



INSULATION EXCELLENCE

**LABC REGISTERED THERMAL
SYSTEMS TO PART L**

2006 AND 2010



**MULTI-FOIL INSULATION
AND BREATHER MEMBRANES**



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1 Foreword

Web Dynamics Ltd manufactures a range of multi-layer reflective insulation materials at its factory in Bolton. This includes the TLX Silver products, which are vapour barriers and TLX Gold which is water vapour permeable.

Web Dynamics Ltd has developed a wide range of thermal insulation solutions involving multi-foil insulation, for new build properties and also conversions and upgrades. These have been independently assessed to make sure they meet the standards within Approved Document Part L.

Web Dynamics Ltd offers a free advice service to customers who require individual U value calculations or condensation risk assessments for structures which are not covered in this guide.

This document explains the LABC Registered Details for the thermal systems currently available from Web Dynamics Ltd. The Web Dynamics Ltd Technical Team is available to provide further help and guidance.

The following extract is from <http://www.labc.uk.com/registerddetails>

‘LABC Registered Details enables all local authority building control surveyors to share technical details and to recognise the building control decisions made by others in the LABC network.

This means that once a ‘Registration’ has been given through one local authority it will be recognised by all LABC surveyors in England and Wales.

The scheme is specifically designed for use within the LABC network. The benefit to LABC surveyors is that technical research does not need to be repeated time after time by different local authorities.

The benefit for LABC’s customers is that the use of Registered Details streamlines Building Regulations applications and saves time (and money).’

‘Through LABC Registered Details, LABC will measure a design, system or solution against the Building Regulations and judge whether, if used correctly in the defined way, compliance with the Building Regulations will be achieved.’

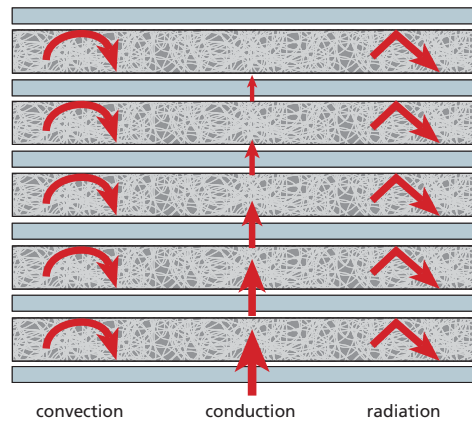
All the solutions in this document are covered by the following LABC Registered Details Certificates.

Product Range	LABC Registered Details Certificate
TLX Silver	RD420710A
TLX Gold	RD420710B

2 How TLX Multi-foils Works

TLX multi-foil insulation works by controlling the three ways in which heat is lost from a building:

- Convection
- Conduction
- Radiation



The outermost layers have low emissivity surfaces. These both reflect infra-red radiation back into the house and prevent the house from emitting radiation to the outside. Inner layers of thick material such as wadding reduce heat loss by conduction through the multi-foil. Inner layers of film prevent air movement through the multi-foil. In addition, the insulation forms an airtight barrier reducing leakage of warm air to the outside.

Multi-foils can be water vapour barriers or vapour permeable depending on their materials of construction.

TLX multi-foils are welded to form a seam along each edge. This is preferable to stitching, which leaves holes through the product. Air and water vapour movement through stitching holes reduces thermal performance and can lead to condensation problems.

3 The TLX Range

The TLX multi-foil range							
TLX Range	Thickness (mm)	Weight (gsm)	Core R Value (m ² .K/W)	Emissivity	Width (m)	Flanges	Vapour resistance (MN.s/g)
TLX Silver	30	545	0.91	0.05	1.2	No	1200
TLX Silver Timber Frame	30	545	0.91	0.05	1.2, 2.4, 2.7, 3.0	Optional	1200
TLX Gold	33	900	0.95	0.16	1.2	Yes	0.5

Core R values for all TLX products are based on single measurements carried out at UKAS approved labs using either the guarded hot box or guarded hot plate test methods, in accordance with BR443 and Approved Document Part L.

4 U Values and Condensation Risk Calculations

All U values have been calculated using the Combined Method, as defined in BS EN ISO 6946.

The physical properties of TLX products have been measured by accredited laboratories according to BS or ISO test methods. In particular the thermal resistances of TLX products have been measured using both the guarded hot plate (BS EN 12667) and the guarded hot box test (BS EN ISO 8990) methods.

The thicknesses and thermal properties of insulation materials such as mineral fibre and rigid board have been taken from manufacturers declared values, supported by certificates issued by an accredited certification body. Manufacturers declared property values have been used for structural materials such as timber, plasterboard and masonry.

The thermal resistance of unventilated air spaces in roofs has been calculated using the detailed method defined in ISO15099. This calculates the thermal resistance of an airspace based on orientation (vertical, horizontal), thickness, emissivity of surfaces, average temperature and temperature drop across the cavity.

Condensation risk analysis has followed the Glaser calculation method in BS EN ISO 13788.

The vapour resistances of materials have again used manufacturers declared values.

It must be stressed that both the U value and condensation risk calculations are specific to the structures and materials used. If the TLX product described is substituted for an alternative, then the calculation will no longer be valid. This is particularly important where the risk of damaging interstitial condensation is involved. The structures in this guide have all been assessed as having no risk of interstitial or surface condensation, but if materials are substituted for alternatives then the calculations will no longer be valid. Particular attention should be paid to multi-foil materials that are stitched and have holes which penetrate the material, or which claim to be breathable but do not have the same properties as TLX Gold.

Condensation risk analyses assume that movement of water vapour occurs by diffusion through materials, and not by movement of moist air through gaps in the structure. The ceiling should therefore be well sealed, as defined in BS5250, to prevent excessive amounts of water vapour entering the roof structure.

- Sheets of plasterboard should be fitted as close together as possible, and the joints sealed with tape or with mastic.
- Gaps around penetrations such as wiring or pipes should also be filled with sealant.
- Junctions of the roof and wall must be sealed.
- Access hatches and frames should be fitted with seals to minimise air leakage. Hatches should not be located in bathrooms or kitchens where large amounts of moisture are produced.
- Recessed light fittings should be designed to reduce air leakage with suitable sealed hood or box if necessary.
- The head of any wall or partition cavity should be sealed.

There must be adequate ventilation in the air space between the breather membrane or TLX Gold and the outer roof covering to remove any water vapour passing into that space.

Some outer coverings are air open, and do not require additional ventilation. Clay or concrete tiles, and natural slates are considered air open.

Other roof coverings such as synthetic slates, fibre cement slates, metal roof coverings are not air open. If this type of roof covering is used, then additional ventilation at eaves and ridge must be provided.

5 Loft Conversions

Most houses that are suitable for a loft conversion will have a cold, ventilated or unventilated loft space. Mineral fibre insulation will be present between and above the floor joists.

Houses built pre-1950 will usually have rafters at 350-450mm centres supported by one or more purlins on each side. These roofs are relatively easy to convert; they are generally of steep pitch, although one purlin may need to be removed to make space for a dormer. After 1950, lower pitches and trussed rafters became more common, generally at 450mm or 600mm centres. These are more difficult to convert, as the cross braces need removing and rafters strengthening. Houses built before 1990 will generally have non-breathable underlay, timber boards or nothing above the rafters. Later houses may have a breathable roofing underlay.

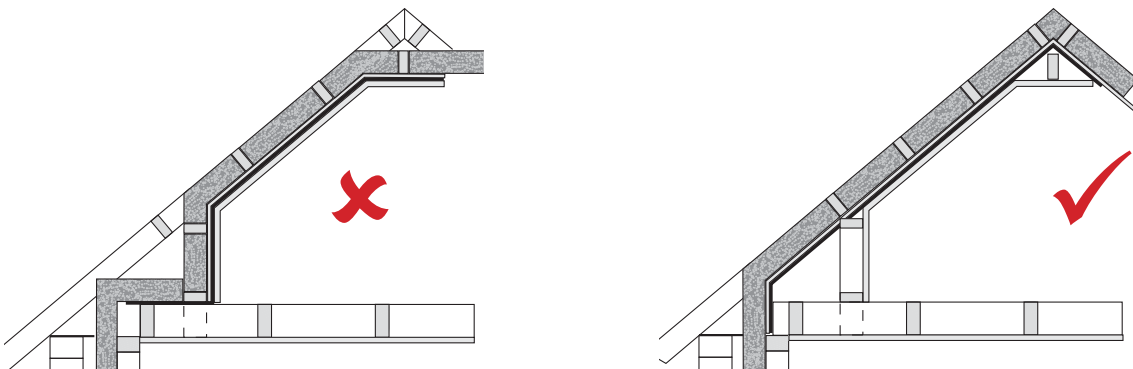
If a dormer is to be built, this will generally have timber stud walls for the face and cheeks, and a flat roof based on flat roof joists and sheathing. Roof lights may be fitted in the line of the pitched roof.

Loft conversions generally require the fitting of thermal insulation to a pitched roof, possibly dormer cheeks and roof, new dwarf walls, party and gable walls.

If the tiles or slates are to be removed, there is the opportunity to fit a modern breathable underlay as part of the new roof. If all work is from the inside, the existing roof structure will stay in place. Where there is not a breathable underlay, Building Regulations require a 50mm ventilated space above the insulation, so that any moisture which penetrates the outer covering can evaporate and not build up in the roof space. Where there is no felt at all, the 25mm tiling batten void may be counted as part of the 50mm space.

BS5250 Control of Condensation recommends that insulation and vapour control layers should be fitted all the way down the pitch of the roof, from ridge to eaves, rather than down dwarf walls and across the ceiling. This is to ensure continuity of vapour control and insulation.

In general, loft conversions need to minimise the depth of roof insulation to preserve head height inside the room.



Fitting a 12.5mm plasterboard provides 30 minutes fire protection.

5 Loft Conversions

5.1 U values needed

The Building Regulations changed in October 2010, and the U values required for different elements of a loft conversion were improved. The U values required in both the 2006 and the 2010 regulations are shown below.

