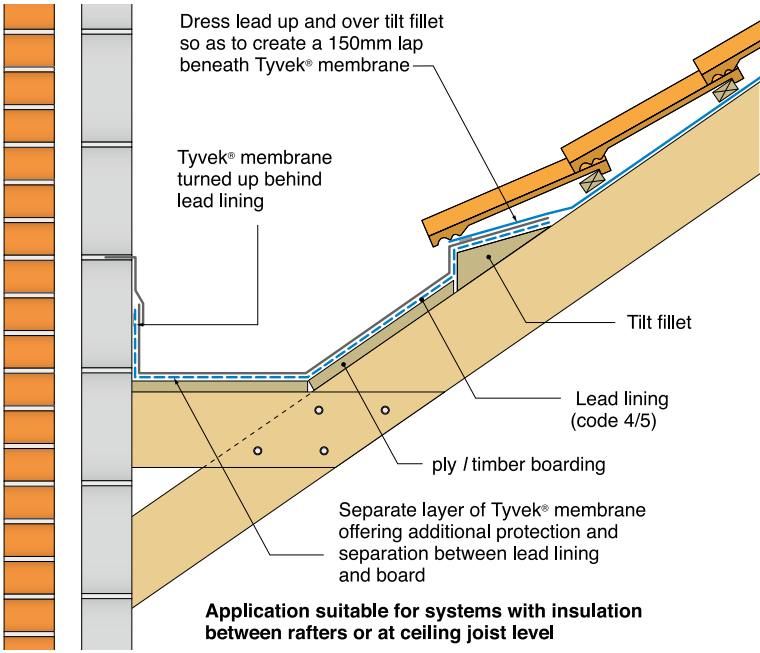
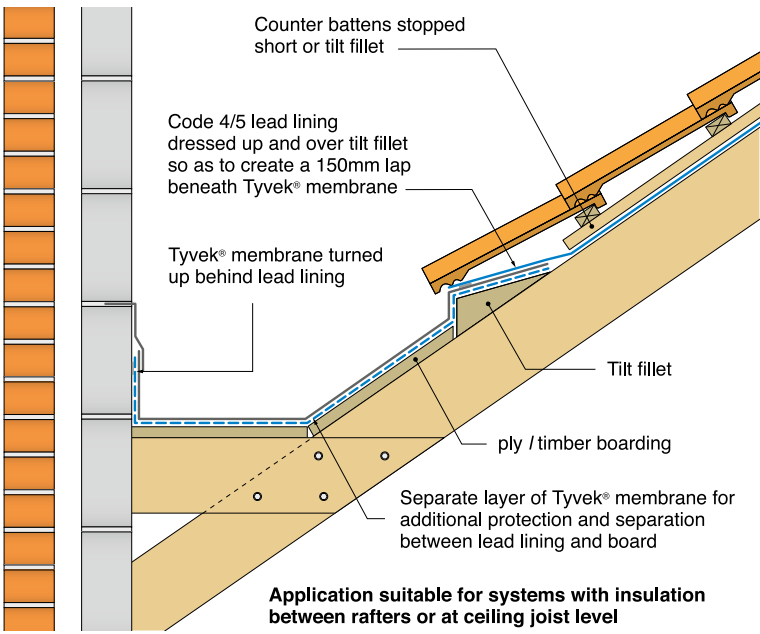


Fig. 37 - Membrane unsupported over rafters (sealed)



Lead lined gutters

A separate layer of Tyvek® beneath a lead lined gutter will provide additional protection against water ingress. As a separation layer the membrane will allow movement to occur between the lead and the supporting board as a result of thermal expansion.

Parapet (Fig. 36)

Lay a strip of Tyvek® over the timber/ply board extending up and over the timber tilt fillet/edge batten. Dress the Tyvek® membrane up the face of the parapet wall to terminate behind the lead flashing.

The roofing underlay should be dressed over the gutter lining with a 150mm min overlap.

Parapet (Fig. 37)

Similar detail includes a counter batten over the underlay.

Note:
Please refer to the wind uplift information on pages 15 & 19 for further guidance on unsupported applications.

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Detailing

Fig. 38 - Valley: Traditional Method

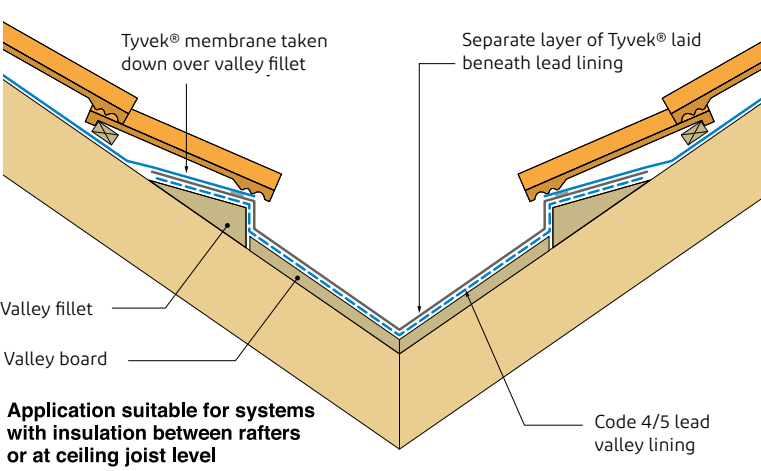
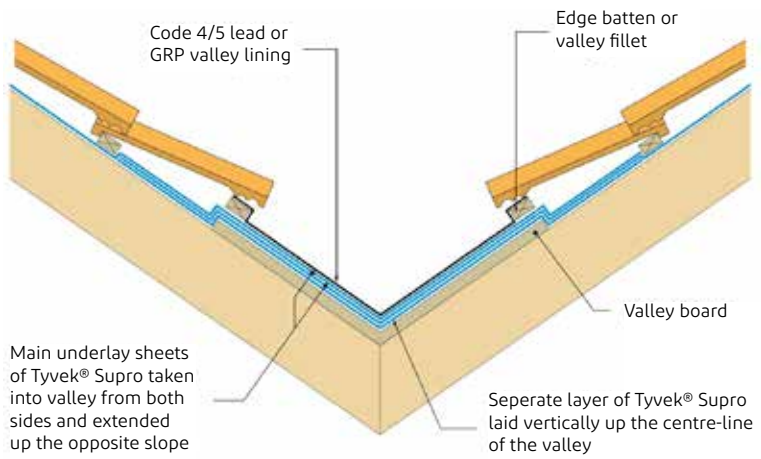


Fig. 39 - Valley: Preferred Method



Valley – Traditional Method (Fig. 38)

Lay a strip of Tyvek® vertically up the centre line of the timber/ply board, extending up and over the timber valley fillets on each side. Apply the valley lining, either in lead or GRP. Terminate the main Tyvek® roofing sheets over the valley fillet, maintaining a 150mm lap over the valley lining.

Valley – Preferred Method (Fig. 39)

Lay a strip of Tyvek® vertically up the centre line of the timber/ply board, extending up the roof slope on each side. Dress the main Tyvek® underlay sheets into the valley from both sides and extend up the opposite slope so they terminate well under the tile or slate covering. The end result is a 3-layer protection system.

Note:
Please refer to the wind uplift information on pages 15 & 17 for further guidance on unsupported applications.

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Detailing Non-ventilated and sealed systems

Fig. 40 - Duo-pitch ridge

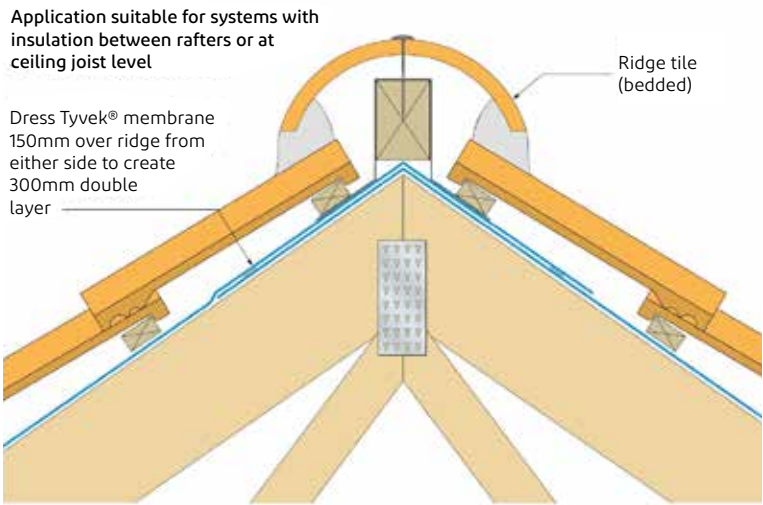
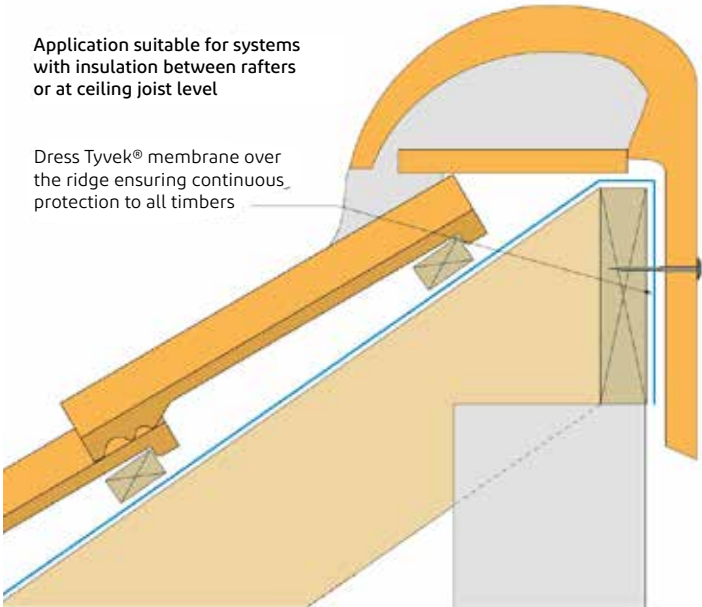


Fig. 41 - Mono-pitch ridge



Ridges

As roof ventilation is not required when using a Tyvek® vapour permeable underlay, it will not be necessary to form a “break” at the ridge. The underlay should therefore continue past the detail helping to maintain a continuous secondary water shedding layer across the entire roof area.

Duo-pitch (Fig. 40)

Extend the Tyvek® membrane over the ridge by 150mm either side. A “double felted” layer of min. 300mm will then be achieved.

Mono-pitch (Fig. 41)

Dress the Tyvek® membrane over the ridge batten, offering maximum protection to the roof structure, by extending the Tyvek® underlay behind the monoridge tile.

Sealed Systems

The Tyvek® underlay can be sealed at laps and perimeters by using Tyvek® Tape 2060B (single sided) or Tyvek® Double-sided Tape (acrylic).

Note 1:
Ridge tiles may need to be mechanically fixed to comply with the wind uplift requirements of BS5534 Annex A.

Note 2:
Please refer to separate Technical Guidance where housing projects are covered by specialist insurance schemes such as NHBC Buildmark. This may affect the ridge detail and the provision for ventilation.

Note 3:
Please refer to the wind uplift information on pages 15 & 17 for further guidance on unsupported applications.

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Detailing Non-ventilated and sealed systems

Fig. 42 - Verge

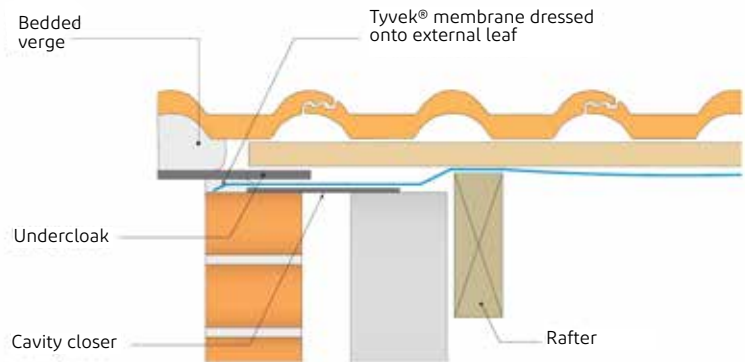


Fig. 43 - Abutment

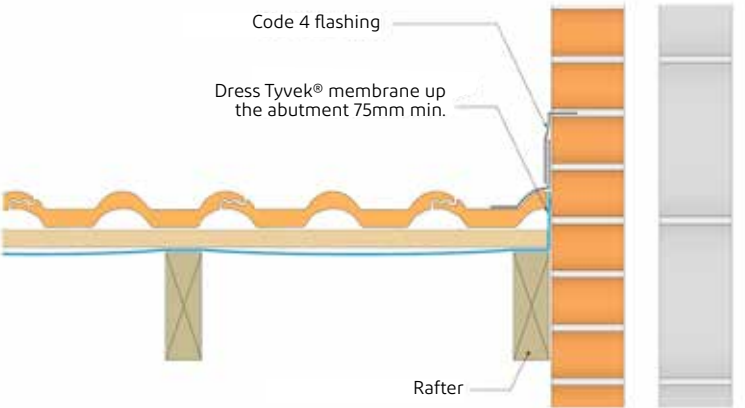
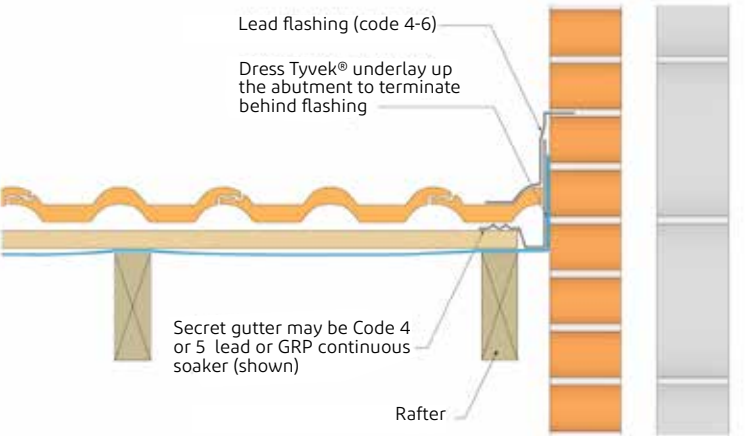


Fig. 44 - Abutment (secret gutter)



Verge (Fig. 42)

It is important to ensure that the Tyvek® membrane is dressed so as to prevent moisture ingress into the roof system.

The membrane should be extended to the external face of the wall and secured with a timber batten or dressed into mortar. If a fascia or barge board is being used, terminate the membrane against the rear face.

Abutment (Fig. 43)

The Tyvek® underlay should be taken up the wall by at least 75mm or ideally behind the lead flashing.

Abutment (Fig. 44)

If a secret gutter is used terminate the membrane over the fixing batten.

Sealed Systems

To further improve the thermal efficiency of the construction the Tyvek® underlay can be sealed at the perimeters by using Tyvek® Butyl Tape (double sided) or Tyvek® Double-sided Tape.

Note:
Please refer to the wind uplift information on pages 15 & 17 for further guidance on unsupported applications.

