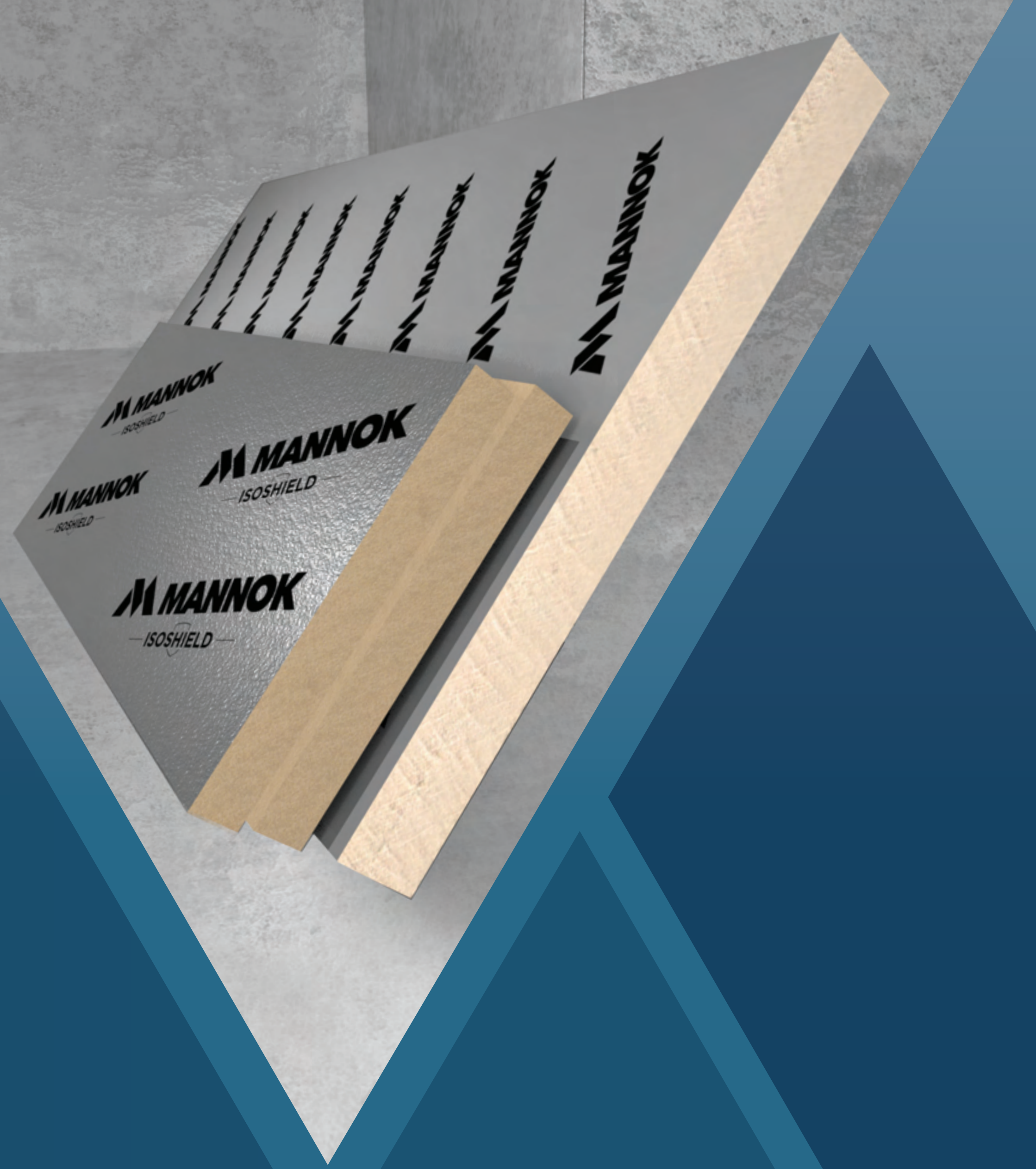


MANNOK

PIR INSULATION

PRODUCT/APPLICATION SELECTOR

GENERAL INFORMATION

N New Build R Refurbishment

CFC FREE AND HCFC FREE PIR BOARD ZERO ODP REPAK

WHY MANNOK PIR INSULATION

Mannok PIR Insulation offer a range of products that are engineered for quality and performance. With nationwide sales coverage and an In-house team of Technical Experts we are uniquely placed to support any project.

EXCELLENT PERFORMANCE

- Excellent life-long thermal performance
- Helps to achieve low energy building standards
- High compressive strength

SUSTAINABILITY

- Zero Ozone Depletion Potential (ODP) & Global Warming Potential (GWP) <5
- A+ BRE Green Guide rating
- Environmental Management System certified to ISO 14001

QUALITY PRODUCTS

- Exceeding performance criteria of national and European Standards
- Products which are CE marked and have BBA and IAB accreditation
- Daily quality control testing to all relevant European standards

TECHNICAL RESOURCES

- Online resource library including BIM objects and Accredited Construction Details
- Free U-value & Y-value calculators and online product converter
- Technical support and CPD seminars by highly experienced technical team

FLEXIBLE SOLUTIONS

- Solutions for new builds & refurbishment
- Suitable for commercial and domestic builds
- Full suite of complimentary building products available

PRODUCT RANGE

Mannok offers an extensive range of PIR Insulation products for use in floor, wall and roof applications in new build and retrofit projects.
Available in range of thicknesses from 20mm to 150mm. All PIR boards achieve a thermal conductivity of 0.022W/mK to 0.026W/mK.

Table 1 Physical characteristics

Board	Surface	Edge	Thicknesses (mm)	Length x width
Therm Floor / MF	Composite foil facings	Butt	20 - 150	2400 x 1200mm
Therm Cavity / MC	Composite foil facings	T&G	25 - 150	450 x 1200mm
Therm Wall / MW	Composite foil facings	Butt	25 - 150	1200 x 2400mm
IsoShield	Embossed Foil Facing	Rebated	72, 97, 122, 147	450 x 1200mm
Laminate-Kraft / MLK	Composite kraft paper facing adhered to plasterboard	Butt	26.5*, 29.5, 34.5*, 37.5, 42.5, 50.5, 62.5, 72.5, 82.5, 92.5	1200 x 2400mm 1200 x 2438mm 1200 x 2743mm
Laminate-Foil / MLF	Composite foil facing adhered to plasterboard	Butt	34.5*, 37.5, 42.5, 52.5, 62.5, 72.5, 82.5, 92.5	1200 x 2400mm
Roof / MR	Composite foil facings	Butt	20 - 150	1200 x 2400mm
Roof / MFR-FFR	Composite foil facings	Butt	25 - 150	1200 x 2400mm
Roof / MFR-DPFR	Fleece-finished, bitumen facing on one side. Mineral coated, perforated, glass tissue facing on other side.	Butt	25 – 150*	600 x 1200mm
Roof / MFR-GFR	Mineral coated, perforated, glass tissue	Butt	25 -150	600 x 1200mm
Roof / MFR-PLY	Composite foil facing adhered to 6mm plywood	Butt	56, 76, 96, 116, 131	1200 x 2400mm

Note: All Mannok Laminate boards thickness include 12.5mm plasterboard except those* which include 9.5mm plasterboard.

PERFORMANCE

Thermal performance

Mannok PIR Insulation has a thermal conductivity as low as 0.022W/mK, making it one of the most effective rigid board insulations available.

The facings have a hemispherical emissivity (Eη) of 0.07 ± 0.02 (BBA test report no. 2270) which enhances the thermal resistance of any cavities adjacent to Mannok PIR Insulation boards (see page 6 for more details).

Vapour control

The water vapour resistivity of the core insulation may be taken as $300MN.s.g^{-1}.m^{-1}$ and a resistance value of $4000MN.s.g^{-1}.m^{-1}$ for each foil facing. In some applications the foil facings may be sealed at the joints on the warm side with metalised tape which will eliminate the requirement for an additional air and vapour control layer (AVCL).

Biological / Chemical

Mannok PIR Insulation does not rot and does not support mould or fungus.

Mannok PIR Insulation is chemically inert, and poses no threat to anyone using it.

Environmental

Mannok PIR Insulation has an ozone depletion potential (ODP) of zero. It has a low Global Warming Potential (GWP), certified to ISO 14001 - Environmental Management Systems. All Mannok PIR Insulation products, with the exception of MFR-GFR and MFR-DPFR, achieve A+ rating when compared to the BRE Green Guide. MFR-GFR and MFR-DPFR achieve A rating.

Dimensional stability

When tested to EN 1604 Mannok PIR Insulation achieves level DS(TH)4 to EN 13165.

Durability

Mannok PIR Insulation will perform for the service life of the building.

Fire Properties

Mannok PIR Insulation products have been tested to BS EN 13501-1 to achieve Euro class rating. Mannok PIR Insulation boards also have a Class 1 rating when tested to BS 476-7.

Table 2 Performance characteristics

Board	Thermal conductivity (W/mK)	Core water vapour resistivity (MNs/gm)	Compressive strength (kPa)
Floor / MF	0.022	≅300	>150
Cavity / MC	0.022	≅300	>150
Wall / MW	0.022	≅300	>150
IsoShield	0.022	≅300	>150
Laminate-Kraft / MLK *	0.022	≅300	>150
Roof / MR	0.022	≅300	>150
MFR-PLY*	0.022	≅300	>150
MFR-FFR	0.022	≅300	>150
MFR-GFR	0.024 - 0.026	≅300	>150
MFR-DPFR	0.024 - 0.026	≅300	>150

*** Values for insulation only**

DESIGN CONSIDERATIONS

Fixings

The selection and specification of fixings are key considerations in achieving efficient insulation systems with Mannok PIR Insulation. Designers must consider both the thermal and mechanical performance of the fixings.

U-value calculations to BR 443 must take account of the additional heat loss caused when an insulation layer is penetrated by metal fixings which have high thermal conductivities. In order to minimise that heat loss and maintain thermal performance it is important to select appropriate fixings.

Stainless steel double triangle ties are recommended for use in Cavity wall constructions. Where Mannok PIR Insulation boards are being fixed internally, for example behind plasterboard linings or beneath rafters, stainless steel clout headed nails should be used to restrain the boards. Specialist fixing systems designed to minimise thermal bridging, such as those with plastic shafted washers, may be used where the required fixing density will significantly reduce thermal performance.

Where boards will be subject to wind-uplift forces, on flat or pitched roofs, the wind loads should be determined by the calculation methods in BS EN 1991-1-4 (which replaces BS 6399-2). The fixing density should then be determined in consultation with the fixing manufacturer.

For boards installed above the rafters on warm pitched roofs consult Annex B of BS 5534:2003 for guidance on calculation methods and fixings.

Low emissivity cavities

The rate at which heat travels across a cavity in the building element is determined by the direction of heat flow and by the surfaces which form the cavity. A cavity with at least one low emissivity surface, such as aluminium foil, will have a better thermal resistance than a similar cavity with high emissivity surfaces such as brick, block or unfaced insulation board.

The composite aluminium foil facings on most Mannok PIR Insulation boards will form a low emissivity surface to any adjacent cavity, and will therefore improve the thermal resistance of the cavity and reduce the rate of heat loss through the building element

Element	Thermal resistance (m^2K/W)	
	Normal cavity	Mannok PIR Insulation cavity
Roof	0.16	0.454
Wall	0.18	0.665
Floor	0.19	0.767

Figures for cavities 25mm wide

Condensation control

Damaging interstitial condensation can form within floors, walls and roofs when water vapour passing through the construction builds up against a cold impermeable surface.

To prevent condensation it is important to extract moisture from the building as close as possible to the source (e.g. bathrooms and kitchens) and to allow any moisture which reaches the inside of the construction to pass safely to atmosphere. That can be achieved by ensuring the materials to the cold side of the insulation have a low vapour resistance.

However, some constructions – such as timber framed walls or warm flat roofs – have layers with high vapour resistance to the cold side of the insulation, and consequently have a high risk of condensation. In such constructions it is vital to prevent water vapour entering the construction, therefore an air and vapour control layer (AVCL) should be formed as close to the internal surface as possible.

As the foil facings of Mannok PIR Insulation boards have an extremely high vapour resistance it is possible in many constructions to form an AVCL by taping the joints between Mannok PIR Insulation boards with metalised tape. Where that is not practicable, a separate AVCL must be provided.

Contact Mannok Technical Services for further advice on condensation control and interstitial condensation risk analysis.

Radon

Radon is a colourless, odourless radioactive gas that occurs naturally in the ground in parts of Britain and Ireland. Radon is carcinogenic and exposure to radon is, after smoking, the main cause of lung cancer.

As radon is released from the ground it can reach dangerous concentrations within buildings; the risk is greater in dwellings and other residential buildings, where people spend a substantial amount of time.

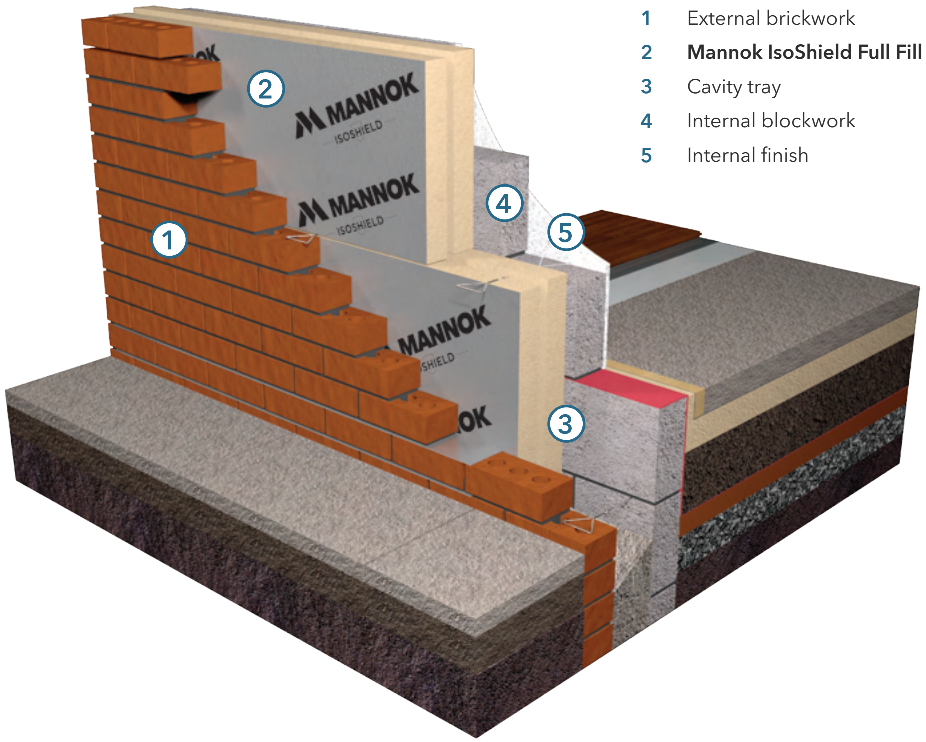
Where there is a risk of radon being present in harmful levels protective measures should be installed. In lower risk areas typical provision is to install a gas-resistant membrane across the whole footprint of the building.

In groundbearing floors the same membrane can protect against radon and form the dpm. In suspended floors the gas-resistant membrane should be installed across the bottom of the sub-floor void and protected by a layer of concrete. In all constructions the gas-resistant membrane must extend to the outer face of external walls: that may be achieved by using gas-resistant cavity trays and dpcs and sealing them to the gas-resistant membrane.

In higher risk areas a radon sump should be provided below the gas-resistant membrane in order to extract radon from beneath a building and so reduce the likelihood of an internal build up.

CAVITY WALLS: MASONRY - FULL FILL

insulated with Mannok IsoShield Full Fill



1 External brickwork
2 **Mannok IsoShield Full Fill**
3 Cavity tray
4 Internal blockwork
5 Internal finish

Design and Installation

Cavities up to 100mm wide require wall ties at maximum 900mm horizontal centres and 450mm vertical centres, with additional ties around openings and at corners. Cavities wider than 100mm may require ties at reduced centres. Wall ties must slope down from the inner leaf in order to shed water into the cavity.

Wall insulation must extend 150mm below the upper edge of floor insulation to prevent thermal bridging at the floor perimeter.

Mannok IsoShield Full Fill boards should be fitted tightly against the leading leaf of masonry supported on the first row of wall ties.

The higher side of the rebated edge should always be against the inner leaf.

The faces of masonry must be kept clean and clear of mortar snots and droppings to enable the Mannok IsoShield Full Fill boards to be installed properly. A cavity board should be used to protect the cavity from droppings.

At corner junctions, the rebated edge should be carefully removed with a handsaw or knife to allow a straight butt joint with no gaps. The corner joint should be staggered and the exposed edge of the board should be protected by a vertical DPC of an appropriate width.

