D3.8_Evaluate Specialist Deep-Retrofit Products Report

Ireland

INTELLIGENT ENERGY – EUROPE II

Energy efficiency and renewable energy in buildings

IEE/12/070

EuroPHit

[Improving the energy performance of step-by-step refurbishment and integration of renewable energies]

Contract N°: SI2.645928

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Technical References

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Abstract

'Retrofitting to the EnerPHit standard will require the following initiatives with respect to building materials and products:

- Use of existing materials in a non-typical method such as additional thickness of insulation;
- Use of non-typical (or non-commonly used) materials to achieve the extraordinary performance of the EnerPHit standard, such as airtightness tapes and membranes, foam glass for thermal bridging and triple glazing in windows;
- Testing of new-to-market materials which have had limited application in real-world scenarios; and
- Identification of short-comings in the marketplace in terms of products or materials that would greatly enhance the application of EnerPHit on a broader scale.

1 Introduction

1.1 Scope of this report

Generic product types will be qualitatively evaluated by the construction teams using such criteria as those listed below:

- Ease of use, including whether specialist training is required for application;
- Fit for purpose;
- General availability in the marketplace;
- Health and Safety considerations; and
- Cost.

2 Building envelope

2.1 (Prefabricated) façades solutions

2.1.1 Lignotrend box beam retrofit system

Manufacturer	:	Lignotrend	
Homepage	:	http://www.lignotrend.de	
Product name	:	Lignotrend U*psi	
URL:	:	http://www.lignotrend.de/produkte/zertifiziertebauteile/b21-daemmung-wand-sanierung-mauerwerk-fachwerk/ http://www.lignotrend.de/uploads/tx_userprodukte/Ges%206_AWS.pdf	
Fit for purpose	:	Various U-Values and surfaces available Applicable on	
U-value [W/(m²K]	:	0,13	
Thickness [mm]	:	240	
Installation pace	:	Very quickly	
Preconditions	:	Suitable on all kinds of wall constructions	Very useful!
Usability	:	Can be installed by common carpenters	
Availability	:	To be ordered from Lignotrend Delivered within 8 weeks	
Health /Safety	:	Cellulose material and timber studs can be installed without additional	
Costs [€/m²] Installed	:	600	Expensive
Other	:		