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Detailing Non-ventilated and sealed systems

Fig. 45 - Soil vent pipe

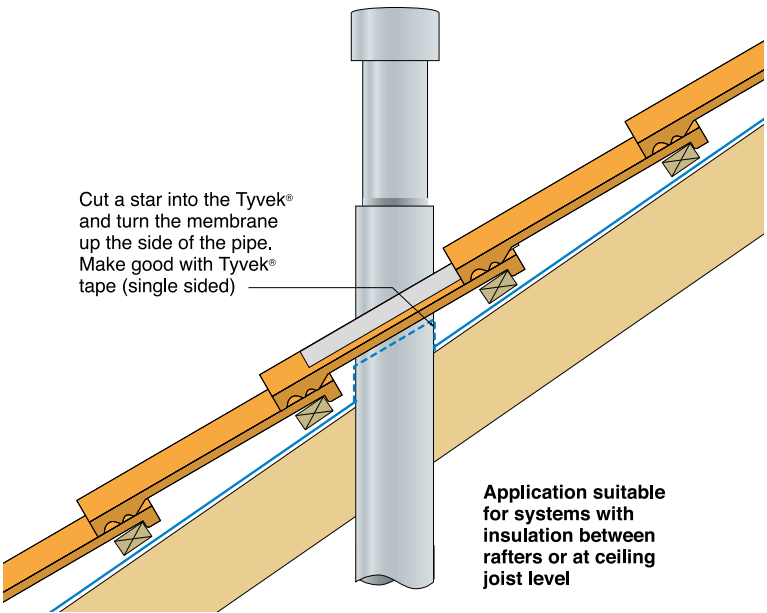
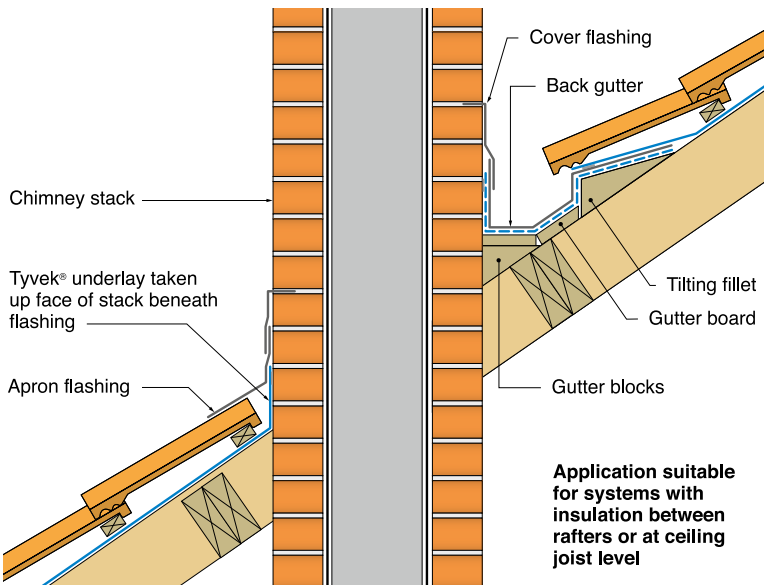


Fig. 46 - Chimney stack



Penetrations

As with all roofing underlays, any surface water should be directed around all penetrations that occur.

Soil vent pipe (Fig. 45)

An “asterisk” or “star” shaped cut should be formed in the membrane and triangular flaps folded upwards. The underlay should then be made good with Tyvek® Tape 2060B (single sided).

Chimney (Fig. 46)

For all intents and purposes the chimney detail incorporates an abutment detail and a parapet gutter, the recommendations for which can be used here.

The main layer of Tyvek® should be taken over the tilt fillet to achieve a 150mm lap over the gutter lining. A separate strip of Tyvek® should be included beneath the gutter lining for thermal movement.

Dress the membrane up the sides of the stack a minimum of 75mm.

At the apron, extend the membrane up the stack and finish behind the flashing.

Note:

Please refer to the wind uplift information on pages 15 & 17 for further guidance on unsupported applications.

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Detailing Non-ventilated and sealed systems

Fig. 47

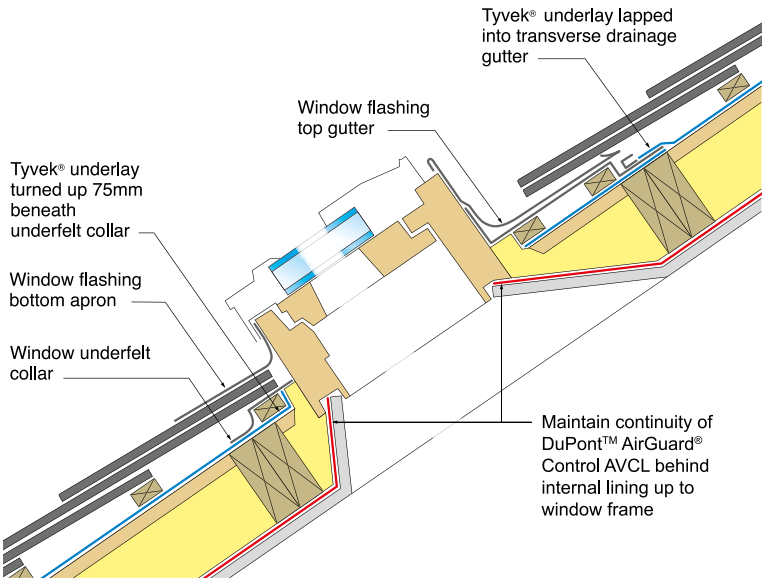
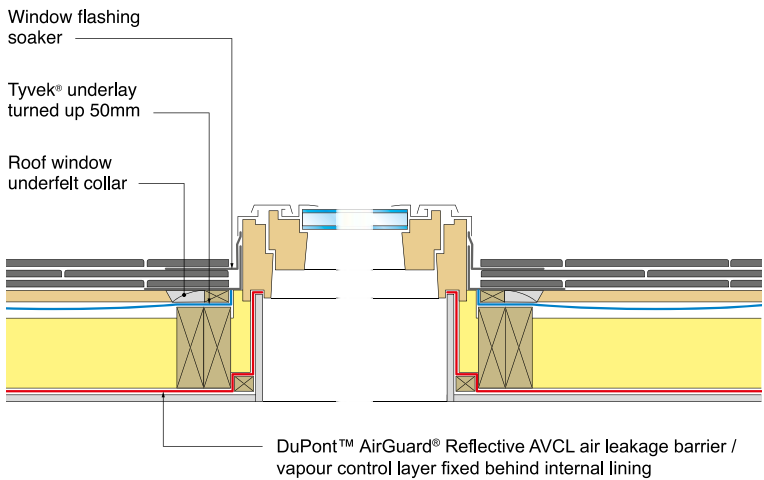


Fig. 48



Roof windows

The criterion when laying an underlay in conjunction with roof windows is the same as for other penetration details, ie. surface water should be directed around the detail.

Top

The Tyvek® underlay should be lapped into transverse drainage gutter above the roof window.

Sides

Turn the membrane up the sides of the window by a minimum of 75mm beneath the underfelt collar. Secure a fixing batten over.

Bottom

Dress the membrane so that it finishes beneath the window's underfelt collar, turning 75mm up a fixing batten if practicable.

Tyvek® Tape 2060B (single sided) may be used for making good to corners and junctions and / or when a sealed system is required.

The recommendations given here represent general advice for laying the Tyvek® underlay around a typical roof window.

Example roof detail is based on Velux GGL centre pivoted roof window by kind permission Velux Company Ltd. For guidance regarding installation of the roof window, the window manufacturer's instructions should be sought.

Vapour control layer

DuPont™ AirGuard® Control or AirGuard® Smart may be installed as the internal AVCL in these details.

Recommendation: Spacing the internal lining off the AVCL with a batten will help maintain the membrane's integrity, as well as to provide a services void for wiring. Please see pages 34 - 37 for details.

For the Installation videos, Installation Guide and Installation Sheets please visit our web site www.building.dupont.co.uk

Restricted details

It is accepted that certain roofing elements will not permit the free passage of moisture laden air to outside atmosphere. Such details will include vapour resistant outer surfaces such as dormer cheeks and valleys clad with lead, and flat roofs with built-up roofing systems.

Whilst these details cannot be regarded as breathable, it is acceptable for them to be incorporated into a non-ventilated Tyvek® system, provided that they represent a relatively small proportion of the roof area.

Fig. 49

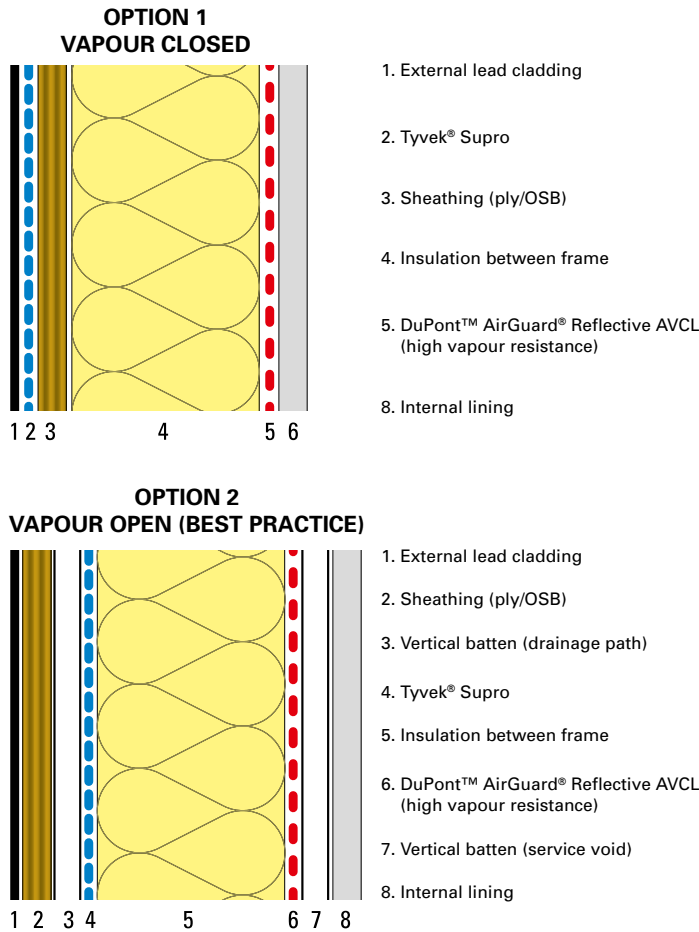
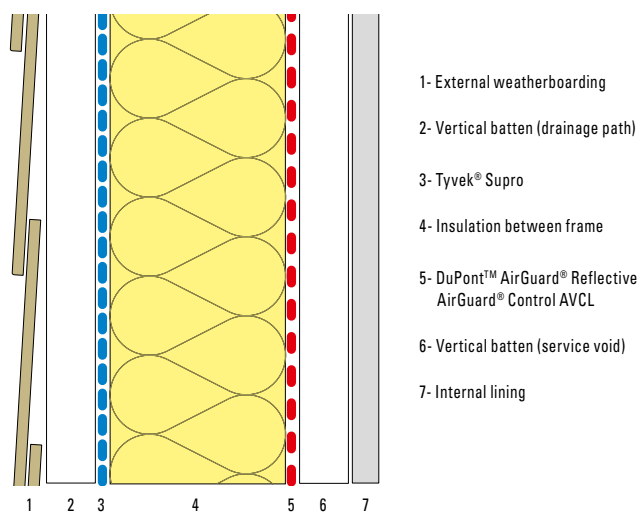


Fig. 50



Dormer walls (cheeks)
Vapour-closed wall system (Fig. 49)

A Tyvek® membrane can also be used to provide secondary protection to the side walls (cheeks) of dormers.

Option 1 to the left shows the most simplistic arrangement where a Tyvek® membrane is acting as a separation layer, directly behind the lead outer cladding. To avoid condensation, this 'vapour-closed' wall element is hugely dependant on a well installed internal AVCL of high vapour resistance.

Option 2 shows the same type of system, but with additional battening. The external battens (vented top & bottom) produce an airspace to assist with vapour permeability and drainage. The internal battens provide a void for electrical wiring and help minimise penetrations through the AVCL. A great improvement in terms of both condensation control and energy efficiency.

In both options the AVCL is providing vapour control and airtightness. Therefore, sealing laps and any penetrations through this membrane is paramount.

Note: Dormer cheeks clad with a rigid metal sheet finish such as copper, zinc, aluminium or stainless steel may be detailed with Tyvek Metal. This breather membrane incorporates a drainage mesh and sits directly behind the outer sheet.

Breathing wall system (Fig. 50)

Dormers can also be finished externally with a discontinuous covering such as tile-hanging or cladding/weatherboarding. If no external ply/OSB sheathing is installed the vapour permeability of these systems will be much improved and the risk of condensation greatly reduced. A true 'breathing wall' system.

Dormer roofs

Recommendations for dormer roofs clad with lead should follow those of lead clad dormer cheeks by using a suitable AVCL. In addition, the condensation risk in flat roofs can be further reduced by specifying a warm roof detail, ie. insulation installed over the joists or above the decking. Dormer cheeks and/or roofs clad with copper, stainless steel or zinc outer sheeting may be detailed with Tyvek® Metal.

Restricted details

Adjoining ventilated roof constructions

It is acceptable and quite common for Tyvek® membranes to be used in refurbishment or building extension projects in a non-ventilated situation. Invariably, the existing construction will incorporate traditional roofing materials with a ventilated roof space. Air movement from the adjoining roof space will introduce air and external humidity which will reduce the roof space temperature and reduce insulation performance. In these circumstances it is important to ensure that any adjoining ventilated roof spaces are isolated from the non-ventilated Tyvek® system.

In order for the membrane to perform its function as a vapour permeable layer, an airtight dividing partition will need to be constructed between the two types of system, so that no common roof space exists.

In a combined system the membrane will provide a similar function to that of a traditional felt, in which case full ventilation should be provided. Installing a Tyvek® underlay in a fully ventilated roof will not be detrimental to the function of the membrane. Its suitability as a secondary water shedding layer will be similar to that of other traditional roof tile underlays.

DuPont™ Tyvek® Supro – Below Pitch Roof Applications

November 2020

The 'double-felt' roof system using a Tyvek® underlay provides a solution for roof systems that are built below the minimum pitch for the tile or slate. This has become accepted practice for over 20 years by many local authorities throughout the UK where a building or design constraint existed.

Tyvek® Supro - installed in two layers with staggered laps has proven to be particularly useful for roofs that suffer from height restrictions such as with single storey lean-to extensions. It is quite common for these roofs to present a relatively small area and are therefore ideal for this method as they would be expected to discharge only a limited amount of rainfall. Whilst this method is very effective it's use is limited in main roofs, especially ones of two storey height. However, this method may be considered depending on the proposed pitch, location data and slate/tile selection.

Wherever possible, our standard pitched roof underlay Tyvek® Supro should be laid at a pitch suitable for the slate or tile that is being used. However, we will accept the 'double felt' method using the following rules as a general guide:

| Tile/slate min pitch | Double felt allowance |
|----------------------|-----------------------|
| 12° - 19° | -3° |
| 20° - 29° | -4° |
| 30° - 39° | -5° |
| 40° + | please contact us |

Following this system will ensure that the absolute minimum pitch allowed with two layers of Tyvek® Supro is 9° (for a tile which has a minimum pitch of 12°). A lower pitch may be acceptable for profiled metal clad industrial roofs or where a tile effect metal roof sheet is used eg. Metrotile, Britmet Tileform.

Rafter length should not exceed 9m for areas of normal exposure to driving rain and 6m for areas of high exposure.

Attention must be paid to details such as hips, valleys and large tilt fillets (eaves sprockets). These are considered 'weak points' in the system as they incorporate lower pitches than that of the main roof areas.

Consideration should also be given to details that penetrate the Tyvek® underlay such as soil vent pipes, chimneys & roof windows. The underlay should turn up against the detail and be sealed with Tyvek® Acrylic Tape (2060B) or correctly lapped to appropriate flashings.

Any cuts and/or corners should be made good with Tyvek® Acrylic Tape (2060B) or Tyvek® FlexWrap EZ to prevent water ingress.

To improve water sealing around fixing penetrations, Tyvek® Butyl Tape may be applied beneath battens prior to their installation.

These factors all govern the risk of water penetration onto the roof underlay. **In all cases the underlay must be laid to a fall with no ponding of water on the underlay under any circumstances. This means that a counter batten, with a DuPont™ Butyl tape seal to the fixing points may be required.**

This policy is not entirely rigid and approval may be given for pitches lower than those stipulated above, according to specific data associated with the proposed project. In these cases details such as roof area, height and location would need to be considered.

Our warranty for Tyvek® Supro is applicable to the double-felting method, provided it is installed in accordance with these guidelines.