5.1.1 New thermal elements

This would apply to a new dormer construction, and also to a new gable wall built as part of a hip-to-gable conversion

New thermal elements	U value (W/m ² .K)	
	Year 2006	Year 2010
Wall	0.30	0.28
Pitched roof insulation at rafter level	0.20	0.18
Flat roof	0.20	0.18
Floor	0.22	0.22

5.1.2 Retained thermal elements

This applies to existing gable walls and pitched roofs that previously were not insulated, but as a result of the loft conversion become part of the insulated envelope. If the U value of the existing element does not meet the Part L1B threshold value given in the table, they must be upgraded to the improved value.

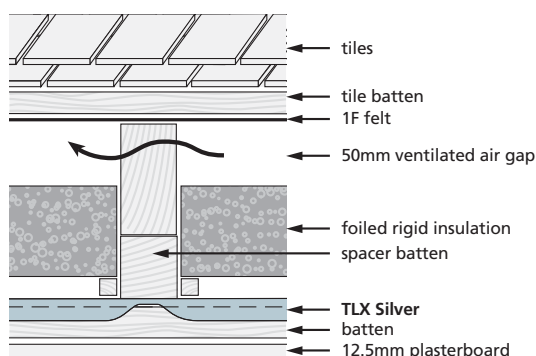
New thermal elements	U value (W/m ² .K)		
	Threshold value	Year 2006 Improved value	Year 2010 Improved value
Cavity wall	0.70	0.55	0.55
Wall	0.70	0.35	0.30
Pitched roof insulation at rafter level	0.35	0.20	0.18
Flat roof	0.35	0.25	0.18
Floor	0.70	0.25	0.25

5 Loft Conversions

5.2 Roofs with 1F non-breathable felt, closed boards or no felt

5.2.1 TLX Silver below rafter, rigid board between rafter, 1F

The rafters may need battening out to greater depth in order to accommodate the amount of insulation required. Rigid insulation board such as PIR or Phenolic board is fitted between the rafters, ensuring there is a 50mm ventilated space above, and a 20mm space below the board. Boards can be held in place with small timber battens, clips or other fixings. Sealing the gap between the side of the board and the rafter is recommended to prevent air movement. TLX Silver is fitted across the bottom of the rafters. Each layer should overlap the previous layer by 50mm, and the overlap sealed with a suitable tape. TLX Silver is held in place with 38mm timber battens and a sheet of 12.5mm plasterboard added.



TLX Silver is a vapour barrier, and this structure gives no risk of surface or interstitial condensation.

The depth of rigid insulation needed will depend on the rafter spacing and the type of board used. Phenolic board has a lower thermal conductivity than polyisocyanurate (PIR), and will generally save 5-10mm of space.

5.2.1.1 - TLX Silver below rafters, 1F felt with Phenolic Foam (λ 0.020), 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	75	155	90	170	110	190
600	65	145	80	160	100	180

5.2.1.2 - TLX Silver below rafters, 1F felt with PIR (λ 0.022), 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	80	160	100	180	120	200
600	70	150	85	165	105	185

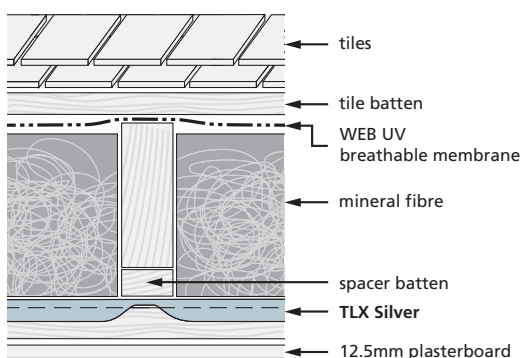
5 Loft Conversions

5.3 Roofs with breathable underlay

Where a breathable roofing underlay is fitted, the entire rafter space can be fully filled with insulation. Deep rafters, of 150mm or above, can use mineral fibre whereas shallower rafters will require rigid board.

5.3.1 TLX Silver below rafter, mineral fibre between rafter, breather membrane

Fit the required thickness of mineral fibre between the rafters. When pushing fibre in from underneath, the rafter space should not be completely filled to ensure that the breather membrane retains a minimum of a 10mm drape. This is to provide a channel for water penetrating the roof covering to run down to the gutter, and also to allow air movement up and down the roof. If the breather membrane does not drape at least 10mm, then counter battens are required above the membrane.



TLX Silver is fitted across the bottom of the rafters, held in place with 38mm timber battens, and a sheet of plasterboard added. It is not practical to design an unventilated air space between TLX and mineral fibre. TLX Silver is a vapour barrier, and this structure gives no risk of surface or interstitial condensation.

The depth of mineral fibre needed will depend on the rafter spacing and the density of fibre used. High density fibre with a thermal conductivity of 0.032W/m.K will give the smallest thickness, but may not be the most cost effective material.

5.3.1.1 - TLX Silver below rafter with Mineral Fibre (λ 0.032) between rafter, BM, 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	125	150	150	175	175	200
600	115	150	140	175	160	200

5.3.1.2 - TLX Silver below rafter with Mineral Fibre (λ 0.035) between rafter, BM, 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	135	160	160	185	190	220
600	130	150	150	175	175	200

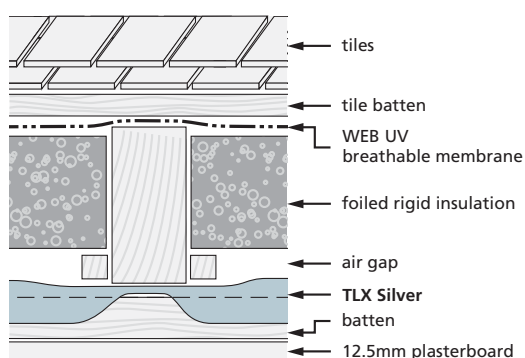
5 Loft Conversions

5.3.2 TLX Silver below rafter, rigid board between rafter, breather membrane

The rafters may need battening out to greater depth in order to accommodate the amount of insulation required. Rigid insulation board such as PIR or Phenolic board is fitted between the rafters. Boards can be held in place with small timber battens, clips or other fixings. TLX Silver is fitted across the bottom of the rafters, held in place with 38mm timber battens, and a sheet of plasterboard added.

TLX Silver is a vapour barrier, and this structure gives no risk of surface or interstitial condensation.

The depth of rigid insulation needed will depend on the rafter spacing and the type of board used. Phenolic board has a lower thermal conductivity than polyisocyanurate (PIR), and will generally require around 5 -10mm less to give an equivalent U value.



5.3.2.1 - TLX Silver below rafter, Phenolic Foam (λ 0.020) between rafter, BM, 38mm batten

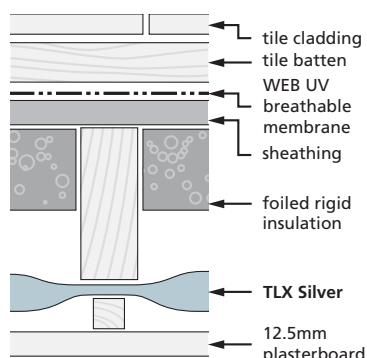
Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	60	100	80	120	100	140
600	55	95	70	110	90	130

5.3.2.2 - TLX Silver below rafter, PIR (λ 0.022) between rafter, BM, 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	65	105	85	125	110	150
600	60	100	75	115	90	130

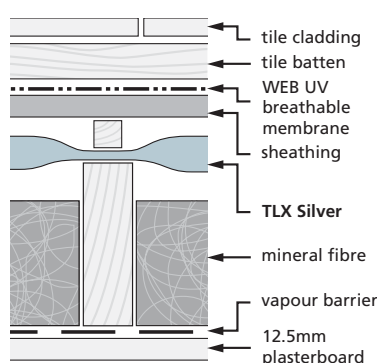
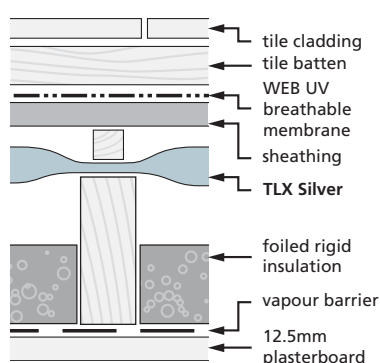
5 Loft Conversions

5.4 Dormer cheeks



The cheeks of a dormer are generally of a new build timber frame construction. Timber studs give the strength to the wall, with sheathing board and breather membrane outside to ensure rigidity and water tightness. The outer cladding may be tiles, slates or weatherboarding.

TLX Silver is installed across the face of the studs to provide thermal insulation, air and vapour barrier. Additional insulation is fitted between the studs.



5.4.1 - TLX Silver in dormer cheeks, 38mm batten

$U = 0.28 \text{ W/m}^2\text{.K}$	PIR ($\lambda 0.022$)		Mineral Fibre ($\lambda 0.032$)	
	Insulation Thickness (mm)	Stud Depth (mm)	Insulation Thickness (mm)	Stud Depth (mm)
TLX Silver inside stud	35	60	50	75
TLX Silver outside stud	35	60	50	75

5.4.2 - TLX Silver in dormer cheeks, 38mm batten

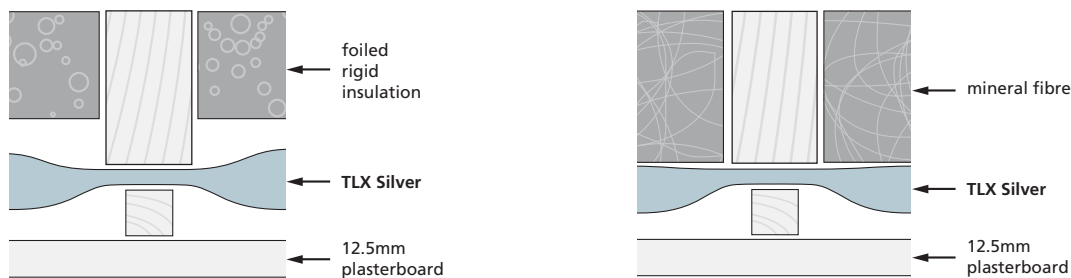
$U = 0.24 \text{ W/m}^2\text{.K}$	PIR ($\lambda 0.022$)		Mineral Fibre ($\lambda 0.032$)	
	Insulation Thickness (mm)	Stud Depth (mm)	Insulation Thickness (mm)	Stud Depth (mm)
TLX Silver inside stud	40	70	60	75
TLX Silver outside stud	45	70	60	75

5 Loft Conversions

5.5 Dwarf wall

It is recommended that insulation and vapour control should follow the roof line from ridge to eaves. However, sometimes it may be necessary to insulate down the dwarf wall and across the ceiling.