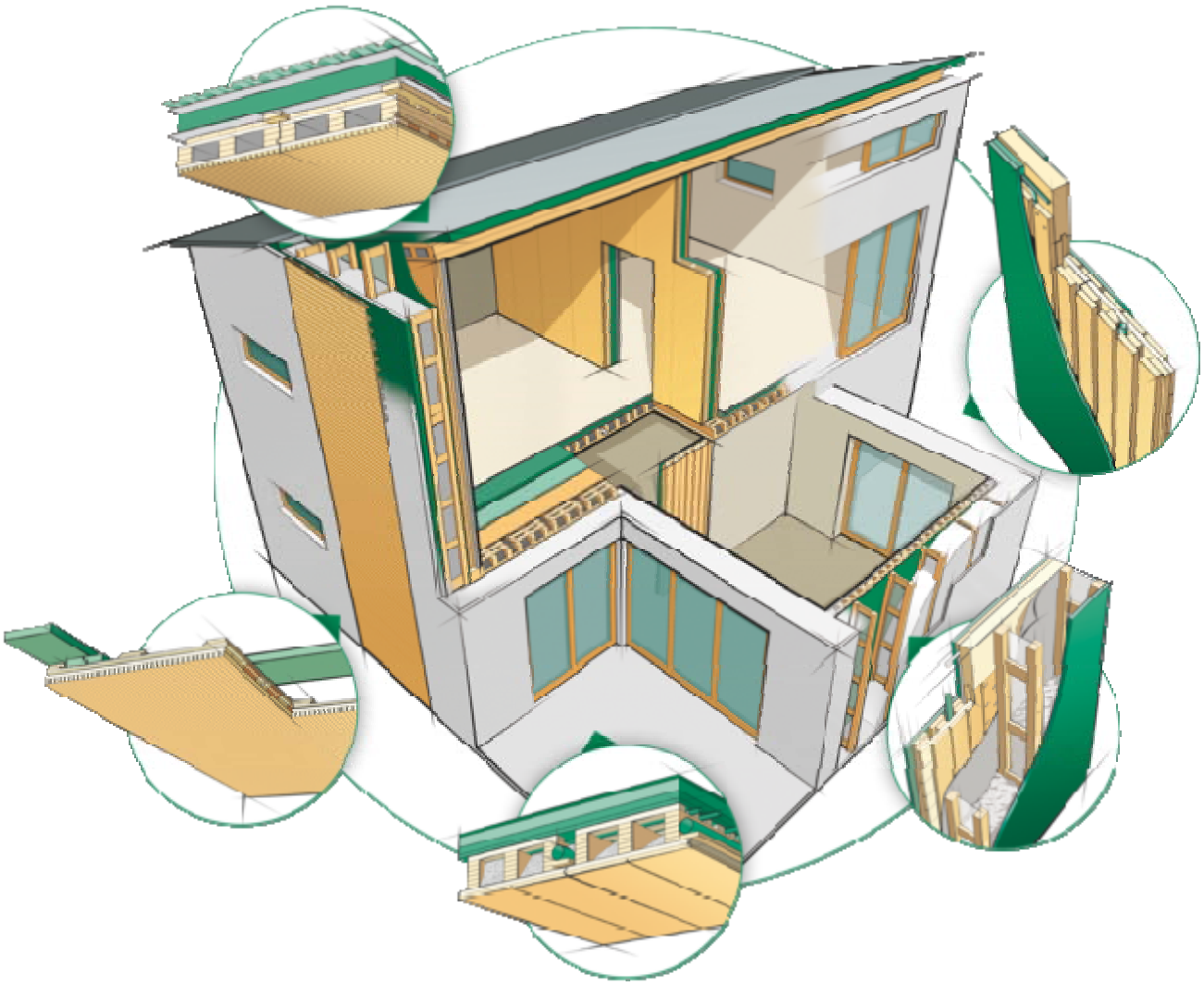


Figure 1: Retrofit wall system by Lignotrend

2.2 Massive walls insulation with treatment for water vapour transfer

Envilop is a curtain wall system based on the wood. Lightweight exterior wall module system was developed under the project Intelligent Buildings (CZ.1.05/3.1.00/13.0283) Operational Programme Research and Development for Innovation which is funded by the EU and the government of the Czech Republic.

Envilop can be used as a substitution for old, metallic light-weight curtain walls used on buildings from the sixties of the twentieth century in Central and Eastern Europe.

The **Envilop** concept is protected by utility model PUV 2013-28513 owned by University Center of Energy Efficient Buildings of Technical University in Prague.

The commercial licence to ***Envilop*** will be offered to the public during summer 2015. The future producer will obtain all the documents, accredited tests results and the technical support by UCEEB.

Integrated elements:

Envilop has integrated wooden structure which allows hiding window frame form the exterior or system solution of electric – driven window blinds. Also, the photovoltaic panels (as the final cladding) or air ventilation unit integration is possible.

Progressive materials:

There was a number of special quality materials based on wood used for Envilop: main frame is made of laminated veneer timber, the outer covering is made of hard wood fibre board; the external elements in the contact with the weather is made from heat treated Thermowood without need of maintenance. Thermal bridges are minimized by usage of cork, aerogel or vacuum insulation.

Maximal prefabrication

Envilop is optimized for automated CNC production, the possibility of mounting without need of scaffolding. The connections of panels are filled with the elastic sealing, which allows the expansion moves of the panels.

Envilop curtain wall system:

- dimensions complies to the previous old curtain wall systems
- plinth and roof parapet elemenets included
- module width adjustable (possibly 0,6 to 1,5 m)
- the elements' connections designed in the height of window parapet to ease the assembly stage without need for scaffolding
- opaque or transparent modules with integrated window
- minimized thermal bridges

The system is developed under public grant project and the licence will be offered to the manufacturers in the public competition during the Summer 2015.