For further advice on the use of Tyvek® membranes please contact BKC Technical: + (44) 117 452 9052/9053

Nick Williams, Technical Manager UK & Ireland, DuPont Safety & Construction

Video installation link: <https://www.dupont.co.uk/resource-center.html?BU=pbs&restyle=video>



Detailing Non-ventilated metal roof systems

The risks

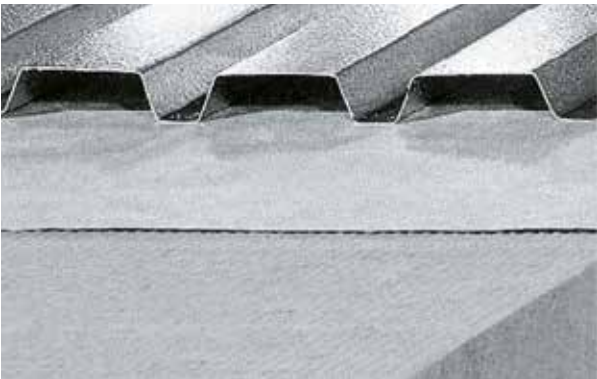
A potential exists for condensation to form beneath metal clad roofs due to the high vapour resistance of the sheet materials employed in this type of construction.

Water vapour that migrates into the roof construction via the internal lining and insulation can condense on the underside of the outer sheets. If allowed to buildup, there is a risk that this condensation will drip back onto the insulation and affect the layer's thermal performance. Metal fixings, the internal lining and indeed the structure are then at risk of suffering from deterioration as a result.

The cycle of events that can occur as a result of night sky radiation can also present a potential risk for roof components and materials to degrade; the temperature drop that occurs during the night increases the risk of condensation forming on the underside of the outer metal sheeting. It is quite common for this moisture to freeze during very cold periods. When the temperature rises the following day, the trapped moisture thaws and saturates the construction once more. The moisture is trapped

within the construction and goes through cycles of evaporation and saturation.

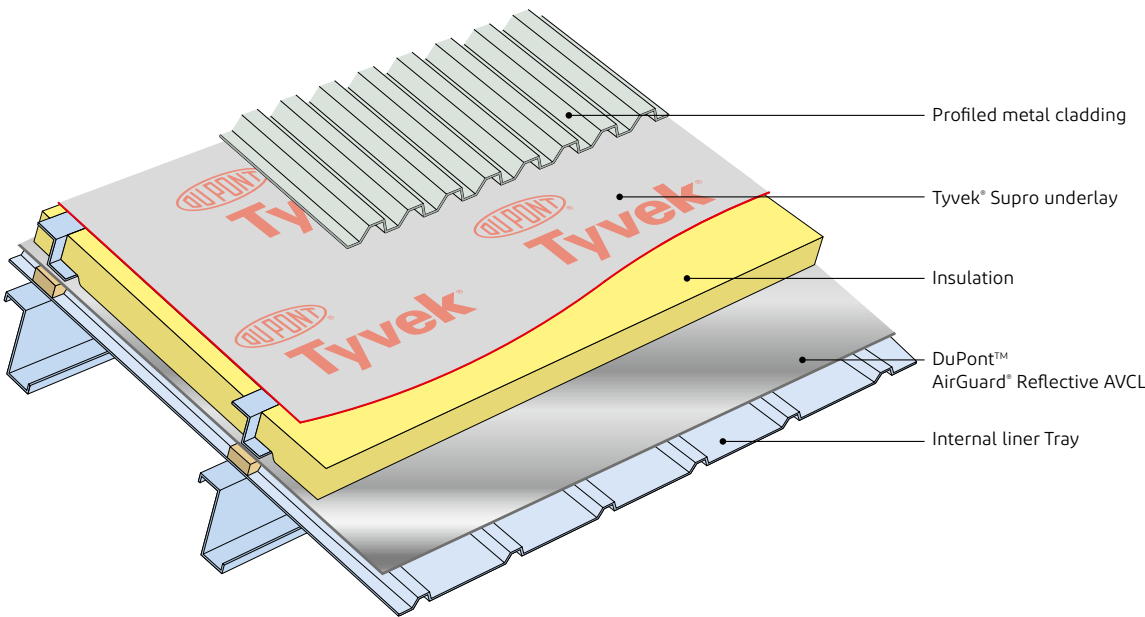
Over time, the weatherproof properties of profiled metal cladding can be compromised by natural weathering and/or the effects of thermally induced movement. This can displace waterproof seals between laps in the sheeting and enlarge penetration points where the sheets are fixed. The risk of moisture ingress, especially as a result of driving rain is increased.



DuPont™ Tyvek® Protection from condensation

The performance of a profiled metal roof can be significantly improved by installing a Tyvek® membrane over the structure and the insulation layer. The high vapour permeability of the Tyvek® membrane will permit the release of vapour through and away from the insulation. The high water resistance of the Tyvek® membrane will prevent any condensed moisture beneath the outer cladding to re-enter the construction, thus ensuring that the insulation operates in a dry environment.

Fig. 51 *



Detailing Non-ventilated metal roof systems

DuPont™ Tyvek® Protection from external moisture

As a secondary water shedding layer, a Tyvek® underlay can protect an insulation layer and the roofing structure from external precipitation. Any moisture that penetrates the primary roof covering will be safely channelled to the eaves by the Tyvek® underlay beneath. The long term durability of the construction is then assured.

Fully supported rigid metal sheet roofs

A Tyvek® underlay can also be of benefit in a standing seam metal roof system. Tyvek® Supro, when installed over a sheathing board or insulation will provide temporary protection during construction, prior to the installation of the external metal sheeting. In addition, when installed over the supporting sheathing Tyvek® Supro will act as a 'slip layer' to allow movement between the steel sheet and the timber boarding. The primary weathering material used in rigid standing seam metal roofing is commonly, copper, stainless steel, aluminium and zinc. These materials are quite capable at keeping the rain out, but similarly are effective at preventing internal water vapour from escaping, possibly leading to condensation beneath the outer sheet. Experience has shown that metals will corrode rapidly from the effects of wetting from condensate leading to white rust. It is therefore important to ensure that any condensation build-up beneath rigid metal sheeting is either eliminated or allowed to drain safely away and not be trapped within the construction layers. In many cases, organisations that specialise in the manufacture and

development of standing seam systems have their own standard details that describe how such a system is designed and constructed. In the case of zinc roofing we can refer to the technical guidance offered by VM Zinc for instance and would recommend that such an organisation is consulted for any such roof system proposals.

Cold roof systems (fig.52a)

In most cases for cold roof construction, condensation control in a standing seam metal system can be achieved by ventilating beneath the supporting outer deck. This will ensure that any water vapour that permeates the insulation will disperse before it has the chance to settle. With an internal AVCL installed and a vapour permeable underlay such as Tyvek® Supro laid over the insulation, all bases, including temporary protection during construction are covered.

Warm roof systems

By far the most efficient type of system in every respect is where the roof structure is situated in a warm internal environment and the thermal insulation layer is installed continuously above. Risks associated with condensation and thermal bridging are greatly reduced. Tyvek® Supro may be specified here as the underlay between the standing seam metal sheet and the supporting board and is suitable for systems such as structural insulated panels (SiPs). Again, on the internal side of the construction is installed an AVCL to limit water vapour transfer and provide airtightness to the system.

DuPont™ Tyvek® Metal (fig.52b)

Also suitable as the underlay in a warm roof system is Tyvek® Metal. This product can be termed a "metal roof drainage membrane" and consists of a Tyvek® breather membrane (Supro) bonded to an open mesh of polypropylene strands approximately 8mm deep. The open mesh will provide adequate support for the rigid sheeting, whilst maintaining an airspace to allow any condensate which forms beneath the metal cladding to drain away. The Tyvek® membrane that is bonded to the mesh is highly water resistant. Tyvek® Metal will allow movement between the steel sheet and the timber boarding and will offer a reduction in sound transmission normally generated by structure borne sounds such as rain-clatter. See installation guidance on page 29.

Air & vapour control layer (AVCL)

A suitable AVCL for use in a standing seam metal roof system is DuPont™ AirGuard® Reflective. Continuity of this layer can be maintained by installing a batten between the AVCL and the internal lining. The batten space will also serve as a service void for wiring.

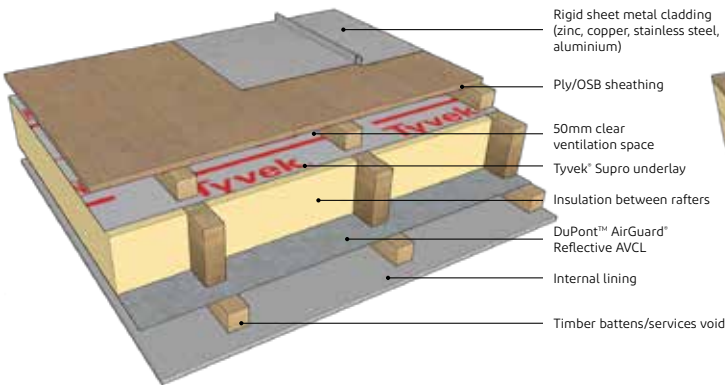


Fig. 52a Cold roof system with Tyvek® Supro

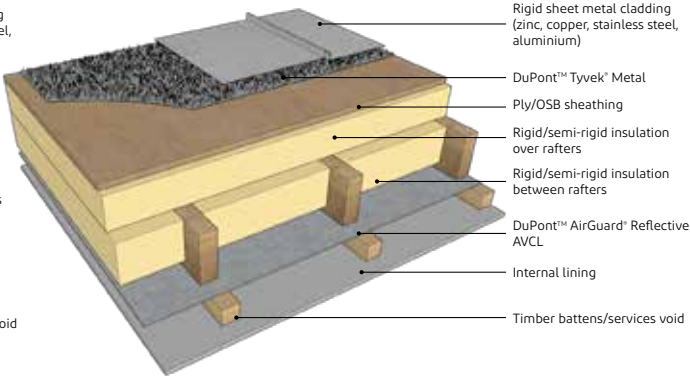
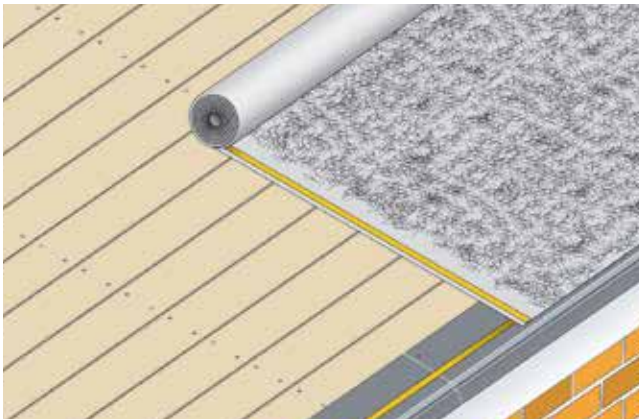


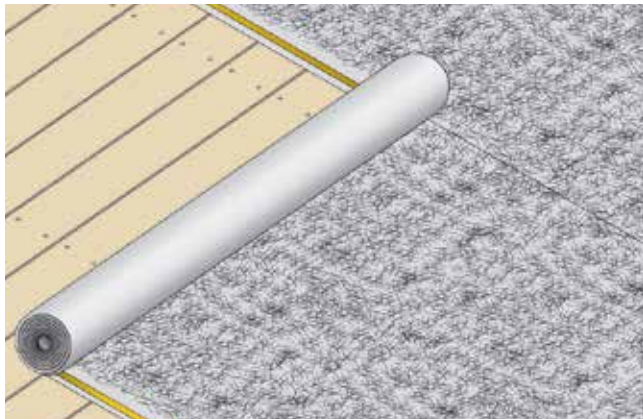
Fig. 52b Warm roof system with Tyvek® Metal

Detailing Non-ventilated metal roof systems

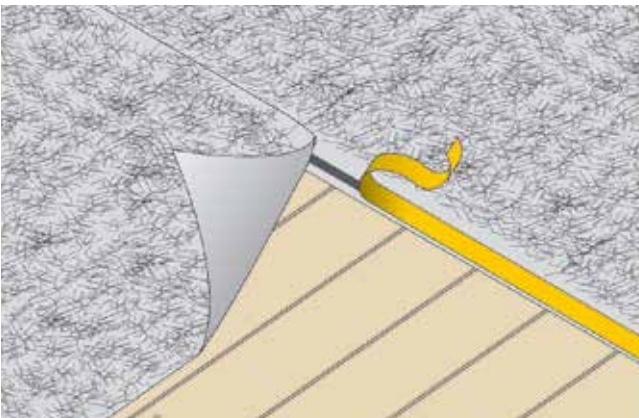
Tyvek® Metal: The installation procedure is as follows:



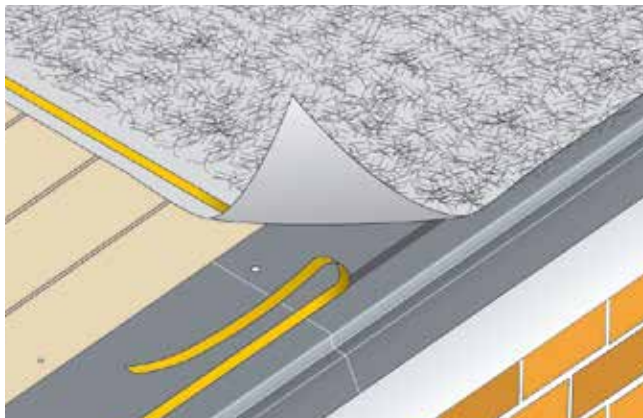
- 1.** Install the eaves sheet as detailed on page 12.
Lay the first run of Tyvek® Metal up-and-over the roof, with the bottom edge lapping on to the eaves sheet. Fix into the board with stainless steel staples or large headed galvanised steel clout nails.



- 2.** Lay the next run of Tyvek® Metal, lapping it 100mm onto the mesh-free selvage of the first run.



- 3.** Peel the backing paper from the self adhesive tape and press the lap down firmly to form a good seal ; between each sheet...



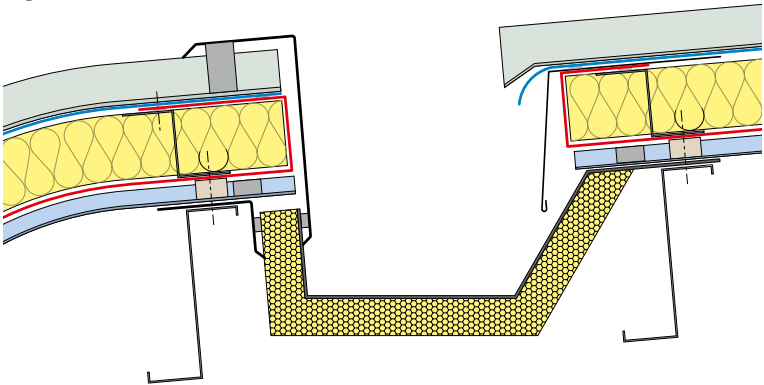
- 4.** ...and over the eaves sheet.

Drainage of moisture from Tyvek® Metal may also be achieved by forming a drainage slot into a soffit.

Please note: Tyvek® Metal is suitable for use on 'vapour closed' sheathing boards of ply or OSB or on a 'vapour open' supporting layer such as timber boarding of nominal size 150mm wide with a 2mm gap (as illustrated above). This latter method should be employed only on warm roof systems such as that illustrated in Fig. 52b (Page 30).

Detailing Non-ventilated metal roof systems

Fig. 53



Eaves (Fig. 53)

Where a Tyvek® membrane is used as the breather membrane in the wall it should be extended onto the roof slope by at least 300mm. The Tyvek® membrane on the roof should be lapped over it and dressed into the gutter. Ensure there is a clear drainage path at the end of the metal sheeting.

Ridge (Fig. 54)

Extend the Tyvek® membrane over the centre line of the ridge by 300mm from both sides, so a double strip of 600mm is formed.

