Decentralised air handling units in offices and administrative buildings

Focus on retrofitting

WOLF GmbH
Postfach 13 80
84048 Mainburg, Germany
Tel. +49 (0)8751 74-0
E-Mail info@wolf.eu
www.wolf.eu

Contents

Thanks to its modern design, the CGL 2 edu looks great in any room

Decentralised air handling technology – Maximum flexibility

Many non-residential buildings – such as offices, government buildings, waiting rooms, etc. – do not have an air handling system installed yet. Moreover, ventilating by opening windows is not always possible, especially in the winter. And yet indoor air quality is a critical factor for ensuring the well-being and health of people in the building.

The high occupancy density of such buildings makes regular air exchange indispensable to ensure that the quality of the indoor air meets hygienic standards.

Since carbon dioxide (CO_2) and other chemical substances (VOC, particulate matter) as well as pathogens (viruses, bacteria) accumulate in indoor spaces, window ventilation alone is often no longer sufficient.

Cognitive performance and comfort are also important factors for employees, guests and anyone else in the building. Adequate ventilation prevents discomfort and even illness-related absences from work that can result from spending time indoors.

At relatively low expense, high-performance ventilation systems can be installed in existing buildings to achieve the required level of indoor air hygiene. Significant energy savings can also be achieved along the way.

Decentralised air handing units offer tremendous flexibility when it comes to meeting the high indoor air quality requirements of offices and administrative buildings. They can be quickly implemented room-by-room and customised to the specific conditions with relatively little planning effort.

Individual control capability for various occupancy situations, compact design that offers outstanding accessibility, simple electrical wiring and a variety of design formats (e.g. floor-standing or ceiling units): Decentralised air handling units from WOLF offer flexible ventilation solutions with heat recovery, especially for existing buildings.

The energy saved by decentralised air handling systems with a high level of heat recovery translates to environmental and economic advantages for investors.

Applicable guidelines and standards for decentralised air handling systems in non-residential buildings

The key publications detailing the comprehensive requirements and individual planning procedures for decentralised air handling systems are VDI Guideline 3803, Part 2, and VDI 6022.

The evaluation criteria and classification for the adequate use of (decentralised) air handling systems can be determined according to the indoor air quality (IDA), supply air quality (SUP), extract air quality (ETA), exhaust air quality (EHA) and secondary air quality (SEC).

For non-residential buildings, such as offices and administrative buildings, most of the requirements lie in quality classes 2 and 3.

Building or room type	Category	Floor area (m² per person)	q_P	q_B	q_{tot}	q_B	q_{tot}	q_B	q_{tot}
			Occupancy (l/s,m²)	Very low-pollutant building (l/s,m²)		Low-pollutant building (l/s,m²)		Non-low-pollutant building(l/s,m²)	
Individual office	I	10	1.0	0.5	1.5	1.0	2.0	2.0	3.0
	II	10	0.7	0.3	1.0	0.7	1.4	1.4	2.1
	III	10	0.4	0.2	0.6	0.4	0.8	0.8	1.2
Open-plan office	I	15	0.7	0.5	1.2	1.0	1.7	2.0	2.7
	II	15	0.5	0.3	0.8	0.7	1.2	1.4	1.9
	III	15	0.3	0.2	0.5	0.4	0.7	0.8	1.1
Conference room	I	2	5.0	0.5	5.5	1.0	6.0	2.0	7.0
	II	2	3.5	0.3	3.8	0.7	4.2	1.4	4.9
	III	2	2.0	0.2	2.2	0.4	2.4	0.8	2.8

Table: Area-based ventilation flow rate for non-residential buildings with standard occupancy density and various uses

Example: The following formula applies to an open-plan office of category I in a low-pollutant building with an occupancy of 10 persons: 150 m² x (0.7+1.0) l/s,m² = 255 l/s = 918 m³/h