Insulation is fitted between the timber studs that make up the dwarf wall, and TLX Silver installed across the front of the studs. A 38mm batten is used to hold the TLX Silver in place and to provide a small unventilated cavity. This cavity may be used for services such as cabling if desired.



5.5.1 - TLX Silver in dwarf wall, 38mm batten

$U = 0.28 \text{ W/m}^2\text{.K}$	PIR ($\lambda 0.022$)		Mineral Fibre ($\lambda 0.032$)	
	Insulation Thickness (mm)	Stud Depth (mm)	Insulation Thickness (mm)	Stud Depth (mm)
TLX Silver inside stud	35	60	50	50

5.5.2 - TLX Silver in dwarf wall, 38mm batten

$U = 0.24 \text{ W/m}^2\text{.K}$	PIR ($\lambda 0.022$)		Mineral Fibre ($\lambda 0.032$)	
	Insulation Thickness (mm)	Stud Depth (mm)	Insulation Thickness (mm)	Stud Depth (mm)
TLX Silver inside stud	45	60	85	85

5.6 Masonry gable or party wall

Please refer to section 9.2.4

6 New Build - Roofs

6 New build - roofs

It has now become fairly common practice to incorporate rooms in the roof in new build construction. This will become increasingly popular in the near future as we move towards carbon zero homes with the roof space offering extra internal floor area for not a great deal more external envelope.

Attic trusses make a room in the roof, which has been planned from the design stage, much simpler to implement as the trusses have been designed to leave an open void through the centre of the roof.

New build roofs will tend to have deeper rafters set further apart, as trusses are commonly designed to be set at up to 600mm centres. Larger centres can give a cost saving on the roof and also minimise the amount of cold bridging through the insulation.

New build roofs give the option to put some of the insulation on the outside of the rafters. This allows the internal lining to be fitted directly to the underside of the rafters in order to maximise internal headroom.

6.1 SAP and the code for sustainable homes

SAP is used to demonstrate compliance with the Building Regulations for new build construction. It is used to calculate the SAP Rating based on the annual energy costs for space and water heating, and also for calculating the Carbon Index based on CO₂ emissions associated with space and water heating.

Because SAP gives an energy rating for the whole dwelling, there are no set U value targets (other than the limiting U values outlined in Part L). SAP determines a Target Emission Rating (TER) for a dwelling of the set dimensions, and calculates the Dwelling Emission Rating (DER) for the proposed dwelling. Effectively the TER is the pass mark for the DER. Often achieving lower U values in the walls or the roof will allow for more glazing to be incorporated and still comply.

From 2013 all new dwellings built for the private sector will be required to have a Code for Sustainable Homes rating 4 and all dwellings in the public sector will need code rating 6. Code 4 requires a 44% improvement in energy standards compared with Part L1 2006 standards, and Code 6 is a zero carbon home.

Further information regarding the Code for Sustainable Homes is available from the Communities and Local Government website:

<http://www.communities.gov.uk/planningandbuilding/buildingregulations/legislation/codesustainable/>

6 New Build - Roofs

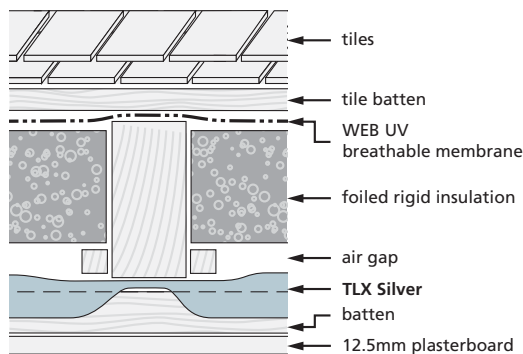
6.2 TLX multi-foil below rafter, breather membrane

6.2.1 TLX Silver below rafter, rigid board between rafter, breather membrane

Typical new build rafter depth of 150mm, or deeper, gives plenty of room to meet the minimum thermal requirements. Rigid insulation board such as PIR or Phenolic board is fitted between the rafters, maintaining a 20mm space between the board and the TLX Silver. Boards can be held in place with small timber battens, clips or other fixings. TLX Silver is fitted across the bottom of the rafters, held in place with 38mm timber battens, and a sheet of plasterboard added.

TLX Silver is a vapour barrier, and this structure gives no risk of surface or interstitial condensation.

The most effective way to alter the U value is to vary the thickness of rigid insulation. However maintaining the air cavities is critical and reducing the depth of any cavities to below 20mm to allow for more rigid insulation is unlikely to improve the U value.



6.2.1.1 - TLX Silver below rafter, Phenolic Foam (λ 0.020), BM, 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	60	150	80	150	100	150
600	55	150	70	150	90	150

6.2.1.2 - TLX Silver below rafter, PIR (λ 0.022), BM, 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	65	150	85	150	110	160
600	60	150	75	150	90	150

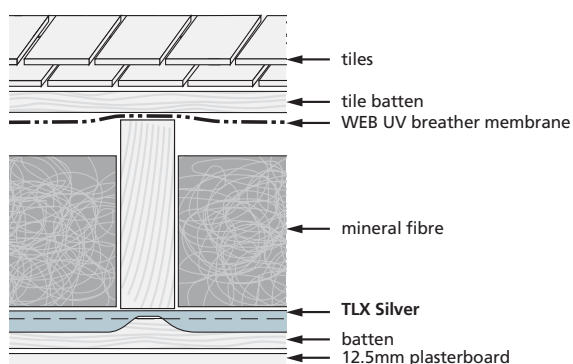
6 New Build - Roofs

6.2.2 TLX Silver below rafter, mineral fibre between rafter, breather membrane

Fit the required thickness of mineral fibre between the rafters. The fibre should be cut slightly over width and pushed into the rafter space to give a friction fit. This reduces the chance of air movement bypassing the insulation. TLX Silver is fitted across the bottom of the rafters, held in place with 38mm timber battens, and a sheet of plasterboard added. It is not practical to provide an unventilated air space between TLX and mineral fibre.

TLX Silver is a vapour barrier, and this structure gives no risk of surface or interstitial condensation.

The most effective way to alter the U value is to vary the thickness of mineral fibre; however the thermal conductivity of the mineral fibre product used is also important as this will vary depending on the density.



6.2.2.1 - TLX Silver below rafter with Mineral Fibre (λ 0.032) between rafter, BM, 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	125	150	150	175	175	200
600	115	150	140	175	160	200

6.2.2.2 - TLX Silver below rafter with Mineral Fibre (λ 0.035) between rafter, BM, 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	135	160	160	185	190	220
600	130	150	150	175	175	200

6 New Build - Roofs

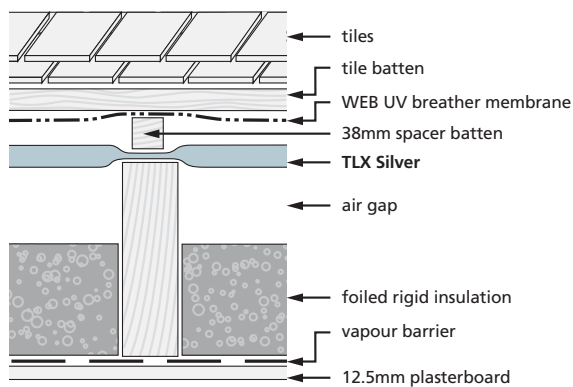
6.3 TLX multi-foil above rafter

6.3.1 TLX Silver above rafter, rigid board between rafter, breather membrane

To avoid encroaching onto the internal space of a building, TLX Silver is often fitted to the top of the rafters before the roofing underlay is installed. Rigid insulation board such as PIR or Phenolic board is fitted between the rafters, maintaining a minimum 20mm air cavity between the board and the TLX Silver. A vapour control layer is then fitted across the bottom of the rafters and a sheet of plasterboard added.

A well-sealed continuous vapour control layer (such as 1000 gauge polythene) is necessary to ensure this structure gives no risk of surface or interstitial condensation. A continuous seal can be achieved by ensuring both the insulation and the vapour control layer run from ridge to eaves.

The most effective way to alter the U value is to vary the thickness of rigid insulation. However the cavity between TLX Silver and the rigid insulation should be maintained.



6.3.1.1 - TLX Silver above rafter with Phenolic Foam (λ 0.020) between rafter, BM, 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	80	120	100	140	120	150
600	70	110	80	120	100	140

6.3.1.2 - TLX Silver above rafter with foiled PIR (λ 0.022) between rafter, BM, 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	90	130	100	140	130	160
600	75	120	90	130	110	140

These solutions are specific to the TLX range and must not be used with other multi-foils

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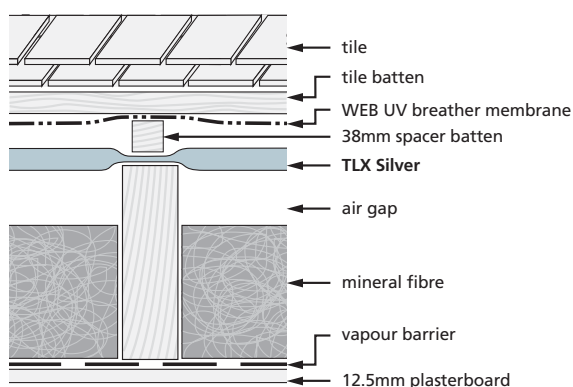
6 New Build - Roofs

6.3.2 TLX Silver above rafter, mineral fibre between rafter, breather membrane

With ease of installation in mind, TLX Silver is often fitted to the top of the rafters before the roofing underlay is installed. Fit the required thickness of mineral fibre between the rafters, maintaining a minimum 20mm air cavity between TLX Silver and the mineral fibre. The fibre should be cut slightly over width and pushed into the rafter space to give a friction fit. This reduces the chance of air movement bypassing the insulation. A vapour control layer is then fitted across the bottom of the rafters and a sheet of plasterboard added.

