Zehnder - your partner of choice for ventilation in Passive House and low energy housing

zehnder

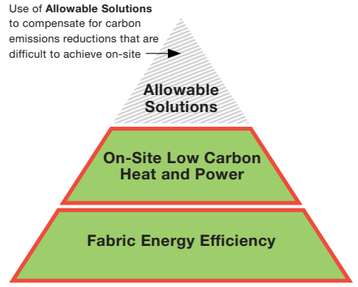
always
around you

Heating | Cooling | Fresh Air | Clean Air

CERTIFIED COMPONENT
Passive House Institute

In 2006 the zero carbon target for new homes was announced and, since then, discussion over how to accomplish this has been extensive. A number of methods have been tried and tested which has led to a broad agreement that, to achieve the target, the approach needs to be twofold:

1. **The fabric of the dwelling should be of a high specification**
2. **Close attention needs to be paid on-site to the detail, materials used and construction methods**



The three parts of the government stepped policy approach to zero carbon homes

Reference to the **Passive House** standard has often been made during these discussions. The standard sets extremely exacting energy performance requirements for design and construction and Passive House has now become a generic term for a low energy building; although energy efficiency was initially a by-product of the original concept which was to find a long-term, sustainable construction solution which offered unparalleled comfort to occupants.

There are no regulations driving the expansion of the Passive House movement, yet over the last two decades the popularity of the standard has gained rapidly across an increasing range of climates. According to 2013 estimates, over 50,000 buildings are now certified with thousands more low energy developments inspired by the model.

Zehnder's experienced staff understands inherently what high performance housing is all about and how to design units which ensure that the house of tomorrow is a reality for today. We are members of Minergie, the AECB (Association of Environmentally Conscious Builders), are founding members of the Passivhaus Trust and have a range of Passive House accredited MVHR units.

With the final steps towards zero carbon new homes throughout the UK now being taken, this brochure aims to explain how specifying Zehnder's Passive House accredited units will give you confidence in your low energy construction projects.

Leading the way

The first certified Passive House buildings in the UK were completed in Machynlleth, Powys, Wales in 2009.

Passive House at a glance

Passive House is a construction concept, not a brand name. It stands for a building standard that is energy efficient, comfortable and affordable. It provides paramount thermal comfort with very low heating demand.

The precise definition, as given by the Passive House Institute is:

“A Passive House is a building in which thermal comfort can be provided solely by post-heating or post-cooling of the fresh air flow which is required for good indoor air quality – without using recirculated air in addition.”

This is a purely functional definition without any numerical values and is valid across all climates. From this definition it is clear that Passive House is a fundamental concept and not a randomly set standard.

The Passive House standard was conceived when Professor Bo Adamson of Lund University, Sweden, and Dr. Wolfgang Feist of the Institute for Housing and the Environment, Germany, collaborated in 1988. The very first pilot project (the Kranichstein Passive House in Darmstadt, Germany in 1990) was Europe’s first inhabited multi-family home to achieve a recorded heating energy consumption of below 12kWh/(m^2a) – just 10% that of the standard house at the time. This consumption level was confirmed via years of detailed monitoring.

The Passive House Institute (PHI) is an independent research organisation that was founded in 1996 to promote and control the standard and has played a crucial role in the development of the Passive House concept.

The ground-breaking products that were used in the Darmstadt pilot home, including high-efficiency MVHR systems, made way for a new line in Passive House compliant components.

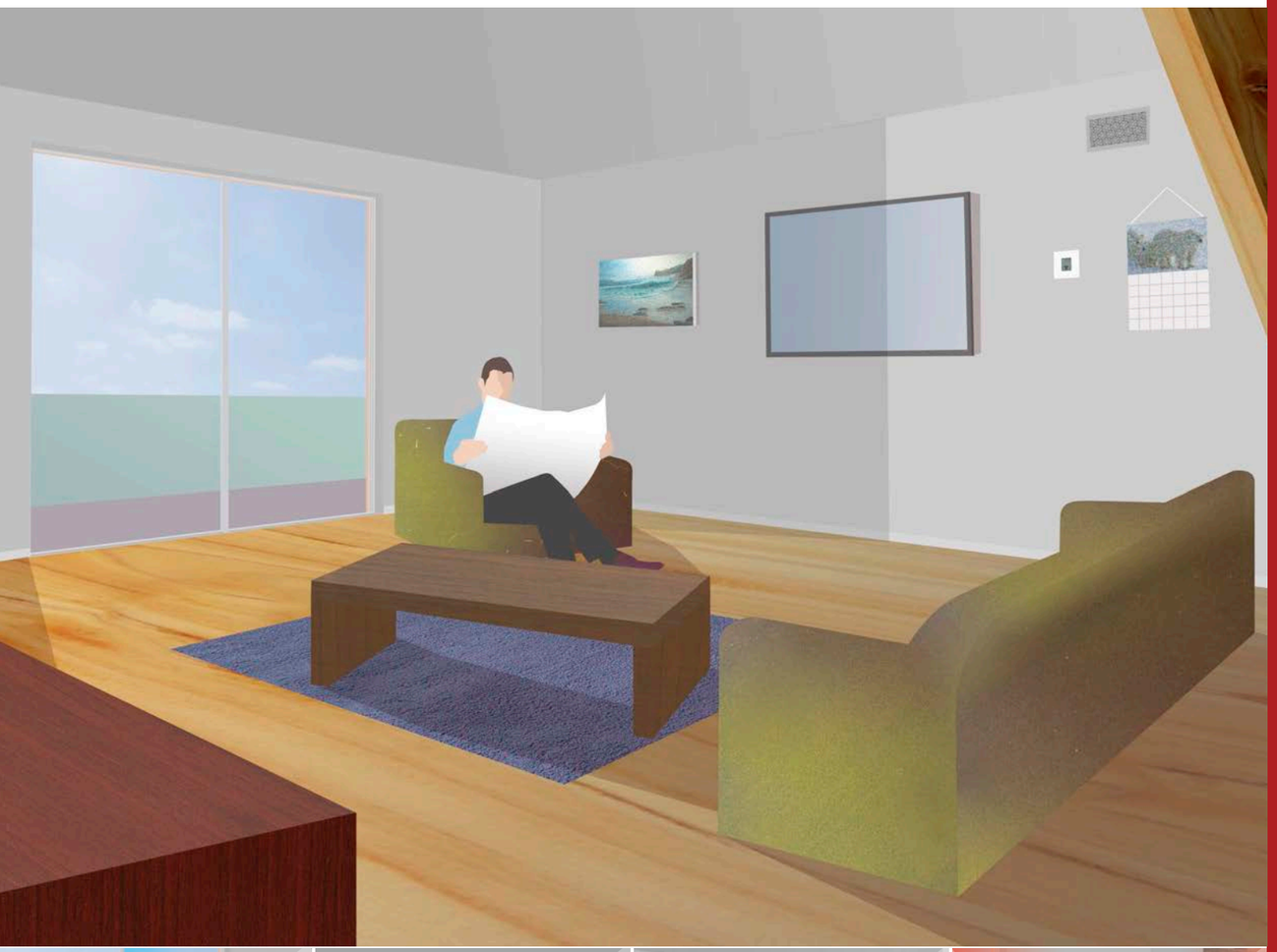
“The heat losses of the building are reduced so much that it hardly needs any heating at all. Passive heat sources like the sun, human occupants, household appliances and the heat from the extract air cover a large part of the heating demand. The remaining heat can be provided by the supply air if the maximum heating load is less that 10W per square metre of living space. If such supply-air heating suffices as the only heat source, we call the building a Passive House.”

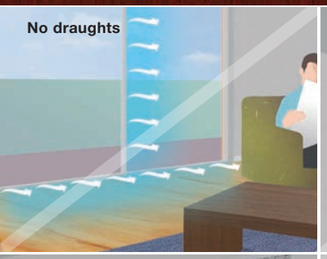
Univ. Prof. Dr. Wolfgang Feist

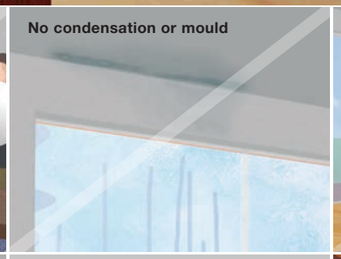
15 - The magic number

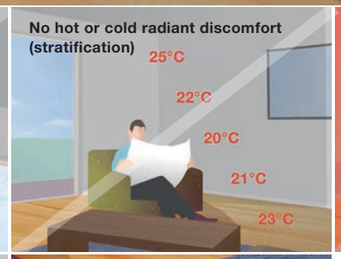
Passive House buildings need roughly 15kWh/m^2/yr of heat which is generally met by using a duct mounted post-heater or a small boiler.

