

Refurbishment & Conservation

NBT PAVADENTRO

*Wood fibre board for internal
insulation of exterior walls*



*The Science of Nature
The Future of Construction*

NBT PAVADENTRO – Energy-oriented Refurbishment

The modernisation of old and historic buildings where changes to the external façade are not permitted can present a real challenge to specifiers and builders. Insulation of the exterior walls can only be carried out internally, but unsuitable insulation can lead to interstitial condensation causing critical problems for the building shell. Moisture damage and biological degradation are common symptoms where the use of conventional internal insulation systems with vapour barriers and non breathing systems are used.

NBT PAVADENTRO wood fibre insulation board, especially designed for internal insulation of the exterior walls on old and historic buildings, was awarded the innovation award by the Swiss Federal Department for the Environment. The board reduces the formation of condensation in the existing construction to a minimum & creates a comfortable living environment.


Advantages of NBT PAVADENTRO:

- natural product made from waste soft wood
- breathable, vapour-permeable construction
- creates healthy, comfortable living environment
- protects building fabric
- outstanding hygroscopic properties
- moisture dispersion through capillary action
- external facade remains visible and unchanged
- easy-to-handle board size (1 person) for modernisation, refurbishment and conservation projects

NBT PAVADENTRO for the internal insulation of exterior walls is an innovative, ecological insulation with excellent capillary and hygroscopic properties which prevent condensation formation and degradation of the building fabric. In addition the specially designed integrated mineral functional layer provides effective moisture control by slowing water vapour diffusion into the fabric, but allowing and creating capillary transmission.

Ideal for refurbishment projects where the facade possesses historical value!



 NBT PAVADENTRO naturally - controls the room climate effectively after the refurbishment

- Mineral functional layer
- Water vapour
- Capillary water

Manufacture and Ecology

NBT PAVADENTRO meets all ecological requirements from its manufacture to final disposal.

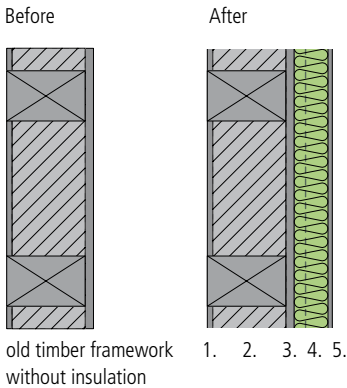
The natural, renewable raw material for NBT PAVADENTRO boards consists of splinters and wood chips of native Swiss softwoods which arise as by-products in local sawmills. The mineral functional layer consists of silicates, which are sourced from German quarries.

The wood's own natural lignin, which already performs the function of a binding agent in the tree, is used as a binder, without the addition of further artificial binding agents.

NBT PAVADENTRO will remain effective as insulation material for the life of the building in which it is incorporated. It contains only natural materials and therefore can be recycled, composted or used to produce heat energy at the end of its life.

NBT PAVADENTRO – Construction Example & Principle

Construction Example



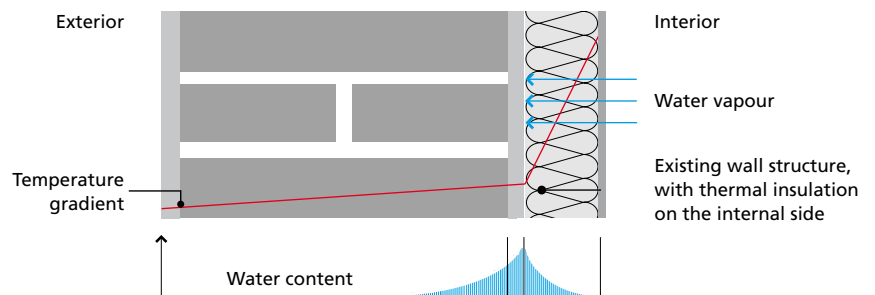
1. External finish
2. Timber frame with brick infill, 140 mm
3. Internal plaster levelling wall (capillary conductive, min. 5 mm)
4. NBT PAVADENTRO 100mm with mineral functional layer
5. Internal plaster

