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Recommendations as to methods, use of materials and construction details are based on the experience and current knowledge of DuPont and are given in good faith as a general guide to designers, contractors and manufacturers. This information is not intended to substitute for any testing you may need to conduct to determine for yourself the suitability of our products for your particular purposes. This information may be subject to revision as new knowledge and experience becomes available. Since we cannot anticipate all variations in actual end-use conditions. DuPont makes no warranties and assumes no liability in connection with any use of this information. Nothing in this publication is to be considered as a licence to operate under a recommendation to infrige any patent right.

Tyvek® construction membranes are manufactured by DuPont under an ISO 9001 Quality Assurance System

01-2006

DuPont™
Tyvek®

Providing protection in construction

VOLUME 2: WALLS AND FLOORS

DUPONT®
The miracles of science™

Tyvek® membranes wall and floor applications

Contents

Introduction

The DuPont™ Tyvek® family of membranes and the DuPont™ Realshield™ family of gas barriers have been developed by DuPont to provide protection against the hazards associated with the construction and use of buildings; the principle hazards are:

- **climatic conditions** – rain, snow, hail, wind, ground moisture
- **condensation** – occurring on and within the building fabric
- **radon** – naturally occurring in various geographical locations
- **methane** – arising particularly from landfill sites
- **chemicals** – associated with brown field sites

For information on Tyvek® membranes for protection against external moisture and condensation and the DuPont™ Realshield™ range of gas barriers

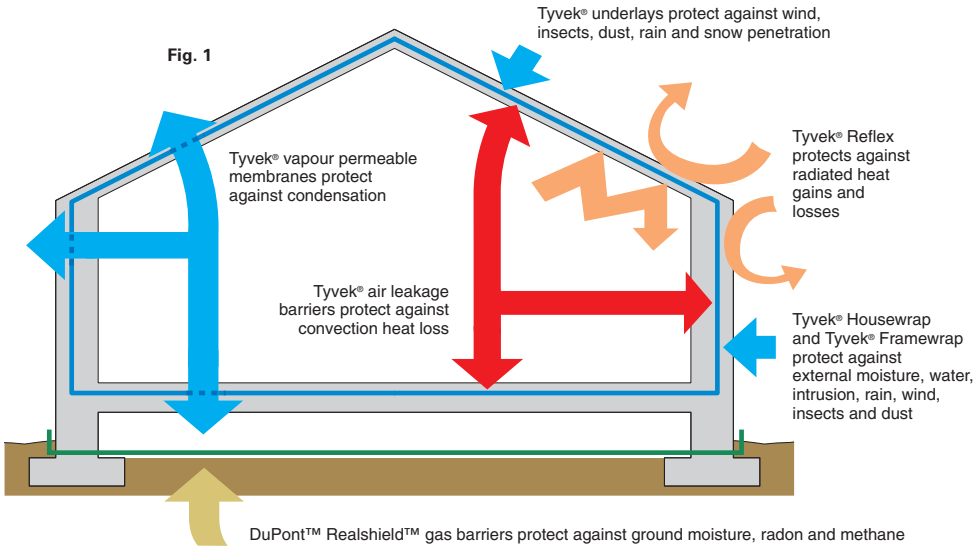
please contact: 01275 879770

Protection in construction

Tyvek® membranes are engineered for the purposes of providing protection to buildings and their occupants from external climatic conditions and from the effects of condensation. This technical manual contains detailed information specifically on the use of Tyvek® membranes in **wall and floor construction**. By controlling the movements of heat, air and moisture through the building envelope Tyvek® membranes can make a major contribution to protecting the environment by improving the energy efficiency of buildings.

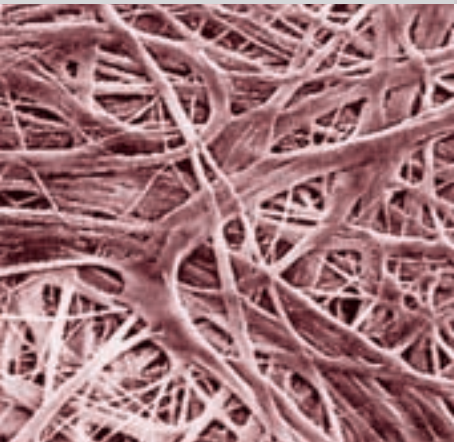
To achieve the required internal conditions with optimum efficiency it is essential to consider air flow and moisture movement together with all aspects of heat transfer, not only by conduction, but also by convection and radiation. The reduction of air leakage, the avoidance of damaging condensation 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.

Fig. 1



Tyvek® product range and applications

Wall and floor products



Tyvek® Solid
BBA certificates: 94/3054, 90/2548
Highly water resistant and lightweight (82 g/m²) vapour permeable membrane. Suitable for use in wall systems as per Tyvek® Housewrap, but also suitable for use as secondary water shedding layer in warm roof systems.

Roll size: 1.5m x 50m.
Horizontal lap: 100mm.

Tyvek® Housewrap
BBA certificate: 90/2548
Highly water resistant and lightweight (61 g/m²) vapour permeable membrane suitable for use as the secondary protection layer in timber frame, steel frame and concrete wall systems. Membrane should be surface applied, fixed directly to ply/OSB sheathing board or blockwork.

Roll sizes: 1.4m x 100m and 2.8m x 100m. Horizontal lap: 100mm, vertical lap: 150mm.

Tyvek® Framewrap
BBA certificate: 90/2548
An alternative to the higher spec Housewrap membrane. A lightweight polypropylene material for use in timber frame applications. Available in "house colours".

Roll sizes: 1.4m x 100m, 2.6m x 100m, 2.7m x 100m and 2.8m x 100m.
Horizontal lap: 100mm
vertical lap: 150mm.

Tyvek® Reflex
BBA certificate: 90/2548
Insulating vapour permeable membrane for use in timber and metal frame wall applications. Lacquered metallised coating provides low emissivity surface to reduce radiated heat losses and thus improve the system's overall thermal efficiency whilst maintaining high vapour permeability.

Roll sizes: 0.48m x 100m, 1.5m x 100m, 2.4m x 100m and 2.7m x 100m.
Horizontal lap: 100mm.

Tyvek® SD2
BBA certificate: 01/3808
Internal Air Leakage Barrier/Vapour Control Layer for roofs, walls and floors. Primary function is to reduce convective heat losses but also provides highly engineered vapour control for breathing systems.

Roll sizes: 1.5m x 50m.
Lap: 100mm.

Tyvek® Tape
Single sided tape for sealing laps and making good around penetrations, pipework, windows and door openings. Carrier is made from hard structure Tyvek® and adhesive is acrylic based, which once cured provides a very durable and long lasting bond.

Roll sizes: 75mm x 60m.

Tyvek® Butyl Tape
A double sided butyl based tape for sealing at laps, perimeters, chimneys, abutments and bonding the membrane to a Tyvek® Eaves Carrier. Suitably compatible for adhering to brickwork, blockwork, masonry, timber, metalwork and most plastic products.

Roll sizes: 20mm x 30m and 50mm x 30m.

Tyvek® Metallised Tape
Single sided reflective tape for sealing laps in Tyvek® Reflex wall membrane. Suitable for making good around penetrations, pipework, windows and doors. Carrier is made from metallised Tyvek® and adhesive is acrylic based, which once cured provides a very durable and long lasting bond.

Roll sizes: 75mm x 60m.

Roofing products

Tyvek® Supro
BBA certificates: 94/3054, 04/4101
Multi-purpose, heavyweight, reinforced Tyvek® grade for use in all supported and unsupported pitched roof applications, including warm, hybrid and cold roofs. Also suitable for Scottish sarking board systems, low pitched metal roofs as well as wall and floor applications.
Roll sizes: 1m x 50m and 1.5m x 50m
Horizontal lap: 150mm.

Tyvek® Supro Plus
BBA certificates: 94/3054, 04/4101
As Tyvek® Supro but with integral adhesive lap tape for use in the "Tyvek® sealed roof system." Sealing all horizontal laps will contribute to the system's thermal efficiency by reducing air infiltration.
Roll size: 1.5m x 50m.
Horizontal lap: 150mm (sealed).

Tyvek® Proclad
Metal roof breather membrane incorporating a supportive polypropylene drainage mesh for use beneath all rigid sheet metal roof systems. Allows condensate which can form beneath stainless steel, copper and zinc roofs to drain away. Membrane should be installed over softwood boarding. Integral lap tape provided.
Roll size: 1.1m x 30m.
Horizontal lap: 100mm (sealed).

Tyvek® Eaves Carrier
Pre-formed black semi-rigid eaves protection sheet installed over the fascia board under lapping the Tyvek® membrane by 150mm. Recommended for long term durability against UV degradation from direct sunlight whilst offering support to the membrane to eliminate ponding at the tilt position.
Sheet sizes: 230mm x 1.3m
Vertical lap: 100mm.

Product selector membrane applications (Fig. 2)

Tyvek® Grade	Warm Pitched Roofs	Cold Pitched Roofs	Metal Clad Industrial Roofs	Scottish boarded Roofs	Walls	Suspended timber floors
Tyvek® Supro	x	x	x	x	x	x
Tyvek® Supro Plus	x	x	x	x	x	x
Tyvek® Solid	x		x		x	
Tyvek® Proclad			x			
Tyvek® Housewrap					x	
Tyvek® Framewrap					x	
Tyvek® Reflex					x	
Tyvek® SD2	x	x	x	x	x	x

Please note: Tyvek® SD2 is internally applied.

Tyvek® membranes – Pitched roof applications
All Tyvek® membranes and ancillary products for use in roof and wall applications available in the Tyvek® construction membrane range are listed here. However, Tyvek® membranes used in pitched roof applications are covered in a separate technical manual.

Tyvek® membranes wall and floor applications

Wall membrane

Tyvek® Housewrap, Tyvek® Framewrap, Tyvek® Reflex and Tyvek® Solid are lightweight flexible sheet materials suitable for use as breather membranes in most forms of wall construction. Manufactured from high density polyethylene or polypropylene Tyvek® membranes are extremely durable and may be incorporated into new-build, refurbishment or extension projects.

Timber frame wall construction

Tyvek® Housewrap, Tyvek® Framewrap and Tyvek® Solid meet the requirements for a Type 1 breather membrane as defined in BS 4016: Specification for Flexible building membranes (breather type). The water resistance, strength and vapour permeable characteristics of the membranes make them suitable for use as breather membranes in timber frame walls as defined by TRADA Wood Information Sheet 1-35.

In timber frame wall constructions a breather membrane must be 'vapour open' so as to allow water vapour to pass through to outside atmosphere whilst at the same time be water-resistant. The functions of a breather membrane are summarized by TRADA in the following bullet points:

- It protects the fabric of the building from rainwater penetration during construction before external claddings are completed.
- *It provides a second line of defence against water penetration during the life of the building as most claddings act as rainscreens, rather than as complete barriers.*
- *It allows water vapour to escape from the construction.*
- *It can also contribute to air sealing the wall and reduce ventilation heat losses. This aspect is likely to be of increasing importance as air leakage becomes more significant in thermal performance requirements under building regulations.*

These points represent the basic functions of a breather membrane. Tyvek® wall membranes will satisfy all of these requirements and have exceptional strength and durability.