Verge (Fig. 55)

Extend the Tyvek® membrane from the walls 150mm onto the roof. Lap the Tyvek® membrane from the roof a minimum of 150mm over the wall membrane.

**The recommended membranes for use in metal clad roof systems is:
Tyvek® Supro**

Fig. 54

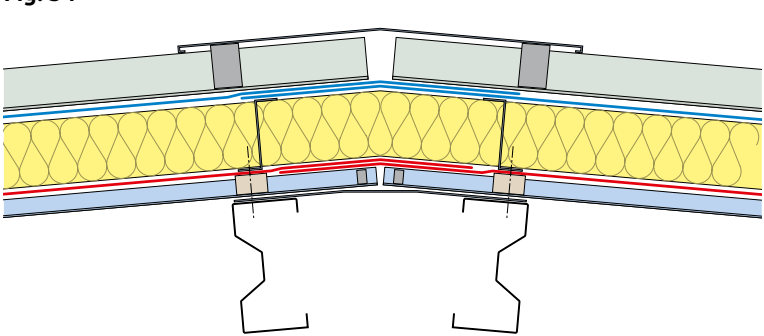
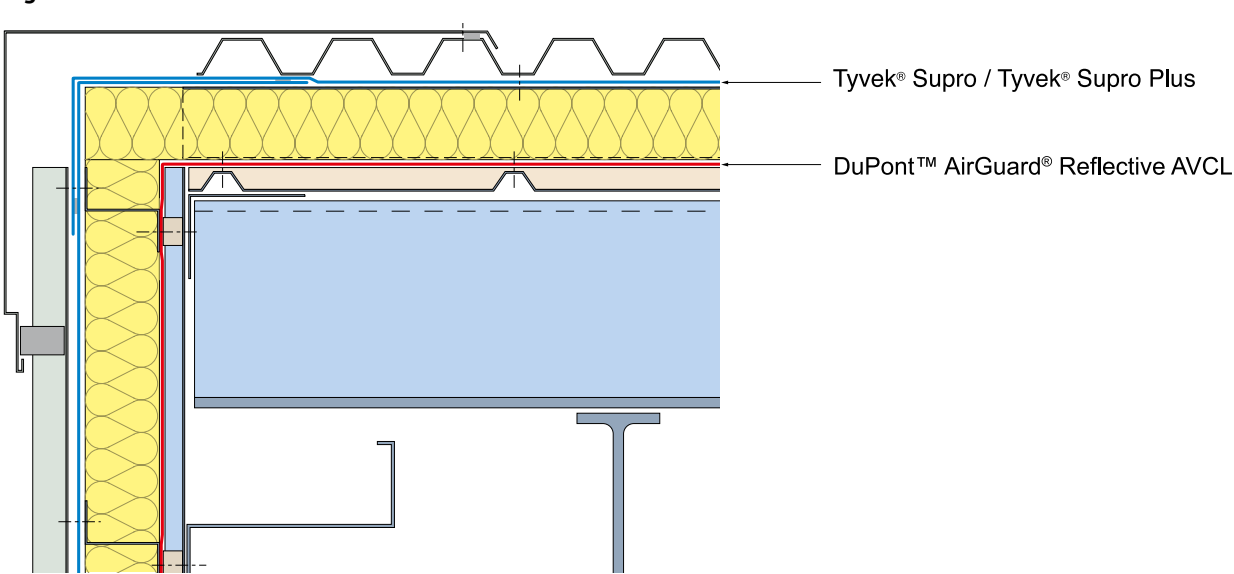
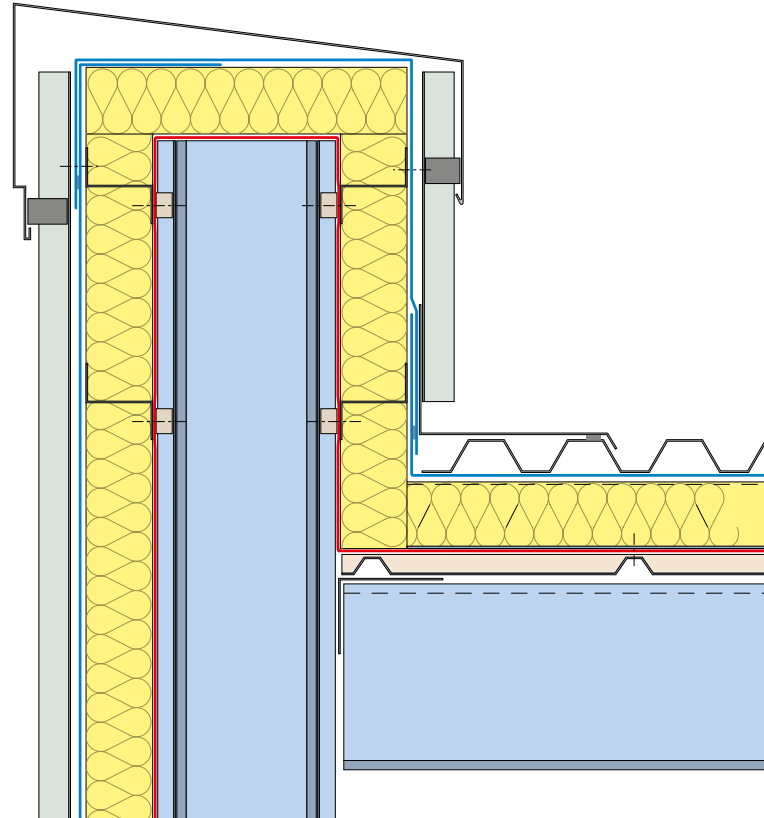


Fig. 55



Detailing Non-ventilated metal roof systems

Fig. 56



Abutment / parapet (Fig. 56)

Dress the Tyvek® membrane up the face of the wall so as to finish 150mm above the surface of the roof. Lap with the Tyvek® membrane on the wall face.

Sealed Systems

To further improve the thermal efficiency of the construction, the laps in the Tyvek® membrane can be sealed by using Tyvek® Tape 2060B (single-sided) or Tyvek® Double-sided Tape (acrylic).

Penetrations through the membrane, roof windows and edge details can also be sealed using Tyvek® Tape 2060B, Tyvek® Double-sided Tape (acrylic) or DuPont™ FlexWrap NF.

Alternatively, Tyvek® Supro Plus which has an integral adhesive tape can be specified.

Specification

Specify the roof membrane as Tyvek® Supro or Tyvek® Supro Plus vapour permeable roof underlay as manufactured by DuPont.

Installation

The Tyvek® membrane should be laid as soon as possible after the insulation has been installed to ensure maximum protection from inclement weather.

On commercial buildings clad with metal sheeting, it is quite common for the membrane to be laid vertically from eaves to ridge, lapping successive runs by 150mm. The fully supported condition in which it is laid sometimes makes this a more practicable method of installation. Tyvek® Supro Plus is most appropriate for this application as the vertical laps in the membrane should be sealed.

The membrane can be taken over the ridge by 300mm or taken over the ridge and down the opposite slope in one run.

Internal Air & Vapour Control Layer

Install DuPont™ AirGuard® Reflective on the warm side of the thermal insulation. All laps in the membrane should be minimum 100mm. Seal all laps, penetrations and abutments with Tyvek® Metallised Tape

Internal Lining - DuPont AirGuard Air & Vapour Control Layers (AVCL's)

DuPont™ AirGuard® Control

In today's modern world, a greater emphasis is being placed on environmental issues and the need to significantly reduce CO2 emissions. It has been reported that buildings in the UK contribute 43% of CO2 emissions - 27% from housing alone. For the prevention of global warming and the benefit of future generations it is **our** obligation to improve the energy efficiency of buildings.

The Building Regulations are already addressing these issues in the form of Approved Documents and in particular Part L, The conservation of fuel and power, now separated into L1 (dwellings) and L2 (buildings other than dwellings). For many years this document has addressed heat loss by conduction and includes various solutions and calculation methods on how to meet current u-value requirements. The theory works, but in practice total continuity of insulation layers can be very difficult to achieve. In reality air infiltration and heat loss by convection will occur through gaps between and around insulation and through hairline cracks in plasterboard linings. These invariably occur during the building drying out process, but are also caused

by settlement and thermal movement over the life of the building.

Building Regulations Approved Document L raises the issue of heat loss by convection and air infiltration under the heading "Limiting air leakage." It states that: "Reasonable provision should be made to reduce unwanted air leakage."

DuPont™ AirGuard® Control air & vapour control layer

DuPont™ AirGuard® Control has been specifically developed for use as a barrier to air leakage. As the majority of vapour transfer through the building envelope will be via convection the membrane may be termed as an AVCL in this regard. However, the membrane's vapour resistance at 26 MNs/g is relatively low and does not fall within the category of an AVCL to BS5250:2011. DuPont™ AirGuard® Control will therefore be an ideal choice for vapour open constructions where a high resistance AVCL is not appropriate. The membrane can be specified as the airtight layer in the ceilings of cold pitched roof systems, helping to reduce

convective heat and vapour transfer into the cold loft space in accordance with BS9250:2007.

Recommendation: Installing a timber batten over DuPont™ AirGuard® Control will help maintain the integrity of the membrane as well as to provide a suitable void for services.

Air & Vapour control layer

DuPont™ AirGuard® Reflective may also be installed where Dupont™ AirGuard® Control is indicated. However, in order to benefit from the extra thermal resistance provided by its low emissivity surface a batten space will need to be incorporated.



DuPont™ AirGuard® Reflective

DuPont™ AirGuard® Reflective is a metallised reinforced polypropylene based membrane designed for use as a continuous air and vapour control layer in walls and warm roof systems. As an internal component the membrane is installed behind a plasterboard lining/ ceiling to provide effective control against interstitial condensation both by diffusion and by convection. The membrane will reduce convective heat loss through the roof construction as well as retaining heat by reflecting it back in. DuPont™ AirGuard® Reflective has been tested in accordance with CE marking and is classified as airtight. The membrane has a very high vapour resistance at 10,000 MNs/g, confirmed by the BBA in Agreement Certificate 08/4548 Product Sheet 4.

To benefit from the membrane's thermal attributes the reflective surface must face a minimum 15mm airspace - usually between the membrane and the plasterboard lining (values for smaller cavities can be established from BS6946). A standard 25mm batten would be ideal

for this and will have the added benefit of providing a services void for electrical wiring and pipework. The batten space will also serve to minimise penetrations through the membrane from plasterboard fixings, light fittings, etc. Whilst this batten space is optional it is highly recommended, as the membrane's continuity is a principal factor in making the complete layer air and vapour tight. A high degree of workmanship is therefore key to a successful pressure test result.

Airtightness

DuPont™ AirGuard® Reflective is completely airtight and therefore will form an integral component in warm roof systems to reduce uncontrolled air leakage and subsequent heat loss. A correctly installed membrane will help to meet the requirements of Approved Document L by limiting the design air permeability well below the required **10m³/(h.m²) at 50 Pa**.

Vapour Control

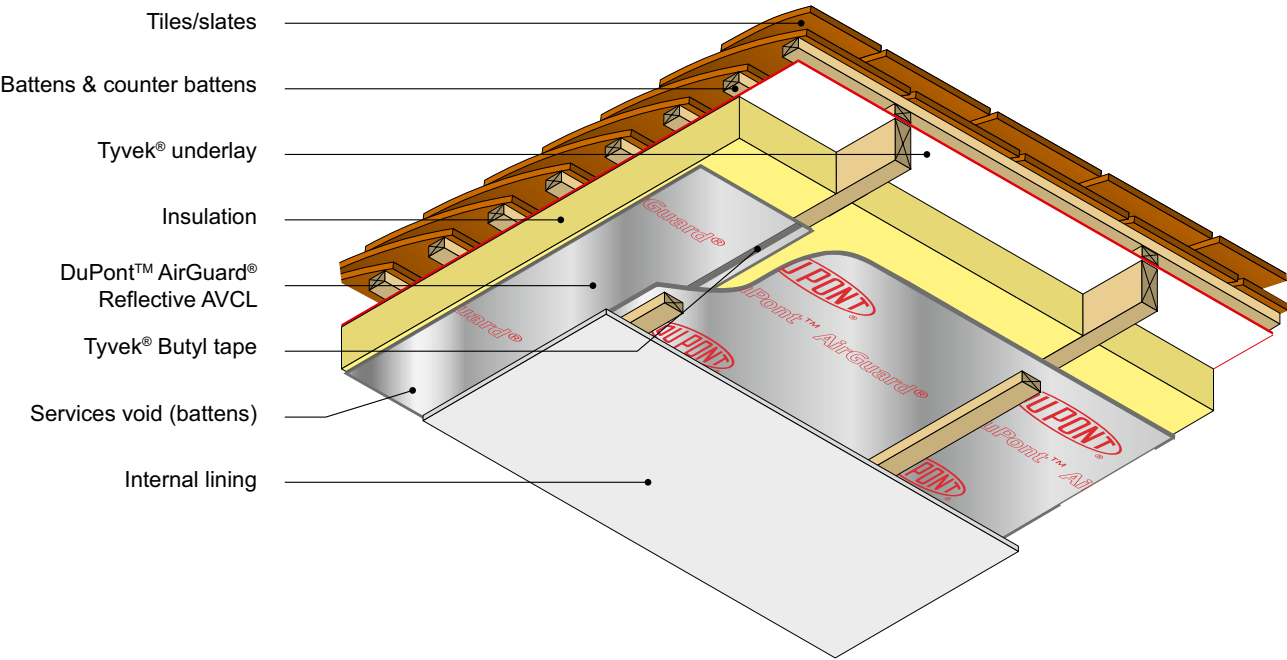
DuPont™ AirGuard® Reflective provides

high resistance to the passage of water vapour both by diffusion and convection. When installed continuously with all laps and penetrations sealed, the membrane will provide effective condensation control for warm roofs in all building types. This includes those of high humidity class, eg. swimming pools, textile factories, etc.

Thermal comfort

The metallised face of DuPont™ AirGuard® Reflective provides a low emissivity surface on the internal side of a warm roof construction. When used with a batten space the membrane will reflect internally generated heat back into the building providing a back-up to traditional insulation. This reduction in heat transmission allows the airspace resistance to be increased to **0.45 m²K/W**, which can be added to the overall U-value of the roof system.

Fig. 57 *



Please refer to page 37 for detailing

Internal Lining

DuPont™ Tyvek® AirGuard® Smart

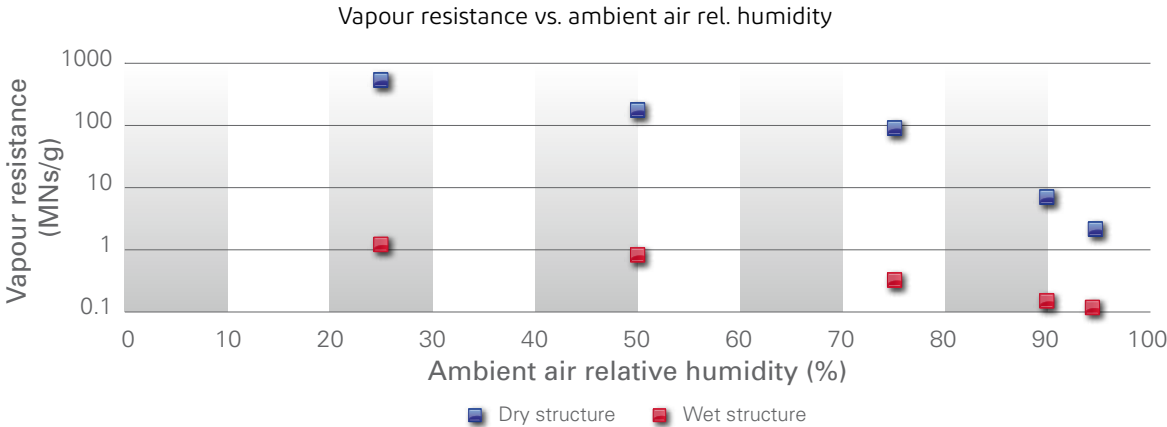
DuPont™ Tyvek® AirGuard® Smart is a strong and lightweight flexible membrane for use as an internally applied airtight vapour control layer (AVCL).