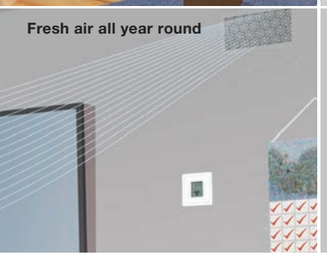
Passive House – a comfort standard











All by simply improving the build quality!

So, what's passive about a Passive House?

In short, the heating system. A Passive House doesn't need to be actively heated because it uses passive heat gains to heat itself. Consequently, only a minimal amount of additional heating needs to be supplied. The concept is based on excellent thermal insulation and a highly efficient heat recovery system. The heat stays indoors and, therefore, doesn't need to be provided by an active system.

The 'passive' principle is well known in engineering. Passive security, passive filters, passive cooling and Passive House are examples of successful implementations of this principle.

Of course, minor intervention is inevitable which means that these applications are not strictly 'passive' in the true sense of the term. Rather than simply allowing it to happen, processes are controlled in such a way that the required goals are met with minimum effort, as if it were happening all by itself.

Passive retention of heat

Active heating

But, doesn't a house need to breathe?

Air infiltration, or draughts, isn't the best way to ensure a comfortable indoor climate. It is, therefore, essential to ventilate the dwelling. Traditionally this would have been achieved by opening windows.

However, in a Passive House, the heat recovery ventilation system provides sufficient fresh air to all habitable rooms whilst exhausting stale, used air outside. An airtight structure prevents moist indoor air from leaking through the fabric of the building.

Cracks and joints allow surfaces to cool which then causes the humidity in the air to condense. This increases the risk of mould growth and puts the home at risk. This would not happen in a Passive House!

Passive House requirements

For a building to be considered a Passive House, it must meet the following criteria:

The **Space Heating Energy Demand** is not to exceed 15kWh per square metre of living space (treated floor area) per year or 10W per square metre peak demand.

In climates where active cooling is required, the Space Cooling Energy Demand requirement roughly matches the heat demand requirements with a slight additional allowance for dehumidification.

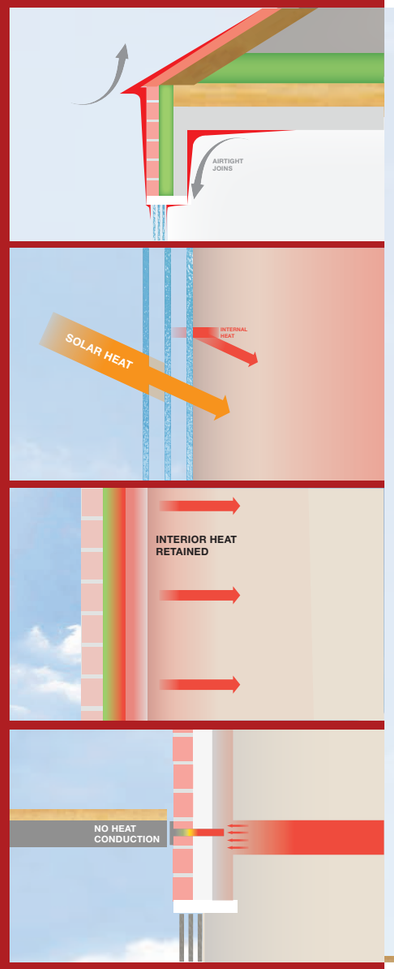
The **Primary Energy Demand**, the total energy to be used for all domestic applications (heating, hot water and domestic electricity), must not exceed 120kWh per square metre of treated floor area.

In terms of **Airtightness**, a maximum of 0.6 air changes per hour at 50 Pascals of pressure (ach50), as verified on-site with a pressure test in both pressurised and depressurised states.

Thermal comfort must be met for all living areas during winter as well as in summer, with not more than 10% of the hours in a given year over 25°C.

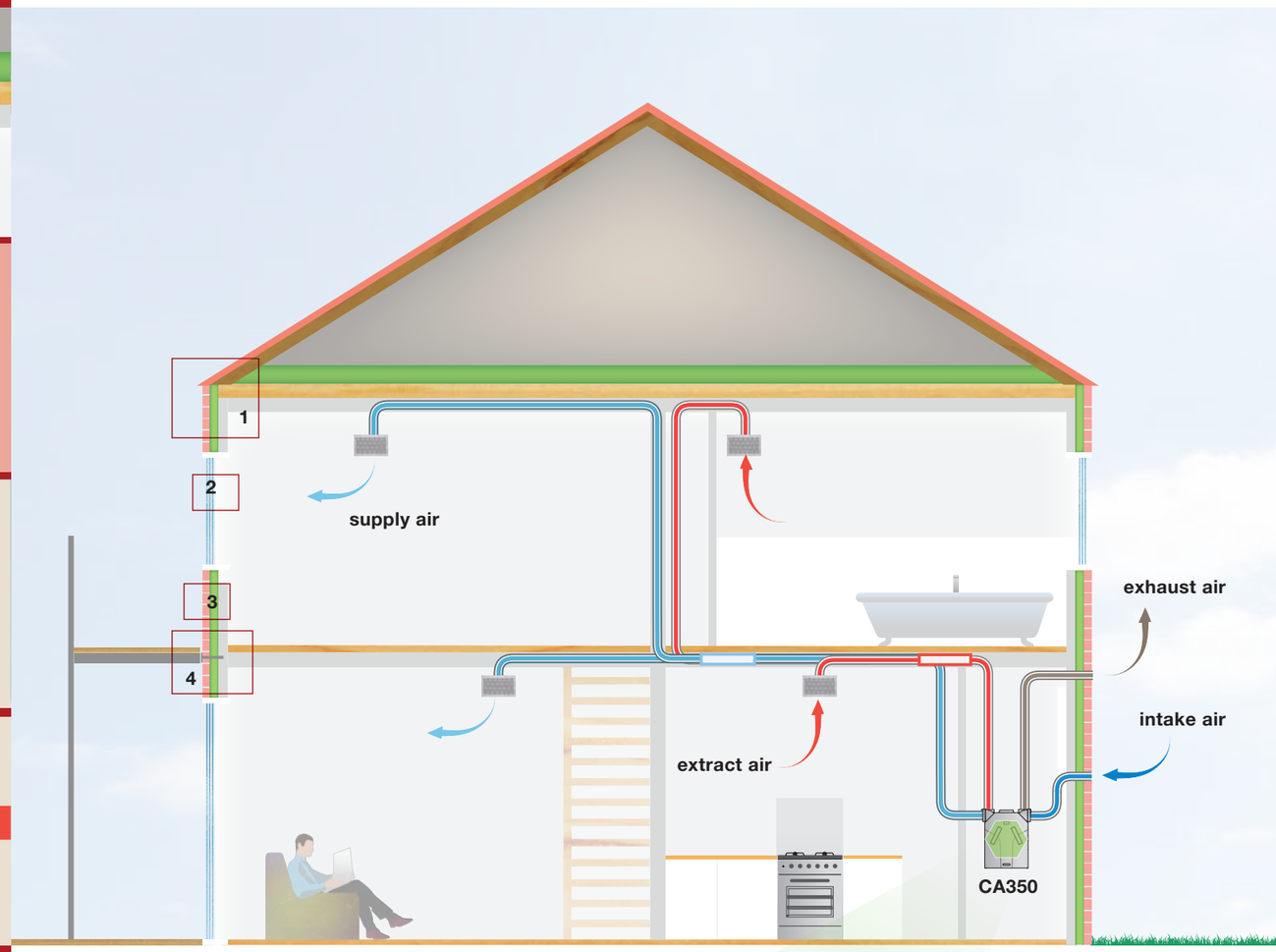
Each of these conditions is achieved through intelligent design and implementation of the five key Passive House principles:

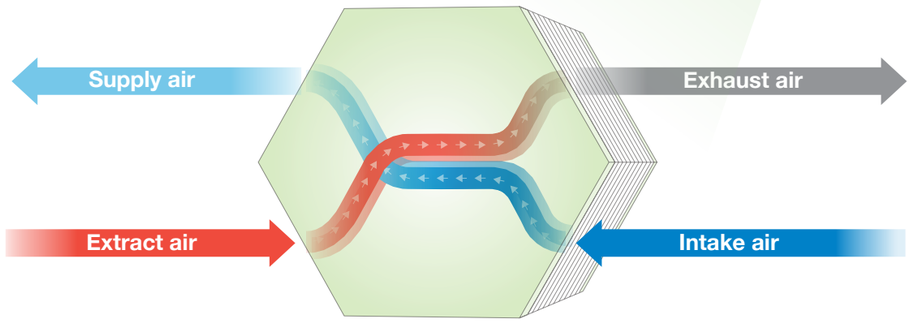
1. **Airtight construction**
2. **Superior windows**
3. **Quality insulation**
4. **Thermal bridge free design**



Airtightness	0.6 ach @ 50 Pa
Surface temperature of windows	>17°C
Summer overheating	Maximum of 10% >25°C
Ventilation	~30m³/hr/person
Heating and cooling	15kWh/m²yr @ 20°C
Primary energy	120kWh/m²yr

5. Ventilation with heat recovery





10 times the energy

When MVHR systems are properly installed, the ratio of electricity required to heat loss prevented is 1:10 or better. This means that the ventilation system saves more than 10 times the energy than it requires for operation!

