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Basics of the technology for controlled domestic ventilation

Relevant standards and regulations

The following standards and regulations are relevant in the planning of systems for controlled domestic ventilation:

- **EN 832** Thermal properties of buildings, calculating heating energy requirements.
- **DIN 4108** - Thermal insulation in high structure buildings
- **DIN 1946, part 6** - Domestic ventilation
- **DIN 18017** - Ventilating bathrooms and WCs without an outside window
- **EnEV** - German Ordinance on energy saving in buildings
- **Building laws** - Building regulations

Obligations of the manufacturer, installer and operator

The**Manufacturer** of systems for controlled domestic ventilation is responsible for testing and certification as well as the documentation; he also guarantees that the device is conformant with the tested model type, if appropriate.

The**Installer** must adhere to the installation regulations and select and install the electrical operating material in accordance with their application.

The**Operator** is responsible for the safety of the system. He must ensure that the system has been installed in accordance with the regulations and that it is checked prior to the initial operation. When the system is operating, he must guarantee that the status of the system complies with the regulations, through regular checking and maintenance.

Definitions

- **Outside air:** Air that is drawn in from the outside.
- **Supply air:** Air that flows into the living area.
- **Exhaust air:** Air that is extracted from the living area.
- **Outgoing air:** Air that is returned to the atmosphere.
- **Air exchange rate:** That portion of the room air, which is exchanged every hour.
- **Overflow opening:** An opening, through which the air will flow from one room to another, depending on the flow direction.
- **Thermal heat recovery rate:** Heat recovery parameters (exhaust heat source) from dry air, i.e. without taking any possible condensation into account. Does not contain heat from other sources, e.g. waste heat from a motor in the supply air flow. Only heat exchanger parameters, without taking into account other system components.
- **Degree of heat provision:** Heat recovery parameters (exhaust heating source) including the energy recovered due to any possible condensation. In addition to this, the heat from other sources that end up in the supply air flow, e.g. waste heat from a motor in the supply air flow, is included in the calculation. Therefore, these are parameters for the entire system, made up of heat exchanger, fans, etc.
- **Telephony:** Sound transfer from one room to another through the duct system.

A brief technical description

The core of the controlled domestic ventilation system is a central unit (ZEG or WRG), in which fan, air filters and, depending on the system, a heat exchanger are integrated. The exhaust air is fed into the control unit via a duct system, from where it leaves the building as outgoing air. With the central WRG systems, the outside and supply air flows through the central unit as well.

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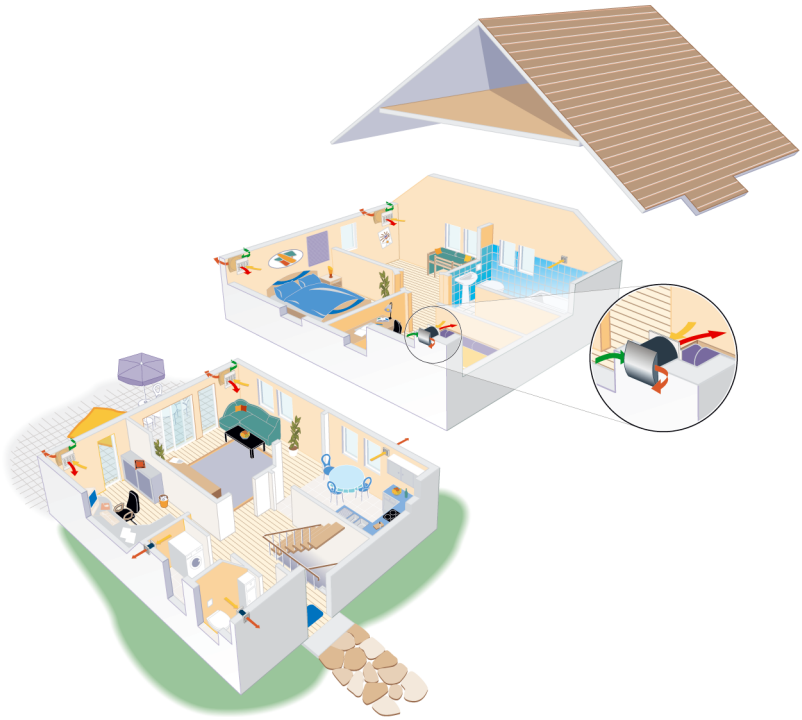
Normally the central unit draws the exhaust air from kitchens, bathrooms and WCs which are polluted with odours and humidity and transports the supply air into bedrooms and living rooms. This stops pollution caused by odours, steam or pollutants from reaching the living rooms.
Systems for controlling domestic ventilation can meet the majority of requirements by the addition of numerous accessories. In particular, the system controller can be used to set many different parameters: time, temperature, air exchange rate, etc. MAICO has specially developed this domestic ventilation control system for detached, single family-unit houses. The system can be installed in new houses as well as during renovations.



