MAICO VENTILATOREN

Practical guide for decentralised ventilation solutions with heat recovery

Information, planning instructions, sample planning

www.maico-ventilatoren.com

“AIR@HOME” app for iOS and Android

“AIR@HOME” WEB TOOL (www.air-home.de)

VENTILATION CONTROL AND ADJUSTMENT

The browser-based air@home web tool provides the user with smart access to one or more controlled domestic ventilation units[1].

Facility managers, tradesmen or end-users can all have convenient access to controlled domestic ventilation units via tablet or PC. State-of-the-art technology and smart operation.

1 Units with controlled domestic ventilation.

CONVENIENT OPTIONS FOR TENANTS AND HOME OWNERS

For example, residents can also flexibly monitor and control their ventilation unit using the iOS app/Android app and their smartphone.

- Select and set various functions, such as operating mode, ventilation level, weekly time program, summer/winter operation
- Adapt the individual room air quality by setting parameters for the sensor limit values (humidity + air quality)
- Depiction of temperature, humidity and air quality trends and the energy recovered

MORE ADVANTAGES

- Smart handling of the ventilation system by smartphone
- Depiction of the current air quality
- Ensuring an optimum room climate, even when no-one is at home
- Documentation as proof of correct ventilation
- App usage with unlimited end-devices
- Filters can be ordered by e-mail or from the filter shop (www.shop.maico-ventilatoren.com)

ADVANTAGES FOR HOUSING COMPANIES

- Simple and flexible unit setting with the web tool
- Support to help the tenant find the right ventilation strategy (for example: usage of home by a single person or by a family of five)
- Perfect control over multiple systems
- Interventions when incorrect ventilation is identified

ADVANTAGES FOR TRADESMEN

- Simple and flexible unit setting with the web tool
- Remote service option

MORE SECURE THAN OTHER SOLUTIONS

All the data transferred with air@home is encrypted. The app never communicates directly with the ventilation unit, but via the secure MAICO server.

Should a smartphone be lost or the tenant/end-user change, access to the ventilation units is easy to block and re-issue.

Table of contents

1 Healthy room air quality in homes

A pleasant indoor climate and hygienic room air quality are essential for healthy living and well-being. And this is the main job of domestic ventilation.

Unpolluted outside air sets the standard for “good air”.

Pollution of room air comes from various sources, including harmful substances which enter the room with the outside air, the persons themselves, as well as construction materials, fittings, home furnishings, heaters, cookers, pets, plants, textiles, foods and household chemicals emit a number of substances.

The most important substances include:

- **carbon dioxide (CO_2)**, that is produced by human metabolism or combustion processes (gas stove, candles, smoking).
- **water vapour**, some of which comes from people and some of which is produced from water evaporated by plants, when cooking, washing, showering etc. A humidity level of between 40 % and 60 % is considered comfortable.
- **odours** from human perspiration or domestic activities.
- **toxic gases and vapours** (nitrogen oxide, hydrocarbons, aldehydes, solvents), which escape from objects and materials or are produced from combustion processes.
- **micro-organisms**, such as bacteria, viruses, mould spores or house dust mites.
- **radioactive substances** from construction materials and the earth.

Achieving a good room air quality requires emissions in the building to be mostly prevented, efficiently removed and adequately diluted.

Research into humidity, CO_2 and odours has found that **30 m³ of fresh air an hour per person is a good guide for the volumetric flow needed to achieve good** hygiene levels.

This figure is also based on DIN 1946-6 “Ventilation for residential buildings”. Depending on the size of living space per person, this means air exchange rates[1] of between 0.3/h and 0.8/h.

Taking into account the unavoidable amount of indoor air pollution from construction materials and furnishings as well as the fact that many materials buffer water vapour and odours, requires a minimum volumetric flow to be designed depending on the size of the home.

If the air volume of a home is used as the gauge for this, the air exchange rate should not fall below 0.3/h.

Controlled domestic ventilation is currently considered to be the only way to ensure a hygienically adequate air exchange, with the sealed building envelope design prescribed by law.

MAICO Ventilatoren develop and produce very efficient and smart ventilation systems with heat recovery at the company’s headquarters in Villingen-Schwenningen, southern German - **“Made in Germany”**.

1 The air exchange rate is the ratio between the exchanged volume of air per hour and the total room volume.

1.1 Ventilation in line with the relevant standards

DIN 1946-6

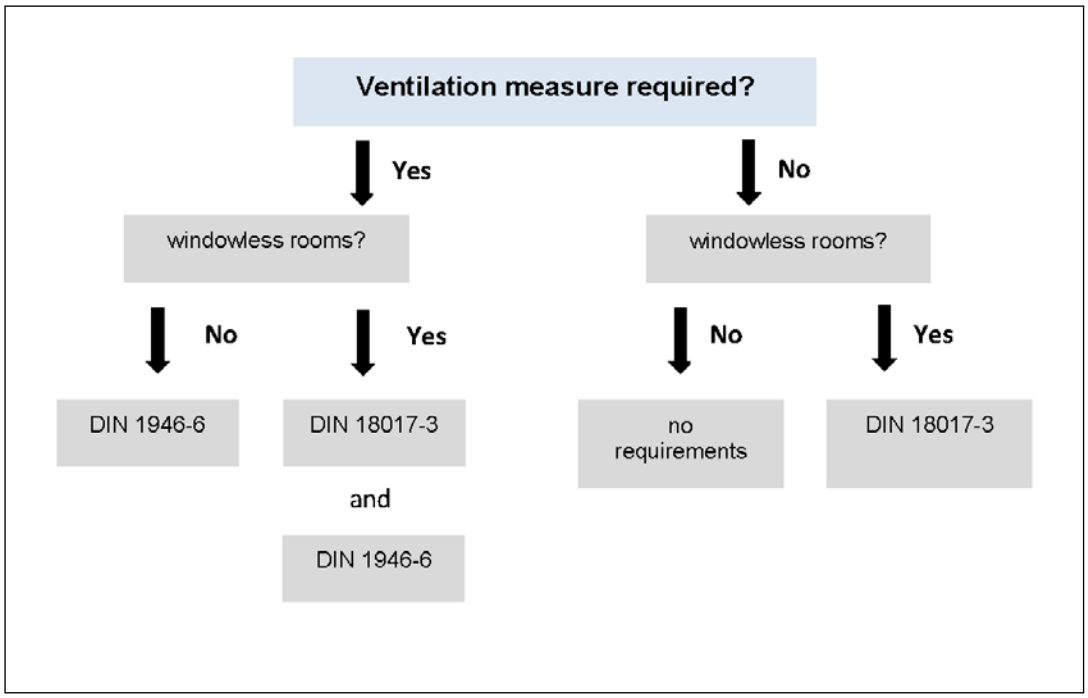
DIN 1946-6 is the ventilation standard of relevance to the design of domestic ventilation systems.
It lays down the planning requirements for:

- equipment for free ventilation and
- fan-assisted ventilation systems.

A **ventilation concept** should always be produced for new buildings or buildings, which are being modernised. This involves working out whether ventilation measures are needed. To do this, the volumetric flow of outside air needed to protect the building or residential unit from humidity is determined and compared with the volumetric flow of outside air resulting from natural infiltration.
If the volumetric flow needed for humidity protection is not reached, ventilation measures are needed. If a home has interior bathrooms or toilet rooms, **DIN 18017-3** should be observed in addition to DIN 1946-6.

DIN 18017-3

DIN 18017-3 applies to fan-assisted extraction systems in bathrooms and toilet rooms without an outside window, in homes and similar occupied areas.
This standard therefore lays down the requirements for how windowless rooms are designed and operated.
A flow of outside air appropriate for the volumetric flow of exhaust air must flow into the living rooms and day rooms from outside through infiltration and, if necessary, through extra suitable outside air openings across the building envelope.
The corresponding flow of supply air is supplied to the exhaust air rooms via suitable overflow air openings in the interior rooms.
In accordance with DIN 1946-6, a ventilation measure is complete when, for example, if providing ventilation in windowless rooms in accordance with DIN 18017-3, the volumetric air flow needed for humidity protection is reached continually for the entire housing unit and all rooms in the housing unit have an adequate and even flow of air.
If the ventilation concept is planned in accordance with DIN 1946-6, DIN 18017-3 will be met at the same time.



1.2 Ventilation concept

Free or fan-assisted systems are available for venting and extracting air from rooms in housing units.
The choice of appropriate system depends on the general and specific requirements.

General requirements include

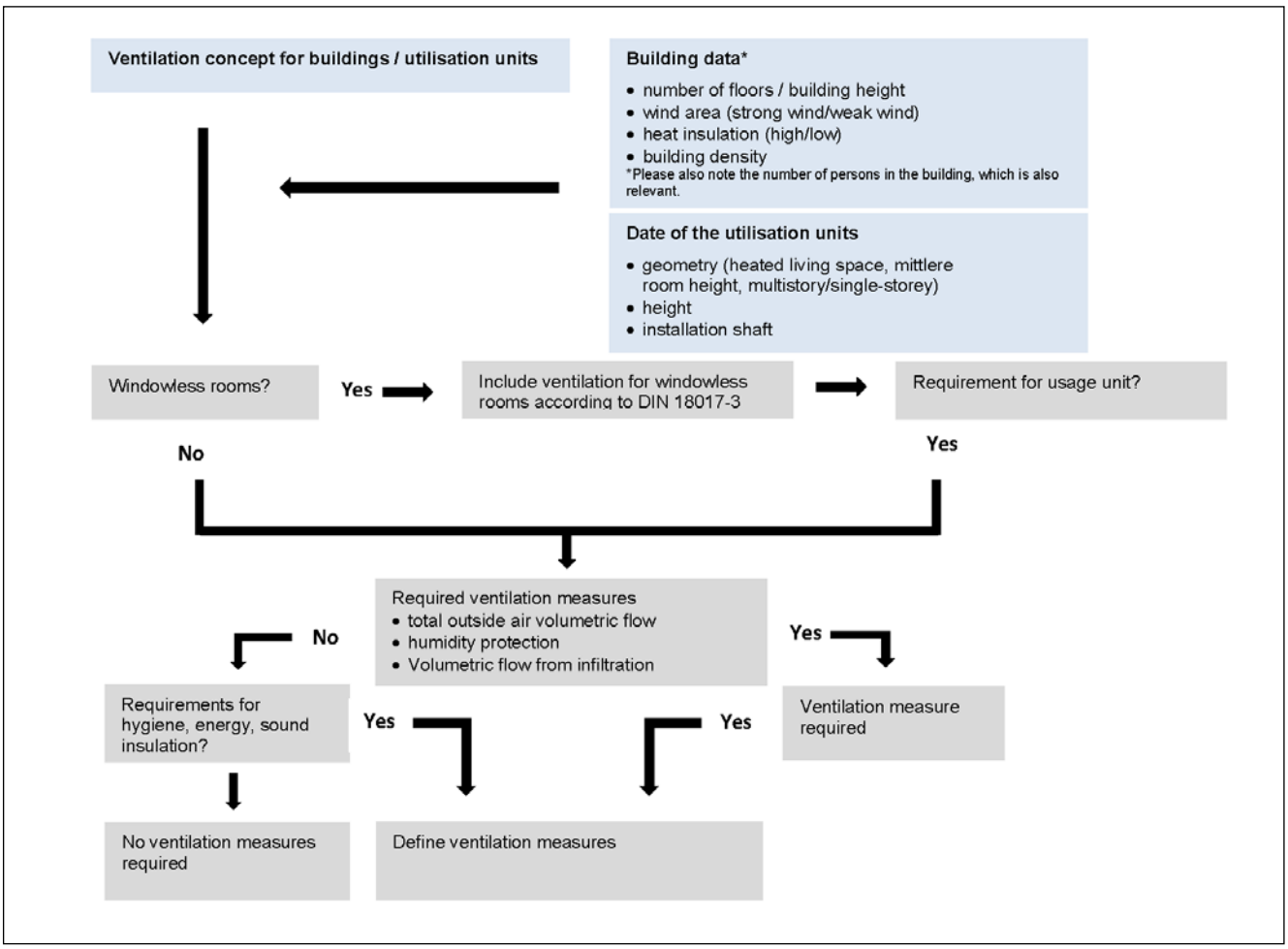
- specifications in ordinances and guidelines, which ventilation systems need to observe;
- technical fire protection and sound insulation requirements in the building;
- requirements relating to how living rooms and day rooms are used (comfort) or volumetric air flows in special rooms.

Specific requirements

- may apply to one housing unit;
- require volumetric air flows to be achieved in specific rooms and if necessary in living rooms and day rooms;
- place more stringent demands on the room air quality (hygiene);
- place more stringent demands on the energy efficiency and/or sound insulation.

In accordance with **DIN 1946-6,** a **ventilation concept** should always be produced for new buildings and existing buildings undergoing modifications of relevance to ventilation (e.g. replacing the windows).
This checks whether sufficient protection against humidity can be ensured by the natural exchange of air through leaks in the building envelope (infiltration).
If the calculated infiltration volumetric air flow is less than the minimum volumetric air flow needed for humidity protection, ventilation measures are essential.

Creating a ventilation concept



You will find more information about ventilation measures here.
The MAICOairplan planning tool allows you to plan your decentralised heat recovery units perfectly.

MAICOairplan – the configuration software

Simple planning at the highest level

1. High-quality planning tool in accordance with DIN 1946-6
2. Free for existing MAICO customers and potential customers of MAICO heat recovery units simply download from the MAICO website
3. Intuitive operation without any time-consuming instruction
4. Time-saving analysis of a residential unit to determine the necessity of ventilation measures (ventilation certificate in accordance with DIN 1946-6)
5. Convenient recording of all rooms in the residential unit
6. Automatic creation of an offer and if required, a specification schedule
7. Different output formats (PDF, GAEB and many others)
8. Individually configurable output documents (ventilation certificate, DIN report, volumetric flow overview, ducting plan and many others).
9. Data protection – MAICOairplan is not an online tool, this means that 100 % of your customer and project data is stored on your computer

2 Basis for planning

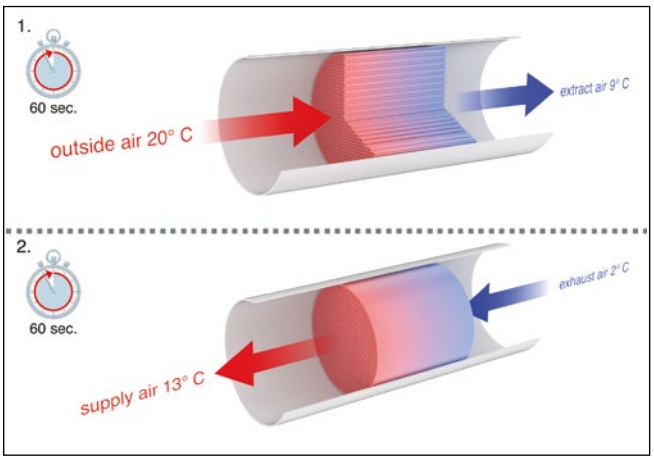
2.1 Ceramic heat storage tank and enthalpy heat exchanger at a glance

2.1.1 Ceramic heat storage tanks

Heat is recovered on the basis of the regenerator principle. This involves the ceramics absorbing and releasing the space heat in turn. This heat can be recovered such that more than 84 % of it is retained. Because of the different air directions, this is known as an alternating operation or push-pull principle.

How ceramic heat storage tanks work

The outside air and internal air for ventilating the living space are drawn through the ventilation unit at a defined interval of 60 seconds. The reversing fan runs in one direction for 60 seconds and transports the used air to the outside. As this happens, the ceramic heat storage tank stores the heat from the used air being removed from indoors. After 60 seconds, the reversing fan changes its direction of rotation and cold outside air now flows into the living space. The stored heat is transferred back to the fresh air.

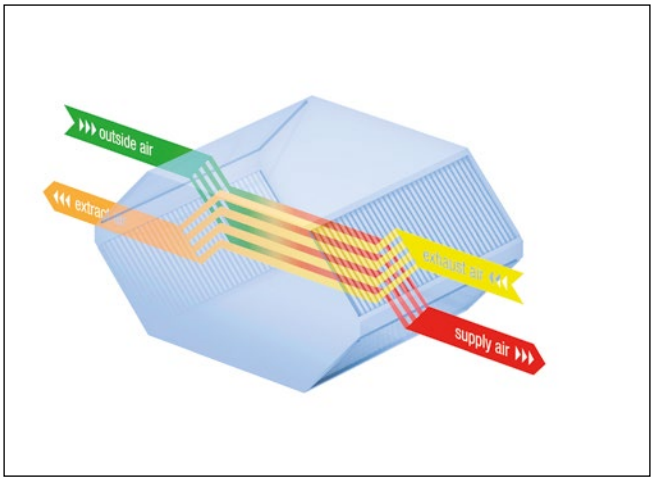


2.1.2 Enthalpy heat exchangers

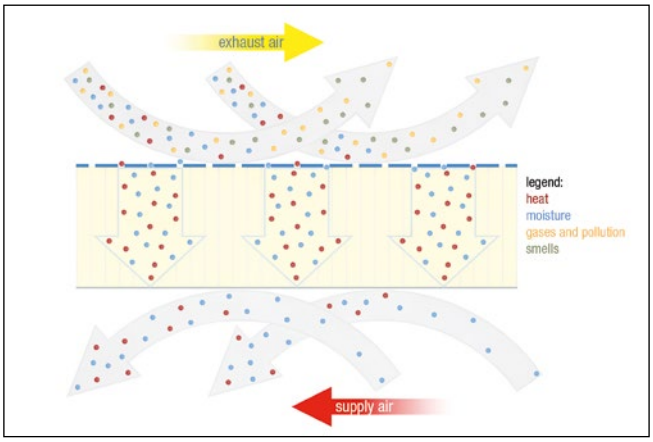
The enthalpy heat exchanger is able to transfer moisture from the exhaust air into the fresh flow of supply air. This latest-generation humidity heat exchanger is a special enthalpy exchanger with an integrated polymer film and/or polymer membrane, which separates the flows of supply and exhaust air.

How the enthalpy heat exchanger works

The principle of osmosis is used to transport humidity through the pore structure of a special polymer membrane. Water molecules of the extracted room air settle on the transfer surfaces of the heat exchanger, from where they migrate through the membrane (osmosis).



Thanks to a special coating, the polymer is impermeable to all kinds of microbes. Hygiene is therefore ensured in homes even if exhaust air from kitchen and sanitary areas passes the heat exchanger.
Compared with a standard heat exchanger, the degree of heat provision of the sensitive heat transfer falls slightly, but the energy stored in the water vapour produces an improved overall energy balance for heat recovery in ventilation units with an enthalpy exchanger.



Facts about enthalpy heat exchangers

- Significantly more pleasant environment because both humidity and heat are recovered. The enthalpic degree of heat provision is up to 120 %, 60-70 % of humidity can be removed in the process.
- High levels of sensitive and latent transfer performance.
- Gases and impurities are not transferred.
- Anti-microbial properties of the polymer film (polymer membrane). It is resistant to mould and bacteria.
- Can be washed using water.
- Frost and heat tolerant.

2.2 Using air filters

Reasons for using air filters in decentralised ventilation units:

- **Fine filter for the outside air**: Filtering takes place regardless of outside pollution and air enters living rooms free from pollution. The heat exchanger and supply air fan therefore remain clean. This results in “pollen filtering”, much lower levels of fine dust and therefore much better air quality in interior rooms. Coupled with the controlled air exchange, this helps prevent illness.
- **Coarse filters for exhaust air:** Used to prevent the heat exchanger and exhaust air fan from becoming too dirty and thereby to extend their service lives.

Air filter classification

In 2018, **DIN EN ISO 16890** superseded the former DIN EN 779. This European standard evaluates the effectiveness of air filters to various fine dust fractions in PM (Particulate Matter).

Class	Fine dust	Example of particles	Deposition of particles
ISO ePM_1	Up to 1 µm	Viruses, combustion particles, nano particles enter the alveoli and blood stream	
ISO $ePM_{2.5}$	Up to 2.5 µm	Bacteria, fungus	Enter the lower respiratory tract
ISO ePM_{10}	Up to 10 µm	Pollen, dusts, large particles	Enter the upper respiratory tract
ISO Coarse	Large dust particles	Sand, hairs, fluff	-

The new filter classification was introduced because over the last few decades a lot more research has been done on the effect of fine dust on human health. It was discovered that fine dust is a serious risk to health and contributes to and may even trigger complications in the respiratory tract and cardio-vascular diseases.