Tyvek® membranes are suitable materials for use as breather membranes in timber frame walls.

Other forms of wall construction

There are many other forms of wall construction, some of which may also benefit from the inclusion of a breather membrane. These can include metal frame, brick and block, stone, masonry and rainscreen cladding systems. The use of a breather membrane would be particularly advantageous if the building is to be constructed in a very exposed location.

The various forms of wall constructions where Tyvek® membranes can be used are shown on page 7.

Installation guidance is given on pages 8-13.

Floor constructions

Tyvek® membranes may also be installed into suspended timber floor constructions, providing a method of support to insulation as well as offering protection against external moisture, condensation and air infiltration.

Installation guidance for the use of Tyvek® membranes in floor constructions is given on pages 20 & 21.

Airtightness

Wall constructions and suspended timber floors should be designed so that the risk of harmful condensation occuring is minimized. This can be achieved by allowing moisture laden air to escape from the construction via natural air movement or ventilation to external airspaces. However, air infiltration through gaps in the building fabric can accelerate the rate of heat loss due to convection and so reduce thermal performance. Where airtightness is required the breather membrane can contribute greatly, particularly when all laps are sealed with adhesive tape.

Achieving airtightness is equally important in both wall and floor construction.

Satisfying the Building Regulations

Approved Documents contain practical guidance on how to meet the requirements of *The Building Regulations* for England and Wales. The requirements of the *Building Standards (Scotland) Regulations* are set out in Technical Standards. The requirements for both regions are very similar:

England and Wales

Approved Document C covers Resistance to moisture under C2. The requirement is set out as follows:

Resistance to moisture
C2. The floors, walls and roof of the building shall adequately protect the building and people who use the building from harmful effects caused by:

(a) ground moisture;
(b) precipitation and wind driven spray;
(c) interstitial and surface condensation;
(d) spillage of water from or associated with sanitary fittings or fixed appliances.

Tyvek® membranes will help to achieve compliance with Approved Document C2 (items a, b and c).

Scotland

Guidance on how to achieve compliance with the Building (Scotland) Regulations is set out in two Technical Handbooks covering **Domestic** and **Non-Domestic** building types. The handbooks are divided into several sections and cover a number of related standards.

The requirements of a wall system and its resistance to external moisture and condensation are set out under Section

3:Environment.
Clause 3.10 relates to Precipitation **(G3.1)** and is common to both domestic and non-domestic buildings:

3.10.1 Precipitation
(General Provisions)
A floor, wall, roof or other building element exposed to precipitation, or wind driven moisture, should prevent penetration of moisture to the inner surface of any part of a building/dwelling so as to protect the occupants and to ensure that the building is not damaged.

Clause 3.15 relates to Condensation **(G4.1, G4.2)** and is common only to domestic buildings:

3.15.4 Interstitial condensation (G4.1)
A floor, wall, roof or other building element should minimize the risk of interstitial condensation in any part of a dwelling that it could damage.

Tyvek® membranes will help to achieve compliance with Sections 3.10 and 3.15 (G3.1 and G4.1) of the Scottish Building Standards.

The installation of a Tyvek® membrane will offer protection to the structural and insulation elements of a floor, wall and roof* construction.

* Note: For details of how Tyvek® membranes can help to achieve compliance in roof constructions, please refer to our Tyvek® Roofing Manual.

BBA Approvals

In order to demonstrate the suitability of Tyvek® breather membranes for use in wall construction, DuPont enlisted the services of the British Board of Agrément (BBA).

BBA assessments for materials such as Tyvek® are thorough and take into account the purpose for which the products have been designed and manufactured. As a breather membrane for use in timber frame wall systems BBA assessments will include tests for:

Strength	BS2782:1976 BS3137:1972
Water resistance	BS4016:1997 MOAT No.27/1983
Vapour permeability	BS3177:1959 BS EN ISO 12572

Other tests include: accelerated ageing, fire, quality control and practicabilty of installation.

After extensive testing of the individual Tyvek® grades the BBA have confirmed that Tyvek® Housewrap, Tyvek® Framewrap, Tyvek® Reflex and Tyvek® Solid are:
"…suitable breather membranes for use in timber frame constructions, either factory or site applied."

BBA BRITISH BOARD OF AGRÉMENT
TECHNICAL APPROVALS FOR CONSTRUCTION
N°90/2548

Performance information indicating results from the BBA assessments for all Tyvek® wall and floor products is contained in the Technical Data tables on page 26.

Agrément Certificate No 90/2548

All Tyvek® wall membranes share the same BBA certificate. The various grades however have their own Detail Sheet:

Detail Sheet 1	**Tyvek® CONSTRUCTION MEMBRANES** Covers all Tyvek® wall membranes providing general information on suitability of products, conditions of certification, compliance with Building Regulations and Standards and design data.	
Detail Sheet 2	**Tyvek® HOUSEWRAP**	61g/m^{-2} HDPE
Detail Sheet 3	**Tyvek® SOLID**	81g/m^{-2} HDPE
Detail Sheet 4	**Tyvek® FRAMEWRAP**	100g/m^{-2} PP
Detail Sheet 5	**Tyvek® REFLEX**	85g/m^{-2} HDPE metallised and lacquered

HDPE = High Density Polyethylene, PP = Polypropylene

Agrément Certificate No 01/3808

Tyvek® SD2 ALB/VCL

Covers the use of Tyvek® SD2 as an AIR LEAKAGE BARRIER/VAPOUR CONTROL LAYER in: pitched roofs, cold flat roofs, walls and floors.

For details on Tyvek® SD2 please refer to page 18.

BBA BRITISH BOARD OF AGRÉMENT
TECHNICAL APPROVALS FOR CONSTRUCTION
N°01/3808

Tyvek® membranes wall applications

There are many different types of wall construction, most of which would benefit from the inclusion of a Tyvek® membrane. We have included some of the more common variations here as typical examples:

Fig. 3 Timber Frame
Traditional

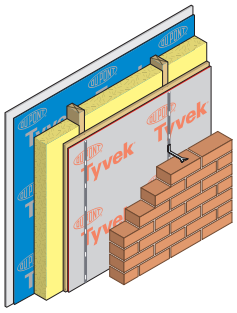


Fig. 4 Timber Frame
(Reverse construction)
Horizontal Weatherboarding

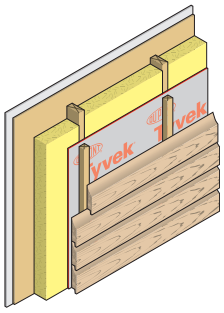


Fig. 5 Timber Frame
Vertical weatherboarding

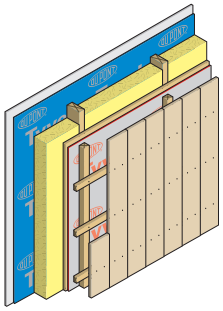


Fig. 6 Timber Frame
Vertical slate/tile hanging

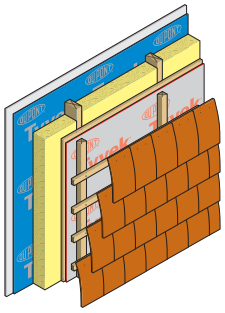


Fig. 7 Timber Frame
Cement render on lathe

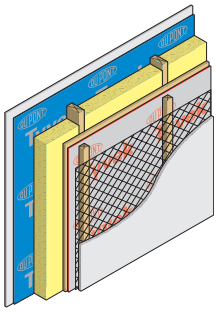


Fig. 8 Timber Frame
Façade cladding system

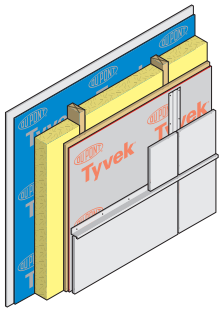


Fig. 9 Metal frame
Metal clad

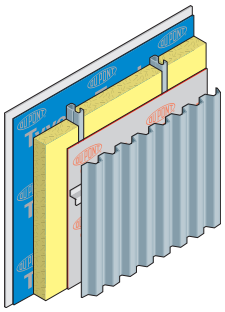


Fig. 10 Masonry wall
Internal insulation upgrade

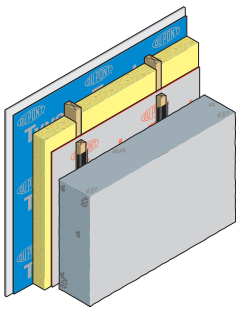
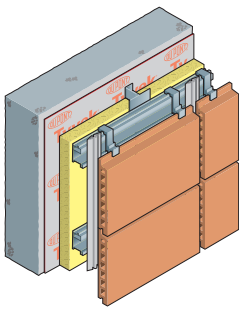


Fig. 11 Masonry wall
Rainscreen cladding



Vertical battens have been included in some details to ensure positive drainage of moisture. Although they may not always be required they are recommended particularly in areas subject to extremes of weather.

Tyvek® membranes Installation in walls

The previous pages in this technical manual confirm the suitability of Tyvek® membranes in wall and floor applications. References to current legislative documents as well as approvals from the BBA further reinforce the message that the materials are 'fit for purpose' as breather membranes in wall constructions. In order to attain maximum benefit from a Tyvek® membrane, both in terms of performance and warranty, it is important to ensure that correct installation procedures are followed.

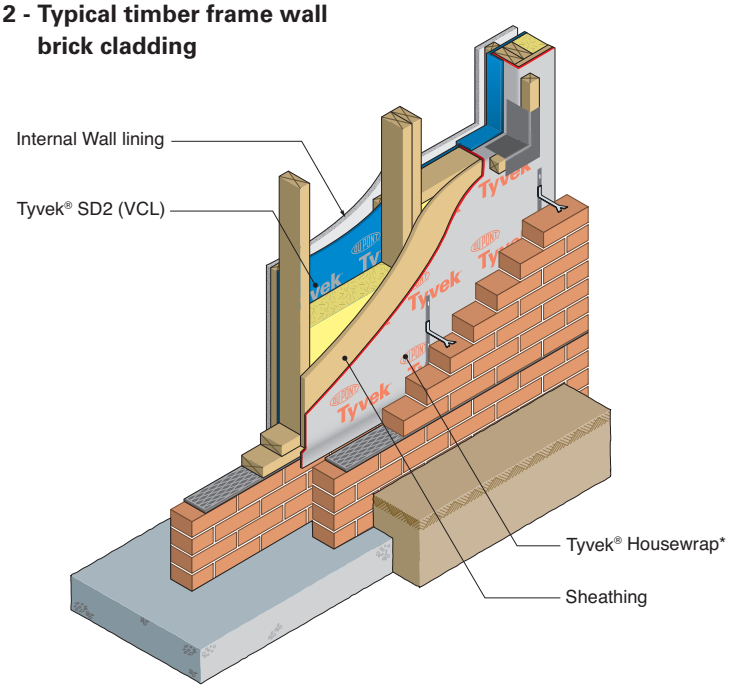
The following pages contain information on how best to install Tyvek® membranes in wall constructions. Although there are many construction variations the basic principles for installation remain the same. Many of the details included here are regarded as standard practise in the timber frame industry, thus we have drawn upon the knowledge and experience of TRADA Technology in these instances.