Air extraction and ventilation of a detached, single family-unit house, using a WS 250 system.

Important information regarding the versions

Central system with heat exchanger (aeronom WS 150)

- Central unit with heat exchanger and DC fans for supply air and exhaust air.
- Reduced heating requirements through heat recovery from the exhaust air.
- Degree of heat provision 90 %.
- A duct system is necessary for transporting the supply and exhaust air.
- The supply and exhaust air is not intermixed in the unit or in the duct system.
- Particularly quiet
- Space-saving, for installation in apartments

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Central system with heat exchanger and summer function (aeronom WS 250)

- Central unit with heat exchanger and DC fans for supply air and exhaust air.
- Reduced heating requirements through heat recovery from the exhaust air.
- Degree of heat provision 92%.
- With integrated bypass for heat-free ventilation (summer function).
- Control with many functions, such as room temperature, filter replacement due, operation and fault
- A duct system is necessary for transporting the supply and exhaust air.
- The supply and exhaust air is not intermixed in the unit or in the duct system.
- For installation in single-family unit houses with up to 200 m² living space.

Central system with heat exchanger (aeronom WS 600)

- Central unit with heat exchanger and DC fans for supply air and exhaust air.
- Reduced heating requirements through heat recovery from the exhaust air.
- Degree of heat provision 90 %.
- A duct system is necessary for transporting the supply and exhaust air.
- The supply and exhaust air is not intermixed in the unit or in the duct system.

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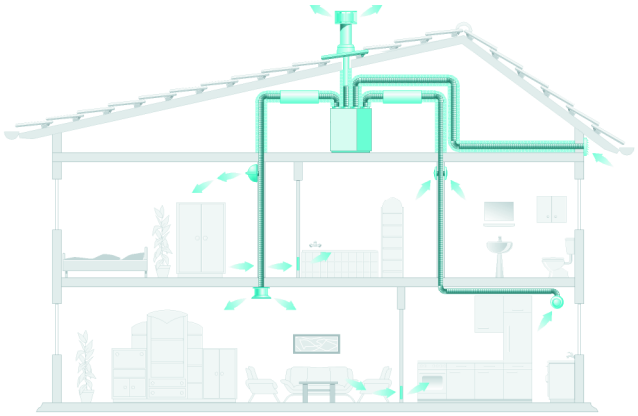
- Particularly quiet
- For installation in single-family unit houses with 200 m² to 400 m living space.

Central system with heat exchanger and DC fans (System WRG 300 DC)

- Central unit with heat exchanger and DC fans for supply air and exhaust air.
- Reduced heating requirements through heat recovery from the exhaust air.
- Degree of heat provision 90 %.
- A duct system is necessary for transporting the supply and exhaust air.
- The supply and exhaust air is not intermixed in the unit or in the duct system.



Central system without heat recovery (System ZEG)

- Central unit with air extraction fans.
- A duct system is necessary for transporting the exhaust air.