So, how does this compare to the UK standard?

The mainstream building sector has to meet minimum energy standards defined in Part L of the Building Regulations. The social housing sector must also ensure that they build to meet tougher standards in the Code for Sustainable Homes (CSH), which covers energy, water use, etc.

It is difficult to compare CSH and the Passive House standard as CSH defines energy performance in terms of carbon emissions, rather than energy used. The CSH has led the effort to achieve zero carbon homes but these buildings still use sizeable amounts of energy due to poor performing fabric still in use. To compensate, they are often covered in photovoltaic panels and heated via bulky, expensive biomass fuelled boilers to reach the target.

The following table from BRE[1] summarises the key differences between Passive House and typical UK new builds:

Some like it hot

In the UK, the average annual energy expenditure is £1195.48 per household.

People in grass houses

In the Middle Ages in Iceland, people started to build turf houses after wood became scarce. These were Passive Houses, although they didn't have adequate windows or sufficient ventilation.

	Passive House standard	UK new-build common practice
Compact form and good insulation	All components of the exterior shell are insulated to achieve a U-Value that does not exceed 0.15 W/m²/K.	Limiting U-values of approximately 0.25-0.35 W/m²/K.
Southern orientation and shade considerations	Passive use of solar energy is a significant factor in Passive House design with shading used where overheating is foreseen as a potential issue.	Some consideration is given with regard to north/ south orientation, but the improved energy savings resulting from passive site design are often overlooked.
Energy-efficient window glazing and frames	U-values not exceeding 0.80 W/m²/K for both glazing and frames. Solar Heat Gain Co-efficient or "g-value" through the glazing should be at least 50%[2].	U-values of 1.8-2.2 W/m²/K typically.
Building envelope airtightness	Air leakage (n50) through unwanted gaps and cracks in the building fabric must be less than 0.6 times the house volume per hour under negative and positive pressurisation.	Design air permeability of 5 to 10 m²/hr/m³ @ 50 Pa. Research shows air permeability values for completed dwellings frequently exceed these limits.
Passive pre-heating of fresh air	Fresh air may be brought into the house through underground ducts that exchange heat with the soil. This preheats fresh air to a temperature above 5°C, even on cold winter days.	The majority of new build dwellings do not achieve good enough air permeability values to warrant the incorporation of a whole house ventilation system - thus trickle vents, extractor fans and/or passive stack ventilation is more commonly used.
Highly efficient heat recovery from extract air	Heat from the extract air is transferred to the incoming filtered fresh air (heat recovery rate must be above 75%).	
Energy-saving household appliances	Low energy refrigerators, cookers, freezers, lamps, washing machines, etc. are essential in a Passive House.	Dedicated low-energy lights are provided in a number of rooms in a new dwelling - if appliances are supplied they will be generally C-rated or 'Energy Saving Recommended'.
Space heating/cooling energy demand	Less than 15 kWh/m²/yr.	A minimum of 55 kWh/m²/yr is the norm.

[1] Building Research Establishment - http://www.passivhaus.org.uk/index.jsp?id=669

[2] The Solar Heat Gain Co-efficient (SHGC) or "g-value" is provided as a guide, it can be adjusted for glazing on different façades.

Passive House key benefits

Comfortable and healthy

- Summer and winter comfort
- No draughts
- No cold surfaces or downdraughts
- Good indoor air quality
- Quiet ventilation

Low energy

- Minimal heating
- Efficient services, lighting and appliances
- Addresses energy security

High quality

- Robust and long lasting
- Real performance matching predictions
- Certified designers and products

Affordable

- Can be achieved for capital costs comparable with standard build
- Lower running costs
- Alleviates fuel poverty

Environmental

- Focus on minimising energy consumption
- Can incorporate other environmentally friendly features
- Helps raise awareness of general environmental issues

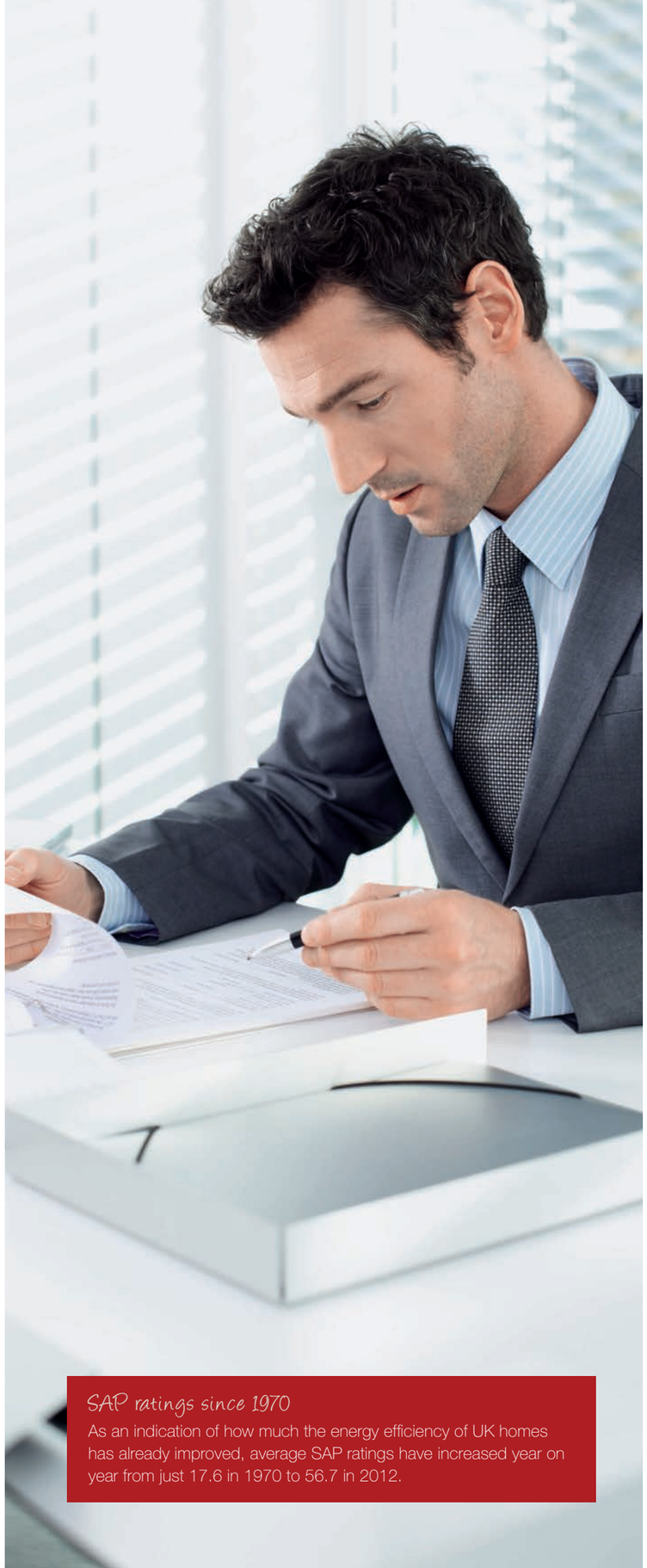
Meets policy requirements

- Performs better than current building regulations
- Will help to meet the 2016 Zero Carbon target
- Measured performance meets the new ‘as-built’ proposals

Comfort and heat input

Average UK house	20,000 kWh	17°C	£700	**Cold and expensive**
Go for comfort	40,000 kWh	22°C	£1,400	**Warm but VERY expensive**
Add insulation and draught-proofing	20,000 kWh	22°C	£700	**Warm but expensive**
Passive House	2,000 kWh	20°C	£70	**Just right!**

All temperatures averaged throughout a typical year.
Cost of fuel based on gas @ 3.5 pence per kWh.
Assumed average external winter temperature of 7°C.
5K lift from gains in row one, hence 5K heating lift required. Row two is 10K lift meaning double fuel cost.
Final row based on 88m² TFA, 15 kWh/m² demand, gas boiler 80%, rounded up.



SAP ratings since 1970

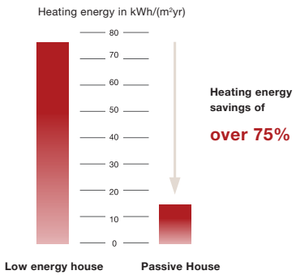
As an indication of how much the energy efficiency of UK homes has already improved, average SAP ratings have increased year on year from just 17.6 in 1970 to 56.7 in 2012.