A well-sealed continuous vapour control layer (such as 1000 gauge polythene) is necessary to ensure this structure gives no risk of surface or interstitial condensation. A continuous seal can be achieved by ensuring both the insulation and the vapour control layer run from ridge to eaves.

The most effective way to alter the U value is to vary the thickness of mineral fibre; however the thermal conductivity of the mineral fibre product used is also important as this will vary depending on the density. The cavity between TLX Silver and the mineral fibre should be maintained.



6.3.2.1 - TLX Silver above rafter with Mineral Fibre (λ 0.032) between rafter, BM, 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	115	150	135	175	160	200
600	100	150	120	170	150	185

6.3.2.2 - TLX Silver above rafter with Mineral Fibre (λ 0.035) between rafter, BM, 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	125	160	150	185	175	215
600	110	150	140	175	160	200

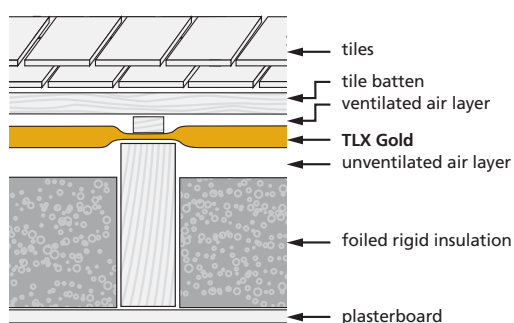
6 New Build - Roofs

6.3.3 TLX Gold above rafter, rigid board between rafter

TLX Gold is a breathable multi-foil primarily designed to be used across the top of the rafters with additional insulation between the rafters. TLX Gold's top layer is a breathable membrane and so no additional roofing underlay is required. Rigid insulation board such as PIR or Phenolic board is fitted between the rafters, maintaining an air cavity of 20mm minimum between the board and the TLX Gold. Plasterboard can then be fixed directly to the underside of the rafters.

Due to the water vapour permeability of TLX Gold, a vapour control layer is not required in any of these solutions. However it is vital that the plasterboard ceiling and rigid board insulation are both well sealed, and that air flow between the roof covering and TLX Gold is not restricted.

The most effective way to alter the U value is to vary the thickness of rigid insulation; however the cavity between TLX Gold and the rigid insulation should be maintained.



6.3.3.1 - TLX Gold above rafter, Phenolic Foam (λ 0.020) between rafter, 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	100	140	120	150	140	170
600	90	125	100	140	120	150

6.3.3.2 - TLX Gold above rafter, PIR (λ 0.022) between rafter, 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	110	150	130	160	150	180
600	90	125	110	150	130	160

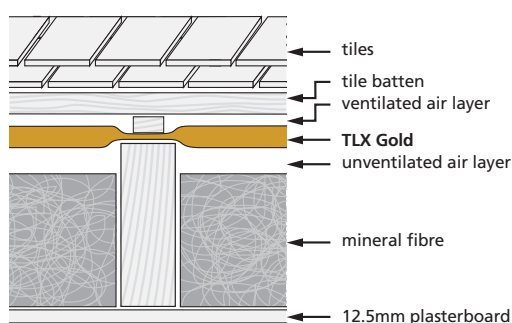
6 New Build - Roofs

6.3.4 TLX Gold above rafter, mineral fibre between rafters

TLX Gold is a breathable multi-foil, primarily designed to be used across the top of the rafters with additional insulation between the rafters. TLX Gold's top layer is a breathable membrane and so no additional roofing underlay is required. Additional insulation such as mineral fibre is fitted between the rafters with an air cavity of around 20mm maintained between the mineral fibre and the TLX Gold. Plasterboard can then be fixed directly to the underside of the rafters.

Due to the water vapour permeability of TLX Gold, a vapour control layer is not required in any of these solutions. However it is vital that the plasterboard ceiling is well sealed and that air flow between the roof covering and TLX Gold is not restricted.

The most effective way to alter the U value is to vary the thickness of mineral fibre; however the cavity between TLX Gold and the mineral fibre should be maintained.



6.3.4.1 - TLX Gold above rafter, Mineral Fibre (λ 0.032) between rafter, 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	145	190	165	210	200	240
600	130	175	150	195	175	220

6.3.4.2 - TLX Gold above rafter, Mineral Fibre (λ 0.035) between rafter, 38mm batten

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	150	200	180	225	210	250
600	140	185	165	210	190	235

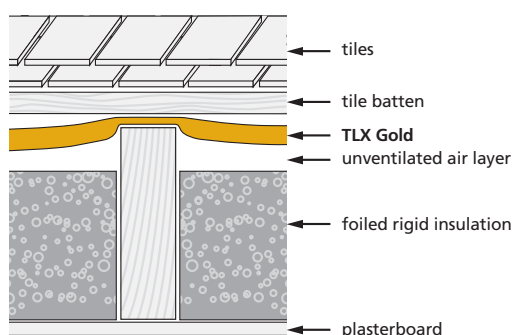
6 New Build - Roofs

6.3.5 TLX Gold draped above rafter, rigid board between rafter

If the top 60mm of the rafter space is not filled with insulation, then TLX Gold can be laid across the rafters and allowed to drape down into the rafter space. Provided the TLX Gold forms a 10mm deep channel in the centre of the rafter space, then tile battens can be fitted directly on top of the TLX Gold without the need to counter batten.

Rigid insulation board is fitted between the rafters, maintaining an unventilated air cavity between the board and the TLX Gold. Plasterboard is fitted directly to the underside of the rafters.

It is important to ensure that the rigid board insulation and the plasterboard ceiling are well sealed to prevent excessive amounts of water vapour entering the roof structure.



6.3.5.1 - TLX Gold above rafter, Phenolic Foam (λ 0.020) between rafter

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	100	160	120	180	140	200
600	90	150	100	160	120	180

6.3.5.2 - TLX Gold above rafter, PIR (λ 0.022) between rafter

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	110	170	130	190	150	210
600	90	150	110	170	130	190

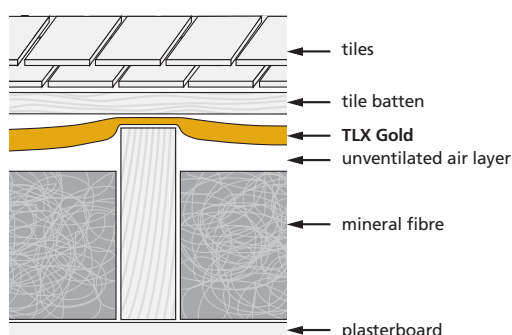
6 New Build - Roofs

6.3.6 TLX Gold draped above rafter, mineral fibre between rafter

If the top 60mm of the rafter space is not filled with insulation, then TLX Gold can be laid across the rafters and allowed to drape down into the rafter space. Provided the TLX Gold forms a 10mm deep channel in the centre of the rafter space, then tile battens can be fitted directly on top of the TLX Gold without the need to counter batten.

Mineral fibre is fitted between the rafters, maintaining an unventilated air cavity between the board and the TLX Gold. Plasterboard is fitted directly to the underside of the rafters.

It is important to ensure that the plasterboard ceiling is well sealed to prevent excessive amounts of water vapour entering the roof structure.



6.3.6.1 - TLX Gold above rafter, Mineral Fibre (λ 0.032) between rafter

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	145	205	165	225	200	260
600	130	190	150	210	175	235

6.3.6.2 - TLX Gold above rafter, Mineral Fibre (λ 0.035) between rafter

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	150	210	180	240	210	270
600	140	200	165	225	190	250

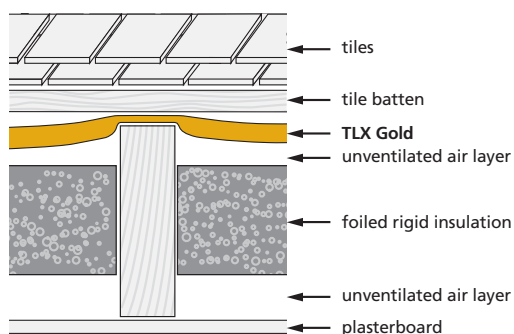
6 New Build - Roofs

6.3.7 TLX Gold draped above rafter, rigid board centrally between rafters

If the top 60mm of the rafter space is not filled with insulation, then TLX Gold can be laid across the rafters and allowed to drape down into the rafter space. Provided the TLX Gold forms a 10mm deep channel in the centre of the rafter space, then tile battens can be fitted directly on top of the TLX Gold without the need to counter batten.

Rigid insulation board is fitted centrally between the rafters, maintaining an unventilated air cavity on both sides of the board. It is essential that the sides of the rigid board fit closely between the rafters to avoid air movement. If necessary, the junction of the board and rafter should be sealed with a sealant. Plasterboard is fitted directly to the underside of the rafters.

It is important to ensure that the rigid board insulation and the plasterboard ceiling are well sealed to prevent excessive amounts of water vapour entering the roof structure.



6.3.7.1 - TLX Gold above rafter, Phenolic Foam (λ 0.020) between rafter

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	90	175	110	185	130	200
600	70	150	90	175	110	200

6.3.7.2 - TLX Gold above rafter, PUR (λ 0.022) between rafter

Rafter Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)	Insulation Thickness (mm)	Rafter Depth (mm)
400	90	175	110	200	130	220
600	75	150	100	175	110	200

7 New Build - Walls

7.1 Timber frame walls

A new timber frame wall generally has the structure:

- Plasterboard
- Battens to create service cavity (optional)
- Insulation across front of studs (optional)
- Vapour control layer
- Timber studs containing insulation
- Sheathing board
- Breather membrane (standard or reflective)
- Cavity
- Outer cladding – brick, tiles, timber boarding

Standard timber stud depths are 89, 140 and 184mm. When calculating U values of stud walls, the timber fraction in the wall is normally taken as 15% to allow for studs, cross pieces, noggins, window and door frames and extra timber used to strengthen areas of the frame. To improve thermal performance, studs in the form of an I-beam may be used, or a twin frame system, where the timber bridging of the insulation is significantly reduced.