Detailing Timber frame walls

The external envelope of a timber frame wall system consists of two elements:

- The loadbearing timber frame wall
- The outer cladding. This may be a heavyweight cladding, supported independently by the foundations, or a lightweight cladding attached to the timber frame.

Fig. 12 - Typical timber frame wall brick cladding



Typical timber frame construction employs timber studs and rails, together with a wood based sheathing, to form a structural frame which transmits all horizontal and vertical loads to the foundations. The exterior cladding is non-loadbearing, although it may contribute to wind resistance; it is used to weatherproof the building and to provide the desired external appearance.

Although vapour permeable and moisture resistant sheathing boards are sometimes used, the sheathing is generally plywood or oriented strand board (OSB). The breather membrane is fixed to the sheathing to form a complete secondary protection layer.

*All Tyvek® wall membranes are suitable in this application.

Detailing Timber frame walls

A Tyvek® breather membrane can be installed either on site or as part of a factory fabrication process. In the UK, timber frame construction generally uses factory manufactured panels, with site application being carried out either by specialist companies or on relatively small scale projects. In this latter method, installation of the Tyvek® breather membrane would be carried out as soon as the shell of the building is erected.

Site installation

Fig. 13 - Overlap at sole plate/bottom rail

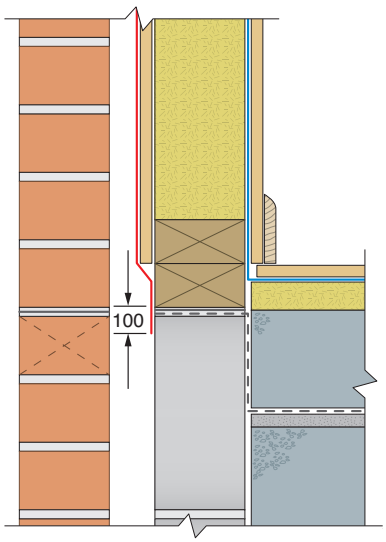
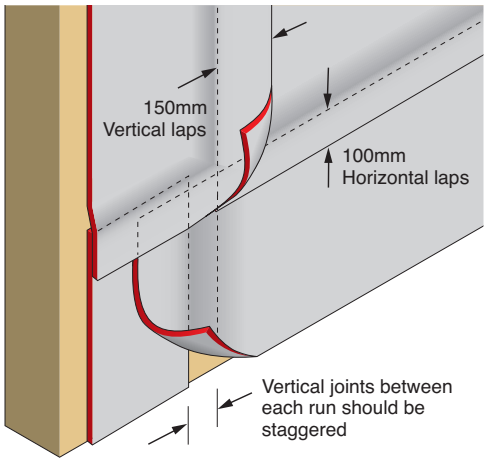


Fig. 14 - Horizontal and vertical laps



Application of the Tyvek® breather membrane on site starts from the sole plate or bottom rail upwards.

Sole plate (Fig. 13)
The Tyvek® membrane should be fixed at least 100mm below the lowest timber member, usually the sole plate.

The standard method of application for a Tyvek® breather membrane is for it to be unrolled horizontally over the face of the sheathing/framing, but it may also be laid vertically if this is more appropriate.

Laps (Fig. 14)
The upper run of Tyvek® membrane must overlap the lower to prevent water which may run down the wall from running behind the membrane. All horizontal laps should be at least 100mm and vertical laps 150mm.

Fixings
Tyvek® membranes are normally fixed to the sheathing with stainless steel staples or corrosion resistant nails. Fixings should be as follows:

Horizontal fixing
generally 600mm or at stud positions,

Vertical fixing

at stud positions	300 mm
at sides of openings	150 mm
at vertical membrane joints	150 mm
at end of panels*	150 mm

** required when membrane is fixed to panels in the factory.*

Suitable membranes:
Tyvek® Housewrap, Tyvek® Framewrap, Tyvek® Reflex, Tyvek® Solid

Detailing Timber frame walls

The locations of the studs should be marked onto the Tyvek® breather membrane to determine wall tie or batten fixing points. This is commonly done by using an indelible marker pen. PVC banding tape may also be used and is particularly recommended where the site is located in an area of very severe exposure, as it strengthens the fixing.

Fig. 15 - Factory manufactured panel

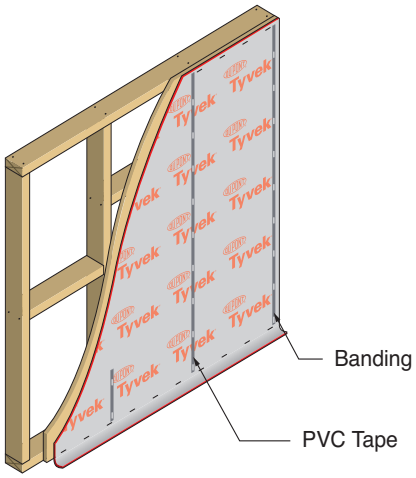


Fig. 16 - Cavity barrier at intermediate floor junction

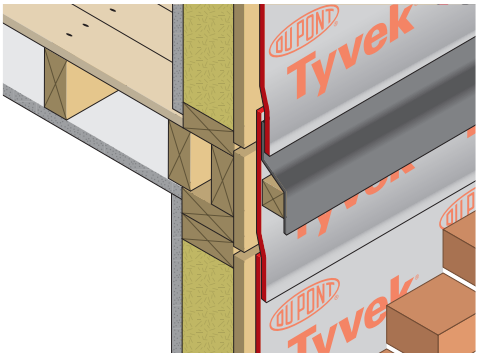
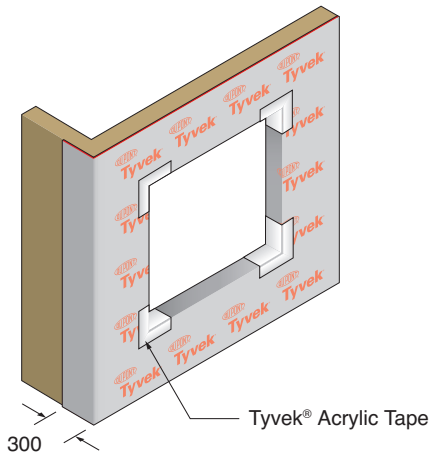


Fig. 17 - External corner and window opening



Pre-fabricated panels (Fig. 15)

Reinforcing tape is generally used where Tyvek® membranes are applied to panels in the factory. This provides additional tear resistance when transporting pre-made panels to site. Tyvek® membranes applied to panels in the factory should be fixed as listed in Table 1 and at the sides, head and base of each panel. The membrane should extend beyond the sides and base of panels to comply with the lap requirements shown in fig. 14.

Floor junctions (Fig. 16)

The membrane at the base of upper storey panels should be extended sufficiently to cover the intermediate floor zone and provide a 100mm lap over the lower panel. Lap sections on pre-fabricated panels should be temporarily fixed back for transport.

Cavity barriers (Fig. 16)

The Tyvek® membrane should lap over DPCs at horizontal cavity barriers, fire stops and cavity trays. Cutting the membrane and sliding a DPC behind will be sufficient. Alternatively a separate skirting strip may be used to ensure an adequate lap detail.

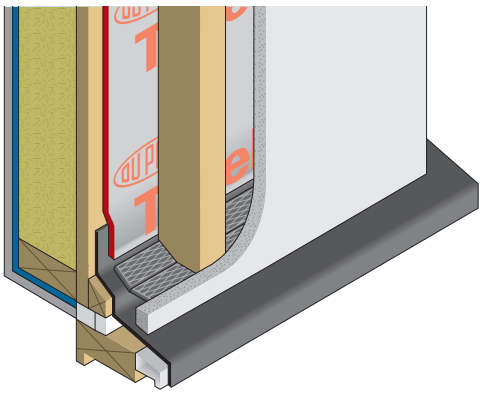
External corner (Fig. 17)

Returns around external corners should be at least 300mm.

Windows and doors (Fig. 17)

Extend the Tyvek® membrane over window and door openings. Cut an 'X' in the membrane and fold back. Make good to the corners with Tyvek® Acrylic Tape (single sided).

Fig. 18 - Window head (render & lathe)



Window head

If an outer leaf of brick/block is being used dress the Tyvek® membrane over the cavity tray as in Fig. 16. If external cladding such as tile hanging, weatherboarding, render and lathe is used, dress the Tyvek® membrane over a proprietary flashing (Fig. 18).

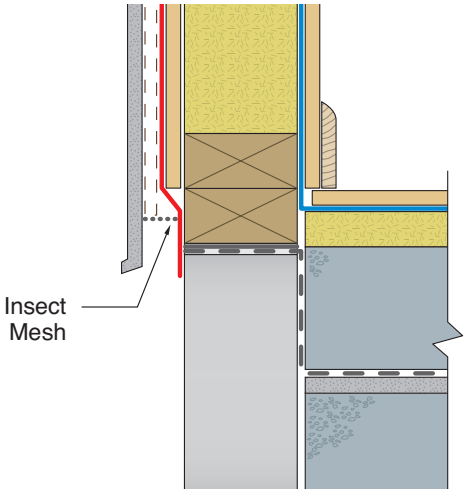
Base details for cladding

Generally, the Tyvek® membrane is finished at base level as in Fig. 13. But the batten space behind the cladding, should be closed off with an insect mesh/screen (Fig. 19).

Fixing to masonry

An anchor fixing system involving a large plastic washer should be employed, such as a *Hilti X-SW soft washer fastener*.

Fig. 19 - Base detail (render & lathe)



Fixing to steelwork

Tyvek® may be fixed to steelwork with a self tapping screw, wall plug and washer, or an anchor system as for masonry, except with dedicated fixing such as *Hilti X-EDNI nail (and X-SW soft washer)*.

Damage repair

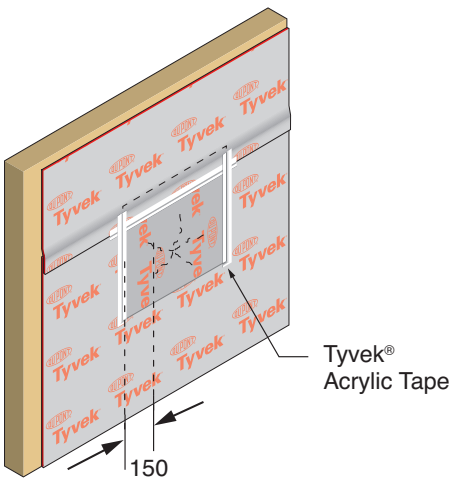
Any damage that occurs in a Tyvek® membrane should be made good as soon as possible:

Minor damage may be repaired with Tyvek® Acrylic Tape (single sided).