Balanced ventilation

Efficient, balanced ventilation, with the added benefit of heat recovery, is key, allowing for good indoor air quality and saving energy. In Passive Houses, a **minimum of 75%** of the heat from the exhaust air is transferred into the fresh air again by means of a heat exchanger.

Passive House certified heat recovery ventilation systems must provide the following benefits:

- Fresh air at all times of the day
- Clean air thanks to ultra-fine filters – invaluable for allergy sufferers
- Supply air at a comfortable temperature
- Air in habitable rooms untainted by odour or contaminants from wet rooms
- A constant supply of fresh air ensuring low levels of velocity with no draughts, cold spots or discomfort
- Low levels of sound emission
- Energy savings of between 75% and 90%



Simply using Passive House components does not necessarily equal a Passive House

A Passive House is far more than the sum of its parts: precise planning is required in order to ensure that components work together to acheive the desired result.

The Passive House Planning Package (PHPP) is the key design tool used and serves as the basis of verification for the Passive House standard. The PHPP’s high level of accuracy and detail sets it apart from any other design tool: energy balances can be calculated with the PHPP to an accuracy of +/- 0.5kWh!

Largely based around European averages, the PHPP makes use of numerous tested and approved calculations to yield a building’s heating, cooling and primary energy demand, as well as the likelihood of overheating in the warmer months.

Draught-free living

The standard target of 0.6 ach is due to the prevention of draughts and discomfort rather than energy loss, which is more commonly assumed.

Mind the gap

Cavity walls were introduced to the UK in the 1920s – but cavity wall insulation didn't make an appearance until the 70s!

Meeting the EnerPHit standard

The Passive House standard can be applied to any new build or refurbishment project, providing a robust method to help the industry achieve the carbon reductions required as we head towards zero carbon. Through improving building fabric and services, Passive House can achieve real energy demand reductions below the level proposed for Building Regulations.

EnerPHit is a slightly relaxed standard for refurbishment programmes where fixed aspects of the existing buildings mean that meeting the Passive House standard is not feasible.

Fixed aspects include:
Existing architecture
Existing occupants
Planning and conservation issues
Fixed form
Fixed orientation

"Quality-Approved Energy Retrofit with Passive House Components"

The goal was to create a standard for an economically and ecologically optimal energy retrofit, for old buildings that cannot achieve Passive House Standard with reasonable effort. (PHI)

The table below shows the criteria for achieving EnerPHit compared to the Passive House standard:

Criteria	Passive House	EnerPHit
Specific Heat Demand	≤ 15 kWh/m².yr	≤ 25 kWh/m².yr
Primary Energy Demand	≤ 120 kWh/m².yr	≤ 120 kWh/m².yr + ((SHD - 15 kWh/ m².yr) x 1.2)
Limiting Value	η50 ≤0.6^{-1}	η50 ≤1.0^{-1}
Water activity of interior surfaces a_w	N/A	Max. 80%

Certification options

The Passive House certification options for domestic refurbishment are:

1. Certification as "Quality-Approved Passive House" based on exactly the same criteria as new buildings,

   or

2. Certification as "Quality-Approved Energy Retrofit with Passive House Components" – EnerPHit

EnerPHit
Quality-Approved Energy Retrofit with Passive House Components
Dr. Wolfgang Feist

- As with new build projects, the energy balance of the refurbished building must be verified using the Passive House Planning Package (PHPP)
- EnerPHit certification is given only if modernisation to Passive House standards would not have been practicable or cost effective
- Only buildings in cool and moderate central European climates are covered by the EnerPHit standard at the moment

Zehnder and Passivhaus Trust

Zehnder is proud to be a Founder Member of Passivhaus Trust – the UK Passive House organisation.

Passivhaus Trust is an independent, not-for-profit organisation that provides leadership in the UK for the adoption of the Passive House standard and methodology. Its aim is to promote the principles of Passive House as a highly effective way of reducing energy use and carbon emissions from buildings in the UK, as well as providing high standards of comfort and building health.

Zehnder is one of a group of forward-thinking companies who are leading the delivery of Passive House in the UK. Zehnder has helped to establish Passivhaus Trust as the Passive House standard body for the UK and signed up as a Founder Member to show full support.

Passivhaus Trust is affiliated to the Passive House Institute (PHI) through the International Passive House Association (iPHA).

Continued Professional Development (CPD)

Zehnder is delighted to be able to provide a RIBA-approved CPD entitled:

'Specifying Heat Recovery Ventilation in the Design of Domestic High Code Level and Passive House Properties.'

This means that we are eligible to deliver this RIBA-certified training course to Architects and other construction professionals.

The hour long seminar covers the following topics:

1. **Understand the key principles of heat recovery ventilation and how it works**
2. **Learn about what constitutes a High Code Level and Passive House dwelling**
3. **Understand how to identify the correct heat recovery system for the project**
4. **Recognise the necessary features to achieve compliance with High Code Levels or Passive House standards**
5. **Be aware of best practice when specifying heat recovery ventilation for domestic properties**

Contact us for more information on 01903 771333 or email your enquiry to cpd@zehnder.com

Zehnder Comfosystems - your Passive House system of choice

As Europe's leading provider of energy efficient indoor climate solutions, we offer a complete range of ComfoAir domestic heat recovery ventilation units in the UK that have all been certified by the Passive House Institute.

Meeting stringent Passive House objectives for performance and efficiency, our ComfoAir range ensures excellent ventilation and heat recovery, with the provision of superb air quality, for low energy, comfortable housing.

Comprising five products to service buildings from 50m² up to 210m², there is a Zehnder ComfoAir product for every residential application.

We have more than forty years of experience in the design, development and manufacture of ventilation systems. Our experience and knowledge allows us to produce intuitive, integrated solutions which meet all the needs of our customers.

Zehnder's high quality products are designed to service the low energy house of tomorrow. Depending on the size and type of system you are looking for, we can offer a ComfoAir heat recovery unit to suit for balanced ventilation and reduced heat loss in an airtight home.

Planning

No one knows our products and their capabilities better than our own technical specialists. We are ideally placed, not only to design installations so that they meet both the Building Regulations and the needs of the homeowner, but also to offer training and support throughout any project.

- Planning support for the installer
- Training of partners via RIBA approved CPDs (see opposite page)
- Compliance with regulations
- Individual designs tailored to customer requirements

Installation

Because we design and manufacture many of the elements of our systems, components are designed to fit together. This integrated functionality allows for a more rapid system installation saving both time and money for the installer and the end user.

- Coordinated system components
- Simple, fast and economical installation
- Technical support and training for installers via BPEC accredited courses and on-site 'Toolbox Talks'

Operation

All Zehnder Comfosystems can be simply and effectively controlled to ensure optimal performance around the clock. A choice of easy to use controls range from simple switches to fully integrated LCD displays featuring programmable timers and system status messages.

- Simple to use
- Comfort temperature can be set by the homeowner
- Control unit with status messages and timer function available

Cleaning

The provision of good air quality is at the heart of everything we do. We have, therefore, designed in a variety of features meaning the system can be easily maintained over its lifecycle so that air quality is never compromised. Our ventilation units contain replaceable, high grade filters on both the supply and extract air streams.

- Smooth internal coating in both the unit and the ComfoTube ducting prevents dirt from settling
- Simple replacement of filters in the device and the air vents
- Heat exchangers that can be easily cleaned

Maintenance

At Zehnder we have designed our units so that they require as little maintenance as possible. Beyond checking the filters and heat exchanger periodically, there is little else to do to ensure the longevity and effectiveness of your system.