- Outstanding properties:**
- Extreme vapour resistance range from 0.26 MNs/g to more than 150 MNs/g, (Sd value 0.05 m - more than 30 m), therefore highly adaptable → one of the widest vapour resistance spans known in the market
 - Combines drying-out and vapour control function in one layer
 - High drying-out potential = maximum protection against structural damage
 - High tensile strength offering superior insulation support/retention
 - Very robust - offering versatility in site work
 - Airtight
 - Transparent allowing the timber members to be easily located for fixing
 - Easy to install - suitable for use in roof or wall constructions

How DuPont™ AirGuard® Smart works

The graph shows 2 extreme examples:

1. Wet (100%) and 2. dry (0%) building envelope structure and corresponding vapour Rs (resistance) - depending on ambient air relative humidity. The actual vapour Rs is a combination of both the moisture content of the building envelope and relative humidity of the internal air. DuPont™ Tyvek® AirGuard® Smart provides traditional vapour control to the diffusion of vapour from the building interior, whilst offering a high drying-out potential of built-in moisture back into the building.



What happens just after a new build construction or after renovation?

New construction

Condition just after completion: Moisture is confined within the building envelope; damp timbers, insulation, etc, due mainly to wet building processes.

A new-build property will very often have a high relative humidity due to the rapid drying of the building fabric. Hence after completion, the owner has to adequately ventilate the building interior to expel the moisture rather than allow it to migrate through the construction where it can condense and cause harm. If needed the DuPont™ Tyvek® AirGuard® Smart allows moisture within the building fabric to migrate back into the building. Where the moisture content within the structure is high the vapour resistance of DuPont™ Tyvek® AirGuard® Smart will always be low. This will allow the structural elements and the insulation to dry out towards the warm side of the building, in addition to the normal process of vapour diffusion through the external DuPont™ Tyvek® breather membrane.

Renovation

Condition just after completion: Building structure and insulation dry after brief humidity stabilisation.

In the case of a dry building structure, DuPont™ Tyvek® AirGuard® Smart acts as a traditional AVCL, providing effective condensation control and airtightness. Even in temporarily high air humidity zones water vapour diffusion is reduced*. The vapour resistance of DuPont™ Tyvek® AirGuard® Smart will be between 0.26 MNs/g and more than 150 MNs/g, (Sd value 0.5 m - more than 30 m). The migration of newly generated moisture through the construction will be significantly reduced.

* DuPont™ AirGuard® Smart is not suitable for places with permanent high ambient air humidity, such as saunas or swimming pools.

Product Portfolio

- DuPont™ Tyvek® breather membranes
- DuPont™ AirGuard® air and vapour control layers
- DuPont™ Tyvek® and DuPont™ AirGuard® adhesive accessories
- DuPont™ Insta Stik™ Polyurethane Foam Adhesive
- DuPont™ Froth-Pak™ Mini Polyurethane Foam Sealant
- DuPont™ Great Stuff™ Polyurethane Foam Sealant

DuPont™ Tyvek® Supro / Tyvek® Supro Plus

The market-leading breather membrane

Tyvek® Supro
Multi-purpose, reinforced, vapour permeable membrane, for use in wall systems where extra weather protection and strength is required. May be installed in direct contact with boards or insulation, but also free-hanging where there is no continuous supporting substrate. Also suitable for use as an insulation support in timber suspended floors and as a Type LR pitched roof underlay. Class W1 water resistance.

Tyvek® Supro Plus; as Tyvek® Supro but with integral adhesive lap tape to improve wind-resistance and/or improve building airtightness.

BBA certificate: 08/4548 – Product Sheets 1, 2 & 8

- Available with integrated tape (Supro Plus)
- Excellent water resistance
- Airtight / Windtight - unrestricted compliance with BS5534
- Vapour-permeable
- Provides superior air and moisture management for commercial and residential buildings
- For all supported and unsupported pitched roof applications - warm, hybrid and cold roofs
- Suitable for Scottish sarking board systems
- Suitable for wall and floor applications
- Long term performance



| Properties | |
|---------------------------------------|---|
| Style name | 2507B |
| Composition | Composite of High Density Polyethylene, Polypropylene |
| Roll size | 1.0 m x 50 m / 1.5 m x 50 m / 3.0m x 50m |
| Roll weight | 7.5kg / 12kg / 22kg |
| Mass per unit area | 145 g/m² |
| UV exposure | 4 months |
| Product- / Functional layer thickness | 450 / 175 µm |
| Water vapour transmission (Sd) | 0.025 m |
| CE marking | Yes |
| BBA certificate | N° 08/4548 |
| NSAI certificate | N° 04/0157 |
| Compliant with BS5534 | In all 5 UK wind zones |

DuPont™ Tyvek® Metal

A vapour-permeable drainage membrane

Vapour permeable drainage membrane based on Tyvek Supro, for use directly beneath rigid sheet standing-seam metal roof systems. Allows condensate which can form beneath stainless steel, aluminium, copper and coated zinc roofs to drain away.

Membrane has integral lap tape and must be installed over supporting boarding e.g. softwood, SiPs, ply or OSB. Please refer to details in technical roof manual.

- With integrated tape
- Excellent water resistance
- Airtight / Windtight
- Vapour-permeable
- Allows condensation beneath stainless steel, aluminium, copper and zinc roofs to drain away
- Should be installed over 150 mm wide timber boarding with 2 mm gaps between
- For use as drainage membrane beneath standing seam metal sheets roofs over timber boarding or SiPs.
- Long term performance



| Properties | |
|---------------------------------------|--|
| Style name | 2510B |
| Composition | Composite of High Density Polyethylene, Polypropylene non-woven and open mesh spacer |
| Roll size | 1.5 m x 25 m |
| Roll weight | 14.6kg |
| Mass per unit area | 407 g/m² |
| UV exposure | 4 months |
| Product- / Functional layer thickness | 7.40 / 0.22 mm |
| Water vapour transmission (Sd) | 0.03 m |
| CE marking | Yes |

DuPont™ Tyvek® Housewrap

The ideal vapour-permeable timber frame wall membrane

Water resistant (W1) and lightweight vapour permeable wall membrane, suitable for use as the secondary protection layer in SFS, timber, CLT and masonry wall systems. Membrane should be fixed directly over supporting sheathing board, insulation or blockwork.

BBA certificate: No 90/2548 - Product Sheet 1

- Highly permeable to water vapour (sd-value: 0.01 m)
- Airtight / windtight and highly water resistant (>W1)
- Enhances the airtightness of the construction
- Lightweight, flexible and easy to install
- Should be surface applied, fixed directly to sheathing ply /OSB, insulation or blockwork
- Established & trusted long-term performance
- Also suitable for steel-frame and concrete structures



| Properties | |
|---------------------------------------|-------------------------------|
| Style name | 3060B |
| Composition | High Density Polyethylene |
| Roll size | 1.4 m x 100 m / 2.8 m x 100 m |
| Roll weight | 9 kg / 18 kg |
| Mass per unit area | 63 g/m² |
| UV exposure | 4 months |
| Product- / Functional layer thickness | 175 µm |
| Water vapour transmission (Sd) | 0.01 m |
| CE marking | Yes |
| BBA certificate | N° 90/2548 |
| NSAI certificate | N° 02/0144 |

DuPont™ Tyvek® StructureGuard™

The professional choice for commercial buildings

A very robust single layer vapour permeable Tyvek® wall membrane with enhanced water resistance (W1) and exceptional airtightness. Suitable for use in many wall systems and building types, but particularly suited to low-rise commercial buildings with steel frame, masonry and rainscreen systems.

BBA certificate: 90/2548 - Product Sheet 9

- Exceptional airtightness
- Windtight and highly water resistant (>W1)
- Lightweight, flexible and easy to install
- Provides superior air and moisture management for commercial and residential buildings
- Long-term performance
- Suitable for walls in timber frame, metal frame, masonry and internal insulation upgrade



| Properties | |
|--------------------------------------|--|
| Style name | 1560B |
| Composition | High Density Polyethylene |
| Roll size | 750mm x 100m / 1.4 m x 100 m / 2.7 m x 100 m |
| Roll weight | 4.5 kg / 8.7 kg / 17.4 kg |
| Mass per unit area | 58 g/m² |
| UV exposure | 4 months |
| Product / Functional layer thickness | 175 µm |
| Water vapour transmission (Sd) | 0.015 m |
| CE marking | Yes |
| BBA certificate | N° 08/4548 |

DuPont™ Tyvek® FireCurb® breather membrane

The new building breather membrane that limits the propagation of flames

A fire-retardant breather membrane with improved Class B fire performance to EN 13501-1. Suitable for use all wall systems and building types, but with focus on high-rise buildings, or projects that demand products with higher fire class. Class W1 water resistance.

BBA certificate: 90/2548 - Product Sheet 8

- All the benefits of a standard breather membrane
- Self-extinguishing when ignited
- Limits propagation of flames
- Halogen-free flame retardant coating
- Includes all previous Tyvek® characteristics for energy efficient and condensation free building
- Long term investment protection
- Greater safety during and after installation

*(if installed freehanging, on mineral wool & cementitious boarding--> B-s1,d0 , if installed onto wood --> D-s2,d2)

Application: Tyvek® FireCurb™ is typically installed onto the external side of the insulation material or integrated in the wall structure system. It can be used as a solution for ventilated Façades.



| Properties | |
|---------------------------------------|---|
| Style name | 2066B |
| Composition | Flash-spun-bond HDPE with flame retardant coating |
| Roll size | 1.5 m x 50 m |
| Roll weight | 6kg |
| Mass per unit area | 68g/m2 g/m² |
| UV exposure | 4 months |
| Product- / Functional layer thickness | 175 µm |
| Reaction to fire* (EN13501-1) | B-s1,d0 |
| Temperature resistance | -40 to +100° C |
| Water vapour transmission (Sd) | 0.035m |
| CE marking | Yes |
| BBA certificate | N° 90/2548 |

DuPont™ Tyvek® Reflex

The right reflective breather membrane

A reflective low emissivity vapour permeable wall membrane for thermal performance. Metallised surface reflects radiant heat in summer and reduces heat loss in winter. Suitable for use in SFS, timber, CLT and masonry wall systems, as well as internal insulation upgrades. Class W1 water resistance.

BBA certificate: 90/2548 - Product Sheet 3

- Windtight and water resistant but vapour-open
- Low emissivity surface (0,10) results in highly reflective product (90 %) for improved thermal comfort
- Reduces heat loss and improves U-value of wall element
- Improves indoor summer comfort by limiting solar heat gain
- Enhances the airtightness of the construction
- Lightweight, flexible and easy to install
- Long-term performance



| Properties | |
|--------------------------------------|--|
| Style name | 3583M |
| Composition | High Density Polyethylene with metallised surface |
| Roll size | 0.48 m x 100 m / 1.50 m x 100 m / 2.70 m x 100 m / 3 m x 100 m |
| Roll weight | 4.2kg / 13kg / 25 kg / 29kg |
| Mass per unit area | 83 g/m² |
| UV exposure | 4 months |
| Product / Functional layer thickness | 220 µm |
| Emissivity | 0.10 |
| Temperature resistance | -40 to +100° C |
| Water vapour transmission (Sd) | 0.03 m |
| CE marking | Yes |
| BBA certificate | N° 90/2548 |

DuPont™ Tyvek® UV Façade / Tyvek® UV Façade Plus

Protection for open and ventilated rainscreen cladding

Tyvek® UV Facade: A black, unbranded, UV resistant vapour permeable wall membrane for use behind open jointed cladding in SFS, timber, CLT and masonry wall systems. Water resistant (W1) and very durable with high tensile and tear strength assuring durable long-term performance.
Tyvek® UV Facade Plus; as Tyvek UV Facade, but with integral adhesive lap tape to improve airtightness and/or resistance to inclement weather.
BBA certificate: 90/2548 - Product Sheet 7

- Black, unbranded membrane
- Tested for 5000 hours UV ageing to EN 13859-2, followed by 90 day heat exposure at 70 °C. The membrane retained its full performance
- Windtight, water resistant and vapour-permeable
- For joint width of up to 3 cm
- Greatly enhances the airtightness of the construction
- Very robust, but flexible & easy to install
- Long-term performance
- Suitable for open or ventilated cladding in timber, metal, stone and other materials
- Reaction to fire class E

| Properties | |
|---------------------------------------|---|
| Style name | 2524B |
| Composition | Composite of High Density Polyethylene, and Polypropylene |
| Roll size | 1.5 m x 50 m / 3.0 m x 50 m |
| Roll weight | 16kg / 31.5kg |
| Mass per unit area | 195 g/m² |
| UV exposure | see details on technical datasheet |
| Product- / Functional layer thickness | 600 /220 µm |
| Water vapour transmission (Sd) | 0.035 m |
| CE marking | Yes |
| BBA certificate | N° 90/2548 |



AirGuard® A2 FR fire retardant AVCL

Airtight Vapour Control Layer for use within the internal lining of roof, ceiling and wall systems.

An airtight vapour control layer (AVCL) with Class A2 fire performance and very high vapour resistance. This internal membrane has a low emissivity reflective surface, which boosts thermal performance when used with a services void/ batten space. Satisfies the fire regulations for use in external walls but may also be used as an AVCL in pitched and flat roofs. Suitable for buildings of any humidity classification, residential or commercial and from single-storey to hi-rise.

- Class A2, Fire Retardant
- System Classification: DuPont™ AirGuard® A2 FR CVCL with DuPont™ AirGuard® FR System tape (1310FR)
- Thermal benefit: low emissivity/reflective surface
- Tested and classified for free-span, on mineral wool slab, gypsum plasterboard or fibre cement board
- Suitable for all building types, heights and proximities
- A fire retardant AVCL with European Fire Classification A2.
- A full system test with AirGuard® FR System tape has been successfully tested according EN 13501-1

* The 25 Year Warranty only applies to the AirGuard® A2 FR product's performance. Warranty document available on request.

| Properties | |
|--------------------------------------|---|
| Style name | 5816X |
| Composition | Laminate of glass fibre-mesh with lacquered Aluminium foil. |
| Product designation acc. to EN 13984 | Type B |
| Roll size | 1.2m x 50m |
| Roll weight | 10.4kg |
| Mass per unit area | 165 g/m² |
| Reaction to fire | A2-s1,d0 (membrane) |
| Emissivity" | 0.05 |
| Water vapour transmission (Sd) | 4,900m |
| CE marking | Yes |



DuPont™ AirGuard® Control

Strong AVCL for optimal airtightness in roofs, walls and floors

A dedicated air barrier with 100% airtightness and low vapour resistance, which allows rapid drying-out of damp wall elements. Primary function is to improve energy-efficiency by reducing convective heat losses through a roof, wall or floor element.

BBA certificates: 90/2548 – Product Sheet 4, 08/4548 - Product Sheet 3

- Limited vapour transmission
- Airtight and water resistant
- CE-conformity for plastic and rubber vapour control layer (EN 13984)
- Superior mechanical strength
- Reaction to Fire: Class E
- Lightweight - easy to install
- Reduces convective heat losses
- Reduces convective vapour transfer
- Reduces risk of trapped moisture in the insulation

| Properties | |
|--------------------------------------|---|
| Style name | 8327AD |
| Composition | DuPont™ Tytar® spunbond & Ethylen-Butylacrylate Copolymer |
| Product designation acc. to EN 13984 | Type A |
| Roll size | 1.5 x 50m / 2.8 x 50m |
| Roll weight | 8.5kg / 19kg |
| Mass per unit area | 108 g/m² |
| Reaction to fire | Class E |
| Water vapour transmission (Sd) | 5 m |
| CE marking | Yes |
| BBA certificate | N° 08/4548 and N° 90/2548 |



DuPont™ AirGuard® Reflective

AVCL which boosts your thermal insulation

A 100% airtight vapour control layer (AVCL) with very high vapour resistance and low emissivity reflective surface. Significantly boosts thermal performance when used with a services void/batten space. Suitable for use in SFS, timber, CLT and masonry wall systems, pitched and flat roofs. Chlorine resistant.