Filter classes according to DIN EN 779 compared with filter classes according to DIN EN ISO 16890

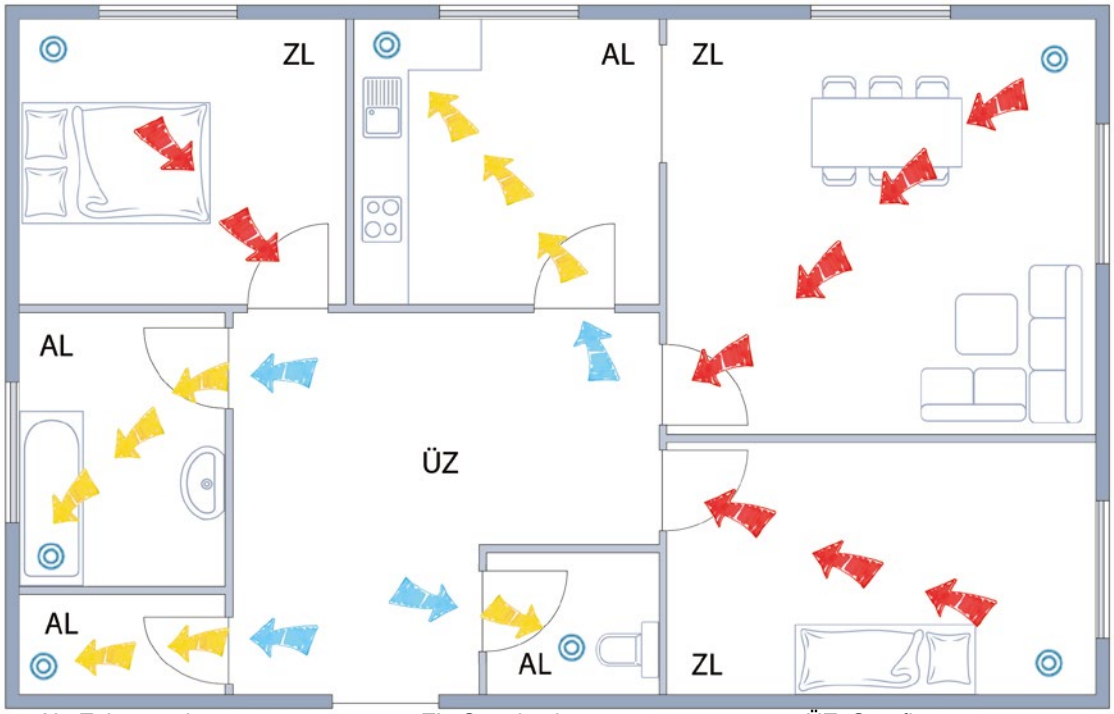
Filter class in accordance with EN 779	Filter class in accordance with ISO 16890
G2	ISO Coarse > 30%
G3	ISO Coarse > 45%
G4	ISO Coarse > 60%
M5	$ePM_{10} \geq 50\%$
M6	$ePM_{2.5} \geq 50\%$
F7	$ePM_{1} \geq 50\%$
F8	$ePM_{1} \geq 70\%$
F9	$ePM_{1} \geq 80\%$

Further filter classes according to EN 1822

Filter class in accordance with EN 1822	Separation rate
H13	99,95%
H14	99,995%

2.3 Cross-ventilation principle

The principle of what is known as “cross-ventilation” is usually used around the clock and reduces the thermal losses of ventilation in buildings with heat recovery units by up to more than 96%. Fresh air is supplied to the living rooms, flows very slowly over the overflow areas to the exhaust air rooms where it is removed directly as used exhaust air with high humidity and odour levels.

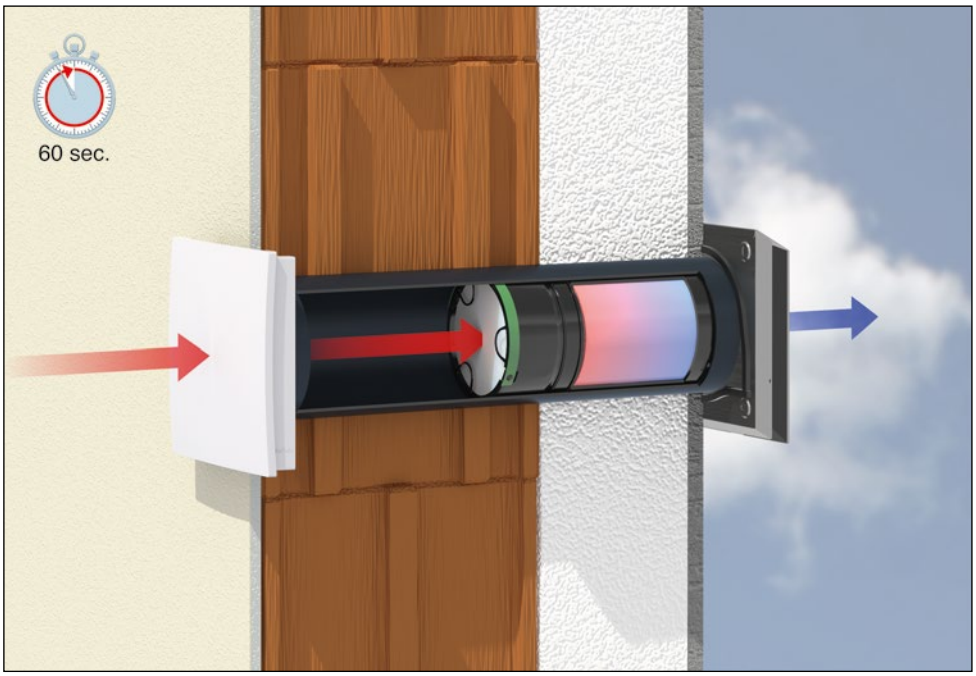


AL: Exhaust air room ZL: Supply air room ÜZ: Overflow area

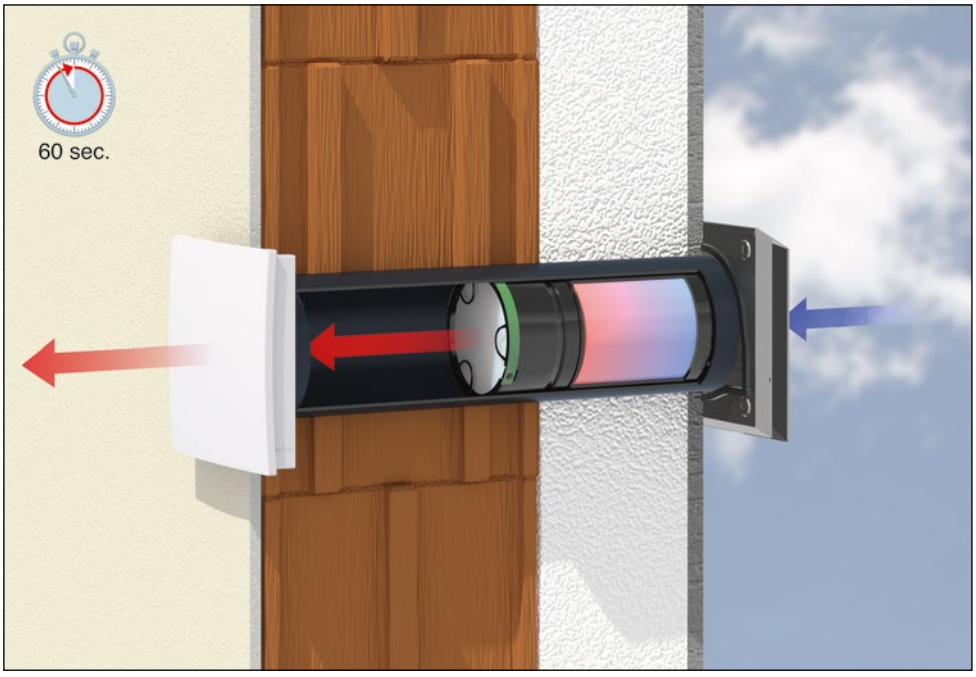
2.4 Push-pull principle of the PP 45 decentralised ventilation unit

MAICO's PP 45 ventilation units for supply air rooms and PPB 30 ventilation units for exhaust air rooms are the ideal supplements for decentralised ventilation solutions. Thanks to their numerous potential combinations, the easy-to-fit system is extremely well suited to both flats and single-family units. The units with efficient heat recovery guarantee an optimum indoor climate in both new buildings and renovation work.

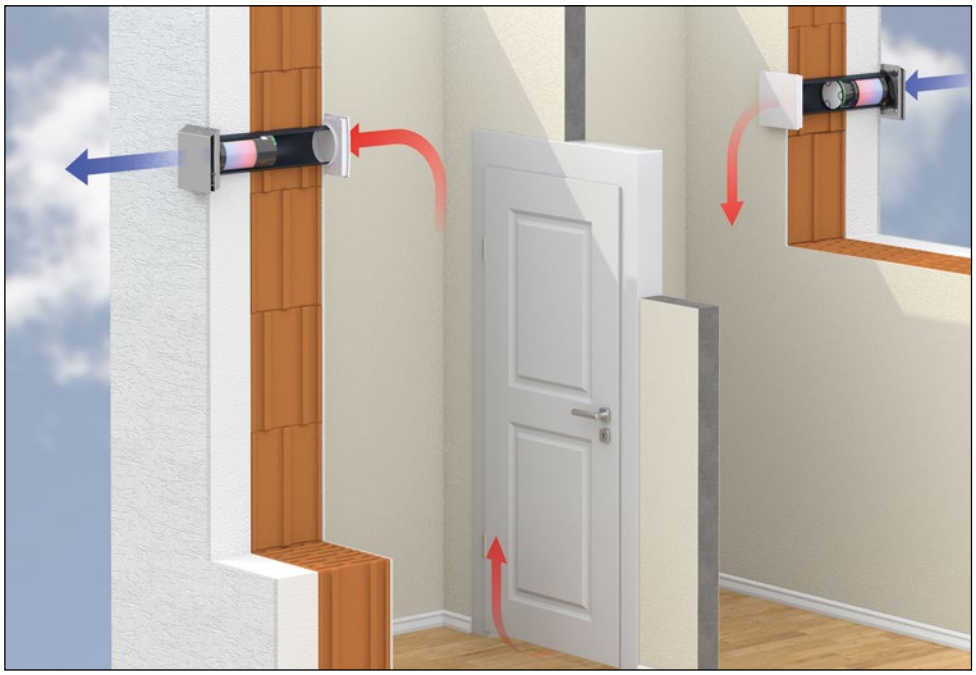
A pair of PushPull 45 units works in turn: one unit conveys used and humid air out of the room. The thermal energy is temporarily stored in the ceramic heat storage tank. Using the ceramic heat storage tank, at the same time the second unit conveys filtered and heated fresh air into the room.



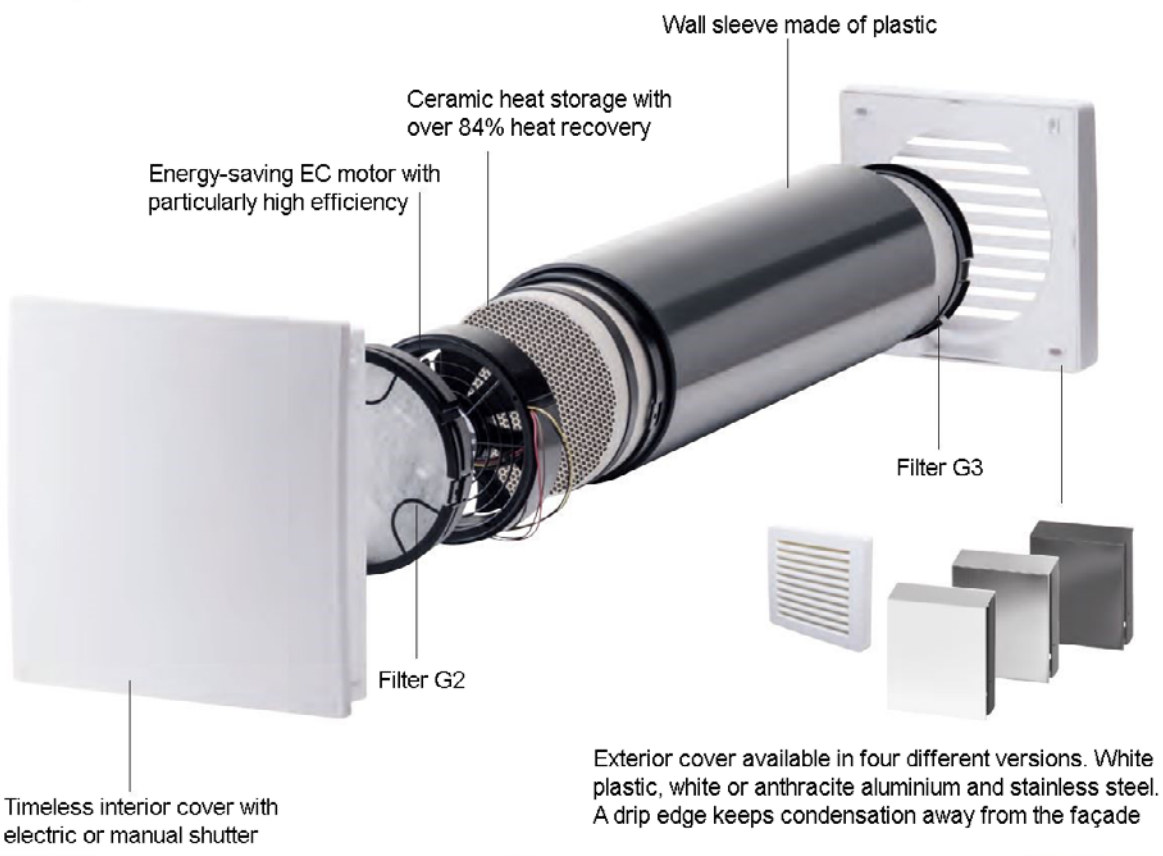
Approx. one minute later, the two units change their direction of ventilation.



The corresponding ventilation unit can be located in the same room or a neighbouring room. In this case, undercut door leaves allow air to circulate between the rooms.



2.4.1 Design of the PP 45 decentralised ventilation unit



A PP 45 unit consists of

- a heat exchanger,
- a reversible fan,
- 2 filters (filter class G2 for indoors and filter class G3 for outdoors) for better air filtration.

PP 45 ventilation units with heat recovery are used for ventilation and air extraction of apartments, offices and similar rooms. They are suitable for new buildings and renovation work. The units are designed for 24h operation. The housing unit's ventilation system should be configured in accordance with DIN 1946-6.

PP 45 are ventilation units, which are generally only suited to use in supply air rooms. To achieve efficient ventilation of PP 45 units, we would recommend operating the PP 45 ventilation units in pairs with alternating ventilation and air extraction.

The PP 45 ventilation units are suitable for installation in external walls (wall thickness 265-790 mm). The installation position should have a slight incline towards the outside wall. The electrical connection is made to a permanent electrical installation.

The ventilation units are operated using a room air control suited to the unit type:

- RLS 45 O or RLS 45 K control for PP 45 O/K and PPB 30 O/K.
- Radio switch DS 45 RC for PP 45 RC/PPB 30 RC.
- Alternatively with RLS 45 K + PP 45 EO radio extension module.

2.4.2 Possible functions of the PP 45 decentralised ventilation unit

Dehumidification function of the RLS 45 O/K room air controls

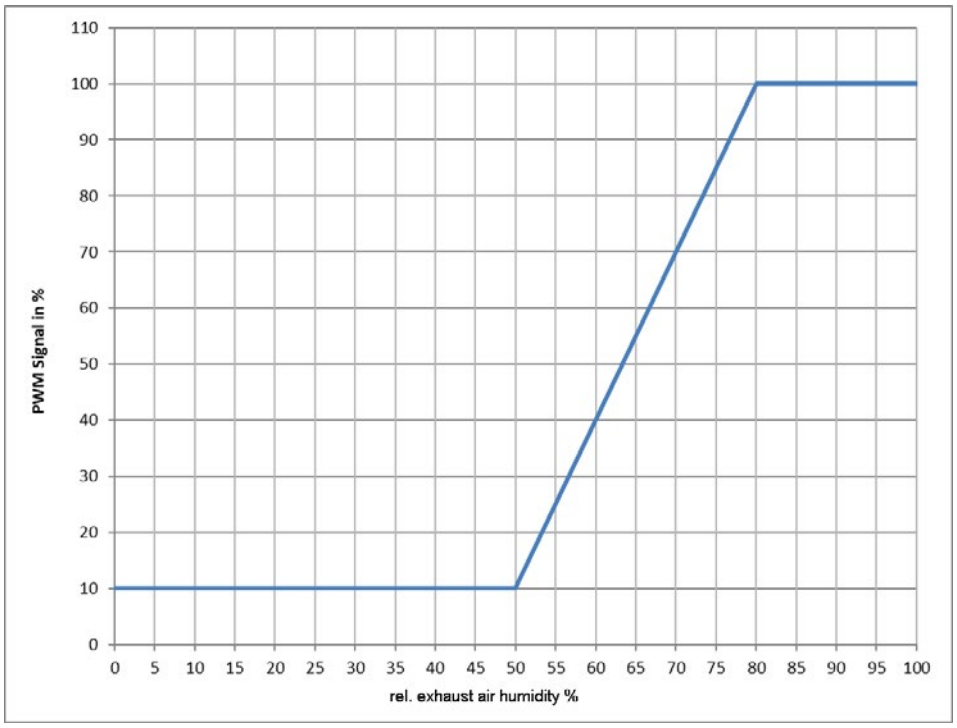
RLS 45 O

RLS 45 K

Each control (RLS 45 O and RLS 45 K) has a slot for an integrated PP 45 HYI humidity sensor.

The PP 45 HYI humidity sensor can be purchased at a later date and installed subsequently as an option. The control's frame has an opening (sensor opening) at this point so that the room air humidity can be recorded. As soon as the PP 45 HYI humidity sensor is plugged in, the sensor should be activated in the service menu or commissioning software (IBS).

Once the humidity sensor has been installed and activated, the dehumidification program has to be activated. This can be done in both heat recovery unit ventilation and cross-ventilation. Once the dehumidification program is active, the volumetric flow is adapted proportionally to the increase in humidity.



When this happens, the fan gradually increases the volumetric flow, starting from basic ventilation at a relative humidity of 50% and ending with intensive ventilation at a relative humidity of 80%.

The lower and upper limits for the relative humidity can be adjusted by the user in the service menu and/or commissioning software.

Sleep mode and/or party mode for the RLS 45 K room air control

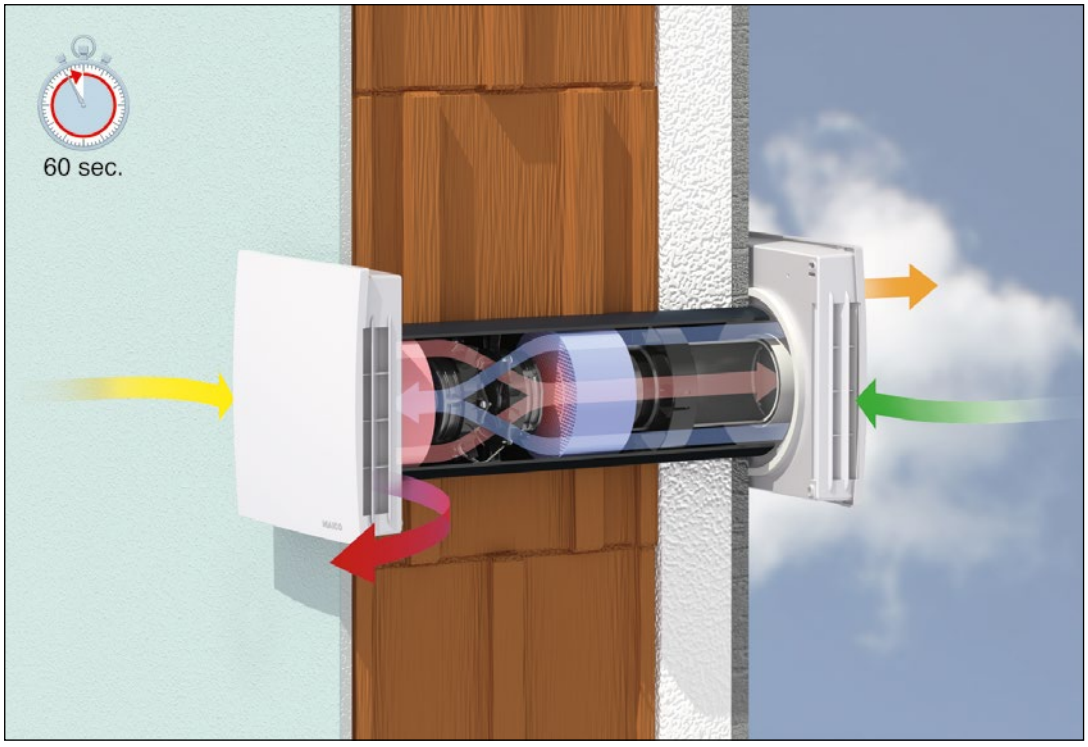
The RLS 45 K control can be put into sleep mode and/or party mode.

In sleep mode, the ventilation unit is shut down for a defined period. Then the ventilation unit starts up again at the preset ventilation level and in the preset operating program. The installer can select a switch-off period of between 15 - 90 min. The factory setting is 60 min.