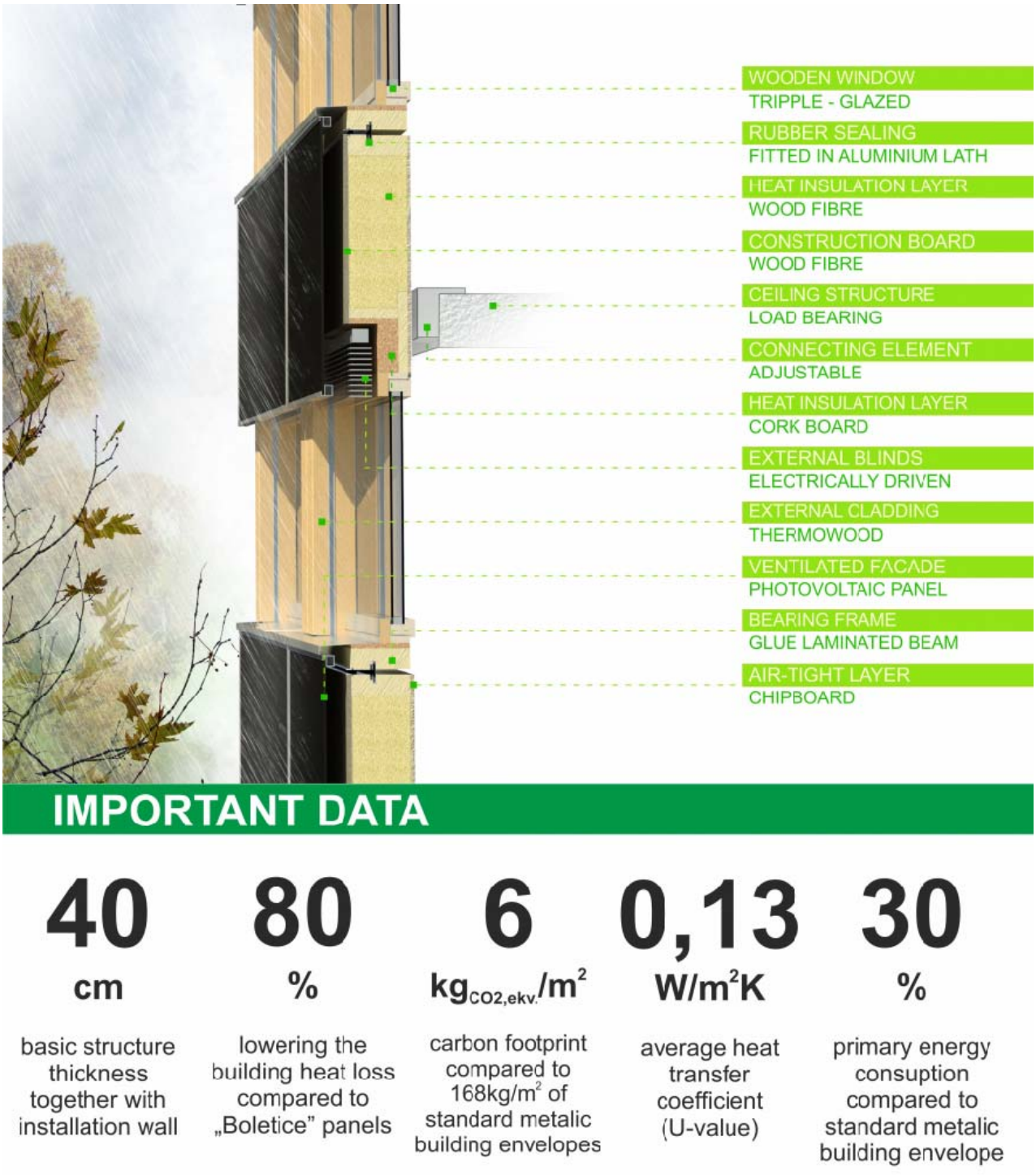


Figure 2: Envilop system - http://www.uceeb.cz/envilop/?page_id=135

2.3 Special products avoiding thermal bridges (e.g. floor, windows, etc.)

Compacfoam (http://www.partel.ie/products2.php?c=34&type=8)

Compacfoam is the new solution that combines the highest compressive strength with excellent thermal insulation and low dead weight. High stiffness (2% deformation under service load) and excellent long-term stability makes COMPACFOAM a solution to many problems in insulation and lightweight applications.

CF200 can be used in a wide range of applications where structural support and the possibility of obtaining secure fixings into the material are required. It can often be used as a replacement for timber battens in these applications, where thermal bridging is to be reduced . It is ideally suited for support for door thresholds and window installation, where is is important to minimise thermal bridging.

It is a strong lightweight rigid insulation made from thermoplastic foam, based on polystyrene a polymer with a density ranging from 100 to 400 kg/m3. Its physical and chemical structure corresponds to that of the more familiar expanded polystyrene (EPS). Tiny closed-cell foam balls of less than a millimetre in diameter are welded thermally into a compact block by their cell walls.

COMPACFOAM's innovation was to dramatically improve the performance of this well established technology, allowing it to reach considerably higher densities. These results in unique material properties combined with the safety of a time-tested and proven material.

COMPACFOAM can be used in a wide range of applications where structural support and the possibility of obtaining secure fixings into the material are required. It can often be used as a replacement for timber battens in these applications, where thermal bridging is to be reduced. It is ideally suited for support for door thresholds and window installation, where it is important to minimise thermal bridging.

- High compressive strength
- Good screw pull-out resistance
- Easy to drill & saw
- Ductile
- Diffusion open
- Resistant to freezing
- Excellent water absorption capacity – does not absorb more than 5-10% moisture
- Applications around windows & door thresholds to reduce thermal bridging.
- Thermal conductivity: 0.046 W/m.K
- Unlimited long term stability

Figure 3: CompacFoam

2.3.1 CASCADIA CLIP

Figure 4: Cascadia Clip

NEW – Cascadia Clip® Fiberglass Thermal Spacers for exterior insulated cladding systems.

Low-conductivity fiberglass material reduces thermal bridging. This greatly improves the effective thermal resistance of the exterior wall, and makes ASHRAE 90.1 compliance simple and cost-effective.

Typical Layout

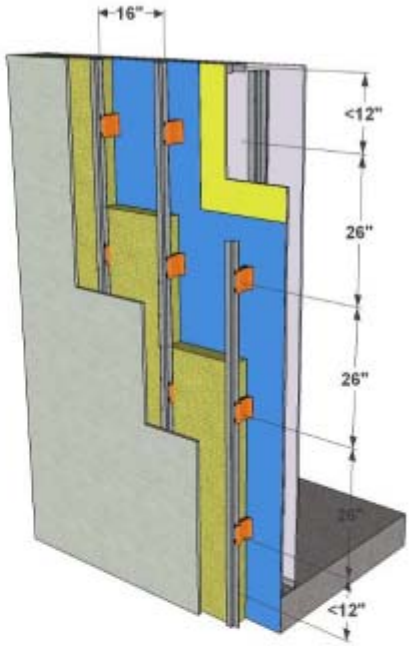
Clips: 26" O.C. vertically
16" O.C. horizontally*

* 24" O.C. horizontal spacing is also possible, when stud layout, or concrete/CMU substrate make this spacing practicable.

Substrates: Steel framing, wood framing, mass concrete, CMU.

Warning: This information is for general guidance only; engineer's specifications always supersede this information – check your project's specific requirements.

Engineers may specify alternate layout patterns, including lesser or greater Clip spacing than the layout shown.



Assembly Sequence

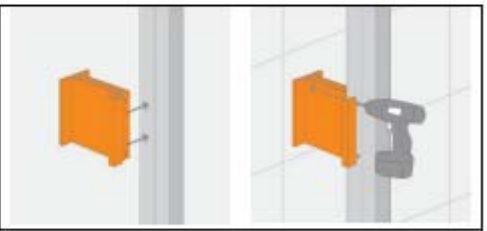
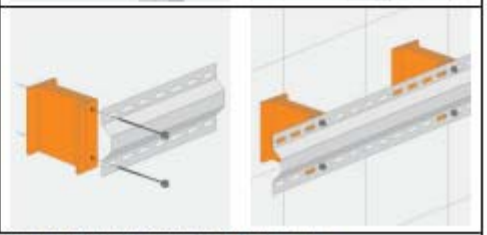
Vertically oriented Z-Girts 1) Slide Clips onto z-girts. Pre-punched Z-girts recommended. 2) Long fasteners attach Z-girt, through Clips, into structure. 3) Next step: insulation.	
Horizontally oriented Hat Tracks 1) Position Clips behind hat track. Slotted track recommended. 2) Long fasteners attach track, through Clips, into structure. 3) Next step: insulation.	
Installation demo video available at www.cascadiaclip.com	

Figure 5: Cascadia Clip typical layout and assembly sequence

2.4 Airthightness

2.4.1 Ampatop Protecta Hollowcore wrap

Three-ply and highly tear-resistant. Two PP fleece layers separated by a central monolithic film. Can be bonded to give draught-proof, rain-proof barrier. Highly permeable to vapour.