Full fill IsoShield insulation with plasterboard on dabs

Innerleaf Conductivity W/m²k	Dense block 1.13	Others 0.45	Others 0.3	Mannok Aircrete Blocks 0.19	0.17	0.12
Thickness(mm)	U-value (W/m²K)					
72	0.26	0.25	0.24	0.24	0.23	0.22
97	0.20	0.20	0.19	0.19	0.18	0.18
122	0.16	0.16	0.16	0.15	0.15	0.15
147	0.14	0.14	0.13	0.13	0.13	0.13

Full fill IsoShield insulation with 12mm plasterfinish

Inner leaf Conductivity (W/m²K)	Dense block 1.13	Others 0.45	Others 0.3	Mannok Aircrete Blocks 0.19	0.17	0.12
Thickness (mm)	U-value (W/m²K)					
72	0.27	0.26	0.25	0.24	0.24	0.23
97	0.21	0.20	0.20	0.19	0.19	0.18
122	0.17	0.16	0.16	0.16	0.16	0.15
147	0.14	0.14	0.14	0.13	0.13	0.13

U-value results above based upon wall construction shown:

103mm brick outer leaf; Mannok IsoShield Full fill insulation, 100mm concrete block (conductivity as shown); 12mm plaster. Brick and block leaves with 10mm nominal mortar joints. Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.

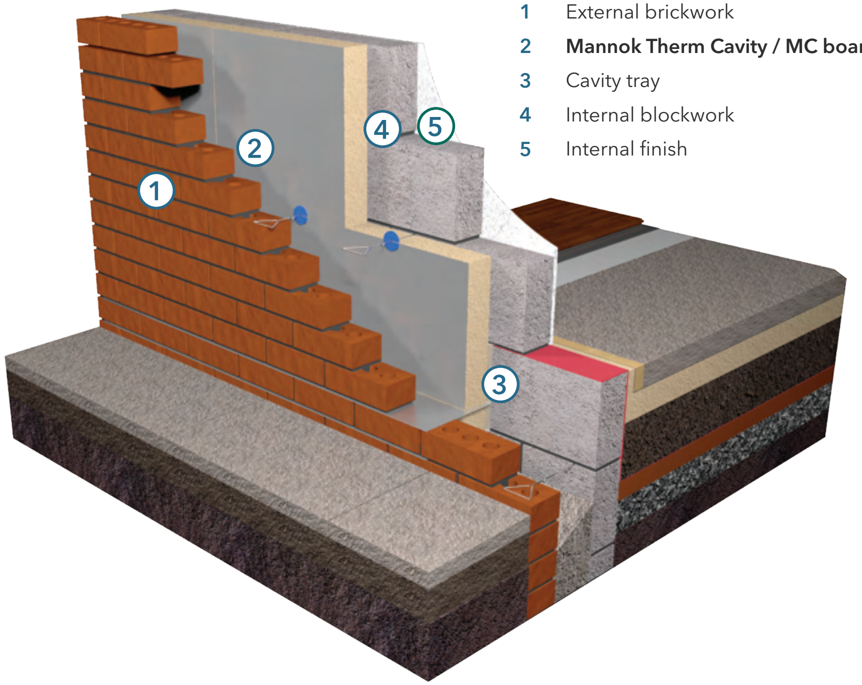
Benefits

- Suitable for new build
- Utilizes full cavity width
- Achieves lower U-values whilst maintaining cavity width
- Precision cut rebated edge ensures block lock tightly together, minimises heat loss and eliminates the passage of moisture
- Extremely durable textured aluminium foil facings

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

CAVITY WALLS: MASONRY - PARTIAL FILL

insulated with Mannok Therm Cavity / MC



1 External brickwork
2 **Mannok Therm Cavity / MC boards**
3 Cavity tray
4 Internal blockwork
5 Internal finish

Design and Installation

Cavities up to 100mm wide require wall ties at maximum 900mm horizontal centres and 450mm vertical centres, with additional ties around openings and at corners. Cavities wider than 100mm may require ties at reduced centres. Wall ties must slope down from the inner leaf in order to shed water into the cavity.

Wall ties can have a significant impact on the overall U-value of the wall. It is therefore important to select ties which will minimise heat loss, such as stainless steel double triangle ties. Ties should comply with EN 845–1 and PD 6697.

Wall insulation must extend 150mm below the upper edge of floor insulation to prevent thermal bridging at the floor perimeter. If the cavity includes a radon barrier the first run of boards should be supported on the cavity tray. Mannok Therm Cavity / MC boards should be fitted against the inner leaf of masonry and held in place by wall-tie clips or collars. Boards must be butted tightly together at corners to give a continuous layer of insulation, and cut neatly to fit tight to the backs of frames, sills, cavity closers and lintels.

The faces of masonry must be kept clean and clear of mortar snots and droppings to enable the Mannok Therm Cavity / MC boards to be installed properly. When raising the outer leaf use a cavity board to protect the cavity from droppings.

Required thickness of Mannok Therm Cavity / MC for different blocks

Partial fill Therm Cavity / MC insulation with internal plasterboard on plaster dabs

Inner leaf Conductivity (W/m²K)	Dense block 1.13	Others 0.45	Others 0.3	Mannok Aircrete Blocks		
				0.19	0.17	0.12
Thickness (mm)	U-value (W/m²K)					
50	0.29	0.28	0.27	0.26	0.26	0.24
60	0.25	0.25	0.24	0.23	0.23	0.22
65	0.24	0.23	0.23	0.22	0.22	0.21
70	0.23	0.22	0.22	0.21	0.21	0.20
75	0.22	0.21	0.21	0.20	0.20	0.19
80	0.21	0.20	0.20	0.19	0.19	0.18
100	0.17	0.17	0.17	0.16	0.16	0.16
110	0.16	0.16	0.15	0.15	0.15	0.15

Partial fill Therm Cavity / MC insulation with internal wet plaster

Inner leaf Conductivity (W/m²K)	Dense block 1.13	Others 0.45	Others 0.3	Mannok Aircrete Blocks		
				0.19	0.17	0.12
Thickness (mm)	U-value (W/m²K)					
50	0.30	0.29	0.28	0.27	0.26	0.25
60	0.26	0.25	0.25	0.24	0.24	0.23
65	0.25	0.24	0.23	0.23	0.22	0.22
70	0.23	0.23	0.22	0.22	0.21	0.21
75	0.22	0.22	0.21	0.20	0.20	0.20
80	0.21	0.21	0.20	0.20	0.20	0.19
100	0.18	0.17	0.17	0.17	0.17	0.16
110	0.16	0.16	0.16	0.15	0.15	0.15

U-value results above based upon wall construction shown:

103mm brick outer leaf; 40 - 50mm low emissivity residual cavity; Mannok Therm Cavity / MC, 100mm concrete block (conductivity as shown); 12mm plaster. Brick and block leaves with 10mm nominal mortar joints. Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.

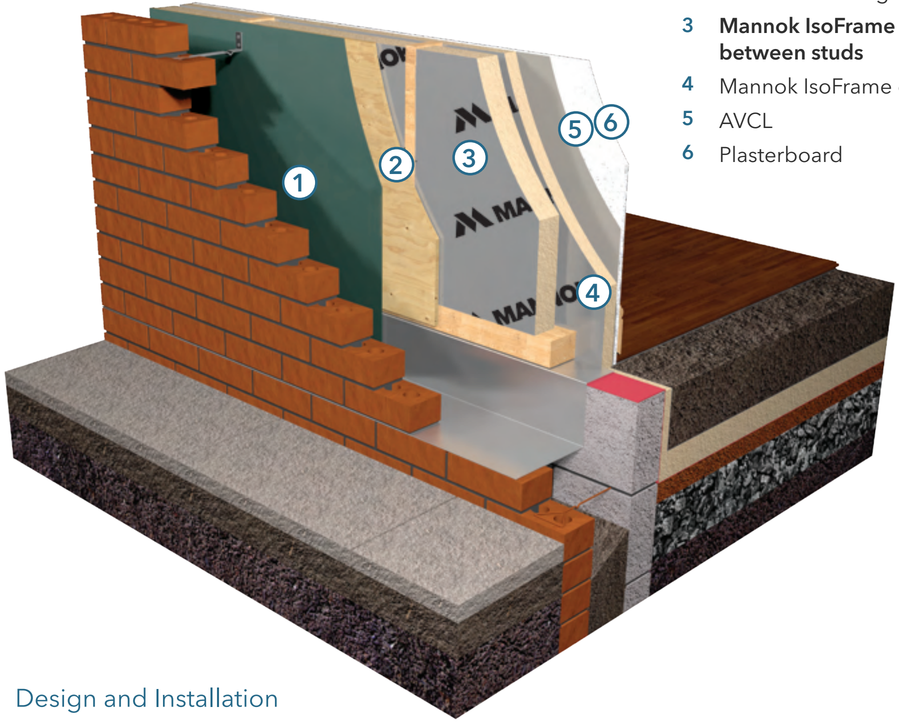
Benefits

- Suitable for new build projects.
- Excellent thermal properties
- Extremely durable
- High thermally resistant cavity due to low emissivity foil facings

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

CAVITY WALLS: TIMBER FRAME

insulated with Mannok IsoFrame and Mannok Therm Laminate - Kraft / MLK



1 Vapour open membrane*
2 Timber sheathing
3 **Mannok IsoFrame boards between studs**
4 Mannok IsoFrame over studs
5 AVCL
6 Plasterboard

Design and Installation

Mannok IsoFrame boards should be cut to fit snugly between studs and to door and window framing. Any gaps between the insulation and studs should be filled with expanding polyurethane foam.

Depending on the depth and spacing of the studs and the U-value required of the wall, an additional layer of Mannok IsoFrame or Mannok Therm Laminate-Kraft / MLK boards may be required, fixed across the inner face of the studs.

Timber framed walls require an AVCL to prevent damaging interstitial condensation forming on the back of the sheathing. Where Mannok IsoFrame is fitted only between the studs a vapour resistant membrane, such as 500 gauge polyethylene, should be installed across the face of the studs.

Where a continuous layer of Mannok IsoFrame is fitted across the inner face of the studs an AVCL may be formed by taping the joints between boards with metalised tape.

Condensation risk analysis should be carried out to ensure the specified AVCL has a sufficiently high vapour resistance for the project.

A service cavity can be formed by fitting plasterboard on battens, rather than nailing directly to the studs. Electrical and other services can then be run in the cavity without compromising the AVCL.

Required thickness of IsoFrame & Mannok Therm Laminate - Kraft / MLK

Mannok Therm Wall / MW between studs and Mannok IsoFrame or Mannok Therm Laminate- Kraft / MLK across studs

Between + Across studs	89mm stud U-Value (W/m²K)	140mm stud U-Value (W/m²K)
50 + 25	0.26	0.25
60 + 25	0.24	0.24
75 + 25	-	0.22
90 + 25	-	0.20
100 + 25	-	0.19
110 + 25	-	0.18
110 + 40	-	0.16
110 + 50	-	0.15
110 + 65	-	0.13

U-value results above based upon wall construction shown:

103mm brick outer leaf; 40 - 50mm cavity; vapour open membrane*; 12mm plywood sheathing; 89 or 140mm timber studs @ 600mm centres (timber bridging fraction 15%); Mannok IsoFrame between studs; Mannok IsoFrame or Mannok Therm Laminate- Kraft / MLK over studs; polyethylene AVCL; 12mm plasterboard. Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.
* Note: improved U-values may be achieved using reflective vapour open membranes.

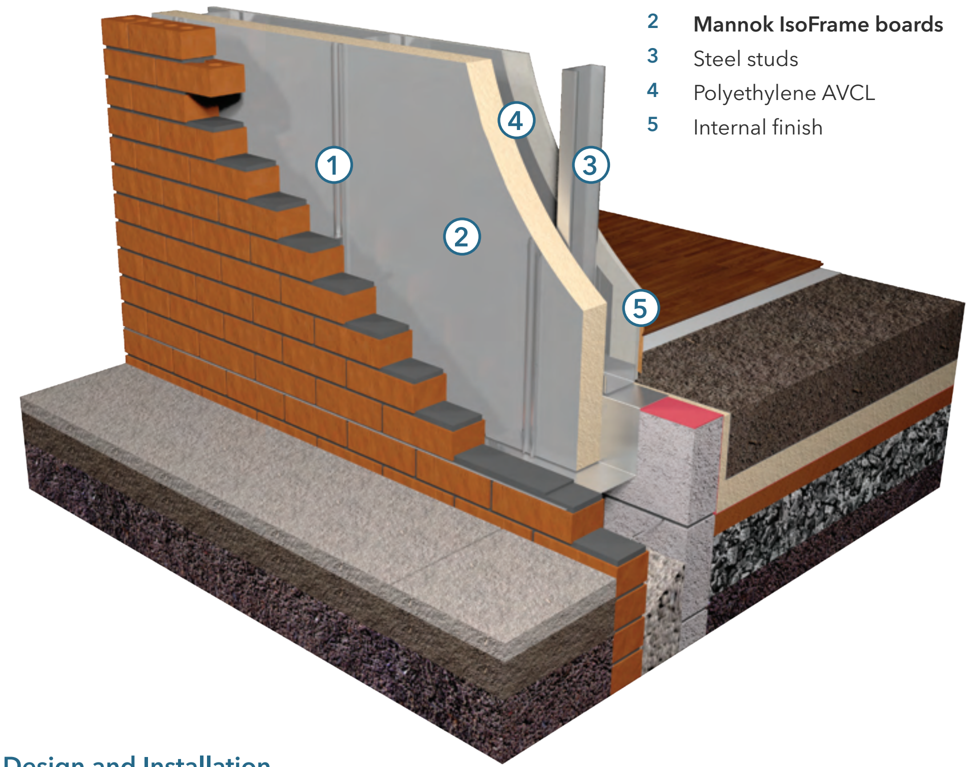
Benefits

- Suitable for new build projects.
- Excellent thermal properties
- Extremely durable
- Mannok IsoFrame can be easily cut between studs
- Mannok Therm Laminate-Foil / MLF across studs eliminate thermal bridging

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

CAVITY WALLS: LIGHT STEEL FRAME

insulated with Mannok IsoFrame



1 Steel runners with wall ties
2 **Mannok IsoFrame boards**
3 Steel studs
4 Polyethylene AVCL
5 Internal finish

Design and Installation

Mannok IsoFrame boards should be butted tightly together to form a continuous layer of insulation. The boards should be cut to fit tightly to the back of door and window framing. Any gaps between the insulation and framing should be filled with expanding polyurethane foam.

The Mannok IsoFrame boards are restrained by steel channels which are screwed back to the studs. The screws must be specified carefully, to ensure they can withstand the transmitted loading from the cladding, while also minimising heat loss where they penetrate the insulation. U-value calculations must take account of that additional heat loss.

Light steel framed walls require an AVCL to prevent damaging interstitial condensation forming within the construction. The AVCL should be installed across the inner face of the studs, immediately behind the surface finish.

Condensation risk analysis should be carried out to ensure the specified AVCL has a sufficiently high vapour resistance for the project. The AVCL will also help reduce air leakage into the stud cavity.

Depending on the depth and spacing of the studs and the U-value required of the wall, an additional layer of mineral fibre insulation can be fitted between the steel studs.

Required thickness of Mannok IsoFrame

No insulation between studs. Mannok IsoFrame across studs.

	Insulation thickness (mm)							
	40	50	60	70	75	80	90	100
U-value (W/m²K)	-	0.27	0.24	0.22	0.21	0.20	0.19	0.17

100mm wool insulation between studs (0.044). Mannok IsoFrame across studs.

	Insulation thickness (mm)							
	40	50	60	70	75	80	90	100
U-value (W/m²K)	0.24	0.21	0.20	0.19	0.18	0.17	0.16	0.15

150mm wool insulation between studs (0.044). Mannok IsoFrame across studs.

	Insulation thickness (mm)							
	40	50	60	70	75	80	90	100
U-value (W/m²K)	0.20	0.19	0.17	0.16	0.16	0.15	0.14	0.14

U-values based on studs at 400mm centres (3% bridging)

U-value results above based upon wall construction shown:

103mm brick outer leaf; 40 - 50mm low emissivity residual cavity; Mannok IsoFrame; steel studs @ 600mm centres; polyethylene AVCL; 12mm plasterboard. Calculations performed to BS EN ISO 6946 and BRE Digest 465, taking account of repeating thermal bridges.

