# sensovent®

Intelligent mechanical ventilation system
for multi-family housing

Harmann®

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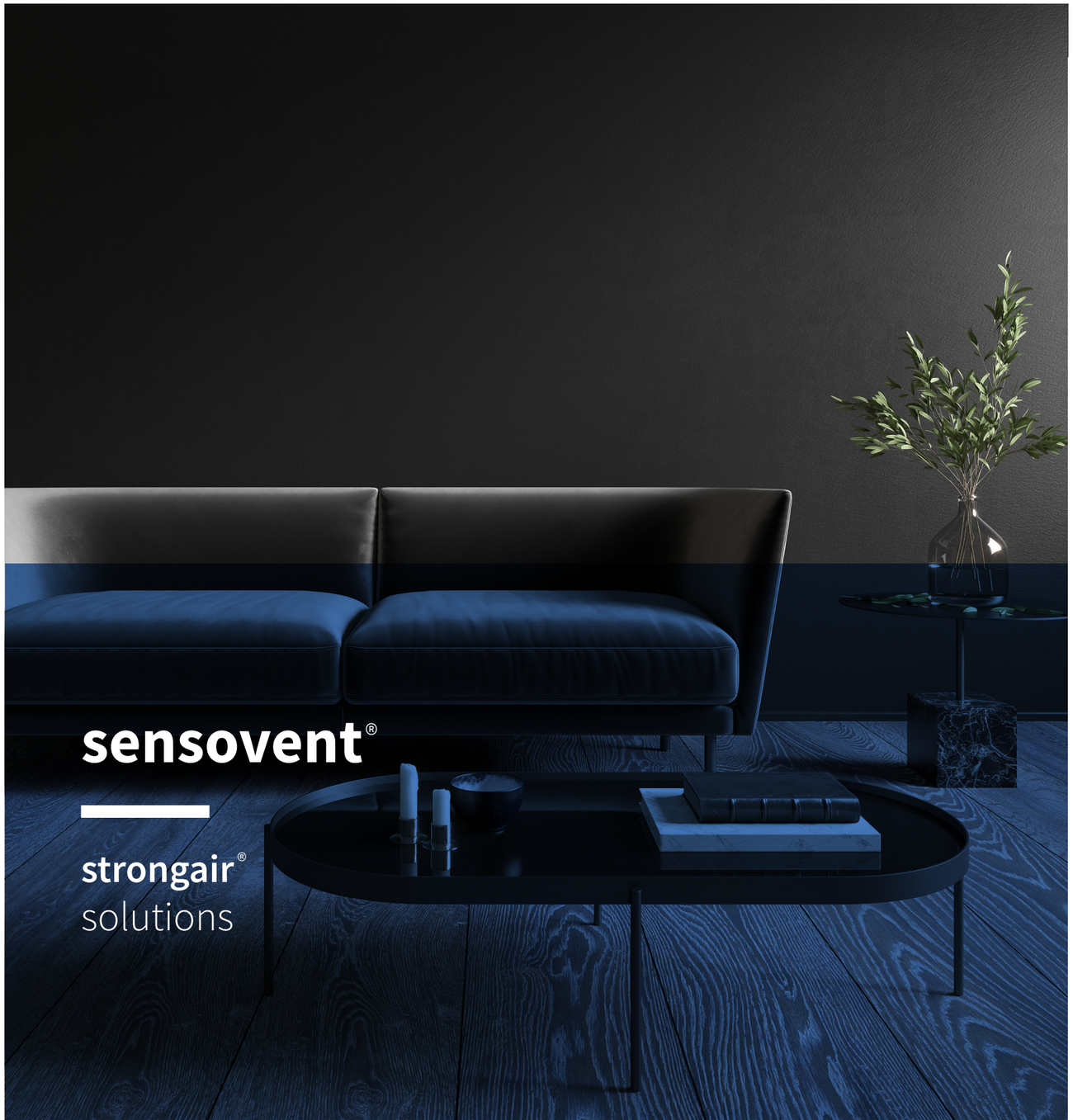



# Intelligent mechanical ventilation system

A natural consequence of the housing development is the growing awareness of investors and a sensible increase in expectations regarding effective and trouble-free ventilation. The **sensovent®** system takes into account a number of alternative solutions and design tools, enabling the selection of the optimal concept adapted to the needs of users, building regulations, the investor's financial capabilities and possible limitations, e.g. architectural.

The offered solutions can be defined as central mechanical exhaust ventilation with compensating gravity air supply. Air exhaust is guided from the kitchen or kitchen annex, bathroom, toilet and dressing room. Fresh air is supplied directly to all rooms, as well as to the kitchen if it is equipped with an external window. Alternative configurations enable obtaining constant air streams (according to PN-B-03430-1983/Az3:2000) with periodic reduction at night, or meeting the criteria of demand-controlled ventilation (DCV).

Discover
the **sensovent®** system

components of the system certified in Poland

silent operation in compliance with the PN-B-02151 requirements

a selection program supporting the design and configuration of the system

5 series of fans ready for every assembly variant

DCV or CAV regulation

a set of dedicated accessories: mounting, electrical, regulating and acoustic

only fans equipped with the EC motor

high energy efficiency in both DCV and CAV systems

fans with low energy consumption

professional technical support

# **sensovent®** selection program

The **sensovent®** system also includes a pioneering selection program that supports the design and technical verification of the installation step by step. The selection of device diameters, extract grilles, the right number of vents or the quietest fan for each duct does not have to involve creating spreadsheets, browsing through brochures, catalogues or numerous characteristics. The pinpointing feature of the **sensovent®** project is an intuitive application from which all relevant and most importantly up-to-date technical information is available. The program performs the necessary and laborious calculations, e.g. hydraulic or acoustic, saving time and giving the designer the freedom to edit conditions at every stage. When designing with the **sensovent®** program, the user will receive clear and transparent selection cards, the content of which can be successfully treated as an attachment and supplement to the prepared technical specification.