Evaluation levels for room air hygiene

CO_2 is considered an important indicator of healthy air in offices and administrative buildings. VDI 6022 (HVAC Systems – Schools), Part 3, describes three levels for classifying indoor air hygiene while also taking other factors into consideration:

Evaluation level 1 (check urgently recommended)
Carbon dioxide (CO_2), humidity (at 20 °C), air temperature

Evaluation level 2 (check if there is reason to suspect an issue)
Particulate matter (PM2.5), carbon monoxide, radon, TVOC

Evaluation level 3 (check only if complaints are common)
Chemical compounds and allergens, mould spores and negatively charged ions

DIN EN 16798-1 offers two procedures for use in Germany to determine the physiological requirement for fresh air, which has a significant impact on indoor air hygiene:

Procedure 1: Calculation based on perceived air quality
When the precise use of the classroom has not yet been determined, the following formula serves for an initial estimate and takes into account both the flow rate of CO_2 per person (q_P) and the building emissions (q_B). The values for category II in the corresponding table can be used for classrooms.

$$q_{tot} = q_P \times n + q_B \times A$$

Procedure 2: Calculation based on pollutant concentration
This procedure determines the required flow rate based on the maximum permitted CO_2 concentration (1,000 ppm) in the room air (C_{RL}), taking into account the CO_2 concentration of the outdoor air (C_{ZU}) and the ventilation effectiveness. Mixed ventilation (ε_V=1) is typically assumed here. This method is particularly well suited for regularly used classrooms because the actual "activity" is already known for determining the pollutant emissions in the room (G_h).

$$q_{V,zu} = \frac{G_h}{(C_{RL} - C_{ZU})} \times \frac{1}{\varepsilon_V}$$

Quick and easy filter changes

Comfort in occupied areas and workspaces

In addition to appropriate lighting and room size (including the number of occupants), the following parameters are particularly important for ensuring high levels of concentration when working in an office environment:

- Temperature
- Relative humidity
- Volume
- Absence of draughts

- ✓ The air temperature in office rooms should be at least 20 °C and no more than 26 °C. Air temperatures of up to 22 °C are considered ideal.
- ✓ The relative humidity should be at least 40%.
- ✓ The equivalent continuous sound level should be kept between 30 dB(A) (small offices) and a maximum of 45 dB(A) (open-plan offices).
- ✓ The air speed must be(up to 0.15 m/s; see also ASR A3.6).

The Technical Rule for Workplaces (ASR A3.6) further states that:

- The supply air must be free of excessive draughts and must enter the room in sufficient quantities.
- Natural air movements (e.g. rising air from warm/hot surfaces) must be enabled and effectively used in occupied areas.
- Substances, moisture and heat must be captured as close to the source as possible and diverted.

Energy efficiency must also be taken into account in the room temperature control. According to the Building Energy Act (GEG), air handling systems must provide heat recovery at least in line with DIN EN 13053:2007-11, classification H3.

In addition, the requirements of ErP Directive 1253/2014 must always be taken into consideration if the air routing of the air handling systems is intended to supply rooms where people are regularly present.

Advantages of decentralised air handling systems

- Centralised ventilation appliances, ventilation shafts and horizontal air distribution ducts are not required
- Low pressure and temperature losses in the system thanks to very short air routing paths
- Fast and individual control for various occupancy situations
- High availability of multiple devices provides redundancy within the building (avoidance of a complete failure)
- Ideally suited for retrofitting thanks to short lead times in planning and design, minimal preparations and fast appliance installation
- Minimal additional measures with respect to fire protection
- Prevents external noise caused by open windows, such as traffic or construction noise
- Heat recovery and high savings potential with regard to energy costs during the colder times of year
- Moisture recovery is often possible thanks to optional enthalpy heat exchangers for optimal regulation of the room humidity
- Eligible for subsidies in many cases (e.g. as an individual measure in a non-residential building eligible for the federal efficient building subsidy)
- Energy-efficient operation based on actual demand thanks to the use of CO_2 sensors


PERSONLICH

Ideal solutions for diverse projects

Retrofitting a decentralised air handling unit in offices and administrative buildings

A number of options exist for relatively quick retrofitting of an air handling unit in an existing building.