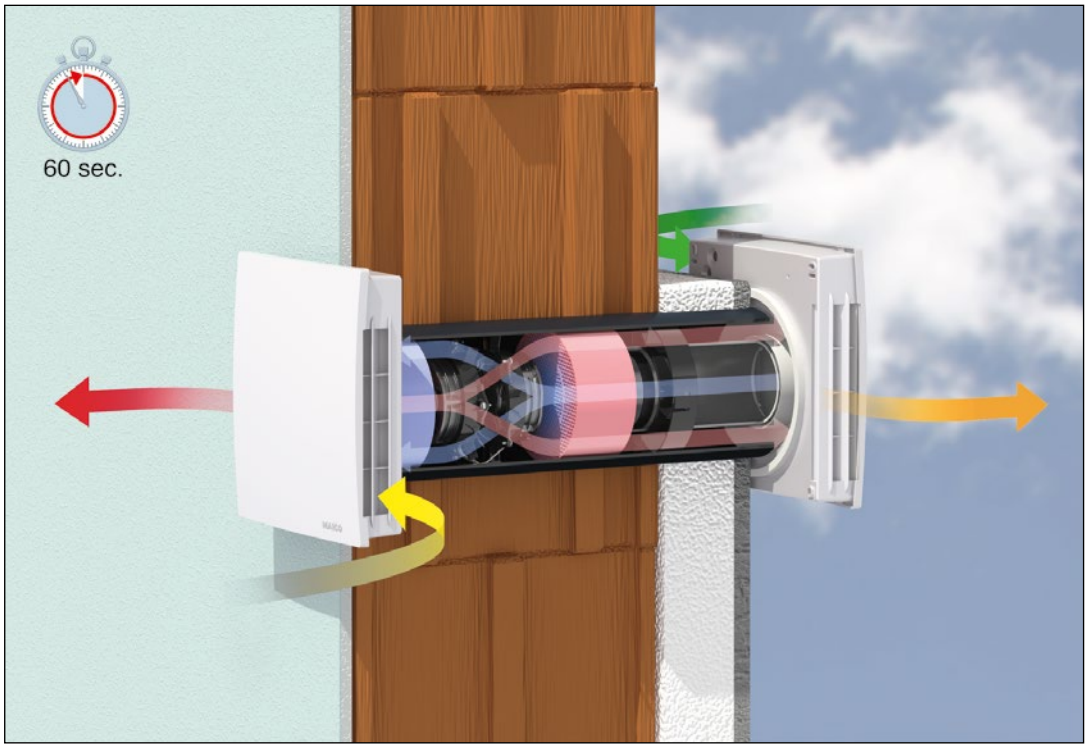
In party mode, the ventilation unit is switched to ventilation level 5 for a defined period. Then the unit starts up again at the preset ventilation level and in the preset operating program. The installer can select a switch-off period of between 5 - 90 min for party modes. The factory setting is 30 min.

2.5 Push-pull principle of the PPB 30 decentralised ventilation unit

The PPB 30 single-room ventilation unit is equipped with two fans and two heat storage tanks. This ensures a continuous, heated supply of air into exhaust air room such as kitchens, bathrooms and WCs. While one heat storage tank absorbs and stores the heat when in exhaust air mode, the other heat storage tank releases the previously absorbed thermal energy to the incoming room air when in supply air mode.



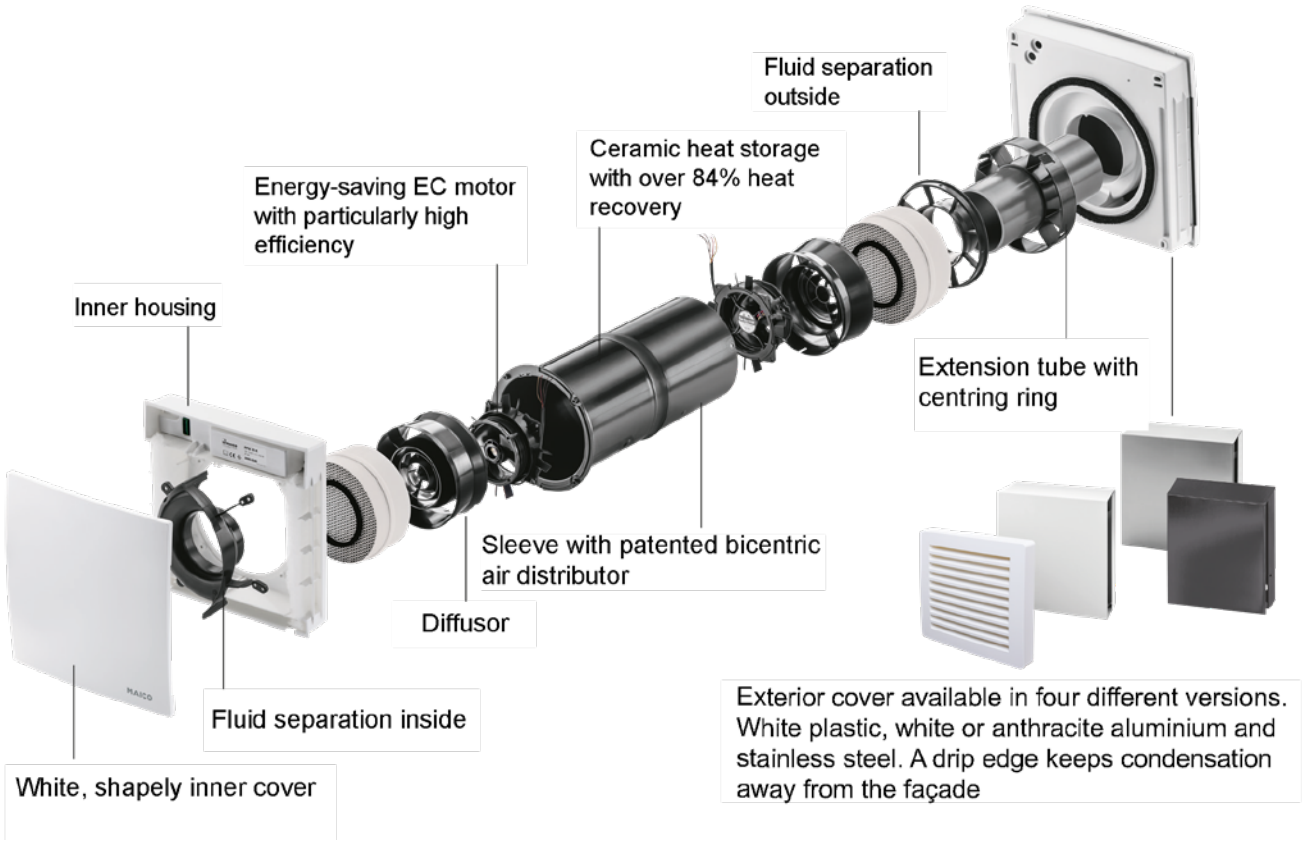
Every 60 seconds, once the thermal energy has been absorbed or released, the fans change air direction, ensuring continuous heat recovery.



Intensive ventilation can be activated via a humidity sensor or manually with a button if the humidity is high and/or if the air quality is inadequate.

Pure exhaust air mode is also possible. This involves both fans in the ventilation unit removing humidity. However, heat recovery does not take place with this function.

2.5.1 Design of the PPB 30 decentralised ventilation unit



A PPB 30 unit consists of

- two fans,
- two ceramic heat exchangers,
- internal cover with two G3 filters.

PPB 30 ventilation units with heat recovery are used for air ventilation and air extraction of apartments, offices and similar rooms. They are suitable for new buildings as well as renovation work. The housing unit's ventilation system should be configured in accordance with DIN 1946-6.

PPB 30 are balanced ventilation units, preferably intended for use in exhaust air rooms, such as a bathroom, WC or kitchen with a window. They ventilate and extract air from the rooms at the same time. Exhaust air mode is started automatically depending on the setting or can be started manually at the touch of a button.

The PPB 30 ventilation units are stand-alone units or can be used in groups with other PPB 30/PP 45 ventilation units. The PPB 30 ventilation units have degree of protection IP X4. The protection zone must be determined depending on the unit variant used.

PPB 30 ventilation units are installed in outside walls (wall thickness 320-790 mm, installation position with slight incline towards the outside wall) and are connected to a permanently wired electrical installation.
The PPB 30 models are available as "O" for object, "K" for comfort and the radio version "RC".
The units are operated using an RLS../DS. room air control suitable for the type. The PPB 30 K unit variant can only be operated with the RLS 45 K control.

PPB 30 RC ventilation units can also be operated using a DS 45 RC radio switch. Alternatively with the RLS 45 K room air control and the PP 45 EO radio extension module.

2.5.2 Special features of PPB 30 PushPull Balanced

PPB 30 O

Like the PP 45 ventilation units, the PPB 30 O ventilation unit without humidity sensor is connected to the interface of the fan (Fan1/Fan2) on the RLS 45 O room air control. Note that the RLS 45 O room air control should be used to operate PPB 30 O units.

If just one PPB 30 O ventilation unit is connected to the RLS 45 O room air control, exhaust air mode (45 m³/h) can be activated by pressing the “Ventilation level” button for more than 2 seconds.

PPB 30 K and PPB 30 RC

The PPB 30 K ventilation unit is connected to the bus (RS485 interface) of the RLS 45 K or RLS 45 O controls. Note that the PPB30 K units can only be controlled with the RLS 45 K control. The PPB 30 RC ventilation unit is taught into the PP 45 RC/ PPB 30 RC/ DS 45 RC system using EnOcean wireless. Another special feature of the PPB 30 K-/ PPB 30 RC ventilation units is that the humidity sensor is installed as standard.

PPB 30 K-/PPB 30 RC ventilation units have **two operating modes:**

Automatic operation

The unit runs totally independently and controls the volumetric flow continuously using values measured by its own humidity sensor. Only the continuous ventilation with heat recovery and cross-ventilation without heat recovery operating programs are adopted by room air control as is ventilation level 0, external switch-off and the sleep function.

Intensive ventilation or exhaust air mode can be activated driven by demand via a humidity sensor or manually with a button if the humidity is high and/or if the air quality is inadequate. The settings for intensive ventilation or exhaust air mode can be conveniently and easily configured in the commissioning software or service menu.

System operation

All functions are adopted by the room air control. If the humidity value in the bathroom exceeds the set value, the unit disconnects from the control and extracts air according to the humidity value settings. Intensive ventilation or exhaust air mode can be activated driven by demand via a humidity sensor or manually with a button if the humidity is high and/or if the air quality is inadequate. Again here, the settings for intensive ventilation or exhaust air mode can be conveniently and easily configured in the commissioning software or service menu.

Dehumidification function of PPB 30 ventilation unit

With the PPB 30 K / PPB 30 RC ventilation units with a humidity sensor installed as standard, the dehumidification function can be freely determined by the user. The following options are available:

Intensive ventilation at 26 m³/h (with heat recovery)

Once the set humidity limit value is reached, the unit switches to intensive ventilation (level 5 = 26 m³/h). In this mode, the ventilation unit continues to run in PushPull mode with heat recovery.

Exhaust air at 45 m³/h (without heat recovery)

Once the set humidity limit value is reached, the ventilation unit switches to exhaust air ventilation. In this mode, the two fans switch to exhaust air, i.e. the humid air is removed from the room by both fans at a volumetric flow of 45 m³/h. Heat recovery does not take place.

The PP 45 ventilation units ensure volumetric flow compensation when the PPB 30 K / PPB 30 RC ventilation units are operated in a system with the PP 45 ventilation unit and RLS 45 K room air control or the PP 45 RC ventilation unit and DS 45 RC radio switch. For as long as the PPB 30 K/RC unit is running in the bathroom in exhaust air mode, the PP 45 units will provide the supply air needed. This operation is compliant with DIN 1946-6. The prescribed volumetric flow of 40 m³/h is attained or exceeded.

Wireless version of the PP 45 and PPB 30 ventilation units

The PP 45 ventilation units are also available in a wireless version.

We would recommend installing the wireless version in renovation work in particular if the existing walls are not to be damaged (e.g. tiled walls). This spares the installer from having to route cables between the control and unit. The ventilation unit is supplied directly with 230 V. The ventilation units are controlled using the DS 45 RC radio pushbutton. The radio pushbutton is based on EnOcean technology and is completely self-sufficient in terms of energy, i.e. no batteries are needed to generate a radio telegram. It can be simply affixed on any surface (glass, tiles) and is also suited to mounting on the wall.

The wireless units are ideally installed in pairs. During installation, you will need to decide which unit is to be set up as the master and which as the slave. The radio switch is set up on the master.

The optional PP 45 HYI humidity sensor is installed on the master unit. Other EnOcean sensors can be set up on the master.

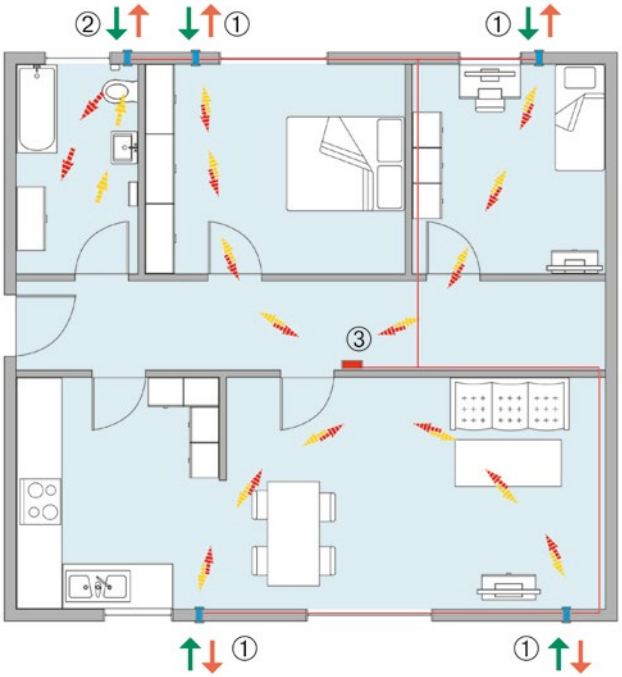
2.6 Installation solutions with various possible combinations

Wired installation solution

Through its PushPull ventilation units, MAICO provides optimum ventilation solutions for various requirements.

- Complete decentralised ventilation system with PP 45 ventilation units for supply air rooms and PPB 30 for exhaust air rooms, each with heat recovery.
- Simple ventilation solution with PP 45 units for supply air rooms only.
- Extended ventilation solution with the ECA 100 ipro and/or ER EC exhaust air units without heat recovery in bathrooms and WCs.
- Separate ventilation solution in exhaust air rooms - “Stand-alone solution” with PPB 30 with heat recovery in bathrooms and WCs.

Wired ventilation solution taking the example of a 3-room apartment
PP 45 O / K for the living rooms and PPB 30 K for the bathroom.



① PP 45 ventilation unit in continuous operation with heat recovery

② PPB 30 K ventilation unit in continuous operation with heat recovery

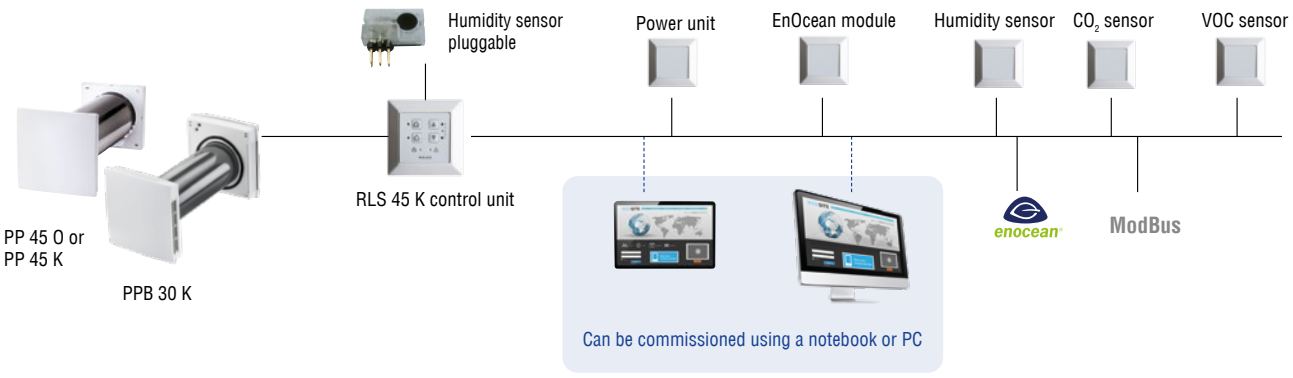
③ RLS 45 K control unit

12 V control and power cable
Star-shaped wiring from control unit to units

Supply air and exhaust air with change of direction

Outside and outgoing air with change of direction

Intelligent PP 45 O / K building technology with PPB 30 K and RLS 45 K control unit

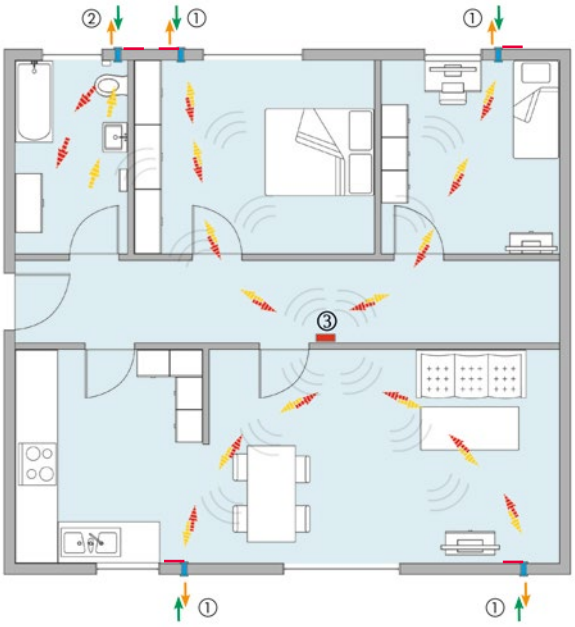


Wireless installation solution

Combined operating solution involving a PP 45 with PPB 30 – wired or wireless.

- The PP 45 and PPB 30 units ventilate and extract air together as standard in a balanced continuous operation.
- When humidity levels in the bathroom are high, the PPB 30 runs automatically in exhaust air mode (45 m^3/h). This function can also be activated manually using a pushbutton / switch if necessary.
- At the same time, the PP 45 units increase their supply air levels and together with the PPB 30 deliver volumetric flow compensation.
- Once the humidity has been removed from the room, all units again run in normal operation.

Wireless ventilation solution taking the example of a 3-room apartment
PP 45 RC for the living rooms and PPB 30 RC for the bathroom.



① PP 45 RC ventilation unit in alternating operation with heat recovery

② PPB 30 RC ventilation unit in continuous operation with heat recovery

③ DS 45 RC radio switch

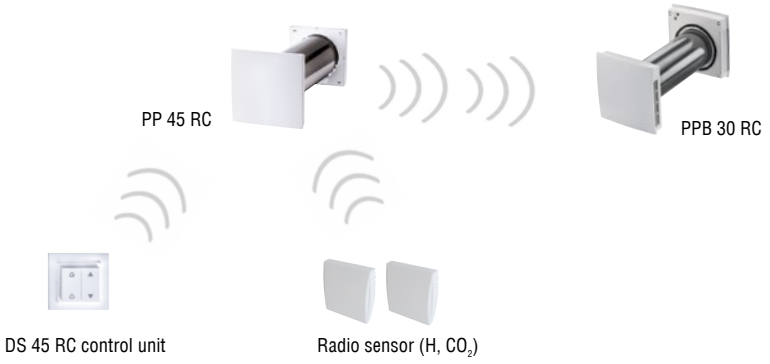
230 V power cable connection

Short radio signal for control commands

Supply air and exhaust air with change of direction

Outside and outgoing air with change of direction

PP 45 RC / PPB 30 RC intelligent building technology and DS 45 RC control unit



More ventilation units and sensors can be connected and controlled using the EnOcean module connector and RLS 45 K control unit.

2.7 Control variants for various installation scenarios - joint control for PP 45 and PPB 30

With three control variants for various installation scenarios, an optimum ventilation solution almost always available.

The controls also provide other benefits:

- Sleep function – the ventilation units can be switched off for set periods.
- Humidity sensor already integrated or can be plugged on as external sensor.
- Time-limited “intermittent ventilation”, the “used air” can be quickly transported away if necessary.
- Additional PushPull units can be controlled with the optional PP 45 LT power unit.

1 RLS 45 O / object variant control unit

The PushPull units are controlled using a cable connection

Extension module

– Plug-in PP 45 HYI humidity sensor

Unit functions

– 5 ventilation levels with various air volumes
– 3 operating programs, can be set individually:
· ventilation with heat recovery
· cross-ventilation, without heat recovery, no time limits
· automatic operation, e.g. with humidity sensor

Options for connecting units

– Up to 6 PP 45 O units can be controlled
– Or up to 3 PPB 30 O units can be controlled

2 RLS 45 K / comfort variant control unit

The PushPull units are controlled using a cable connection

Extension modules

– PP 45 EO EnOcean module
– Sensors, external
· PP 45 HY humidity sensor,
· CO_2 sensor PP 45 CO_2,
· PP 45 VOC air quality sensor

Unit functions

– 5 ventilation levels with air volumes:
– 3 operating programs, can be set individually:
· ventilation with heat recovery
· cross-ventilation, without heat recovery, no time limits
· automatic operation, e.g. with humidity sensor
– Party ventilation: time-limited intermittent ventilation at level 5 (with or without heat recovery)
– Sleep function: the connected units are switched off for a limited period.

Options for connecting units

– Up to 6 PP 45 K units can be controlled
– Up to 4 PP 45 K units + 1 PPB 30 K unit can be controlled
– Up to 3 PPB 30 K units can be controlled
– With the optional PP 45 LT power unit other units can be controlled
– PP 45 combination with ER, ECA exhaust air units as can be implemented in a bathroom, WC, kitchen, for example (not in combination with PPB 30)

3 **DS 45 RC control unit/ wireless variant**

The PushPull units are controlled using the radio switch.

The switch employs EnOcean technology and does not need a battery.