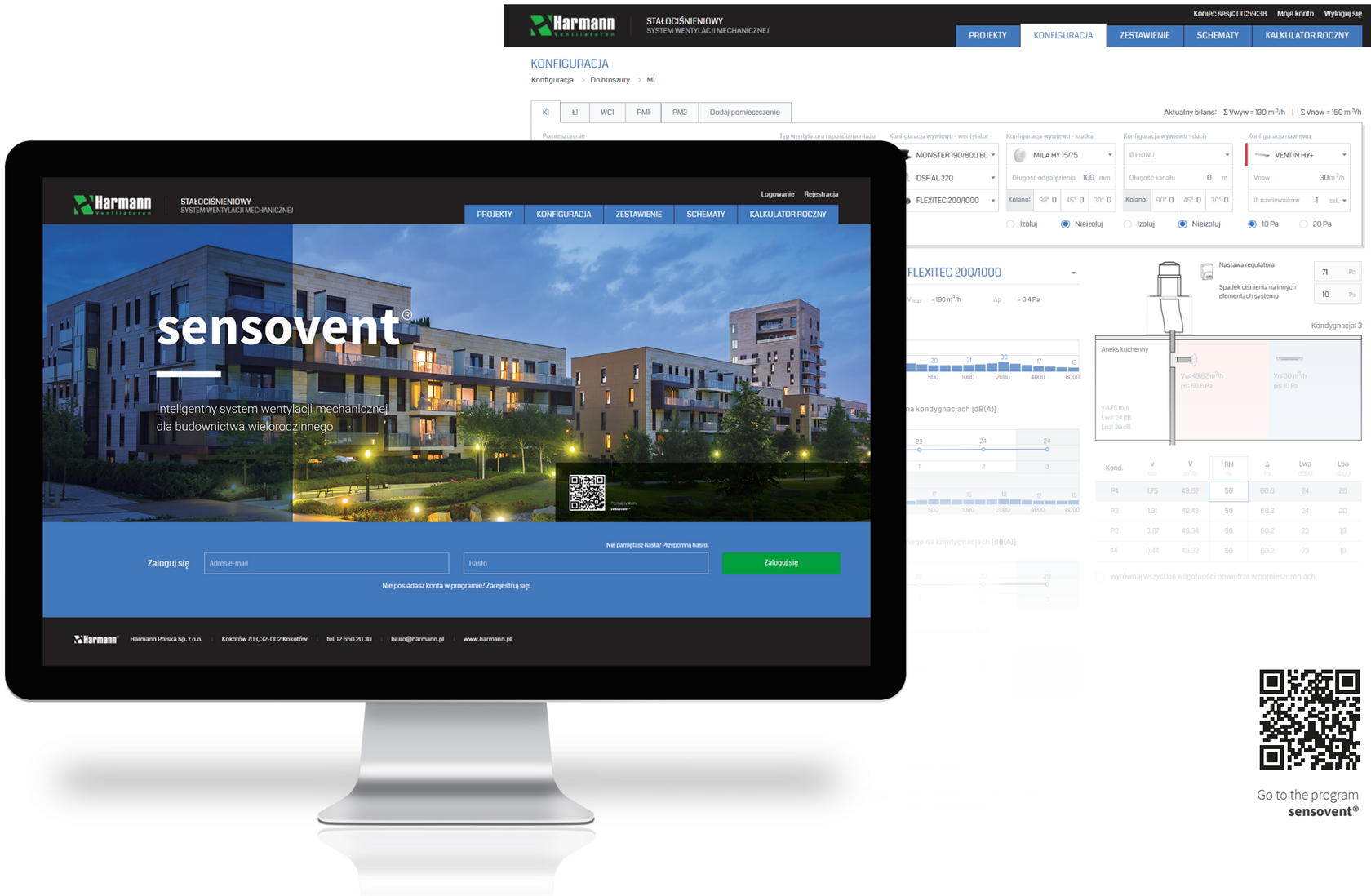
The **sensovent®** program provides the following functionalities:

- selection and computational simulations for components: fan, roof base, silencer, extract grille, vent,
- automatic selection of auxiliary accessories,
- indication of the optimal and minimum diameter of the duct,
- hydraulic calculations,
- calculation of the pressure regulator setting,
- determination of the sound pressure level in the room for each floor,
- verification of the selected number and type of vents,
- calculations for the energy performance of the building, e.g. auxiliary energy of fans,
- PDF selection cards for ducts or complete apartments,
- generating lists of devices and accessories (.pdf and .xls),
- generation of the installation layout diagrams (.dxf).

## Certification and reliability of declared parameters

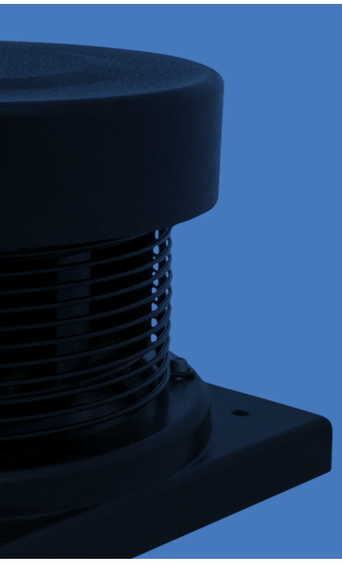
The implementation of each element of the system is preceded by numerous analyses, normative tests and detailed calculations. Own laboratories and studies are often supplemented using the knowledge and competence of independent external facilities. In the case of products, issues or parameters of particular technical importance, the choice usually falls on technical universities. The guarantee of quality, engineering units and an objective approach translates into reliability and transparency of parameters presented in technical materials and available selection programs. Participants in determining or verifying the parameters of the **sensovent®** residential system include:

- Faculty of Energy and Fuels at the AGH University of Science and Technology in Kraków, Poland
- Faculty of Mechanical Engineering and Robotics at the AGH University of Science and Technology in Kraków, Poland
- Faculty of Environmental Engineering at the Wrocław University of Science and Technology in Wrocław, Poland (in the scope of the system energy efficiency)
- Building Research Institute in Poland (in the scope of National Technical Assessment)
- Institute of Power Engineering, Thermal Technology Branch “ITC” in Łódź, Poland




Go to the program **sensovent®**

# Work principle and components



Central sensovent® systems are based on the operation of a collective exhaust fan connected to one or several general ventilation ducts of apartments. Air exhaust is carried out through constant-flow or hygro-controlled extract grilles. The compensatory air supply is performed through window or wall vents. Negative pressure control in the duct ensures precise and smooth adjustment of the fan's characteristics and its response to such factors as: self-regulation of grilles and vents, changing weather conditions or user intervention. If demand-based ventilation (DVC) is selected, the EC fan with the pressure control module is a necessary element of the system. Their combination with humidity-controlled MILA HY+ extract grilles ensures local regulation, i.e. according to individual internal conditions, while maintaining the advantages and benefits of central systems. The use of MILA A+ constant flow grilles allows you to choose between negative pressure control and a simple system based on a constant fan characteristic, precisely regulated in the full range.

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**The sensovent® system includes only fans:**

- equipped with electronically-commutated motors in EC technology
- steplessly regulated (0-10V) in the entire area of the flow characteristics
- made of materials ensuring long operational life: high-quality plastic resistant to UV radiation and aluminium
- verified in detail at standardized measurement stands in terms of cooperation with dedicated regulators, compliance with the ErP directives, flow characteristics, energy (PN-EN ISO 5801), and acoustic (PN-EN ISO 5136, PN-EN ISO 3745 or PN-EN ISO 3741) properties
- constituting a well-thought-out construction monolith, without unnecessary screw connections and risky solutions, e.g. in terms of rainwater leakage
- equipped with regulators as standard

**The construction and assembly conditions allow to distinguish 3 main categories of fans:**

**roof** - constituting the end of the ventilation system (exhausts)

**duct** - mounted in spaces not exposed to weather conditions

**outdoor duct** - made in thermally and acoustically insulated versions

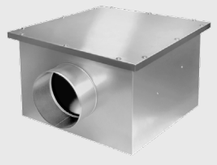
**sensovent®** is not just fans. It consists as well of numerous accessories, supply and exhaust elements that, when combined, form a coherent system tailored to the needs and specifics of the investment. A wide range of assortment enables a variant approach to each project. Detailed comparisons, guidelines or individual drawings prepared by the technical department are helpful in the final selection.

## Fans

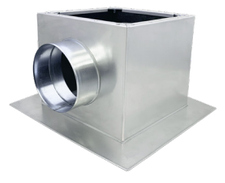
The most important element of any central system is the fan. In the **sensovent®** system solutions, special attention has been paid to construction design, material and workmanship, as well as normative tests enabling precise illustration of parameters in available selection programs.

Roof

Duct



Outdoor duct



Mounting and silencing accessories

Electrical accessories

Active humidity-controlled and constant-flow exhaust grilles

In-duct accessories

Humidity-controlled and pressure vents

# Roof fans

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The series of roof fans usually differ in solutions in the scope of:

- the direction of the air discharge
- housing material
- efficiency and possibilities regarding the number of connected ventilation ducts
- type of control and regulation used

| | MONSTER.PT EC | MONSTER.R EC |
|---|---|---|
| **Housing material** | ASA/ABS material resistant to UV and corrosion | ASA/ABS material resistant to UV and corrosion |
| **Air discharge** | horizontal | horizontal |
| **Motor** | EC | EC |
| **Regulation** | DCV | CAV |
| **Automatic control** | integrated in the housing | integrated in the housing |
| **Day/night setting** | in standard<br>with no auxiliary elements | constant setting |
| **Flowrate range** | 15-800 $m^3/h$ | 15-800 $m^3/h$ |
| **Service switch** | external/AS16 4P | external/AS16 4P |
| **Number of models** | 2 | 2 |
| **Connection diameters** | 125/160/200 mm | 125/160/200 mm |

Discover MONSTER.PT EC

Discover MONSTER.R EC

# Duct fans

The duct fans used in the **sensovent®** system are located in heated and unheated rooms, as well as on the roof of the building, after using a cover protecting against weather conditions. A common solution is the location directly above the ventilation duct, established at the architectural design stage.