1. Hybrid ventilation

One option for designing and selecting suitable appliances consists of "hybrid ventilation". Hybrid ventilation refers to approaches to satisfying the requirements that always include open ventilation or window ventilation. However, this means sacrificing some of the advantages of a sufficiently dimensioned mechanical ventilation system while also accepting some of the disadvantages of open ventilation.

Advantages of hybrid ventilation

- ✓ Lower air flow requirements on mechanical ventilation system(s)
- ✓ Ventilation concept can be combined with existing infrastructure (windows)

Disadvantages of hybrid ventilation

- × Higher energy losses in the winter
- × Higher heat influx in the summer
- × Dependence on weather conditions, such as wind and buoyancy forces
- × Dependence on human factors
- × Actual ventilation effectiveness is unpredictable
- × Influx of pollutants, such as particulate matter, due to window ventilation
- × Noise
- × Procurement, installation and maintenance expenses remain

2. Purely mechanical ventilation

The following examples focus on semi-centralised and decentralised solutions (which can also be combined) without a hybrid ventilation concept.
When retrofitting air handling systems in existing buildings, central solutions typically do not come into consideration because the required modifications to the building are too extensive, making a relatively quick solution impossible.

Decentralised solution

With a decentralised solution, each air handling unit supplies exactly one room.

Application

- Building situation requires a decentralised solution
- Installation only in individual, separate rooms / only a single room
- Implementation must be completed promptly and quickly without interrupting normal operations (room-by-room installation)
- Very diverse ventilation requirements in the various rooms (high level of individual regulation required)

Other advantages

- ✓ Demand-based operation poses no difficulties
- ✓ Fast implementation possible
- ✓ No openings need to be created between rooms, meaning no noise transmission from room to room
- ✓ Low fire protection requirements

Reference example of floor-standing decentralised air handling unit

Reference example of ceiling-mounted decentralised air handling unit

CGL 2 edu compact ventilation unit
The decentralised, floor-standing AHU

Features:

- Whisper quiet with a very high flow rate
- CO_2-based flow rates as standard feature
- Heat recovery via high-performance plate heat exchanger with efficiency of over 90%
- Optional enthalpy heat exchanger for moisture recovery
- Integral bypass for night ventilation as standard feature
- Integrated damper for outdoor and extract air
- Compliance with the strictest hygiene requirements as per VDI 6022
- Optional second filter stage in supply air line
- WOLF WRS-K control system with interfaces for building management system
- Optional integration of electric preheater and reheaters
- Various options for air distribution in the room

		CGL 2 edu		
Max. air volume	m³/h	1,100		
Air volume at 35 dB(A) sound pressure level *	m³/h	930		
Sound pressure level *	dB(A)	28 (600 m³/h)	32 (800 m³/h)	37 (1,000 m³/h)
Height	mm	2,133		
Width	mm	1,070		
Depth	mm	620		
Weight	kg	283		

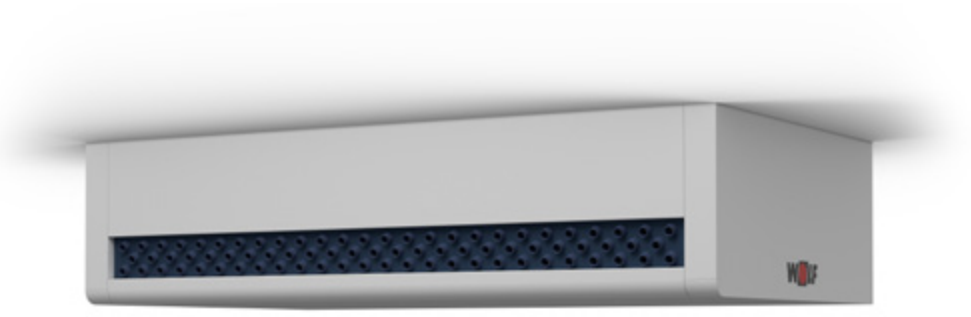
Including intake silencer and exhaust module