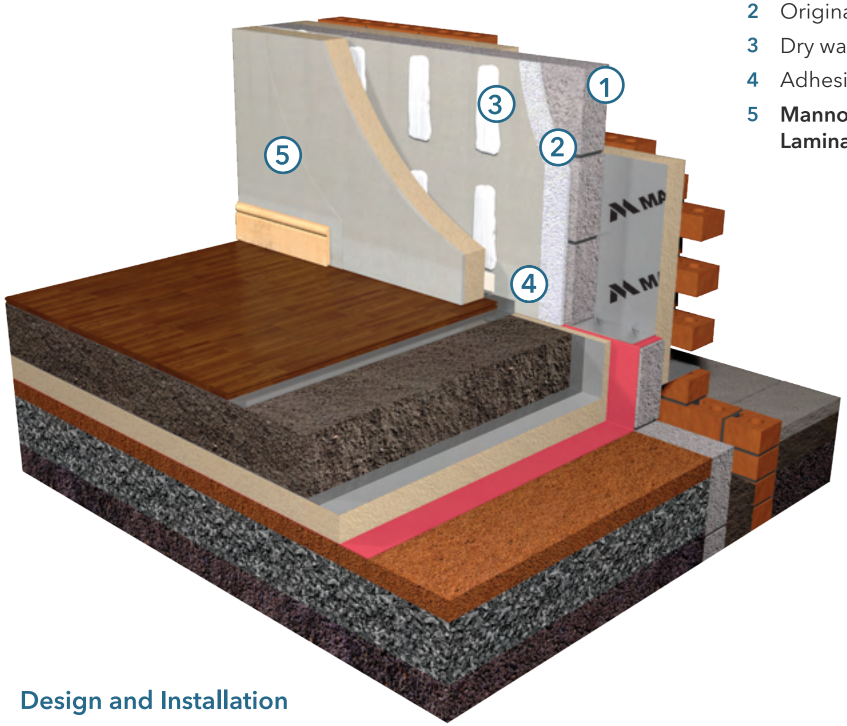
Benefits

- Suitable for new build projects.
- Warm frame construction avoids significant thermal bridging
- Excellent thermal properties
- Extremely durable
- High thermally resistant cavity due to low emissivity foil facing

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

CAVITY WALLS: MASONRY - INTERNAL DRY LINING

with Mannok Therm Laminate-Kraft / MLK insulated plasterboard



1 Internal blockwork
2 Original plaster finish
3 Dry wall adhesive
4 Adhesive strip
5 **Mannok Therm Laminate-Kraft / MLK**

Design and Installation

Cavities up to 100mm wide require ties at maximum 900mm horizontal centres and 450mm vertical centres, with additional ties around openings and at corners. Cavities wider than 100mm may require ties at reduced centres.

Cavity wall ties can have a significant impact on the overall U-value of the wall. It is therefore important to select ties which will minimise heat loss, such as stainless steel double triangle ties. Ties should comply with EN 845–1 and
PD 6697.

Insulation in the wall cavity must extend 150mm below the upper edge of floor insulation to prevent thermal bridging.

If the cavity includes a radon barrier the first run of boards should be supported on the cavity tray.

Mannok PIR Insulation boards should be fitted against the inner leaf of masonry and held in place by wall-tie clips or collars. Boards must be butted tightly together at corners to give a continuous layer of insulation, and cut neatly to fit tight to the backs of frames, sills, cavity closers and lintels.

To minimise air infiltration, a continuous strip of dry-lining adhesive should be used to seal the perimeter of the Mannok Therm Laminate-Kraft / MLK boards, including around window and door openings. (For further guidance on installing Mannok Therm Laminate-Kraft / MLK see page 22.)

Required thickness of Mannok Therm Laminate-Kraft / MLK

Cavity wall with internal dry lining

Mannok Therm Laminate-Kraft / MLK	Partial fill cavity insulation (mm)				
	50	60	75	80	100
Thickness (mm)	U-value (W/m²K)				
37.5	0.22	0.20	0.17	0.17	0.15
42.5	0.21	0.19	0.17	0.16	0.14
50.5	0.19	0.18	0.16	0.15	0.13
62.5	0.17	0.16	0.14	0.14	0.12
72.5	0.16	0.15	0.14	0.13	0.12
82.5	0.15	0.14	0.13	0.12	0.11
92.5	0.14	0.13	0.12	0.12	0.11

U-value results above based upon wall construction shown:

103mm brick outer leaf; 40 - 50mm low emissivity residual cavity; Mannok Therm Wall / MW; 100mm concrete block (conductivity as shown); 12mm plaster with dry wall adhesive; Mannok Therm Laminate-Kraft / MLK insulated plasterboard on plaster dabs. Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.

Benefits

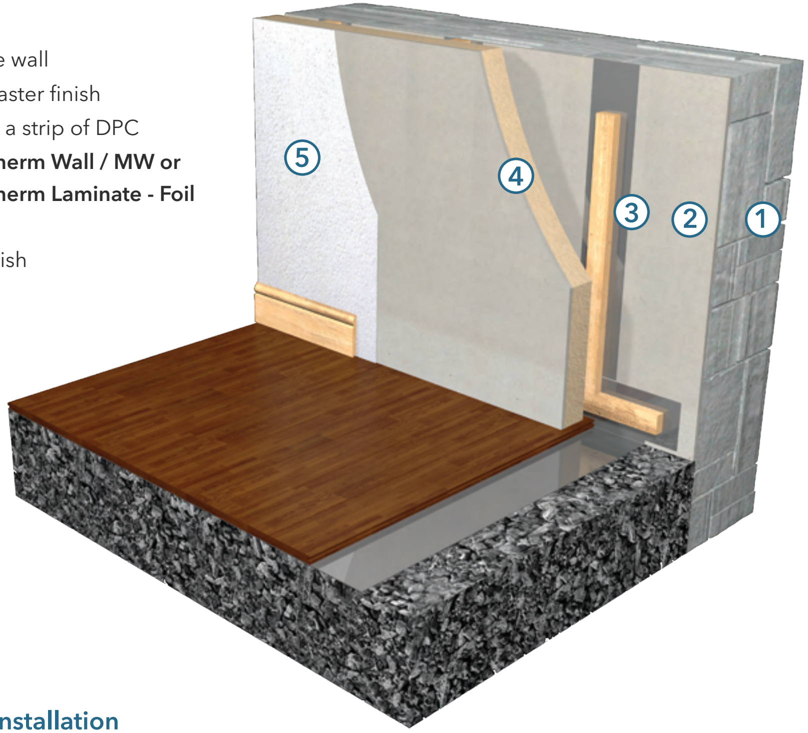
- Suitable for new build projects and refurbishment projects
- Excellent thermal properties
- Extremely durable
- No additional plasterboard finish requires
- Compatible with dot and dab adhesive
- Reduced labour costs

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

SOLID WALLS: INTERNAL DRY LINING

insulated with Mannok Therm Wall or Mannok Therm Laminate- Foil / MLF fixed to battens

1 Solid stone wall
2 Existing plaster finish
3 Battens on a strip of DPC
4 **Mannok Therm Wall / MW or Mannok Therm Laminate - Foil / MLF**
5 Internal finish



Design and Installation

Insulating an existing wall changes the heat and moisture patterns in the wall, so it is vital to carry out condensation risk analysis before undertaking any work on site. To minimise the risk of condensation the joints between Mannok Therm Wall / MW boards should be taped with metalised tape to form an AVCL which will prevent moisture from the building interior condensing on the cold side of the insulation.

Existing wall surfaces should be prepared by removing existing skirting, picture rails and window boards, as well as any wall coverings with high vapour resistance, such as vinyl wallpaper or gloss paint.

Battens should be isolated from the wall surface by a strip of DPC material and on uneven walls should be packed out to give a true surface for installing Mannok Therm Cavity / MC. Additional battens should be fixed to support cupboards, shelves and other fittings.

The screws which fix Mannok Therm Wall / MW to the battens should be selected to minimise heat loss: U-value calculations for the wall should account for the additional heat loss resulting from mechanical fasteners. The plasterboard lining should also be fixed back to the battens.

Using Mannok Therm Laminate-Foil / MLF insulated plasterboard enables the insulation and internal lining to be applied in one process.

Required thickness of Mannok Therm Wall / MW or Mannok Therm Laminate- Foil / MLF

Mannok Therm Wall / MW or Mannok Therm Laminate- Foil / MLF insulation fixed to timber battens @ 400mm centres

Masonry Type	215mm Brick	500mm Stone	215 Dense Block	215mm Mannok Aircrete Block (Lite Standard)
Thickness (mm)	U-value (W/m²K)			
37.5	0.44	0.43	0.47	0.32
42.5	0.41	0.40	0.43	0.30
50.5	0.35	0.34	0.37	0.27
62.5	0.29	0.29	0.30	0.24
72.5	0.26	0.26	0.27	0.21
82.5	0.23	0.23	0.24	0.19
92.5	0.21	0.21	0.22	0.18
102.5	0.19	0.19	0.20	0.17
112.5	0.18	0.17	0.18	0.15

U-value results above based upon wall construction shown:

Masonry (see table); 15mm plaster; 25mm cavity; Mannok Therm Wall / MW with 12.5mm plasterboard or Mannok Therm Laminate-Foil / MLF insulated plasterboard. Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.

Benefits

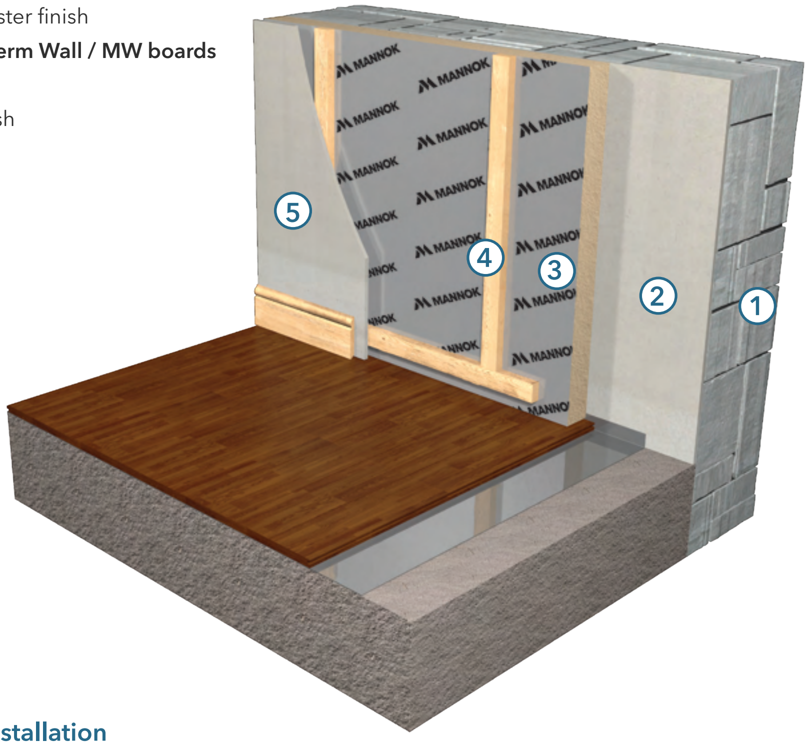
- Suitable for new build and refurbishment projects.
- Significantly improves thermal performance of old uninsulated walls.
- Extremely durable
- Improves finish on old uneven walls
- High thermally resistant cavity due to low emissivity foil facings

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

SOLID WALLS: INTERNAL DRY LINING

insulated with Mannok Therm Wall / MW fixed by battens

1 Solid stone wall
2 Existing plaster finish
3 **Mannok Therm Wall / MW boards**
4 Battens
5 Internal finish



Design and Installation

Insulating an existing wall changes the heat and moisture patterns in the wall, so it is vital to carry out condensation risk analysis before undertaking any work on site.

To minimise the risk of condensation the joints between Mannok Therm Wall / MW boards should be taped with metalised tape to form an AVCL which will prevent moisture from the building interior condensing on the cold side of the insulation.

Existing wall surfaces should be prepared by removing existing skirting, picture rails and window boards, as well as any wall coverings with high vapour resistance, such as vinyl wallpaper or gloss paint.

Additional battens should be fixed to support cupboards, shelves and other fittings.

Mechanical fixings which penetrate thermal insulation result in additional heat loss. The screws which fix the battens and Mannok Therm Wall / MW to the wall should be selected to minimise the additional heat loss through Mannok Therm Wall / MW.

U-value calculations for the wall should account for the additional heat loss resulting from mechanical fasteners.

Fixings for the plasterboard lining should not penetrate the insulation.

Required thickness of Mannok Wall / MW

Therm Wall / MW insulation fixed by timber battens @ 400mm centres

Masonry Type	215mm Brick	500mm Stone	215 Dense Block	215mm Mannok Aircrete Block (Lite Standard)
Thickness (mm)	U-value (W/m²K)			
25	0.44	0.43	0.47	0.32
30	0.41	0.40	0.43	0.30
40	0.35	0.34	0.37	0.27
50	0.29	0.29	0.30	0.24
60	0.26	0.26	0.27	0.21
70	0.23	0.23	0.24	0.19
80	0.21	0.21	0.22	0.18
90	0.19	0.19	0.20	0.17
100	0.18	0.17	0.18	0.15

U-value results above based upon wall construction shown:

Masonry (see table); 15mm plaster; Mannok Therm Wall / MW; 25mm cavity; 12.5mm plasterboard. Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.

Benefits

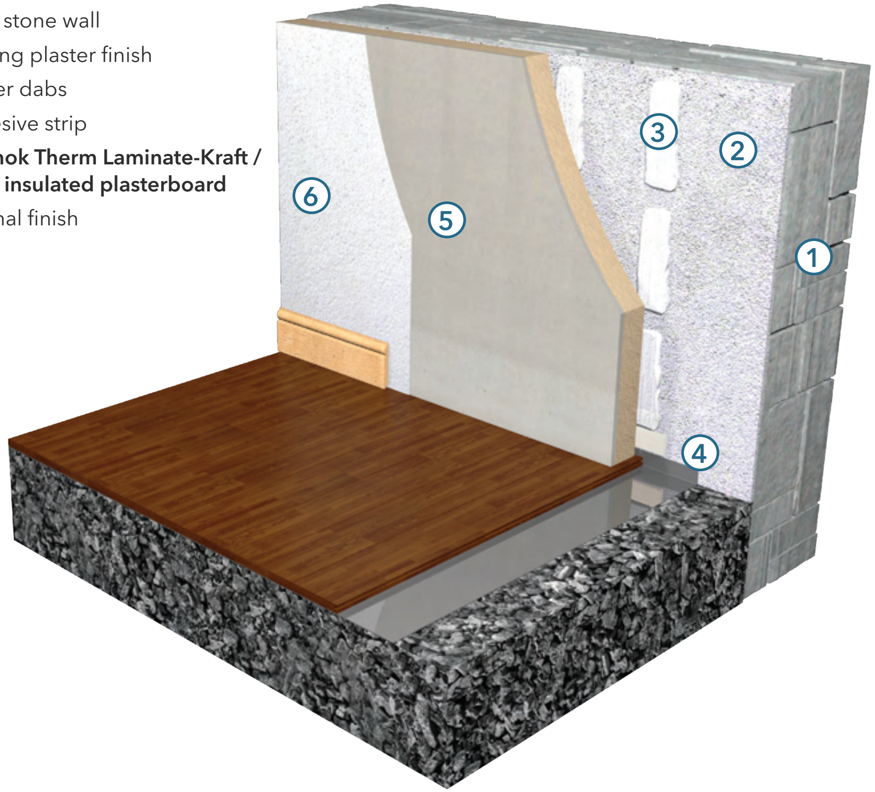
- Suitable for new build and refurbishment projects.
- Significantly improves thermal performance of old uninsulated walls.
- Creates cavity for services
- Improves finish on old uneven walls
- High thermally resistant cavity due to low emissivity foil facings

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

SOLID WALLS: INTERNAL DRY LINING

with Mannok Therm Laminate-Kraft / MLK insulated plasterboard fixed by dabs

1. Solid stone wall
2. Existing plaster finish
3. Plaster dabs
4. Adhesive strip
5. **Mannok Therm Laminate-Kraft / MLK insulated plasterboard**
6. Internal finish



Design and Installation

Insulating an existing wall changes the heat and moisture patterns in the wall, so it is vital to carry out condensation risk analysis before undertaking any work on site.

Wall surfaces should be prepared by removing existing skirting, picture rails and window boards, as well as any wall coverings with high vapour resistance, such as vinyl wallpaper or gloss paint.

Mannok Therm Laminate-Kraft / MLK insulated plasterboard should be fixed to the wall with adhesive dabs and secured with 2 secondary mechanical fixings at mid height and at a minimum of 15mm from the board edge. The screws which fix Mannok Therm Laminate-Kraft / MLK to the battens should be selected to minimise heat loss: U-value calculations for the wall should account for the additional heat loss resulting from mechanical fasteners.

Cupboards and other heavy fixtures should be fixed back to the masonry.

To minimise air infiltration, a continuous strip of dry-lining adhesive should be used to seal the perimeter of the Mannok Therm Laminate-Kraft / MLK boards, including around window and door openings.