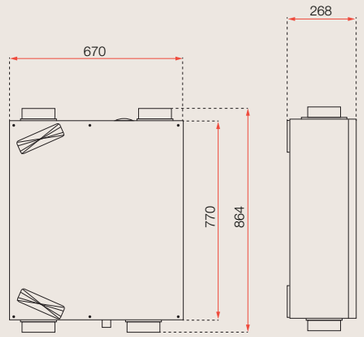
- Low maintenance units
- Long-lasting effectiveness and efficiency
- Inspections/servicing by specialists
- Easy to replace components

Zehnder ComfoAir 160 Luxe PH

- Designed specifically for flats and apartments up to 100m² (2010 Building Regulations)
- Low energy consumption thanks to EC motors
- Automatic 100% filtered bypass
- Constant volume motors ensure guaranteed installed performance (GIP)
- Can be mounted on either walls or ceilings
- Has a 100% variable air volume setting
- Dual-handed unit

Physical specification

Weight:
28kg
Ducting:
External Ø - 125mm
Internal Ø - 100mm
Condensate connection:
32mm
Materials:
Internal body - EPP
Unit housing - coated steel
Fans:
EC constant volume
Heat exchanger material:
Polystyrene
Orientation:
Wall or ceiling mounting
Installation:
Dual handed



Passive House certified performance data - with standard heat exchanger (HRV)

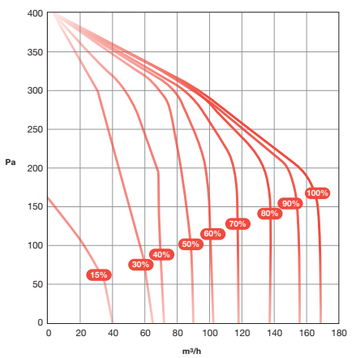
- Air flow rates of 73 – 109m³/h
- Heat recovery efficiency of 89%
- Power consumption at 100Pa of 0.36 Wh/m³
- Maximum power consumption with pre-heater of 797W
- Airtightness and insulation
  - Internal leakage at 2.37%
  - External leakage at 1.49%

Acoustic data

The following sound power levels were determined at an air flow rate of 113m³/h

dB(A) at unit	dB(A) at intake	dB(A) at supply	dB(A) at extract	dB(A) at exhaust
52.9	33.3	61.1	39.1	59.7

Performance graph



Passive House certified performance data - with optional Enthalpy Exchanger (ERV)

- Air flow rates of 73 – 115 m³/h
- Heat recovery efficiency of 85%
- Average moisture recovery ηx=0.64
- Power consumption at 100Pa of 0.33 Wh/m³
- Maximum power consumption with pre-heater of 797W
- Airtightness and insulation
  - Internal leakage at 1.92%
  - External leakage at 1.45%

Acoustic data

The following sound power levels were determined at an air flow rate of 115 m³/h

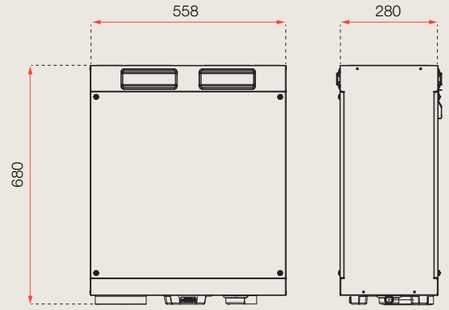
dB(A) at unit	dB(A) at intake	dB(A) at supply	dB(A) at extract	dB(A) at exhaust
53.8	35.9	61.4	40.6	57.2

Zehnder ComfoAir 180 Luxe PH

- Designed specifically for flats and apartments up to 105m² (2010 Building Regulations)
- Low energy consumption thanks to highly efficient EC motors
- Automatic 100% filtered bypass
- Compact dimensions making CA180 ideal for installation in a kitchen or bathroom cupboard
- The unit can be left or right handed
- Designed for use with the unique ComfoPipe Plus Twin Duct system
- Offers particular benefits for refurbishment projects
- Features an additional supply air connection at the bottom of the unit for added installation flexibility

Physical specification

Weight:
27kg
Ducting:
2 x 220x60mm spigots
2 x 220x115mm spigots
1 x Ø125mm optional supply air connector
Condensate connection:
20mm
Materials:
Internal body - EPP/PA
Unit housing - coated steel
Fans: EC
Heat exchanger material:
Polystyrene
Orientation:
Wall mounting
Installation:
Dual handed



Passive House certified performance data - with standard heat exchanger (HRV)

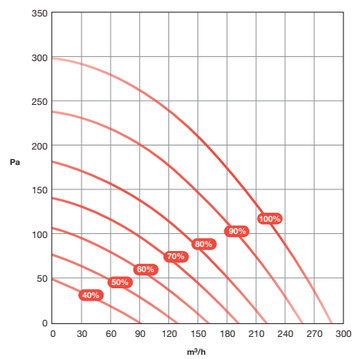
- Air flow rates of 90 – 143m³/h
- Heat recovery efficiency of 83%
- Power consumption at 100Pa of 0.27 Wh/m³
- Maximum power consumption with pre-heater of 1250W
- Air tightness and insulation
  - Internal leakage at 1.00%
  - External leakage at 1.10%

Acoustic data

The following sound power levels were determined at an air flow rate of 142m³/h

dB(A) at unit	dB(A) at intake	dB(A) at supply	dB(A) at extract	dB(A) at exhaust
43.0	41.2	52.4	53.1	43.7

Performance graph



Zehnder ComfoAir 200 Luxe PH

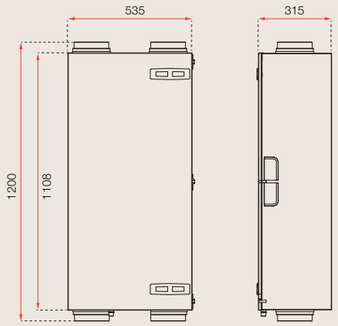
- Designed specifically for flats and apartments up to 110m² (2010 Building Regulations)
- Low energy consumption thanks to EC motors
- Automatic 100% filtered bypass
- Can be mounted on either walls or ceilings
- Integrates simply and flexibly into building services

There she blows!

In 2012 wind turbines in the UK generated more than 16 TWh – enough electricity for around 4 million homes.

Physical specification

Weight:
30kg
Ducting:
External a Ø150mm
External b Ø160mm
Internal Ø125mm
Condensate connection:
20mm
Materials:
Internal body - EPP
Unit housing - coated steel
Fans:
EC
Heat exchanger material:
Polystyrene
Orientation:
Wall or ceiling mounting



Passive House certified performance data - with standard heat exchanger (HRV)

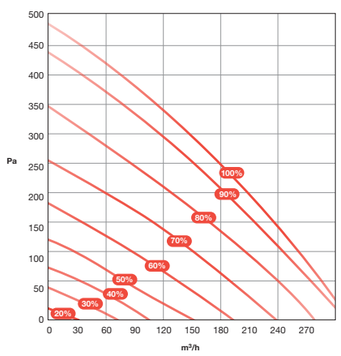
- Air flow rates of 60 – 150m³/h
- Heat recovery efficiency of 92%
- Electric power consumption at 100Pa of 0.42 Wh/m³
- Maximum power consumption with pre-heater of 951W
- Airtightness and insulation
  - Internal leakage at 2.84%
  - External leakage at 0.80%

Acoustic data

The following sound power levels were determined at an air flow rate of 150m³/h

dB(A) at unit	dB(A) at intake	dB(A) at supply	dB(A) at extract	dB(A) at exhaust
49.0	64.7	57.2	54.1	67.1

Performance graph

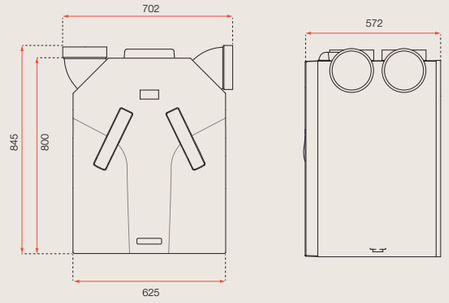


Zehnder ComfoAir 350 Luxe PH

- Designed specifically for residential dwellings up to 150m² (2010 Building Regulations)
- Low energy consumption thanks to EC motors
- Automatic 100% filtered bypass
- The insulating, sound-absorbing ducting connections can be rotated individually to simplify the installation
- High specification PCB featuring 4 x 10v inputs for greater system control
- Can be mounted either on the wall or free-standing on the optional assembly base
- Suitable for use with the optional ComfoFond-L Eco sub-soil heat exchanger or ComfoCool custom designed cooling unit
- Input available for the connection of a post-heater which can be activated without the need for a separate controller

Physical specification

Weight:
35kg
Ducting:
External Ø180mm
Internal a Ø150mm
Internal b Ø160mm
Condensate connection:
32mm
Materials:
Internal body – EPP / PA
Unit housing – coated steel / ABS
Fans:
EC
Heat exchanger material:
Polystyrene
Orientation:
Wall mounting or free-standing (with optional assembly base)



Passive House certified performance data - with standard heat exchanger (HRV)

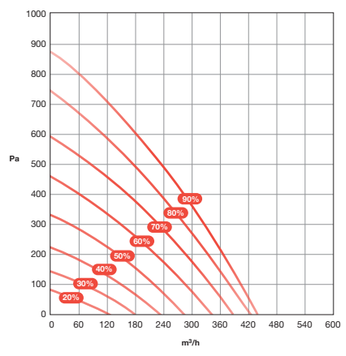
- Air flow rates of 71 – 293m³/h
- Heat recovery efficiency of 84%
- Electric power consumption at 100Pa of 0.29 Wh/m³
- Maximum power consumption with pre-heater of 1051W
- Airtightness and insulation
  - Internal leakage at 1.5%
  - External leakage at 1.9%