* Determined by TÜV Süd Industrie Service GmbH at a distance of 1 m as per DIN EN ISO 11203

CFL edu compact ventilation unit
The decentralised, ceiling-mounted AHU

Features:

- Extremely quiet with a very high flow rate
- CO_2-based flow rates as standard feature
- Efficient plate heat exchanger for heat recovery
- Integrated electrical preheating coil
- VDI 6022-compliant
- Integral bypass as standard for night ventilation
- Integrated wide-angle nozzles for very good air distribution without an additional duct network
- WOLF WRS-K control system with BacNet interface and much more



CFL edu		675	1,000
Max. air volume	m^3/h	675	1,150
Air volume at 35 dB(A) sound pressure level *	m^3/h	430	850
Height	mm	540	600
Width	mm	1,708	2,303
Depth	mm	1,170	1,300
Weight	kg	210	275

* Determined by TÜV Süd Industrie Service GmbH at a distance of 1 m as per DIN EN ISO 11203

Semi-centralised solution

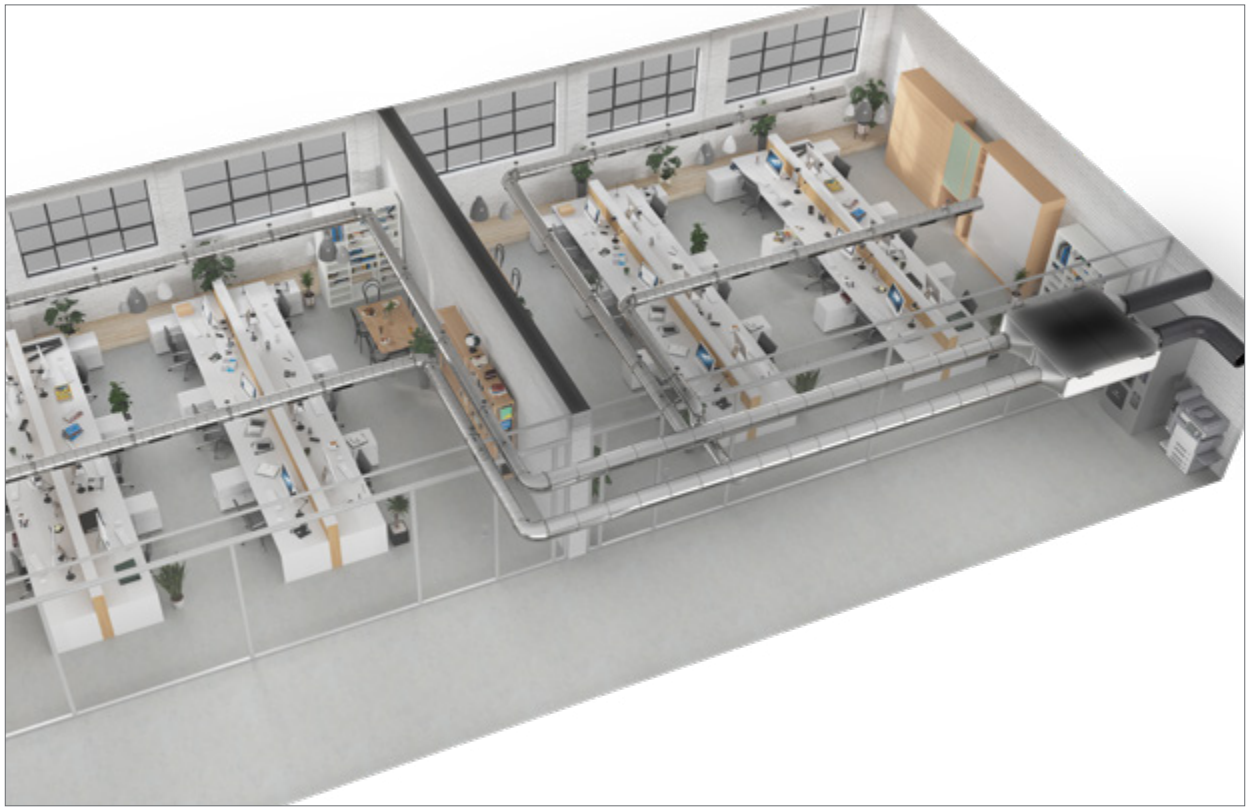
With a semi-centralised solution, multiple rooms are supplied by a single appliance.