Withstands driving rain and is resistant to aging
Printed-on cutting and orientation aid
Slip-resistant on both sides
Vapour open
Monolithic technology
Ampatop Protecta plus with integrated tape

so value: 0.2 m
Weight: 185 g/m2
Resistance to water penetration: W1, DIN EN 1928:2001
Fire behaviour: E, EN 13 501-1
Outdoor exposure time: 3 months
Minimum roof slope: 10°
CE marking: EN13859-1:2005-05/2006
Roll dimensions: 50 m x 1.5 m = 75 m2
Pallet details: 18 rolls, 1'350 m2

Processing instructions
Ampatop® Protecta should be laid onto the existing support structure or shell, parallel to the eaves, with an overlap of 10 cm. It should then be nailed (with broad-headed nails) or stapled in the overlapping section, with the overlap covering the nails or staples. Tape the overlaps down with Ampacoll® XT 60 mm or with the integrated tape to make them rain-proof and windproof. Rub the adhesive locations in well. Transverse joints should also overlap by 10 cm. These should be taped with Ampacoll® XT 60 mm or Ampacoll® Superfix. Fix cross battens with Ampacoll® ND nail seals or Ampacoll® ND.Band / ND Duo nail seal tape. Connections to gutter beds and the edges of chimneys, dormer windows and other built-in fitments must be permanently glued with Ampacoll® Superfix and mechanically secured. Penetration points such as ventilation shafts, ventilation flues, etc must be sealed with Ampacoll® BK 535 butyl rubber tape. Porous, dusty or fleecy sub-surfaces must be pretreated with a Ampacoll® Primer 531 or Ampacoll® Connecto before applying Ampacoll® BK butyl tapes.

Notes
Use cross battens to secure roof liners (against the risk of storm damage) after they have been laid. If the nail sealant or nail seal tape is glued directly onto the liner, the adhesive layer will form an additional seal. Cross battens that are screwed down are better at sealing off the fixing points than those that are nailed down. It will not be possible to apply glue to roof liners or underlays that are damp (let alone wet). Make sure that the correct techniques are used if treading on the roof liner in its untreated state, or protect the roof liner in any areas of heavy traffic (escape exits etc.). A variety of chemicals, wood preservatives and alkaline construction materials may reduce the liner's resistance to the ingress of water and should be avoided – please ask us if you are in any doubt. You will find further information on the use of our materials on the Internet, at www.ampack.eu.

Figure 6: Ampatop

2.4.2 605 Alfa EPDM-Foil

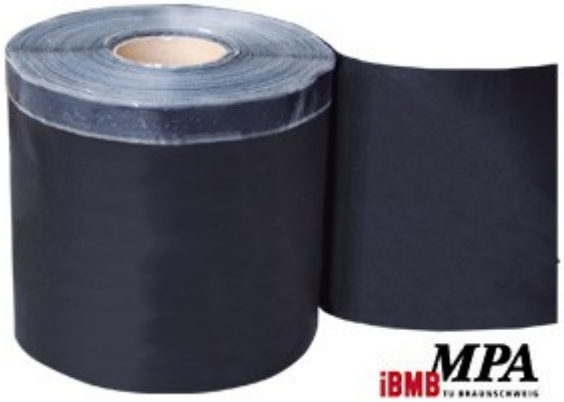


Figure 7: Alfa EPDM-Foil

Durable sealing in external areas

Alfa EPDM-Foil 605 is a elastomer-sealing-foil made of EPDM-rubber with an one-side Butyl-self-adhesive-strip (2 cm). On the inside is a release film, for an ideal storage, that must be removed before applying.

Alfa EPDM-Foil 605 is for the exterior sealing of window elements and door elements at facade constructions. The elastic sealing tape has a very high resistance to weathering and levels out building activities. It also has the potential to let steam diffuse from the inside to the outside.

Alfa EPDM-Foil 605 is suitable for private buildings as well as for commercial sectors.

The optimal sealing-connection for window sills, floor-length windows and balcony doors, exterior threshold, winter gardens and at facade constructions.

Advantages

- one-side with 2 cm wide Butyl-self-adhesive-strip
- high temperature and weathering resistance
- bitumen compatible
- high UV-resistance
- elastic foil levels out building activities
- prevents structural damages caused by dampness
- easy handling
- waterproof & breathable

2.4.3 857 Alfa EPDM Foil-Adhesive

Figure 8: Alfa EPDM-Adhesive

Durable elastically bonding of EPDM-foils

Alfa EPDM Foil-Adhesive 857 is a solvent free 1K Hybrid-Adhesive that was developed for the elastically bonding of sealing profiles made of EPDM-foils and butyl-foils.
Alfa EPDM Foil-Adhesive 857 bonds to standard building surfaces e.g. concrete,brickwork,wood,aluminium,steel and is also suitable for overlaps, folds at EPDM and butyl foils.
Alfa EPDM Foil-Adhesive 857 is quickly waterproof (early water resistant) during the processing and has a very good UV-resistance, is free of solvents and is coating compatible according to DIN 52452, Part 4.