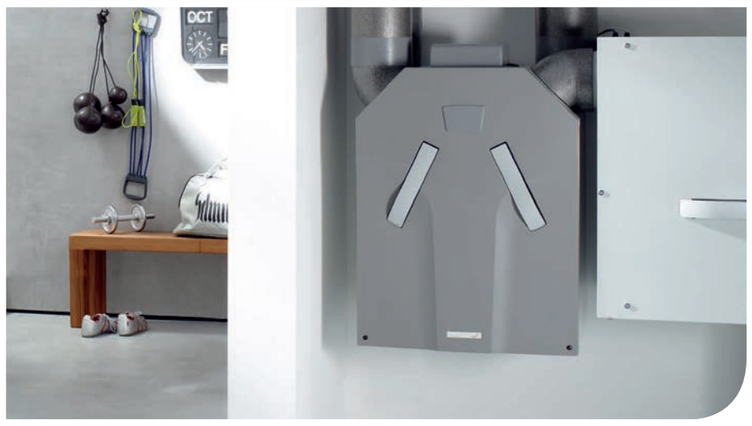
Acoustic data

The following sound power levels were determined at an air flow rate of 290m³/h

dB(A) at unit	dB(A) at intake	dB(A) at supply	dB(A) at extract	dB(A) at exhaust
54.1	50.1	63.8	50.2	61.4

Performance graph



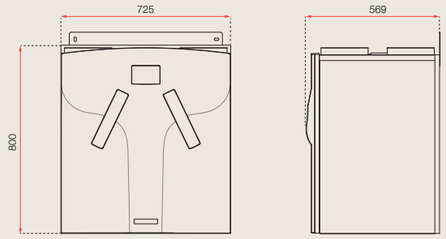


Zehnder ComfoAir 550 Luxe PH

- Designed specifically for large residential dwellings up to 210m² (2010 Building Regulations)
- Low energy consumption thanks to EC motors
- Automatic 100% filtered bypass
- High specification PCB featuring 4 x 10v inputs for greater control
- Input available for the connection of a post-heater which can be controlled without the need for a separate thermostat
- Can be mounted either on the wall or free-standing on the optional assembly base
- Suitable for use with the optional ComfoFond-L Eco sub-soil heat exchanger or ComfoCool custom designed cooling unit

Physical specification

Weight:
47kg
Ducting:
External Ø200mm
Internal Ø180mm
Condensate connection:
32mm
Materials:
Internal body – EPP
Unit housing – coated steel / ABS
Fans:
EC
Heat exchanger material:
Polystyrene
Orientation:
Wall mounting or free-standing (with optional assembly base)



Passive House certified performance data - with standard heat exchanger (HRV)

- Air flow rates of 110 – 308m³/h*
- Heat recovery efficiency of 84%
- Electric power consumption of 0.31 Wh/m³
- Maximum power consumption with pre-heater of 1158W
- Airtightness and insulation
  - Internal leakage at 1.93%
  - External leakage at 2.51%

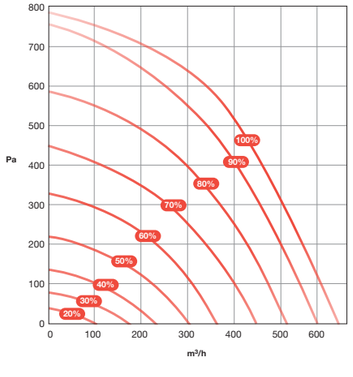
Acoustic data

The following sound power levels were determined at an air flow rate of 242m³/h

dB(A) at unit	dB(A) at intake	dB(A) at supply	dB(A) at extract	dB(A) at exhaust
48.1	44.8	47.6	48.2	47.6

*308 m³/h with additional pre-heater protection

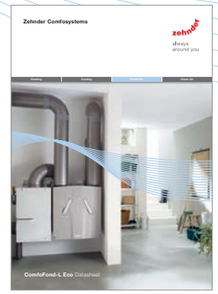
Performance graph



Ancillaries and controls

ComfoFond-L Eco 350

Zehnder ComfoFond-L Eco earth brine sub-soil heat exchanger uses the relatively constant annual temperature of the earth at a depth of one to one and a half metres. This 'passive store' of energy remains at a temperature of 8-12°C all year round and can be used to pre-temper incoming supply air in winter and summer months, improving the efficiency of the heat recovery unit, saving energy and providing an optimised indoor climate.

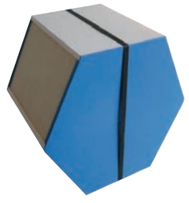


ComfoCool

Zehnder ComfoCool is a custom designed cooling unit for use with Zehnder ComfoAir 350 and 550 Luxe units. It is capable of reducing the indoor temperature by up to 5°C and the relative humidity of an entire home by up to 20%, thereby creating a pleasant indoor climate. Request the brochure to discover how ComfoCool differs from air conditioning.

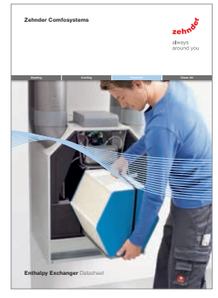
ComfoTube and Flat 51

Heat recovery is a system – the unit and the ducting – and it is the combination of these two elements that deliver ventilation into the home. **Zehnder ComfoTube and Flat 51** – our high-performance, semi-rigid air distribution systems - offer a whole host of benefits to developers, installers and homeowners and include many innovative and distinctive features.



Enthalpy Exchanger

The **Zehnder Enthalpy Exchanger** is designed to maintain comfortable moisture levels within the home. Too much moisture can lead to mould and overheating. Too little causes dry eyes, chapped lips and an environment in which bacteria and viruses can thrive. The Zehnder Enthalpy Exchanger recovers both the thermal and the latent energy from the stale air extracted from wet rooms around the home. This additional energy, which would otherwise have been lost, is transferred into the incoming fresh air stream before being supplied to habitable rooms.



ComfoSense

Power is nothing without control! Our units can be simply and effectively controlled to ensure optimal performance around the clock. **Zehnder controls** range from standard switches to fully integrated LCD displays featuring programmable timers and system status messages. The controllers can be linked with a variety of proprietary sensors to enhance comfort and offer total flexibility. By combining Zehnder units with any of our range of controllers you are ensuring that the system can be truly tailored to become an integral and autonomous part of the home.

Technical data sheets and brochures can be downloaded from our website – www.zehnderpassivehouse.co.uk
Alternatively, you can download our app for free to your smart device where you will find all of our literature, installation instructions and homeowner guides – the links to the iTunes App Store or the Google Play Store can be found on our website.

Glossary of ComfoAir Luxe PH features

Here are some concise explanations of the Zehnder ComfoAir features that are common to the entire range of LUXE PH models.

Heat recovery
Besides ensuring a healthy balance between incoming and outgoing air, the ComfoAir units also provide the benefits of heat recovery. Heat recovery means that heat from the extracted air is transferred to the fresh incoming air before being supplied to all habitable rooms in the home.

Bypass
An MVHR has to operate in many different conditions. In winter the heat exchanger is working to ensure that heat from the dwelling is not lost through extraction **(figure 1)**.
In spring and autumn, conditions may occur where heat recovery is not required. If it is warmer indoors that the preset comfort temperature, yet the outside temperature is lower, the bypass will open automatically so that the cooler outdoor air bypasses the heat recovery function and lowers the internal temperature **(figure 2)**. The same method also applies during cool summer nights, which is why the feature is often known as “Summer Bypass”.
What sets Zehnder ComfoAir units apart is that Summer Bypass does not mean filter bypass. With ComfoAir, the incoming air continues to be filtered before it is supplied to the home when the bypass is open. This is especially important for allergy sufferers in the hay fever season!

However, during hot summer days, we aim to keep the heat outside whilst ventilating to maintain a balanced system and ensure indoor air quality remains high. In this situation, the bypass would stay closed so that the fresh filtered air enters the home but not the heat **(figure 3)**.

This could strictly be referred to as ‘cold recovery’, as the cooler indoor air is used to temper the hotter incoming air, yet the generally accepted term is still ‘heat recovery’. So, heat recovery does not generate heat or cold, but reuses the warmth or coolness that would otherwise have been extracted.

Chimney Sweep programme
This feature is required in houses that have a fireplace to ensure safe use as there is a risk of air being sucked back from the chimney. The Chimney Sweep programme works automatically but requires activation by the installer. Whilst the programme is activated, the supply and exhaust fans cannot be turned off manually.

Pre-heater
The pre-heater gives the added bonus that balanced ventilation is intact for temperatures as low as -15°C meaning that the supply of fresh outside air to the home won’t be reduced / prevented. The pre-heater is activated and deactivated automatically based on continual monitoring of the temperature of the intake air.

Post-heater (optional)
It is possible to fit Zehnder ComfoAir units with a post-heater, ensuring that the supply air is tempered further before it reaches any of the living areas of the dwelling. The main benefit is that the supply air can be instantly released into the home at the set-comfort temperature – particularly important for Passive Houses in colder climates.