Humidity sensor already integrated in PP 45 RC and PPB 30 RC

Unit functions

– 5 ventilation levels with air volumes.
– 3 operating programs, can be set individually:
  · ventilation with heat recovery
  · cross-ventilation, without heat recovery, no time limits
  · automatic operation, e.g. with humidity sensor
– Intermittent ventilation at level 5 with or without heat recovery,
  for a limited period.
– The PushPull units can be switched off for a limited period in sleep mode.

Overview of Push-Pull controls and their associated components

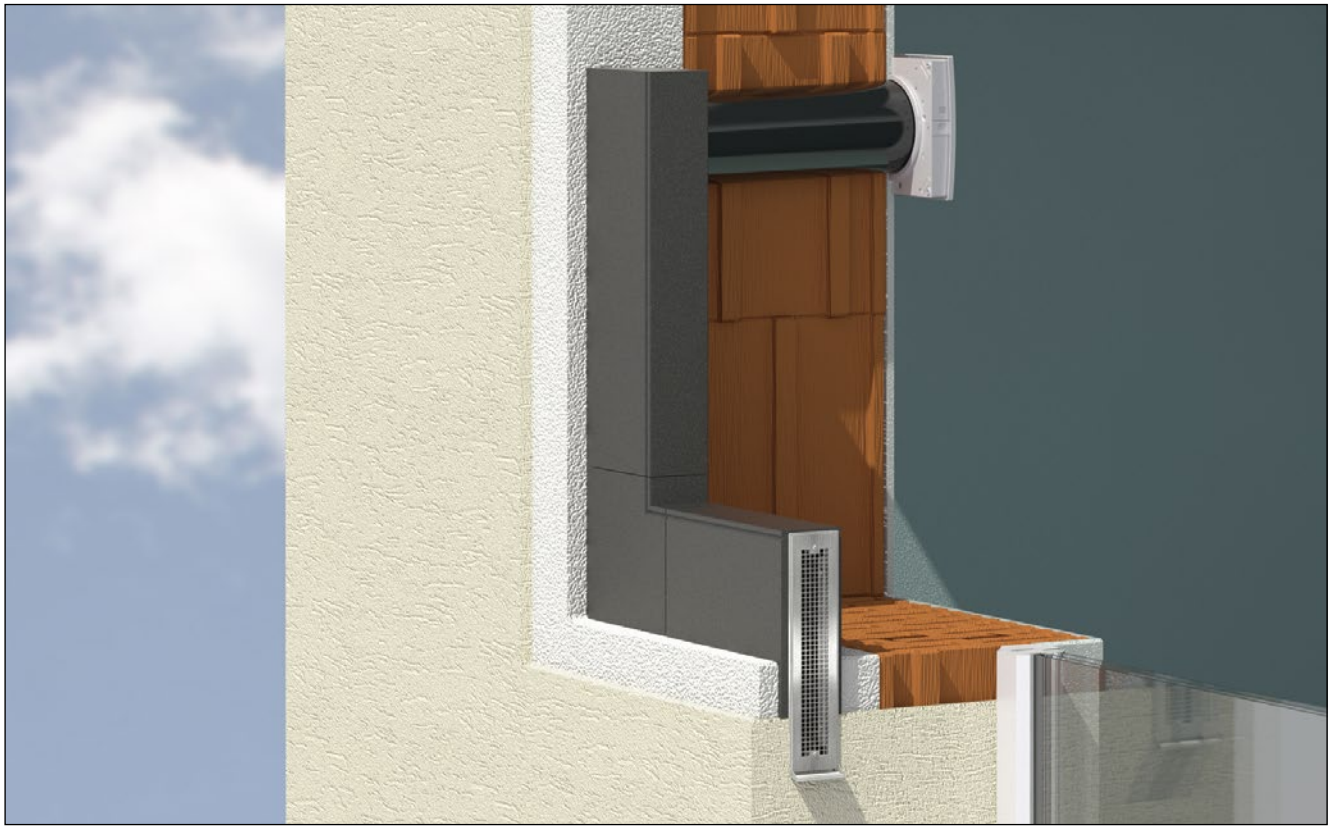
Control unit / control	Article	Article no.
Object variant	RLS 45 O	0157.0359
Comfort variant	RLS 45 K	0157.0360
Wireless variant	DS 45 RC	0157.0363

Control components / extension modules	Article	Article no.
Humidity sensor internal, pluggable	PP 45 HYI	0157.0364
Humidity sensor, external	PP 45 HY	0157.0365
CO_2 sensor, external	PP 45 CO2	0157.0366
VOC sensor, external	PP 45 VOC	0157.0367
EnOcean extension module	PP 45 EO	0157.0362
Power unit	PP 45 LT	0157.0361

2.8 Sound reduction measures for PP 45 and PPB 30

PP 45 LE/LEV/LEW90 soffit element

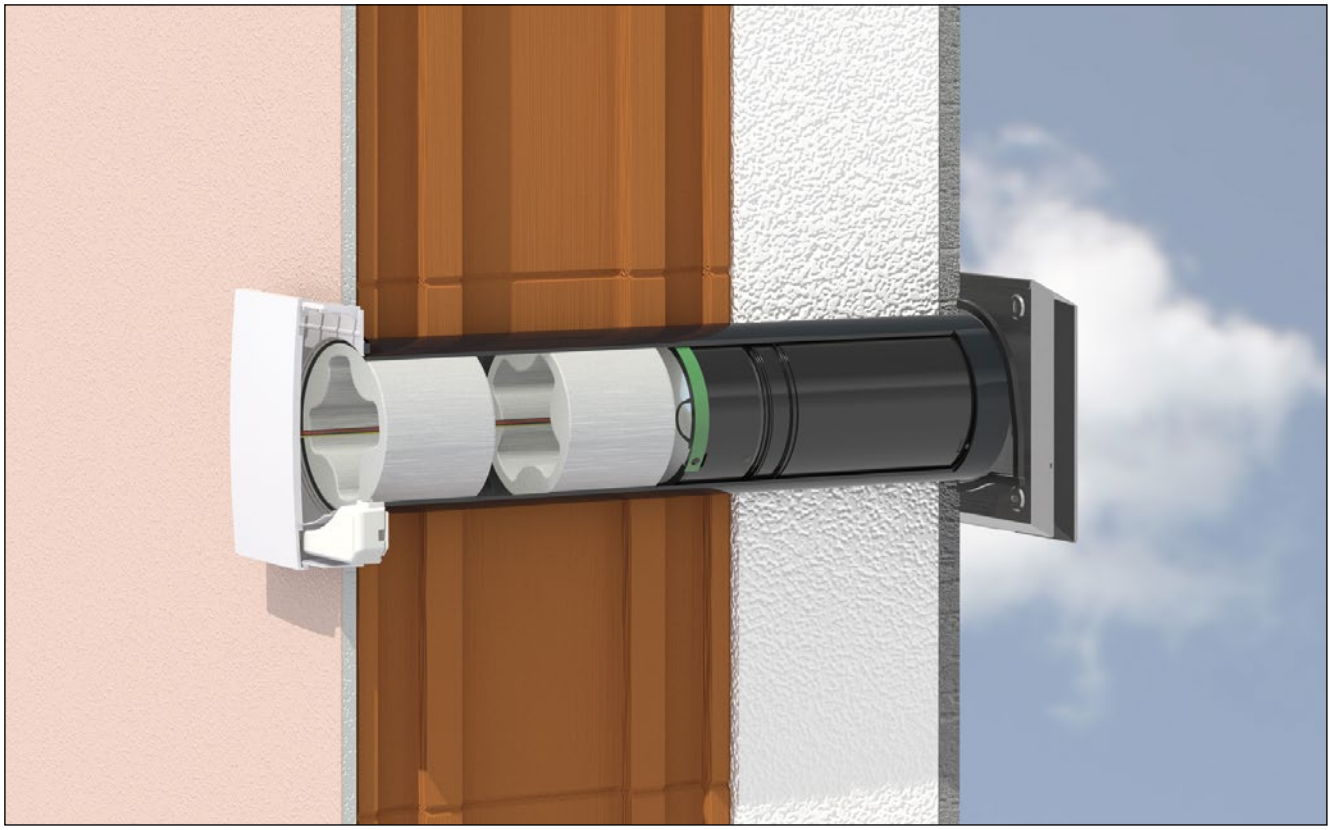
The PP 45 LE window soffit element is fitted in the thermal insulation composite system layer. By deflecting the air flow 90°, it provides an elegant solution for making the external cover of the PushPull unit virtually invisible in the window soffit. Another advantage of using window soffit elements is that it minimises noise (both noise from the unit and from outside).



Using other components, such as the PP 45 LEV extension and PP 45 LEW90 90° bracket, provides scope for great flexibility in locating the PushPull unit next to the window. By using the 90° bracket and by further deflecting the air flow as a result, the sound deadening is boosted by another 5 dB.

PP 45 SE sound-absorbing unit

Another way to minimise noise (both noise from the unit and from outside) is to use the PP 45 SE sound-absorbing elements.



When using these elements, the PP 45 slide-in module is slid out as far as possible from the room side. The sound-absorbing elements can then be inserted from the inside.

By using two sound-absorbing elements which are rotated 45° in relation to one another, a sound reduction of up to 3.5 dB can be achieved.

2.9 System configuration for PP 45 and PPB 30

Important points to consider when configuring the decentralised PushPull ventilation:

- a correctly calculated amount of air in accordance with the requirements of DIN 1946-6.
- For reasons of comfort, we would recommend configuring the ventilation system to deliver an air exchange rate of around 0.3-0.8 [1/h]. Pay special attention to the air exchange rates in DIN 1946-6.
- The PP 45 / PPB 30 units are only fitted in external walls.
- We recommend PPB 30 units for exhaust air rooms such as WCs, bathrooms, kitchens.
- We would recommend using the PP 45 units in pairs for efficient ventilation.
- For smaller rooms (up to approx. 20 m²), you only need one PP 45 ventilation unit per room. The occupancy level should be taken into account. Air is exchanged between the rooms and/or with the other unit by means of a door undercut and/or door ventilation grille.
- In larger rooms, we would recommend using two or more PP 45 units per room. And the units should be positioned as far apart as possible.
- To achieve efficient ventilation with the PPB 30 ventilation unit, a fresh supply of sufficient supply air should be ensured. This is achieved by designing a system including the control and PP 45 units. A fresh air supply is needed when the PPB 30 unit is in exhaust air mode.
- The installation instructions provided with the units should be observed.
- Appropriate overflow openings must be provided.

2.10 System description of PP 45 / PPB 30 with ECA/ER EC exhaust air solution

Ventilation solution in a single-family unit with or without heat recovery in exhaust air rooms

MAICO's PPB 30 provides another option for single-family units or flats where the exhaust air rooms are located right next to an outside wall. The ECA 100 ipro exhaust air fan extracts air for a limited period as required.

Mode of operation

• The PP 45 units ventilate and extract air as standard in a balanced continuous operation.

- An odd number of PP45-ventilation units can also be installed.
- If necessary, the on/off switch in the guest WC can be used to activate the ECA 100 ipro or PPB30 K exhaust air unit in the bathroom.
- The PP 45 units ensure volumetric flow compensation and the supply air increases at the same time.

PushPull PP 45

PushPull PPB 30 Balanced

ECA 100 ipro optional

Ventilation solution in a single-family home with comfort units

① PP 45 ventilation unit in continuous operation

② PPB 30 K ventilation unit in continuous operation

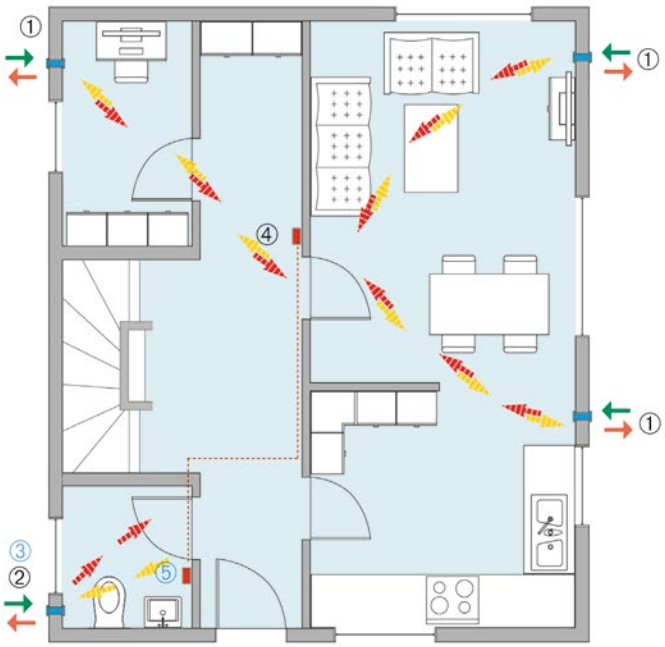
③ Exhaust air unit ECA 100 ipro, Air extraction as required without heat recovery

④ Control unit in the corridor RLS 45 K or DS 45 RC

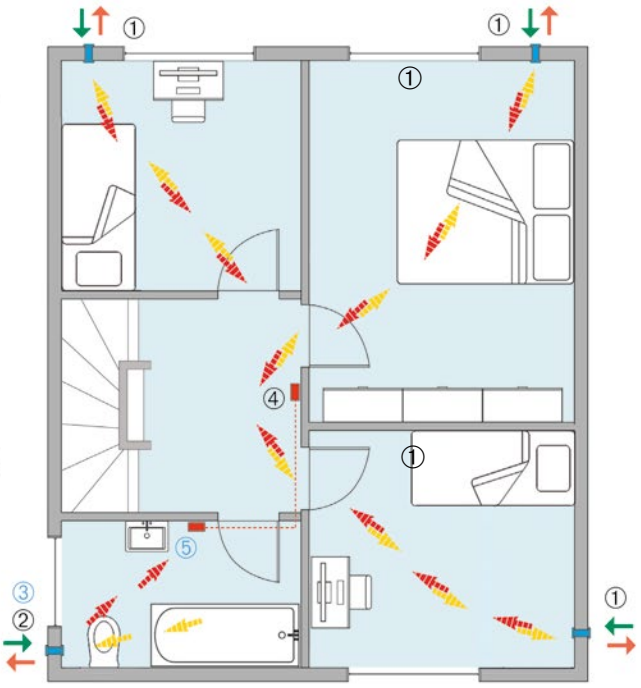
⑤ Switch in the bathroom

Supply and exhaust air with change of direction

Outside and outgoing air with change of direction



Ground floor



Upper floor

Ventilation in a multi-storey residential building in accordance with DIN 18017-3 / DIN 1946-6

By supplying the PP 45 single-room ventilation unit and ER EC exhaust air fan, MAICO also provides an optimum ventilation concept for multi-storey residential buildings with a central exhaust air duct.

Mode of operation

- The PP 45 units ventilate and extract air as standard in a balanced continuous operation
- If necessary, the on/off switch in the bathroom can be used to activate the ER EC exhaust air unit
- The PP 45 units ensure volumetric flow compensation and the supply air increases at the same time
- When the switch is pressed again, exhaust air mode is deactivated and the supply air for the PP 45 units reduces automatically

ER EC

PushPull PP 45

Ventilation solution taking the example of a 3-room apartment in a multi-storey building

① PP 45...ventilation unit in continuous operation

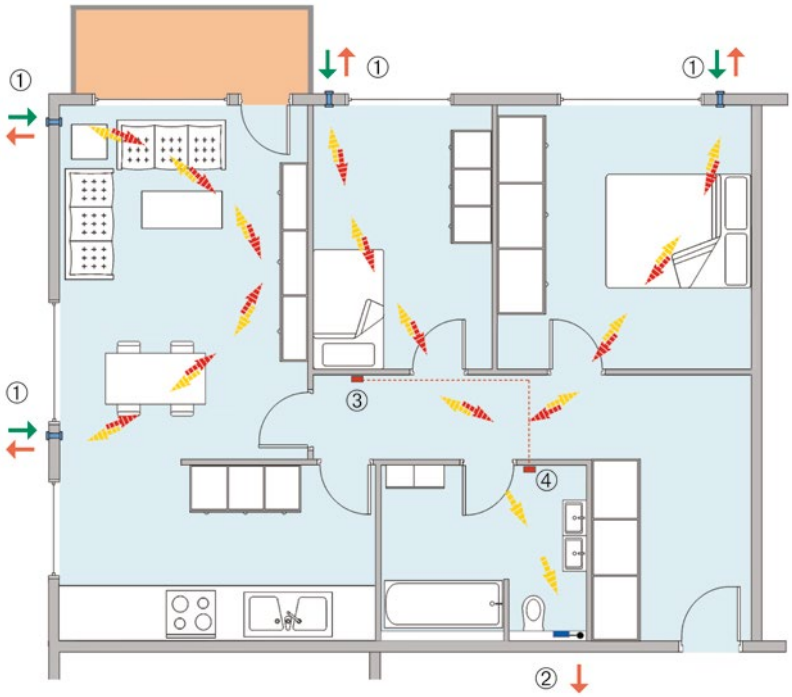
② ER EC exhaust air unit, Demand-based ventilation using ventilation shaft without heat recovery

③ RLS 45 K and/or DS 45 RC control unit in the corridor

④ Switch in the bathroom for ER EC

Supply and exhaust air with change of direction

Outside and outgoing air with change of direction

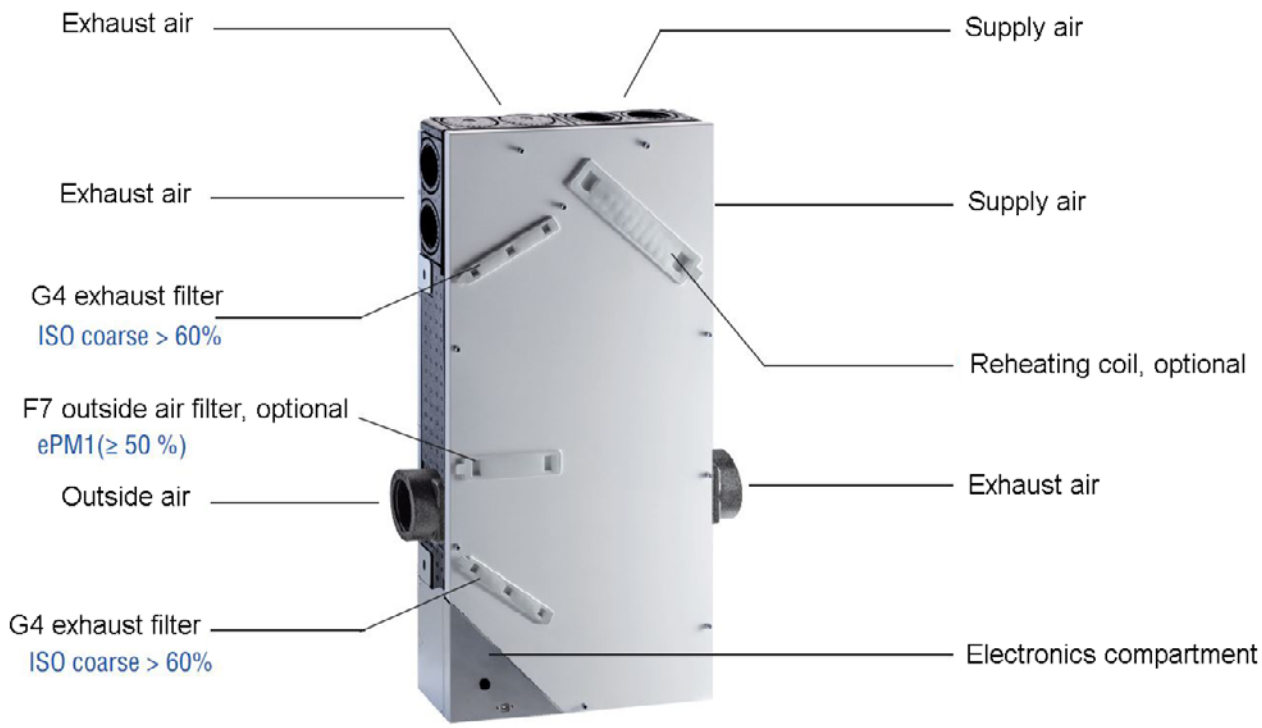


2.11 The decentralised ventilation unit with heat recovery: WS 75 Powerbox

The WS 75 Powerbox is a decentralised ventilation system with heat recovery. It runs permanently with an EC centrifugal fan with constant volumetric flow in both the outside air and outgoing air ducts. The volumetric flow can be controlled manually using the operating options or automatically depending on measurement values such as humidity, CO2 or VOC. The fan in the outside air duct draws in the fresh outside air. This is pre-filtered by a G4 filter and conveyed through the enthalpy heat exchanger into the living space as supply air. In the outgoing air duct, the second fan draws in the used exhaust air from the living space. This is pre-filtered by a G4 filter and conveyed out through the enthalpy heat exchanger as outgoing air. Both fans work with the same quantities of air in parallel and thereby provide a pleasantly fresh indoor climate.

There is also a possibility of filtering the outside air through an M6 filter. Furthermore, the supply air can be pre-heated by an optional supplementary heat register before being conveyed into the living space.

2.11.1 How the WS 75 Powerbox S works



The WS 75 Powerbox consists of

- a high-quality RLS G1 WS glass control element,
- a highly-efficient enthalpy cross-counterflow heat exchanger,
- EC centrifugal fans with constant volumetric flow in outside air and outgoing air,
- temperature and humidity monitoring,
- two G4 filters.