Advantages

- for the bonding of EPDM and Butyl-Foils
- very good stability (low shrinkage)
- very good UV, weathering and chemical resistance
- coating compatible according to DIN 52452, Part 4
- broad adhesion spectrum on standard building surfaces
- free of solvents, isocyanate, silicon & PCP
- early water resistant
- no blistering
- for interior & exterior use

2.4.4 Staifix Universal Wall Starter System

This system includes all necessary fixings to join a single skin of masonry, 2400mm high, to an existing wall. Each pack includes two fixing strips, five plugs, five washers, five screws and ten wall ties. It is suitable for wall widths from 60mm to 250mm and has a design resistance of 1.7kN per metre. Wall ties slide within the fixing strip to course with the bed joints of any masonry unit.

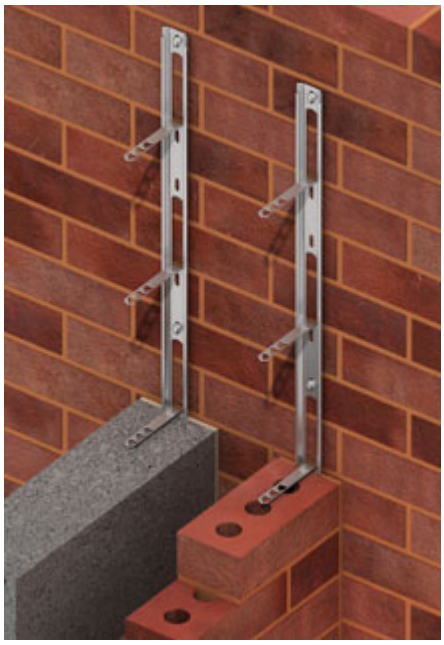


Figure 9: Staifix QuickStart Wall Starter System

This stainless steel system includes all the wall ties and fixings needed to join a new wall, 2400mm high, to existing brickwork. The wall ties are integral to the stainless steel starter strip and fold out at pre-set 225mm vertical centres. Each pack contains 2 starter strips (10 integral wall ties), 5 screws, 5 plugs and 5 washers.

The QuickStart wall starter is suitable for wall widths from 60mm to 250mm and has a design resistance of 1.7kN per metre.

http://www.ancon.co.uk/products/wall-ties-and-restraint-fixings/wall-starter-systems

3 Ventilation

3.1 Ventilation ducts for refurbishment

3.1.1 Lunos Ventilation

The new LUNOtherm facade element ensures that the inflow opening disappears from the wall surface.

By developing the LUNOtherm façade elements, LUNOS has satisfied the wish for inconspicuous façade form.

For the first time, all benefits of air transfer devices, such as high air throughput, no draft, hygiene and sound protection can be realised in connection with an almost invisible outer appearance.

For this purpose, the LUNOtherm is integrated in the insulation layer of the heat composite insulation system as a final element of the ALD. Supply air is then located in the window lintel, the reveal or underneath the window. It can be mounted above, to the side of the window or underneath the window, which also enables combination with a rolling shutter box.

The LUNOtherm is supplied in various insulation thickness and is applied by thebuilder in the same way as an insulation plate of external Insulation. Please request the detailed assembly instructions.

Since the LUNOtherm is mounted in the flashover range, suitability has been tested within the scope of generalconstructional admissibility of DIBt. Therefore, LUNOtherm A may be mounted in non-combustible WDVS pursuant to DIN 4102-A, and LUNOtherm B in flame resistant WDVS pursuant to DIN 4102-B1 up to an insulation thickness of 300 mm.

The LUNOtherm A 60 can also be fitted easily into the **masonry** for new constructions. The bricks are appropriately recessed.

On account of the very low heat conductivity of the dam core of LUNOtherm of = 0.030 W/mK, the reduction of the heating insulation layer in the area of the ventilation gap is compensated. The temperature difference on the façade is max. 2.5 K.

Figure 10: Lunotherm facade element: http://www.partel.ie/products-lunos-ventilation.php

3.1.2 e² - with heat recovery

Figure 11: e2 HRV

Silent

Highly efficient motors with state-of-the-art electric technology in combination with mechanical-flow, reworked and especially balanced fans have almost eliminated the known ventilation noises. With a total of 16 dB (A)* in level 1, 19.5 dB (A)* at level 2 and 26 dB (A)* at level 3 (each 17, 32 or resp. 38 m3/h volume throughput) the fans are well below the required values of DIN for living and sleeping rooms. As comparison: 3 dB decrease stands for 50 % less sound intensity. A ventilator that just complies with this standard is therefore 16 times as loud.Once again new standards set in matters noise.

Environmentally friendly

With a specific fan power of 0.09 W/m3/h the e2 is second to none in matters of energy efficiency and thus contributes actively to environmental protection and at the same time spares your purse. The requirements of the current DIN 1946-6 for devices of the efficiency class E are undercut by far which clearly underline the world class of the device.