More extensive damage should be covered with a Tyvek® patch (Fig. 20)

Large areas of damaged Tyvek® should be replaced completely.

Fig. 20 - Damage repair



Airtightness

Heat loss by convection will occur at all horizontal and vertical laps, door and window details. Air leakage can be reduced by sealing the membrane at these points with adhesive tape. This can be achieved by using Tyvek® Acrylic Tape (single sided) and/or Tyvek® Butyl Tape (double sided).

Suitable membranes:
Tyvek® Housewrap,
Tyvek® Framewrap,
Tyvek® Reflex,
Tyvek® Solid

Detailing Timber frame walls

Vapour control - vapour diffusion

Timber frame wall construction involves the installation of a sheathing board fixed to provide wind bracing, lateral strength, etc. This layer is fixed to the external face of the framework, which is regarded as standard practice (see Fig. 12). Sheathing boards of plywood or oriented strand board (OSB) are commonly used, but contain adhesives and are relatively vapour resistant. Performance requirements regarding thermal and condensation control are generally met, but are in part dependant on the existence of other essential components such as an internal vapour control layer (VCL). Workmanship in installing a VCL is important as the integrity of this layer will determine its effectiveness in preventing/reducing water vapour transfer via convection into the construction. This is water vapour that can condense on any cold impermeable surface within the construction.

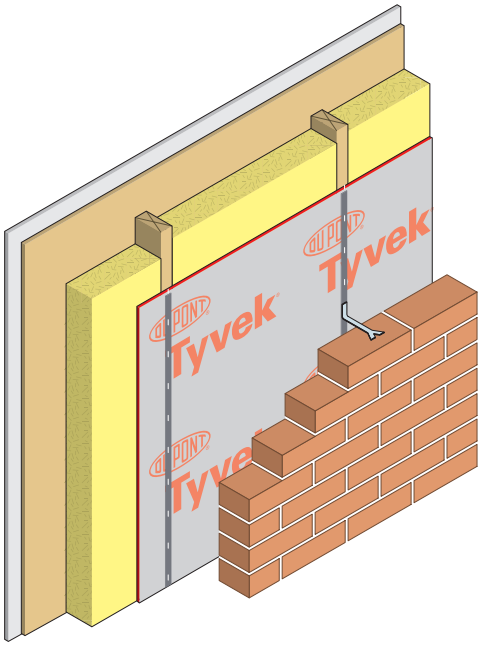
The "5 times rule"

Effective vapour diffusion, or *vapour release*, on the cold (external) side of the construction is equally as important as *vapour control* on the warm (internal) side. Materials on the warm side of the construction should have a greater vapour resistance than those on the cold side. As a guide, a ratio of at least 5:1 is recommended, also known as the "5 times rule" for vapour resistance. Installing a vapour resistant membrane internally to stop the vapour and a breathable membrane fixed externally to let vapour out will ensure that moisture is not trapped within the construction. This forms the basis of a "breathing wall" construction.

Reverse wall construction (Fig. 21)

An alternative process of constructing timber frame walls is to install the sheathing board on the internal side of the framework. The Tyvek® breather membrane can then be fixed directly to the external face of the timber studs, providing protection to the construction as well as retaining the insulation. The benefit here is that when a sheathing board is installed internally it can provide additional vapour control for the system as the materials are generally vapour resistant. In this case particular attention will need to be paid at all board joints and penetrations to prevent excessive water vapour transfer into the construction. Sealing these weak points will assist in achieving a convection tight system. However, the use of a dedicated vapour control layer/air leakage barrier such as Tyvek® SD2 is still recommended between the sheathing board and insulation.

Fig. 21 - Reverse wall construction



When timber frame walls are internally sheathed, the sheathing board may provide the racking strength, contribute to fire resistance, comply with surface spread of flame (reaction to fire) classification and provide the internal decorative surface. Such boards may include cement-bonded particleboard, fibre reinforced gypsum board, mineral fibre boards, and flame spread-treated plywood, OSB and chipboard.

The use of timber based boards as internal linings may be limited by surface spread of flame (reaction to fire) requirements. Their fire resistance can be improved with the application of treatments/coatings, but demonstration of compliance with the relevant fire regulations may still be required.

Suitable membranes:
Tyvek® Housewrap, Tyvek® Framewrap,
Tyvek® Reflex, Tyvek® Solid

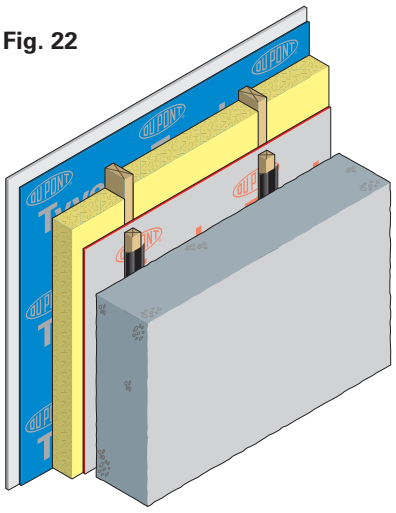
Note: Specifying a reverse wall construction may affect details at junctions, floors, roof, etc. and designers should take this into account when considering this method of construction.

Detailing Masonry walls

Internal insulation upgrade (Fig. 22)

Existing solid masonry/stone walls invariably suffer from internal mould problems arising from condensation due to their poor thermal performance. Upgrading these constructions commonly involve the installation of an internal insulated panel. This has the benefit of providing a clean, dry internal lining as well as improving overall thermal performance. Condensation and mould growth will not then be apparent, but potentially can still occur on the masonry/stone surface, which is now hidden from sight within the construction. In normal circumstances the cavity between a timber frame wall and brick and block cladding should be 'self draining' and 'vented' to prevent the build-up of moisture. The installation of airbricks, cavity tray and weep holes would ensure this. However, as this may not be possible with an internal insulation upgrade, emphasis should be placed on the vapour controlling abilities of the internal lining to prevent vapour from diffusing into the construction in the first instance.

Fig. 22



Battens should be fixed to the inside face of the existing wall via strips of DPC for protection against moisture. A new Tyvek® covered insulated panel can then be constructed away from the existing wall.

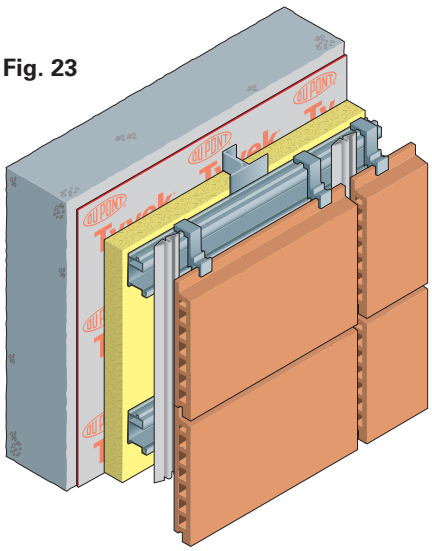
The internal vapour control layer (VCL) should be installed with meticulous attention paid to all laps, edge details and penetrations. Sealing the VCL in this system is key to the prevention of condensation.

If space permits, the internal lining (plasterboard) can be spaced off the VCL with battens, helping to minimise penetrations in the VCL.

Rainscreen cladding (Fig. 23)

Rainscreen cladding systems differ from other wall constructions, as although the membrane is still fixed directly to the structure, it is situated behind the insulation, This is due to the nature of the cladding system which employs a supporting rail that penetrates the insulation, making the application of an external membrane very problematic. Many rainscreen systems offer high levels of protection from precipitation and several insulation types are moisture resistant. In these instances a Tyvek® membrane may not be required, but joints should be considered.

Fig. 23



Where there is a risk of moisture penetration through the insulation and internal layers, a protection membrane behind the insulation is advised. The material to specify is dependant on the risk of condensation at this interface, determined in the main by the temperature. If in doubt a breather membrane should be used. In any case the material should be water resistant.

Fixing: *For guidance on fixing Tyvek® to masonry and steelwork please refer to the notes on page 11*

Suitable membranes:
Tyvek® Housewrap, Tyvek® Framewrap,
Tyvek® Reflex*, Tyvek® Solid

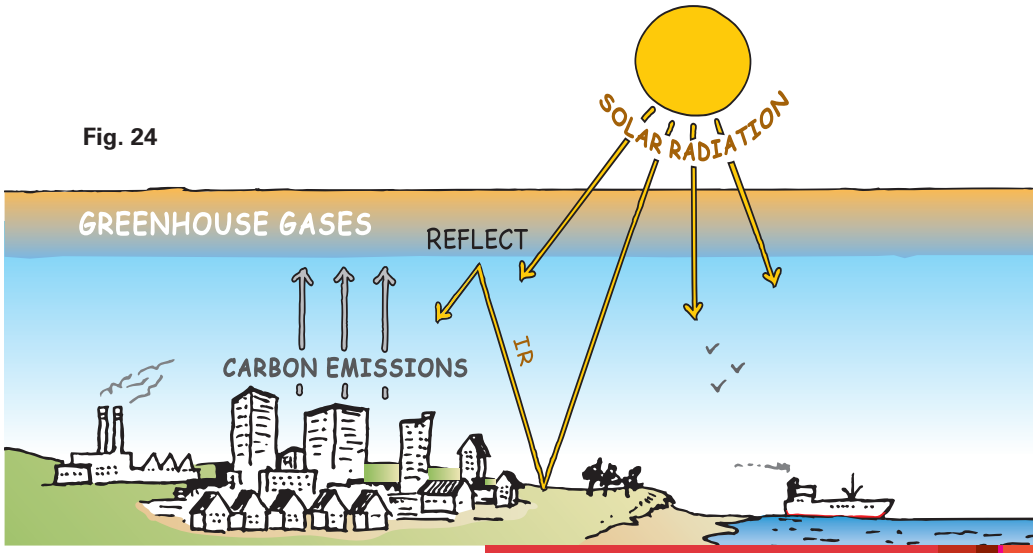
Note: Tyvek® Reflex will not be suitable for use in Fig. 23.

Energy Efficiency

Global Warming

In February 2003 the government acknowledged 'global warming' in the Energy White Paper and confirmed atmospheric carbon dioxide as being the main cause. As a result and as part of the country's commitment to the Kyoto Agreement the government have revealed plans for a 60% reduction in carbon dioxide emissions for the UK by 2050. As it is claimed that around 46% of all C02 emissions come from buildings, the government is looking to the Building Regulations to help achieve an initial target of a 20% reduction in CO_2 emissions by 2010.