There are 2 series available which vary depending on:

- type of impeller used
- housing material
- flowrate and pressure range
- type of control used

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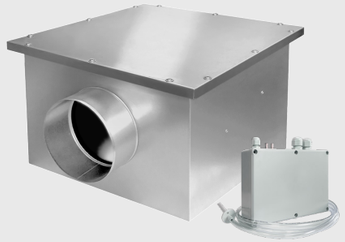
| | SENSOVENT DUCT EC | ML EC.R |
|---|---|---|
| **Housing material** | material resistant to UV, corrosion and mechanical damage | material resistant to UV, corrosion and mechanical damage |
| **Impeller type** | high-efficiency – diagonal | high-efficiency – diagonal |
| **Air flow** | In-line | In-line |
| **Motor** | EC | EC |
| **Regulation** | DCV | CAV |
| **Automatic control** | Sensoflow Advance+ in the set | integrated in the housing |
| **Day/night setting** | standard – no auxiliary elements required | constant setting |
| **Flowrate range** | 15-1200 m³/h | 15-1200 m³/h |
| **Service switch** | external/AS16 4P | external/AS16 4P |
| **Number of models** | 6 | 6 |
| **Connection diameters** | 100-315 mm | 100-315 mm |

Discover SENSOVENT DUCT EC

Discover ML EC.R

# Outdoor duct fans

The outdoor duct fans used in the **sensovent®** system can be located on the roof of the building. They are used when the project requires an extensive duct system, e.g. when connecting several ducts on the roof with a shared exhaust fan. The main advantage of this variant over a standard roof fan is the possibility of using additional noise attenuation on the air outlet side. The SENSOVENT DUCT BA series is therefore recommended for acoustically demanding locations, such as the vicinity of windows, balconies or terraces of a building.



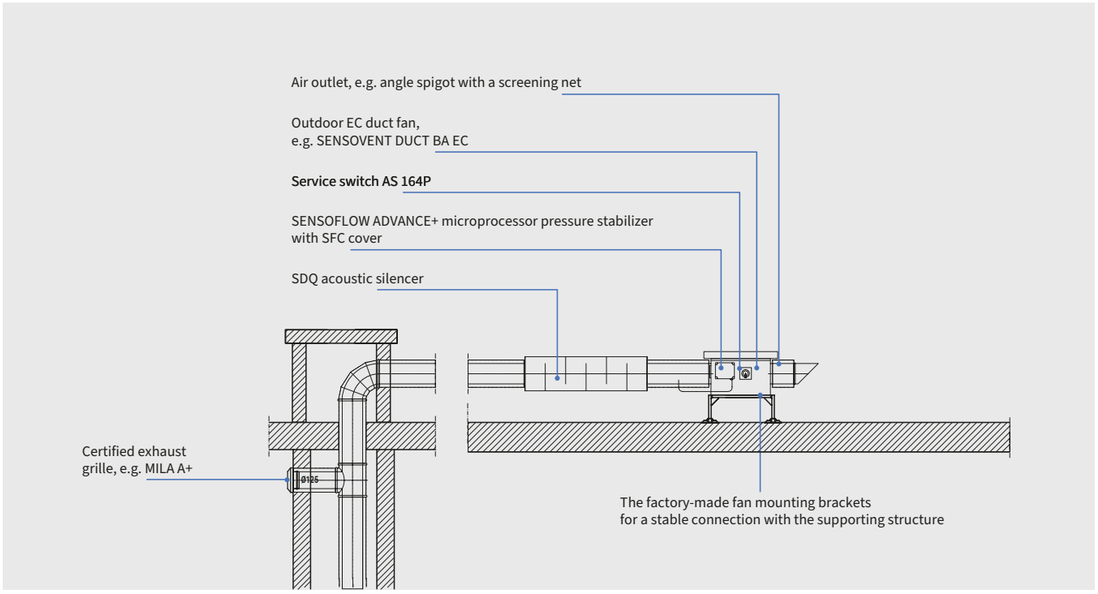
## SENSOVENT DUCT BA EC

| | |
|---|---|
| **Housing material** | Galvanized steel sheet isolated with rubber foam |
| **Impeller type** | high-efficiency – radial |
| **Air flow** | In-line |
| **Motor** | EC |
| **Regulation** | DCV |
| **Automatic control** | Sensoflow Advance+ in the set |
| **Day/night setting** | standard – no auxiliary elements required |
| **Flowrate range** | 15-3500 m³/h |
| **Service switch** | external/AS16 4P |
| **Number of models** | 3 |
| **Connection diameters** | 125-200 mm |