Innovative

The e2 operates according to the known principle of regenerative heat exchange which has almost been developed to perfection by the company LUNOS. The so-called AcuVent storage stone is located in the middle of the airflow of an electric motor with axial fan. By a reversing airflow, which results for the targeted change of direction of the fan, the ceramics are charged with heat-energy that is offloaded into the room air and discharged again to the air added from outdoors. This is carried out so effectively that a mere 10 % of the heating energy is lost by the ventilation. Efficient filters are just as important. Allergy patients can take a deep breath, pollen and airborne particles can no longer enter the living areas.

Lean

The e2 is the smallest room wise apartment ventilation device with heat recovery and is based on the principle of regenerative heat exchange. With the help of state-of-the-art manufacturing processes it has been possible to develop a compact heat exchanger from a ceramic composite material which supplies a thermal efficiency factor of approx. 90.6 %. The combination with highly efficient electric motors and an intelligent control has made it possible for LUNOS to develop one of the most economical ventilators.

Compatible

If a LUNOS ventilation system has already been installed, the e2 can be inserted through the outlets/passages of the types ALD-R 160 or ALD-R 160L with LUNOtherm. In a new building the LUNOS e2 can also be combined with all LUNOtherm elements. In combination with the LUNOtherm façade element only a small slit remains in the window reveal. Hardly anything can be seen from outside. Unattractive grids or large wall installations belong to the past.

Universal

In a new building, as in a renovated building, the LUNOS e2 can be used. The e2 is either installed in a new building with the help of a wall recess casing position between the stones, or subsequently, e.g. when renovating with the help of a 162 mm large core bore. The wall need only be a minim 30 cm thick. The cabling is effected directly from the control which is installed in the appertaining flush mount patters. From there only three leads of cable are required which are charged with 12 V extra low voltage.

Heat recovery efficiency	90.6%
Delivered volume	17/32/38 m3/h
Power intake per device	1,4/2,8/3,3 W
Specific fan power	0,09 W/m3/h
Voltage/frequency	230 V/50 Hz
Humidity recovery	ca. 20-30 %
Noise level	16,5/19,5/26 dB
Sound level difference	42 dB
Ø unit	150 mm
Length of unit	243 mm
Min. of wall thickness incl. pattern and thermal insulation	300 mm
Ø core bore	162 mm
Dimension of inside cover plate	180 x 180 mm
Ø outside grid	180 mm oder LUNOtherm

Technical specifications e²:

- Certification Z-51.3-242
- RoHS and WEEE compliant
- Tested according to DIN 308 and DIBT Standard
- EnEV and DIN 1946-6 compliant
- Used in low energy houses