Applications

- Insufficient space in the rooms for a separate decentralised appliance in each room
- Desire to minimise penetrations of the outer facade, such as for reasons of monument protection
- No connections for heating and cooling media available in the corresponding rooms
- Draining (condensate connection) not possible in the respective rooms
- Room arrangement supports the installation of a semi-centralised air handling unit

Additional advantages

- ✓ Minimal sound emitted into offices and administrative rooms
- ✓ Space savings in the classroom
- ✓ System technology with fewer points of maintenance

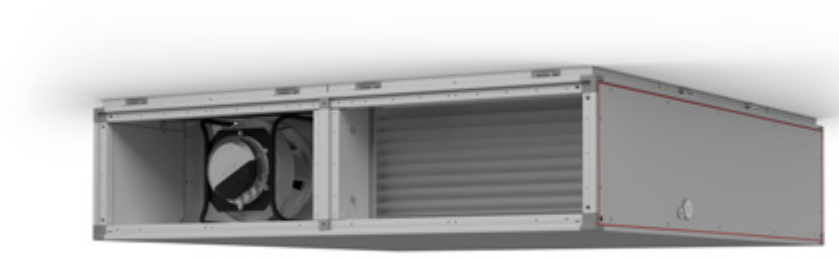


Reference example of ceiling-mounted semi-centralised air handling unit

CFL slimline ventilation unit with plate heat exchanger

The compact installed heights of CFL appliances make them ideal for use in suspended ceilings.
They are available in four different sizes as pure supply or extract air units (CFL-EC) or equipped with highly efficient heat recovery (CFL-WRG).

- Fans designed as free-running impellers are infinitely variable with EC technology
- Heat recovery with an efficiency of over 90% using an aluminium countercurrent plate heat exchanger (PHE)
- Flat, compact design enables easy integration and assembly
- Wide range of accessories available
- Fully wired
- Models in four sizes with air volumes up to 3,200 m³/h
- Optional enthalpy heat exchanger



CFL		10 WRG	15 WRG	22 WRG	32 WRG
Max. air volume	m³/h	1,000	1,500	2,200	3,200
Height	mm	367	367	411	495
Width	mm	1,017	1,423	1,830	1,932
Depth	mm	1,322	1,322	1,525	1,932
Weight	kg	130	160	240	340

CKL evo compact ventilation unit with plate heat exchanger

The CKL evo is available as an indoor unit with vertical or horizontal duct connection (CKL-iV/iH evo) and as a weatherproof outdoor unit CKL-A evo.

Advantages:

- Optional double filter stage for maximum hygiene requirements as well as numerous extension modules and extensive accessories (e.g. enthalpy heat exchanger)
- Night ventilation (cooling) with bypass mode as standard
- Heat recovery: Heat recovery factors up to and exceeding 90%

CKL-iH evo		1,400	2,400	3,300	4,700	6,100
Max. air volume	m³/h	1,400	2,400	3,300	4,700	6,100
Height	mm	1,017	1,424	1,424	1,424	1,424
Width	mm	1,525	2,033	2,033	2,237	2,237
Depth	mm	750	750	950	1,360	1,665
Weight	kg	250	360	450	645	725

CRL and CRL evo max compact ventilation unit with thermal wheel heat exchanger

The CRL series features high-performance thermal wheel heat exchangers and various duct connection options. This makes it ideal for flexible applications.