Discover SENSOVENT DUCT BA EC

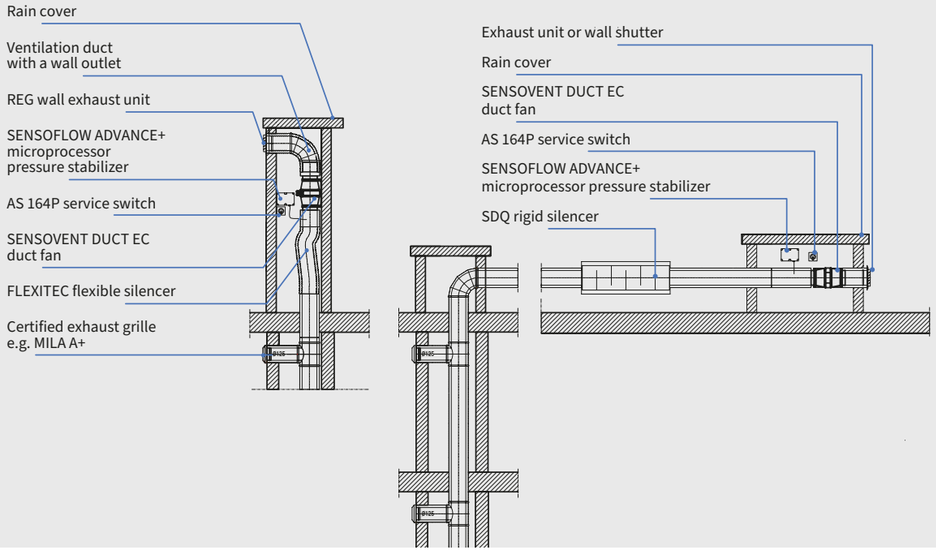


# Fans – installation examples



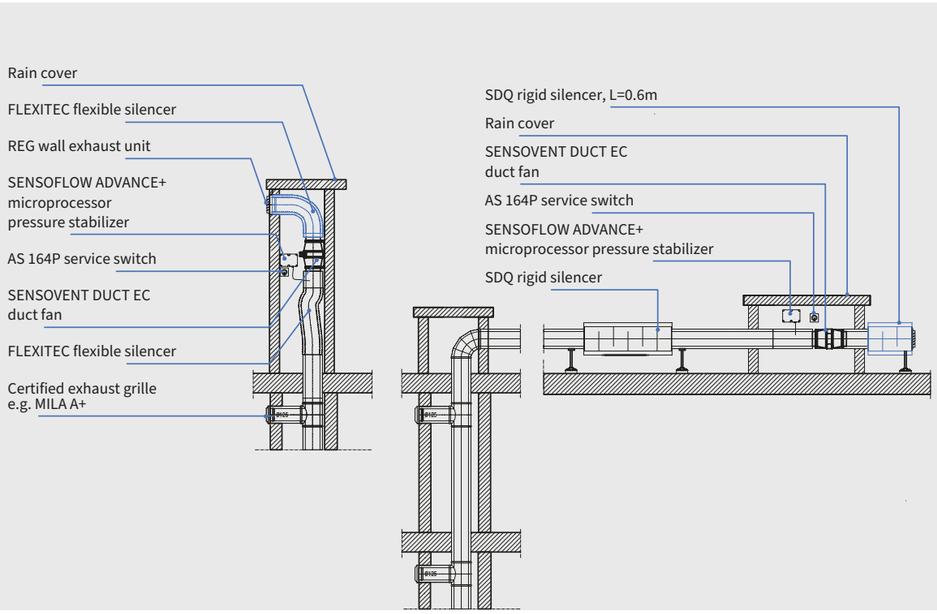

**Outdoor duct fan**
**SENSOVENT DUCT BA EC**
with accessories

**Duct fans for outdoor applications**



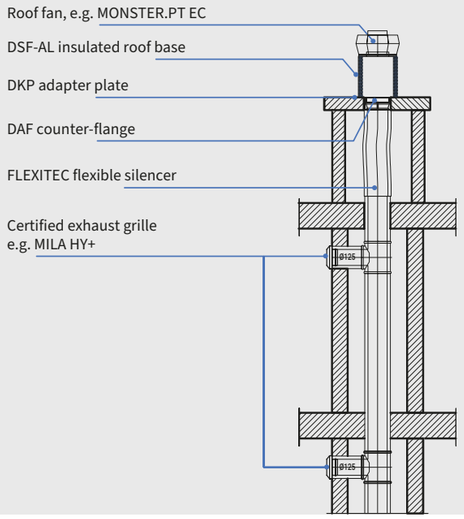

**Duct fans in the sensovent® system**

are always designed together with acoustic silencers mounted on the suction side of the device



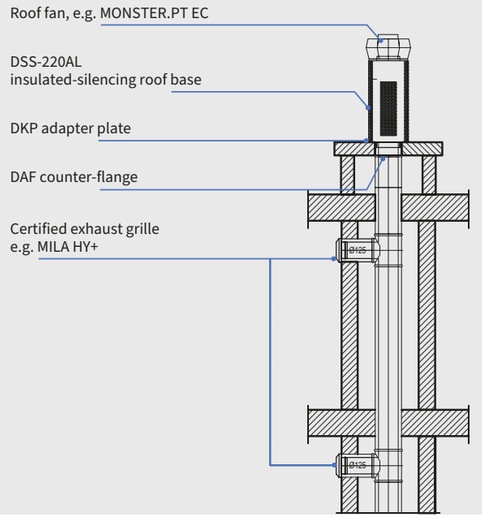

**At higher acoustic requirements**

e.g. location in close proximity to windows or terraces, silencers can also be used on the fan outlet side



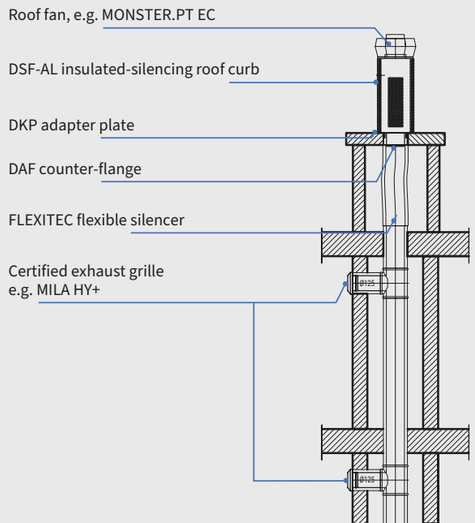

**Roof fan**

with a standard insulated base and a flexible silencer




**Roof fan**

with insulated base




**Roof fan**

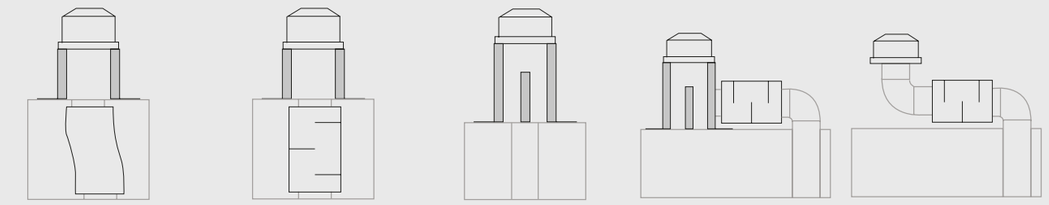
with an insulated base and flexible silencer

The **sensovent®** products available in the REVIT library

# Roof bases
# from the **sono**® product line

System accessories enable various variants of device assembly. The roof fan is most often located directly above the ventilation duct. In such a case, a roof base is used, with a flexible or rigid duct silencer in front of it. The standard base (DSF-AL) has an internal acoustic and thermal insulation made of mineral wool.

The standard version is occasionally replaced with a version having an additional damping baffle (DSS) or a system base with a side connection with the ventilation duct (DSF AL/B), which allows the fan to be moved with relation to the operated duct. The fans can also be mounted without the use of a roof curb, using a direct connection to the ventilation duct.



| Standard roof base flexible silencer | Standard roof base rigid silencer | Damping roof base | Base with a side inlet rigid silencer | Rigid silencer no base |
|---|---|---|---|---|



## DSF AL roof base

- material: weather-resistant aluminium sheet
- internal thermal and acoustic insulation (30 mm preventing the formation of condensate)
- flange around the main plinth enabling sealing to the roof surface
- compatibility with the MONSTER.PT and MOSTER.R fan models
- additional accessories: flexible FLEXITEC or rigid SDQ/SDS silencers, DAF connection spigot

Discover DSF AL

## DSS AL roof base

- material: weather-resistant aluminium sheet
- internal thermal and acoustic insulation (30 mm) preventing the formation of condensate
- increased damping thanks to the additional baffle made of mineral wool with a thickness of 60 mm
- flange around the main plinth enabling sealing to the roof surface
- compatibility with the fan models: MONSTER.PT and MONSTER.R
- designed together with duct silencers (FLEXITEC, SDQ/SDS) or as independent acoustic protection (buildings up to 4 storeys)
- additional accessories: DKP adapter plate, DAF connection spigot

Discover DSS AL

## DKP adapter plate

- material: galvanized steel sheet
- enables tight connection of the base with the circular ventilation duct
- used with roof bases: DSF AL, DSS AL and DAF spigots

### DAF counter-flange

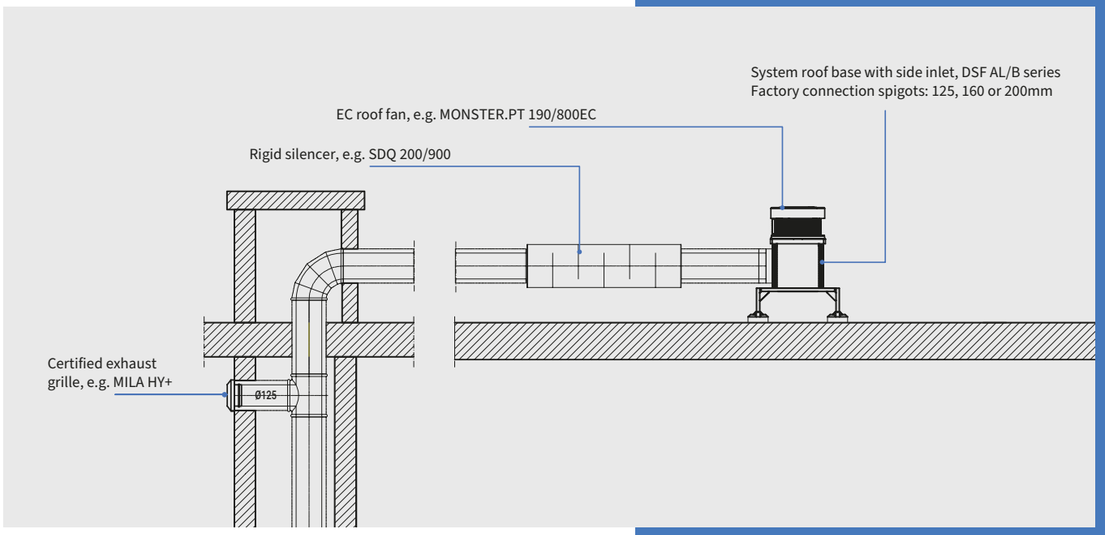
- material: galvanized steel sheet
- compatible with MONSTER.R and MONSTER.PT roof fans
- enables the connection of a straight duct with a round cross-section
- to use with roof bases: DSF AL, DSS AL and DKP adapter plate