Your advantages

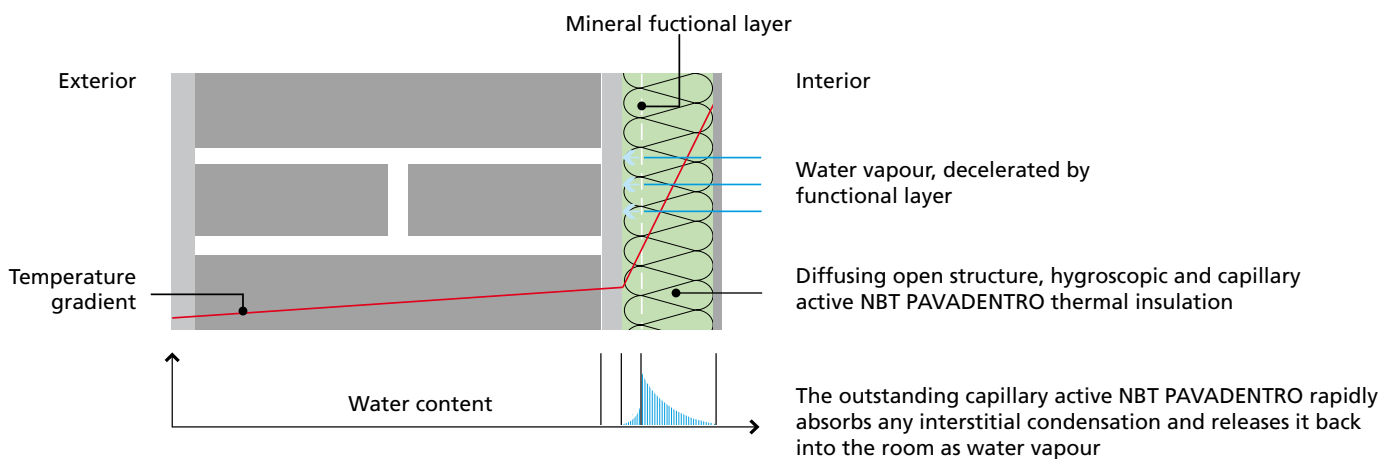
- U-value Before: Minimal thermal protection
U-value After: Provides good thermal protection, guarantees a comfortable & healthy living environment & minimises energy consumption
- η Before: Very little overheating protection
 Decrement delay = 3.9 hours
- η After: Keeps interior temperatures at comfortable levels in summer
 Decrement delay = 7.9 hours

Comparison between standard refurbishment and NBT PAVADENTRO

By insulating an existing exterior wall with standard insulation on the inside the dew point is on the cold side of the insulation, in the existing wall. Moisture damage and degradation of the envelope are common symptoms. Often vapour barriers are used to prevent moisture passing into the existing structure. However these membrane solutions often do not work properly in refurbishment because the sealing fails and/or is not feasible on integrated elements such as partition walls or timber beams that commonly have cracks. This then results in significant amounts of moisture penetrating these areas leading to condensation and decay.



Principle of the capillary action of NBT PAVADENTRO internal insulation: By insulating an existing exterior wall with this wood fibre insulation interstitial condensation occurs within the insulation. Through the board's hygroscopic and capillary active properties it is released back into the room as water vapour and no elements are damaged.



NBT PAVADENTRO – Application: Key Considerations

Suitable buildings:

The existing wall should be vapour open (does not contain any resin paint etc.). NBT PAVADENTRO is suitable for:

- Solid masonry (brick/block)
- Cavity wall
- Timber frame with brick infill
- Natural stone*

* Depending on thickness of insulation and wall and type of stone

Thickness of insulation:

For insulation boards of different thicknesses the difference should not be more than 20 mm

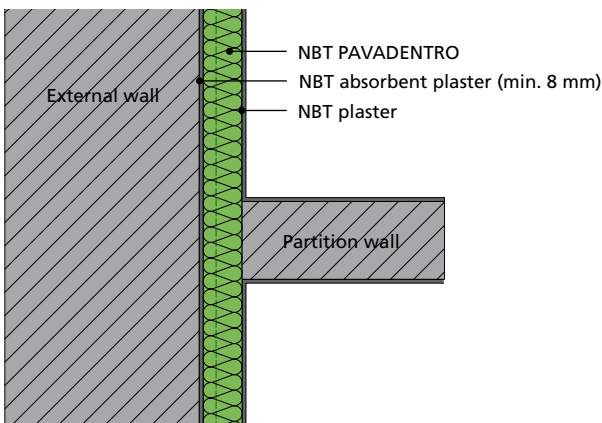
Installation criteria:

- Insulation only for dry areas (not suitable for rooms with constantly high humidity)
- External wall must be sufficiently protected against driving rain
- No rising damp within the structural element
- No application below DPC level
- Only above ground level

Services:

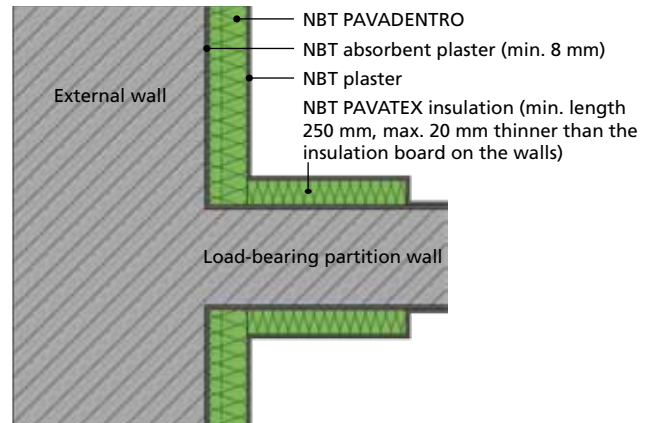
Please refer to NBT for advise on installing services within the insulation layer.

Integrated partition walls



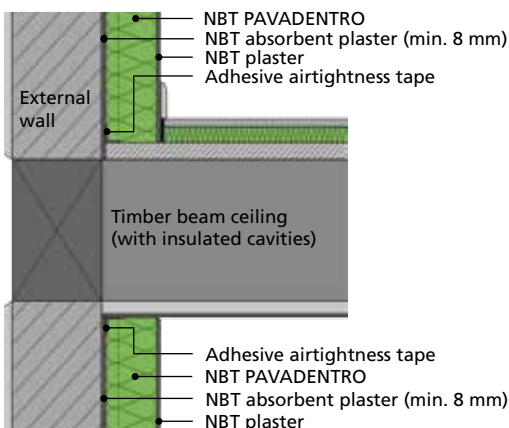
Non structural solid building elements can be separated at the external element to allow continuous insulation on the external element surface

Integrated load-bearing walls

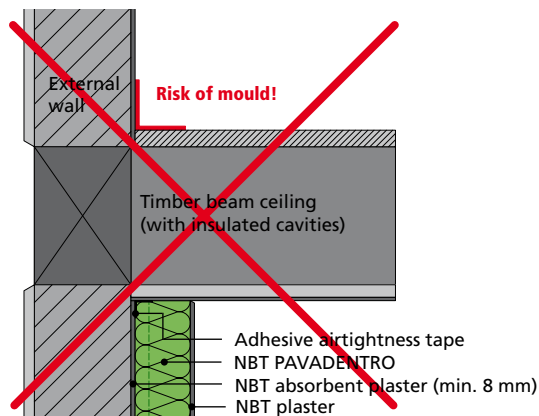


NBT recommends that integrated solid building elements, which cannot be separated from the external wall should be insulated with NBT DIFFUTHERM, NBT DIFFUTHERM reveal boards or NBT PAVADENTRO.

Insulation covering two storeys

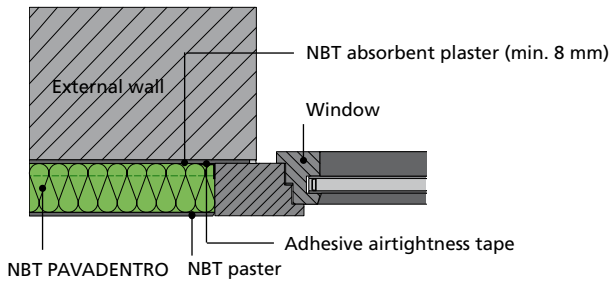


WRONG!



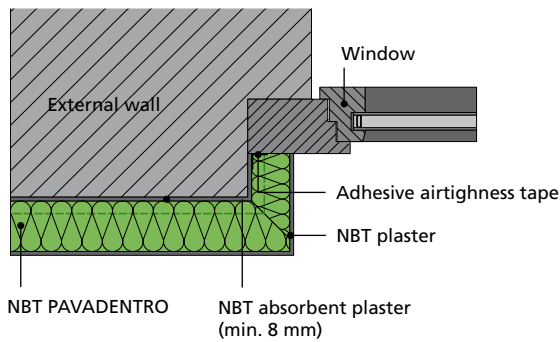
Partially installed internal insulations increase the risk of mould formation (see also "irb-report" F2454) and should be avoided. If possible always install room-sided insulation on both sides of the dividing structural element.