3.1.3 bluMartin freeAir 100

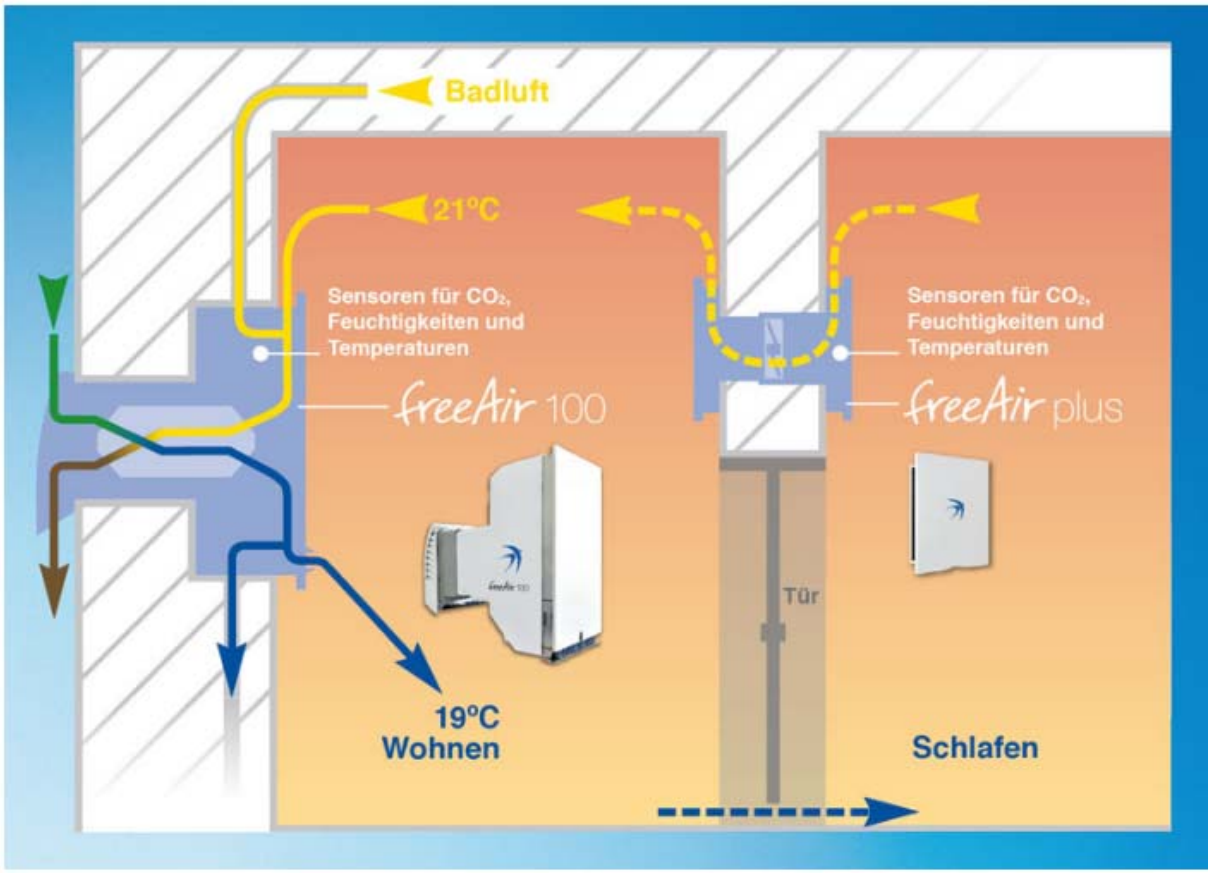


Figure 12: freeAir100 and freeAir plus

Effective, energy-efficient and quiet - the indoor ventilation FreeAir offers a sophisticated ventilation solution for energy-efficient construction and the modernization of existing buildings. The sensor-controlled demand management ensures a healthy indoor climate. A recovery of 90% was offset by a very low demand for operating power. Another plus is the ability to serve more than one device several rooms with fresh air. The FreeAir 100 combined the benefits of decentralized and centralized ventilation systems. This is a recently PHI certified component (source: http://www.blumartin.de/ and http://database.passivehouse.com/en/components/)

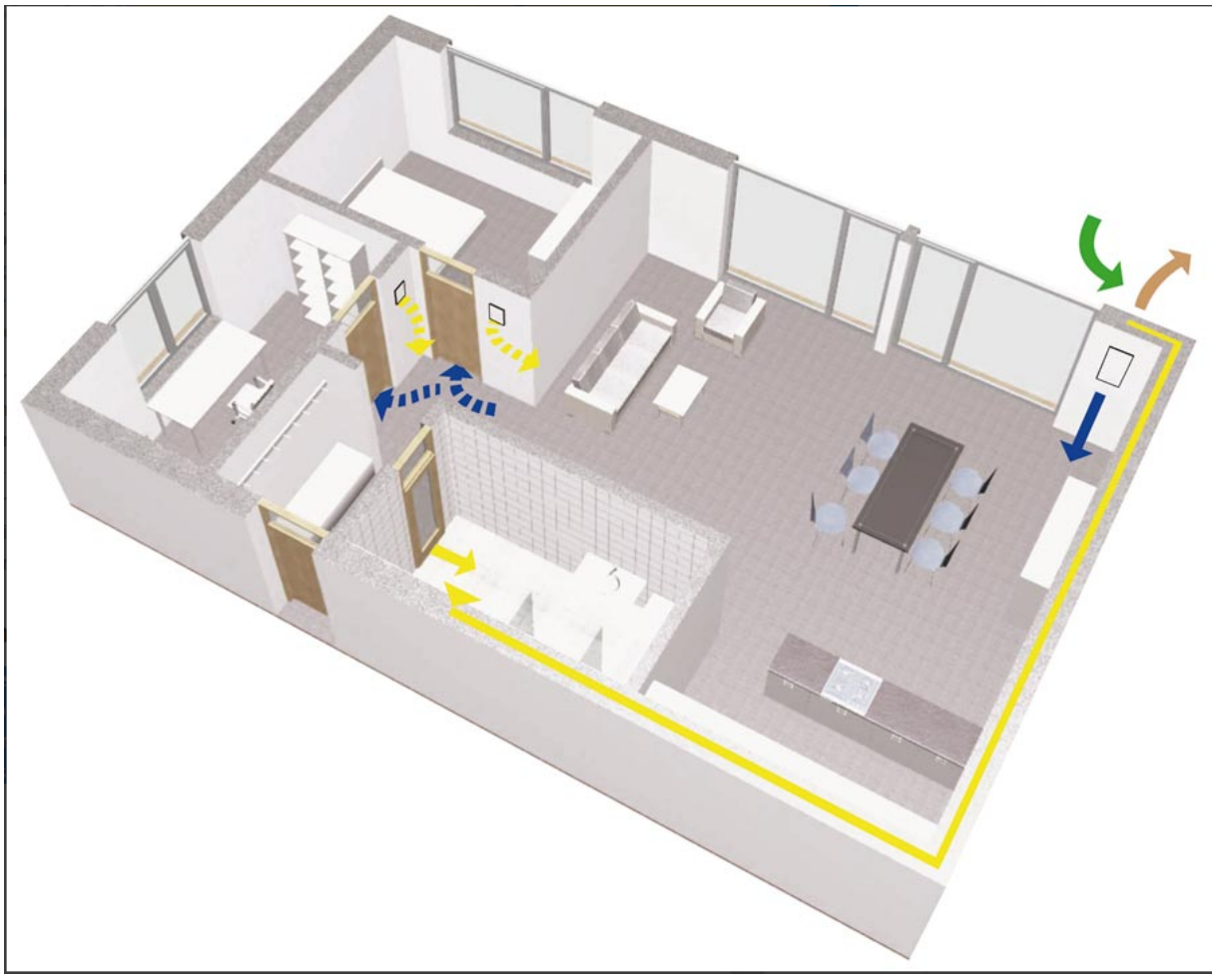


Figure 13: freeAir100 and freeAir plus layout

For the ventilation of this 3-bedroom apartment just outside wall ventilation unit with a remote room exhaust air connection is required through the use of two active transfer ports FreeAir plus.

3.1.4 Vaventis

Decentralised ventilation with heat recovery (source http://vaventis.com/fresh-r/specifications/):

- Uses less energy than a LED-light (at 30m3/hr, the unit consumes a total of just 6W)
- A low pressure drop in the heat exchanger and the aerodynamic design, give the fresh-r the capacity of sound level of 30dB.
- With a heat transfer coefficient of 400 W/mK copper transfers heat 1000 times better than polyethylene of which traditional heat exchangers are made. Combined with intelligent controls it has a higher overall efficiency, which results in more comfortable air coming in and a shorter payback time.