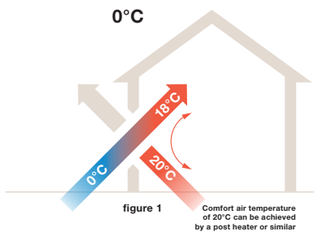


figure 1

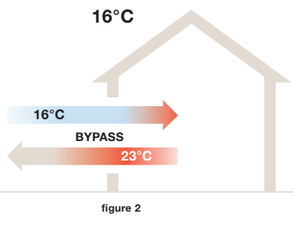


figure 2

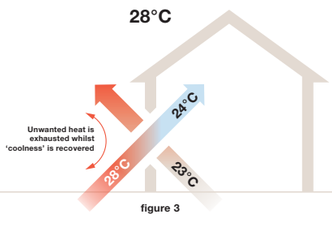


figure 3

Extra savings

Ecology building society offer special discounted mortgage rates for homes built to the Passive House or EnerPHit standard.

Pet Walk!

One of the standout innovations at Ecobuild 2014 was a Passive House certified, automated pet door from Austrian company, Pet Walk!

Zehnder – your Passive House partner

We offer a fully integrated support package to all of our customers where our aim is to partner with you and your construction project throughout the process. We are not just a supplier of brown boxes to site!

Our approach works through a number of stages so that we ensure all elements of regulations, whatever standard you are building to, are achieved. Above everything else, we safeguard your particular requirements.

Consultation and estimates
We will begin by having initial discussions about the requirements for your building design. From there we can estimate the approximate costs based on the most suitable units and components required to meet the needs of your project.

Design and quote
We will provide outlined CAD plans in line with the Best Practice requirements of your chosen build methodology. At this time we also provide a detailed quote of the system and components required. When it comes to planning a Passive House standard dwelling, our experienced designers will carefully ensure that the following requirements are incorporated:

- Reduction of any potential thermal losses and noise by the **appropriate siting** of the unit
- Decrease the motor speed and achieve optimal performance by using a **low velocity** ducting approach
- **Limiting cross-talk transmission** and removing the requirement for cross-talk attenuators by the use of a ComfoFresh ducting system
- Using coanda effect grilles to improve the ventilation levels and the occupant comfort (**none of the draughts** associated with standard grilles)
- **Dampening any potential noise** from the fans

Supply
Following order placement, we will organise the safe delivery to site of your systems and ancillaries in line with the needs of your build plan and installers.

Training
We offer a variety of comprehensive training course for our partners, installers and specifiers. They cover theory, specification, installation and commissioning and servicing.

We can also recommend a whole host of training events that are organised by BRE. Their courses vary based on which part of the Passive House process you are working in – from the design of a Passive House to the construction techniques required. Although qualifications in Passive House construction aren't currently mandatory in the UK, this may become a requirement in the future.

On-site support
We have developed in-depth and simple to follow installation instructions. However, we are always available to come to site and help support the installers to ensure it gets done right first time.

This includes commissioning the heat recovery system so that it delivers on performance and comfort from the moment it is turned on.

After installation support
If, for any reason, there is a problem with the whole house ventilation system, we can offer advice and support over the phone, via email or in person. Each project that we work on is individual to us and is tailored to suit.

If you are looking for a partner – that's us! You don't want a supplier of brown boxes. You want a company who can provide consultation and comfort systems for your whole project.

Comfort in the Rockies

An extremely well-insulated solar passive house was built in Old Snowmass in Colorado, at an altitude of 2,164 metres. Tropical vegetation flourished in the winter garden and the stove was seldom used. In 2011, at the International Passive House conference, this building was awarded the "Passive House Pioneer Award".

Knight’s Place
A Passive House Case Study

Knight’s Place in Exeter
Amongst the first multi-residential, certified Passive Houses in the UK

Built to the highest level of energy efficient construction, with MVHR from Zehnder Group UK, Knight’s Place in Exeter has set new Passive House design standards within the social housing sector.

Knight’s Place Passive House Housing is a sustainable social housing development of 18 one and two-bedroom apartments, designed by Gale & Snowden Architects for Exeter City Council. Built with meticulous attention to detail, the two blocks have been designed to strict Passive House standards, which deliver high comfort levels for residents via a mechanical ventilation system with heat recovery (MVHR). This produces consistent and uniform internal temperatures and excellent air quality whilst minimising energy use for heating and cooling, resulting in significantly reduced energy bills. Knight’s Place is amongst the first multi-residential, certified Passive Houses in the UK.

With MVHR an integral feature of all Passive House developments, it was essential that a highly efficient, quality MVHR system was specified for Knight’s Place, enabling the buildings to meet stringent energy performance criteria. Offering excellent rewards in Standard Assessment Procedure (SAP) through the Dwelling Emission Rates calculation, Zehnder’s ComfoAir 200 whole house heat recovery system was specified for each apartment. Guaranteeing the provision of optimum quality indoor air all year round, the CA200 recovers heat from the warm air extracted from kitchens and bathrooms and transfers it to the fresh incoming air supplied to living rooms and bedrooms. The CA200 system provides both the ventilation and heating needs at Knight’s Place - no other heating system is required. As the heat loss in each flat is so minimal, this is met during winter extremes via a small air heater in the supply air duct just after the heat exchanger.

Outstanding Energy Performance
Commenting on the specification of the products, Principal Mechanical and Renewable Energy Engineer at Gale & Snowden, Jason Fitzsimmons explains, “Generally the key issue for passive houses is controlling heat loss through the fabric and windows and achieving excellent airtightness levels. You can insulate well, but in naturally ventilated homes you still have fresh, cold air affecting the interior climate so the use of a MVHR system with a high heat exchange efficiency rate is very important. While the average unit on the market stands at between 75 and 80 per cent efficiency, Zehnder’s CA200 model offers a 92 per cent heat exchange efficiency rate, which is outstanding. It’s one of the reasons we selected the product because, for this type of dwelling, there’s no doubt that it’s the most efficient on the market.”

Passivhaus Accredited
Alongside its superior energy and heat exchange performance, the CA200 has been independently certified by the Passive House Institute as an accredited component, making it suitable for a wide range of highly insulated new build developments and a perfect fit for Knight’s Place. “Achieving Passive House certification is still relatively unusual in the UK, particularly for this type of social housing development, but it was a key objective for Knight’s Place,” explains Fitzsimmons. “Obviously it made sense for us to select a high quality, independently accredited MVHR system such as Zehnder’s CA200 to help us meet the strict requirements of certification. Knight’s Place is now one of the first multi-occupancy buildings in the country to be recognised as achieving true Passive House standards.”

Another key benefit of the CA200 is its filtered bypass, which circumvents the heat recovery mode during warmer months. Ventilation is provided continuously without warm and humid air entering unnecessarily which can assist in reducing summertime overheating. Each unit can be provided with grade F7 filters on the supply and extract air, with GU4 filters as standard. Year round filtration of incoming air is crucial to ensuring a good level of indoor air quality at all times and is particularly important in highly insulated dwellings like Knight’s Place.

Key achievements

- Passive House certified
- Minimal heating requirements and greatly reduced carbon emissions
- Designed to meet Code 4 of the Code for Sustainable Homes (CSH)
- Fully compliant with Lifetime Homes Standards
- Designed to meet best practice daylight levels in accordance with the requirements of the CSH
- Compliant with Secured by Design
- Independently assessed under the Building for Life Standard with a final score of 18.5 out of 20
- Considerate Constructors Scheme rating of 37.5 out of 40

Strong technical support

Commenting on the choice of MVHR system for Knight's Place, Fitzsimmons adds, "Aside from the main energy benefits of the CA200, one of the deciding factors for specifying Zehnder's unit was the expertise and excellent technical support available from the dedicated team. We were very happy with the service they provided and they even supported us through our two year energy efficiency monitoring programme, where we examined the energy and comfort performance of the flats. They provided the MVHR duct sensors which enabled us to test in detail the heat exchanger efficiency and air stream humidity and temperature."

Two years on from completion, Knight's Place apartments maintain a comfortable temperature of 21°C year round for residents, with minimal heating required and low running costs. According to the SAP Energy Performance Certificate, some of the dwellings at Knight's Place can be heated for as little as **£18** a year.

Images courtesy of Gale and Snowden Architects

Two Passive House Myths

1 "You can't open the windows!"

Windows can be opened in Passive House buildings but, in practice, most occupants choose to keep them closed as continuous fresh air is provided by mechanical ventilation.

Comfort levels are very high and the air quality is excellent. In summer, opening windows at night will help keep the house cool but in winter, doing so may increase fuel costs for the resident as heat will be needed to warm the house back up again.