Window

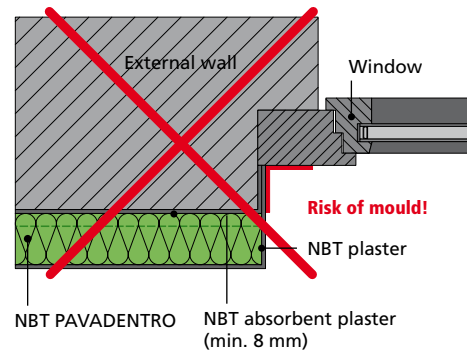


The window frame may be fixed flush with the inside of the existing wall to reduce thermal bridging in the reveal.

Reveal



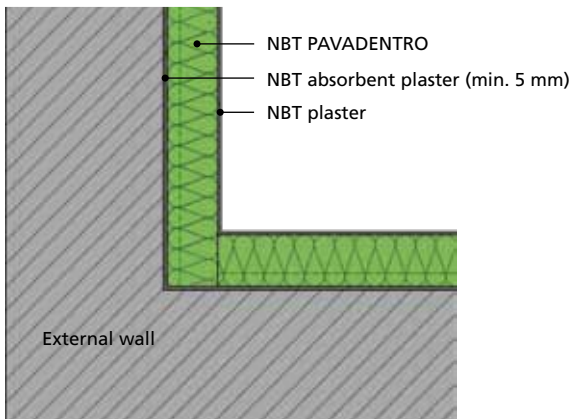
WRONG!



Reveal: Always insulate reveals with maximum possible thickness of insulation (maximum 20 mm thinner than the insulation board on the walls)

Joints for external and internal corners

To be butt-jointed and tight fitted.



The insulation method shown above (inside corner) should also be applied correspondingly for an external corner



NBT PAVADENTRO – Installation Procedures

Installation Procedures:

1. NBT levelling plaster: If the existing wall has unevennesses greater than 8 mm a levelling coat has to be applied. This levelling plaster has to be capillary conductive. Allow 1 day per 1 mm thickness drying time for the levelling coat before applying the absorbent plaster and the NBT PAVADENTRO boards. NBT recommends using the following lime plaster:

- As levelling coat use NBT lime plaster RK 38

2. NBT absorbent plaster: It is essential to apply a capillary conductive absorbent plaster across the whole surface between existing wall and NBT PAVADENTRO insulation board. The NBT absorbent plaster can either be applied to the wall or the boards surface as an adhesive bond. This should be at least 8 mm thick and applied with a toothed trowel.

Suitable materials are lime plaster systems. These plasters should contain no cement or minimum amounts of cement if possible. NBT recommends using the following plasters:

- As absorbent plaster use NBT lime plaster RK 70 N

Note:

The absorbent plaster also acts as the *airtightness layer* if at least 5 mm thick in all places and sealed with adhesive airtightness tape at all junctions (see detail drawings on pages 4 and 5).

3. Mounting: Ensure that the green mineral functional layer in the NBT PAVADENTRO board is nearer to the wall:

- Ensure that the board joints are staggered ≥ 200 mm
- All horizontal and vertical joints must be firmly butted and should not be in line with wall openings or wall projections (windows, doors, beams etc.).

4. Fixing: NBT PAVADENTRO wood fibre insulation boards can be fixed with either insulation screws fixings or wide staples. Fixings need to be flush with the surface of the NBT PAVADENTRO insulation board. The fixing given below depend on board thickness:

4.1 Onto timber substrates:

Fixing with insulation screw fixings

- EJOT washer plate SBH-T, diameter: ≥ 60 mm
- EJOT VHT-R or TKR, lengths: 90 - 170 mm
- Embedment of screw into timber: ≥ 40 mm
- Optimum distance from edge of board: 100 mm
- Minimum distance from edge of board: 50 mm
- Fixings per board: ≥ 3

Fixing with wide staples

- Required clamp lengths: 95 - 135 mm
- Embedment of staple into timber: ≥ 30 mm
- Optimum distance from edge of board: 100 mm
- Minimum distance from edge of board: 30 mm
- Distance between staples: ≤ 180 mm
- Fixings per board: $4 \times 3 = 12$ pieces

4.2 Onto masonry:

- EJOT NT U, lengths: ≥ 95 mm
- Embedment into masonry ≥ 35 mm
- Optimum distance from edge of board: 100 mm
- Minimum distance from edge of board: 50 mm
- Fixings per board: ≥ 3

5. Corners: To be butt-jointed and tightly fitted.

6. Plastering: Can be done with either NBT lime plaster or NBT clay plaster.

6.1 With lime: Apply NBT RK 70 N plaster in the following way:

- Apply NBT lime plaster to a thickness of 5 - 7 mm and embed mesh just below surface over the whole area. When the plaster over the mesh has completely dried apply one layer of your top coat plaster, minimum 2 mm thickness, to increase to an overall thickness of minimum 7 mm. Rule off flat with a straight edge. As finish coat use NBT KalkGlätte or NBT RK 70 N.