Discover DAF

### DSF AL/B roof base

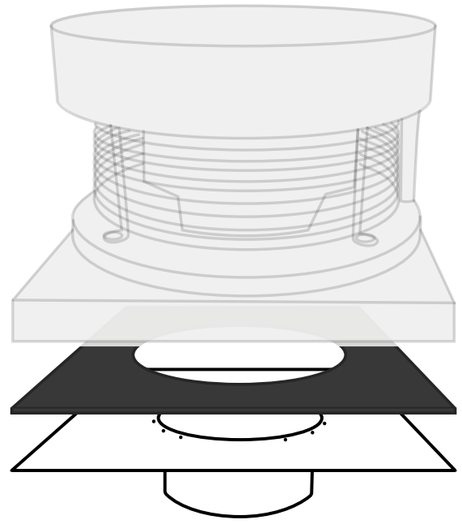
- material: weather-resistant aluminium sheet
- internal thermal and acoustic insulation preventing the formation of condensate
- compatibility with the MONSTER, CAPP fan series and other selected models
- usually designed together with rigid duct silencers (SDQ/SDS) enabling installation of the fan at a distance from the ventilation duct
- integrated connection spigots: 125, 160 or 200mm nipple type

Discover DSF AL/B




**An example of the fan assembly diagram**
on the base with the side connection with the ventilation duct (DSF-AL/B)

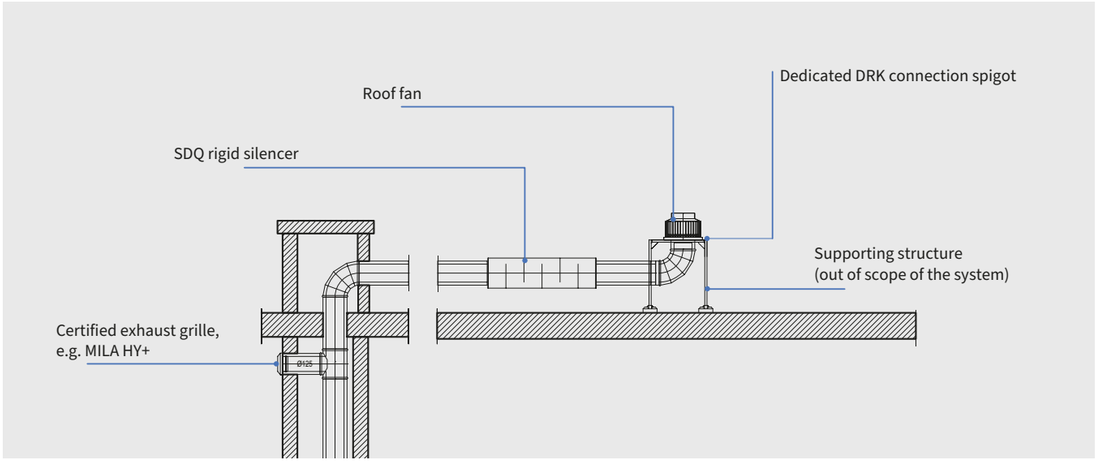
# Connection spigots for mounting without a base



### DRK

**Connection spigot to be used with MONSTER.PT and MONSTER.R fans**

Discover DRK



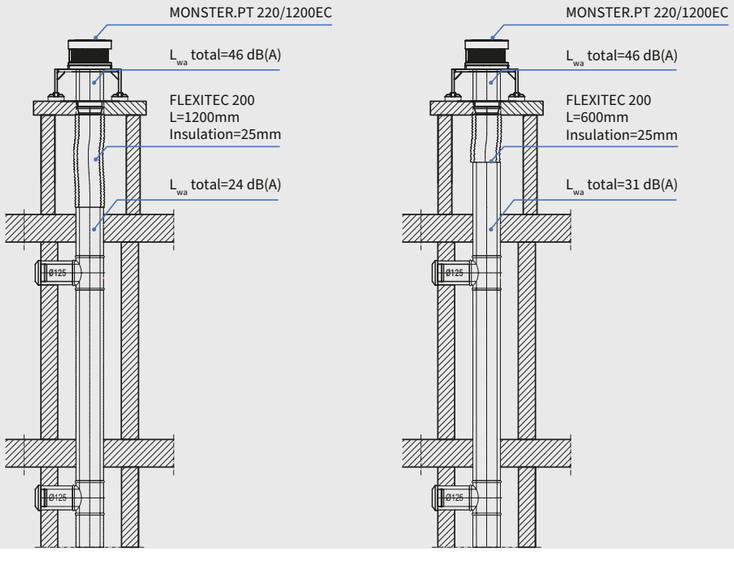

**An example of the fan assembly diagram without curb adapter**
with dedicated connection spigot and rigid silencer

# Acoustic silencers from the **sono**® product line

### FLEXITEC flexible silencer

- damping effectiveness confirmed by laboratory tests
- connection diameters: 100-315mm
- available lengths: 600/1200mm
- sound insulation thickness, standard version: 25mm
- inner and outer layer protecting the insulation against moisture
- possibility of use at negative temperatures
- outer layer of foil reinforced with aluminium-polyester laminate

Discover FLEXITEC

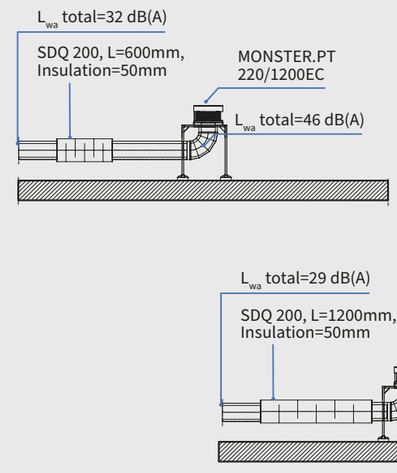



Comparison of damping effectiveness for an analogous fan with different variants of the FLEXITEC silencer

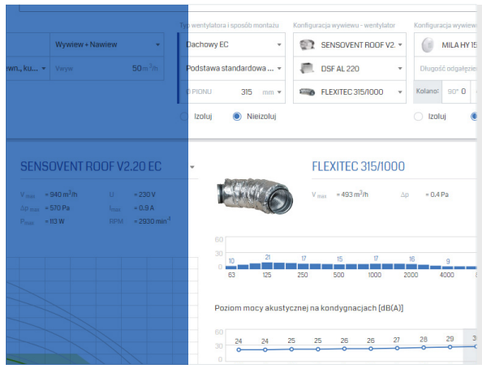
### SDQ/SDS rigid silencer

- damping effectiveness confirmed by laboratory tests
- connection diameters: 100-315mm (larger sizes available on request)
- available lengths: 600/900/1200mm
- sound insulation thickness, standard version: 50mm
- internal finish of the silencer, separation of the air stream from the insulating layer
- possibility of use at negative temperatures
- sealed nipple connections (EPDM)

Discover SDQ




Comparison of damping effectiveness for an analogous fan with different variants of the SDQ silencer




## sensovent®

Each system component can be easily configured using the **sensovent®** selection software. The program enables quick and intuitive selection of a silencer and immediate verification of the appropriate length / required damping effectiveness for the selected fan.