BBA certificates: 90/2548 – Product Sheet 5, 08/4548 - Product Sheet 4

- Highly vapour resistant
- Airtight and water resistant
- CE-conformity for plastic and rubber vapour control layer (EN 13984)
- Reflects ca. 95% of radiant heat
- Reduces heat loss by increasing R-value of the airspace to 0.67m²k/w
- Superior mechanical strength
- Reaction to Fire: Class E
- Considerably reduces risk of condensation into the insulation
- Reduces convective heat losses

| Properties | |
|--------------------------------------|--|
| Style name | 5814X |
| Composition | Composite of Polypropylene, Polyethylene and an aluminium foil |
| Product designation acc. to EN 13984 | Type A |
| Roll size | 1.5 m x 50 m |
| Roll weight | 12kg |
| Mass per unit area | 149 g/m² |
| Reaction to fire | Class E |
| Emissivity** | 0.05 |
| Water vapour transmission (Sd) | 2000 m |
| CE marking | Yes |
| BBA certificate | N° 08/4548 and N° 90/2548 |

** A low emissivity value = high reflectivity = superior thermal performance.



DuPont™ AirGuard® Reflective E

AVCL which boosts your thermal efficiency

A 100% airtight vapour control layer (AVCL) with very high vapour resistance and low emissivity reflective surface. Significantly boosts thermal performance when used with a services void/batten space. Suitable for use in SFS, timber, CLT and masonry wall systems, pitched and flat roofs. Chlorine resistant.

BBA certificates: 90/2548 – Product Sheet 5, 08/4548 - Product Sheet 4

- Highly vapour resistant
- Airtight and water resistant
- CE-conformity for plastic and rubber vapour control layer (EN 13984)
- Reflects ca. 95% of radiant heat
- Reduces heat loss by increasing R-value of the airspace to 0.75m²k/w
- Good mechanical strength
- Reaction to Fire: Class E
- Considerably reduces risk of condensation



| Properties | |
|--------------------------------|---|
| Style name | 8314X |
| Composition | DuPont™ Tytar®, PE and Aluminum composite |
| Roll size | 1.5 m x 50 m |
| Roll weight | 9 kg |
| Mass per unit area | 122 g/m² |
| Reaction to fire | Class E |
| Emissivity** | 0.05 |
| CE marking | Yes |
| Water vapour transmission (Sd) | 2400 m |

** low emissivity value = high reflectivity = superior thermal performance when combined with an air gap.

DuPont™ Tyvek® AirGuard® Smart

AVCL with variable vapour resistance

A 100% airtight vapour control layer with extreme variable vapour resistance which adapts to changes in humidity.

Provides efficient drying-out capacity for structures with built-in moisture. Suitable for roof, wall and floor elements in projects of low to medium moisture classification.

- Prevents structure damage and loss of insulation efficiency by smartly adapting to various moisture conditions and regulating the humidity in building elements
- Reduced drying out time
- Durability, health and longevity of buildings
- Greater energy efficiency
- Additional drying capacity for unplanned humidity infiltration
- Enhanced interior comfort



| Properties | |
|--|---|
| Style name | 2009B |
| Composition | Tyvek® with polymeric coating |
| Product designation acc. to EN 13984 | Type B |
| Roll size | 1.5 m x 50 m |
| Roll weight | 12kg |
| Mass per unit area | 92 g/m² |
| Reaction to fire | Class E* |
| Watertightness acc. to EN13859-1 based on 1928 (A) | W1 |
| Water vapour transmission (Sd) | 35 m (dry environment) 0.2 m (humid environment) |
| CE marking | Yes |

* Installed on mineral wool.

Essential DuPont™ Tyvek® and DuPont™ AirGuard® Tapes and adhesive accessories

Create windtight, airtight and watertight seals with DuPont™ Tyvek® and DuPont™ AirGuard® tapes and accessories

The energy efficiency of domestic and non-domestic buildings is to a great extent dependant on the continuity of materials used in the building envelope. The range of accessories has been developed to complement and enhance building envelope solutions with Tyvek® and AirGuard® membranes.

- It helps to:
- reduce or avoid air leakage through the building envelope
 - reduce or avoid wind washing
 - reduce or avoid dust and pollen penetration
 - prevent animals (birds, insects...) from entering buildings.

Tyvek® Acrylic Tape (2060B)

Single-sided DuPont™ Tyvek® (HD-PE) with modified acrylic adhesive with or without a paper split-release liner.

- Suitable for sealing membrane laps, but particularly suitable for making good around penetrations and for damage repair for most Tyvek® underlays and AirGuard® vapour control layers
- With a split liner it is ideal to seal the AirGuard® vapour control layer to windows and doors

| | |
|---------------|-----------------------------|
| Dimensions | 75mm x 25m |
| | 60mm x 25m with split liner |
| Rolls per box | 75mm: 8 |
| | 60mm: 10 |



Tyvek® Metallised Tape (2060M)

Single-sided reflective tape for sealing laps of Tyvek® Reflex, AirGuard® Reflective, AirGuard® Reflective E and AirGuard® A2 FR.

- Ideal for making good around penetrations, pipework, windows and doors
- Made of metallised Tyvek® and modified acrylic adhesive
- Provides a durable bond

| | |
|---------------|------------|
| Dimensions | 75mm x 25m |
| Rolls per box | 75mm: 8 |



DuPont™ AirGuard® FR System Tape (1310FR)

A high performance, reflective, single-sided Air & Vapour Control Layer Tape (ACVL), with European fire class A2 in combination with DuPont™ AirGuard® A2 FR AVCL. Dedicated for use with DuPont™ AirGuard® A2 FR AVCL for airtight sealing of laps, joints, functions, windows and doors and sealing around penetrations such as pipework, wiring and structural elements.

| | |
|---------------|------------|
| Dimensions | 75mm x 25m |
| Rolls per box | 20 |



DuPont™ AirGuard® Tape (1310V)

High performance airtight vapour control layer overlap tape, that is very flexible, hand-tearable with a very high tack that sticks on all smooth or rough surfaces such as PE films, spun-bond, wood or PVC.

| | |
|---------------|------------|
| Dimensions | 60mm x 25m |
| Rolls per box | 60mm: 10 |



Tyvek® FlexWrap EZ and NF (2064FW and FLEXNF)

- High performance flexible self-adhesive flashing tape.
- Significantly helps in facilitating the creation of airtight and water tight seals around windows, doors, chimney breasts, pipe penetrations and any custom shapes
- Designed to ensure continuity, compatibility and integrity with all Tyvek® breather membranes and AirGuard® air and vapour control layers.

| | |
|---------------|------------------|
| Dimensions | 60mm x 10m (EZ) |
| | 152mm x 23m (NF) |
| | 228mm x 23m (NF) |
| Rolls per box | 60mm: 3 |
| | 152mm: 1 |
| | 228mm: 1 |



Tyvek® Window Tape/Plastering Tape (1310PT)

A high performance airtight and moisture adaptive carrier tape that can be plastered over. It seals difficult areas like windows, doors and timber to block connections – one product that fits application outside and inside.

| | |
|---------------|-------------|
| Dimensions | 80mm x 25m |
| | 150mm x 25m |
| Rolls per box | 80mm: 6 |
| | 150mm: 4 |



DuPont™ FlexWrap Tapes

Saving time and money to make a more durable seal



Tyvek® FlexWrap NF
Length: 23 m
Width: 15 cm
Width: 23 cm

(For NF products other widths are available)



Tyvek® FlexWrap EZ
Length: 10 m
Width: 60 mm

Flexible and expandable high performance tapes for air and water tight seals around roof, ceiling and wall penetrations

Applications:

- Building penetrations including roof and window junctions (VCL/frame interface), pipes, brackets, vents, cables and other openings to resist air, wind & water ingress
- For external application behind a building facade or roof covering and internal air and vapour sealing
- For floor to wall seals (using appropriate surface primer where required)
- Suitable for gap closures where a small amount of building material movement over time may affect the performance of other products

Benefits:

Superior protection /air and watertight seals

- Helps seal the building envelope
- Creates more airtight seals compared to standard tapes used on irregular shapes/ penetrations

Easy installation

- Packaged in ready-to-use rolls
- No requirement for additional fixings
- Approx. 50% quicker to fit compared to standard tapes and seals

Superior durability

- Extendable tape constructed with a durable Tyvek® top-sheet, a premium butyl adhesive layer, and a specially designed split release liner
- Allows for structural movements
- UV resistant

Excellent adhesion performance

- Ensures continuity, compatibility and integrity with all Tyvek® breather membranes, AirGuard® AVCLs and other membranes at penetrations
- 100% butyl adhesive performs over a wide temperature range
- Compatible with most common building materials



DuPont™ FlexWrap NF and EZ Tapes Flexible and Expandable

Installation around pipes



Installation around windows



Installation around beams and joists



| Technical Data | FlexWrap NF | FlexWrap EZ |
|--------------------------|--|--|
| Coverage | 3.4 m² | 0.6 m² |
| Colour | white (black adhesive) | white (black adhesive) |
| Rolls per box | 1 | 3 |
| Temperature resistance | from - 30 °C rather + 80 °C (temporary 100 °C) | from - 30 °C rather + 80 °C (temporary 100 °C) |
| Elongation | ca. 160 % (2.6 x of the original length) | ca. 130 % (2.3 x of the original length) |
| Installation temperature | > 0 °C | > 0 °C |
| UV resistance | 4 months | 4 months |

Installation guidelines

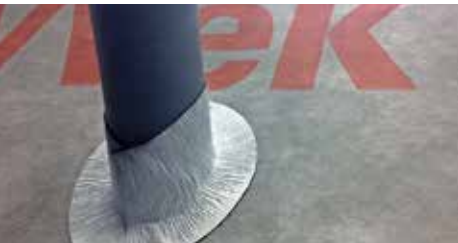
Surface preparation

The surface must be free from dirt, moisture, ice, grease and other materials which could reduce the adhesion. Tyvek® FlexWrap is to be installed when dry and at temperatures above 0 °C. A primer may be used for application temperatures below 0 °C and non-ideal surface conditions.

Installation

- Properly position Tyvek® FlexWrap around the surface to seal.
- Minimise wrinkles and bubbles by smoothing the surface and by repositioning as necessary.
- Apply pressure by hand along the entire surface to achieve a good bond to the substrate. (After pressure has been applied repositioning may be difficult.)
- After completion of the installation Tyvek® FlexWrap has to be covered within 4 months with the appropriate building materials.
- For step by step guidance on how to use Tyvek® FlexWrap please see our Installation Guide and videos in the downloads section of our web site www.energy-efficiency.dupont.com or use the QR code below

Installation around pipes (EZ)



Watch the installation video for more details goo.gl/dZGcq



ELONGATION (Stretch capability)

- Tyvek® FlexWrap NF - approx. 160% (2.6 times original length)
- Tyvek® FlexWrap EZ - approx. 130% (2.3 times original length)

Tyvek® Double-sided Tape (1310D)

Double-sided acrylic tape ideal for sealing overlaps and bonding Tyvek® membranes to smooth surfaces.

- Excellent adhesion properties under extreme humidity conditions
- Strong initial tack
- Recommended for Tyvek® UV Façade, but suitable for all Tyvek® membranes and AirGuard® air and vapour control layers (AVCL)

| | |
|---------------|------------|
| Dimensions | 50mm x 25m |
| Rolls per box | 50mm: 12 |



Tyvek® Double-sided Tape (1310D)

Double-sided acrylic tape ideal for temporary fixings of a vapour control layer and limited space detailing.

| | |
|---------------|------------|
| Dimensions | 20mm x 25m |
| Rolls per box | 20mm: 10 |



Tyvek® Butyl Tape (1311B)

Double-sided butyl based sealant, used to form a moisture and airtight seal between a Tyvek® membrane or an AirGuard® air and vapour control layer and most commonly used building materials.

- The product is compatible with brickwork, blockwork, masonry, timber, metalwork and most plastic products
- Tyvek® Butyl Tape is most effective when used under compression, e.g. under a timber batten and is recommended for use at perimeters, chimneys, abutments and for sealing nail penetrations and around electrical sockets

| | |
|---------------|------------|
| Dimensions | 20mm x 30m |
| | 50mm x 30m |
| Rolls per box | 20mm: 8 |
| | 50mm: 4 |



Tyvek® UV Façade Tape (1312F)

- Single-sided acrylic tape with high UV resistance.
- Especially designed for sealing Tyvek® UV Façade overlaps, penetration and joints in a durable and non-contrasting manner.
- Excellent ageing and outdoor performance.

| | |
|---------------|------------|
| Dimensions | 75mm x 25m |
| Rolls per box | 75mm: 8 |



Tyvek® Primer (1310P)

Transparent primer that is permanently tacky after curing and with very fast curing time. It is recommended for very porous surfaces to create a good adhesion.

| | |
|-----------------|----|
| Capacity | 1L |
| Bottles per box | 6 |



DuPont™ AirGuard® Sealant (1211S)

An adhesive sealant for permanently elastic, airtight bonding of joints and structural connections as well as connections of vapour control layers to many surfaces. It provides excellent adhesion to most surfaces such as stone, concrete, plaster, plasterboard and wood.

| | |
|--------------------|-------|
| Capacity | 310ml |
| Cartridges per box | 20 |



Spray Polyurethane Accessories- Sealants, Adhesives and Insulation*

DuPont™ Great Stuff™ All Direction Straw Foam

All direction Spray Polyurethane Foam

- **Composition:** One component, moisture curing, Polyurethane foam
- **Product size:** 150ml, 300ml, 500ml and 750ml cans
- **Dispenser:** Plastic Straw included
- Expanding foam, can be sprayed with the can in every position, works any way up
- Bonds to Masonry, Metal, Glass, wood and most plastics



DuPont™ Great Stuff™ Pro Fixer Window & Door

Minimal expansion Spray Polyurethane Sealant

- **Description:** Spray Polyurethane foam sealant for Windows and Doors
- **Composition:** One component, moisture curing, Polyurethane foam
- **Product size:** 750ml cans
- **Dispenser:** Spray Gun (not included)
- Bonds to Aluminium, PVC, Masonry, Metal, Glass, wood and most plastics



DuPont™ Great Stuff™ Pro Fire Rated Foam

Regular expansion Spray Polyurethane Sealant Fire Rated

- **Foam colour:** Pink foam for easy identification
- **Composition:** One component, moisture curing, Polyurethane foam
- **Product size:** 750ml cans
- **Dispenser:** Straw (Plastic Straw included) / Spray Gun (not included)
- Spray Polyurethane foam sealant Fire Rated / B1 Fire Rated according to DIN 4102
- 5 hours fire rating obtain with a concrete gap size of 15mm x 220mm according to the BS 476 Pt 20:1987
- Different gap size and material will impact the fire performance
- Bonds to Masonry, Metal, Glass, wood and most plastics, for other surfaces please contact DuPont
- Noise reduction according to EN ISO 717-1:2013 up to 58dB



DuPont™ Great Stuff™ Pro Gaps & Cracks

Spray Polyurethane expanding foam

- **Composition:** One component, moisture curing, Polyurethane foam
- **Product size:** 750ml cans
- **Dispenser:** Spray Gun (not included)
- Spray Polyurethane foam gap filler and cracks
- Bonds to Masonry, Metal, Glass, wood and most plastics, for other surfaces please contact DuPont