7.1.1 TLX Silver in timber frame walls

TLX Silver is installed across the front face of the timber studs, providing both thermal resistance and a vapour barrier. Battens are fixed through TLX Silver to the studs to hold it securely in place and provide a cavity for services. A wall structure with TLX Silver fitted in this way has no risk of surface or interstitial condensation.

To minimise joints in the vapour barrier, TLX Silver is available in widths up to 3.0m

A breather membrane on the outside of the sheathing board ensures the frame is watertight. This membrane can be a standard or a reflective, low emissivity product. The cavity between the breather membrane and brick cladding can be considered as an unventilated cavity. The thermal resistance of the cavity is:

	Unventilated Cavity	
	Emissivity	R value
Standard breather membrane	0.90	0.184
Reflective breather membrane	0.05	0.665

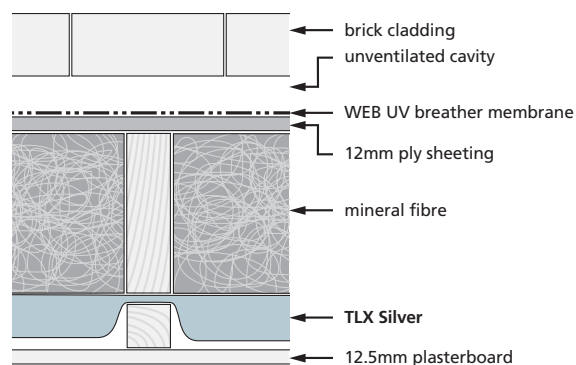
The cavity between the breather membrane and tile or weatherboard cladding is considered to be ventilated. The thermal resistance of the cavity is taken as zero. However, there is still a slight advantage to using a reflective breather membrane, since the exterior surface resistance of the wall is increased:

	Ventilated Cavity	
	Emissivity	Rse value
Standard breather membrane	0.90	0.130
Reflective breather membrane	0.05	0.290

7 New Build - Walls

7.1.2 Timber frame walls with TLX Silver and mineral fibre

Fill stud cavity with mineral fibre to prevent slumping.



7.1.2.1 - Timber frame wall, reflective breather membrane e 0.05, brick cladding, 38mm batten

Stud Depth (mm)	U - values W/m².K		
	Thermal conductivity of mineral fibre		
	λ 0.032	λ 0.035	λ 0.040
89	0.23	0.23	0.24
140	0.18	0.19	0.20
184	0.15	0.16	0.17

7.1.2.2 - Timber frame wall, standard breather membrane e 0.90, brick cladding, 38mm batten

Stud Depth (mm)	U - values W/m².K		
	Thermal conductivity of mineral fibre		
	λ 0.032	λ 0.035	λ 0.040
89	0.26	0.26	0.28
140	0.20	0.21	0.22
184	0.17	0.17	0.18

7.1.2.3 - Timber frame wall, reflective breather membrane e 0.05, timber cladding, 38mm batten

Stud Depth (mm)	U - values W/m².K		
	Thermal conductivity of mineral fibre		
	λ 0.032	λ 0.035	λ 0.040
89	0.26	0.27	0.28
140	0.20	0.21	0.22
184	0.17	0.17	0.19

7.1.2.4 - Timber frame wall, standard breather membrane e 0.90, timber cladding, 38mm batten

Stud Depth (mm)	U - values W/m².K		
	Thermal conductivity of mineral fibre		
	λ 0.032	λ 0.035	λ 0.040
89	0.27	0.28	0.30
140	0.21	0.22	0.23
184	0.17	0.18	0.19

These solutions are specific to the TLX range and must not be used with other multi-foils

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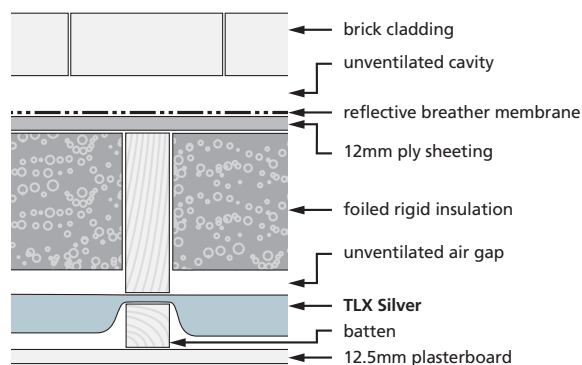
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7 New Build - Walls

7.1.3 Timber frame walls with TLX Silver and rigid insulation board

The thickness of rigid board is 20mm less than the stud depth, allowing an unventilated air cavity to form between the board and TLX Silver inside the studs.



7.1.3.1 - Timber frame wall, with reflective breather membrane and brick cladding, 38mm batten

Stud Depth (mm)	Insulation Thickness (mm)	U - values W/m ² .K	
		Board and thermal conductivity	
		Phenolic λ 0.020	PIR λ 0.022
89	70	0.19	0.19
140	120	0.14	0.15
184	160	0.12	0.13

7.1.3.2 - Timber frame wall, with standard breather membrane and brick cladding, 38mm batten

Stud Depth (mm)	Insulation Thickness (mm)	U - values W/m ² .K	
		Board and thermal conductivity	
		Phenolic λ 0.020	PIR λ 0.022
89	70	0.21	0.21
140	120	0.16	0.16
184	160	0.13	0.14

7.1.3.3 - Timber frame wall, with reflective breather membrane and timber cladding, 38mm batten

Stud Depth (mm)	Insulation Thickness (mm)	U - values W/m ² .K	
		Board and thermal conductivity	
		Phenolic λ 0.020	PIR λ 0.022
89	70	0.21	0.22
140	120	0.16	0.16
184	160	0.13	0.14

7.1.3.4 - Timber frame wall, with standard breather membrane and timber cladding, 38mm batten

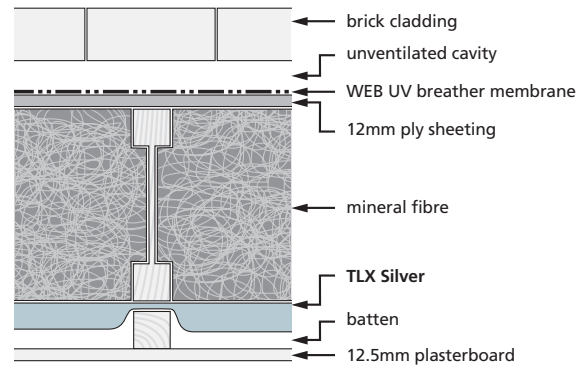
Stud Depth (mm)	Insulation Thickness (mm)	U - values W/m ² .K	
		Board and thermal conductivity	
		Phenolic λ 0.020	PIR λ 0.022
89	70	0.22	0.23
140	120	0.16	0.17
184	160	0.14	0.14

7 New Build - Walls

7.1.6 I-beam studs

I-beam studs consist of two outer flanges held together by a thinner web. This introduces less timber bridging of the insulation between the studs and leads to lower U values.

The flange is generally 39mm deep and 38 – 89mm wide and the web is 10mm wide. The total depth of the I-stud is 140, 200, 240, 300mm

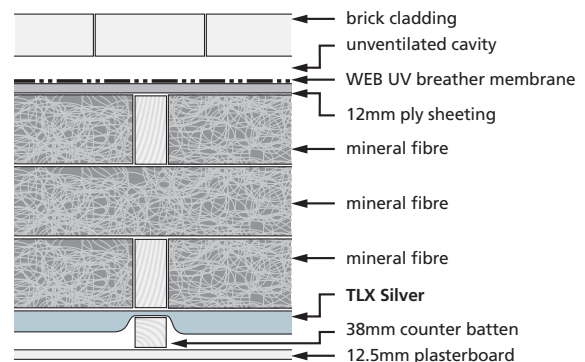


7.1.6 - Timber frame wall, standard breather membrane e 0.90, brick cladding, 38mm batten

I Beam Depth (mm)	U - values W/m².K	
	Thermal conductivity of mineral fibre	
	λ 0.032	λ 0.035
140	0.18	0.19
200	0.14	0.15
240	0.12	0.13
300	0.10	0.11

7.1.7 Timber frame walls with split studs

Split studs, or twin frame is another way to reduce timber bridging of the insulation. The central layer of insulation is effectively unbridged by timber.



7.1.7 - Timber frame wall, standard breather membrane e 0.90, brick cladding, 38mm batten

Outer Stud (mm)	Gap (mm)	Inner Stud (mm)	U - values W/m².K	
			Thermal conductivity of mineral fibre	
			λ 0.032	λ 0.035
90	90	90	0.11	0.12
90	120	90	0.10	0.11

7 New Build - Walls

7.2 Masonry cavity walls

Masonry cavity walls are a traditional and widely used method of building walls. The cavity can be fully filled with insulation, either fitted or injected, or partially filled to leave a clear cavity.

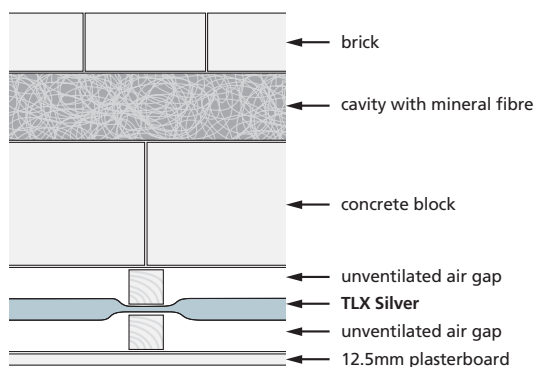
TLX Silver can be installed to the interior of cavity masonry walls on timber studs or battens fixed to the inner leaf of the wall. Additional insulation may be fitted between the studs to lower the U value of the wall. A second set of battens holds the TLX Silver in place and provides a service cavity.