6.2 With clay: Apply NBT clay plaster in the following ways:

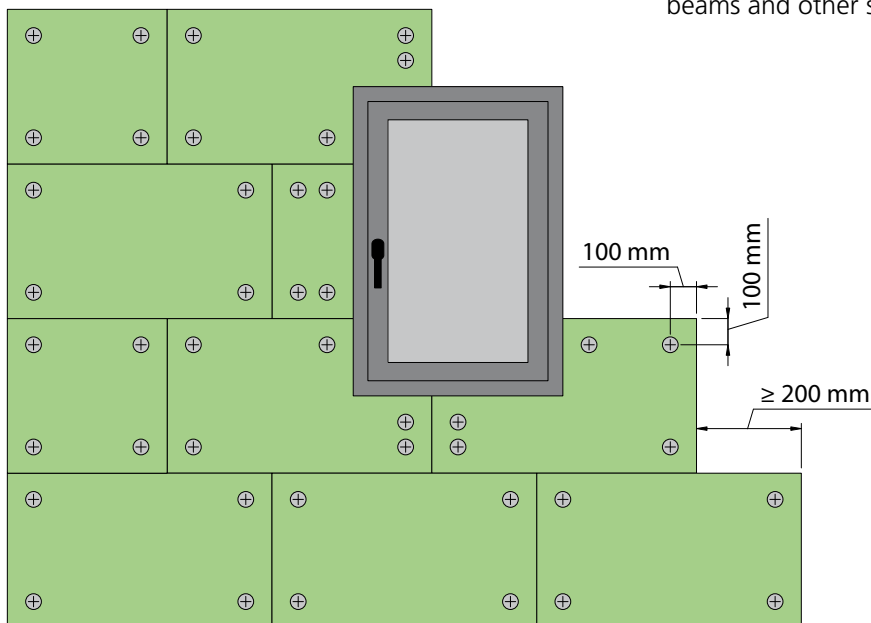
- Apply one layer of NBT clay undercoat plaster 5 - 7 mm thick (e.g. reinforced with straw fibres). Embed mesh just below surface over the whole surface in the first layer. Finish with 2 mm clay top coat plaster. The plastered surface can then be finished to the desired colour with a coat of mineral, casein or clay paint.
- Apply one layer of NBT clay undercoat plaster 5 - 7 mm thick (e.g. reinforced with straw fibres) with embedded mesh just below surface, second coat with NBT clay decorative mineral plaster 1 - 2 mm thick, available in a wide range of colours, without any additives.

Do not apply plasters or allow drying if air or wall temperature is below +5° C. Ensure sufficient ventilation during application.

7. Additional meshing: To reduce the risk of cracking, additional mesh reinforcement is required along all exposed board edges and around all openings.

Bed the mesh in NBT base coat mortar and then apply the main meshed plaster layer, overlapping with the edge strips by more than 100mm.

8. Joints: Apply expansion joints to ceiling, integrated beams and other structural elements.



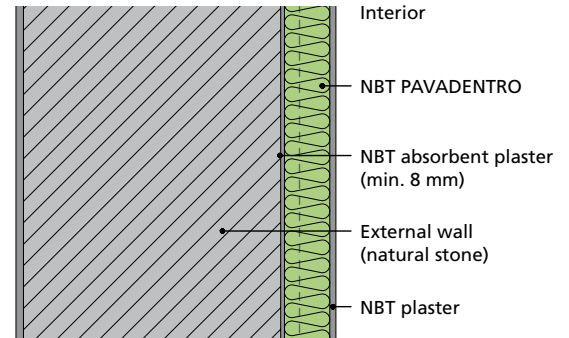
▲ Mounting and screw fixing of NBT PAVADENTRO

NBT PAVADENTRO – Examples of Thermal Improvement

Natural stone (rubble etc.)

up to 4.5 x less energy required after refurbishment!