DuPont™ Insta Stik™ Multi-Purpose Fast Cure

Spray Polyurethane foam adhesive

- **Description:** Spray Polyurethane foam adhesive
- **Composition:** One component, moisture curing, Polyurethane foam
- **Product size:** 750ml cans
- **Dispenser:** Straw (Plastic Straw included) / Spray Gun (not included)
- Fast curing
- B2 Fire Rated according to DIN 4102, for thickness up to 10mm
- Adhesion to Plasterboard, Insulation boards (PU, PIR, MW, XPS, EPS), Timber, Blockwork, Bricks, Glass, Metal, Roof tiles, for other surfaces please contact DuPont
- Adheres up to 15m² with one can
- Can be used horizontally or vertically



DuPont™ Insta Stik™ Flex +

Spray Polyurethane Flexible foam adhesive

- **Description:** Spray Polyurethane Flexible foam adhesive
- **Composition:** One component, moisture curing, Polyurethane foam
- **Product size:** 750ml cans
- **Dispenser:** Straw (Plastic Straw included) / Spray Gun (not included)
- Fast curing
- Noise reduction according to EN ISO 717-1:2013 up to 60dB
- Airtightness according to EN 12114 of 600Pa
- B2 Fire Rated according to DIN 4102, for thickness up to 20mm
- Adheres to Aluminium, PVC, timber, Blockwork, Bricks, Glass, Metal, Roof tiles



DuPont™ Froth-Pak™


Spray Polyurethane Insulation

- **Description:** Spray Polyurethane foam insulation
- **Composition:** Two component Polyurethane foam (Component A MID, Component B Polyol)
- **Product Variant:** QR (quick rise), SR (slow rise), HD (high density)
- **Product size:** 2 x 5,5 kg (FP180), 2 x 23 kg (FP600)
- **Dispenser:** INSTA-FLO™ Gun (not included in FP600, include in the FP180)
- Supplied in the UK by DuPont BKC, Bristol, UK
- Adheres to timber, Blockwork, Bricks, Glass, Metal, Roof tiles, PVC, Aluminium and most plastics



* For where to buy (UK and Ireland) information on any of the above SPU products please contact the DuPont™ Tyvek® Building Knowledge Centre, Bristol, UK

Product Data

| Composition | |
|--|--------------------------------------|
| Product thickness (mm) | |
| Functional layer thickness (mm) | |
| Weight (g/m²) | |
| Roll width (m) | |
| Roll length (m) | |
| Roll weight (kg) | |
| Rolls per pallet | |
| Performance characteristics | British/European Standard |
| Water vapour resistance (MN.s/g) | EN ISO 12572 |
| Sd (m)* | EN ISO 12572 |
| Water Resistance | EN 1928 (A) |
| Water Head (m) | BS EN ISO 811 |
| Air Permeability (m³/m²/hr at 50Pa) | EN 12114 |
| Air resistance / permeance | ISO 5636/5 (Gurley) |
| Tensile strength (N/5cm) | EN 12311-1 (MD/XD) |
| Elongation (%) | EN 12311-1 (MD/XD) |
| Nail tear resistance (N) | EN 12310-1 (MD/XD) |
| Fire classification | EN 13501-1 |
| Thermal resistance (Airspace) (m²K/W) | BS EN ISO 6946 |
| CE Certification  | EN 13859-1 EN 13859-2 EN 13984 |

| Roof | |
|---|--|
| Tyvek® Supro/Supro Plus <small>BBA Certificate 08/4548</small> | Tyvek® Metal |
|  |  |
| HDPE and PP | HDPE and PP with PP mesh |
| 0.49 | 7.4 |
| 0.175 | 0220 |
| 145 | 407 |
| 1.0 / 1.5 / 3.0 | 1.5 |
| 50 | 25 |
| 7.5 / 12 / 22 | 14.6 |
| 24 / 30 | 4 |
| Tyvek® Supro/Supro Plus (2507B) | Tyvek® Metal (2510B) |
| 0.1 | 0.156 |
| 0.02 | 0.03 |
| W1 | W1 |
| 2.0 | >2.0 |
| <0.23 | <0.1 |
| - | - |
| 290/235 | 340/280 |
| 13 / 21 | 12/18.5 |
| 180/205 | 165/175 |
| E** | E** |
| - | - |
| Yes Yes - | Yes Yes - |

| Wall | | | | |
|---|---|---|---|---|
| Tyvek® Housewrap <small>BBA Certificate No 90/2548</small> | Tyvek® Reflex <small>BA CertificateB0/2548</small> | Tyvek® StructureGuard™ <small>BBA Certificate No 90/2548</small> | Tyvek® UV Facade/ Facade Plus <small>BRE Certificate No 155/10</small> | Tyvek® FireCurb® Breather Membrane <small>BBA Certificate 90/2548</small> |
|  |  |  |  |  |
| HDPE | Metalised HDPE | HDPE | HDPE and black PP | HDPE with char layer |
| 0.175 | 0.220 | 0.175 | 0.60 | 0.175 |
| 0.175 | 0.220 | 0.175 | 0.22 | 0.175 |
| 63 | 83 | 58 | 195 | 68 |
| 1.4 / 2.8 | 0.48 / 1.5 / 2.7 / 3.0 | 0.75 / 1.4 / 2.7 | 1.5 / 3.0 | 1.5 |
| 100 | 100 | 100 | 50 | 50 |
| 9 / 18 | 4.2 / 13 / 25 / 29 | 4.5 / 8.7 / 17.4 | 16 / 31.5 | 6 |
| 20 / 35 | 80 / 24 / 20 / 20 | 35 / 24 / 24 | 24 | 24 |
| Tyvek® Housewrap (3060B) | Tyvek® Reflex (3583M) | Tyvek® StructureGuard™ (1560B) | Tyvek® UV Facade (2524B) | Tyvek® FireCurb® Breather Membrane (2066B) |
| 0.5 | 0.15 | 0.075 | 0.175 | 0.075 |
| 0.01 | 0.03 | 0.015 | 0.035 | 0.015 |
| W1 | W1 | W1 | W1 | W1 |
| 1.5 | 2.0 | 2.0 | 3.0 | 1.4 |
| <2 | < 0.05 | ≤0.25 | <0.1 | <2 |
| - | - | - | - | - |
| 310/310 | 250/210 | 165/135 | 390/320 | 275 / 275 |
| 17/20 | 10/13 | 9/14.5 | 13/19 | 15/18 |
| 55/50 | 90/85 | 60/60 | 310/370 | 41 / 36 |
| E** | | E** | E** & D-s1,d0**** | B-s1,d0*** & D-s2,d0**** |
| - | 0.57 | - | - | - |
| - Yes - | Yes Yes - | Yes Yes - | Yes Yes - | - Yes - |


| Roof • Wall • Floor | | | |
|---|---|---|---|
| DuPont™ AirGuard® Reflective <small>BBA Certificate: 90/2548 and 08/4548</small> | DuPont™ AirGuard® Control <small>BBA Certificates 90/2548 and 08/4548</small> | DuPont™ Tyvek® AirGuard® Smart <small>BBA Certificate July 2021</small> | DuPont™ AirGuard® A2 FR |
|  |  |  |  |
| HDPE, PP and aluminium | PP with copolymer | HDPE with polymeric coating | Glass fibre and aluminium |
| 0.43 | 0.32 | 0.2 | 0.15 |
| - | - | - | - |
| 149 | 108 | 92 | 165 |
| 1.5 | 1.5 / 2.8 | 1.5 | 1.2 |
| 50 | 50 | 50 | 50 |
| 12.0 | 8.5 / 19 | 12 | 10.4 |
| 25 | 24 | 24 | 25 |
| DuPont™ AirGuard® Reflective (5814X) | DuPont™ AirGuard® Control (8327AD) | DuPont™ Tyvek® AirGuard® Smart (2009B) | DuPont™ AirGuard® A2 FR (5816X) |
| 10,000 | 25 | 1 to 182 | 24,000 |
| 2,000 (>500) | 5 | 0.2 to 35 | 4,900 |
| pass | pass | W1 | pass |
| - | - | 3.0 | - |
| - | - | - | - |
| >2,000s | >2,000s | >2,000s | >2,000s |
| 440/210 | 200 / 175 | 390 / 380 | 800/800 |
| 25 / 21 | 40 / 40 | 16 / 19 | 4/4 |
| 210 / 210 | 210 / 220 | 75 / 65 | 170/150 |
| E | E | E | A2-s1,d0*** |
| Roof: 0.45, Wall: 0.67 | - | - | Roof: 0.45, Wall: 0.66 |
| - - Yes | - - Yes | - - Yes | - - Yes |

Table last updated 12th October 2021 please check for any more recent updates

* tested acc.to EN ISO 12572 climate C (multilayer method).

** installed on mineral wool.

*** Installed free-span and on materials with at least A2-s1, d0 classification to EN 13501-1.

****installed on timber.

Product Data

| Acrylic Tapes | | | | | | | | | | Butyl Tapes | | | Accessories | |
|--|--|--|--|--|---|---|---|---------------------------------------|---|---|---|---|---------------|---------------------------|
| | | | | | | | | | | Tyvek® Butyl Tape | FlexWrap NF | FlexWrap EZ | Tyvek® Primer | DuPont™ AirGuard® Sealant |
| Product Style Code | 2060B | 2060B | 2060M | 1312F | 1310D | 1310D | 1310PT | 1310V | 1310FR | 1311B | FLEXNF | 2064FW | | 1211S |
| | | | | | | | | | | | | | | |
| Product Type | Single-Sided | Single-Sided | Single-Sided | Single-Sided | Double-Sided | Double-Sided | Single-Sided | Single-Sided | Single-Sided | Double-Sided | Single-Sided | Single-Sided | Bottle | Cartridge |
| Composition | Spunbonded polyethylene /single sided acrylic adhesive | Spunbonded polyethylene /single sided acrylic adhesive | Spunbonded polyethylene / single sided acrylic adhesive / metallised paper release liner | Single-sided acrylic tape / high UV-stabilised Polypropylene | PES/PVA-grid / acrylic adhesive / paper liner | PES/PVA-grid / acrylic adhesive / paper liner | PET/PA film/acrylic adhesive / PP liner | PE film / acrylic adhesive / PP liner | Glassfibre & Aluminium / acrylic adhesive / paper liner | 100% butyl mastic / siliconised paper liner | A crimped DuPont™ Tyvek® top sheet / butyl mass | A crimped DuPont™ Tyvek® top sheet / butyl mass | | |
| Thickness (mm) | 0.3 | 0.3 | 0.3 | 0.7 | 0.15 | 0.15 | 0.3 | 0.3 | 0.15 | 1.2 | 1.6 | 1.6 | 1 litre | 310ml |
| Weight (g/m²) | 320 | 220 | 320 | 410 | 220 | 220 | 300 | 375 | 215 | 1560 | 1200 | 1200 | | |
| Roll width (mm) | 75 | 60 | 75 | 75 | 50 | 20 | 80 150 | 60 | 75 | 50 20 | 152 228 | 60 | | |
| Roll length (m) | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 30 | 23 | 10 | | |
| Roll weight (kg) | 0.62 | 0.45 | 0.62 | 0.7 | 0.3 | 0.15 | 0.6 1.13 | 0.6 | 0.57 | 2.5 1.0 | 4.4 7.5 | 1.1 | | |
| Rolls/Tubes/Bottles per pallet/box | 8 | 10 | 8 | 8 | 12 | 10 | 6 4 | 10 | 20 | 4 8 | 1 | 3 | 6 | 20 |
| | | | | | | | | | | X | X | X | X | X |
| | | | | | | | | | | X | X | X | X | |
| Overlaps and overall repair | DuPont™ Tyvek® underlays for roof (EN13859-1) | ● | ● | ● | ● | ● | ● | | | ● | ● | ● | | |
| | DuPont™ Tyvek® underlays for walls (EN13859-2) | ● | ● | ● | ● | ● | ● | | | ● | ● | ● | | |
| | DuPont™ Tyvek® UV Facade (EN13859-2 with open joints) | | | | ● | ● | ● | | | ● | ● | ● | | |
| Material compatibility and recommended use | DuPont™ AirGuard® AVCL all applications (EN13984) | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● |
| | Masonry / concrete / render (smooth) | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | Brick / block / concrete / render (rough) | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | Plasterboard | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | Eaves Carrier | | | | | ● | | | | ● | | | | |
| | Window / door frames (PVC, Wood, Aluminium) | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | OSB & Wood fibre | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | Timber (rough, sawn) | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | Timber (planed) | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | Metal (aluminium, steel, copper, ...) | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● |
| Penetrations & other applications | Construction membranes (PE, PVC, PP, PES, Alu, ...) | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● |
| | Pipe penetrations (plastic & metal) | ● | ● | | ● | | | | ● | ● | ● | ● | | |
| | Wiring / cable penetrations | ● | ● | | ● | | | | ● | ● | ● | ● | | ● |
| | Around electrical sockets | ● | ● | | ● | | | | ● | ● | ● | ● | | ● |
| | Windows & Doors to timber frame (inside) | ● | ● | | | | | | ● | ● | ● | ● | | ● |
| | Windows & Doors to timber frame (outside) | ● | ● | | ● | | | | ● | ● | ● | ● | | |
| | Windows & Doors to bricks & blocks (inside) * | ● | ● | | | | | | ● | ● | ● | ● | | ● |
| | Windows & Doors to bricks & blocks (outside) * | ● | ● | | ● | | | | ● | ● | ● | ● | | |
| | Plasterable or under rendering * | | | | | ● | ● | | | | | | | |
| | Temporarily fixing AVCL to rafters | | | | | | | | | ● | | | | |

* Necessity for primer application (Yes/No): see under material compatibility and recommended use
■ recommended to use primer - ● recommended and designed for - ● works out properly but not designed for

General Notes

Ordering, supply and delivery

DuPont™ Tyvek® membranes and accessories are supplied and technically serviced in the UK and are available through most local and national roofing and builders merchants.

Packaging and identification

Rolls of Tyvek® membranes are individually wrapped and contain a label bearing the Tyvek® grade (eg. Tyvek® Reflex), the company name, address and telephone number, together with fixing instructions. A printed overlap line is indicated on the top outerface of the material together with a continuous identification legend: DuPont™ Tyvek®. This information is printed on the inner face of Tyvek® Reflex.

Damage

Whilst Tyvek® membranes are extremely durable there may be occasions when the membrane is damaged as a result of careless handling. Minor damage can be easily repaired with Tyvek® Acrylic Tape (single sided) applied either externally or internally or Tyvek® UV Facade should be repaired by using Tyvek® UV Facade Tape. Areas of the membrane that suffer extensive damage should be replaced, or covered with a Tyvek® patch. In this case the affected area should be covered entirely, taking care to lap the sheets correctly by a minimum 100mm horizontal laps/150mm vertical laps. Sealing the membrane can be achieved by using the appropriate Tyvek single-sided tape.

Fire

The products have similar properties in relation to other polyolefinic sheets. Tyvek® membranes will melt and shrink away from heat, but will burn in the presence of an ignition source. They will not give off any harmful gases.

Tyvek® membranes generally have Fire Classification E in accordance with EN 13501-1, with the following exceptions:

Tyvek® FireCurb: Class B-s1,d0
AirGuard A2 FR: A2-s1,d0.
The substrate material lying directly behind all membranes has significant influence over their fire performance. To benefit from the improved fire classes of Tyvek® FireCurb® and AirGuard® A2FR the supporting material must have a minimum fire class of A2 to EN 13501-1.

Insect attack

Tyvek® membranes will not encourage attack from insects, birds or vermin.

Compatibility

Tyvek® membranes are compatible with most materials associated with the construction process, including sand/ cement and lime rendering, silicone and bitumen. Fibre contraction within the membrane can sometimes occur when in contact with water or solvent based timber treatments, temporarily resulting in a loss of water resistance. This only applies to wet treatments which have been freshly applied or soaked (by rainfall). Sufficient time must be allowed for timber treatments to dry before the installation of the Tyvek® membrane.

Health and safety

In normal installation and usage Tyvek® membranes do not present a hazard under the COSHH regulations. Handling single rolls of Tyvek® does not present a risk of injury, provided recommended safe practices in lifting and handling are followed. As with paper, freshly cut edges can be sharp, but cutting the material does not produce hazardous dust. COSHH information in accordance with directive 93/112/EC is available on request.