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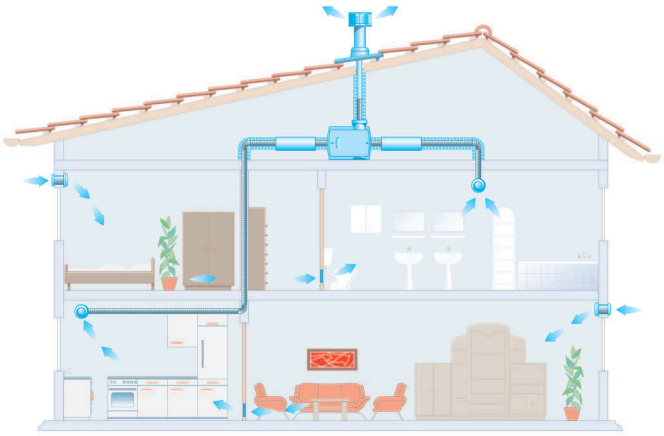
- Decentral supply air with several possible distribution variations, e.g. active ventilation with outside air fans, passive ventilation with outside air openings, dust or pollen filters, etc.
- Can also be used in multiple family units. In this case air is extracted separately for each individual family unit. A central exhaust air shaft is not necessary.



Planning process

1. Define the exhaust air volumetric flow.
2. Define the volume of supply air
3. Select the system fans.
4. Check the required air exchange rate.
5. Specify the duct system:
   - Determine the installation location for the central unit.
   - Determine the outside and outgoing air openings.
   - Determine the exhaust air and supply air openings.
   - Specify the duct layout.
6. Take special cases into consideration, e.g. fire places.

Important planning details for central systems.

When planning a system for controlled domestic ventilation, different points are important in respect of the central unit and the duct system. Important planning details for the central unit are explained in sections 1 to 4, followed by the duct system.

Central unit installation location

The central unit should be installed so that the shortest possible duct system can be fitted. MAICO recommends installation in the heating cellar or equivalent room. However, the compact construction enables it to be installed in a storage room or even in a cupboard.

Whether it is installed on the floor or on a wall depends on the unit.

Ensure that the central unit can be accessed for filter changes and maintenance work and that there is sufficient space for removing the covers.

Ensure that there is an electrical supply, 230 V AC, available.

A siphon connection must be available for draining any condensation. For this purpose, the central unit must be installed on a base approx. 200 mm high. If the siphon duct passes through an unheated area, it must be insulated, in order to prevent icing and any resulting break in the duct.

Central unit sound insulation

Decouple the central unit with impact sound plates.

Only the fans in the central unit produce a low noise level, which is comparable to the sound made by a fridge. Therefore, in a normal situation no supplementary sound insulation measures are necessary.

Central unit thermal insulation

The central unit must be insulated when installed in unheated rooms, e.g. attics. Only in this case will the system achieve the optimum degree of heat provision.

Maintaining and cleaning the central unit

Maintenance activities to be carried out by the user are restricted to checking and cleaning the air filter. The service intervals are dependant on the prevailing air quality.

Clean the air filter using a vacuum cleaner or luke-warm water. The air filter should be changed after several cleanings.

Additional maintenance activities for cleaning the heat exchanger and the fans should be carried out once a year by a specialist.

Volumetric flow regulations - layout of the duct system

The German Ordinance on energy saving in buildings (EnEV) stipulates an air exchange rate of at least 0.4 for living units.

The following guide values for the exhaust and supply air volumetric flows are valid here. This means that the air in odorous and humid areas such as kitchens, bathrooms and WCs must be extracted and the fresh air must be supplied to living-rooms and bedrooms.

	Volumetric flow [m³/h]
Kitchen	40
Bathroom	40
WC	20
2. Bathroom	40
2. WC	20

	Volumetric flow [m³/h]
Living room	50
Office	30
Parents' bedroom	40

	Volumetric flow [m³/h]
Children's room	30

The exact values depend on the quantity of air being supplied by the fans in use and the size of the rooms.

Layout example:

	Volumetric flow [m³/h]
Kitchen	40
Bathroom	40
WC	20
Total exhaust air volumetric flow	100

The supply air volumetric flows are based on the following 3 definitions:

- Guide values in accordance with DIN 1946
- 30 m³/h per person in accordance with DIN 1946
- Target air exchange rate 0.4
  - The air exchange rate should not be less than 0.3 and should not exceed 0.6.

Design the layout of fans and the duct system, based on these specific supply and exhaust air volumetric flows.