- Slim design _ The in-the-wall unit is designed to be integrated in the facade, flush with the wall front panel. The on-the-wall version is designed for easy installation. Its slim design is only 14 cm deep at the sides and 16.5 cm in the middle.

The costs are listed and available in the website http://www.vaventiswebshop.com/

4 Heating, cooling and domestic hot water generation and distribution

4.1 Combined Heat and Power

Vitobloc 200 module EM-20/39

Figure 14: Viessman CHP

A gas driven combined heat and power unit (CHP) generates heat and power simultaneously. These units are sized to suit residential complexes and commercial operations. On the heating side, the CHP unit operates in parallel to a boiler. Both heat sources are connected to the heating system when generating heating water or DHW.

Viessmann compact appliances are designed as decentralised CHP units with a bias towards heating. Comparatively small units generate electric power for consumption on site. The heat that is generated by this process is used simultaneously, almost without losses, for heating. Any power not required is fed into the public grid and reimbursed accordingly by the power supply utility.

The overall efficiency of CHP units can reach up to 96 %. The Vitobloc 200 module EM-20/39 achieves thermal efficiency of over 62 % and electrical efficiency of over 32 %

The GENVEX COMBI system from PICHLER

Figure 15: GENVEX COMBI

The GENVEX COMBI system combines a service water heat pump with a ventilation device, and is used to provide basic heating in the home and treat service water. The system can be used for living spaces measuring between 85 m² and 150 m² in area, in passive houses and low-energy buildings. The ventilation device is capable of covering the hot water requirements of a family of four for a whole year. (source: http://www.pichlerluft.at/awards-certificates.html)

Fans:

Energy-saving radial fans with highly effective EC motors that need no maintenance

Counterflow heat exchanger:

Air-to-air/air-to-water heat pump with aluminium counterflow heat exchanger (highly efficient heat recovery system)

Water tank with 185-litre capacity

Connection for solar panels or central heating

Ease of use, remote control panel (black or white) included

Straightforward filter change

Suitable for floor mounting

Ready to plug in

4.2 Products for summer comfort

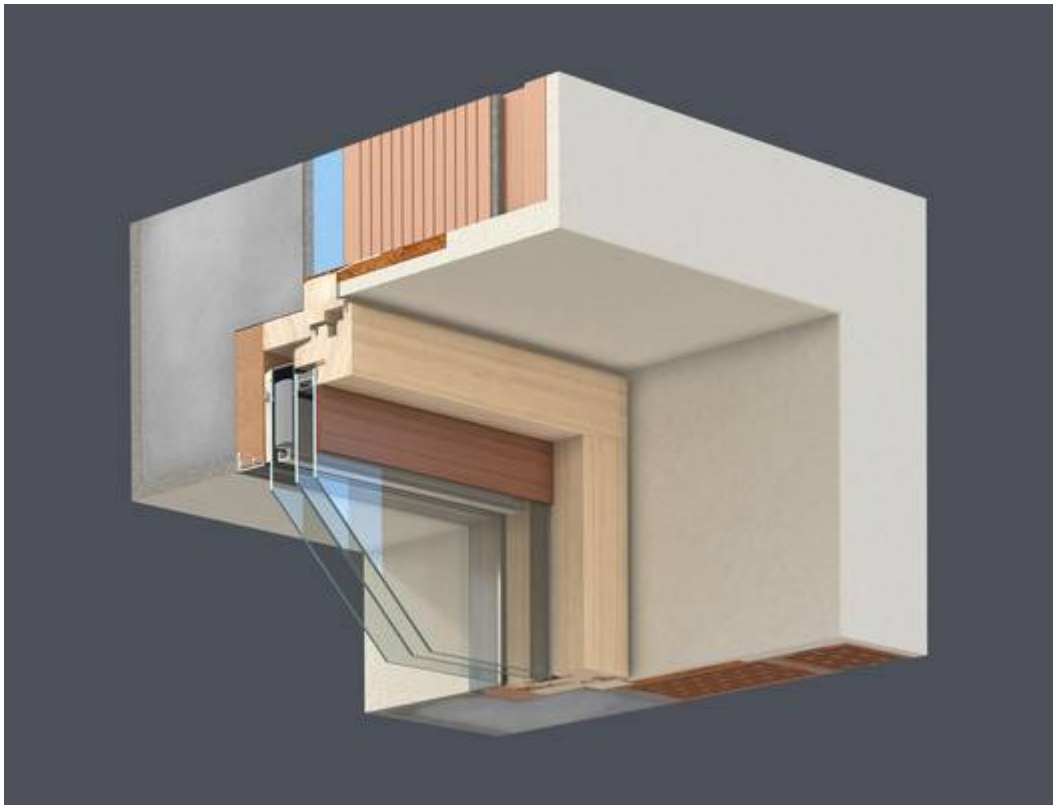


Figure 16: Smartwin compact S and Smartwin artic .

This is a certified passive house window with louvers within the window air gaps. It eliminates the need for external or internal louvers and therefore avoiding risks of thermal bridging along a shutter box within the wall. This is a new product, new to the market, presented at the Leipzig international passive house conference 2015.

5 Final remarks

New products are coming into the marked every year. The products listed above are in general new in the market, some available since early 2016. The initial costs might be considerably high; however the energy savings and the thermal comfort improvements are worth to pursue.