Durability

Tyvek® membranes will retain their durability at temperatures down to –40°C and up to +100°C. Tyvek® membranes will have a service life similar to that of the building fabric which incorporates them, provided their exposure to direct sunlight does not exceed 4 months.

Technical Support

DuPont™ Tyvek® offer a high level of technical support to assist with detailed proposals or specifications that include Tyvek® membranes. Full technical back up includes:

Telephone helpline:

discuss details and solutions with one of our technical consultants

Written confirmation:

for assistance with Building Regulations applications, warranties, acceptance of proposals and suitability of applications
Technical literature:
Agrément certificates, technical brochures and COSHH information

Site assistance:

on-site technical liaison with one of our Regional Managers

Seminars:

guidance on Tyvek® applications, control of condensation, energy efficiency and legislative compliance.

For information, please call our Technical Support Department: **+44 (0) 117 452 9052/9053**

Condensation Risk Analysis:

to demonstrate compliance with the Approved Documents of the Building Regulations, condensation risk assessments in accordance with BS5250: 2011 are available on request. (See following page)

Questions & Answers

Re: Tyvek® Housewrap, Tyvek® StructureGuard™, Tyvek® UV Facade, Tyvek® Supro and Tyvek® Reflex.

Where does a Tyvek® breather membrane go?

In wall constructions, behind the external cladding / brickwork, etc.

What does a Tyvek® breather membrane do?

Tyvek® breather membranes provide protection to the structure and thermal insulation from external moisture and condensation. They also assist in achieving airtightness to reduce convective heat losses from the building if the joints are sealed.

Do the joints in Tyvek® breather membranes have to be sealed?

No, sealing is optional unless superior airtightness/water resistance is required.

Should there be a vented cavity / airspace on the outside of the Tyvek® membrane?

Yes, to allow vapour to escape to outside atmosphere. The cavity/airspace may be vented naturally through cladding/tile joints or ventilated with airbricks, vents, etc.

Can a Tyvek® membrane be installed directly behind cladding or render & lathe?

Yes, but the breathability of the membrane will be less effective. Please note, Tyvek® Reflex requires an air space to provide thermal benefits.

Can a Tyvek® membrane be installed behind continuous metal sheeting as the separation layer?

Yes: Tyvek® Supro
No, if Tyvek® Reflex is being used.

Can a Tyvek® breather membrane be left exposed prior to the external cladding being installed?

Yes, for 4 months, provided that the membrane is secured sufficiently to prevent wind damage.

Re: Tyvek® Reflex.

Why use Tyvek® Reflex?

As well as providing protection against external moisture, condensation and air infiltration Tyvek® Reflex considerably reduces the amount of heat that is lost by radiation.

Which way around should it be installed?

Tyvek® Reflex is installed so that the shiny silver side faces a cavity.

Re: Tyvek® Supro

Can Tyvek® Supro be used as the breather membrane in a wall system?

Subject to fire resistance requirements, yes, Tyvek® Supro has all the attributes of a breathable membrane to EN13859. Its extra strength allows it to be surface applied or used in a ‘free spanning’ application (page 26).

What does Tyvek® Supro do in floor construction?

Tyvek® Supro will provide a support to insulation as well as providing protection against external moisture, condensation and air infiltration.

Re: DuPont™ Tyvek® AirGuard® Smart

What is DuPont™ Tyvek® AirGuard® Smart for?

DuPont™ Tyvek® AirGuard® Smart is a strong and lightweight flexible AVCL with variable vapour resistance, which means that its ability to resist the passage of water vapour varies according to the surrounding environment. DuPont™ Tyvek® AirGuard® Smart adapts to the presence of moisture by reducing its vapour resistance and thereby allowing the moisture to migrate back into the building interior. In this case the vapour resistance can be as low as 1 MNs/g (sd 0.2m). Conversely, when the structure is dry and the building moisture levels are stable DuPont™ Tyvek® AirGuard® Smart will perform as a traditional AVCL.

Re: DuPont™ AirGuard® Control

What is DuPont™ AirGuard® Control for?

DuPont™ AirGuard® Control is an internal air-barrier for installation behind plasterboard linings, etc. When all joints are taped it provides an airtight layer, reducing convective heat losses as well as providing limited vapour control.

Re: DuPont™ AirGuard® Reflective

What is DuPont™ AirGuard® Reflective for?

DuPont™ AirGuard® Reflective is a 100% airtight internal membrane for installation in pitched and flat roofs and as an effective airtight vapour control layer (AVCL) behind the dry-lining of all wall systems. When installed with a batten space DuPont™ AirGuard® Reflective will provide considerable thermal improvement to a roof or wall element. Using the product in conjunction with Tyvek® Reflex breather membrane will offer significant energy savings.

Re: DuPont™ AirGuard® A2FR

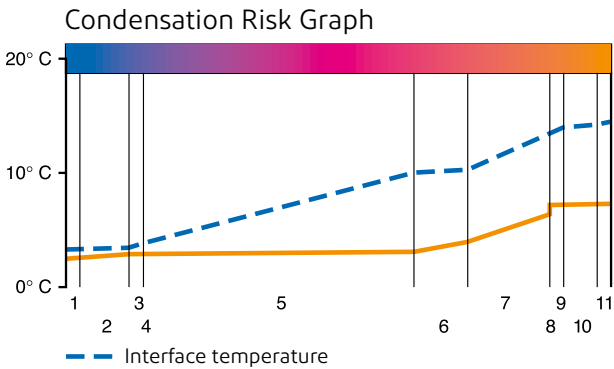
Can DuPont™ AirGuard® A2FR be used above 18m?

Yes, it can be used in all applications regardless of building height.



Condensation Risk Analysis

In order to assess the risk of interstitial condensation a free analysis can be carried out for proposed wall or floor constructions where a Tyvek® membrane is specified. The analysis uses the calculation method contained in BS EN ISO 13788, and as referred to within Annex D of BS 5250: 2021.



To obtain the analysis please complete this form, scan and mail it to Tyvek® Technical Support on: tyvek.construction@dupont.com

| | |
|----------------------|-------------------------|
| Name & address:..... | Tel:..... |
| | Mob: |
| | E-mail:..... |
| Project ref: | Project location: |

Building type

(please tick **one** only)

- ☐ Office/shop
- ☐ Domestic/residential
- ☐ Public/community building
- ☐ Church
- ☐ School
- ☐ Sports/activity
- ☐ Swimming pool
- ☐ Other

Pitched roof system

(please tick **one** only)

- ☐ Insulation at joist level (roof pitch
- ☐ Insulation beneath rafters
- ☐ Insulation beneath & between rafters
- ☐ Insulation between rafters
- ☐ Insulation between and over rafters
- ☐ Insulation over rafters
- ☐ Insulation over rafters & between counter battens
- ☐ Other

Studs/joists =mm xmm @centres

Exposure rating (please specify) ☐ sheltered ☐ normal ☐ exposed

Construction details (please list construction build-up starting with the external layers)

- Outside 1.....
- 2.....
- 3.....
- 4.....
- 5.....
- 6.....
- 7.....
- 8.....
- Inside 9.....

Typical example:
Tiles / slates
25 x 38mm battens
Tyvek® Supro
25mm airspace
100mm PIR Insulation
DuPont™ AirGuard® control
12.5mm plasterboard.

British & European Standards

| | |
|-------------------------|--|
| BS 5534:2014+A2 2018 | Slating and tiling for pitched roof and vertical cladding - Code of practice |
| BS 3177: 1959 (95) | Method for determining the permeability of flexible sheet materials used for packaging |
| BS EN 1107-2: 2001 | Flexible sheets for water-proofing - Determination of dimensional stability plastic and rubber sheets for roof waterproofing |
| BS5250: 2021 | Code of practice for control of condensation in buildings |
| BS 5268-2: 2002 | Structural use of timber - Code of practice for permissible stress design, materials and workmanship |
| BS 5268-3: 2006 | Structural use of timber - Code of practice for trussed rafter roofs |
| BS EN 13859-2: 2014 | Flexible sheets for waterproofing - Definitions and characteristics of underlays - Underlays for walls |
| BS EN 13984: 2013 | Flexible sheets for waterproofing. Plastic and rubber vapour control layers. Definitions and characteristics |
| BS 7374: 1990 | Methods of test for water vapour transmission resistance of board materials used in buildings |
| BS 2782: Pt 3 1976 (96) | Methods of testing plastics: Mechanical properties. Methods 320A-320F. Tensile strength, elongation and elastic modulus |
| BS EN ISO 6946: 1997 | Building components and building elements Thermal resistance and thermal transmittance – calculation method |
| Moat No.27: 1983 | General Directive for the assessment of roof waterproofing systems |
| BS EN 13501-1:2018 | Fire classification of construction products and building elements |
| BS EN 12114:2000 | Thermal performance of buildings. Air permeability of building components and building elements. Laboratory test methods |
| EN ISO 12572:2016 | Hygrothermal performance of building materials and products - Determination of water vapour transmission properties - Cup method |

About DuPont



DuPont - 220 years of global innovations

DuPont (NYSE: DD) is a global innovation leader with technology-based materials and solutions that help transform industries and everyday life. Our employees apply diverse science and expertise to help customers advance their best ideas and deliver essential innovations in key markets including electronics, transportation, construction, water, healthcare and worker safety. More information about the company, its businesses and solutions can be found at www.dupont.com.

In the world of construction, DuPont developed Tyvek® over 60 years ago and has more than 40 years experience in the market with Tyvek® construction membranes, which are used extensively today in the protection of roofs and walls of millions of homes all over the world. Since its first installation, more than 15 million buildings have been protected with Tyvek® membranes worldwide. This shows that Tyvek® membranes have a well-established pedigree and are fit for purpose over the entire lifetime

of the building. As part of DuPont's company culture and core values of safety and protection, DuPont protects buildings and their occupants through the use of unique and highly advanced technological materials such as Tyvek®. At the same time, DuPont also protects the environment for future generations, as Tyvek® roofs and walls are extremely efficient - cutting energy consumption, heating bills and greenhouse gas emissions to the atmosphere, and thus reducing the risk of global warming.

With one of the best R&D capabilities in the world, DuPont has an outstanding track record as a strong and reliable manufacturer with a long standing commitment to sustainable growth, meeting the specific needs and requirements of all customers and contacts for all types of building.

DuPont and the circular economy

DuPont is using its innovative technology to enable a low-carbon and circular economy.

In 2020, we made strides in our ability to

upcycle byproduct from our production of Tyvek®, nylon and other high-performance synthetic fibres. We opened a new recycling factory at our Tyvek® production site in Luxembourg specifically to scale up our ability to advance circularity in our DuPont Safety business, and enacted new innovation-based partnerships with external partners and between our own DuPont businesses. As we improve our ability to innovate for circularity, we're continuing to pursue new beneficial uses of byproduct in our operations, while we improve our ability to avoid the generation of hazardous and non-hazardous waste.

The DuPont Sustainability Leadership Council is working to develop processes, collaborative workstreams and action plans that will allow us to aggregate, quantify and amplify our ability to enable a circular economy.

For greater details on our Sustainability goals and achievements please see our websites:

www.dupont.com

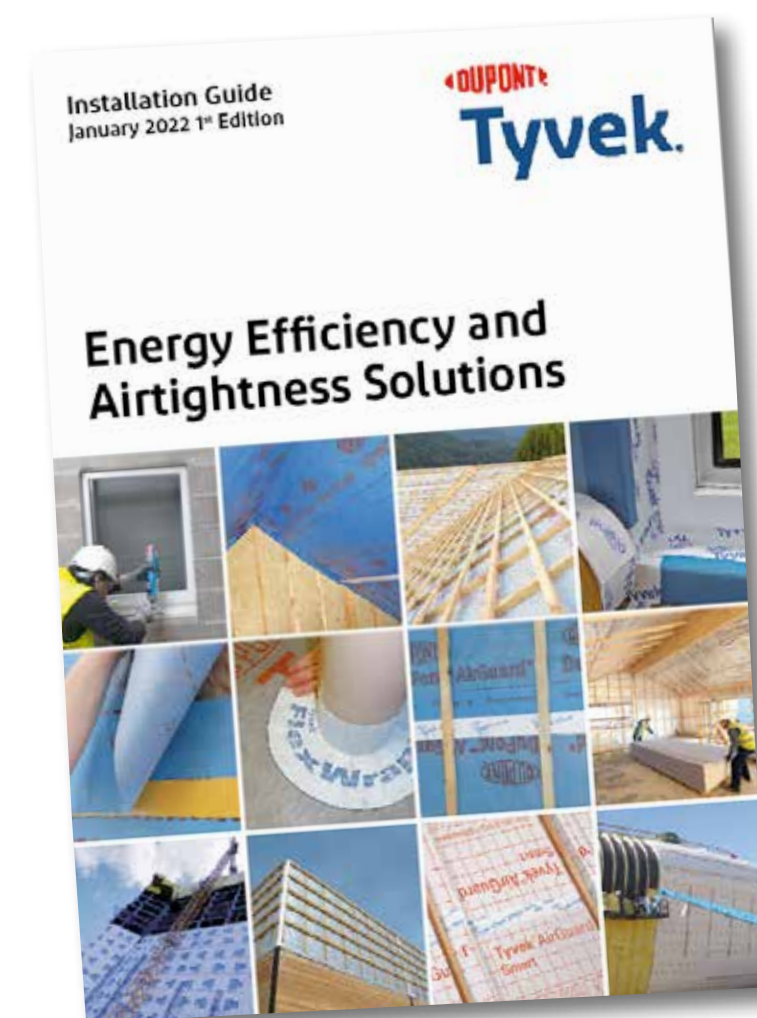
www.building.dupont.co.uk

Installation Guide

Plus helpful demonstration videos and product information

Dear Professional Installers, Architects, Designers, Self Builders and many others,

To find additional useful information on our membranes, tapes and accessories, for all building types, please see our latest Installation Guide



The Installation Guide, Know-how videos, documentation and other information can be easily found on our following web sites:

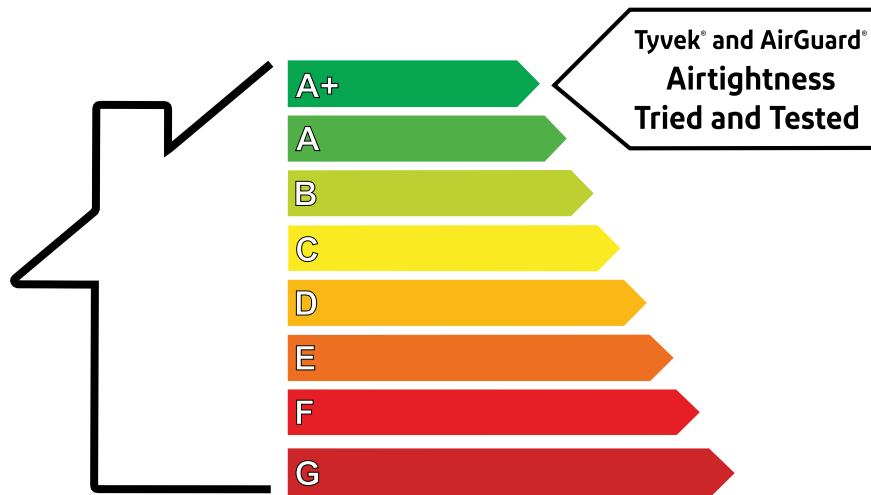
www.building.dupont.co.uk and
www.energy-efficiency.dupont.com

If you would like to discuss your project with one of our technical experts please contact the DuPont™ Tyvek® Building Knowledge Centre in Bristol, UK Tel: +44 (0) 117 452 9052/9053; e-Mail: Tyvek.construction@dupont.com

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For help with projects please contact our technical team at the Tyvek® Building Knowledge Centre or one of our Regional Managers (details above and on our web sites) For installation guides and videos, technical data sheets, certification, case studies and other useful information