- Wide range of rotor types:
  - > Sorption rotor – recommended by WOLF
  - > Enthalpy rotor
  - > Condensation rotor
- Patented WOLF labyrinth seal with a leakage rate of less than 2%
- Easy transport to the installation site thanks to compact dimensions or possibility of disassembly
- Wide range of air duct routing options
- Indoor installation:
  - > Bottom horizontal – top vertical (iD)
  - > Horizontal (iH)
  - > Bottom horizontal – top vertical/horizontal (iHD)
- Weatherproof outdoor installation: Horizontal (A)

CRL		1,300	2,500	3,500	4,800	6,200	9,000
Max. air volume	m³/h	1,300	2,500	3,500	4,800	6,200	9,000
Height	mm	1,017	1,424	1,424	1,424	1,424	1,627
Width	mm	1,525	1,626	1,626	1,728	1,932	2,136
Depth	mm	750	950	1,155	1,360	1,665	2,070
Weight	kg	266	381	470	590	715	845

CRL evo max		11,000	13,500	16,500	19,500
Max. air volume	m³/h	11,000	13,500	16,500	19,500
Height	mm	2,034	2,644	2,644	2,644
Width	mm	2,950	2,950	2,950	2,950
Depth	mm	1,970	1,970	2,275	2,580
Weight	kg	1,370	1,550	1,790	2,020

Our expert advisers are more than happy to help:

Air Handling North
Kieler Str. 303
22525 Hamburg, Germany
Tel. +49 40 42934680
E-Mail vkb.nord@wolf.eu

Air Handling East
Seestraße 35
14974 Ludwigsfelde, Germany
Tel. +49 3378 209670
E-Mail vkb.ost@wolf.eu

Air Handling West
Katzbergstr. 3a
40764 Langenfeld, Germany
Tel. +49 2173 6851030
E-Mail vkb.west@wolf.eu

Air Handling South
Industriestraße 1
84048 Mainburg, Germany
Tel. +49 8751 74-2650
E-Mail vkb.sued@wolf.eu

PROKLIMA
Gradna 78e
10430 Samobor, Hrvatska
Tel. +385 1 6546343
www.proklima.hr

WOLF Italia S.r.l.
Via XXV Aprile, 17
20097 S. Donato Milanese
Tel. +39 02 5161641
www.wolf.eu/it-it

WOLF Energiesystemen BV
Blauwe Engel 1
8265 VB Kampen
Tel. +31 38 3335086
www.wolf.eu/nl-nl

WOLF France S.A.S.
ZI La Prairie
10 rue de la Prairie
91140 Villebon-sur-Yvette
Tel. +33 1 60136470
www.wolf.eu/fr-fr

WOLF Iberica S.A.
Avenida de la Astronomia 2
28830 San Fernando de Henares
Tel. +34 91 6611853
www.wolf.eu/es-es

WOLF HVAC Systems (Shanghai) Co., Ltd.
Unit 203, Building B, No. 388
North Fuquan Road
200335 Shanghai
Tel. +86 21 6125 6246
www.wolfhvac.com

WOLF Technika Grzewcza Sp. z o.o.
Ul. Sokolowska 36
05-806 Komorow Warszawa
Tel. +48 22 7206901
www.wolf.eu/pl-pl

Do you have any questions about this brochure?
Feel free to contact us via feedback@wolf.eu

We look forward to hearing from you.

WOLF GmbH
Postfach 13 80
84048 Mainburg, Germany
Tel. +49(0)8751 74-0
E-Mail info@wolf.eu
www.wolf.eu

Perfectly in tune with you.

EN/01.23 art. no. 4801976