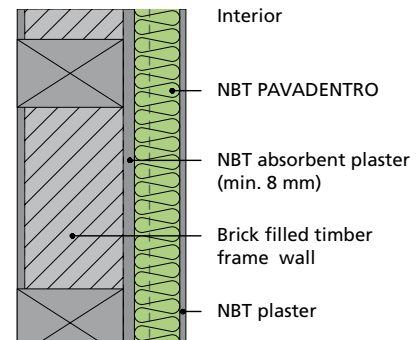
Existing structure	U-value before	NBT PAVADENTRO	U-value after
350 mm	1.43 W/m ² K	60 mm	0.47 W/m ² K
350 mm	1.43 W/m ² K	80 mm	0.38 W/m ² K
350 mm	1.43 W/m ² K	100 mm	0.32 W/m ² K
450 mm	1.19 W/m ² K	60 mm	0.44 W/m ² K
450 mm	1.19 W/m ² K	80 mm	0.36 W/m ² K
450 mm	1.19 W/m ² K	100 mm	0.31 W/m ² K



Timber frame (brick infill)

up to 7 x less energy required after refurbishment!

Existing structure	U-value before	NBT PAVADENTRO	U-value after
100 mm	2.70 W/m ² K	60 mm	0.55 W/m ² K
100 mm	2.70 W/m ² K	80 mm	0.43 W/m ² K
100 mm	2.70 W/m ² K	100 mm	0.36 W/m ² K
140 mm	2.35 W/m ² K	60 mm	0.53 W/m ² K
140 mm	2.35 W/m ² K	80 mm	0.42 W/m ² K
140 mm	2.35 W/m ² K	100 mm	0.35 W/m ² K

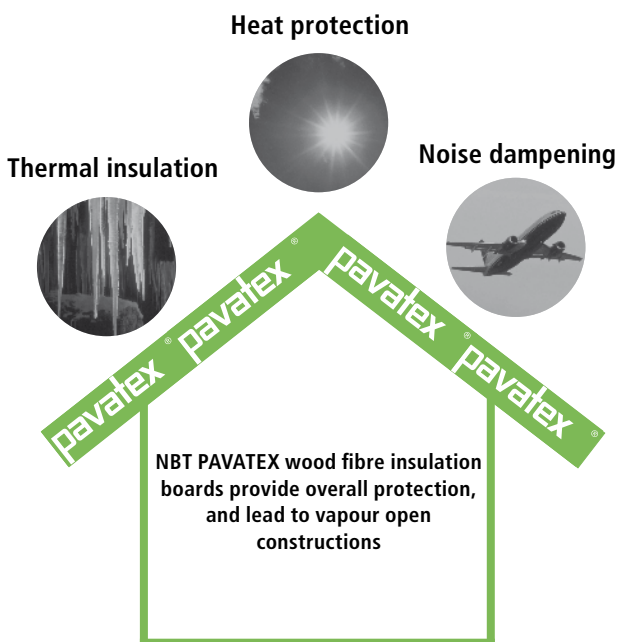
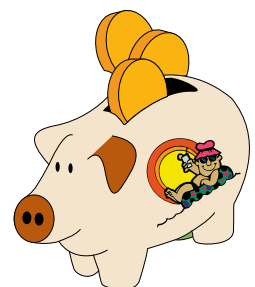


Cost saving through additional thermal insulation!

Effective cost and energy saving – you need to know where!

Almost 90% of the energy consumption in domestic households is spent on heating and hot water. Up to two thirds of energy consumption can be saved in old buildings through appropriate thermal insulation. Therefore, energy-efficient refurbishment of existing building stock is recommended. The average consumption of a house with 100 m² living area is currently 2300 litre oil per year. In contrast new buildings use only 700 litres maximum.

Source: Passivhaus Institut, Darmstadt



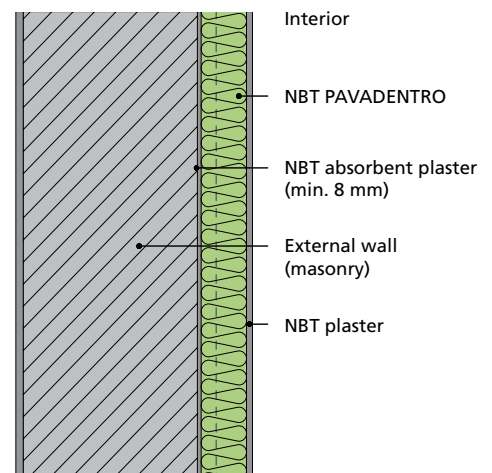
NBT Natural Insulation Products for:

Simple and robust
 Excellent acoustic performance
 Highly vapour permeable constructions that do not need membranes to control interstitial condensation
 Warmer internal surfaces and less thermal bridges at reveals and openings (reduces condensation)
 Dry masonry substrate to improve thermal insulation and moisture storage capacity
 Locked up CO₂ and waste can be safely composted

Masonry (brick/block)

up to 6 x less energy required after refurbishment!