Required thickness of Mannok Therm Laminate-Kraft / MLK

Masonry Type	215mm Brick	500mm Stone	215 Dense Block	215mm Mannok Aircrete Block (Lite Standard)
Thickness (mm)	U-value (W/m²K)			
37.5	0.55	0.53	0.58	0.38
42.5	0.50	0.48	0.52	0.35
50.5	0.41	0.40	0.43	0.31
62.5	0.34	0.33	0.34	0.27
72.5	0.29	0.29	0.30	0.24
82.5	0.26	0.25	0.27	0.21
92.5	0.23	0.23	0.24	0.20
102.5	0.21	0.21	0.21	0.18
112.5	0.19	0.19	0.20	0.17

U-value results above based upon wall construction shown:

Masonry (see table); 15mm plaster; plaster dabs; Mannok Therm Laminate-Kraft / MLK with 12.5mm plasterboard. Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.

Benefits

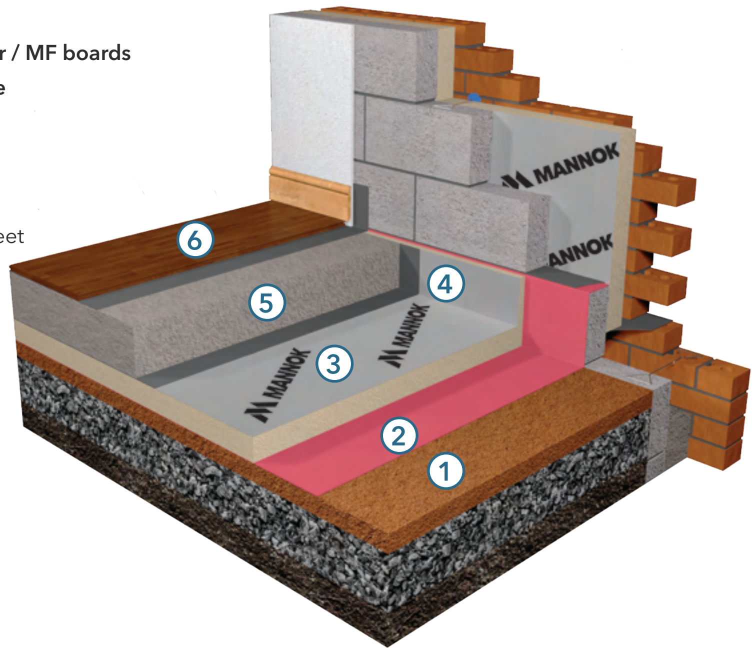
- Suitable for new build and refurbishment projects.
- Significantly improves thermal performance of old uninsulated walls
- Extremely durable
- Improves finish on old uneven walls
- Compatible with dot and dab adhesive

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

SOLID GROUND FLOOR

insulated below groundbearing slab with Mannok Therm Floor / MF

1 Sand blinding and hardcore
2 Radon barrier / DPM
3 **Mannok Therm Floor / MF boards**
4 **Mannok Therm edge insulation**
5 Concrete slab on separating layer
6 Timber flooring on polyethylene slip sheet



Design and Installation

Installing thermal insulation below the slab brings the thermal mass of slab within the insulated envelope, giving the building a steady thermal response.

Where radon control measures are required, a gas-resistant membrane should be specified for the dpm. The gas-resistant membrane should extend to the outer faces of all external walls. Cavity walls will require gas-resistant cavity trays.

Mannok Therm Floor / MF boards should be butted tightly together, to give a continuous layer across the whole floor. Boards should be cut neatly around service penetrations to minimise heat loss.

To prevent thermal bridging at the perimeter of the floor a continuous run of Mannok Therm Floor / MF boards should be fitted vertically against the perimeter walls, for the whole depth of the slab. The edge insulation should be at least 25mm thick and the exposed top edge should be protected from damage until covered by the wall finish and/or skirting. Insulation in perimeter walls should extend at least 150mm below the top of the floor insulation.

A polyethylene slip sheet should be laid across the insulation, to isolate it from the slab and prevent concrete working down between boards. The slip sheet will also function as a VCL, reducing the risk of condensation forming beneath the insulation.

Mannok Therm Floor / MF must be protected from damage while the concrete slab is being poured.

Required thickness of Mannok Therm Floor / MF

	Perimeter / Area ratio									
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Thickness (mm)	U-value (W/m²K)									
50	0.15	0.21	0.24	-	-	-	-	-	-	-
60	0.14	0.19	0.21	0.23	0.24	0.25	-	-	-	-
70	0.13	0.17	0.19	0.21	0.22	0.23	0.23	0.24	0.24	0.24
75	0.12	0.16	0.18	0.20	0.21	0.21	0.22	0.22	0.23	0.23
80	0.12	0.16	0.18	0.19	0.20	0.21	0.21	0.21	0.22	0.22
90	0.12	0.15	0.16	0.18	0.18	0.19	0.19	0.19	0.20	0.20
100	0.11	0.14	0.15	0.16	0.17	0.17	0.18	0.18	0.18	0.18
110	0.10	0.13	0.14	0.15	0.16	0.16	0.16	0.16	0.17	0.17
120	0.10	0.12	0.13	0.14	0.15	0.15	0.15	0.15	0.15	0.16
125	0.10	0.12	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.15
140	0.09	0.11	0.12	0.13	0.13	0.13	0.13	0.13	0.14	0.14
150	0.09	0.10	0.11	0.12	0.12	0.12	0.13	0.13	0.13	0.13
160	0.08	0.10	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12
180	0.08	0.09	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11
200	0.07	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10

U-value results above based upon floor construction shown:

Radon barrier / DPM; Mannok Therm Floor / MF; 150mm concrete; timber flooring (floor finish omitted); 150mm depth of Mannok Therm Floor / MF vertical edge insulation. Calculations performed to BS EN ISO 6946 and BS EN ISO 13370, taking account of repeating thermal bridges.

Benefits

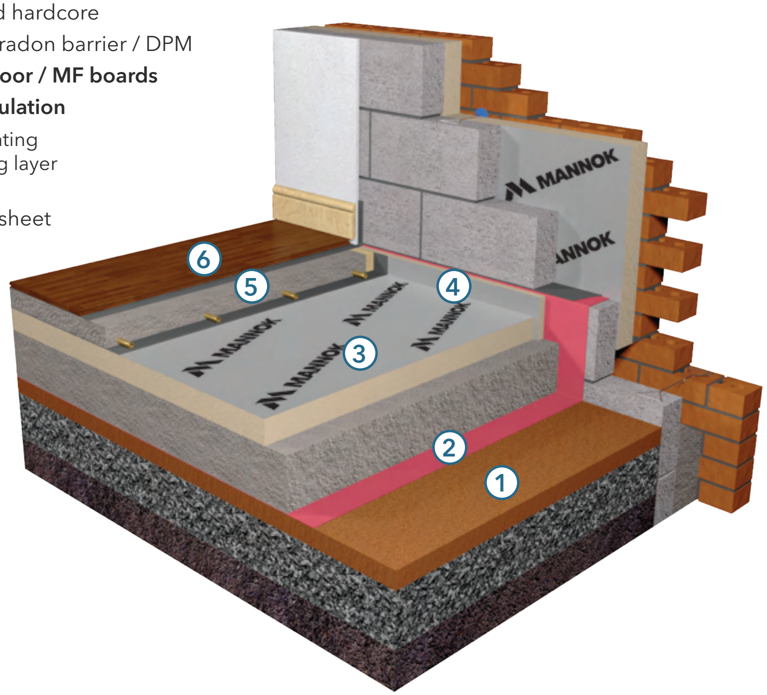
- Suitable for new build and refurbishment projects
- High compressive strength
- Excellent thermal properties
- Extremely durable
- Suitable for domestic and most commercial applications
- Suitable for use with underfloor heating

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

SOLID GROUND FLOOR

insulated above groundbearing slab with Mannok Therm Floor / MF

1. Sand blinding and hardcore
2. Concrete slab on radon barrier / DPM
3. **Mannok Therm Floor / MF boards**
4. **Mannok edge insulation**
5. Screed with u/f heating pipes on separating layer
6. Timber flooring on polyethylene slip sheet



Design and Installation

Installing thermal insulation above the slab isolates the thermal mass of slab from the building interior, giving the building a rapid thermal response. Where heating pipes are embedded in the screed, insulating immediately beneath the screed improves the responsiveness of the heating system.

Where radon control measures are required a gas-resistant membrane should be specified for the dpm. The gas-resistant membrane should be extended to the outer faces of all external walls. Cavity walls will require gas-resistant cavity trays.

To reduce thermal bridging at the perimeter of the floor a continuous run of Mannok Therm Floor / MF boards should be fitted vertically against the perimeter walls, for the whole depth of the screed.

The edge insulation should be at least 25mm thick and the exposed top edge should be protected from damage until covered by the wall finish and/or skirting. Insulation in perimeter walls should extend at least 150mm below the top of the floor insulation.

Mannok Therm Floor / MF boards should be butted tightly together, to give a continuous layer across the whole floor. Boards should be cut neatly around service penetrations to minimise heat loss.

A polyethylene separating layer should be laid across the insulation, to isolate it from the screed and prevent concrete working down between boards. The slip sheet will also function as a VCL, reducing the risk of condensation forming beneath the insulation. Mannok Therm Floor / MF must be protected from damage while the screed is being laid.

Required thickness of Mannok Therm Floor / MF

	Perimeter / Area ratio									
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Thickness (mm)	U-value (W/m²K)									
50	0.15	0.21	0.24	-	-	-	-	-	-	-
60	0.14	0.19	0.21	0.23	0.24	0.25	-	-	-	-
70	0.13	0.17	0.19	0.21	0.22	0.23	0.23	0.24	0.24	0.24
75	0.12	0.16	0.18	0.20	0.21	0.21	0.22	0.22	0.23	0.23
80	0.12	0.16	0.18	0.19	0.20	0.21	0.21	0.21	0.22	0.22
90	0.12	0.15	0.16	0.18	0.18	0.19	0.19	0.19	0.20	0.20
100	0.11	0.14	0.15	0.16	0.17	0.17	0.18	0.18	0.18	0.18
110	0.10	0.13	0.14	0.15	0.16	0.16	0.16	0.16	0.17	0.17
120	0.10	0.12	0.13	0.14	0.15	0.15	0.15	0.15	0.15	0.16
125	0.10	0.12	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.15
140	0.09	0.11	0.12	0.13	0.13	0.13	0.13	0.13	0.14	0.14
150	0.09	0.10	0.11	0.12	0.12	0.12	0.13	0.13	0.13	0.13
160	0.08	0.10	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12
180	0.08	0.09	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11
200	0.07	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10

U-value results above based upon floor construction shown:

Radon barrier / DPM; 150mm concrete; Mannok Therm Floor / MF; 60mm sand/cement screed with U/F heating pipes; timber flooring (floor finish omitted); Mannok Therm Floor / MF vertical edge insulation.
Calculations performed to BS EN ISO 6946 and BS EN ISO 13370, taking account of repeating thermal bridges.

Benefits

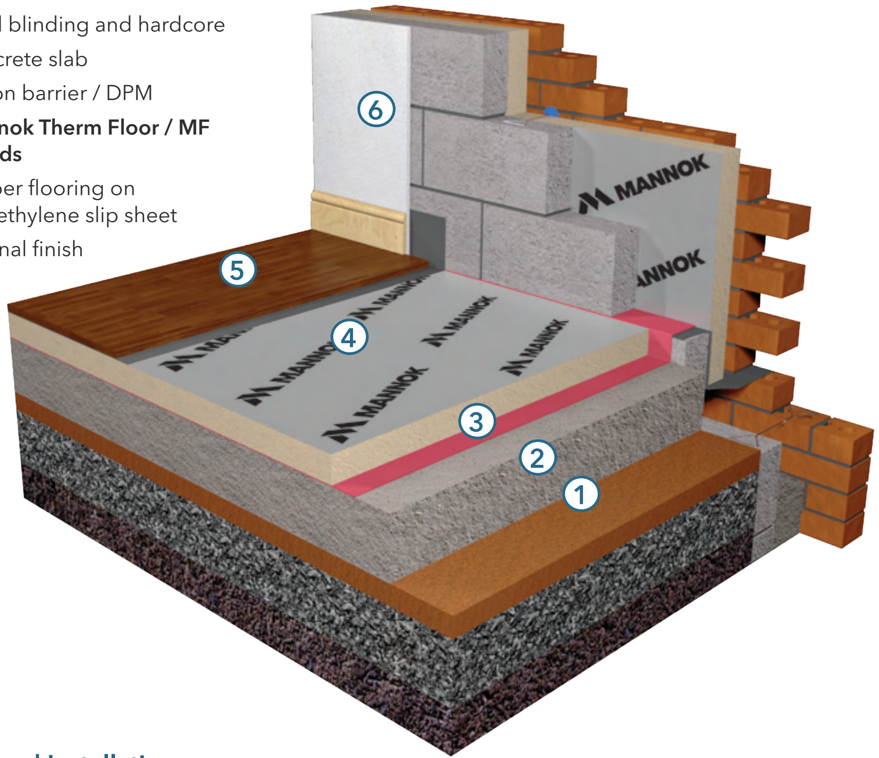
- Suitable for new build and refurbishment projects
- Compatible with underfloor heating
- High compressive strength
- Excellent thermal properties
- Extremely durable
- Suitable for domestic and most commercial applications
- Suitable for use with underfloor heating

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

SOLID GROUND FLOOR: TIMBER FLOATING FLOOR

insulated with Mannok Therm Floor / MF

1. Sand blinding and hardcore
2. Concrete slab
3. Radon barrier / DPM
4. **Mannok Therm Floor / MF boards**
5. Timber flooring on polyethylene slip sheet
6. Internal finish



Design and Installation

Installing thermal insulation above the slab isolates the thermal mass of slab from the building interior, giving the building a rapid thermal response. It offers a good solution for upgrading the thermal performance of an uninsulated concrete floor. When upgrading an existing floor it is important to consider the impact of the change of floor levels on doors and thresholds.

Where radon control measures are required a gas-resistant membrane should be laid across the floor slab before Mannok Therm Floor / MF is installed. In new buildings the gas-barrier should be extended as far as the outer faces of the external walls.

The surface of the concrete slab should be free from projections and level, with no more than a 5mm deflection over 2m.

Mannok Therm Floor / MF boards should be butted tightly together, to give a continuous layer across the whole floor, and laid with joints staggered between rows. Boards should be cut neatly around service penetrations to minimise heat loss. Preservative treated timber battens should be installed where high point loads are expected, for example at thresholds.

Timber flooring should be isolated from the insulation by a polyethylene slip sheet.Partition walls should be built off the concrete deck, not off the Mannok Therm Floor / MF boards.

Required thickness of Mannok Therm Floor / MF

	Perimeter / Area ratio									
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Thickness (mm)	U-value (W/m²K)									
50	0.15	0.21	0.24	-	-	-	-	-	-	-
60	0.14	0.19	0.21	0.23	0.24	0.25	-	-	-	-
70	0.13	0.17	0.19	0.21	0.22	0.23	0.23	0.24	0.24	0.24
75	0.12	0.16	0.18	0.20	0.21	0.21	0.22	0.22	0.23	0.23
80	0.12	0.16	0.18	0.19	0.20	0.21	0.21	0.21	0.22	0.22
90	0.12	0.15	0.16	0.18	0.18	0.19	0.19	0.19	0.20	0.20
100	0.11	0.14	0.15	0.16	0.17	0.17	0.18	0.18	0.18	0.18
110	0.10	0.13	0.14	0.15	0.16	0.16	0.16	0.16	0.17	0.17
120	0.10	0.12	0.13	0.14	0.15	0.15	0.15	0.15	0.15	0.16
125	0.10	0.12	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.15
140	0.09	0.11	0.12	0.13	0.13	0.13	0.13	0.13	0.14	0.14
150	0.09	0.10	0.11	0.12	0.12	0.12	0.13	0.13	0.13	0.13
160	0.08	0.10	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12
180	0.08	0.09	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11
200	0.07	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10

U-value results above based upon floor construction shown:

150mm concrete; radon barrier / DPM; Mannok Therm Floor / MF; timber flooring (floor finish omitted);
Calculations performed to BS EN ISO 6946 and BS EN ISO 13370, taking account of repeating thermal bridges.