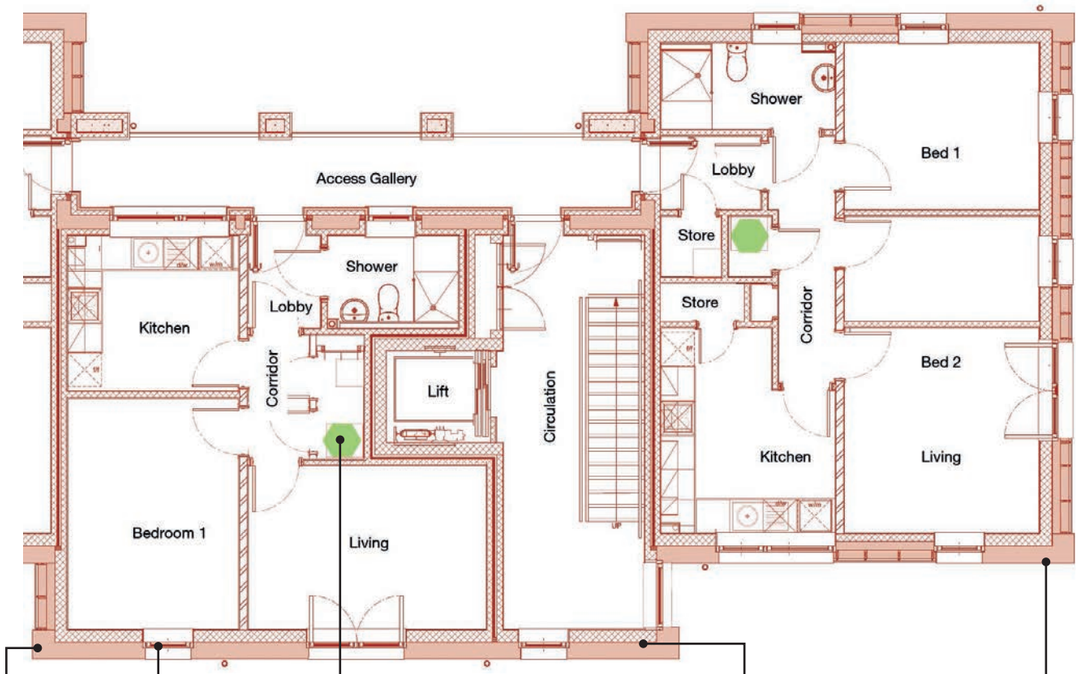
2 "They don't have a heating system!"

It's true, Passive House buildings don't have a traditional central heating system. Instead, they have smaller, lower cost heating systems which can meet the reduced heat demand.

On the coldest days, a post-air heater in the ventilation duct is usually enough to keep the house warm and comfortable.

"While the average unit on the market stands at around 80 per cent efficiency, Zehnder's CA200 model offers a 92 per cent MVHR efficiency rate, which is outstanding. This, alongside its compactness, is one of the reasons we selected the unit because, for this type of dwelling, there's no doubt that it's the most efficient on the market."

Jason Fitzsimmons,
Principal Mechanical and Renewable Energy Engineer at Gale & Snowden Architects.



Windows & glazing

- High performance triple glazed windows and doors - maximum U-value 0.85Wm²K.
- Daylight design is maximised in all rooms where possible to reduce reliance on artificial light and utilise solar gain. Light coloured walls help to reflect daylight into the rooms.

Airtightness

- Exceptionally high levels of airtightness <0.6 m^3/m^2.hr.
- Careful detailing throughout to ensure continuous airtight barrier.

MVHR

- Mechanical ventilation with high efficiency heat recovery (MVHR) - minimises ventilation heat losses through controlled ventilation, ensuring optimum indoor air quality and reduced heating requirements by retaining heat from exhaust air. The MVHR systems provide both the ventilation and heating needs for the flats. No other form of heating is required.
- Warm, 'dirty' air is extracted from the kitchen and shower room and exhausted once it has exchanged its heat with the fresh incoming air supplied to the living room and bedrooms as 'clean', tempered air.

Running costs

- According to the Standard Assessment Procedure (SAP) Energy Performance Certificate (EPC), the flats in Knights Place can be heated for as little at £18 per year.
- The EPC shows that another £24 and £86 might be required for lighting and hot water per year respectively.
- This shows that these flats are truly affordable for future tenants.

Wall construction

- Externally insulated masonry walls achieve high insulation levels and a U-value of no greater than 0.13Wm²K.
- The inclusion of thermal mass within internal spaces reduces internal temperature fluctuations, stores winter solar gain and reduces the risk of overheating in summer.

For more case studies visit our Passive House website at **www.zehnderpassivehouse.co.uk**

References

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Carbon Emissions

Carbon Dioxide emissions per household have fallen dramatically over the past four decades – from 10.4 tonnes in 1970 to 4.5 tonnes in 2011.

Summary

The UK's experience with building to the stringent Passive House standard is currently in its infancy. Nonetheless, experience across Europe proves that Passive House is a viable way of delivering low energy housing.

However, whether building to the Passive House model, current UK Building Regulations or the Code for Sustainable Homes, the fact remains that the UK is heading down a path to more airtight, zero carbon homes, and MVHR is expected to become the leading form of ventilation as a result.

By aligning yourself with a manufacturer and supplier who knows the ins and outs of the Passive House regulations, you take a step towards safeguarding your development against the possibility of non-compliance.

Choosing Zehnder as your partner of choice for all of your Passive House and high code level construction ensures that your project runs smoothly – great news for you, for the health of the dwelling, for the comfort of the occupants and for the environment!

Zehnder – everything you need to create a comfortable, healthy and energy-efficient indoor climate

Heating, cooling, fresh and clean air: at Zehnder, you will find everything you need to create a comfortable, healthy and energy-efficient indoor climate. Zehnder's wide and clearly structured portfolio can offer the right product for any project, be it private, public or commercial, new build or refurbishment. As far as service is concerned, you'll find that Zehnder is "always around you".

Heating

At Zehnder, Heating doesn't just come in the form of designer radiators. We offer heating solutions in all shapes and sizes, from radiant ceiling panels to heat pumps with integrated ventilation devices.

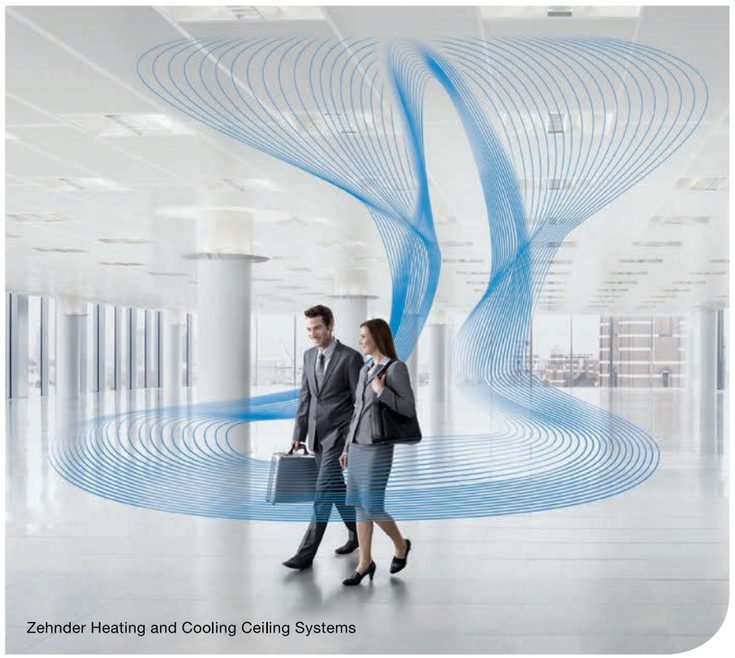
- Designer radiators
- Compact energy station with integrated heat pump
- Heating and cooling ceiling systems
- Comfortable indoor ventilation with heat recovery

Zehnder Designer Radiators

Cooling

Zehnder also offers sophisticated solutions for indoor Cooling. These range from cooling ceiling systems to comfortable indoor ventilation with a supply of pre-cooled fresh air.

- Heating and cooling ceiling systems
- Compact energy station with heat pump and brine pipe
- Comfortable indoor ventilation with geothermal heat exchanger for fresh air pre-cooling



Zehnder Heating and Cooling Ceiling Systems

Fresh Air

Fresh Air – a product range with a long tradition at Zehnder. Zehnder Comfosystems provides products and solutions for comfortable indoor ventilation with heat recovery for houses and apartments, for new builds and for renovation projects.

- Comfortable indoor ventilation
- Compact energy station with integrated ventilation device

Zehnder Comfosystems

Clean Air

Zehnder Clean Air Solutions provide Clean Air in buildings particularly prone to dust. In residential applications, the comfortable indoor ventilation provided by Zehnder Comfosystems filters external pollutants out of the air.

- Comfortable indoor ventilation with integrated fresh-air filter
- Compact energy station with integrated fresh-air filter
- Systems for clean air

Zehnder Clean Air Solutions

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