Information on the WS 75 Powerbox H version with the exhaust and fresh air connection at the rear of the unit can be found here.

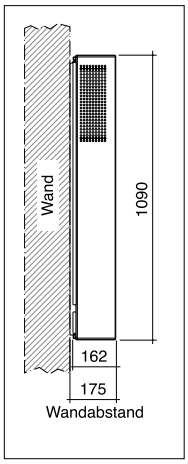
2.11.2 Installation variants of the WS 75 Powerbox

The WS 75 Powerbox is equipped for a wide variety of ventilation solutions and for diverse requirements:

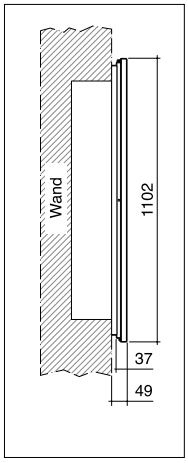
- **Surface-mounted installation**
  - Supply and exhaust air directly via the ventilation unit.
  - Supply and exhaust air via the unit and second room connection via ventilation ducts.
- **Flush-mounted installation**
  - Supply and exhaust air via ventilation ducts.

Dimensions for wall installation

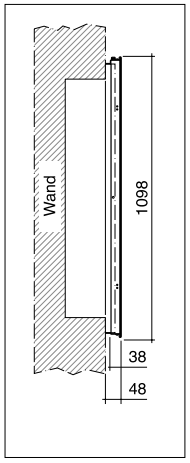
Surface-mounted variant
Unit cover
with glass insert



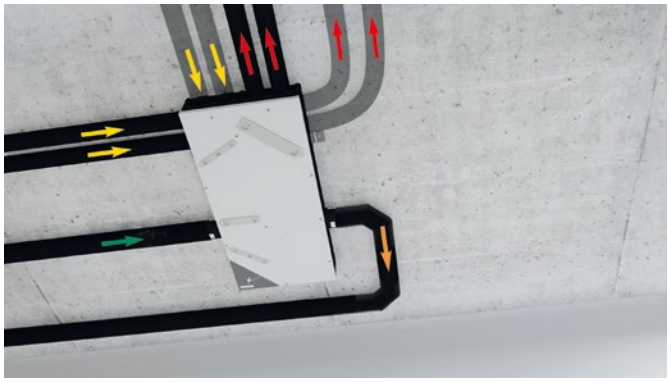
Flush-mounted variant
Unit cover
with glass insert



Flush-mounted variant
Unit cover
made of solid glass



WS 75 Powerbox ceiling installation



WS 75 Powerbox wall installation

2.12 Sound reduction measures for WS 75 Powerbox

- Compliance with maximum volumetric flows and minimum bend radii of the flexible duct.
- It is essential that maximum volumetric flows are noted, especially for supply air valves.
- Select installation locations and models for the ventilation units to keep noise emissions down. If possible avoid sound bridges with the structure by observing sufficient distance from other façade elements.

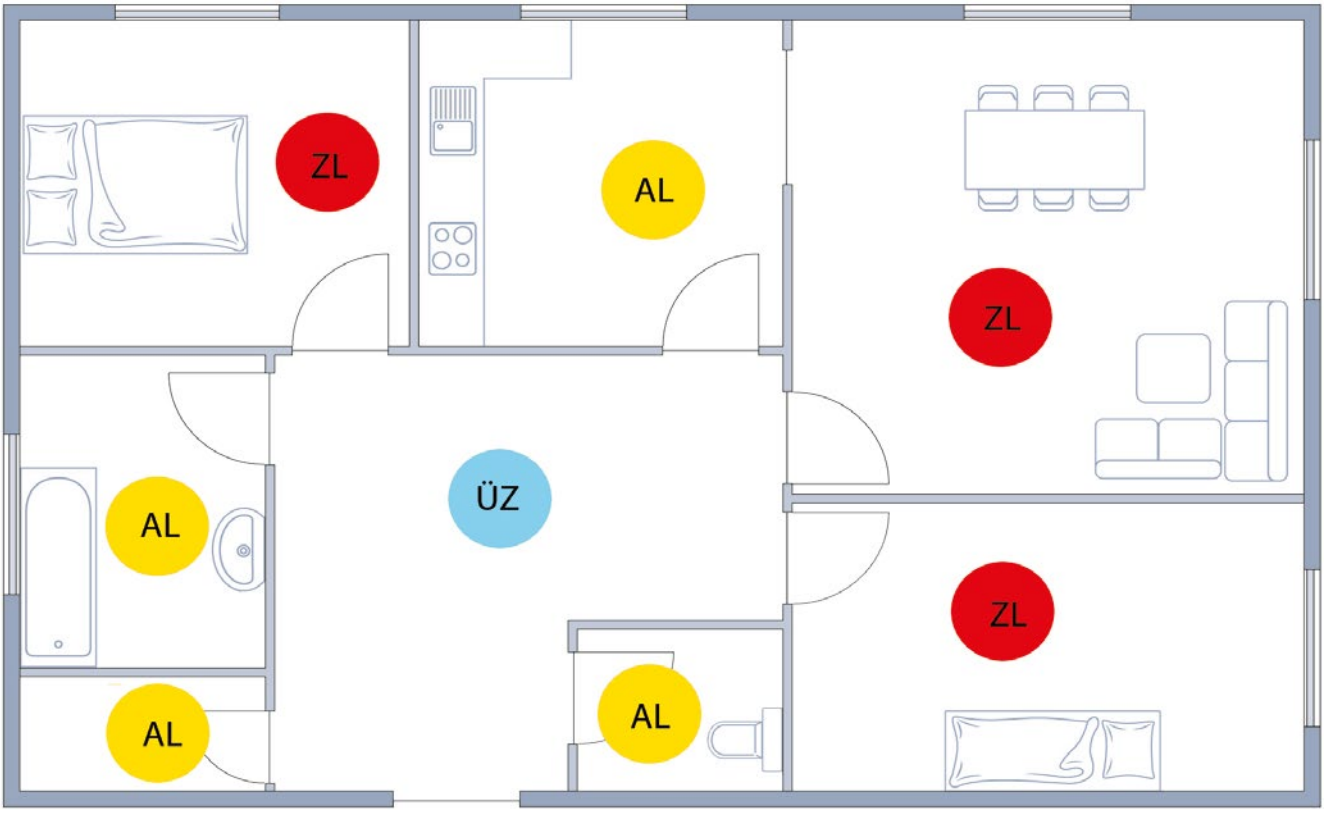
2.13 System design of WS 75 Powerbox

Important points to consider when configuring the WS 75 Powerbox:

- a correctly calculated amount of air in accordance with DIN 1946-6.
- When connecting ducts:
  - Calculation of duct cross-sections and air speeds (recommendation: max. 2 m/s for supply air; max. 3 m/s for exhaust air);
  - Application-specific air throughputs;
  - Laying of the ventilation ducts in line with relevant specifications;
  - Correct settings for supply air and exhaust air valves.
- For reasons of comfort, we would recommend configuring the ventilation system to deliver an air exchange rate of around 0.3-0.8 [1/h].
- The WS 75 Powerbox H is fitted to external walls only.
- The WS 75 Powerbox S can also be installed in suspended ceilings or in a drywall (note inspection opening!).
- The WS 75 Powerbox is suited to all rooms of up to 60 m²: hotel rooms, student rooms, retirement home / assisted living, offices, 1- and 2-room apartments, waiting rooms and consulting rooms as well as other rooms with similar functions.
- The installation instructions provided with the units should be observed.
- Appropriate overflow openings must be provided.

3 Practical planning

3.1 Defining supply air, exhaust air and overflow areas



AL: Exhaust air room ZL: Supply air room ÜZ: Overflow area

3.2 Determining volumetric air flows

When configuring the room air system, the criteria of **room air quality** and **room air humidity** should be taken into account. This considers the volumetric air flow in m³/h. To ensure a good quality of room air, in accordance with DIN EN 15251 we would recommend a minimum outside volumetric flow of **15 m³/h per person** (configuration for sleeping areas according to DIN 1946-6).

DIN 1946-6 and DIN 18017-3 also contain recommendations regarding outside air volumetric flows in line with the planning. In accordance with DIN 1946-6, a ventilation system should be configured on the basis of nominal ventilation (NV).

Air volume calculation

The air volume calculation is based on DIN 1946-6. This states that controlled domestic ventilation is needed if the amount of air needed to protect against humidity exceeds the volumetric flow provided by infiltration.

Ventilation measures are needed if		
effective volumetric air flow through infiltration $q_{v,Inf}$	<	total outside air volumetric flow needed for humidity protection $q_{v,ges,NE,FL}$

Four ventilation operating levels are defined.

- Ventilation for humidity protection (HPV)
- Reduced ventilation (RV)
- **Nominal ventilation (NV)**
- Intensive ventilation (IV)

The air volume is calculated for the **nominal ventilation** operating level according to DIN 1946-6.

Total exhaust air volumetric flows $_{v,ges,R,ab}$ with fan-assisted ventilation for individual rooms with or without windows. Including effective infiltration

	Total exhaust air volumetric flow[a] qv,ges,R,ab (in m³/h)			
Room[g]	Ventilation for humidity protection HPV	Reduced ventilation RV	Nominal ventilation[h] NV	Intensive ventilation IV
Housework room Cellar room (e.g. hobby room) [a, f] corridor (optional) WC[c]	0.2-0.4 of NV	0.7 of NV	20 [c,d]	1.3 of NV
Kitchen, kitchenette[b] Bathroom with/without WC Shower room			40	
Sauna / Fitness room			40 [e]	

a heated and inside the thermal envelope.

b intensive ventilation of windowless rooms: The general building guideline demands 200 m³/h for kitchens without windows.

c if required for the housing unit's ventilation concept, the corridor can also be planned with an exhaust air volumetric flow of 25m³/h.

d if laundry is dried in the room, e.g. using clothes dryers, an exhaust air volumetric flow of 40 m³ should be planned.

e alternatively, the volumetric flow can be defined in line with the humidity levels expected taking building preservation into account.

f a separate approach is needed for rooms which are used in a way which produces high humidity/pollution levels.

g other rooms, such as storage rooms, dressing rooms or utility rooms, can also be included in the ventilation concept as exhaust air rooms if the usage conditions specified in planning (expected humidity levels) are taken into account.

Ventilation for humidity protection (qv,total,HPV)

Ventilation dependent on user, which aims to prevent damage to the building from mould and humidity (minimal operation) depending on the building's level of thermal protection under usual usage conditions (humidity levels, room temperatures).

Reduced ventilation (qv,total,RV)

Ventilation not dependent on user, which meets the minimum requirements of room air quality under usual usage conditions (humidity and pollution levels).

Nominal ventilation (qv,total,NV)

Ventilation needed to ensure preservation of the building and hygienic and health requirements when a housing unit is used as planned (normal operation).

Intensive ventilation (qv,total,IV)

Increased ventilation needed at times to reduce load peaks (load operation).

Volumetric air flow for humidity protection

Ventilation for humidity protection is a form of ventilation not dependent on the user intended to prevent damage to the building from mould and humidity under usual usage conditions (user temporarily absent and no laundry being dried). It is crucial to the need for ventilation measures (ventilation concept).

The building's thermal protection should be taken into account when determining the volumetric air flow for humidity protection.

$$q_{v,Fläche} = f_{ws}(-0{,}002 * Ages^2 + 1{,}15 * Ages + 11)$$

$q_{v,Fläche}$	volumetric air flow by living space
Ages	area of the residential unit
f_{ws}	Factor for consideration of the building's thermal protection

Factors for consideration of thermal protection f_{ws}

	High thermal protection [a]	Low thermal protection [b]
Low occupancy [c]	0.2	0.3
High occupancy	0.3	0.4

a High thermal protection: New building constructed after 1995 or full renovation with corresponding level of thermal protection.

b Low thermal protection: building with partial or no renovation work (e.g. only windows have been changed so the seal integrity of the building envelope is improved yet the building has a low level of thermal insulation).

c Low occupancy usually applies when building is used by the owner ≥ 40m²/person, as in a single-family home, for example. An analysis of needs according to building contract law is needed for new buildings.

Please note:
The volumetric flow requirements of ventilation for humidity protection are based on the following assumptions: average daily amount of humidity released by people, plants, personal hygiene and cooking (rooms with an average amount of humidity released > 200 g/h or > 4.8 kg/d – this also includes drying laundry – should be considered separately).
Housing unit of 70 m²: approx. **6.5 kg/d**
Housing unit of 90 m²: approx. **7.0 kg/d**
Housing unit of 120 m²: approx. **7.5 kg/d**
Housing unit of 160 m²: approx. **8.0 kg/d**

Room temperatures:
bedroom, children's room (at night): **17°C**
living room, children's room (during the day), kitchen: **20°C**
bathroom: **24°C**
Temperature factors (in the range of critical thermal bridges)
Low thermal protection (before 1995 German Heat Insulation Ordinance): **f**Rsi = **0.59**
High thermal protection (1995 German Heat Insulation Ordinance or better): **f**Rsi = **0.72**

Volumetric air flow through infiltration (influence of the building envelope)

Every building envelope has certain leaks. When a natural differential pressure arises, this results in the infiltration (and also exfiltration) of outside air.

$$q_{v,Inf} = f_{Inf} * V_{NE} * n_{50}$$

$q_{v,inf}$	volumetric air flow from infiltration
f_{Inf}	infiltration factor (table)
V_{NE}	building volume to be vented
n_{50}	air exchange at 50 Pa differential pressure (in accordance with table 1)

Defined factors can be used to determine this infiltration air volumetric flow via the building volume.

Infiltration factors f_{inf}

Type of housing unit	Building location low wind	Building location high wind
single-storey	0.04	0.08
multi-storey	0.06	0.09

Applies to a new single-family home up to 15 m in height in a normal building location.
Building location with high winds: Annual average wind speed > 3.3 m/s.

Table 1 - n_{50}, configuration with 50 Pa differential pressure

Air exchange configuration n_{50} for new buildings and renovations in h^{-1}		
Category		
A Fan-assisted ventilation in single-family homes and multiple-family dwellings	B Free ventilation in single-family homes and multiple-family dwellings constructed after 2002 as well as in renovated multiple-family dwellings	C Free ventilation in renovated single-family homes constructed before 2002
1.0	1.5	2.0

1. Determining total outside air volumetric flow

To calculate the total outside air volumetric flow neededqv,total, you first need to determine the maximum value for volumetric flow needed by living space, exhaust air rooms and occupation according to planning.

$$q_{v,ges,NE} = f_{Lst} \times (-0{,}002 \times A_{NE}^2 + 1{,}15 \times A_{NE} + 11)$$

$q_{v,ges,NE}$ of the volumetric air flows for the ventilation level, in m³/h
A_{NE} the area of the housing unit, in m²
f_{Lst} the factor for consideration of the ventilation level (LSt)

Determining fan levels

The volumetric flows for the individual fan levels can be calculated from the total outside air volumetric flow.

Type of ventilation	Formula for volumetric air flow
Ventilation for humidity protection	qv,FL = 0,2 to 0,4 * qv,ges
Reduced ventilation	qv,RL = 0,7 * qv,ges
Nominal ventilation	qv,NL = 1,0 * qv, ges
Intensive ventilation	qv,IL = 1,3 * qv,ges

Intensive ventilation can also be ensured with the help of the user (window ventilation). It is not absolutely essential that this is done by the ventilation unit.

Use the tables below to determine the total outside air volumetric flow.:

$q_{v,ges,NE}$ in m³/h for housing units (NE) [a,b]

Area of housing unit A_{NE} [c] m²		≤ 20	30	50	70	90	110	130	150	170	190	210
Ventilation for humidity protection, high thermal protection qv,ges,NE,FLh	Low occupancy [d]	not specified	not specified	15	15	20	25	25	30	30	30	35
	High occupancy	10	15	20	25	30	35	40	40	45	45	50
Ventilation for humidity protection, low thermal protection qv,ges,NE,FLg	Low occupancy [d]	not specified	not specified	20	25	30	35	40	40	45	45	50
	High occupancy	15	20	25	35	40	45	50	55	60	65	65
Reduced ventilation qv,ges,NE,RL		25	30	45	55	70	80	90	95	105	110	115
Nominal ventilation [e] qv,ges,NE,NL		35	45	65	80	100	115	125	140	150	155	165
Intensive ventilation qv,ges,NE,IL		45	55	85	105	130	145	165	180	195	205	215

For housing units with an area > 210 m², first the volumetric air flow for nominal ventilation for 210 m² is calculated. 4 m³/h per 10 m² is added for nominal ventilation for any living space above and beyond this.
a The values in the tables are rounded to 5 m³/h.
b Including infiltration.
c Heated area A_{NE} inside the building envelope, which is to be taken into account as part of the ventilation concept:
— for housing unit areas A_{NE} < 20 m² (per apartment or housing unit) A_{NE} = 20 m² is set,
— for housing unit areas A_{NE} > 210 m² (per apartment or housing unit) the planned outside air volumetric flows should be adjusted by adding 4 m³/h per 10 m² of additional living space to the volumetric flow for nominal ventilation calculated for 210 m². Reducing the volumetric air flows as the area of the housing unit increases is not permitted.
D Ventilation for humidity protection: Low occupancy can be assumed if a usable area of ≥ 40 m²/person is included in the planned use.
e Nominal ventilation: The number of people permitted in a housing unit from a ventilation standpoint can be determined by dividing the total outside air volumetric flow specified for nominal ventilation by roughly 30 m³/h per person, e.g. for a housing unit of 110 m²: 120 m³/h/30 m³/(h*pers.) = 4 people (rounded value). In terms of the housing unit, this corresponds to cat I to cat II of DIN EN 15251:2012-122), Table B.5.
In exceptional circumstances, the number of people permitted in intensely used housing units from a ventilation standpoint can be determined by dividing the total outside air volumetric flow specified for nominal ventilation by 20 m3/h per person (in terms of the housing unit, this corresponds to cat III of DIN EN 15251:2012-122), Table B.5).
In cases with more stringent requirements (e.g. if pollution levels extend above usual values), the outside air volumetric flows can be increased, see national appendix to DIN EN 15251:2012-122).
See DIN 1946-6, page 26.

Total outside air volumetric flow by total exhaust air rooms qv,exhaust

Exhaust air rooms	Volumetric flow in m³/h
Kitchen	40
Bathroom	40
Shower/WC	40
WC	20
Utility room	20
Hobby room	20
Corridor (exhaust air optional)	20

In housing units with a large number of exhaust air rooms, the total exhaust air volumetric flows for individual rooms $q_{v,ges,R,ab,NL}$ may greatly exceed the volumetric flow $q_{v,total,NE,NL}$ calculated from the housing unit's usable area so this is limited to 1.2 times $q_{v,ges,NE,NL}$ in equation (28).

Ventilation for humidity protection

$$q_{v,ges,FL} = \frac{q_{v,ges,NL}}{q_{v,ges,NE,NL}} \times q_{v,ges,NE,FL}$$

Reduced ventilation

$$q_{v,ges,RL} = \frac{q_{v,ges,NL}}{q_{v,ges,NE,NL}} \times q_{v,ges,NE,RL}$$

Nominal ventilation

$$q_{v,ges,NL} = \max \{q_{v,ges,NE,NL}; \min(\sum_{R,ab} q_{v,ges,R,ab,NL}; 1{,}2 \times q_{v,ges,NE,NL})\}$$

Intensive ventilation

$$q_{v,ges,IL} = \frac{q_{v,ges,NL}}{q_{v,ges,NE,NL}} \times q_{v,ges,NE,IL}$$

2. Determining supply air volumetric flows

The calculated total outside air volumetric flow is split into the individual supply air rooms using the supply air factors from the following table:

Supply air factors $f_{supply\ air}$ according to DIN 1946-6

Type of use	Supply air factor
Living	3.0 (±0.5)
Eating	1.5 (±0.5)
Sleeping	2.0 (±1.0)
Child	2.0 (±1.0)
Working	1.5 (±0.5)
Guests	1.5 (±0.5)

For each room, the associated factor must be divided by the total of all factors defined for the building. This quotient is the equivalent of the share of the total outside air volumetric flow.

qv,supply air,room = (fsupply air,room / Σfsupply air) * qv,total

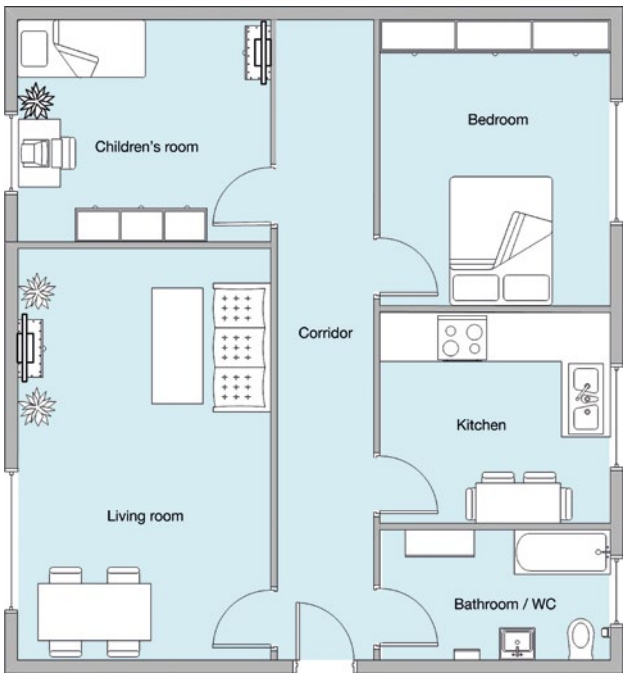
Building-specific peculiarities can be taken into account using the specified tolerance ranges of the individual factors.