It is unlikely that a new build cavity wall would require internal insulation, since it is more effective to insulate inside the cavity. However, TLX Silver may be used to upgrade the thermal performance of existing cavity walls. For example, the wall:

- 105mm brick
- 100mm cavity injected with mineral fibre 0.040W/m.K
- 100mm dense concrete block
- 12.5mm plasterboard on 15mm plaster dabs

has a U value of 0.35W/m².K

Removing the existing plasterboard and replacing it with 25mm studs, TLX Silver, 25mm battens and 12.5mm plasterboard reduces the U value to 0.24W/m².K and only takes up an additional 37mm of space.



7 New Build - Walls

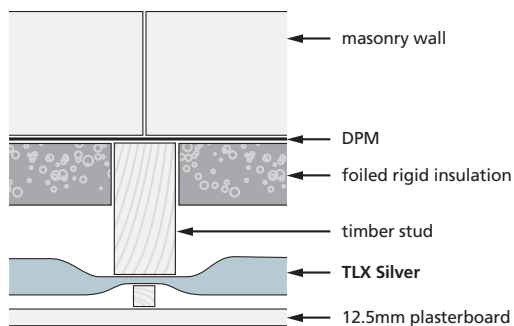
7.3 Solid masonry walls

Upgrading the insulation of solid masonry walls represents a real challenge to improving the energy efficiency of housing stock. In many cases, external insulation would alter the appearance of the building and may not be acceptable. Internal lining of solid walls is sometimes the only way to upgrade solid walls.

7.3.1 Masonry wall with TLX Silver

TLX Silver can be installed to the interior of cavity masonry walls, on timber studs or battens fixed to the inner leaf of the wall. A damp proof membrane should be fitted between the inner leaf of the masonry and any timber studs or battens. Additional insulation may be fitted between the studs to lower the U value of the wall. A second set of battens holds the TLX Silver in place and provides a service cavity.

TLX Silver helps to improve the airtightness of existing houses, and prevents condensation inside the wall.



7.3.1 - TLX Silver on inside, 9" masonry walls, 38mm batten					
Stud Depth (mm)	Batten Depth (mm)	Insulation Depth (mm)	U - values W/m².K		
			PIR λ 0.022	Mineral Fibre λ 0.032	Mineral Fibre λ 0.037
25	25	0	0.47	0.47	0.47
50	25	25	0.33	0.36	0.37
50	38	40	0.28	0.32	0.33

8 Barn Conversion - Exposed Rafters

8 Barn conversion - exposed rafters

Although not limited to barn conversions, exposed rafters often come hand in hand with buildings of this type where retaining the character they offer is important. These tend to be shallow rafters set at narrow and uneven centres.

The key in finding an exposed rafter solution that suits a particular project is compromise. Fully exposed rafters, not raising the roofline and achieving a U value $0.18\text{W/m}^2\text{.K}$ is impossible and there has to be some compromise to one or more of these in order to find a suitable solution.

The TLX exposed rafter solution aims to compromise on the amount of rafter exposed, raising the roofline, or a bit of both. Any compromise on U value targets can be accounted for by our Technical Team and supporting calculations supplied.

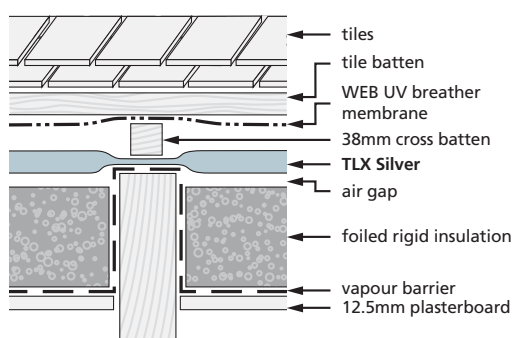
8.1 TLX Silver, semi-exposed rafter, rigid board between rafters, breather membrane

Fitting some of the insulation between the rafters to leave the rafters partially exposed internally can be a good compromise to save on raising the height of the roofline.

TLX Silver is fitted to the top of the rafters before the roofing underlay is installed. Rigid insulation board such as PIR or Phenolic board is fitted between the rafters, maintaining a minimum air cavity of 20mm between the board and the TLX Silver. A vapour control layer is then fitted between the rigid board and the plasterboard ceiling.

A well-sealed continuous vapour control layer (such as 1000 gauge polythene) is necessary to ensure this structure gives no risk of surface or interstitial condensation. A continuous seal can be achieved by ensuring both the insulation and the vapour control layer run from ridge to eaves.

The most effective way to alter the U value is to vary the thickness of rigid insulation; however the cavity between TLX Silver and the rigid insulation should be maintained.



8.1.1 - TLX Silver above rafters, rigid board between rafters, BM, 38mm batten

Rafter Centres (mm)	U = 0.25 W/m ² .K		U = 0.20 W/m ² .K		U = 0.18 W/m ² .K	
	Phenolic λ 0.020	PIR λ 0.022	Phenolic λ 0.020	PIR λ 0.022	Phenolic λ 0.020	PIR λ 0.022
400	60	60	80	85	100	105
600	45	50	70	75	90	95

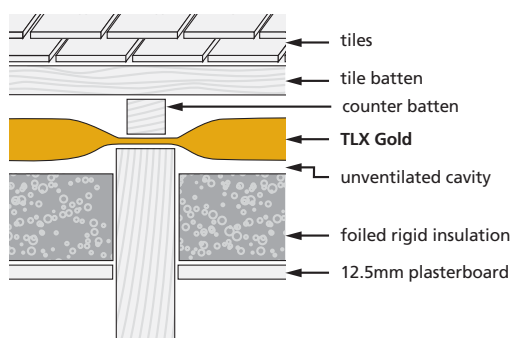
8 Barn Conversion - Exposed Rafters

8.2 TLX Gold, semi-exposed rafter, rigid board between rafters

TLX Gold is a breathable multi-foil primarily designed to be used across the top of the rafters with additional insulation between the rafters. TLX Gold's top layer is a breathable membrane and so no additional roofing underlay is required. Rigid insulation board such as PIR or Phenolic board is fitted between the rafters, maintaining an air cavity of 20mm minimum between the board and the TLX Gold. Plasterboard can then be fixed between the rafters to maintain an exposed rafter internally.

Due to the water vapour permeability of TLX Gold, a vapour control layer is not required. However it is still important to ensure the rigid board insulation and the plasterboard ceiling are both well sealed.

The most effective way to alter the U value is to vary the thickness of rigid insulation; however the cavity between TLX Gold and the rigid insulation should be maintained.



8.2.1 - TLX Gold above rafter, rigid board between rafters, 38mm batten

Rafter Centres (mm)	U = 0.30 W/m ² .K		U = 0.25 W/m ² .K		U = 0.20 W/m ² .K	
	Phenolic λ 0.020	PIR λ 0.022	Phenolic λ 0.020	PIR λ 0.022	Phenolic λ 0.020	PIR λ 0.022
400	50	55	70	75	100	110
600	45	45	60	65	85	90

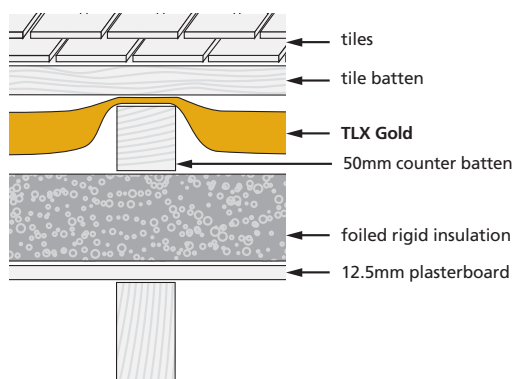
8 Barn Conversion - Exposed Rafters

8.3 TLX Gold, fully exposed rafter, PIR above rafters

Plasterboard is first fitted above the rafters with a rigid insulation board such as PIR or Phenolic board fitted above it. A 50mm deep counter batten is then fitted above the rigid insulation board maintaining an air cavity of 10mm minimum between the board and the TLX Gold.

Due to the water vapour permeability of TLX Gold, a vapour control layer is not required. However it is still important to ensure the rigid board insulation and the plasterboard ceiling are both well sealed.

The most effective way to alter the U value is to vary the thickness of rigid insulation; however the cavity between TLX Gold and the rigid insulation should be maintained.



8.3.1 - TLX Gold above rafter, rigid board between rafters, 38mm batten

Rafter Centres (mm)	U = 0.26 W/m ² .K	U = 0.20 W/m ² .K	U = 0.18 W/m ² .K
	PIR λ 0.022	PIR λ 0.022	PIR λ 0.022
400	50	75	85
600	50	75	85

9 Refurbishment and Upgrade of Existing Properties

9.1 Roofs - above rafter insulation

9.1.1 TLX Gold single layer draped

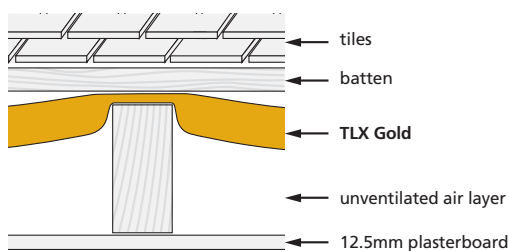
Much of the existing stock of buildings, particularly housing, was built when energy performance standards were lower than today. Upgrading these houses is essential if future carbon emissions are to be reduced. Two potential measures are improved insulation and airtightness, but traditional insulation materials struggle to overcome the constraints in “difficult to upgrade” buildings such as historic buildings, and houses with vaulted ceilings or room-in-roof structures.

TLX Gold allows the simple upgrading of existing buildings by reducing heat loss through the fabric of the building and reducing air leakage, without causing condensation.

The most difficult situation is a house where interior space is extremely limited, and the roof-line cannot be raised - for example with a listed building, or a terraced or semi-detached house. The rafter space must accommodate both insulation and roofing underlay, but cannot be extended in either direction.

75mm deep rafters

In older houses, the lath and plaster ceiling may intrude into the lower 20mm of the rafter space, leaving very limited space. TLX Gold is installed above the rafters as a single layer, combined insulation and breather membrane. The TLX Gold must be draped 10mm into the rafter space so that tile battens can be fitted directly above. The drape creates a channel for air movement, and also so that any rain water or snow that penetrates outer covering can run down to the gutter. The roof line is not raised and the external appearance is not affected.