Check the **sensovent®** program

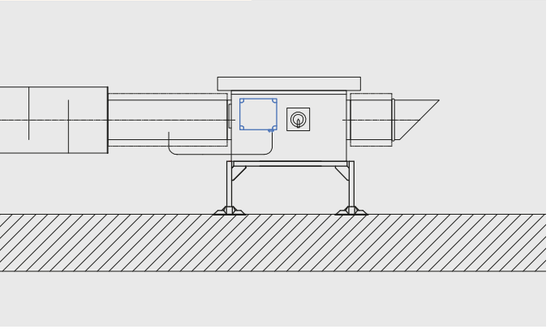
# Electrical and regulating accessories

The basic feature of all fans offered as part of the **sensovent®** system is the automatic speed control. Standard solutions are based on the pressure control module and DCV automation (SENSOFLOW ADVANCE+ / GT3 T). In selected configurations, it is also possible to use less advanced control, providing constant flows with precise adjustment of revolutions to the system hydraulics.

It is worth emphasizing that none of the offered solutions allows for the location of the regulator in the exhaust air stream. The lack of stream disturbance and additional air throttling on the discharge side is an important distinguishing feature of the system against the competing solutions.

## SENSOFLOW ADVANCE+ integrated automation unit

Discover
SENSOFLOW ADVANCE+

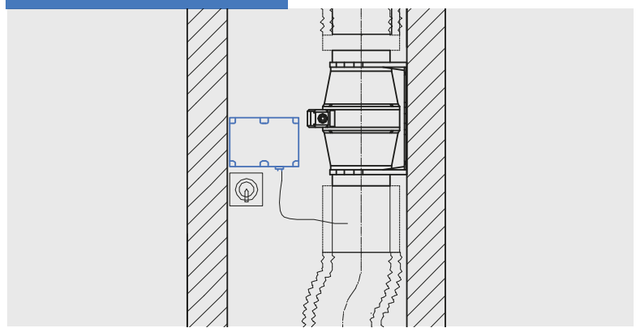


**Basic automation functions:**

- Precise adjustment of rotational speed and electric power consumption to the actual momentary DCV demand
- Accurate setting of the available static pressure in relation to the actual hydraulic resistance (accuracy 1Pa)
- Auto-calibration of the pressure value in the duct with the elimination of the influence of fluctuating draft
- Stable performance of ventilation grilles (no uncontrolled flow and differentiation of the air stream depending on the floor and/or weather conditions)
- Limiting the maximum fan speed and blocking the possibility of uncontrolled power consumption during decompression (e.g. in the case of pulled out grille by the resident)
- Flexible, stable, quiet and economical operation in the entire range of flow characteristics
- Protection of the central fan against overload resulting from limited or lack of air flow
- Programmable function for differentiation of the pressure setting for day and night time
- Option of remote activation of the night reduction mode by a potential-free contact
- User-friendly interface: clear display, intuitive menu, reading and edition of parameters
- Integrated in the MONSTER.PT fans and used with the fan series: SENSOVENT DUCT EC / DUCT BA EC

## GT3 T multifunctional speed controller

Discover
GT3 T



**Basic automation functions:**

- Remote (three-speed) or automatic (weekly programmer) fan speed control
- A programmer operating on a weekly basis and in defined time intervals
- Precise setting of any voltage value for each time interval defined in the programmer
- Three digital inputs for connecting external devices (relays, detectors, thermostats, humidistats, motion sensors)
- Possibility to control fan speed via ModBus
- Additionally equipped with a relay, e.g. to activate the connected frequency converter
- Designed to work with all fans equipped with a 0-10V analog signal input

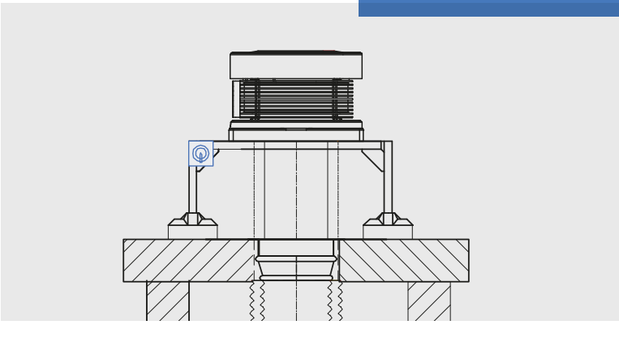
## AS 16A 4P service switch

The system allows for individual, dedicated service/repair switches installed together with individual fans. The basic function of these elements is to cut off the device from the power supply and prevent it from being switched on during service and maintenance. Some of the fans offered in the system have integrated switches. For the others, the AS 16A 4P series is a dedicated solution. It is strongly recommended to use the rule: number of fans = number of AS service switches to use with them.

Poznaj
AS 16A 4P

**Basic features and functions:**

- Optional lock in the power-off position
- Warning colours
- All-pole disconnection guaranteed
- Maintaining the required distance from pole-separating contacts
- Used with the following fans: MONSTER.PT, SENSOVENT DUCT EC, MONSTER.R, ML EC.R, SENSOVENT DUCT BA EC

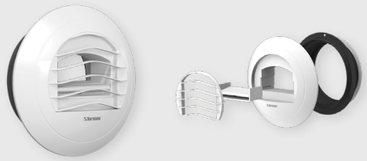


# Ventilation grilles

An important element of the **sensovent®** system are dedicated exhaust grilles from the MILA series, responsible for removing stale air from rooms such as the kitchen and bathroom. Depending on the solution, it is possible to choose automatic grilles that maintain a constant air flow, taking into account night reduction, or hygro-controlled grilles that adjust the amount of air removed depending on the relative humidity level in the room.

Discover MILA HY+

Discover MILA A+



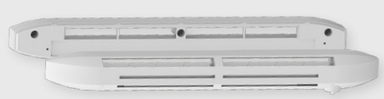
| Type | MILA HY+ | MILA A+ |
|---|---|---|
| **Nominal flowrate** | In accordance with PN/B-03430/AZ3:2000<br>15 m³/h, 30m³/h, 50m³/h, 70m³/h | In accordance with PN/B-03430/AZ3:2000<br>15 m³/h, 30m³/h, 50m³/h, 70m³/h |
| **Type of the system** | DCV | CAV (+ night reduction) |
| **Operation principle** | Smooth adjustment of the air stream relative to the nominal value, depending on the humidity of the removed air (adjustment to the user's needs) | Maintaining a constant flow at the nominal level, reduction to 60% at night (so-called night reduction) |
| **The acoustics of the grilles while ensuring the normative flow*** | **$L_{pA}$ [dB(A)]** | **$L_{pA}$ [dB(A)]** |
| **Room** / **Achieved in sensovent®** | Room with a kitchen annex: 21.2 / Kitchen: 26 / Bathroom: 28.2 | Room with a kitchen annex: 23 / Kitchen: 28 / Bathroom: 30 |
| **Acoustic reduction coefficient at maximal opening $D_{n,e,w}$(C)** | 52-56 dB | 50-61 dB |
| **Acoustic reduction coefficient at maximum opening Dn,e,w(C) (with damping module)** | 57-59 dB | 56-64 dB |
| **Connection spigots** | D 100/125 mm | D 100/125 mm |
| **Models available** | 6 | 5 |

*Values apply to: flow according to PN-83/B-03430/Az3 and the period of more rigorous acoustic requirements (10 PM – 6 AM)

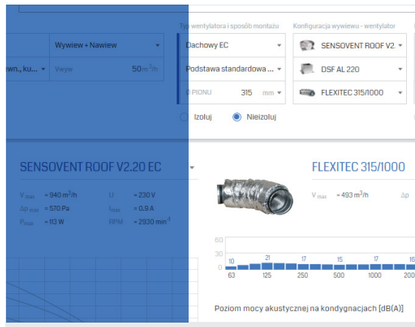
# Window vents

Compensating air supply in the **sensovent®** system is provided through window vents. The location of the vents includes all rooms, as well as the kitchen, if it is equipped with an external window. Regardless of the place of installation (window frame / external partition), pressure and humidity-controlled operation modes are available. All of the above makes the air flow dependent on the negative pressure inside the rooms. In addition, the humidity-controlled operation allow regulation as a function of relative humidity.