Practical example of calculation for volumes of air for PP 45 with ECA 100 ipro exhaust air fan

The procedure for calculating the total outside air volumetric flow and the amounts of supply air and exhaust air for the individual rooms is shown below on the basis of a sample building.

Building data (example only):

- Rented apartment in multiple-family dwelling, ventilated living space: approx. 90 m²
- Occupancy: 3 people
- location with low winds
- Building location: normal
- Height above ground: ≤ 15m
- Thermal protection: high (renovated object)
- Seal integrity n_{50}= 1h^{-1}



Room	Supply air area in m²	Exhaust air area in m²	Overflow area in m²
Living	27.0		
Sleeping	19.0		
Child	16.0		
Kitchen		10.0	
Bathroom		7.0	
Corridor			11.0
In total	62.0	17,0	11.0
Heated / ventilated living space A_{NE} in m²			**90.0**
Average room height h in m			2.50
Air volumes V_{NE} in m³			225.0

1. Determining infiltration volumetric air flow:

$q_{v,Inf,Konzept} = e_{z,Konzept} \times V_{NE} \times n_{50}$

where

$e_{z,Konzept}$ = 0.04 (single-storey, low wind)
V_{NE} = 225,0 m³
n_{50} = 1,0 h-1
$q_{v,Inf,Konzept}$ = 9 m³/h

2. Determining volumetric air flow for humidity protection

$q_{v,ges,NE,FL} = f_{ws} \times (-0{,}002 \times A_{NE}^2 + 1{,}15 \times A_{NE} + 11)$

where

f_{ws} = 0.3 (thermal protection, high occupancy)
A_{NE} = 90 m²
$q_{v,ges,NE,FL}$ = 30 m³/h

$$q_{v,Inf,Konzept} < q_{v,ges,NE,FL}$$

Ventilation measures are needed!

Outside air volumetric flows needed for housing units

In combined ventilation systems, the area of the exhaust air rooms in accordance with DIN 1946-6 Section 9.3.3 is not taken into account.

$$\mathbf{q_{v,ges,NE} = f_{Lst} \times (-0{,}002 \times A_{NE}^2 + 1{,}15 \times A_{NE} + 11)}$$

$q_{v,ges,NE,\,RL} = 0{,}7 \times (-0{,}002 \times 73^2 + 1{,}15 \times 73 + 11)$
$q_{v,ges,NE,\,RL} = 59\ m^3/h$

$q_{v,ges,NE,\,NL} = 1{,}0 \times (-0{,}002 \times 73^2 + 1{,}15 \times 73 + 11)$
$q_{v,ges,NE,\,NL} = 84\ m^3/h$

$q_{v,ges,NE,\,IL} = 1{,}3 \times (-0{,}002 \times 73^2 + 1{,}15 \times 73 + 11)$
$q_{v,ges,NE,\,IL} = 110\ m^3/h$

Total outside air volumetric flows

Nominal ventilation

$q_{v,ges,NL} = \max \{q_{v,ges,NE,NL}\ ; \min(\sum_{R,ab} q_{v,ges,R,ab,NL}; 1{,}2 \times q_{v,ges,NE,NL})\}$

$q_{v,ges,NE,NL} = 1{,}0 \times (-0{,}002 \times A_{NE}^2 + 1{,}15 \times A_{NE} + 11)$

$q_{v,ges,NE,NL} = 1{,}0 \times (-0{,}002 \times 73^2 + 1{,}15 \times 73 + 11)$

$q_{v,ges,NE,NL} = 84\ m^3/h$

$\sum_{R,ab} q_{v,\,ges,\,R,\,ab,\,NL}$ = bathroom, kitchen
$\sum_{R,ab} q_{v,\,ges,\,R,\,ab,\,NL} = 40\ m^3/h + 40\ m^3/h$
$\sum_{R,ab} q_{v,\,ges,\,R,\,ab,\,NL} = 80\ m^3/h$

$$\sum_{R,ab} q_{v,\,ges,\,R,\,ab,\,NL} < q_{v,ges,NE,\,NL}$$

$$q_{v,ges,NL} = 84\ m^3/h$$

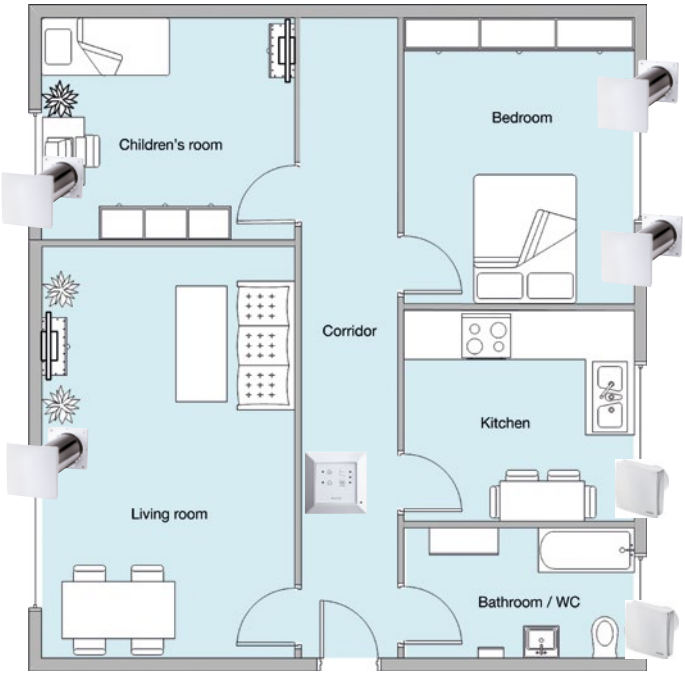
Distribution of supply air

Supply air factors fZuluft in accordance with DIN 1946-6, type of use, supply air factor
Living 3.0 (±0.5)
Eating 1.5 (±0.5)
Sleeping 2.0 (±1.0)
Child 2.0 (±1.0)
Working 1.5 (±0.5)
Guests 1.5 (±0.5)

Calculation with selected supply air factors:

Living	3.0	(3 x 9.3 m³/h = 28 m³/h)		
Sleeping	3.0	(3 x 9.3 m³/h = 28 m³/h)		
Child	3.0	(3 x 9.3 m³/h = 28 m³/h)		
Total:	9.0	Total:	84 m³/h	Calculation: 84 m³/h : 9 = 9.3 m³/h

Positioning of units & distribution of air



LS1 = $\frac{4 \times 15\ m^3/h}{2}$ = 30 m³/h = HPV

LS2 = $\frac{4 \times 20\ m^3/h}{2}$ = 40 m³/h

LS3 = $\frac{4 \times 30\ m^3/h}{2}$ = 60 m³/h = RV

LS4 = $\frac{4 \times 36\ m^3/h}{2}$ = 72 m³/h

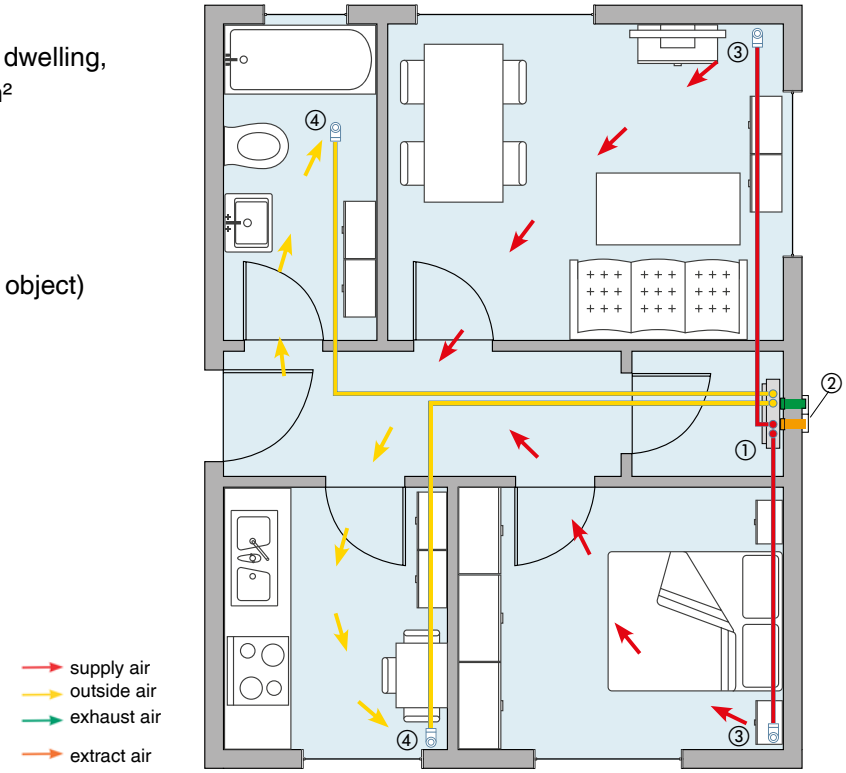
LS5 = $\frac{4 \times 42\ m^3/h}{2}$ = 84 m³/h = NV

Practical example of air volumes calculation for WS 75 Powerbox

The procedure for calculating the total outside air volumetric flow and the amounts of supply air and exhaust air for the individual rooms is shown below on the basis of a sample building.

Building data (example only):

- Rented apartment in multiple-family dwelling, ventilated living space: approx. 50 m²
- Occupancy: 2 people
- location with low winds
- Building location: normal
- Height above ground: ≤ 15m
- Thermal protection: high (renovated object)
- Seal integrity n_{50}= 1h^{-1}



Room	Supply air area in m²	Exhaust air area in m²	Overflow area in m²
Living	15.4		
Sleeping	11.6		
Storage room			2.0
Kitchen		6.5	
Bathroom		5.5	
Corridor			9.0
In total	27.0	12,0	11.0
Heated / ventilated living space A_{NE} in m²			**50.0**
Average room height h in m			2.50
Air volumes V_{NE} in m³			125.0

1. Determining infiltration volumetric air flow

$$q_{v,Inf,Konzept} = e_{z,Konzept} \times V_{NE} \times n_{50}$$

where

$e_{z,Konzept}$ = 0.04 (single-storey, low wind)
V_{NE} = 125,0 m³
n_{50} = 1,0 h^{-1}
$q_{v,Inf,Konzept}$ = 5 m³/h

2. Determining volumetric air flow for humidity protection

$$q_{v,ges,NE,FL} = f_{ws} \times (-0{,}002 \times A_{NE}^2 + 1{,}15 \times A_{NE} + 11)$$

where

f_{ws} = 0.3 (thermal protection & high occupancy)
A_{NE} = 50 m²
$q_{v,ges,NE,FL}$ = 19 m³/h

$qv,_{Inf,Konzept} < q_{v,ges,NE,FL}$
Ventilation measures are needed!

3. Determining outside air volumetric flows needed for housing units

$$q_{v,ges,NE,FL} = f_{LSt}(-0{,}002*A_{NE}^2 + 1{,}15*A_{NE} + 11)$$

where

f_{LSt} = 0.3 (thermal protection, high occupancy)
A_{NE} = 50 m²

qv,ges,NE,RL = **0,7 (-0,002*50² + 1,15 *50 + 11)** = 44 m³/h

qv,ges,NE,NL = **1,0 (-0,002*50² + 1,15 *50 + 11)** = 64 m³/h

qv,ges,NE,IL = **1,3 (-0,002*50² + 1,15 *50 + 11)** = 83 m³/h

The maximum of the total outside air volumetric flow (qv,ges,NE) is significant for determining the total outside air volumetric flow (v,ges,R,ab).

Total of exhaust air rooms in accordance with "Total exhaust air volumetric flows v,ges,R,ab" table:
Bathroom + kitchen = 40 m³/h + 40 m³/h = **80 m³/h**

In apartments with many exhaust air rooms, the total of the exhaust air volumetric flows for individual rooms (v,ges,R,ab) may significantly exceed the volumetric flow of the housing unit (qv,ges,NE,NL) such that this is limited to 1.2 times qv,ges,NE,NL.

Calculation of volumetric air flow
Total outside air volumetric flow for fan-assisted ventilation

Nominal ventilation

$q_{v,ges,NL} = \max \{q_{v,ges,NE,NL} ; \min(\sum_{R,ab} q_{v,ges,R,ab,NL}; 1.2 \times q_{v,ges,NE,NL})\}$

$q_{v,ges,NE,NL} = 1.0 \times (-0.002 \times A_{NE}^2 + 1.15 \times A_{NE} + 11)$

$q_{v,ges,NE,NL} = 1.0 \times (-0.002 \times 50^2 + 1.15 \times 50 + 11)$

$q_{v,ges,NE,NL} = 64 m^3/h$

$\sum_{R,ab} q_{v,ges,R,ab,NL}$ = bathroom, kitchen
$\sum_{R,ab} q_{v,ges,R,ab,NL} = 40 m^3/h + 40 m^3/h$
$\sum_{R,ab} q_{v,ges,R,ab,NL} = 80 m^3/h$

$\sum_{R,ab} q_{v,ges,R,ab,NL} > q_{v,ges,NE,NL}$

$q_{v,ges,NL} = 1.2 \times q_{v,ges,NE,NL} = 1.2 \times 64 m^3/h = 76 m^3/h$

Ventilation for humidity protection

$$q_{v,ges,FL} = \frac{q_{v,ges,NL}}{q_{v,ges,NE,NL}} \times q_{v,ges,NE,FL} = \frac{76 m^3/h}{64 m^3/h} \times 19 m^3/h = 23 m^3/h$$

Reduced ventilation

$$q_{v,ges,RL} = \frac{q_{v,ges,NL}}{q_{v,ges,NE,NL}} \times q_{v,ges,NE,RL} = \frac{76 m^3/h}{64 m^3/h} \times 44 m^3/h = 52 m^3/h$$

Nominal ventilation

$q_{v,ges,NL} = \max \{q_{v,ges,NE,NL} ; \min(\sum_{R,ab} q_{v,ges,R,ab,NL}; 1.2 \times q_{v,ges,NE,NL})\}$

$q_{v,ges,NL} = 1.2 \times 64 m^3/h = 76 m^3/h$

Intensive ventilation

$$q_{v,ges,IL} = \frac{q_{v,ges,NL}}{q_{v,ges,NE,NL}} \times q_{v,ges,NE,IL} = \frac{76 m^3/h}{64 m^3/h} \times 83 m^3/h = 99 m^3/h$$

Distribution of supply air

Supply air factors fZuluft in accordance with DIN 1946-6, type of use, supply air factor
Living 3.0 (±0.5)
Eating 1.5 (±0.5)
Sleeping 2.0 (±1.0)
Child 2.0 (±1.0)
Working 1.5 (±0.5)
Guests 1.5 (±0.5)

Calculation with selected supply air factors:

Living	3.0	(3 x 15.2 m³/h = 46 m³/h)		
Sleeping	2.0	(2 x 15.2 m³/h = 30 m³/h)		
Total:	5.0	Total:	76 m³/h	Calculation: 76 m³/h : 5 = 15.2 m³/h

3.3 Selecting ventilation unit and determining installation site

The factors to consider when selecting an appropriate ventilation unit are:

- The determined total outside air volumetric flow
  (a reserve of approx. 30 % should be available for increased ventilation).
- Max. ambient temperature of 40°C

Planning and conditions for the installation site

When installing the ventilation unit in a room, the following conditions should be met:

- Frost-free room.
- It must be ensured that operation of the second ventilation unit is not impaired.
- Take into account accessibility for maintenance and repair work.

PP 45

PPB 30

WS 75

3.4 Planning outside and outgoing air openings

The openings for outgoing and outside air can be fitted on both the roof and wall. Ensure an adequate cross-section, depending on the volumetric flows calculated: Recommendation: max. 5 m/s air speed.

The outside and outgoing air openings should be fitted at least 2 - 3 m away from one another to avoid “short-circuit effects” between the outgoing and outside air. Duo KWS combi-wall connections can also be used. Note DIN 1946-6 chapter 8.7.5.10 Arrangement and spacing of outside and outgoing air connections.

3.5 Configuration of outside and outgoing air lines for WS 75 Powerbox

- To prevent condensate from forming, design outside and outgoing air lines with the heat-insulated MAICOTherm ventilation duct system or folded spiral-seams duct (with sufficient insulation).
- Feeds through the sealed building envelope should be professionally sealed.
- We would recommend a minimum spacing of 2m between the outside and outgoing air openings or the use of combi-wall connections (KWH ... L/R).
- Ensure fire protection (minimum spacing, ...) if necessary. See Building Codes of the individual German states (LBO) and Specimen Guideline on fire protection requirements pertaining to ventilation systems. If in any doubt, contact an expert.
- Outside air intake
  - in the shade wherever possible
    (cool air in the summer)
  - not in places affected by bad odours
    (garage, compost etc.)
  - as high as possible, > 2m
    (to ensure air is free from dust and odours)
  - not on the side affected by the weather
- Outgoing air openings
  - not opposite neighbours’ windows
  - > 2m (out of reach of children).

MaicoFlex

- Line lengths of up to 8 m.
- The same or similar line lengths guarantee an even distribution of air.
- Note minimum bend radii.
- Seal pipes during the construction phase.
- The maximum flow velocity in the ventilation duct system should be 2-3 m/s (recommendation: max. 2 m/s for supply air; max. 3 m/s for exhaust air).

Determine the line diameter and number of connection ducts per valve depending on volumetric flow calculated and using the following table:

MAICOFlex diameter (mm)		Bending radius	Recommendation
outer	inner	(mm)	V (m³/h)
75	64	150	30

3.6 Defining position, quantity and size of supply air and exhaust air valves and overflow openings

Supply air elements

- Not directly above areas occupied by people, beds or seats, maintain gap of 1m.
- Not behind curtains, cupboards or other construction elements and/or fittings, which hamper the air inlet.
- It is essential that maximum volumetric flows are noted, especially for supply air valves.
- Ceiling and wall spacing of approx. 50 cm.
- Wherever possible, above radiators.
- Blower nozzles at max. 20 cm from ceiling.

Exhaust air elements

- Position as high as possible. Ceiling and wall spacing of approx. 20 cm.
- As close to the source of humidity or odour as possible.
- Not directly above radiators.
- If grease is present (kitchens), use DAE exhaust air valve.
- Position as far as possible away from the door to achieve a good flow through the room.

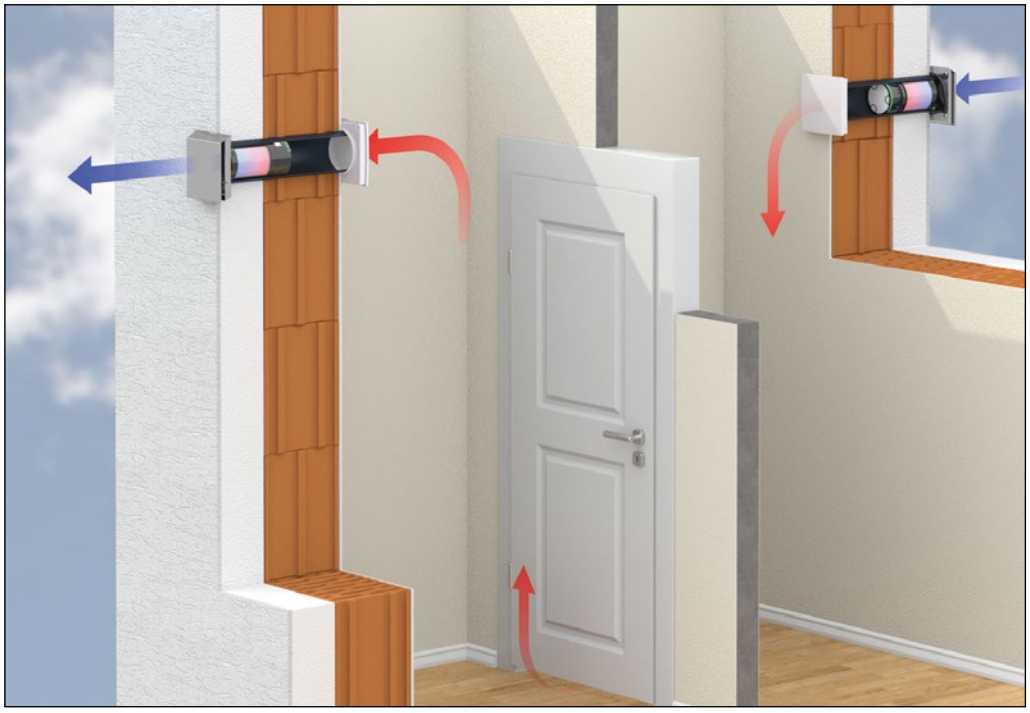
Maximum volumetric flows

To minimise flow noise, we recommend the following max. volumetric flows for living areas:

Diameter (mm)	Air direction	Max. volumetric flow (m³/h)
100	Exhaust air	30
100	Supply air	30
125	Exhaust air	50
125	Supply air	50

Overflow area

Overflow areas define the space between two rooms in a home. Because of the difference in pressure, air flows from the supply air area to the exhaust air area.