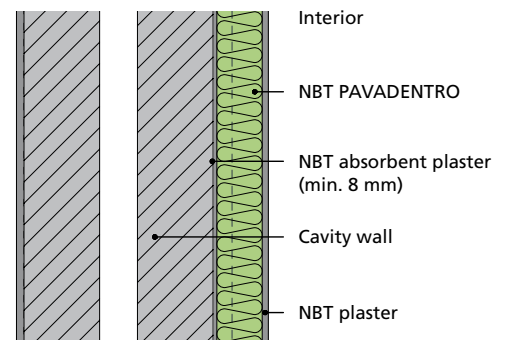
Existing structure	U-value before	NBT PAVADENTRO	U-value after
215 mm	2.14 W/m ² K	60 mm	0.52 W/m ² K
215 mm	2.14 W/m ² K	80 mm	0.42 W/m ² K
215 mm	2.14 W/m ² K	100 mm	0.35 W/m ² K
240 mm	2.00 W/m ² K	60 mm	0.51 W/m ² K
240 mm	2.00 W/m ² K	80 mm	0.41 W/m ² K
240 mm	2.00 W/m ² K	100 mm	0.34 W/m ² K
300 mm	1.74 W/m ² K	60 mm	0.49 W/m ² K
300 mm	1.74 W/m ² K	80 mm	0.40 W/m ² K
300 mm	1.74 W/m ² K	100 mm	0.34 W/m ² K



up to 4.6 x less energy required after refurbishment!

Cavity Wall (50mm cavity uninsulated (A) & insulated (B))

Existing structure	U-value before	NBT PAVADENTRO	U-value after
250 mm (A)	1.48 W/m ² K	60 mm	0.47 W/m ² K
250 mm (A)	1.48 W/m ² K	80 mm	0.38 W/m ² K
250 mm (A)	1.48 W/m ² K	100 mm	0.32 W/m ² K
250 mm (B)	0.57 W/m ² K	60 mm	0.31 W/m ² K
250 mm (B)	0.57 W/m ² K	80 mm	0.27 W/m ² K
250 mm (B)	0.57 W/m ² K	100 mm	0.24 W/m ² K



NBT PAVADENTRO – Product Characteristics

Delivery Form

Design	Unit	Value
Board thickness	mm	40, 60, 80, 100
Size	mm	600 x 1020
Cover area	mm	590 x 1010
Edges	-	Tongue and groove

Technical Data

Properties	Unit	Value
Density ρ	kg/m ³	180
Thermal conductivity λ_p (k-value)	W/(mK)	0.042
Compression strength at 10 % compression	N/mm ²	≥ 0.07
Tensile strength	N/mm ²	≥ 0.005
Specific heat capacity c	J/(kgK)	2100
Flow resistance per unit length	kPa s/m ³	≥ 100
Euroclass EN 13 501-1	Class	E
Water vapour diffusion at 50 % rel. air humidity W_{ddu}	g/(m ² d)	ca. 45.5
S-values (40, 60, 80 and 100 mm thickness)	m	0.65 – 0.75 – 0.85 – 0.95
Wood fibre board according to BS EN 13171		

Constituents

Raw material	weight-%
Softwood	94.5
Starch	2.0
Silicate	3.0
PVAc-wood glue*	0.5

*bonding of individual layers

NBT Product Overview: Insulation

NBT ISOLAIR sarking board



Wood fibre board for breathable roof & wall constructions

Size: 770 x 2500 mm
 Cover area: 750 x 2480 mm
 Thicknesses: 22, 35 & 60 mm
 k-value / λ_D : 0.047 W/(mK)
 Density: 240 kg/m³

NBT DIFFUTHERM external wall insulation



Wood fibre board for rendered external wall insulation (EWI)

Size: 790 x 1300 mm
 Reveal board: 600 x 1200 mm
 Thicknesses: 60, 80, 100 & 120 mm
 k-value / λ_D : 0.043 W/(mK)
 Density: 190 kg/m³