Benefits

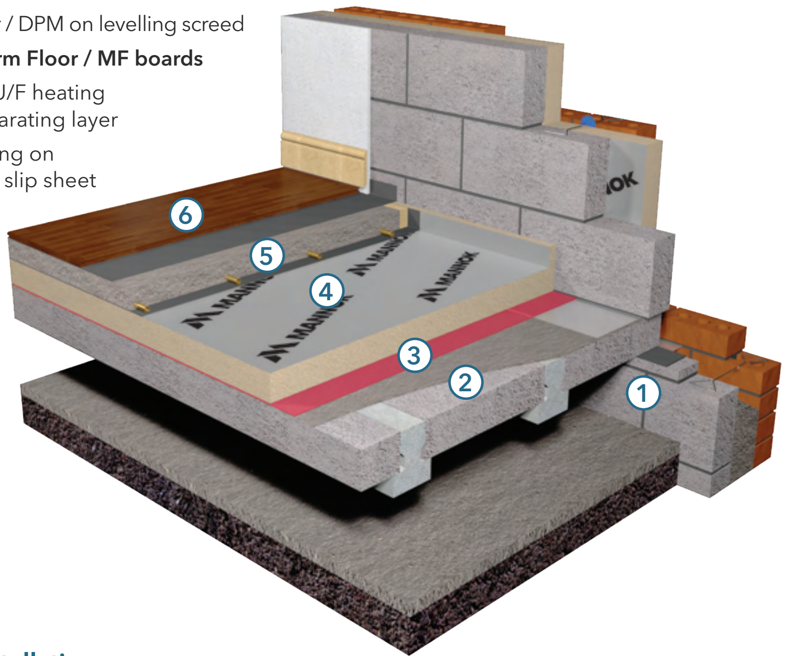
- Suitable for new build and refurbishment projects
- No screed required
- Ideal for upgrading existing floors
- High compressive strength
- Excellent thermal properties
- Extremely durable
- Suitable for use with underfloor heating

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

SUSPENDED BEAM AND BLOCK FLOOR

insulated with Mannok Therm Floor / MF

1 Slip block
2 Beam and block floor
3 Radon barrier / DPM on levelling screed
4 **Mannok Therm Floor / MF boards**
5 Screed with U/F heating pipes on separating layer
6 Timber flooring on polyethylene slip sheet



Design and Installation

Suspended floors are quick to construct and can be used where site conditions preclude a ground-bearing construction. Concrete suspended floors are formed of concrete beams with infill units. The void beneath the deck should be vented to prevent problems with damp.

The surface of the deck should be levelled with grout or a levelling topping. Where a radon barrier is required it should be laid over the grouting layer and extended across the wall cavity to the outer leaf.

To achieve required energy efficiency standards, Mannok Therm Floor / MF should be installed between the structural deck and the screed or finish. Mannok Therm Floor / MF boards should be butted tightly together, to give a continuous layer of insulation across the whole floor. Boards should be cut neatly around service penetrations to minimise heat loss.

Mannok Therm Floor / MF should be isolated from the screed with a polyethylene separating layer, to prevent moisture from the screed penetrating board junctions and causing movement.

Where heating pipes are to be embedded in the screed a proprietary clip system should be used to keep flexible piping in place until the screed has been laid.

Mannok Therm Floor / MF must be protected from damage while the screed is being laid.

Required thickness of Mannok Therm Floor / MF

	Perimeter / Area ratio									
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Thickness (mm)	U-value (W/m²K)									
50	0.16	0.21	0.24	-	-	-	-	-	-	-
60	0.15	0.19	0.22	0.23	0.24	0.25	0.25	-	-	-
70	0.14	0.18	0.20	0.21	0.22	0.22	0.23	0.23	0.23	0.24
75	0.14	0.17	0.19	0.20	0.21	0.21	0.21	0.22	0.22	0.22
80	0.13	0.17	0.18	0.19	0.20	0.20	0.21	0.21	0.21	0.21
90	0.12	0.15	0.17	0.18	0.18	0.19	0.19	0.19	0.19	0.19
100	0.12	0.14	0.16	0.16	0.17	0.17	0.17	0.18	0.18	0.18
110	0.11	0.13	0.14	0.15	0.15	0.16	0.16	0.16	0.16	0.16
120	0.11	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15
125	0.10	0.12	0.13	0.14	0.14	0.14	0.14	0.15	0.15	0.15
140	0.10	0.11	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.13
150	0.09	0.11	0.11	0.12	0.12	0.12	0.12	0.13	0.13	0.13

U-value results above based upon floor construction shown:

Suspended concrete beams infilled with concrete blocks; radon barrier /DPM; Mannok Therm Floor / MF; 60mm sand/cement screed with U/F heating pipes; timber flooring (floor finish omitted). Calculations performed to BS EN ISO 6946 and BS EN ISO 13370, taking account of repeating thermal bridges.

Benefits

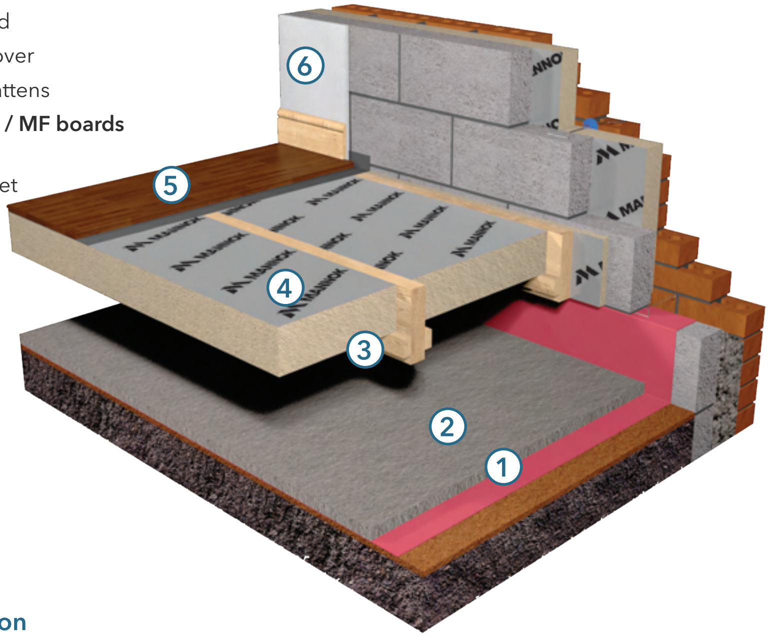
- Suitable for new build projects.
- High compressive strength
- Excellent thermal properties
- Extremely durable
- Suitable for domestic and most commercial applications
- Suitable for use with underfloor heating

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

SUSPENDED TIMBER GROUND FLOOR

insulated between timber joists with Mannok Therm Floor / MF

1. Radon barrier on sand
2. Concrete or gravel cover
3. Joists and support battens
4. **Mannok Therm Floor / MF boards**
5. Timber flooring on polyethylene slip sheet
6. Internal finish



Design and Installation

The simplest way of insulating suspended timber ground floors is to fit Mannok Therm Floor / MF between the joists. As this has no impact on floor levels it is a good solution for upgrading the performance of existing timber floors.

For new build, where a radon barrier is required it should be installed within the concrete or gravel cover of the sub-floor and continued through the entire thickness of the wall.

Mannok Therm Floor / MF insulation should be supported between the joists by either:

- purpose-made saddle clips at 400mm centres,
- stainless steel nails partially driven into the joists at 400mm centres,
- or preservative treated timber battens nailed to the joists.

The supports should be positioned so the depth of joist above them matches the thickness of the Mannok Therm Floor / MF boards. Alternatively, the supports can be set lower, to allow services to be run between the Mannok Therm Floor / MF and the flooring.

The Mannok Therm Floor / MF boards should be cut to fit tightly between the joists then set between the joists and pressed down until they sit on the supports.

Strips of Mannok Therm Floor / MF should be packed between the joists and perimeter walls to reduce thermal bridging. Wall insulation must extend 150mm below the upper edge of floor insulation to prevent thermal bridging.

A polyethylene slip sheet may be installed immediately beneath the flooring to protect against spills and reduce air leakage.

Ventilation of the sub-floor void is vital for avoiding problems with damp. When installing Mannok Therm Floor / MF ensure ventilation paths are maintained.

Required thickness of Mannok Therm Floor / MF

	Perimeter / Area ratio									
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Thickness (mm)	U-value (W/m²K)									
50	0.18	0.25	-	-	-	-	-	-	-	-
60	0.17	0.23	-	-	-	-		-	-	-
70	0.16	0.22	-	-	-	-	-	-	-	-
75	0.16	0.21	0.25	-	-	-	-	-	-	-
80	0.16	0.20	0.23	0.25	-	-	-	-	-	-
90	0.15	0.19	0.22	0.23	0.24	0.25	0.25	-	-	-
100	0.14	0.18	0.20	0.22	0.22	0.23	0.25	0.24	0.24	0.25
110	0.14	0.17	0.19	0.20	0.21	0.22	0.22	0.22	0.23	0.23
120	0.13	0.16	0.18	0.19	0.20	0.20	0.21	0.21	0.21	0.21
125	0.13	0.16	0.18	0.19	0.19	0.20	0.20	0.20	0.21	0.21
140	0.12	0.15	0.16	0.17	0.18	0.18	0.18	0.19	0.19	0.19
150	0.12	0.14	0.16	0.16	0.17	0.17	0.18	0.18	0.18	0.18

U-value results above based upon floor construction shown:

Timber joists (150mm x 47mm @ 400mm centres); Mannok Therm Floor / MF installed between joists; timber flooring (floor finish omitted). Calculations performed to BS EN ISO 6946 and BS EN ISO 13370, taking account of repeating thermal bridges.

Benefits

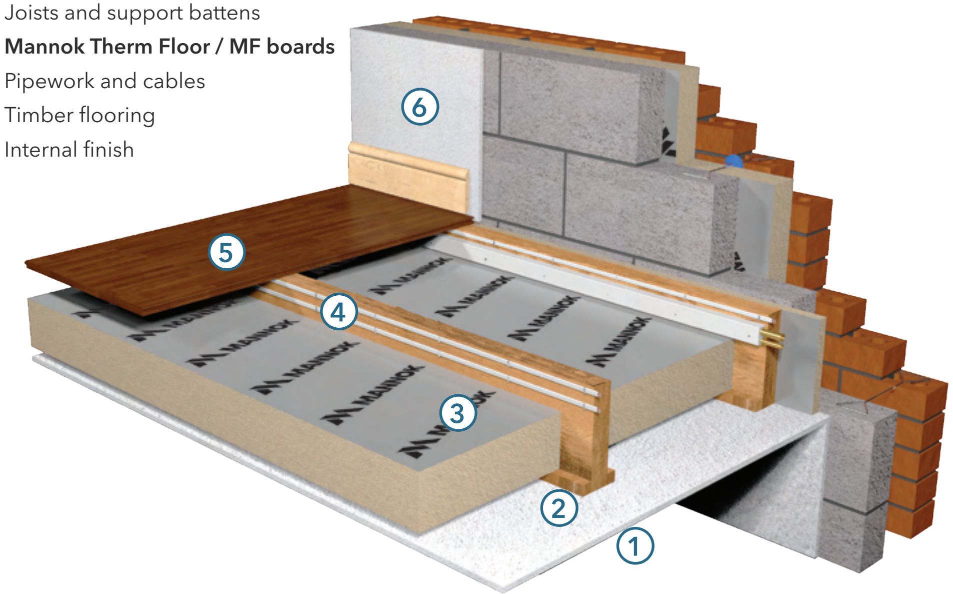
- Suitable for new build and refurbishment projects
- Can be easily cut between joists
- Excellent thermal properties
- Extremely durable
- Reduces air infiltration through floor
- Suitable for domestic and most commercial applications

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

SUSPENDED TIMBER FLOOR OTHER THAN GROUND FLOOR

insulated between timber joists with Mannok Therm Floor / MF

1. Plasterboard
2. Joists and support battens
3. **Mannok Therm Floor / MF boards**
4. Pipework and cables
5. Timber flooring
6. Internal finish



Design and Installation

The simplest way of insulating suspended timber floors is to fit Mannok Therm Floor / MF between the joists. As this has no impact on floor levels it is a good solution for upgrading the performance of existing timber floors.

Mannok Therm Floor / MF insulation should be supported between the joists by either:

- purpose-made saddle clips at 400mm centres,
- stainless steel nails partially driven into the joists at 400mm centres,
- or preservative treated timber battens nailed to the joists.

The supports should be positioned so the depth of joist above them matches the thickness of the Mannok Therm Floor / MF boards. Alternatively, the supports can be set lower on the joists to provide a service void below the flooring.

The Mannok Therm Floor / MF boards should be cut to fit tightly between the joists then set between the joists and pressed down until they sit on the supports.

Strips of Mannok Therm Floor / MF should be packed between the joists and perimeter walls to reduce thermal bridging.

A polyethylene slip sheet may be installed immediately beneath the flooring to protect against spills and reduce air leakage.

The soffit boarding must have a suitable level of fire resistance.

Required thickness of Mannok Therm Floor / MF

Mannok Therm Floor / MF between joists	U-value (W/m²K)
100	0.25
110	0.24
120	0.22
125	0.21
140	0.2
150	0.19
160	0.18
175	0.16
200	0.15

Based on 25mm un-ventilated air gap next to insulation

U-value results above based upon floor construction shown:

Plasterboard; timber joists (150mm x 47mm @ 400mm centres); Mannok Therm Floor / MF installed between joists; timber flooring (floor finish omitted). Calculations performed to BS EN ISO 6946 and BS EN ISO 13370, taking account of repeating thermal bridges.

Benefits

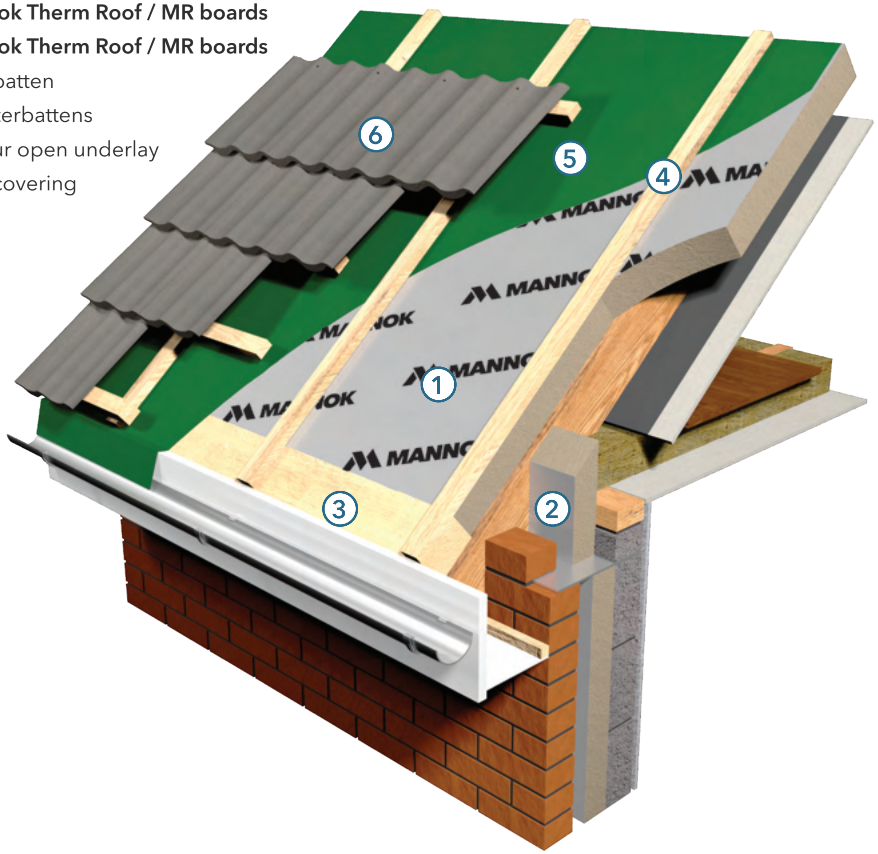
- Suitable for new build and refurbishment projects
- Can be easily cut between joists
- Excellent thermal properties
- Extremely durable
- Reduces air infiltration through floor
- Suitable for domestic and most commercial applications

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

PITCHED ROOF: INSULATED ABOVE RAFTERS

with Mannok Therm Roof / MR

1 **Mannok Therm Roof / MR boards**
2 **Mannok Therm Roof / MR boards**
3 Stop batten
4 Counterbattens
5 Vapour open underlay
6 Roof covering



Design and Installation

Insulating a pitched roof at rafter line - to create what is usually known as a warm roof - makes full use of the building volume by making the roof space available for occupation.

Having the insulation at rafter line allows building services to be located within the insulated volume.

When installing Mannok Therm Roof / MR above the rafters on warm pitched roofs consult BS 5534 Code of practice for slating and tiling (including shingles) - Annex B for guidance on calculation methods and fixings.

To minimise the risk of interstitial condensation the roof structure should be progressively more vapour open from inside to outside.

An AVCL between the insulation and the internal finish is essential.

The underlay should be vapour open (vapour resistance <0.25MNs/g) but water resistant, to protect against wind-driven rain and snow.

Required thickness of Mannok Therm Roof / MR

	Mannok Therm Roof / MR Insulation (mm)						
	100	110	120	125	130	140	150
U-Value (W/m²K)	0.19	0.17	0.16	0.16	0.15	0.14	0.13

U-value results above based upon pitched roof construction shown:

150mm deep rafters @400mm centres; Mannok Therm Roof / MR; vapour open underlay; 38mm cavity formed by counterbattens; large format concrete tiles. Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.