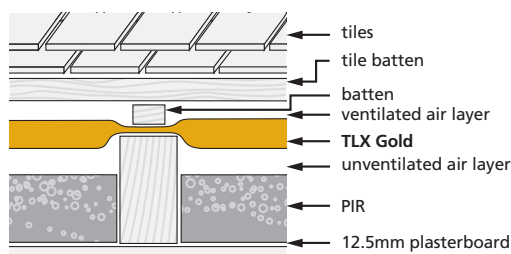


The U value of the refurbished structure is 0.67W/m².K. This U value does not meet the prescribed standard for new build, but in cases of simple improvement may be the best that can be practically obtained.

9 Refurbishment and Upgrade of Existing Properties

9.1.2 TLX Gold, insulation between rafters

Where the roofline can be raised slightly, it is possible to install TLX Gold taut above the rafters, leaving enough rafter space for additional insulation. TLX Gold must be counter-battened before the tile battens are fitted, to create the channel required for air and water movement.



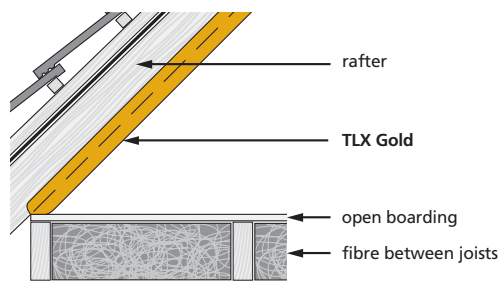
9.1.2 - TLX Gold above rafters, insulation between rafters, 38mm battens

Rafter Depth (mm)	Insulation Thickness (mm)	U value W/m ² .K	
		PIR λ 0.022	Mineral Fibre λ 0.032
75	50	0.33	0.39
100	75	0.26	0.31
150	125	0.19	0.23

9.2 Roofs - below rafter insulation

9.2.1 TLX Gold, mineral fibre in loft floor

Existing houses can have insulation retrofitted from the inside without the need to re-roof. In a cold, ventilated roof, TLX Gold can be fitted beneath the rafters to supplement the existing mineral fibre in the loft floor. This allows the roof insulation to be improved whilst retaining the loft space for storage.



Before installation of TLX Gold this roof had a U value of 0.41W/m².K.
After the installation of TLX Gold the U value was 0.28W/m².K.

9 Refurbishment and Upgrade of Existing Properties

9.2.2 Walls - internal wall insulation

A large amount of heat is lost through poorly insulated walls, and retro-fitting insulation can save energy. Insulation can be fitted to either the internal or the external face of the wall. External fitting is usually completed with a render finish, and changes the appearance of the building. Where space allows, this is a viable upgrading method, but is not applicable where the building appearance must be maintained, or it is not possible to fit insulation to the outside. Internal insulation inevitably takes up some of the living space, but leaves the exterior unchanged.

9.2.3 Masonry cavity walls

Masonry cavity walls are a traditional and widely used method of building walls. The cavity can be fully filled with insulation, either fitted or injected, or partially filled to leave a clear cavity.

TLX Silver can be installed to the interior of cavity masonry walls on timber studs or battens fixed to the inner leaf of the wall. Additional insulation may be fitted between the studs to lower the U value of the wall. A second set of battens holds the TLX Silver in place and provides a service cavity.

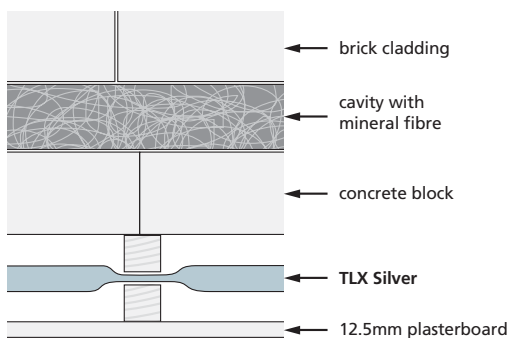
It is unlikely that a new build cavity wall would require internal insulation, since it is more effective to insulate inside the cavity. However, TLX Silver may be used to upgrade the thermal performance of existing cavity walls.

For example, the wall:

- 105mm brick
- 100mm cavity injected with mineral fibre 0.040W/m.K
- 100mm dense concrete block
- 12.5mm plasterboard on 15mm plaster dabs

has a U value of 0.35W/m².K

Removing the existing plasterboard and replacing it with 25mm studs, TLX Silver, 25mm battens and 12.5mm plasterboard reduces the U value to 0.24W/m².K and only takes up an additional 37mm of space.



9 Refurbishment and Upgrade of Existing Properties

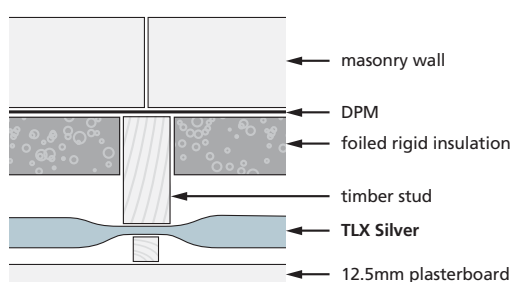
9.2.4 Solid masonry walls

Upgrading the insulation of solid masonry walls represents a real challenge to improving the energy efficiency of the housing stock. In many cases, external insulation would alter the appearance of the building and may not be acceptable. Internal lining of solid walls is sometimes the only way to upgrade solid walls.

TLX Silver can be installed to the interior of cavity masonry walls, on timber studs or battens fixed to the inner leaf of the wall. A damp proof membrane should be fitted between the inner leaf of the masonry and any timber studs or battens. Additional insulation may be fitted between the studs to lower the U value of the wall. A second set of battens holds TLX Silver in place and provides a service cavity.

TLX Silver helps to improve the airtightness of existing houses, and prevents condensation inside the wall.

The following table of U values is for a solid 9" brick wall, with TLX Silver fitted from the inside.



9.2.3 - TLX Silver inside, insulation against wall, 9" brick wall, 38mm battens

Stud Depth (mm)	Insulation Thickness (mm)	U value W/m ² .K		
		PIR λ 0.022	Mineral Fibre λ 0.032	Mineral Fibre λ 0.035
25 + 25	0	0.47	0.47	0.47
50 + 25	25	0.33	0.36	0.37
50 + 38	40	0.28	0.32	0.33

10 Flat Roof

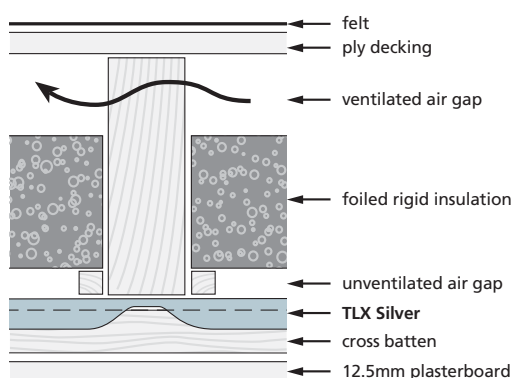
10.1 Cold deck

The traditional flat roof system is to install the insulation between and under the joists, with ventilation below the timber deck. TLX Silver can be used to reduce the thickness of additional insulation required between the joists to help ensure a ventilated gap is maintained between the insulation and the deck.

TLX Silver is a vapour barrier, and this structure gives no risk of surface or interstitial condensation.

10.1.1 TLX Silver below joist, rigid insulation between joist

The most effective way to alter the U value is to vary the thickness of rigid insulation. However maintaining the air cavities is critical and reducing the depth of any cavities to below 20mm to allow for more rigid insulation is unlikely to improve the U value.



10.1.1.1 - TLX Silver below joists, Phenolic (λ 0.020) between joists, 38mm batten

Joist Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Joist Depth (mm)	Insulation Thickness (mm)	Joist Depth (mm)	Insulation Thickness (mm)	Joist Depth (mm)
400	80	155	90	170	110	190
600	70	150	80	160	100	180

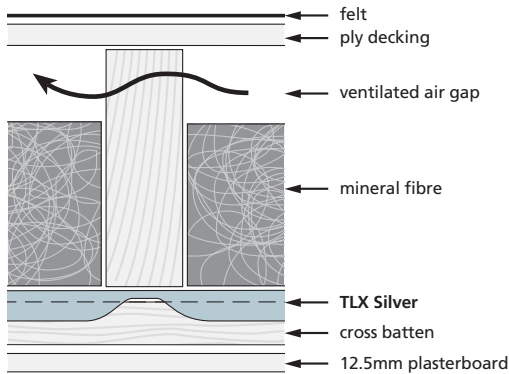
10.1.1.2 - TLX Silver below joists, PIR (λ 0.022) between joists, 38mm batten

Joist Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Joist Depth (mm)	Insulation Thickness (mm)	Joist Depth (mm)	Insulation Thickness (mm)	Joist Depth (mm)
400	85	160	100	180	120	200
600	75	155	85	165	110	185

10 Flat Roof

10.1.2 TLX Silver below joist, mineral fibre between joist

The most effective way to alter the U value is to vary the thickness of mineral fibre; however the thermal conductivity of the mineral fibre product used is also important as this will vary depending on the density.



10.1.2.1 - TLX Silver below joists, Mineral Fibre (λ 0.032) between joists, 38mm batten

Joist Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Joist Depth (mm)	Insulation Thickness (mm)	Joist Depth (mm)	Insulation Thickness (mm)	Joist Depth (mm)
400	135	195	160	220	185	245
600	125	185	145	205	170	230

10.1.2.2 - TLX Silver below joists, Mineral Fibre (λ 0.035) between joists, 38mm batten

Joist Centres (mm)	U = 0.20 W/m ² .K		U = 0.18 W/m ² .K		U = 0.16 W/m ² .K	
	Insulation Thickness (mm)	Joist Depth (mm)	Insulation Thickness (mm)	Joist Depth (mm)	Insulation Thickness (mm)	Joist Depth (mm)
400	145	205	170	230	195	255
600	135	195	155	215	180	240

11 General Installation Instructions

11 GENERAL INSTALLATION INSTRUCTIONS

- Protective clothing is not required when handling the TLX Range.
- Bare electrical wiring must not be allowed in contact with TLX. PVC coated electrical wiring to normal domestic items such as light fittings may come into contact with TLX.
- If electrical cables are surrounded by insulation they may need to be de-rated and guidance should be sought from a qualified electrician.