Appropriate measures should be taken to ensure that the air flows as described. For example, this can be achieved with the following measures:

- Shorten the door leaves in the lower part of the door
- Use appropriate air grilles in doors or walls.

Overflow openings in accordance with EN 1946-6

Amount of air **89 cm door with sealing**	**m³/h**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
Overflow area	cm²	25	50	75	100	125	150	175	200	225	250
Shortening measurement	mm	3	6	8	11	14	17	20	22	25	28

Amount of air **89 cm door without sealing**	**m³/h**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
Overflow area	cm²	0	25	50	75	100	125	150	175	200	225
Shortening measurement	mm	0	3	6	8	11	14	17	20	22	25

Details in accordance with EN 1946-6:
The shortening measurement states the number of millimetres by which a 89 cm door leaf needs shortening. If the door is of a different width, the shortening measurement can be determined afresh so that the overflow area remains the same.

3.7 Commissioning and maintenance of ventilation units

Before regulating, check that

- all filters and valves are inserted correctly;
- all overflow openings are in place;
- the electrical connection has been undertaken correctly.

Before commissioning:

- set nominal operation;
- regulate the valves until the desired amount of air is reached;
- use our commissioning software.

All calculated and set data should be documented. The operating company must note and keep the installation and maintenance instructions. The company responsible for regulation may offer a maintenance contract service.

You will find detailed information about maintenance work and how to perform it in the respective ventilation unit operating instructions. Pay particular attention to the safety instructions in the respective instructions.

The following maintenance should be undertaken at the specified intervals:

Maintenance interval	Maintenance work to be undertaken
Quarterly	Check the filters. Depending on the level of contamination, replace if necessary.
Annually	Replace all filters.
	Depending on the level of contamination, we recommend cleaning the inside of the unit.

3.8 Combining a ventilation system with fireplaces

What should I note when operating ventilation systems with fireplaces?

Air-extracting equipment, such as a ventilation system, may produce a dangerous vacuum in the building if there is not a sufficient supply of combustion air from outside. This may cause the waste gases from the fireplace, fatal carbon monoxide in particular, to be drawn into the living room.

If operating a ventilation unit together with a fireplace, e.g. a stove, we would recommend a room-sealed fireplace. This can only be done in conjunction with a safety device installed and tested separately. Furthermore, the fireplace will need a separate air connection to provide an adequate supply of combustion air.

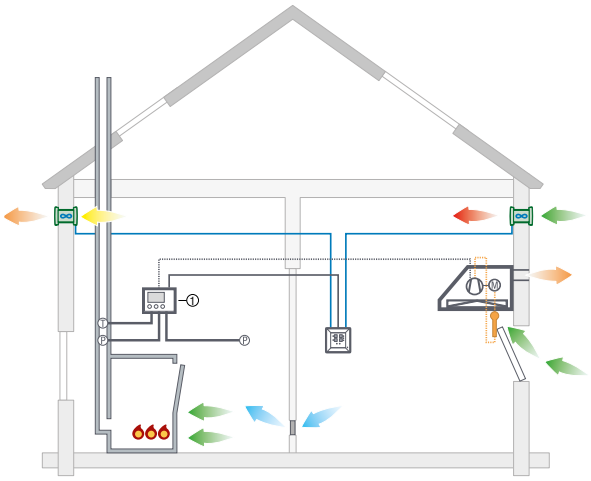
The fireplace installation should always be approved by the chimney sweep responsible. The chimney sweep must therefore always be consulted during the planning phase!

Air-ventilated single-room fireplaces

Air-ventilated fireplaces are single-room fireplaces, which draw their combustion air from the living room.

Unit system

- Room-sealed fireplace for solid fuels (e.g. stove)
- Range hood in exhaust air mode
- Controlled domestic ventilation (centralised/decentralised)



① Max. differential pressure 4 Pa

Ⓣ Temperature sensor

Ⓟ Pressure sensor

supply air
outside air
exhaust air
extract air

System part	Special requirements	Potential actions
Fireplace	None	-
Connection piece	None	-
External supply of combustion air (if available)	No comments: Note the manufacturer's installation instructions	-
Range hood	Yes	Changeover the range hood to circulating air mode or
		Position monitoring (window contact switch) as safety device with abZ or
Controlled domestic ventilation (centralised/decentralised)	Yes	Differential pressure monitoring as safety device with abZ

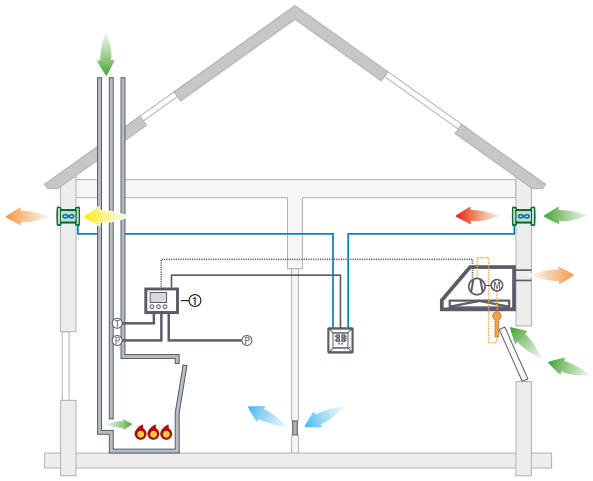
abZ: National technical approval

Room-sealed single-room fireplaces

In accordance with the leaflet issued by the German association of chimneysweeps (Bundesverband des Schornsteinfegerhandwerks) on the joint operation of fireplaces, room-sealed single-room fireplaces are fireplaces where the combustion air is only supplied directly from outside via pipes or shafts. If these fireplaces are operated as intended, dangerous levels of waste gas cannot escape into the room in which they are installed. Room-sealed single-room fireplaces for solid fuels with up-to-date usage certificates under building law are suited to installation in rooms, apartments or housing units of a comparable size from which air is extracted with the aid of fans, such as ventilation or warm air heaters, range hoods, exhaust air clothes dryers. Installers must size the supply air side accordingly to ensure that operating air-extracting systems does not result in a vacuum greater than 8 Pa relative to the outside air in the installation room, apartment or comparable housing unit.

Unit system

- Room-sealed fireplace for solid fuels (e.g. stove)
- Range hood in exhaust air mode
- Controlled domestic ventilation (centralised/decentralised)



① Max. differential pressure 8 Pa

Ⓣ Temperature sensor

Ⓟ Pressure sensor

supply air
outside air
exhaust air
extract air

System part	Special requirements	Potential actions
Fireplace	Yes	abZ (8 Pa)
Connection piece	Yes	See abZ of fireplace
External supply of combustion air	Yes	See abZ of fireplace
Range hood	Yes	Changeover to circulating air mode or
		Position monitoring (window contact switch) as device for room-sealed fireplaces for solid fuels (requires no abZ) or usual window contact switch with abZ or
		Measuring technology certificate (8 Pa)*
Controlled domestic ventilation (centralised/decentralised)	Yes	Mathematical approach (with 8 Pa) or
		measuring technology certificate (8 Pa)

abZ: National technical approval

* Differential pressure monitoring for room-sealed fireplaces (8 Pa) as safety device does not need abZ (The devices are not stated in the Building Rules List B Part 2).

3.9 Technical background knowledge

Terms relating to ventilation

Air exchange
Air exchange is understood as the exchange of air in closed rooms.
The exchange is measured as the air exchange rate.

Air exchange rate
This states how often the total volume of room air is exchanged for fresh air in a particular period. The air exchange rate tells you how frequently the air is exchanged per hour. A single air exchange rate means that the air in the room is “replaced” once an hour.

Outside air
Air that is drawn in from the outside.

Outside air rate
When calculating the personal air volume, the number of people continually present in the room is taken into account. Guide: 30 m³/h per person.

Supply air
The air flowing into the room

Exhaust air
The air drawn out of the room.

Outgoing air
The air given off to the outside

Volumetric air flow
Amount of air needed over a certain period [m³/h]

Air opening
Opening in the room (wall, ceiling or floor), through which air can exit or enter (e.g. grille, disk valve or blower nozzle).

Overflow opening
Opening through which the air overflows from one room to another depending on the flow direction.

Degree of heat provision
Heat recovery parameter (thermal source: exhaust air), including the amount of energy gained from potential condensation. The heat from other sources, entering the flow of supply air (e.g. waste heat from motor in flow of supply air) is included too.

4 Subsidy for ventilation systems

Efficient ventilation systems with heat recovery can benefit from generous subsidies. For renovations and/or new buildings, subsidies are available not just for material and installation but also planning work and system acceptance.

The Kreditanstalt für Wiederaufbau (KfW) is the main bank involved and provides subsidy packages for individual measures and installing ventilation.

Decentralised ventilation solutions are usually considered as one individual energy measure. The KfW categorises these as measures not taken to achieve a KfW efficiency standard.

The corresponding programs are 152 and 430.

More information can be found on the Kreditanstalt für Wiederaufbau (KfW) website.

5 Sample planning

Better system-based ventilation - all from one source

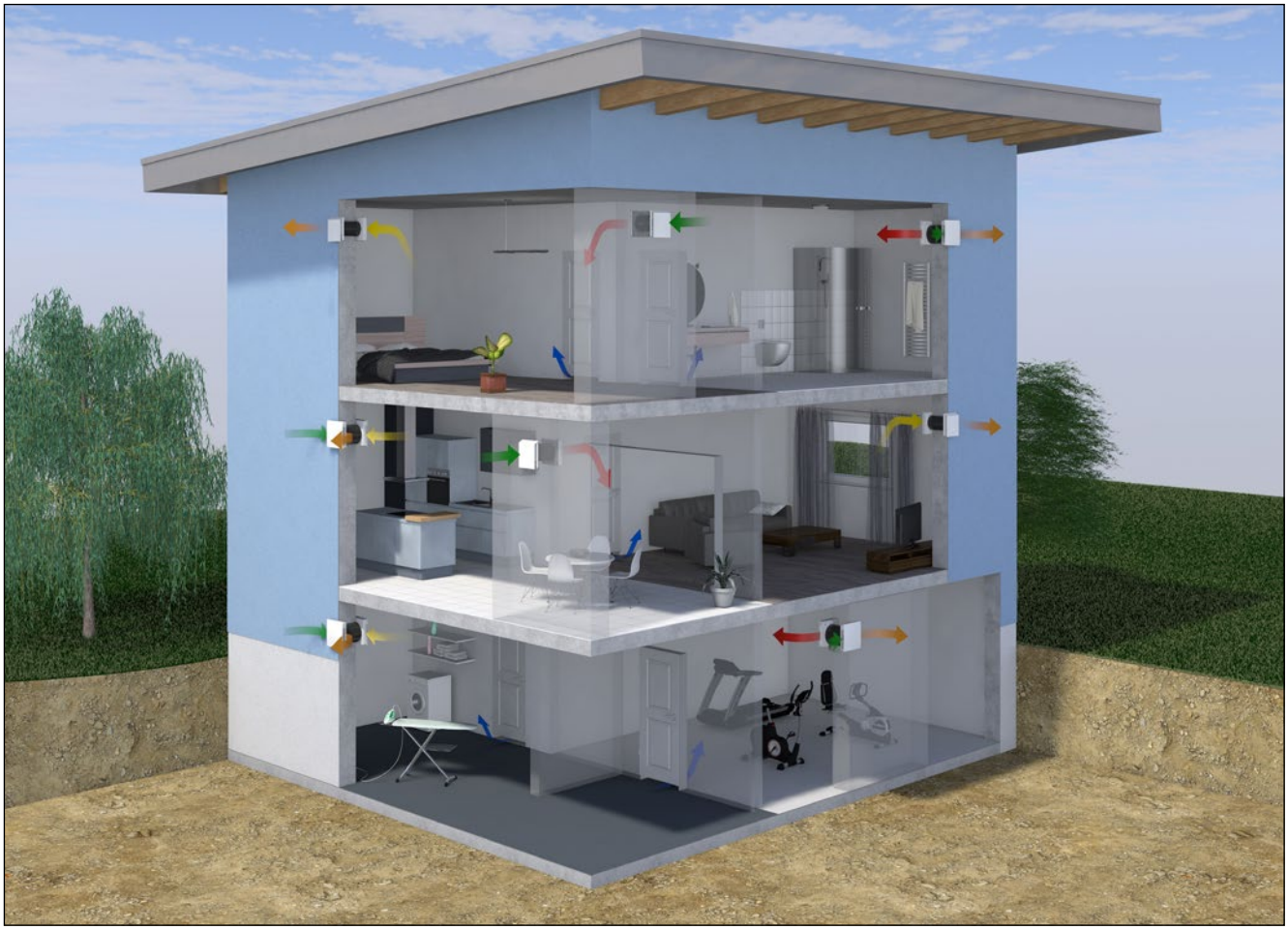
- Decentralised ventilation units for a huge range of different housing sizes.
- PP 45 - for supply air rooms in new buildings or when renovating a building.
- PPB 30 - ventilation solution in a single-family home with or without heat recovery in exhaust air rooms.
- PP 45 with ER EC - ventilation in a multi-storey residential building in accordance with DIN 18017-3 / DIN 1946-6.

Sample planning for decentralised ventilation of flats, bathrooms, WCs and kitchens as well as consulting rooms and offices

The benefits in detail

- 5x real-life sample plans: PP 45, PPB 30, PP 45 RC and PPB 30 RC, PP 45 with ER EC, WS 75 exhaust air fan
- Consistent and clear for rapid orientation
- Typical installation locations of MAICO ventilation units

Sample planning for Push Pull single-room ventilation units PP 45 and PPB 30



PP 45

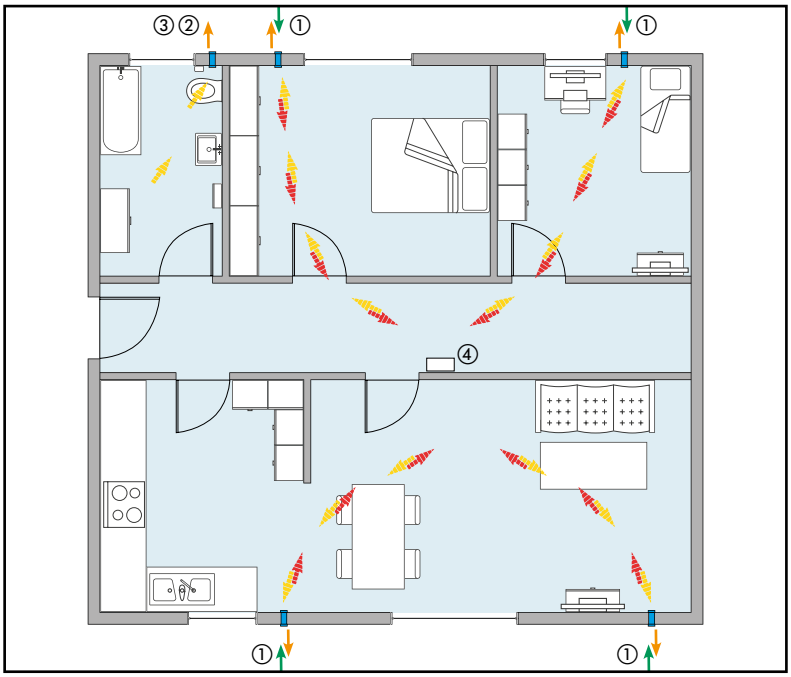
Decentralised domestic ventilation with heat recovery

Highlights

- Diameter of core hole just 162 mm
- Odd number of units possible
- Remote control possible
- Flow-optimised external covers direct air flow away from façade, protect this from contamination
- Pitched room version available as option
- > 84% heat recovery
- Efficiency class A+
- Sleep function

Mode of operation

- Unit installed in the wall with alternating exhaust air and supply air mode for ventilating living rooms
- In exhaust air mode, > 84 % of heat is stored and then returned when in supply air mode
- At least 2 units needed
- Damp rooms and kitchens can be included in the ventilation system with exhaust air fans or PPB 30 K
- Central control with RLS 45 K control unit



Supply air and exhaust air with change of direction

Outside and outgoing air with change of direction

① PushPull 45 ventilation unit in continuous operation with heat recovery
② ECA 100 ipro
③ PPB 30 K ventilation unit in continuous operation with heat recovery as option
④ RLS 45 K control unit

PP 45

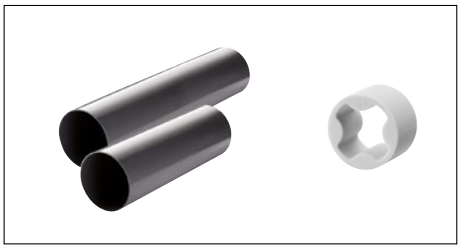
Decentralised ventilation of apartments with heat recovery

MATERIAL PER RESIDENTIAL UNIT (example)

FINAL ASSEMBLY SET	ART. NO.	CONTENT/ QUANTITY
① PP 45 K comfort variant with electric internal shutter	0095.0241	4

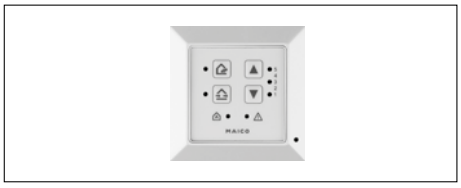
OPTIONAL FINAL ASSEMBLY SET	ART. NO.	CONTENT/ QUANTITY
③ PPB 30 K comfort variant with electric internal shutter	0095.0246	optional

SHELL SLEEVE Ø 160 mm	ART. NO.	CONTENT/ QUANTITY
Shell sleeve 500 mm, PP 45 RHK	0059.0081	4
Optional: Shell sleeve 800 mm, PP 45 RHL	0059.0082	optional
Sound-absorbing element PP 45 SE	0093.0308	optional



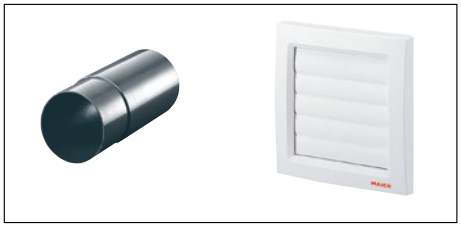
INDIVIDUAL COMPONENTS FOR OUTSIDE AND OUTGOING AIR	ART. NO.	CONTENT/ QUANTITY
External cover, plastic white PP 45 AK	0093.0176	4
Optional: External cover, brushed stainless steel, PP 45 AE	0093.0177	optional
Soffit element PP 45 LE with stainless steel cover	0093.0179	optional
Soffit element extension, PP 45 LEV	0093.1483	optional

ROOM AIR CONTROL	ART. NO.	CONTENT/ QUANTITY
④ RLS 45 K comfort variant Control unit for up to 6 ventilation units	0157.0360	1



EXHAUST AIR FAN	ART. NO.	CONTENT/ QUANTITY
② ECA 100 ipro small room fan	0084.0200	1

WALL SLEEVE	ART. NO.	CONTENT/ QUANTITY
WH 100 wall sleeve	0059.1030	1
SHUTTER		
AP 100 shutter	0059.1058	1



PPB 30

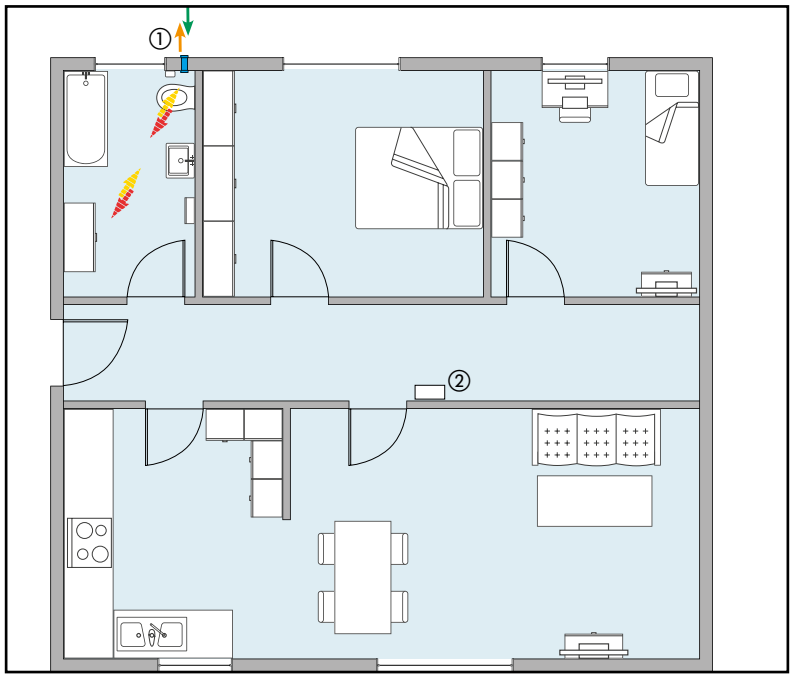
Decentralised ventilation of bathrooms , WCs and kitchens with heat recovery

Highlights

- Diameter of core drill hole just 162 mm.
- > 73 % heat recovery.
- Flow-optimised external covers direct air flow away from façade, protect this from soiling.
- The quietest ventilation in this class of unit.
- Cheapest solution for extracting air from a bathroom/ WC with heat recovery.