NBT PAVATHERM-PLUS⁺ sarking board



Composite wood board for roof & wall insulation

Size: 780 x 1580 mm
 Thicknesses: 60, 80, 100 & 120 mm
 k-value / λ_D : 0.043 W/(mK)
 Density: 180 kg/m³
 Compr. strength: ≥ 70 kPa (at 10 % compression)

NBT PAVADENTRO internal wall insulation



Innovative wood fibre insulation board for refurbishment

Size: 600 x 1020 mm
 Cover area: 590 x 1010 mm
 Thicknesses: 40, 60, 80 & 100 mm
 k-value / λ_D : 0.042 W/(mK)
 Density: 180 kg/m³

NBT PAVATHERM general purpose insulation board



Universal wood fibre board for use in external & internal walls, floors & roofs

Sizes: 600 x 1020 mm & 1200 x 2050 mm
 Thicknesses: 20 - 120 mm
 k-value / λ_D : 0.038 W/(mK)
 Density: 140 kg/m³

NBT PAVABOARD load bearing insulation



Wood fibre board for highly insulated floors that have to carry loads

Size: 600 x 1020 mm
 Thicknesses: 40 & 60 mm
 k-value / λ_D : 0.046 W/(mK)
 Density: 210 kg/m³
 Compr. strength: ≥ 150 kPa (at 10 % compression)

NBT PAVATHERM-PROFIL wall & floor board



Wood fibre board for insulating floors or internal walls with plaster

Size: 600 x 1020 mm
 Thicknesses: 40 & 60 mm
 k-value / λ_D : 0.043 W/(mK)
 Density: 180 kg/m³
 Compr. strength: ≥ 70 kPa (at 10 % compression)

NBT PAVAWALL external wall insulation



Wood fibre board for rendered external wall insulation (EWI) for masonry substrates

Size: 600 x 800 mm
 Reveal board: 600 x 1200 mm
 Thicknesses: 80 - 160 mm (20mm increments)
 k-value / λ_D : 0.040 W/(mK)
 Density: 155 kg/m³

NBT PAVAFLEX flexible insulation batt



Flexible wood fibre insulation batt for roofs, walls, lofts, floors & ceilings

Size: 375^{*} / 575 x 1350 mm
 Thicknesses: 40 - 240 mm (20mm increments)
 Stock sizes: 50, 80, 100 & 140 mm
 k-value / λ_D : 0.038 W/(mK)
 Density: 55 kg/m³ ^{*} only stock sizes

NBT PAVATEX accessories



NBT provides the full range of PAVATEX accessories & complementary products:

- NBT PAVATAPE incl. waterbased/solvent primers (for junctions on walls & roofs)
- NBT PAVATEX cutting blades & knives
- NBT PAVATEX system glue (for sarking boards)

NBT ISOLAIR, all NBT PAVATHERM products & NBT PAVAFLEX are certified by natureplus. This testifies to excellent natural & ecological compatibility. NBT PAVATEX wood fibre insulation boards are manufactured in Switzerland according to BS EN 13171, have the CE marking and are monitored by 3rd parties. The following applies to all NBT PAVATEX products: Specific heat capacity $c = 2100$ J/(kg·K), Euroclass E (according to BS EN 13501-1), vapour resistivity $\mu = 5$ (25 MNs/gm)

NATURAL BUILDING MATERIALS & SYSTEMS



high performance systems NBT PAVATEX woodfibre systems provide exceptional thermal & acoustic insulation, summer overheating protection and moisture control for the whole building in wall, roof & floor



low carbon, renewable products NBT PAVATEX boards are made of wastewood & lock up the equivalent of ca. 11 tonnes of CO₂ per building; raw material resources are entirely renewable, unlimited & FSC certified



healthy housing NBT PAVATEX insulation boards are certified by natureplus as non-polluting & the NBT systems lead to breathable constructions; NBT PAVATEX insulation is specified exclusively by the Sentinel Haus Institut for healthy housing



tried & tested systems NBT PAVATEX woodfibre insulation boards are widely used across Europe in all climates & conditions; physical values are 3rd party tested & guaranteed & production is according to BS EN



local service & support Pavatex's partner in the UK is Natural Building Technologies (NBT) who are a Technical Sales Company with nationwide coverage based in Oakley, Bucks. NBT lead the UK in sustainable materials & systems for high performance building shells



Swiss Made

swiss quality & know-how for the UK produced & developed in Switzerland for more than 70 years by the the world's most innovative wood fibre insulation manufacturer

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