Fig. 24



Greenhouse effect

Energy efficiency

Improving energy efficiency by reducing heat loss from buildings is a reasonable way forward, and as insulation thickness' have increased steadily over the last 20 years we are indeed already taking steps in the right direction. Up to now the increases have in the main been quite realistic and achievable, but there comes a time when the 'law of diminishing returns' comes into play. As the insulation thickness' increase the energy savings made become less, due to the energy expended in manufacture. We should therefore consider collectively the **three modes of heat transfer:**

Conduction As solid construction materials allow heat to be lost by conduction, heat loss can be reduced by providing a layer of insulation - a material that has a low thermal conductivity (lambda (λ) or K-value). Reducing heat loss by conduction will mean an increase in insulation thickness. This will result in an increase in the overall wall build-up, leading to a larger building footprint or reduction in internal space.

Convection Heat is lost as it is carried out of the construction by air movement through cracks and joints in the building envelope. Installing an air leakage barrier such as Tyvek® SD2 (internally) and a Tyvek® wall membrane (externally) with sealed joints will help to reduce convective heat losses. Please refer to page 18 for information.

Radiation As heat energy is conducted to the external side of a construction layer, its mode of transfer changes from conduction to radiation. The heat energy is then emitted away from the surface of the construction, across an airspace in wave form - similar to radio and light waves. Heat loss by radiation can be reduced by installing a material that has an external surface of 'low emissivity' such as aluminium foil. This idea has been utilised already by some insulation manufacturers that face their products with foil. The benefits of reducing heat loss by radiation have also been realised by DuPont in the manufacture of a low emissivity membrane that is also vapour permeable:

Tyvek® Reflex
insulating breather membrane

Tyvek® Reflex - insulating breather membrane

Tyvek® Reflex is a low emissivity breather membrane that is designed specifically for incorporation into timber frame walls. It is the result of many years of research and development by DuPont to create a strong, water resistant and breathable membrane that assists in the reduction of heat transmission through the building envelope.

Fig. 25

Composition

Tyvek® Reflex is manufactured by vacuum deposition of aluminium to the external face of a "soft structure" grade Tyvek® membrane. It is this metallised face that presents the low emissivity surface, reducing the amount of heat being emitted from the construction. The overall thermal transmittance, or U-value of the construction will be reduced because Tyvek® Reflex will reduce radiated heat losses.

Tyvek® Reflex can be categorised as a **"Radiant Barrier"**.

A specially formulated lacquer has been applied to the metallised face of Tyvek® Reflex to provide maximum protection against oxidation and abrasion. The lacquer presents minimum resistance to the passage of water vapour, with no risk of cracking. Tyvek® Reflex is therefore suitably durable and flexible for factory or site installation.

TRADA Technology and BRE testing

TRADA Technology carried out initial tests on an early version of Tyvek® Reflex during 2002. This was to confirm the material as suitable for use as a breather membrane in timber frame wall construction. The product was assessed to determine water and tear resistance to BS 4016:1997 and water vapour transmission resistance to BS 7374:1990.

After the TRADA Technology report showed successful results, further tests to ascertain the thermal benefits offered by Tyvek® Reflex were carried out at the BRE site at Garston. The tests involved the construction of two similar timber frame wall sections; one with a standard breather membrane, and the other with Tyvek® Reflex. The meticulous attention in matching the sections is noted in the report; *"Much care was taken to build the two wall sections to identical dimensions and using the same batch of materials to ensure identical thermal properties."* Temperature sensors and thermocouples were installed at various locations within each test section to measure heat flow through the wall sections. The tests were invaluable in demonstrating the advantages of using Tyvek® Reflex over a conventional breather membrane, establishing the following:

"It is clear from the test results that there is a significant difference between the heat flow through the wall installed with Tyvek® Reflex breather membrane and the wall with a conventional breather membrane. Since all other aspects of the construction of the two walls were identical it is concluded that the reason for this difference is the claimed lower surface emissivity of the Tyvek® Reflex compared with the standard breather membrane."

The report further confirms even when allowing for sensor and measurement system uncertainties in the test that a reduction in thermal transmittance by up to 15.6% was achieved when using Tyvek® Reflex.

Tyvek® Reflex insulating breather membrane

BBA Approval

The next obvious step was for DuPont to prove to the industry that Tyvek® Reflex is fit for its intended use by applying for an independent test certificate. In March 2003 the British Board of Agrément (BBA) issued Detail Sheet 5 of certificate no 90/2548 (see page 6). In addition to the use of Tyvek® Reflex as a breather membrane the certificate further confirms its suitability as an 'Insulating' breather membrane in walls. It confirms an average 13% reduction in heat loss when compared to the same construction incorporating a conventional 'high emissivity' breather membrane. When the membrane is installed with the metallised side facing a cavity the thermal resistance of the cavity is increased to **0.54 m²K/W**. This is due to the capacity of Tyvek® Reflex as a **Radiant Barrier**.

Achieving U-values

Tyvek® Reflex is particularly advantageous in timber frame wall construction. Timber stud dimensions are critical factors in timber frame design and manufacturing, and increasing stud depths is not always practical. Despite this, stud sizes may need to be increased to accommodate more insulation in order to comply with the thermal regulations. Tyvek® Reflex can help to alleviate this due to the extra thermal resistance that it provides. This can be demonstrated by carrying out comparative U-value calculations.

The tables below represent typical wall constructions; one incorporating a standard breather membrane and one with Tyvek® Reflex. The aim of the exercise here is to achieve the 'area weighted U-value' of **0.35 W/m²K** for a wall construction of a new dwelling.

Fig. 26 Typical wall construction standard breather membrane

Element	Thickness (mm)	Conductivity (W/mK)	Resistance (m²K/W)	Bridging	
External Resistance	---	---	0.04		
Brickwork	102.5	0.77	0.13		
Cavity	+25	----	0.18		
Breather membrane	0.2	---	---		U-value =
OSB	9.5	0.13	0.07		0.41W/m²K
Insulation	89	0.038	2.34	15%	
VCL	---	---	---		
Plasterboard	12.5	0.18	0.07		
Internal Resistance	---	---	0.13		

Fig. 27 Typical wall construction – Tyvek® Reflex

Element	Thickness (mm)	Conductivity (W/mK)	Resistance (m²K/W)	Bridging	
External Resistance	---	---	0.04		
Brickwork	102.5	0.77	0.13		
Cavity	+25	----	0.54		
Breather membrane	0.2	---	---		U-value =
OSB	9.5	0.13	0.07		0.35W/m²K
Insulation	89	0.038	2.34	15%	
VCL	---	---	---		
Plasterboard	12.5	0.18	0.07		
Internal Resistance	---	---	0.13		

Conclusion: The calculations clearly indicate that the extra thermal resistance provided by Tyvek® Reflex is enough to enable the construction to fall within the reasonable limits as set out in Building Regulations Approved Document L1A.

U-value calculations are available on request from Thermal Economics on **01582 544255**.

Condensation Risk

Increasing the thermal resistance of the adjacent airspace will also have the added benefit of reducing the risk of interstitial condensation. More heat will be retained within the ply/OSB sheathing as there is less heat being emitted by the membrane across the cavity. The sheathing board will be maintained at a higher temperature with Tyvek® Reflex than if a standard breather membrane is used. Condensation forming within the construction will therefore be less likely if Tyvek® Reflex is used.

To reinforce this point the BBA have confirmed that Tyvek® Reflex *"…will maintain the frame sheathing at a higher temperature than for the same construction incorporating a conventional breather membrane. This will in turn assist in limiting the risk of interstitial condensation …"*

"…The risk of interstitial condensation is equivalent to or less than, that attending walls incorporating a conventional breather membrane meeting criteria to BS 4016:1997."

Solar heat gain

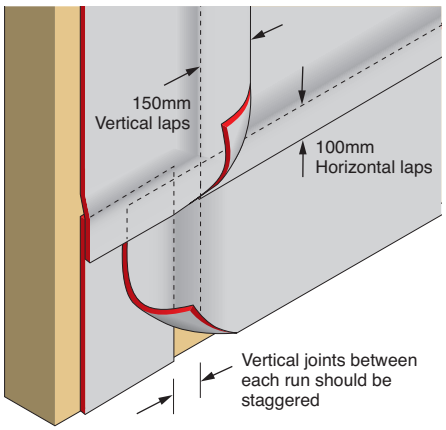
Tyvek® Reflex will also help to reduce summer heat gain by reflection. Heat that builds up in the cavity behind brick/blockwork or an airspace behind cladding would normally be absorbed by the insulation/structure. The heat would then be transfered into the building by conduction and radiation. The metallised surface of Tyvek® Reflex will help to reduce this by reflecting the heat away from the structure beforehand. This would be particularly advantageous in constructions that contain minimal thermal insulation, eg. portable, lightweight or temporary buildings, etc. A reduction in solar heat gain would also lessen the requirement for internal cooling provisions such as air-conditioning and will also help in energy conservation.

Tyvek® Reflex - General Notes

Application

Tyvek® Reflex is installed into a wall system in a similar way to a standard breather membrane.

Fig. 28



Orientation

Tyvek® Reflex is installed so that the "shiny silver" metallised side faces into an airspace or cavity. The reverse side of Tyvek® Reflex is printed with the DuPont™ Tyvek® logo. This side does not face into the cavity.

The upper run of Tyvek® Reflex must overlap the lower to prevent water from running behind the membrane. All horizontal laps should be at least 100mm and vertical laps 150mm (Fig. 28).

Pre-fabricated panels

(See also page 10)

Roll widths of 2.4m and 2.7m are particularly suitable for fixing Tyvek® Reflex to panels in the factory. When applying half-panel-width rolls such as 1.5m care should be taken to ensure horizontal joints are lapped correctly to provide adequate water shedding capability.

Damage Repair/Sealing

Tyvek® Metallised Tape is appropriate for sealing laps in Tyvek® Reflex to achieve airtightness and for damage repair.

Fixings

Tyvek® Reflex should be fixed to the sheathing with stainless steel staples or corrosion resistant nails. Fixings should be as follows:

Horizontal fixing

generally 600mm or at stud positions,

Vertical fixing

at stud positions	300 mm
at sides of openings	150 mm
at vertical membrane joints	150 mm
at end of panels*	150 mm

** required when membrane is fixed to panels in the factory.*

Detailing Internal Lining

In today's modern world, a greater emphasis is being placed on environmental issues and the need to significantly reduce CO_2 emissions. It has been reported that buildings in the UK contribute 46% of CO_2 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, in particular Part L; The conservation of fuel and power. For many years this document has addressed heat loss by conduction and has included various solutions and calculation methods on how to meet current U-value and energy rating 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.