11.1 INSTALLATION PROCEDURES

11.1.1 TLX Silver

- TLX Silver may be installed either way up.
- TLX Silver is unrolled above or below the rafters in horizontal layers, parallel to the eaves. The product should be installed from ridge to eaves, and over- or under-lapped to ensure that any water inside the rafter space runs down and does not penetrate the insulation or the rafter space. As the TLX Silver is unrolled across the rafters it is fixed in place using nails or staples of at least 14mm depth. The next roll of Silver must overlap the preceding layer by at least 50mm, and the overlap should be sealed along the entire length using the specified adhesive tape.
- When installing TLX Silver, try to retain the full width (with two seams) whenever possible. For the bottom layer, it is better to use a complete layer, and increase the overlap with the next layer up, rather than cutting along the Silver to maintain a 50mm overlap.
- TLX Silver should be permanently held in place using wooden battens fixed with nails. Battens may run either parallel or perpendicular to the rafters.
- Plasterboard is fixed to the battens.
- A breathable roofing membrane is fitted above the rafters following the manufacturer's instructions. Tiling battens and tiles are then fitted.

11.1.2 TLX for Walls

- TLX Silver for walls may be installed either way up.

11.1.2.1 Timber Frame Wall

- Installation may be either vertical or horizontal. If horizontal, installation should start at the floor and go up to the ceiling.
- The product is unrolled across the inside of the timber studs and fixed using staples or nails of at least 14mm length.
- The next layer must overlap the first layer by at least 50mm and be taped along the entire length of the joint with a suitable tape. If securely taped, the product will also function as a vapour barrier.
- The product should be permanently fixed in place using wooden battens of size at least 38 x 25mm, perpendicular to the wall studs held in place with nails. When the top layer has been battened, any excess material may be removed by running a sharp knife along the edge of the batten.
- Plasterboard is fixed to the battens. The batten size should be sufficient to ensure a 20mm gap between the product and the plasterboard. This gap may be used as a cavity for services.

11.1.2.2 Solid Masonry Wall

- Fit vertical timber studs of at least 38 x 25mm, down the wall, held in place with screws. The product is unrolled across the inside of the timber studs and fixed using staples or nails of at least 14mm length.
- The next layer must overlap the first layer by at least 50mm and be taped along the entire length of the joint with suitable tape.
- The product should be permanently fixed in place using wooden battens of size at least 32 x 25mm, perpendicular to the wall studs held in place with nails.
- When the top layer has been battened, any excess material may be removed by running a sharp knife along the edge of the batten.

11 General Installation Instructions

11.1.3 TLX GOLD INSTALLATION

11.1.3.1 TLX Gold - Installation Without Counter Battening

- The left hand side of TLX Gold is fixed in place with staples or nails of at least 14mm, and TLX Gold rolled across the rafters leaving a 10mm drape between each rafter space. Staple TLX Gold every few rafter spaces to hold it in place. The product is installed horizontally, either from ridge to eaves or from eaves to ridge.
- Each layer of TLX Gold must butt-join the previous layer, with the membrane overlap running onto the lower layer, thus ensuring that any water runs down the roof slope without penetrating between layers. The drape should be consistent for each layer of TLX Gold.
- A 10mm channel should run above the TLX Gold, up the centre of each rafter space, to allow water to run down and for air movement. If a clear channel is not formed, 10mm spacers underneath the tiling battens may be fitted.
- The membrane overlap on the bottom layer of TLX Gold should extend onto a suitable eaves carrier. Additional breather membrane may be used to cover the gaps between TLX Gold and the eaves carrier if required.
- TLX Gold is permanently held in place by tiling battens and tiles are fitted. The tiling battens should hold the layers of TLX Gold in close contact, if there is any doubt then the overlap may be taped in place with a suitable double sided tape.

11.1.3.2 TLX Gold - Installation With Counter Battening

- TLX Gold is rolled taut across the rafters in horizontal layers parallel to the eaves. The product can be installed either from ridge to eaves or from eaves to ridge.
- The membrane overlap on the lowest layer of TLX Gold should extend onto a suitable eaves carrier. Additional breather membrane may be used to cover the gaps between TLX Gold and the eaves carrier if required.
- As TLX Gold is unrolled across the rafters it is fixed in place with nails or staples of at least 14mm length. The next layer of TLX Gold must butt-join the previous layer, with the membrane overlap running onto the lower layer, thus ensuring that any water runs down the roof slope without penetrating between layers.
- TLX Gold is permanently held in place with 25mm deep counter battens, then tiling battens and tiles are fitted. The counter battens should hold the layers of TLX Gold in close contact, if there is any doubt then the overlap may be taped with a suitable double or single sided tape.

11.2 CUTTING

- TLX can be cut using a sharp knife with the TLX resting on a board, with sharp scissors, a special cutter or a hot knife.
- Pieces which have been cut should be stapled and battened as soon as possible, and should not be left unsecured overnight.
- Small pieces (such as around Velux windows or in dormer cheeks) should be taped in place, stapled and battened immediately.
- Any small tears or holes should be repaired with tape. Larger holes in the top layer of TLX Gold should be patched with a piece of breathable underlay.

11 General Installation Instructions

11.3 TAPING

11.3.1 TLX Silver and Timber Frame

- It is important that TLX is securely taped at overlaps and junctions with walls or windows.
- TLX must always be taped together when the surfaces are clean and dry.
- Short lengths of TLX can be joined together with a suitable tape.

11.3.2 TLX Gold

- Where TLX Gold requires taping, it is recommended that ATP tape or equivalent double sided tape is used.

11.4 AIR LAYERS

- Unventilated air layers form an important part of the TLX system. If the air spaces are omitted, whilst there is no danger of condensation, the overall thermal performance of the structure will decrease, and the U value will be higher. Additional insulation may be needed to achieve the desired U value for the roof.

11.5 ADDITIONAL INSULATION

- Install additional insulation according to the manufacturer's instructions.
- Provide for air gaps between TLX and additional insulation as required.

11.6 STORAGE

- TLX rolls must be stored on a dry flat surface, protected from the weather and direct sunlight.
- Make sure when installing TLX that it does not come into contact with heat sources above 80°C.

11.7 VAPOUR CONTROL AND VENTILATION

11.7.1 TLX Silver and Timber Frame

- Where TLX Silver is fitted below rafters it also performs as an effective vapour barrier, preventing water vapour from the house from penetrating the roof structure and possibly condensing on a cold surface. No additional vapour barrier is required.
- Where Silver is fitted above rafters, then it is necessary to install an additional vapour barrier below the rafters. Foil-backed plasterboard where joints between boards are well sealed or 500 gauge (0.12mm) polythene sheet may be acceptable vapour barriers.
- Ventilation of the rafter space is not needed if a breathable roofing membrane has been used. If a non-breathable (or 1F type) membrane is in place, then a 50mm ventilated air space beneath the felt is required.
- Ventilation of the space between the membrane and the outer roof covering is not required for air-open coverings such as clay or concrete tiles and natural slates.
- If in any doubt about possible harmful condensation, contact Web Dynamics Ltd for guidance.

11.7.2 TLX Gold

- A vapour control layer is not required for any of the recommended solutions, using breathable products prevents trapping of water vapour.
- A well-sealed ceiling is essential to prevent large amounts of water vapour from entering the roof space through air movement.
- Ventilation of the space between the TLX Gold and the outer roof covering is not required for air-open coverings such as clay or concrete tiles and rough natural slates. Smooth fibre cement slates and sealed roof coverings such as metal roofs require additional ventilation of this space.
- If in any doubt about possible harmful condensation, contact Web Dynamics Ltd for guidance.

11 General Installation Instructions

11.8 TAPE

- Taping the overlaps of TLX Silver is an important part of the overall system to ensure airtightness.
- It is preferred that tapes are silver reflective, but it is not essential since the area of tape is only a small proportion of the total roof.
- Tapes should be at least 50mm in width. Tape may or may not have a backing release paper.
- The adhesive used in the tape must bond strongly and quickly to the outer surface of TLX Silver. The tape must bond well at low temperatures, down to 0°C, for example if the TLX Silver is being installed on a cold winters day. The tape must also maintain adhesion at temperatures up to 70°C.

The strength of adhesion of the tape to TLX Silver must be at least 30 N / 50mm. Suitable adhesives may include solvent based acrylic or butyl, or synthetic rubber. Water based adhesives may not be suitable.

If in doubt, consult Web Dynamics Ltd for advice.

- Suitable tapes include:
 - Henkel All-Purpose Duck tape
 - Venture Tape 1507CW
 - SCAPA 875
 - Lohmann Duplocoll TM11471
 - Unibond Power Tape

11.9 ACCESSORIES

- For more information on suitable tapes, cutters and spacers please refer to www.webdynamics.co.uk or phone the thermal hotline 01204 674 730 for advice.

12 Glossary of Terms

GLOSSARY OF TERMS	
λ value	Lambda value. Thermal conductivity (W/m.K), relates to a materials ability to conduct heat. May also be expressed as k value.
R value	Thermal resistance (m ² .K/W), is the measure of a materials ability to prevent heat transfer.
U value	Thermal transmittance (W/m ² .K), is the rate at which heat is transferred through a structure.
e	Emissivity (expressed as e or ε), is the ability of a surface to emit energy by radiation. The more reflective a surface is, the lower its emissivity.
1F	Traditional non-breathable roofing felt, generally bitumen based.
BM	Breathable membrane, can be used in place of a traditional 1F felt but unlike 1F breather membrane offers very little resistance to the passage of water vapour.
VCL	Vapour control layer, these are used on the warm side of a structure (typically installed directly behind plasterboard) to restrict the passage of water vapour.
PIR	Polyisocyanurate insulation
PUR	Polyurethane insulation



UK's leading manufacturer
of multi-foil insulation and
breather membranes

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