Mode of operation

- Balanced supply air / exhaust air mode with heat recovery.
- With switching using switch or humidity sensor, exhaust air mode in accordance with DIN 1946-6 Table 7.
- Can be used as stand-alone solution or in combination with PP 45.
- Activation via RLS 45 O.



Supply and exhaust air with change of direction

Outside and outgoing air with change of direction

① PPB 30 O ventilation unit in continuous operation with heat recovery
② RLS 45 O control unit

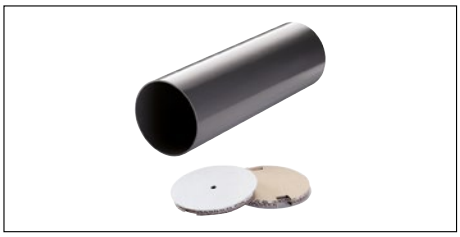
PPB 30

Decentralised ventilation of bathrooms , WCs and kitchens with heat recovery

MATERIAL PER BATHROOM/WC/KITCHEN (example)

FINAL ASSEMBLY SET	ART. NO.	QUANTITY
① PPB 30 O comfort variant	**0095.0245**	1

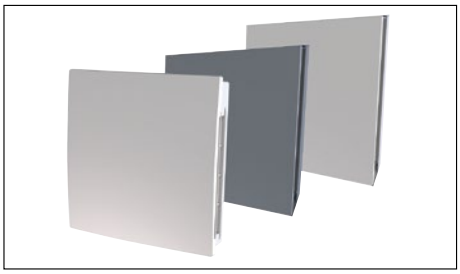
SHELL SLEEVE Ø 160 mm	ART. NO.	CONTENT/ QUANTITY
Shell sleeve 500 mm, PP 45 RHK	**0059.0081**	1



Optional:	ART. NO.	CONTENT/ QUANTITY
Shell sleeve 800 mm, PP 45 RHL	**0059.0082**	optional
Extension set of inner fluid channel in shell sleeve 800 mm, PPB 30 VS	**0093.1522**	optional

OPTIONAL ACCESSORIES FOR SHELL SLEEVE	ART. NO.	CONTENT/ QUANTITY
Wall block, thermally insulated, 365 mm deep, can be shortened, PP 45 MB	**0058.0143**	optional

INDIVIDUAL COMPONENTS FOR OUTSIDE AND OUTGOING AIR	ART. NO.	CONTENT/ QUANTITY
Plastic external cover, white, PPB 30 AK	**0093.1498**	1
Optional: External cover, brushed stainless steel, PPB 30 AE	**0093.1499**	optional
Optional: External cover, aluminium, painted white, PPB 30 AW	**0093.1500**	optional



ROOM AIR CONTROL	ART. NO.	CONTENT/ QUANTITY
② Control unit RLS 45 O	**0157.0359**	1

PP 45 RC and PPB 30 RC

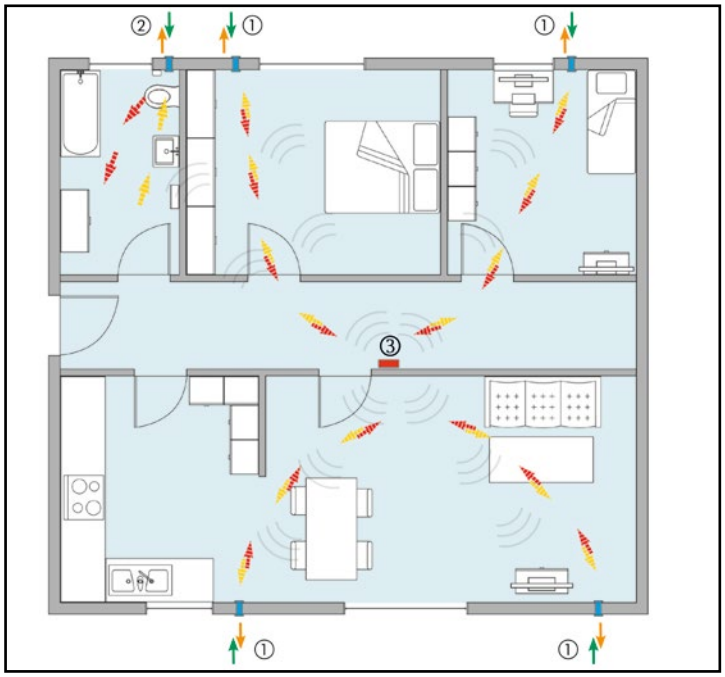
Decentralised ventilation of bathrooms , WCs and kitchens with heat recovery

Highlights

- Diameter of core hole just 162 mm.
- Any number of units possible provided within range.
- Flow-optimised external covers direct the air flow away from façade so that this is protected from soiling.
- Pitched room version available as option.
- > 84% heat recovery.
- Efficiency class A+
- Sleep function, party ventilation.

Mode of operation

- Unit installed in the wall with alternating exhaust air and supply air mode for ventilating living rooms.
- In exhaust air mode, > 84% of heat is stored and returned when in supply air mode.
- At least 2 units needed
- Damp rooms and kitchens can be included in the ventilation system with exhaust air fans or PPB 30 K.
- Central control with DS 45 RC radio switch.



230 V power cable connection

Short radio signal for control commands

Supply air and exhaust air with change of direction

Outside and outgoing air with change of direction

① PP 45 RC ventilation unit in alternating operation with heat recovery

② PPB 30 RC ventilation unit in continuous operation with heat recovery

③ DS 45 RC radio switch

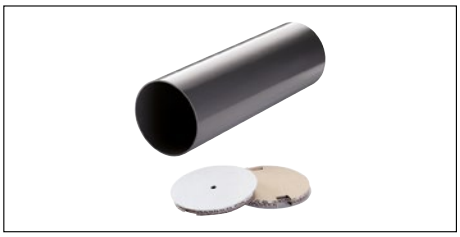
PP 45 RC and PPB 30 RC

Decentralised ventilation of bathrooms , WCs and kitchens with heat recovery

MATERIAL PER BATHROOM/WC/KITCHEN (example)

FINAL ASSEMBLY SET	ART. NO.	QUANTITY
① PP 45 RC	0095.0242	4

SHELL SLEEVE Ø 160 mm	ART. NO.	CONTENT/ QUANTITY
Shell sleeve 500 mm, PP 45 RHK	0059.0081	5

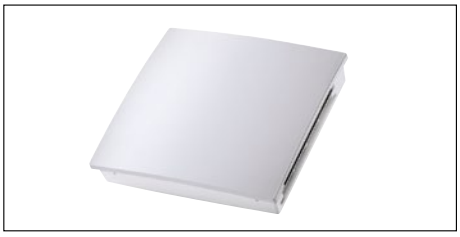


INDIVIDUAL COMPONENTS FOR OUTSIDE AND OUTGOING AIR	ART. NO.	CONTENT/ QUANTITY
Plastic external cover, white, PP 45 AK	0093.0176	4
Optional: External cover, brushed stainless steel, PP 45 AE or PP 45 AW	0093.0177 or 0093.0178	optional

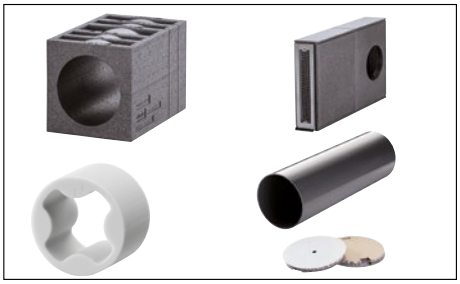
ROOM AIR CONTROL	ART. NO.	CONTENT/ QUANTITY
③ DS 45 RC radio switch	0157.0363	1

FINAL ASSEMBLY SET	ART. NO.	CONTENT/ QUANTITY
② PPB 30 RC	0095.0244	1

INDIVIDUAL COMPONENTS FOR OUTSIDE AND OUTGOING AIR	ART. NO.	CONTENT/ QUANTITY
Plastic external cover, white, PPB 30 AK	0093.1498	1



OPTIONAL ACCESSORIES FOR FINAL ASSEMBLY SET PP 45 RC	ART. NO.	CONTENT/ QUANTITY
Wall block, thermally insulated, 365 mm deep, can be shortened, PP 45 MB	0058.0143	optional
Soffit element PP 45 LE with stainless steel cover	0093.0179	optional
Sound-absorbing element PP 45 SE	0093.0308	optional
Shell sleeve 800 mm, PP 45 RHL	0059.0082	optional



PP 45 with ER EC

Decentralised ventilation for flats with heat recovery

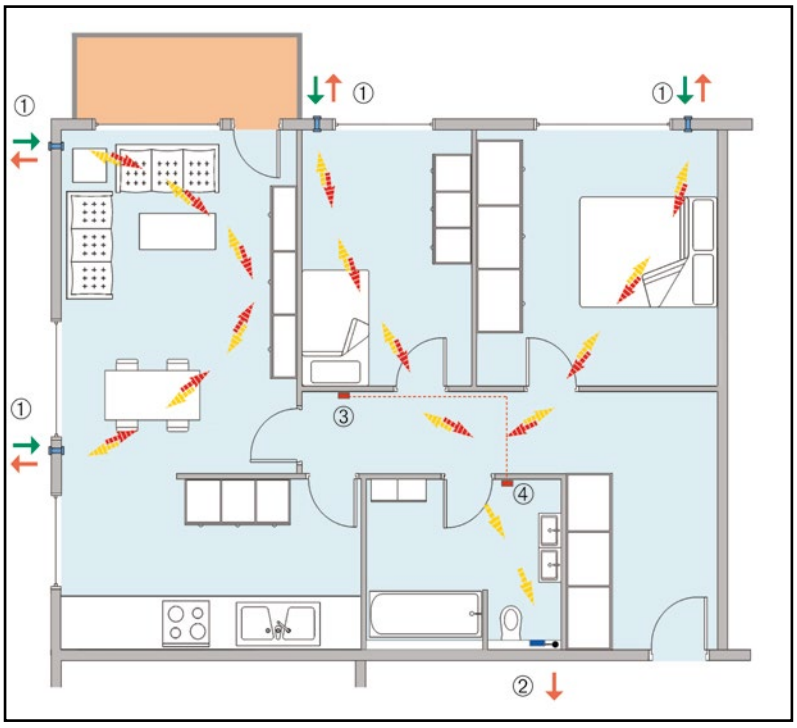
Option for extending decentralised ventilation system

Combination of PP 45 single-room ventilation units for supply air rooms with ER EC for exhaust air rooms in accordance with DIN 18017-3. By supplying the PP 45 single-room ventilation unit and ER EC exhaust air fan, MAICO also provides an optimum ventilation concept for multi-storey residential buildings with a central exhaust air duct.

Mode of operation

- The PP 45 units ventilate and extract air as standard in a balanced continuous operation.
- If necessary, the on/off switch in the bathroom can be used to activate the ER EC exhaust air unit.
- The PP 45 units ensure volumetric flow compensation and the supply air increases at the same time.
- When the switch is pressed again, exhaust air mode is deactivated and the supply air for the PP 45 units reduces automatically.

Ventilation solution taking the example of a 3-room apartment in a multi-storey building



Supply and exhaust air with change of direction

Outside and outgoing air with change of direction

① PP 45...ventilation unit in continuous operation

② ER EC exhaust air unit, Demand-based ventilation using ventilation shaft without heat recovery

③ RLS 45 K control unit

④ Switch in the bathroom for ER EC

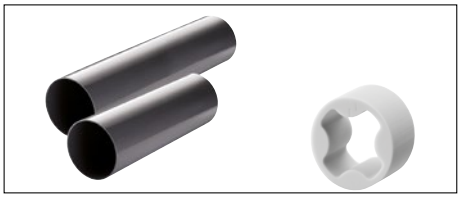
PP 45 with ER EC

Central ventilation for flats with heat recovery

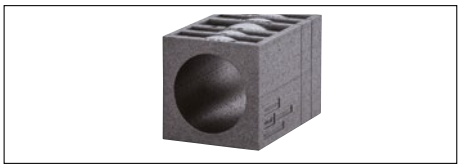
MATERIAL PER RESIDENTIAL UNIT (example taking 3-room flat)

FINAL ASSEMBLY SET	ART. NO.	CONTENT/ QUANTITY
PP 45 K comfort variant with electric internal shutter	0095.0241	4

SHELL SLEEVE Ø 160 mm	ART. NO.	CONTENT/ QUANTITY
Shell sleeve 500 mm, PP 45 RHK	0059.0081	4
Optional: Shell sleeve 800 mm, PP 45 RHL	0059.0082	optional
Sound-absorbing element PP 45 SE	0093.0308	optional



OPTIONAL ACCESSORIES FOR SHELL SLEEVE	ART. NO.	CONTENT/ QUANTITY
Wall block, thermally insulated, 365 mm deep, can be shortened, PP 45 MB	0058.0143	optional



INDIVIDUAL COMPONENTS FOR OUTSIDE AND OUTGOING AIR	ART. NO.	CONTENT/ QUANTITY
External cover, plastic white, PP 45 AK	0093.0176	4
Optional: External cover, brushed stainless steel, PP 45 AE	0093.0177	optional
Soffit element PP 45 LE with stainless steel cover	0093.0179	optional
Soffit element extension, PP 45 LEV	0093.1483	optional

ROOM AIR CONTROL	ART. NO.	CONTENT/ QUANTITY
RLS 45 K comfort variant Control unit for up to 6 ventilation units	0157.0360	1

FAN INSERT FOR KITCHEN AND BATHROOM	ART. NO.	CONTENT/ QUANTITY
② ER EC single duct air extraction unit	0084.0360	1

COVER WITH CONTROL	ART. NO.	CONTENT/ QUANTITY
ER-AK cover with comfort control for kitchen	0084.0362	1
ER-AH cover with humidity control for bathroom	0084.0363	optional

FLUSH-MOUNTED HOUSING FOR ER EC	ART. NO.	CONTENT/ QUANTITY
ER GH flush-mounted housing	0084.0350	1

WS 75

Ventilation unit for small residential units as well as for consulting rooms, offices and business premises.

Highlights

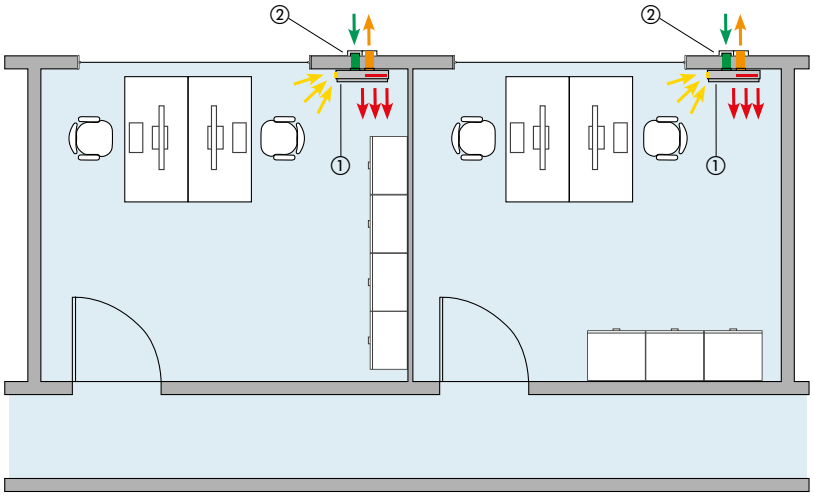
– Fully-automatic demand-driven operation via humidity sensor
  - VOC and CO2 sensors available as accessories
  - Air quality display via LED
– Innovative glass control element
– The integrated W-LAN module enables operation via the Air@home app
– Very quiet ventilation due to extremely sound-absorbing and heat-insulating housing construction
– Simple installation, Plug and Play
– No condensate drain required
– High energy efficiency due to EC DC motor, energy efficiency class A
– Fully automatic frost protection with continuous ventilation thanks to an innovative antifreeze circuit

Mode of operation

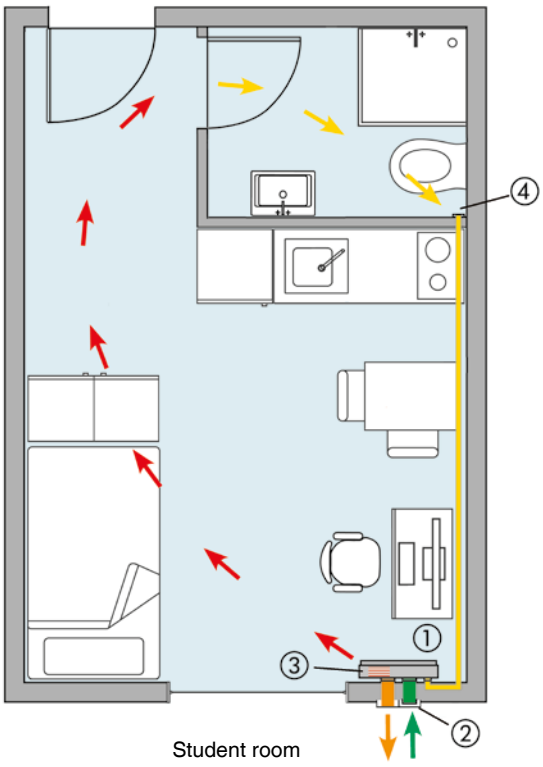
– The WS 75 Powerbox serves as a decentralised ventilation unit with heat recovery for controlled ventilation of individual rooms.

① WS 75 ventilation unit
② Outside air and outgoing air cowls
③ Supply air opening
④ Exhaust air duct with valve

Supply air
Exhaust air
Outside air
Outgoing air



Offices



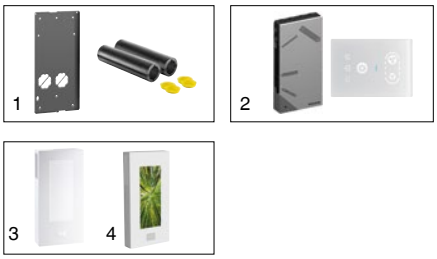
Student room

WS 75

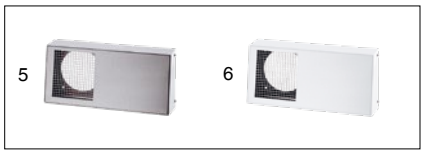
Decentralised ventilation for residential units of up to 50 m², e.g. offices (30 m²)

MATERIAL PER RESIDENTIAL UNIT (example)

Surface-mounted version	ART. NO.	CONTENT/ QUANTITY
1 WS 75 RSAP shell kit	**0093.1615**	1
2 Ventilation unit incl. control element WS 75 Powerbox H	**0095.0646**	1
3 WS 75 APA unit cover	**0093.1617**	1
4 Glass insert with printed motif	**on request**	optional



Façade / external cover	ART. NO.	CONTENT/ QUANTITY
5 Façade (brushed stainless steel) Duo KWS E	**0093.1440**	2
6 Façade (stainless steel, white powder-coated RAL 9010) Duo KWS W	**0093.1441**	optional

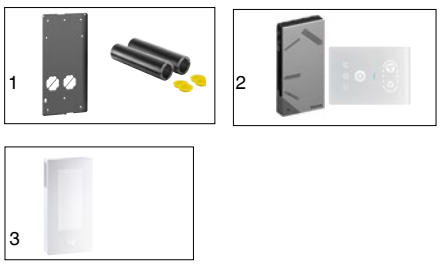


WS 75

Decentralised ventilation for residential units of up to 50 m², e.g. student room (20 m²)

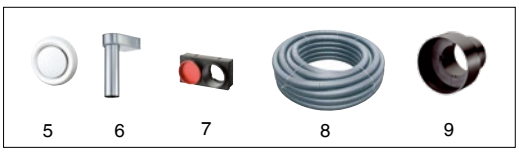
MATERIAL PER RESIDENTIAL UNIT (example)

Surface-mounted version	ART. NO.	CONTENT/ QUANTITY
1 WS 75 RSAP shell kit	**0093.1615**	1
2 Ventilation unit incl. control element WS 75 Powerbox H	**0095.0646**	1
3 WS 75 APA unit cover	**0093.1617**	1



Façade / external cover	ART. NO.	CONTENT/ QUANTITY
4 Façade (brushed stainless steel) Duo KWS E	**0093.1440**	1

Accessories for WS 75 flush mounting	ART. NO.	CONTENT/ QUANTITY
5 Plastic disk valve plastic for supply air/ exhaust air TK 10	**0151.0192**	1
6 MF-WL 100/80/200 bracket	**0018.0530**	1
7 MF-WE75 slide-in adaptor	**0059.0972**	1
8 DN75 MF-F75 flexible duct	**0055.0096**	1
9 MF-A75 adapter	**0059.0964**	1



6 Product overview

Decentralised ventilation units

		Volumetric flow in m^3/h	Degree of protection	Heat exchanger	Installation location	Airstream temperature	Maximum degree of heat provision	Sound power in dB(A)	Mobile control via APP
For supply air and exhaust air rooms									
PP 45...		15-42	IP 00	Ceramic	Supply air room	-15°C- +40°C	84.3 %	21-38	No
PPB 30...		5-26	IP X4	Ceramic	Exhaust air room	-15°C- +40°C	73.3 %	23-51	No
For small residential units as well as for consulting rooms, offices and business premises									
WS 75...		20 - 70	IP 00	Enthalpy	Supply and exhaust air room	-15°C - + 60°C	93 %	15-20	Yes

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Miscellaneous

- http://www.kostenlose-landkarten.de/bilder/Deutschlandkarte.png, p. 49 image on right

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