Duct dimensioning

The duct diameter to be installed, depends on the calculated volumetric flow:

Duct diameter [mm]	Maximum volumetric flow [m³/h]	Maximum flow velocity [m/s]
100	90	3,2
125	150	3,4
150	200	3,0

Use smooth walled folded spiral seams ducts or synthetic ducts for the duct system.

Ducts with rough inner surfaces should not be used for reasons of hygiene and flow.

Outgoing and outside air openings

The outgoing and outside air openings can be made in the roof as well as the walls.

Ensure that the cross section is sufficient for the corresponding planned volumetric flow.

Do not make openings on the prevailing wind side, in order to prevent problems caused by wind pressure.

Make the 2 openings at a distance of at least 2 m from each other, in order to prevent "short circuit effects" between the outgoing and outside air.

Outside air opening:

- Should be at a height of at least 3 m.
- Do not fit close to garages and roads, so that contaminated air is not drawn in.

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- Ideal in a well ventilated attic, as the air that is drawn in is already pre-heated.

Outgoing air opening:

- Do not fit opposite windows of neighbouring houses.

Exhaust and supply air openings

In general, one opening per room is sufficient. In the case of rooms with more than 25 m² 2 openings should be used, in order to better ventilate the room.

Exhaust air openings:

- As close to the ceiling as possible.

- Close to sources of humidity and odours.
- As far away as possible from the door.

Supply air openings:

- Not near seating areas.
- Close to radiators.
- As far away as possible from the door.

Duct layout

Pay attention to safety regulations when fitting the duct system:

- Observe the fire lobbies.
- Ensure that fire places can function.

The duct system must be fitted so that it is as short as possible, in order to guarantee better thermal insulation.

In addition to this, you must always ensure that the air flow generated is not noticeable and could not be considered to be intrusive.

If the controlled domestic ventilation system is installed as a retrofit, experience has shown that it is better to put the duct system in corridor areas. Suspended ceilings are also a good location for installing duct systems.

Other possible installation sites:

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- On walls or sunk into the plastering.
- Floors.
- Floor paving.
- Jamb wall
- Cladded pitched roofs.

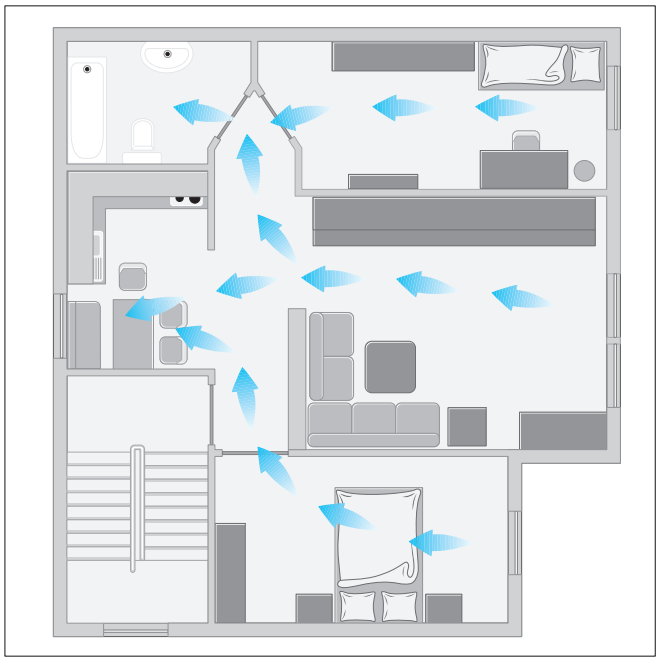
With supply and exhaust air, one must always differentiate between cross-room and individual room ventilation:

Cross ventilation means that the supply air flows through the entire living area before it is extracted. A simple duct system is sufficient for this.

Example of cross ventilation in a detached, single family-unit house.

Supply and exhaust air openings are made in each room for individual room ventilation. An extensive duct system is required for this.

Cooker extraction hood



It is forbidden to connect the domestic ventilation control system to a cooker extraction hood.