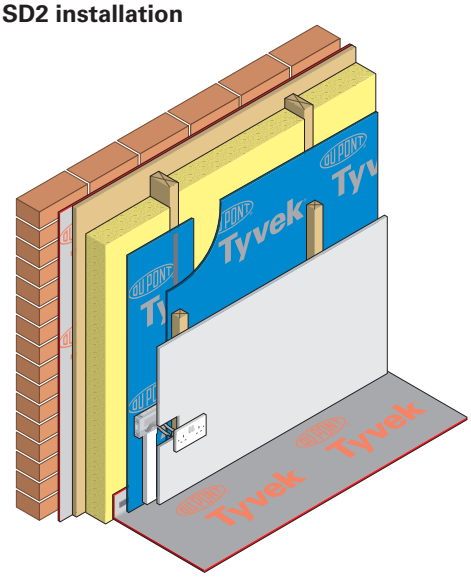
In order to minimise this uncontrolled heat loss Building Regulations Part L has set limits on the "design air permeability" of the building fabric to 10m³/(h.m²) @ 50PA. Similarly, Part F recommends ventilation to internal spaces by way of "controlled air exchange".

Tyvek® SD2 air leakage barrier

Installing Tyvek® SD2 as part of the internal lining will minimise uncontrolled convected heat losses through the building fabric. The objective is to provide a continuous barrier to air movement around the habitable space that is in contact with the inside of the thermal insulation layer. This includes separating walls and the edges of intermediate floors.

Tyvek® SD2 has been specifically developed for use as an air leakage barrier (ALB), but will also contribute in controlling the passage of vapour through a structure. Its use is particularly applicable in 'vapour open' wall constructions where external layers are of low vapour resistance.Installing Tyvek® SD2 as the VCL will ensure that the overall 'breathability' of the construction is maintained with the correct balance of vapour resistances between internal and external layers. (See page 12 – The '5 times rule')

Fig. 29 - Tyvek® SD2 installation



Composition

Tyvek® SD2 is composed of a layer of spunbonded polypropylene with a polyolefin coating.

Strength

Tyvek® SD2 is rot proof and has a nail tear resistance of 260N. It is an extremely durable material.

Fixing

Install Tyvek® SD2 directly to the inside face of the timber frame. Fix with non-ferrous staples or nails at maximum 300mm centres.

Laps

Maintain 100mm laps between each sheet and seal with Tyvek® Butyl Tape.

Detailing Internal Lining

Fig. 30 - Wall roof junction

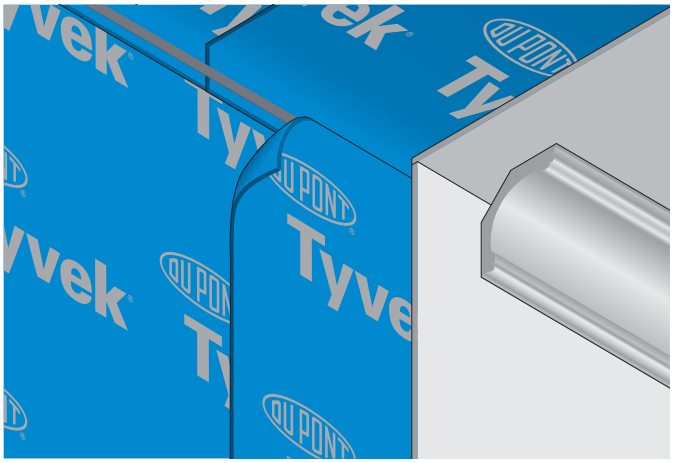


Fig. 31 - Wall upper floor junction

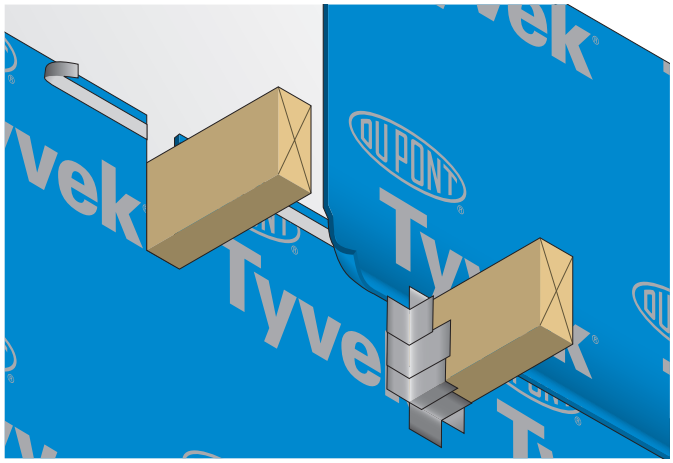
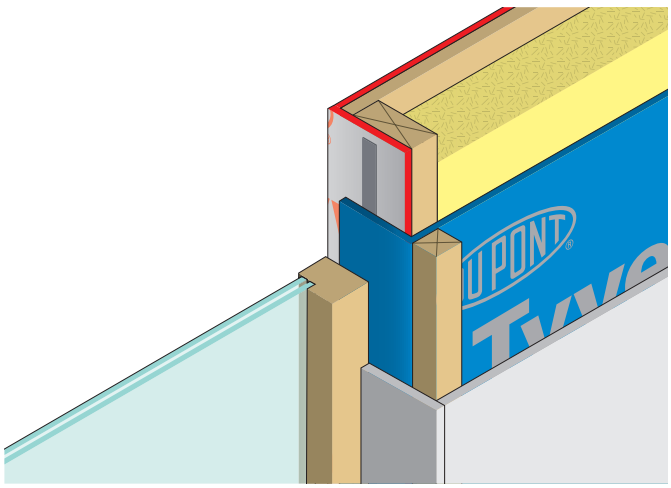


Fig. 32 - Window/door frame sealing



Detailing

The integrity of Tyvek® SD2 is essential for it to perform as an effective vapour control layer and air leakage barrier.

The internal lining (plasterboard, etc.) may be fixed directly through the membrane if required. However, for maximum efficiency the internal lining can be fixed via battens creating a services void to minimise penetrations (Fig. 29).

Continuity of the membrane should be maintained at adjacent walls, floors and roofs with Tyvek® Butyl Tape (Figs. 29 & 30)

Wall - upper storey floor joists (with joist hangers)

Extend Tyvek® SD2 above ceiling/ floor joists by minimum 100mm. Bond to upper storey sheets using Tyvek® Butyl Tape (Fig.31).

Wall - upper storey floor joists (without joist hangers)

Note: To ensure continuity, Tyvek® SD2 must be installed before installation of plasterboard to the ceiling and boarding to the upper floors.

Extend Tyvek® SD2 above ceiling/ floor joists by minimum 100mm. Cut and dress Tyvek® SD2 around joists and make good/seal with Tyvek® Acrylic Tape. Bond Tyvek® SD2 to upper storey sheets using Tyvek® Butyl Tape (Fig.31).

Windows/doors

Tyvek® SD2 should be made vapour and convection tight at all window and door openings. The membrane should be sealed with Tyvek® Butyl Tape or tucked in and compressed by the frame (Fig. 32).

Penetrations and making good

Penetrations through the membrane should be kept to a minimum and any that are made should be sealed. Penetrations for pipework, wiring and electrical sockets should be sealed with Tyvek® Butyl Tape or Tyvek® Acrylic Tape.

Tyvek® membranes
Installation in suspended timber floors

Moisture Management

When a structural timber floor system is installed, the joists should be strength graded and have an average wood moisture content of not more than 20%. Any higher and the risk of mould formation is increased leading to eventual decay and structural failure. In order to retain the integrity of timber floor components, current guidance recommends that cross ventilation is provided to the airspace beneath. This is common practise and is recommended to ensure that any water vapour in the air beneath the floor will not condense and damage the structure. Moisture that is present in adjacent concrete, brick and block components will also be allowed to dry out sufficiently.

Air-leakage

Ventilating beneath a suspended timber floor system is an effective means of removing moisture laden air, but can be thermally detrimental. Insulated timber floor systems commonly include discontinuous insulation between the joists. The gaps and joints at the edges of the insulation will allow cold external air to filtrate into the construction, accelerating the rate of heat loss and so reducing thermal performance. Cold air infiltration may also create cold surfaces within the construction, potentially increasing the risk of condensation. It is therefore important to achieve airtightness in suspended timber floor systems.

Airtightness

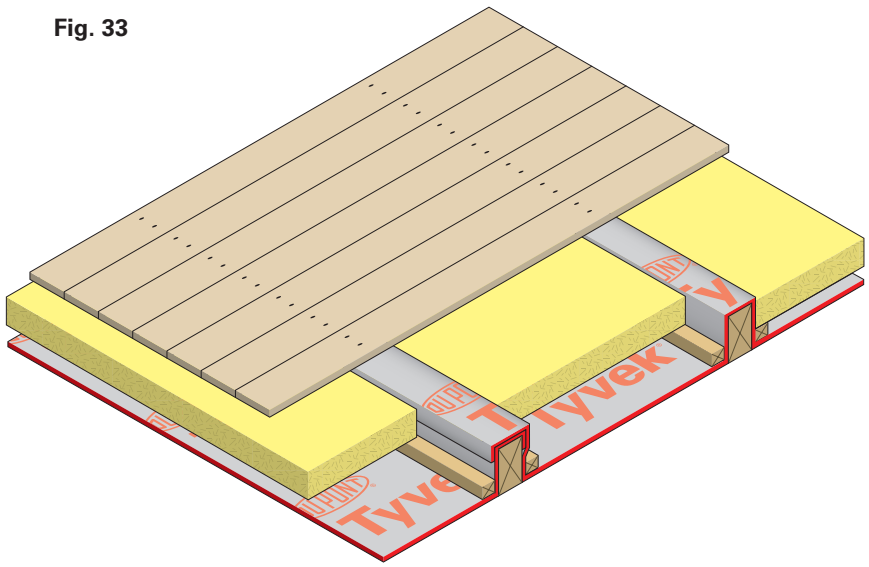
Tyvek® membranes are generally regarded as airtight materials as they will resist the passage of convective air currents. Installing a Tyvek® membrane continuously beneath floor insulation will therefore assist in achieving airtightness for the floor construction. Similar to the installation of Tyvek® SD2 (see internal lining), workmanship in installing a Tyvek® membrane for airtightness is paramount. The extent of penetrations made by fixing the membrane should be controlled to a reasonable minimum. Sealing the membrane around fixing points may not be necessary if flat headed nails are used, but laps and edge details should be sealed.

Note: Airtightness can only be achieved if the membrane is laid continuously with sealed laps.

It is common knowledge that heat displaces air upwards. As moisture is contained within the air, it is reasonable to suggest that a large amount of water vapour within a building will escape at high level by convection. Vapour control layers are therefore not normally required in insulated timber suspended ground floors.

However, water vapour should still be allowed to diffuse freely through the floor into the ventilated space. The vapour permeable characteristics of a Tyvek® membrane will ensure the floor construction is airtight and vapour open.

Fig. 33



Material selection

Tyvek® Supro is a reinforced grade material which will provide adequate support to the insulation and is recommended for use in timber suspended floor systems. Please refer to pages 3 & 26 for product information.