Benefits

- Suitable for new build projects and refurbishment projects
- Excellent thermal properties
- Extremely durable
- High thermally resistant cavity beneath insulation due to low emissivity foil facings
- Eliminates thermal bridging through rafters

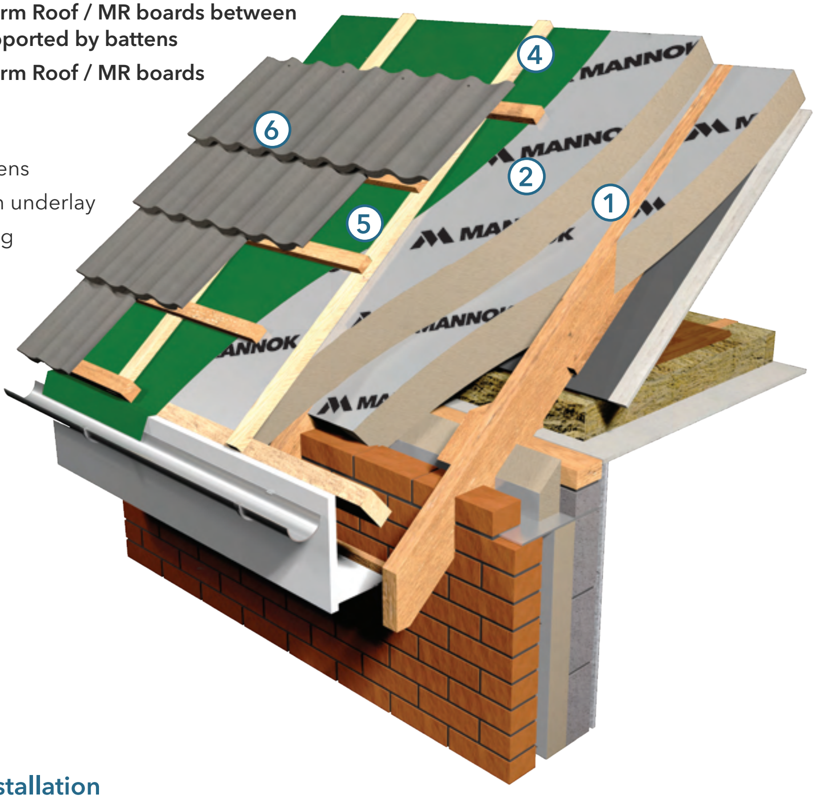
For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

PITCHED ROOFS

PITCHED ROOF: INSULATED ABOVE & BETWEEN RAFTERS

with Mannok Therm Roof / MR

1. **Mannok Therm Roof / MR boards between rafters & supported by battens**
2. **Mannok Therm Roof / MR boards over rafters**
3. Stop batten
4. Counterbattens
5. Vapour open underlay
6. Roof covering



Design and Installation

Insulating a pitched roof at rafter line - to create what is usually known as a warm roof - makes full use of the building volume by making the roof space available for occupation. Installing part of the insulation between the rafters reduces the depth of insulation required above the rafters, which reduces the load on fixings and makes installation easier.

When installing Mannok Therm Roof / MR above the rafters on warm pitched roofs consult
BS 5534 Code of practice for slating and tiling (including shingles) - Annex B for guidance on calculation methods and fixings.

To minimise the risk of interstitial condensation the roof structure should be progressively more vapour open from inside to outside.

An AVCL between the insulation and the internal finish is essential. The underlay should be vapour open (vapour resistance <0.25MNs/g) but water resistant, to protect against wind-driven rain and snow.

To limit heat loss and prevent problems such as condensation, mould growth and staining occurring at cold spots in the construction, insulation should be continuous at junctions between the roof and other elements, particularly the eaves and gable.

Required thickness of Mannok Therm Roof / MR

Insulation between rafters	Insulation above rafters (mm)							
	60	70	80	90	100	110	120	125
Thickness (mm)	U-value (W/m²K)							
50	0.20	0.18	0.17	0.16	0.15	0.14	0.13	0.13
60	0.19	0.17	0.16	0.15	0.14	0.13	0.13	0.12
70	-	0.16	0.15	0.14	0.13	0.12	0.12	0.12
80	-	-	0.14	0.13	0.13	0.12	0.11	0.11
90	-	-	-	0.13	0.12	0.11	0.11	0.11
100	-	-	-	-	0.12	0.11	0.11	0.10
110	-	-	-	-	-	0.11	0.10	0.10
120	-	-	-	-	-	-	0.10	0.10

U-value results above based upon pitched roof construction shown:

150mm deep rafters @400mm centres; Mannok Therm Roof / MR between rafters; Mannok Therm Roof / MR above rafters; vapour open underlay; 50mm cavity formed by counterbattens; large format concrete tiles. Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.

Benefits

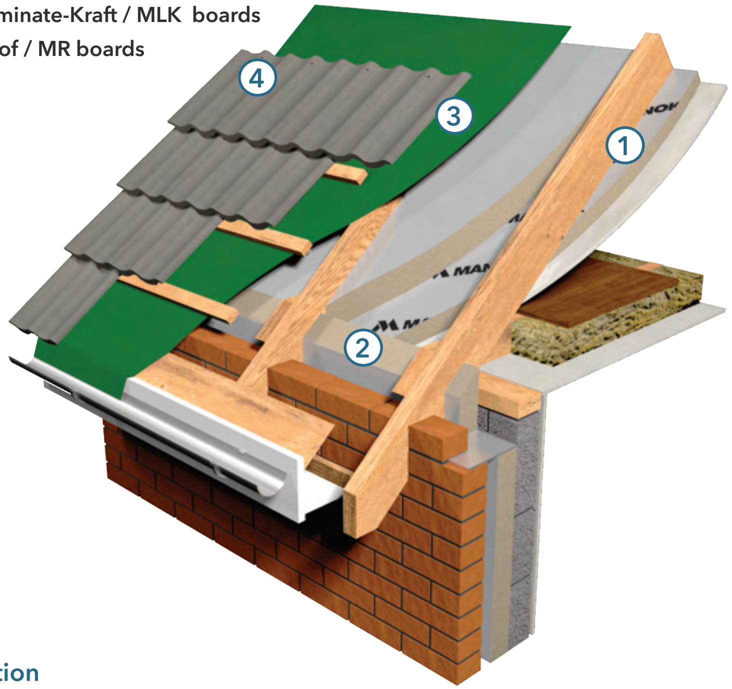
- Suitable for new build and refurbishment projects.
- Excellent thermal properties
- Extremely durable
- High thermally resistant cavity beneath insulation due to low emissivity foil facings
- Eliminates thermal bridging through rafters

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

PITCHED ROOF: INSULATED BETWEEN & BELOW RAFTERS

with Mannok Therm Roof / MR & Mannok Therm Laminate-Kraft / MLK

1 **Mannok Therm Laminate-Kraft / MLK boards**
2 **Mannok Therm Roof / MR boards**
3 Underlay
4 Roof covering



Design and Installation

Insulating a pitched roof at rafter line makes full use of the building volume by making the roof space available for occupation. Installing part of the insulation between the rafters reduces the depth of insulation required beneath the rafters, which minimises the loss of headroom.

To avoid interstitial condensation the roof structure should be progressively more vapour open from inside to outside. For new build, this can be achieved by specifying a vapour open underlay. In refurbishments where the roof covering is not being replaced, 50 mm vented air spaces should be maintained between the insulation and underlay.

The foil facing on the rear of Mannok Therm Laminate-Kraft / MLK has a very high vapour resistance and can be formed into an AVCL by sealing the joists between boards: set the boards onto a wide (30mm) bead of vapour resistant sealant applied to the under surface of all the joints and cross noggins. Alternatively, a separate AVCL can be installed.

To limit heat loss and prevent problems such as condensation, mould growth and staining occurring at cold spots in the construction, insulation should be continuous at junctions between the roof and other elements, particularly the eaves and gable.

At eaves, wall insulation should be continued between the rafters until it butts the underside of the Mannok Therm Roof / MR boards. Where there is a cavity closer at the wall head the additional wall insulation may be fixed to the wall plate.

Required thickness of Mannok Therm Roof / MR

New build: Mannok Therm Roof / MR and Mannok Therm Laminate-Kraft / MLK , unvented cavities

Mannok Therm Laminate-Kraft / MLK Insulation below rafters	Mannok Therm Roof / MR Insulation between rafters (mm)				
	75	100	125	150	175
Thickness (mm)	U-value (W/m²K)				
37.5	-	0.20	0.17	0.15	-
42.5	-	0.19	0.17	0.15	0.24
50.5	0.20	0.18	0.15	0.14	0.22
62.5	0.18	0.16	0.14	0.13	0.21
72.5	0.17	0.15	0.13	0.12	0.20
82.5	0.16	0.14	0.12	0.11	0.18
92.5	-	0.13	0.12	0.11	0.17

Refurbishment: Mannok Therm Roof / MR and Mannok Therm Laminate-Kraft / MLK , vented cavities

Mannok Therm Laminate-Kraft / MLK Insulation below rafters	Mannok Therm Roof / MR Insulation between rafters (mm)				
	75	100	125	150	175
Thickness (mm)	U-value (W/m²K)				
37.5	-	-	0.19	0.16	0.15
42.5	-	-	0.18	0.16	0.14
50.5	-	0.19	0.17	0.15	0.13
62.5	0.20	0.17	0.15	0.14	0.12
72.5	0.18	0.16	0.14	0.13	0.12
82.5	0.17	0.15	0.13	0.12	0.11
92.5	-	0.14	0.12	0.11	0.10

U-value results below above upon pitched roof construction shown:

Mannok Therm Laminate-Kraft / MLK insulated plasterboard beneath rafters; 150mm deep rafters @400mm centres; Mannok Therm Roof / MR between rafters (new build); 50mm unvented cavity, vapour open underlay (refurbishment); 50mm vented cavity; bituminous underlay; large format concrete tiles. Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.

Benefits

- Suitable for new build and refurbishment projects.
- Excellent thermal properties
- Extremely durable
- Mannok Therm Laminate-Foil / MLF reduces labour costs

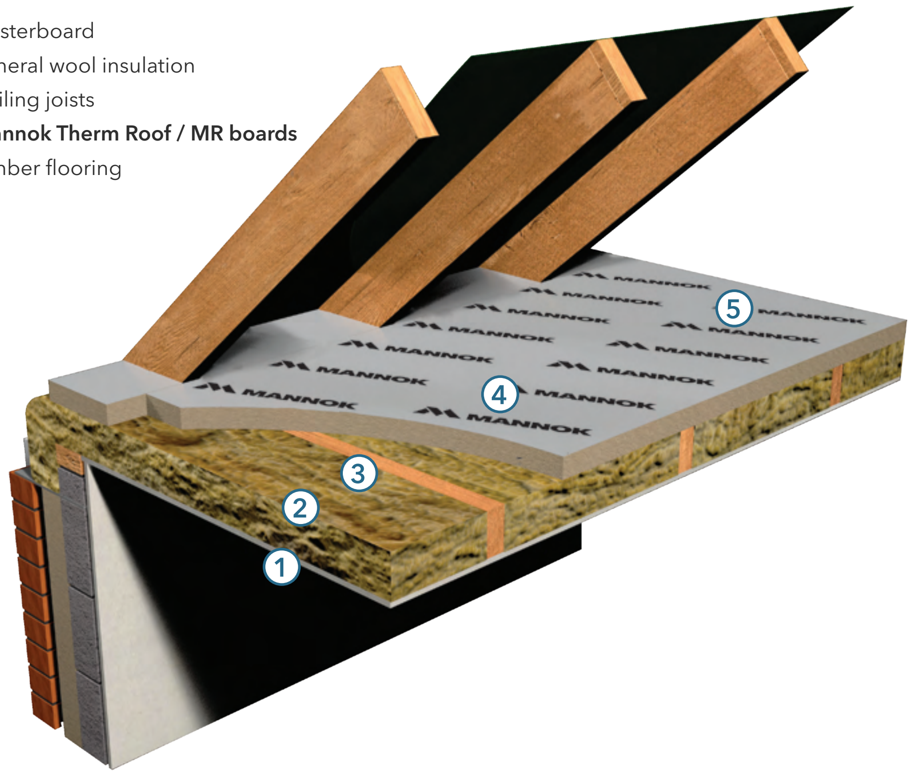
For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

PITCHED ROOFS

PITCHED ROOF: INSULATED AT CEILING

with Mannok Therm Roof / MR

1 Plasterboard
2 Mineral wool insulation
3 Ceiling joists
4 **Mannok Therm Roof / MR boards**
5 Timber flooring



Design and Installation

Mannok Therm Roof / MR should be installed with joints staggered between rows. All board ends must be supported on joists. Where the loft is going to be boarded out it is good practice to mark the line of joists on the surface of the boards.

Where the loft is boarded out, the Mannok PIR Insulation boards will be restrained by the screws used to fix the chipboard, which should have a minimum 30mm penetration into the joists. If the insulation is not being covered then the boards should be fixed by nailing to the joists, with two nails for each board at each joist.

When upgrading the insulation in an existing pitched roof, ensure all the pipes and cold water storage tank are properly insulated to avoid the risks of freezing.

Installing insulation over electrical cables will reduce the rate of heat dissipation, which may result in overheating. This is a particular risk with cables to showers and immersion heaters which usually run at a greater proportion of their capacity.

Cables may need to be de-rated to prevent overheating. Alternatively, a clear air space may be left between the top of the fibrous insulation and the Mannok Therm Roof / MR.

Required thickness of Mannok Therm Roof / MR

Mannok Therm Roof / MR above joists (mm)	U-value (W/m²K)
60	0.16
70	0.15
80	0.14
90	0.13
100	0.12
120	0.11
140	0.10

150mm x 50mm joists at 400mm centres. 150mm wool insulation between joists - λ 0.040.

U-value results above based upon pitched roof construction shown:

12.5mm plasterboard; 150mm mineral wool insulation between joists; 150mm deep joists @400mm centres; Mannok Therm Roof / MR; timber flooring. Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.

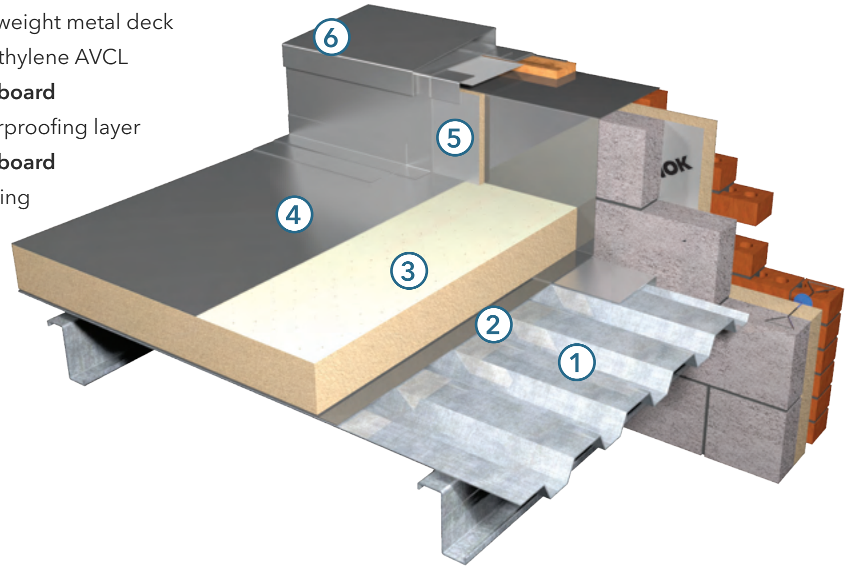
- High compressive strength
- Extremely durable
- Utilises valuable attic storage

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

FLAT ROOF: METAL DECK

insulated with Mannok Therm Roof / MFR

1 Lightweight metal deck
2 Polyethylene AVCL
3 **MFR board**
4 Waterproofing layer
5 **MFR board**
6 Capping



Design and Installation

When installing Mannok Therm Roof / MFR boards to a metal deck an AVCL should be laid over the deck with 150mm sealed laps turned up at any vertical upstand. The AVCL should consist of a minimum 1000 gauge (250μm) polyethylene sheet.

Mannok Therm Roof / MFR boards should be laid across the troughs of metal decks in accordance with the minimum thickness of insulation shown in the table. Boards should be laid with the long edges at right angles to the troughs with all joints fully supported.

Minimum insulation thickness (mm)	Trough opening
25	≤75
30	76 - 100
35	101 -125
40	126 -150
45	151 - 175
50	176 - 200

The number of fixings required to fix each board will vary with building location, geometry and topographical data and should be assessed in accordance with BS EN 1991-1–4. As a general rule a minimum of 4 fixings should be used per 1200 x 600mm board. Fixings should be placed 50–150mm from the edges of the board with an additional row of fixings along the middle of the board.

When calculating U-values to BS EN ISO 6946 the number and type of mechanical fixings can change the thickness of insulation required. The tabulated U-values were calculated based on telescopic tube fasteners with a thermal conductivity of 1.00W/mK or less, the effect of which is insignificant.