Discover the window vents



| Type | VENTIN HY+ \| SHY+ \| STHY+ |
|---|---|
| **Nominal flowrate (open vent)** | In accordance with PN/B-03430/AZ3:2000<br>Vnom ~30 m³/h at dP~10Pa |
| **Nominal flowrate (closed vent)** | In accordance with PN/B-03430/AZ3:2000<br>Vmin~7m³/h at dP~10Pa |
| **Used in the system** | DCV or CAV with night reduction |
| **Operation principle** | Adjustment of the amount of supplied air depending on the negative pressure and relative humidity |
| **Acoustic insulation coefficient (open vent)** | $D_{n,e,w}$ [dB]: 38-43 / $D_{n,eA2}$ [dB]: 39-43 / $D_{n,eA1}$ [dB]: 38-42 |
| **Acoustic insulation coefficient (closed vent)** | $D_{n,e,w}$ [dB]: 41-45 / $D_{n,eA2}$ [dB]: 41-45 / $D_{n,eA1}$ [dB]: 41-45 |
| **Window frame** | PCV |
| **Models available** | 3 |



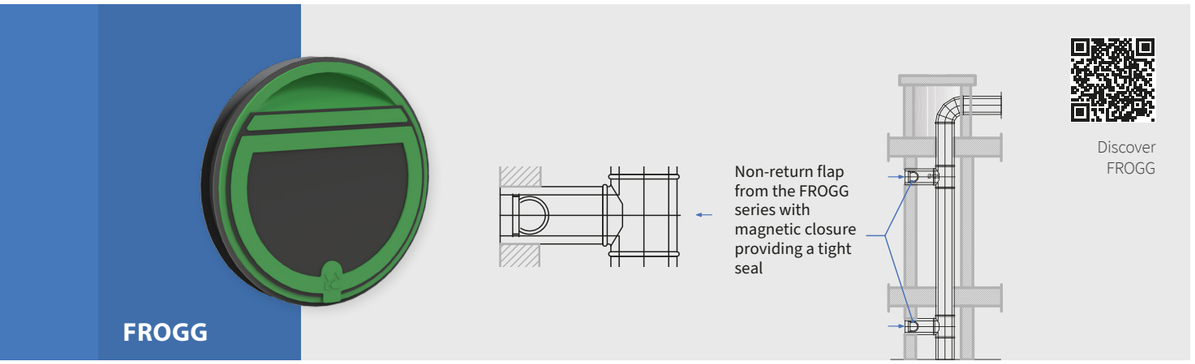

**sensovent®**

Each element of the system can be easily configured using the **sensovent®** selection program. The program suggests the appropriate air vent and exhaust grille for the selected system and amount of storeys in the building. It takes into account the choice of fans and acoustic calculations, and also checks the correct amount and exhaust air compensation.

Check the **sensovent®** program

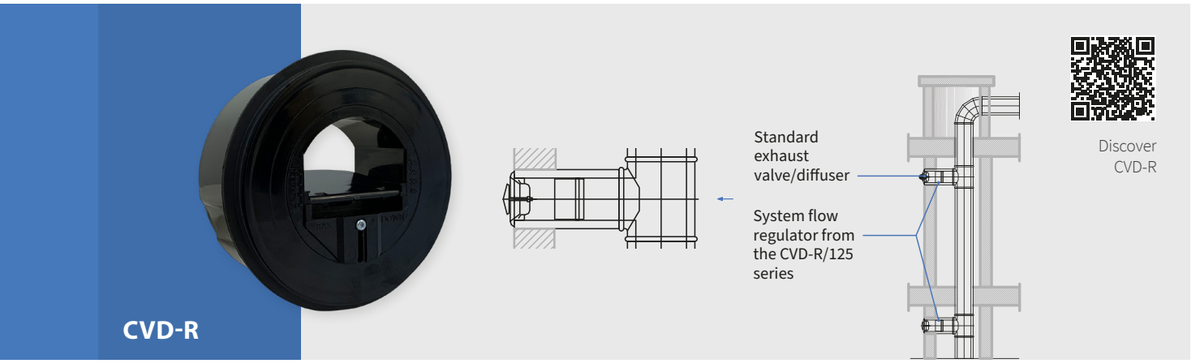
# In-duct exhaust accessories

In addition to active ventilation grilles, the **sensovent®** system uses a number of cartridge-type duct accessories.




### FROGG non-return flap

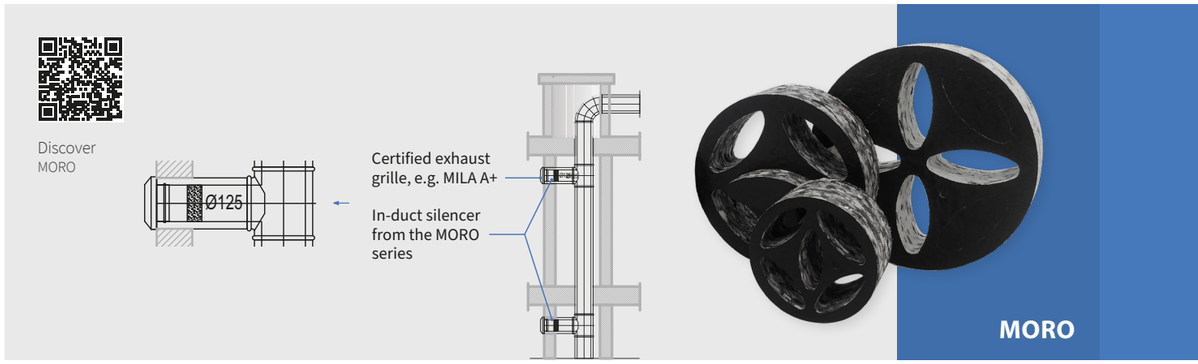
- Application: connection of individual kitchen hoods to collective exhaust ducts
- Elimination of odour migration between floors, as well as room cooling due to gravitational reverse air flow
- Installation in a horizontal duct with a diameter of 125mm
- Magnetic closure increasing the tightness and eliminating the susceptibility and noise of the flap clapping as a result of the natural gravitational draft
- Documented and confirmed by independent tests tightness in the closed position
- Class 4 tightness, in terms of typical residential ventilation conditions (dPmax ~ 215Pa), confirmed by the Institute of Power Engineering, Thermal Technology Branch “ITC” in Łódź, Poland
- Maximum pressure in the duct, confirmed by a leak test, in the closed position: 1300Pa
- The air flow through the element in the open position for residential use: maximum 720m³/h, nominal 300m³/h
- Used in the duct as an independent element and in combination with the CVD-R regulator and/or the BFDC damper
- Maximum operating temperature: 90°C