Suspended timber floors

Fig. 34 - Wall junction - joists running parallel

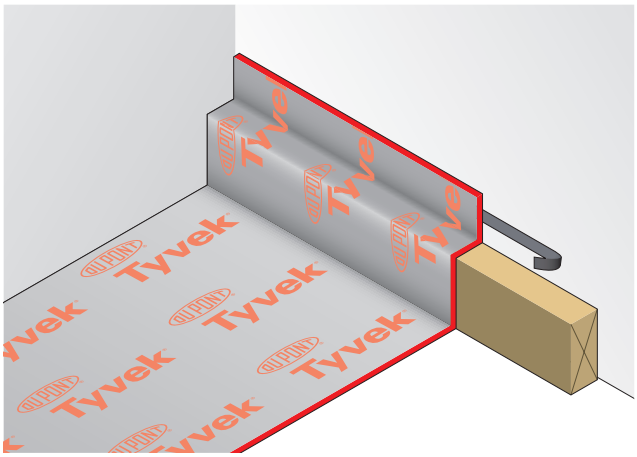


Fig. 35a - Wall junction - joists at right angles

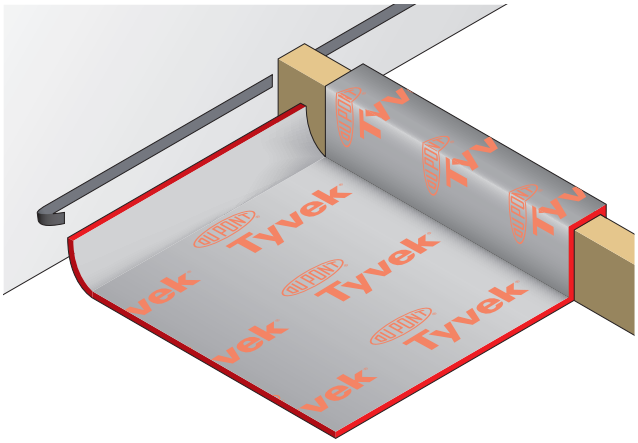
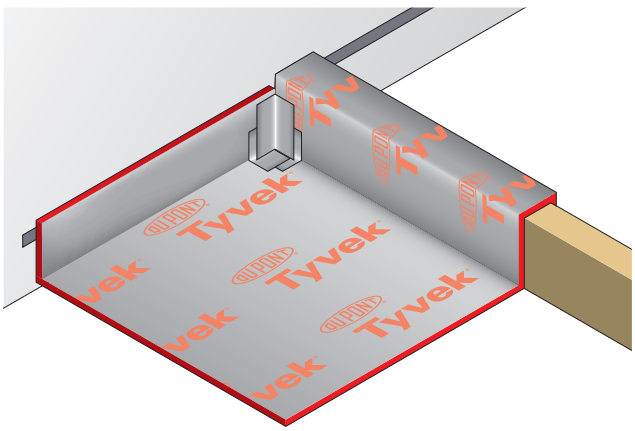


Fig. 35b



Installation

Ideally Tyvek® Supro would be fixed continuously to the underside of the joists, although in most cases this would not be possible as the space beneath the floor would not permit access. The most workable procedure is to wrap the membrane over the joists as in Fig. 33.

Fixing

Tyvek® Supro can be fixed into the tops of the joists using non-ferrous staples or nails at approx. 500mm centres. Fix Tyvek® Supro to the sides of the joists with battens at low level.

Laps and sealing

Laps between each sheet of Tyvek® Supro should be 100mm min. Seal the laps with Tyvek® Butyl Tape or compress beneath floor boards.

Wall junction - joists parallel

Continue Tyvek® Supro up and over the perimeter joist and lap 100mm against the wall, behind the VCL. Seal Tyvek® Supro to the wall using Tyvek® Butyl Tape (Fig. 34).

Wall junction - joists at right angles

Sealing Tyvek® Supro will be difficult where the joists run into the wall. In order to achieve airtightness, the membrane should be cut, shaped and sealed against the wall and joist. Cuts and edge joints should be made good with Tyvek® Acrylic Tape (Figs. 35a/35b).

Additional notes on sealing

Tyvek® Supro should also be sealed against a VCL in the wall using Tyvek® Butyl Tape.

Service penetrations through the Tyvek® membrane should be sealed using Tyvek® Butyl and/or Tyvek® Acrylic Tape.

Internal layers

A further reduction in air leakage can be achieved by installing Tyvek® SD2 with taped laps directly beneath the internal floor finishes. The membrane can be installed either above or beneath the floor boarding to form a continuous internal vapour control layer and air leakage barrier.

Tyvek® membranes
wall and floor applications

SPECIFICATION

Breather Membrane

Shall be Tyvek® Housewrap, Tyvek® Framewrap, Tyvek® Reflex or Tyvek® Solid as manufactured and sold by DuPont de Nemours (Luxembourg) S.à r.l. and serviced by

DuPont™ Tyvek®
Hither Green Trading Estate,
Clevedon, North Somerset.
BS21 6XU.
Tel: 01275 879770
Fax: 01275 879773

Storage
Rolls should be stored palletised or on their sides on a smooth clean surface, under cover and protected from direct sunlight.

General
Care should be taken when handling the membrane in order to prevent tears and punctures occurring. Any that do occur should be repaired with Tyvek® Acrylic Tape. A special metallised tape is available for repairing Tyvek® Reflex

Timber frame construction
Unroll Tyvek® …. (membrane type) horizontally over the face of the sheathing/framing. Ensure protection to lowest timber members/sole plate by extending beyond to a minimum of 100mm.

Fixing to timber studs/sheathing
Fix Tyvek® …. (membrane type) with stainless steel staples or corrosion resistant nails. Fix at max. 600mm centres horizontally and 300mm centres vertically.
Fix membrane at max. 150mm centres at joints and openings.

Fixing to masonry
Fix Tyvek® …. (membrane type) to masonry with an anchor fixing system and large plastic washer such as a Hilti X-SW soft washer fastener and/or similar.

Fixing to steelwork
Fix Tyvek® …. (membrane type) to steelwork with an appropriate fixing system such as Hilti X-EDNI nail (and X-SW soft washer) and/or similar.

Tyvek® Supro "free spanning" wall applications
Tyvek® Supro is a reinforced membrane, the technical differences between it and other Tyvek® membranes are strength, weight and thickness. Minor variations occur in other characteristics such as vapour permeability, but the membrane falls well within the criteria for a Type 1 breather membrane to BS 4016. It is recommended that for 'free spanning' wall applications where no sheathing board or insulation exists directly behind the membrane Tyvek® Supro is specified.

- **Fixing to timber studs (free spanning)**
  Fix Tyvek® Supro with stainless steel staples or corrosion resistant nails.
  Fix at max. 600mm centres horizontally and 300mm centres vertically.
  Fix membrane at max. 150mm centres at joints and openings.
- **Fixing to metal framing (free spanning)**
  (Applicable to metal clad wall systems where external cladding is continuous and the wind load imposed upon the membrane is minimal) Fix Tyvek® Supro to steelwork with Tyvek® Butyl Tape and an appropriate fixing system such as Hilti X-EDNI nail (and X-SW soft washer) and/or similar. Maximum free span between metal frame should not exceed 1200mm. Fix vertically at min. 300mm centres.

Laps
All horizontal laps should be 100mm min.
Vertical laps should be 150mm min.

External corners
Dress Tyvek® …. (membrane type) around external corners ensuring a return of 300mm min.

SPECIFICATION

Window openings
Wrap Tyvek® …. (membrane type) into window/door openings and make good to corners with Tyvek® Acrylic Tape.

Cavity barriers/trays/flashings
Dress Tyvek® …. (membrane type) over cavity barrier/tray/flashing ensuring a min. lap of 100mm.

Floor junctions
Dress Tyvek® … (membrane type) over intermediate floor zone ensuring a min. lap of 100mm between sheets.

Rainscreen cladding –
Fix Tyvek® …. (membrane type) to structural wall at max. 600mm centres horizontally and 300mm centres vertically using appropriate fixings:
- Timber: stainless steel staples or corrosion resistant nails.
- Steelwork: appropriate fixing system such as Hilti X-EDNI nail (and X-SW soft washer) and/or similar.
- Masonry: anchor fixing system/ large plastic washer such as a Hilti X-SW soft washer fastener and/or similar.

Note: Tyvek® Reflex may be used in rainscreen cladding systems, provided that the silver metallised surface faces a clear airspace of min. 25mm.

Sealing (optional)
Laps in Tyvek® Housewrap, Tyvek® Framewrap or Tyvek® Solid can be sealed with Tyvek® Butyl Tape or Tyvek® Acrylic Tape.

Laps in Tyvek® Reflex can be sealed with Tyvek® Butyl Tape or Tyvek® Metallised Tape.

Internal vapour control layer/air leakage barrier (VCL/ALB)

Shall be Tyvek® SD2
as manufactured and sold by DuPont de Nemours (Luxembourg) S.à r.l.
and serviced by

DuPont™ Tyvek®
Hither Green Trading Estate,
Clevedon, North Somerset.
BS21 6XU.
Tel: 01275 879770
Fax: 01275 879773

Fixing
Fix Tyvek® SD2 to internal timber frame surface with stainless steel staples or corrosion resistant nails at max. 600mm centres horizontally and 300mm centres vertically. Tyvek® Butyl Tape may be used for temporary fixing to steelwork or masonry.

Laps
Maintain min. 100mm laps between each sheet and seal with Tyvek® Butyl Tape.

Window openings (before window installation)
Dress Tyvek® SD2 into window/door openings and seal to head, cill and reveal with Tyvek® Butyl Tape. Make good to corners with Tyvek® Acrylic Tape.

Window openings (after window installation)
Dress Tyvek® SD2 into window/door openings and seal to frame with Tyvek® Butyl Tape.

Wall - Floor junction
Bond Tyvek® SD2 to floor screed/VCL/DPM with Tyvek® Butyl Tape, ensuring overlap of 100mm min.

Wall - Ceiling junction
Bond Tyvek® SD2 to ceiling VCL/Tyvek® SD2 with Tyvek® Butyl Tape, ensuring overlap of 100mm min.

Wall - upper storey floor joists
(Tyvek® SD2 must be installed before installation of plasterboard to the ceiling and boarding to the upper floors) Extend Tyvek® SD2 above ceiling/floor joists by min. 100mm. Cut and form membrane around joists and make good with Tyvek® Acrylic Tape. Use Tyvek® Butyl Tape to seal Tyvek® SD2 to the sheets of the upper storey.

Note: Upper storey floor joists supported on joist hangers can be installed after application of Tyvek® SD2.

Fixing - beneath ceiling joists
Unroll Tyvek® SD2 at right angles to ceiling joists and secure with stainless steel staples or corrosion resistant nails. Fix at 300mm centres along each joist. Maintain laps of min. 100mm and seal with Tyvek® Butyl Tape. Penetrations around light fittings and loft hatches, etc. should be made good with Tyvek® Acrylic Tape.