Extracted kitchen air is usually very greasy. This would contaminate the exhaust duct and the heat exchanger, which in turn will severely reduce the degree of heat provision.

Sound insulation - duct system

There are 2 classes of sound disturbances, which can be emitted by controlled domestic ventilation systems:

- Sound transfers within the duct system, e.g. from fans in the central unit.
- Flow sounds coming from the supply and exhaust air openings.

Both classes of sounds can be prevented by taking different measures:

Sound absorbers in the supply and exhaust air ducts to the central unit to absorb the sound of the fans.

Disk valve - nominal size	Maximum volumetric flow [m³/h]
100	30 to 60

Disk valve - nominal size	Maximum volumetric flow [m³/h]
125	40 to 70
150	50 to 90

Sound absorbers in each of the interconnected supply and exhaust air duct branches, to prevent telephony effects.
Flow sounds first occur at specific volumetric flows; these depend on the diameter of the openings. Therefore, the openings must be made large enough for the supply and exhaust air flows, or else more openings must be provided.

Thermal insulation - duct system

Temperature losses along the duct system reduce the degree of heat provision.
Therefore the supply and exhaust air ducts must be laid within the thermally insulated building envelope. In areas where this is not possible, e.g. in uninsulated attics, the supply and exhaust air ducts must be insulated with approx. 50 mm thick insulating material.
In principle, outside and outgoing air ducts must be insulated with approx. 100 mm thick insulating material. An additional insulating steam-tight padding should be fitted, in order to prevent the insulation material from becoming soaked through. Damp insulation no longer provides the required insulation.

Check list

	ZEG	WRG
Central unit installation location	Central position Wall and floor installation is possible Ensure access Ensure that there is a mains connection available	Central position Wall and floor installation is possible Ensure access Ensure that there are siphon and voltage connections available.
Acoustic protection for the central unit	Impact sound plates	Impact sound plates
Central unit thermal insulation	-	Thermal insulation required if installed in unheated rooms
Maintaining and cleaning the central unit	Clean the filter Annual cleaning by a specialist	Clean the filter Annual cleaning by a specialist
Volumetric flow regulations - layout of the duct system	Exhaust air and supply air guide values in accordance with DIN 1946	Exhaust air and supply air guide values in accordance with DIN 1946
Duct dimensioning	Folded spiral seams or plastic ducts Volumetric flow in accordance with the guide values	Folded spiral seams or plastic ducts Volumetric flow in accordance with the guide values
Exhaust and supply air openings	Exhaust air: Close to the ceiling	Exhaust air: Close to the ceiling

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	ZEG	WRG
	Near sources of humidity and odours Away from the door Supply air: Avoid seating areas Close by heaters Away from the door	Near sources of humidity and odours Away from the door Supply air: Avoid seating areas Close by heaters Away from the door
Outside air and exhaust air openings	Can be fitted to ceilings and walls No openings on the prevailing wind side 2 m distance between the openings Outside air inlet should be at a height of at least 3 m Outside air inlets should not be by garages or roads	Can be fitted to ceilings and walls No openings on the prevailing wind side 2 m distance between the openings Outside air inlet should be at a height of at least 3 m Outside air inlets should not be by garages or roads
Duct layout	Retain the fire lobbies Ensure that fire positions can be operated Duct system should be as short as possible Single room or cross ventilation	Retain the fire lobbies Ensure that fire positions can be operated Duct system should be as short as possible Single room or cross ventilation
Cooker extraction fan hoods	It is forbidden to connect it to the duct system Circulating air cover	It is forbidden to connect it to the duct system Circulating air cover
Acoustic protection for the duct system	Sound absorber in the exhaust air duct branches Determine the volumetric flow for the exhaust air openings	Sound absorbers in exhaust air and supply air duct branches Determine the volumetric flow for the supply air and exhaust air openings
Thermal insulation duct system	Exhaust air ducts in unheated parts of the building must have thermal insulation Outgoing air ducts must be thermally insulated and be steam-tight	Exhaust air and supply air ducts must be thermally insulated if installed in unheated parts of the building Outside air and outgoing air ducts must be thermally insulated and be steam-tight