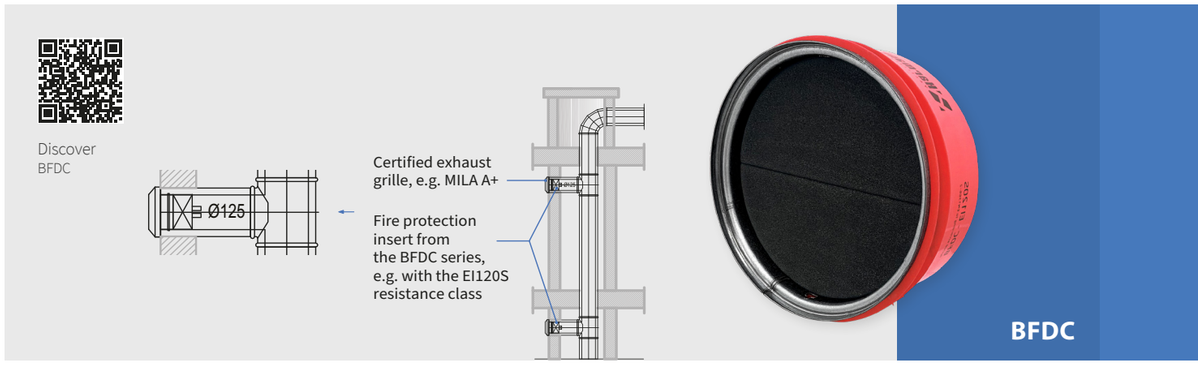

### CVD-R flow regulator

- Application: alternative to the MILA A+ grilles (in combination with an exhaust air valve) and/or limiting the maximum flow of the kitchen hood in combination with the FROGG flap
- Possibility of setting the required capacity at the element assembly stage, e.g. diameter 125mm available in capacities: 15-180m³/h
- Airflow range for the series: 15-500m³/h
- Number of available models/diameters: 6 (diameters 80-250mm)
- Standard operating pressure range: 50-250Pa (special versions max 600Pa)
- Used in the duct as an independent element cooperating with the exhaust valve and in combination with the FROGG flaps and/or the BFDC damper
- Maximum operating temperature: 60°C




### In-duct MORO silencer from the sono® line

- Application: additional attenuation of the noise from the collective fan (highest floors), lowering the operating pressure of grilles (highest floors - tall buildings), reducing sound transmission between floors
- Available models/diameters: 6 (diameters of 100-315mm)
- Made of polyurethane foam with high attenuating properties
- Optional adjustment of the flow and the resistance of the element by convenient and intuitive change of the flowsurface
- To be used in the duct as an accessory to the MILA series grilles
- The flowrate range through the element taking into account all sizes: 15-1200 m³/h




### BFDC fire damper

- Application: additional equipment for duct elements (MILA, CVD-R, FROGG) in the case of passage of the duct through a shaft which constitutes a fire separation (usually tall and high-rise buildings)
- Available fire-resistance classes: EI60S, EI90S, EI120S
- Operation in both horizontal and vertical position
- Available diameters: 100mm, 125mm, 160mm i 200mm
- Possibility of use in partitions constituting solid walls as well as lightweight construction (plasterboard) with a minimum thickness of 100mm
- Element used in combination with the MILA series grille, CVD-R regulator and/or FROGG flap or as a stand-alone element

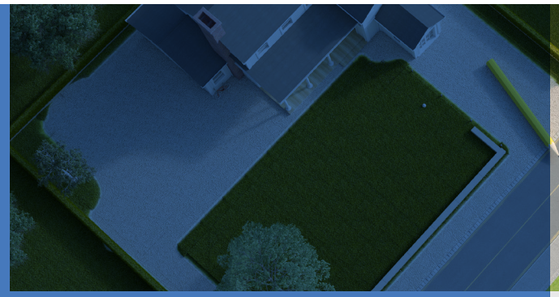
# Energy efficiency of the **sensovent**® system

**REPORT**

The measure of the energy efficiency of the ventilation system is undoubtedly its impact on the building's ability to meet the restrictive recommendations of the European Union regarding the annual demand for non-renewable primary energy $PE_{H+W}$. The capabilities of **sensovent®** in this respect have been confirmed by an analysis carried out by independent experts from the Faculty of Environmental Engineering at the Wrocław University of Technology.

The report was prepared for an exemplary, representative multi-family building in Poland that meets the rigorous requirements in terms of energy coefficients. The building was not equipped with alternative energy sources. Two exemplary configurations of the **sensovent®** system are included::

- Humidity-controlled (DCV regulation)
- Constant-flow (CAV regulation with night reduction)



| Location | Obtained PE coefficient [kWh/(m²year)] |
|---|---|
| Warszawa | 64.4 |
| Wrocław | 52.9 |
| Kraków | 64.9 |
| Gdańsk | 61.1 |

Results for exemplary locations in Poland in case of the **sensovent®** - humidity-controlled system (heat source: municipal heating network)

| Location | Obtained PE coefficient [kWh/(m²year)] |
|---|---|
| Wrocław | 52.7 |
| Kraków | 65.0 |
| Poznań | 65.0 |
| Łódź | 64.3 |
| Gdańsk | 60.9 |

Results for exemplary locations in Poland in case of the **sensovent®** - constant-flow system (heat source: municipal heating network)

The results of the analysis for a representative building showed that the **sensovent®** reference configurations make it possible to meet the rigorous PE requirements in key locations with respect to the dynamics of housing development. It is worth emphasizing that in the case of the **sensovent®** system, compliance with the PE index was demonstrated not only in the variable-flow (DCV) variant, but also for constant flow, periodically reduced in accordance with PN. Similar analyses and studies on competing systems indicate only illustrative possibilities in the field of humidity-controlled systems. They cannot be generalized and translated into constant-flow variants. For Harmann systems, PE values will be achieved in most cases, regardless of the chosen variant, constant-flow (CAV) or humidity-controlled (DCV).



# References


PROMENADY WROCŁAWSKIE | VANTAGE DEVELOPMENT

OLIMPIA PORT | ARCHICOM

PORT POPOWICE | VANTAGE DEVELOPMENT

OSIEDLE KOMEDY | DOM DEVELOPMENT

LOKUM PORTO | LOKUM DEVELOPER

OSIEDLE BROWARY WROCŁAWSKIE | ARCHICOM

OSIEDLE KĘPA MIESZCZAŃSKA | MILART

MIESZKAJ W MIEŚCIE | HENNIGER INVESTMENT

GRZEGÓRZECKA 77 | DEVELIA – LC CORP

TARASY WIŚLANE | INTERBUD KRAKÓW

LOKUM SALSA | LOKUM DEWELOPER

OSIEDLE KRK | ECHO INVESTMENT

NOWE OGRODY | PROXIN INVESTMENT

OSIEDLA NOWA SŁONECZNA | IMS BUDOWNICTWO

AURA TOWERS | JHM DEVELOPMENT

RIVERVIEW | VASTINT

APOLLO RIDA | APOLLO RIDA – POLAND

BROWAR GDAŃSKI | PB GÓRSKI

CENTAURUS | INOPA SA

TRITON WINNICA | TRITON DEVELOPMENT

MARINA APARTAMENTY | ATAL

PRAHO | SPRAVIA – BUDIMEX NIERUCHOMOŚCI

WOLA SKWER | SPRAVIA – BUDIMEX NIERUCHOMOŚCI

OSIEDLE PRZY ARKADII | DANTEX

BLISKIE BEMOWO | GRUPO LAR

APARTAMENTY DOLNY MOKOTÓW | DOM DEVELOPMENT

STACJA WOLA | ECHO INVESTMENT

VIS A VIS WOLA | POLSKI HOLDING NIERUCHOMOŚCI

AURORA | DANTEX

OSIEDLE PRZY SARNIEJ | PROFI DEVELOPMENT

APARTAMENTY TYSIĄCLECIA | ROGOWSKI DEVELOPMENT

OSIEDLA PARKOWE | MURAPOL

APARTAMENTY NOVUM | HINES

SASKA BLU | BRYKSY

ZAJEZDNIA POZNAŃ | REF EASTERN OPPORTUNITIES

OSIEDLE GRUNWALD2 | RONSON DEVELOPMENT

SZKLANE TARASY | DEWELOPER SZKLANE TARASY

SKY RES | DEVELOPRES

**sensovent®**
intelligent system

**sensovent®**
selection program

Harmann®

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