Quality Management
The Tyvek® production units are certified ISO 9001. The Luxembourg site as a whole is certified according to the ISO 14001 environmental standard and was the first site in Luxembourg to be registered within the voluntary EMAS eco-management system.

SPECIFICATION Timber Suspended Floors

Breather membrane/insulation support membrane

Shall be Tyvek® Supro
as manufactured and sold by DuPont de Nemours (Luxembourg) S.à r.l. and serviced by

DuPont™ Tyvek®
Hither Green Trading Estate,
Clevedon, North Somerset.
BS21 6XU.
Tel: 01275 879770
Fax: 01275 879773

Laying - continuously beneath floor joists (if access permits)
Unroll Tyvek® Supro at right angles to timber joists and secure with stainless steel staples or corrosion resistant nails. Fix at max. 300mm centres along each joist.

Laps
Maintain min. 100mm laps between each sheet and seal with Tyvek® Butyl Tape.

Laying – wrapped over floor joists
Unroll Tyvek® Supro so that it is laid at right angles to the timber joists. Form the membrane over the tops and down the sides of the joists.

Fixing - with battens
Fix Tyvek® Supro with stainless steel staples or corrosion resistant nails at min. 500mm centres along the tops of each joist. Secure Tyvek® Supro to the sides of the joists at lower level using battens of 19x38mm min.

Fixing - without battens
Fix Tyvek® Supro with stainless steel staples or corrosion resistant nails at max. 300mm centres along the tops of each joist.

Laps
Maintain min. 100mm laps between each sheet and seal with Tyvek® Butyl Tape or Tyvek® Acrylic Tape.

Wall junction
Bond Tyvek® Supro to wall VCL/Tyvek® SD2 with Tyvek® Butyl Tape, ensuring overlap of 100mm min. If cutting around joists make good to cuts and joints using Tyvek® Acrylic Tape.

Sealing – additional notes
Service penetrations through the Tyvek® membrane should be sealed using Tyvek® Butyl and/or Tyvek® Acrylic Tape.

Questions & Answers

Re: Tyvek® Housewrap, Tyvek® Framewrap, Tyvek® Solid, 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.

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.
No, if Tyvek® Reflex is being used.

Can a Tyvek® membrane be installed behind continuous metal sheeting as the separation layer?
Yes.
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 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 ?
Yes, Tyvek® Supro has all of the attributes required of a BS4016 breather membrane. Its extra strength allows it to be surface applied or used in a 'free spanning' application (page 22).

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: Tyvek® SD2

What is Tyvek® SD2 for?
Tyvek® SD2 is an internal membrane for installation behind plasterboard linings, etc. When all joints are taped it provides a barrier to convective heat losses as well as providing limited vapour control.

Product Data

	Supro / Supro Plus	Solid	Housewrap
Composition	Spunbonded polyethylene and polypropylene / Tyvek® Supro Plus includes acrylic adhesive	100% HDPE, spunbonded	100% HDPE, spunbonded
Thickness (mm)	0,45	0,23	0,17
Weight (g/m²)	145	82	61
Roll width (m)	1,0 1,5	1,5	1,4 2,8
Roll length (m)	50	50	100
Roll weight (kg)	8,5 12	6,2	8,5 18
Rolls per pallet / box	24	24	20

Performance characteristics	Test Method	Supro / Supro Plus	Solid	Housewrap
Water vapour resistance MN.s.g-1	**BS 3177:1959**	0.22	0,23	0,17
Water vapour permeability (g/m²/day)	**BS 3177:1959**	935	874	1195
Water vapour transmission Sd (m)	**EN ISO 12572**	0,015	0,03	0,01
Mullen burst strength (kN.m-2)	**BS 3137:1972 (1987)**	724	870	978
Resistance to water penetration	**BS 4016:1972 (Eosin test)** **MOAT 27:5.1.4.2:1983 1.0m head of water**	pass no penetration	pass no penetration	pass no penetration
Head of water sustained with no penetration (m)	**BS 20811:1992 (1996) (speed 60 cm.min-1)**	2,0	2,0	1,5
Tensile strength (N/5cm)	**EN 12311-1**	300/250	245/215	300/310
Elongation (%)	**EN 12311-1**	13/22	10/16	17/20
Nail tear resistance (N)	**EN 12310-1 MD/XD**	175/190	90/85	54/50
Fire classification	**EN 11925-2**	E	E*	E*
Resistance to penetration of air m³/(m².hr.50Pa)	**EN 12114**	< 0,1	< 0,1	< 2

* tested on mineral wool and wood

Reflex	Framewrap	SD2 ALB/VCL	Acrylic Tape	Butyl Tape	Metallised Tape
Spunbonded polyethylene, metallised lacquered	100% spunbonded polypropylene	Spunbonded polypropylene and polyolefin coating	100% HDPE spunbonded and acrylic adhesive	100% butyl	Single layer Tyvek® with high coat weight water based modified acrylic adhesive
0,23	0,5	0,25	ca. 0,3	ca. 1,5	ca. 0,3
83	100	108	ca. 320	ca. 1850 ca. 1700	ca. 350
0,48 1,5 2,4 2,7	1,4 1,5 2,7 2,8 2,9 3	1,5	0,075	0,020 0,050	0,075
100	100	50	60	30	60
4,08 12,75 20,4 23	14 15 27 28 29 30	8,5	1,5	ca. 1 ca. 2,5	ca. 1,6
24 20	12	24	6	8 4	6

Reflex	Framewrap	SD2 ALB/VCL
0,6	0,09	> 10
248	2388	/
0,08	< 0,01	≤2
870	587	525
pass no penetration	pass no penetration	pass no penetration
2	0,3	1,5
245/210	200/200	180/150
9/13	35/60	30/30
90/85	160/160	140/130
E*	/	E
< 0,03	/	/

Tyvek® membranes wall and floor applications

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. 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 Tyvek® Acrylic tape or Tyvek® Butyl 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.

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 slight 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. Tyvek® membranes are 100% recyclable.

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. Correctly installed Tyvek® membranes have a 15 year product warranty from DuPont.

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

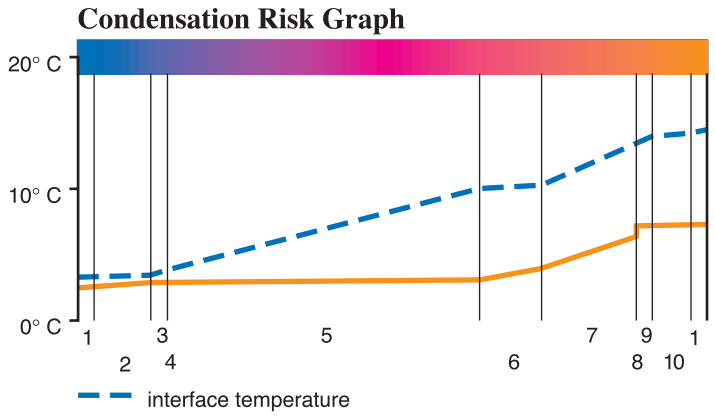
Seminars:
guidance on Tyvek® applications, control of condensation, energy efficiency and legislative compliance.

Condensation Risk Analysis:
to demonstrate compliance with the Approved Documents of the Building Regulations, condensation risk assessments in accordance with BS5250: 2002 are available on request. (See following page)

For information, please call our Technical Support Department:
01275 879770

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 5250:2002.



To obtain the analysis please complete this form and fax to Tyvek® Technical Support on:

> 01275 87 90 33

Name & address : .....

.....

.....

Tel: .....

Fax: .....

e-mail: .....

Projet Ref: .....

BUILDING TYPE
(please tick one only)

- ❑ office/shop
- ❑ domestic/residential
- ❑ public/community building
- ❑ church
- ❑ school
- ❑ sports/activity
- ❑ swimming pool
- ❑ other

WALL SYSTEM
(please tick one only)

- ❑ timber frame
- ❑ metal frame
- ❑ masonry
- ❑ stone
- ❑ internal insulation
- ❑ external insulation
- ❑ brick/block
- ❑ precast concrete
- ❑ rainscreen cladding
- ❑ other

FLOOR SYSTEM
(please tick one only)

- ❑ suspended timber
- ❑ block and beam
- ❑ concrete slab
- ❑ other .....

studs/joists = ... mm x ..... mm @ ..... 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:
102mm brickwork
50mm cavity
Tyvek® Reflex
9.5mm OSB sheathing
90mm insulation
SD2 vapour control layer
12.5mm plasterboard

Tyvek® membranes wall and floor applications

British and European Standards

BS3137: 1972 (95)	Methods for determining the bursting strengh of paper and board
BS3177: 1959 (95)	Method for determining the permeability of flexible sheet materials used for packaging
BS 4016: 1997	Specification for flexible building membranes (breather type)
BS 5250: 2002	Code of practice for control of condensation in buildings
BS EN ISO 13788: 2002	Calculation methods (Interstitial condensation)
BS EN 20811: 1992 (96)	Textiles – Determination of resistance to water penetration. Hydrostatic pressure tests
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
DIN52615: 1987	Determination of water vapour (moisture) permeability of construction and insulating materials
ISO 9001: 2000	Quality systems – Model for quality assurance in design, development, production, installation and servicing
ISO 14001: 1994	Implementation of an environmental Management System (EMS)

Regulations and Technical References

- Building Regulations 2000 (as amended)
  Approved Document L (L1A, L1B, L2A, L2B)

- Building Regulations 2000 (as amended)
  Approved Document C (C2)

- Building (Scotland) Regulations 2004 The Scottish Building Standards:
  > Section 3.10.1 Precipitation – General Provisions (G3.1)
  > Section 3.15.4 Condensation – Interstitial Condensation (G4.1)
  > Section 6.2.1 Building Insulation Envelope - Elemental Method (J3.2, J8.3)

- TRADA Wood Information Sheet 1-35

- TRADA Technology, Timber Frame Construction
  (Third Edition 2001)

- CIBSE Guide A:1999 Environmental Design

About DuPont

DuPont Luxembourg site

DuPont is a science company. Founded in 1802, DuPont puts science to work by solving problems and creating solutions that make people's lives better, safer and easier. Operating in more than 70 countries, the company offers a wide range of products and services to markets including agriculture, nutrition, electronics, communications, safety and protection, home and construction, transportation and apparel. Recognized as the number 1 for scientifically driven solutions, DuPont is the world's leading company in chemical technology and innovation, with more than 200 years of experience in developing and introducing very successful products (such as Corian®, Teflon®, Kevlar®, Nomex®, Sentryglas®), which have changed the lives of millions of people.

In the world of construction, DuPont developed Tyvek® 50 years ago and has more than 30 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, such as architects, designers, specifiers, builders, roofing contractors, etc.

DuPont is the world's largest manufacturer of breather membranes for construction. The company carries out exhaustive market research and listens to the market, applying continuous technological improvement and focusing on market development.