Required thickness of Mannok PIR Insulation* on a flat roof with a metal deck

Mannok Therm Roof / MFR-FFR		Mannok Therm Roof / MFR-GFR		Mannok Therm Roof / MFR-DPFR	
Thickness (mm)	U-value (W/m²K)	Thickness (mm)	U-value (W/m²K)	Thickness (mm)	U-value (W/m²K)
90	0.24	100	0.24	100	0.24
100	0.21	110	0.22	110	0.22
110	0.19	120	0.19	120	0.19
120	0.18	125	0.19	125	0.19
125	0.17	130	0.18	130	0.18
130	0.16	140	0.17	140	0.17
140	0.15	150	0.16	150	0.16
150	0.14	80+80	0.15	80+80	0.15
80+80	0.13	80+90*	0.14	80+90*	0.14

U-value results above based upon flat roof construction shown:

Lightweight metal deck; polyethylene AVCL; Mannok Therm Roof / MFR insulation (MFR-GFR shown for illustration); waterproofing layer (single ply membrane with 5 fixings per m² shown). Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.

*Where different thicknesses of insulation are used, the thicker Mannok PIR Insulation board should be placed outermost.

When calculating U-values to BS EN ISO 6946, the type of mechanical fixing used may change the thickness of insulation required. The U-values in these tables were calculated using telescopic tube fasteners with a thermal conductivity of 1.00W/m.K or less, the effect of which is insignificant.

Compatability

- **Mannok Therm Roof / MFR-FFR:** suitable for mechanically fixed single ply membranes.
- **Mannok Therm Roof / MFR-GFR:** suitable for fully adhered and mechanically fixed single ply membranes, partially bonded built up felt, mastic asphalt and cold liquid applied waterproofing systems.
- **Mannok Therm Roof / MFR-DPFR: Glass tissue face up** - suitable for fully adhered and mechanically fixed single ply membranes, partially bonded built up felt, mastic asphalt and cold liquid applied waterproofing systems. **Bituminous fleece face up** – suitable for hot or cold bonded build-up bituminous waterproofing systems.

Benefits

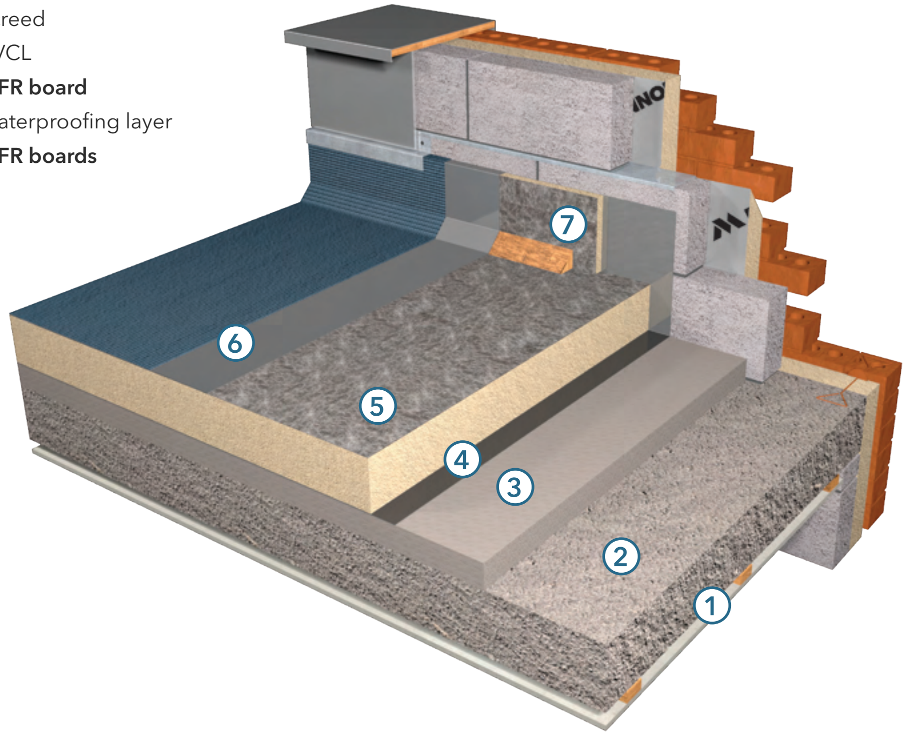
- Suitable for new build projects.
- Compatible with most waterproofing systems
- Compatible with concrete, metal and timber decks
- LPCB approval on selected boards
- Excellent thermal properties
- High compressive strength

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

FLAT ROOF: CONCRETE DECK

insulated with Mannok Therm Roof / MFR

1 Plasterboard
2 Concrete deck
3 Screed
4 AVCL
5 **MFR board**
6 Waterproofing layer
7 **MFR boards**



Design and Installation

When installing Mannok Therm Roof / MFR boards to a concrete deck a bituminous AVCL should be laid over the deck with 150mm sealed laps turned up at any vertical upstand and sealed to the waterproofing layer.

Boards should be laid with joints staggered between rows.

The number of fixings required to fix each board will vary with building location, geometry and topographical data and should be assessed in accordance with BS EN 1991-1-4. As a general rule a minimum of 4 fixings should be used per 1200 x 600mm board.

Fixings should be placed 50–150mm from the edges of the board with an additional row of fixings along the middle of the board. The boards can also be fixed using hot bitumen.

When calculating U-values to BS EN ISO 6946 the number and type of mechanical fixings can change the thickness of insulation required.

The tabulated U-values were calculated based on telescopic tube fasteners with a thermal conductivity of 1.00W/mK or less, the effect of which is insignificant.

Required thickness of Mannok PIR Insulation on a flat roof with a concrete deck

Mannok Therm Roof / MFR-FFR	
Thickness (mm)	U-value (W/m²K)
75	0.25
80	0.24
90	0.22
100	0.20
110	0.18
120	0.17
125	0.16
130	0.15
140	0.14
150	0.14
80+80	0.13
80+90*	0.12

Mannok Therm Roof / MFR-GFR	
Thickness (mm)	U-value (W/m²K)
90	0.24
100	0.22
110	0.20
120	0.18
125	0.17
130	0.17
140	0.16
150	0.15
80+80	0.14
90+90	0.13

Mannok Therm Roof / MFR-DPFR	
Thickness (mm)	U-value (W/m²K)
90	0.24
100	0.22
110	0.20
120	0.18
125	0.17
130	0.17
140	0.16
150	0.15
80+80	0.14
90+90	0.13

U-value results above based upon flat roof construction shown:

Plasterboard on battens, 150mm concrete deck; 50mm sand/cement screed; AVCL bonded to screed with hot bitumen; Mannok Therm Roof / MFR insulation (MFR-DPFR shown for illustraton); waterproofing layer (built-up felt shown). Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.
*Where different thicknesses of insulation are used, the thicker Mannok PIR Insulation board should be placed outermost.

When calculating U-values to BS EN ISO 6946, the type of mechanical fixing used may change the thickness of insulation required. The U-values in these tables were calculated using telescopic tube fasteners with a thermal conductivity of 1.00W/m.K or less, the effect of which is insignificant.

Compatability

- **Mannok Therm Roof / MFR-FFR:** suitable for mechanically fixed single ply membranes.
- **Mannok Therm Roof / MFR-GFR:** suitable for fully adhered and mechanically fixed single ply membranes, partially bonded built up felt, mastic asphalt and cold liquid applied waterproofing systems.
- **Mannok Therm Roof / MFR-DPFR: Glass tissue face up** - suitable for fully adhered and mechanically fixed single ply membranes, partially bonded built up felt, mastic asphalt and cold liquid applied waterproofing systems. **Bituminous fleece face up** – suitable for hot or cold bonded build-up bituminous waterproofing systems.

Benefits

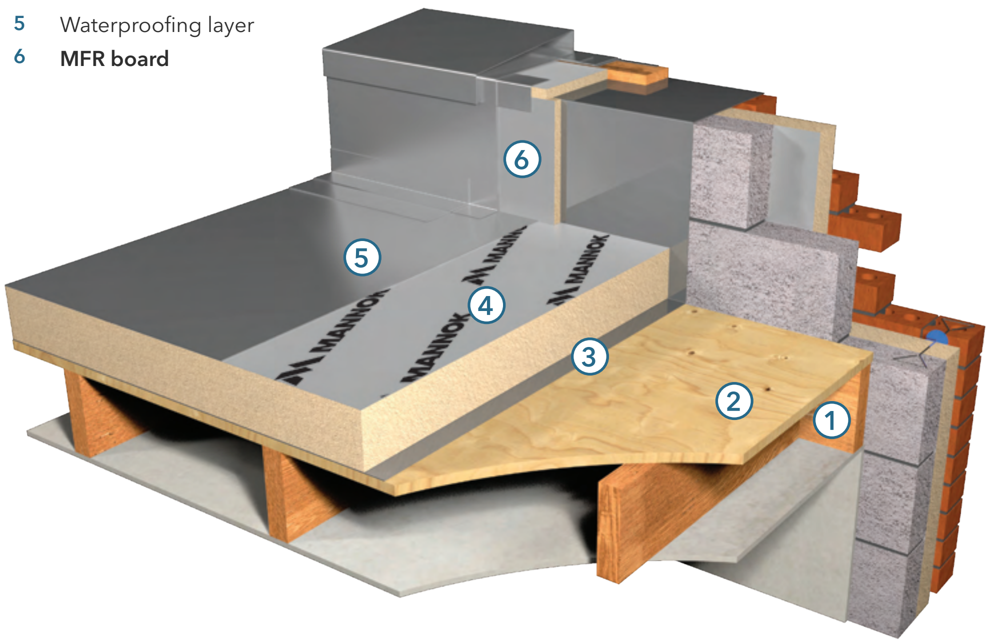
- Suitable for new build and retrofit projects
- Compatible with most waterproofing systems
- Compatible with concrete, metal and timber decks
- Excellent thermal properties
- High compressive strength

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

FLAT ROOF: TIMBER DECK

insulated with Mannok Therm Roof / MFR

1 Roof joists
2 Timber deck
3 AVCL
4 **MFR board**
5 Waterproofing layer
6 **MFR board**



Design and Installation

When installing Mannok Therm Roof / MFR boards to a timber deck an AVCL should be laid over the deck with 150mm sealed laps, turned up at any vertical upstand. The AVCL should consist of minimum 1000 gauge (250µm) polyethylene sheet.

Mannok Therm Roof / MFR boards should be laid with joints staggered between rows.

The number of fixings required to fix each board will vary with building location, geometry and topographical data and should be assessed in accordance with BS EN 1991-1-4.

As a general rule a minimum of 4 fixings should be used per 1200 x 600mm board. Fixings should be placed 50–150mm from the edges of the board with an additional row of fixings along the middle of the board.

When calculating U-values to BS EN ISO 6946 the number and type of mechanical fixings can change the thickness of insulation required.

The tabulated U-values were calculated based on telescopic tube fasteners with a thermal conductivity of 1.00W/mK or less, the effect of which is insignificant.

Required thickness of Mannok PIR Insulation on a flat roof with a timber deck

Built-up roofing: Mannok Therm Roof / MFR-FFR	
Thickness (mm)	U-value (W/m²K)
75	0.25
80	0.24
90	0.22
100	0.20
110	0.18
120	0.17
125	0.16
130	0.15
140	0.14
150	0.14
80+80	0.13
80 +90*	0.12

Built-up roofing: Mannok Therm Roof / MFR-GFR	
Thickness (mm)	U-value (W/m²K)
90	0.24
100	0.22
110	0.20
120	0.18
125	0.17
130	0.17
140	0.16
150	0.15
80+80	0.14
90+90	0.13

Built up roofing: Mannok Therm Roof / MFR-DPFR	
Thickness (mm)	U-value (W/m²K)
90	0.24
100	0.22
110	0.20
120	0.18
125	0.17
130	0.17
140	0.16
150	0.15
80+80	0.14
90+90	0.13

U-value results above based upon flat roof construction shown:

12.5mm plasterboard; roof joists; timber deck; AVCL;Mannok Therm Roof / MFR insulation (MFR-FFR shown for illustration); waterproofing layer (single ply membrane with 5 fixings per m² shown).
Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.
*Where different thicknesses of insulation are used, the thicker Mannok PIR Insulation board should be placed outermost.

When calculating U-values to BS EN ISO 6946, the type of mechanical fixing used may change the thickness of insulation required. The U-values in these tables were calculated using telescopic tube fasteners with a thermal conductivity of 1.00W/m.K or less, the effect of which is insignificant.

Compatability

- **Mannok Therm Roof / MFR-FFR:** suitable for mechanically fixed single ply membranes.
- **Mannok Therm Roof / MFR-GFR:** suitable for fully adhered and mechanically fixed single ply membranes, partially bonded built up felt, mastic asphalt and cold liquid applied waterproofing systems.
- **Mannok Therm Roof / MRFR-DPFR: Glass tissue face up** - suitable for fully adhered and mechanically fixed single ply membranes, partially bonded built up felt, mastic asphalt and cold liquid applied waterproofing systems. **Bituminous fleece face up** – suitable for hot or cold bonded build-up bituminous waterproofing systems.

Benefits

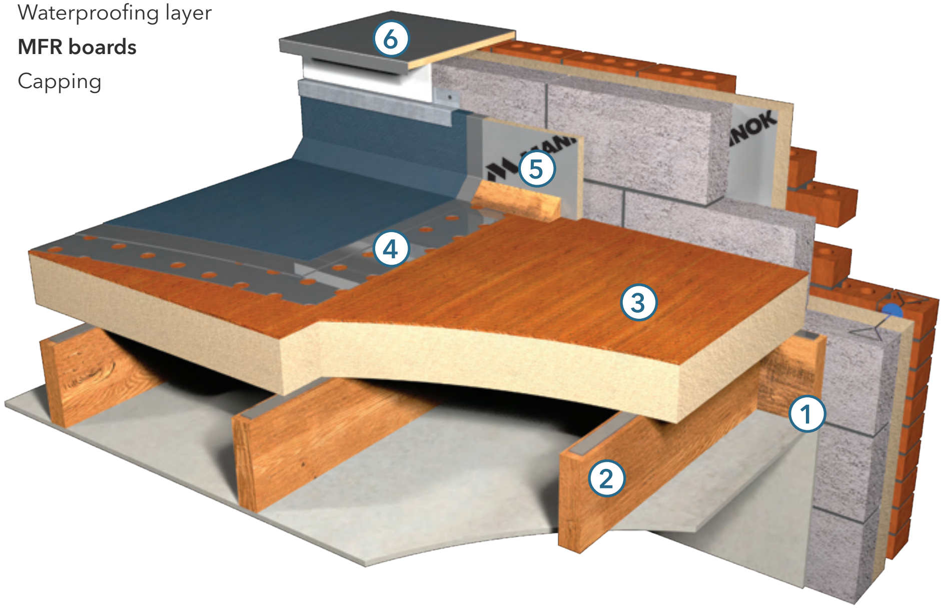
- Suitable for new build and retrofit projects
- Compatible with most waterproofing systems
- Compatible with concrete, metal and timber decks
- Excellent thermal properties
- High compressive strength

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

FLAT ROOF: TIMBER DECK INSULATED ABOVE JOISTS

with Mannok Therm Plydeck / MFR-PLY

1 Timber deck
2 Vapour resistant sealant strip
3 **Mannok Therm Roof / MFR-PLY boards**
4 Waterproofing layer
5 **MFR boards**
6 Capping



Design and Installation

The foil facing on the underside of Mannok Therm Roof / MFR-PLY has a very high vapour resistance and can be formed into an AVCL by sealing the joints between boards: set the boards onto a wide (30mm) bead of vapour resistant sealant applied to the upper surface of all the joists and cross noggins.

Mannok Therm Roof / MFR-PLY should be fixed with low profile headed screws, long enough to give minimum 35mm embedment into the timbers. Fixings should be at 200mm centres around the board edges (300mm centres on any intermediate timbers) and set at least 10mm from board edges and 50mm from corners. Fixings for adjacent boards should be staggered to the same joist or noggin and screw heads must finish flush with the surface of the plywood.

To prevent water damage to Mannok Therm Roof / MFR-PLY the waterproofing system should be installed as soon as possible. In poor weather Mannok Therm Roof / MFR-PLY should be protected by polyethylene sheeting until the waterproofing system is installed.

Thermal bridging at roof-wall junctions must be avoided: at eaves and verges the joist space should be packed with insulation; at parapets vertical edge insulation should be applied to the inner face and the wall insulation carried at least 150mm above the surface of the Mannok Therm Roof / MFR-PLY.

Access to flat roofs constructed with MFR-PLY laminate should be for maintenance and repair only.

Required thickness of Mannok Therm Roof / MFR-PLY and MR

Mannok Therm Roof / MR between joists	Mannok Therm Roof / MFR-PLY above joists (mm)	U-value (W/m²K)
-	76	0.25
-	96	0.21
-	106	0.19
-	116	0.17
-	131	0.15
25	131	0.14
30	131	0.13
50	131	0.12

* Thickness of Mannok Therm Roof / MRFR-PLY includes 6mm WPB plywood
Joists at 400mm centres.

U-value results above upon flat roof construction shown:

Plasterboard; timber deck; Mannok Therm Roof / MFR-PLY plywood laminate on vapour resistant sealant strips (over joists at 400mm centres); waterproofing layer. Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.

Benefits

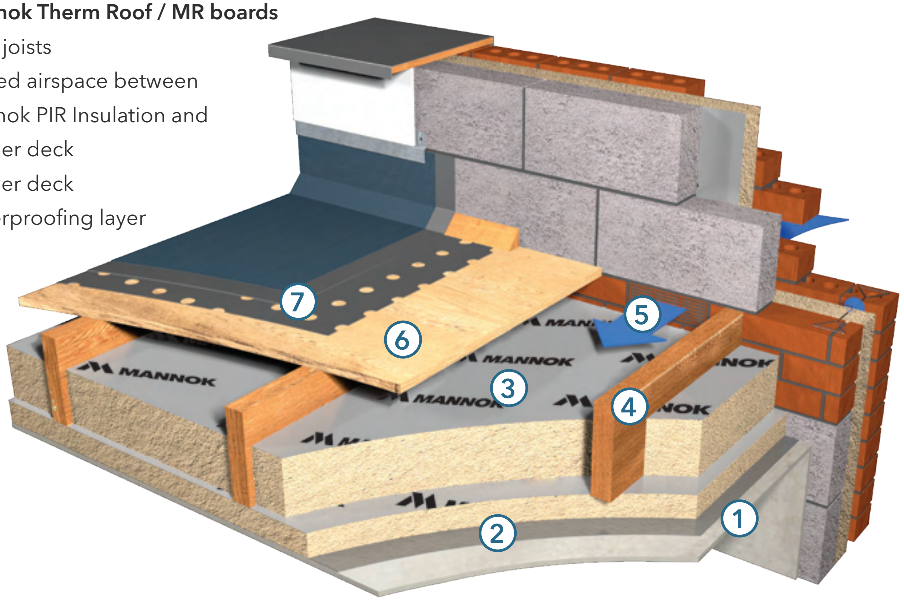
- Suitable for new build and retrofit projects N R
- No requirement for additional structural deck*
- Reduces labour costs
- Excellent thermal properties
- High compressive strength

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

FLAT ROOF: TIMBER DECK

insulated between & below joists with Mannok Therm Roof / MR

1 Plasterboard
2 AVCL
3 **Mannok Therm Roof / MR boards**
4 Roof joists
5 Vented airspace between Mannok PIR Insulation and timber deck
6 Timber deck
7 Waterproofing layer



Design and Installation

Where the thermal performance of an existing flat roof needs to be upgraded without affecting the waterproofing system Mannok Therm Roof / MR insulation can be fitted between the joists.

To prevent damaging condensation forming on the underside of the deck, vented air spaces at least 50mm deep must be maintained between the deck and the upper surface of the insulation, with ventilation openings at each end of every air space. The openings must be equivalent in area to a continuous opening of 25mm along each side.

The Mannok Therm Roof / MR boards should be cut to fit tightly between the joists. The boards should be supported on stainless steel nails partially driven into the joists at 400mm centres, or preservative treated timber battens nailed to the joists. The distance from the underside of the deck to the upper surface of the supports should be a minimum of the insulation thickness plus 50mm. The boards should be seated firmly on the supports.

An AVCL should be fitted to the warm side of the insulation (between the insulation and the ceiling). Laps should be sealed and the AVCL itself sealed to the walls.

It is good practice to avoid penetrations of the AVCL by fixing battens to the underside of the joists to form an void in which to run services.

Required thickness of Mannok Therm Roof / MR

Mannok Therm Roof / MR insulation between and below joists: Ventilated cold roof

Mannok Therm Roof / MR Insulation below joists	Mannok Therm Roof / MR Insulation between joists (mm)			
	75	100	125	150
Thickness (mm)	U-value (W/m²K)			
25	-	-	0.19	0.16
30	-	-	0.18	0.16
40	-	0.19	0.17	0.15
50	0.20	0.17	0.15	0.14
60	0.18	0.16	0.14	0.13

100mm x50mm studs @ 400mm centres. 100mm Mannok PIR Insulation between Studs

U-value results above based upon flat roof construction shown:

12.5mm plasterboard; AVCL; Mannok Therm Roof / MR; roof joists; Mannok Therm Roof / MR between joists @ 400mm centres; timber deck; waterproofing layer (built-up felt shown). Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.

Benefits

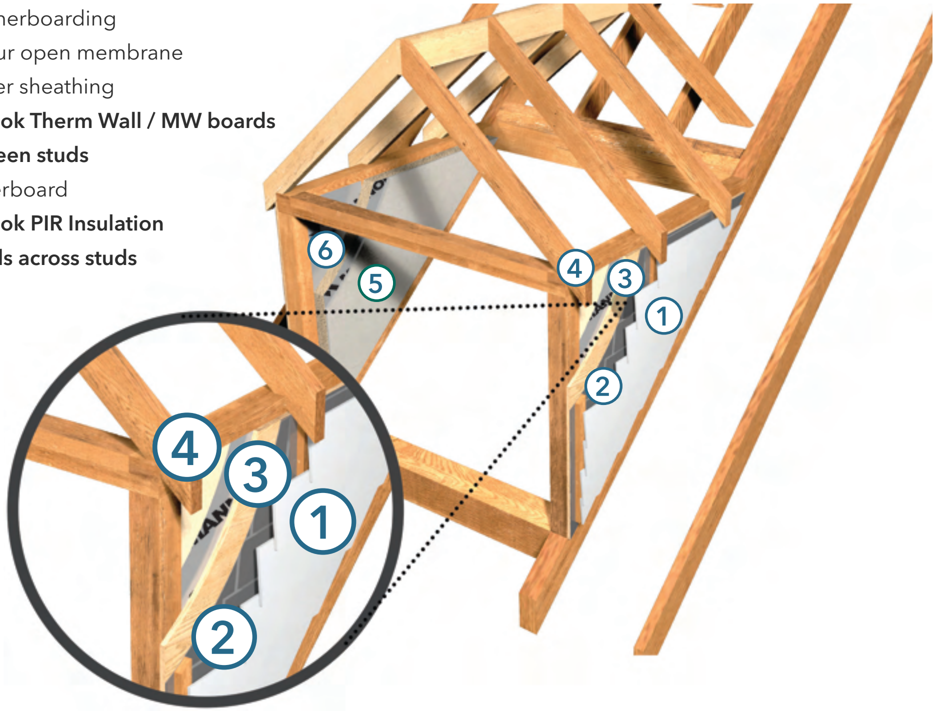
- Suitable for retrofit projects
- Insulation can be installed form beneath
- Excellent thermal properties

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

TIMBER FRAME WALL WITH WEATHERBOARDS

insulated between studs at dormer cheek with Mannok Therm Wall / MW

1 Weatherboarding
2 Vapour open membrane
3 Timber sheathing
4 **Mannok Therm Wall / MW boards between studs**
5 Plasterboard
6 **Mannok PIR Insulation boards across studs**



Design and Installation

Mannok Therm Wall / MW boards should be cut to fit snugly between studs and to window framing. Any gaps between the insulation and studs should be filled with expanding polyurethane foam.

Timber stud dormer checks require an AVCL to prevent interstitial condensation forming on the back of the sheathing. Where Mannok Therm Wall / MW is fitted only between the studs a vapour resistant membrane, such as 500 gauge (125μm) polyethylene, should be installed across the face of the studs.

Condensation risk analysis should be carried out to ensure the specified AVCL has a sufficiently high vapour resistance for the project. Laps should be sealed and the AVCL itself sealed to the AVCLs in the adjoining elements and to the frame of the dormer window.

Where a continuous layer of Mannok Therm Wall / MW is fitted across the inner face of the studs an AVCL may be formed by taping the joints between boards with metalised tape.

The junction between the dormer cheek and the roof plane should be designed and constructed so as to minimise thermal bridging. This is most easily achieved where both the dormer and the roof plane both have a layer of insulation drawn over the internal faces of the studs and rafters. The insulation on the dormer face can then be carried down the face of the supporting rafter to meet the insulation to the underside of the rafter.

Required thickness of Mannok Therm Wall / MW

Mannok Therm Wall / MW between + across studs (mm)	89mm stud U-value (W/m²K)
60+20	0.27
60+25	0.25
60+30	0.24
60+35	0.23
60+40	0.21
60+45	0.20
60+50	0.19
60+60	0.18

89mm x 50mm studs @ 400mm centres. 60mm Mannok Therm between studs.

Mannok Therm Wall / MW between + across studs (mm)	100mm stud U-value (W/m²K)
75+20	0.24
75+25	0.23
75+30	0.21
75+35	0.20
75+40	0.19
75+50	0.18
75+60	0.16
75+70	0.15

100mm x 50mm studs @ 400mm centres. 75mm Mannok Therm between studs.

Mannok Therm Wall / MW between + across studs (mm)	140mm stud U-value (W/m²K)
110+20	0.19
110+25	0.18
110+30	0.17
110+40	0.16
110+45	0.15
110+50	0.15
110+60	0.14
110+70	0.13

140mm x 50mm studs @ 400mm centres. 110mm Mannok Therm between studs.

Mannok Therm Wall / MW between studs and Mannok Therm Wall / MW or Laminate-Kraft / MLK across studs

U-value results above based upon wall construction shown:

Weatherboarding; 25mm air cavity formed by battens; vapour open membrane; 12mm plywood sheathing; Mannok Therm Wall / MW between timber studs @ 400mm centres; Mannok w Wall / MW; AVCL; plasterboard. Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.

Benefits

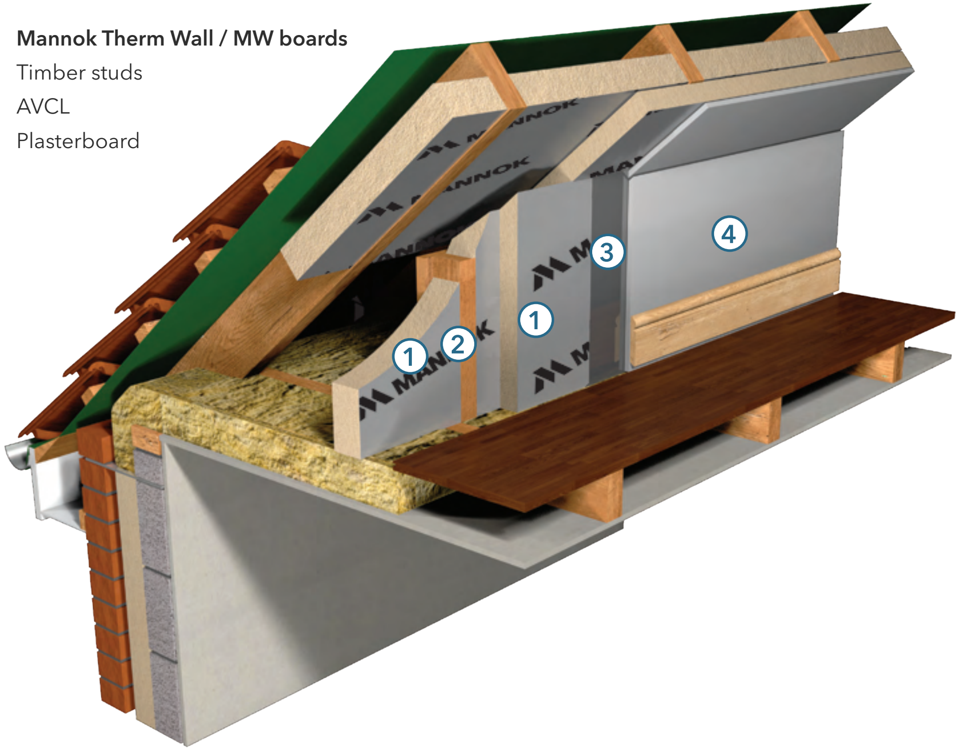
- Suitable for new build and retrofit projects. (N) (R)
- Excellent thermal properties
- Extremely durable
- Mannok Therm Wall / MW can be easily cut between studs

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

WALL: ROOM IN ROOF

insulated stud wall with Mannok Therm Wall / MW

1 **Mannok Therm Wall / MW boards**
2 Timber studs
3 AVCL
4 Plasterboard



Design and Installation

Mannok Therm Wall / MW or Mannok Therm Roof / MR boards should be cut to fit tightly between the timber studs. The boards should be supported on stainless steel nails partially driven into the studs at 400mm centres.

Where the required U-value cannot be obtained by insulating between the studs, an additional continuous layer of Mannok PIR Insulation should be installed across the face of the studs.

In order to avoid interstitial condensation in the remaining unheated roof void an AVCL is required on the warm side of the insulation. The AVCL may consist of minimum 1000 gauge (250µm) polythene sheet, with all joints lapped and sealed, and should be sealed to the AVCL in the ceiling. Alternatively, an AVCL can be formed by taping of the joints on the Mannok PIR Insulation boards placed across the studs with metalised tape.

To avoid thermal bridging, exposed gable walls may also be insulated, with Mannok Therm Wall / MW fixed by battens or with Mannok Therm Laminate-Kraft / MLK insulated plasterboard (see pages 30 to 33 of this brochure).

The insulation in the stud walls must be continuous with that in the ceiling of the room in the roof. The insulation should also meet the insulation laid across the joists in the remaining roof cavity.

Required thickness of Mannok Therm Wall / MW or Mannok Therm Roof / MR

Mannok Therm Wall / MW between & across joists	U-value (W/m2K)
100 + 0	0.26
100 + 25	0.20
100 + 35	0.18
100 + 40	0.17
100 + 50	0.16
100 + 60	0.15
100 + 70	0.14
100 + 80	0.13

U-value results above based upon wall construction shown:

Plasterboard; timber battens; AVCL; Mannok Therm Wall / MW over timber studs; 50mm x 100mm timber studs @ 400mm centres; Mannok Therm Wall / MW between studs; timber battens fixed to studs to secure boards. Calculations performed to BS EN ISO 6946, taking account of repeating thermal bridges.

Benefits

- Suitable for new build and retrofit projects.
- Excellent thermal properties
- Extremely durable
- Can be easily cut between studs

For performance properties, including fire properties, thermal conductivity and compressive strength, see Page 5.

REFERENCES / ACCREDITATIONS

BS 476-7
Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame on products.

BS 5250
Code of practice for control of condensation in buildings.

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

PD 6697
Recommendations for the design of masonry structures to BS EN 1996-1-1 and BS EN 1996-2.

BS EN 826
Thermal insulating products for building applications. Determination of compression behaviour.

BS EN 845-1
Specification for ancillary components for masonry. Ties, tension straps, hangers and brackets.

BS EN 1604
Thermal insulating products for building applications. Determination of dimensional stability under specified temperature and humidity conditions.

BS EN 1991-1-4
Eurocode 1. Actions on structures. General actions. Wind actions.

BS EN 13165
Thermal insulation products for buildings. Factory made rigid polyurethane foam (PU) products. Specification.

BS EN 13172
Thermal insulation products.
Evaluation of conformity.

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

BS EN ISO 13370
Thermal performance of buildings.
Heat transfer via the ground.
Calculation methods.

BS EN ISO 6946
Building components and building elements.
Thermal resistance and thermal transmittance.
Calculation method.

BS EN ISO 9001
Quality management systems. Requirements.

BRE Digest 465
U-values for light steel-frame construction.

BRE 443
Conventions for U-value calculations. 2006 edition.

STORAGE & HANDLING

Health & Safety

DELIVERY AND STORAGE

Mannok PIR Insulation boards are shrink-wrapped in clear polyethylene for delivery to site. Each pack is labelled with the product description, product characteristics, manufacturers name and brand name, quantity per pack, and any identification marks. For packaging details please refer to www.mannokbuild.com.

Mannok PIR Insulation boards should be stored in a dry environment, out of direct sunlight. The boards should preferably be stored indoors. If they must be stored outdoors the boards should be stacked on battens clear of the ground and covered with weatherproof tarpaulin.

HANDLING

Mannok PIR Insulation boards should be handled carefully. Take care not to knock corners and edges.

Mannok PIR Insulation boards can be cut with a fine tooth saw or trimming knife.

Protect boards from damage by following trades after installation.

Please be aware of sharp edges when handling boards.

HEALTH AND SAFETY

Mannok PIR Insulation boards are robust, but are not designed to support the weight of a person. Do not stand on the boards or use them as a working platform unless the board is fully supported by a load bearing surface.

MANNOK

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BREEAM Cert. ENP 481
LPCB 893A Factory Production Control Assessed to PN111
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