



FSL-U-ZAS



TESTED TO VDI 6022



WATER CONNECTIONS

## FSL-U-ZAS



### SUPPLY AND EXTRACT AIR COMBINATIONS WITH SECONDARY AIR ADDITION

Ready-to-operate, decentralised ventilation units for supply and extract air, with heat exchangers; addition of secondary air; heat recovery all year round; for the ventilation of rooms and for providing comfortable room temperatures

- Acoustically optimised EC fans with low specific fan powers, category SFP 1 according to EN 13779
- Plate heat exchanger for heat recovery (air to air)
- Heat exchanger for heating and cooling as 2-pipe or 4-pipe system
- Reduced fine dust and pollen contamination due to integral filters that conform to VDI 6022; F7 fresh air filter and G3 extract air filter
- Removable ventilation grille allows for easy access to all components for maintenance
- Condensation-free operation all year round
- Motorised shut-off dampers, power off to close
- Motorised secondary air damper for adding secondary air to increase the thermal output
- Modular control system FSL-CONTROL II, specially for decentralised ventilation systems
- Particularly compact height to fit low floor voids
- Visible part with ventilation grille available in bespoke heights to fit individual projects

#### Optional equipment and accessories

- Air quality sensor
- Fresh air temperature sensor
- Lockshields
- Sleeves for raised floor pedestals

## Application



### Application

- Type FSL-U-ZAS decentralised supply and extract air units with secondary air addition, for installation into raised floors
- Ventilation and extract ventilation of rooms, preferably rooms with a depth up to 6 m
- 2-pipe or 4-pipe heat exchangers enable good comfort levels
- Energy-efficient solution since water is used for heating and cooling
- Supply air discharge as inducing displacement flow
- For new buildings, refurbishment projects and revitalisation projects
- For use in, for example, offices, meeting rooms and rooms with floor to ceiling glazing

### Special characteristics

- 2 energy-efficient and acoustically optimised EC fans with low specific fan powers, category SFP 1 according to EN 13779
- Increased capacity due to secondary air addition
- Supply air discharge as inducing displacement flow
- Hygiene tested and certified to VDI 6022
- Compact construction, hence particularly suitable for refurbishment projects
- No additional heating or cooling system required
- Demand-based ventilation and extract ventilation is possible by means of monitoring the room air quality

## Description



## Variants

### Heat exchanger

- 2: 2-pipe systems
- 4: 4-pipe systems

### Arrangement of water connections

Left and right as viewed from the inside towards the outside. Right-hand version: Water connections and exhaust air opening on the right. Left-hand version: Water connections and exhaust air opening on the left.

- AR: Right-hand version
- AL: Left-hand version

## Parts and characteristics

- Energy-efficient EC fans for supply air and extract air
- Cross flow plate heat exchanger for heat recovery
- Air-to-water heat exchanger for two-pipe or four-pipe systems
- Motorised shut-off dampers for fresh air and exhaust air, normally closed (NC) in order to prevent uncontrolled airflows
- Secondary air damper for secondary air addition
- F7 fresh air filter and G3 extract air filter
- FSL-CONTROL II as a master or slave
- Separate terminal box for the connection of external control components
- RTC real time clock (optional)
- LON, BACnet or Modbus interface as an option
- Air quality sensor (VOC), for master version only, optional
- Supply air temperature sensor
- Fresh air temperature sensor, for master version only, optional
- Heating valve
- Cooling valve, for four-pipe system only
- Lockshield(s)
- 2 integral sleeves for raised floor pedestals (M16 threaded pedestals) up to nominal point load  $PN = 3 \text{ kN} - 5 \text{ kN}$ , tile size 350 – 450 mm. Since no M16 lock nut can be used, we recommend using Kleiberit 504.0 glue to secure the pedestals. Optional.

## Useful additions

- Ventilation grilles for floor installation
- Connecting hoses

## Construction features

- Compact height to fit low floor voids
- Visible part with ventilation grille available in bespoke heights to fit individual projects
- Easy maintenance access to all components after simply removing the ventilation grille
- Levelling feet
- Heat exchanger water connections with G $\frac{1}{2}$ " union nut and flat seal

## Materials and surfaces

- Casing, filter chamber cover, fans and levelling feet are made of galvanised sheet steel
- Heat exchanger with copper tubes and aluminium fins
- Plate heat exchanger made of aluminium
- F7 supply air filter made of synthetic fibres, frame made of non-woven fibres
- G3 extract air filter made of chemical fibres
- Closed cell seals
- Lining is mineral wool
- Casing powder-coated RAL 9005, jet black

## Mineral wool

- To EN 13501, fire rating class A1, non-combustible
- RAL quality mark RAL-GZ 388
- Biosoluble and hence hygienically safe according to the German TRGS 905 (Technical Rules for Hazardous Substances) and EU directive 97/69/EC
- Faced with glass fibre fabric as a protection against erosion through airflow velocities of up to 20 m/s
- Inert to fungal and bacterial growth

## Standards and guidelines

- Meets the requirements of VDI 6035 and VDMA 24390
- Meets the requirements of Commission Regulation (EU) No. 1253/2014 (Ecodesign requirements for ventilation units) implementing Directive 2009/125/EC with regard to ecodesign requirements for ventilation units
- Hygiene certificate to VDI 6022

## Maintenance

- Inspection and cleaning to VDI 6022
- It can also be cleaned with commercial, non-aggressive cleaning agents
- Easy maintenance access to all components after simply removing the ventilation grille
- The heat exchanger can be vacuumed with an industrial vacuum cleaner if necessary
- Easy filter change due to removable ventilation grille

# TECHNICAL INFORMATION

Function, Technical data, Quick sizing, Specification text, Order code



## Functional description

Decentralised supply and extract air units with secondary air addition for room ventilation and for dissipating cooling loads and heat loads.

An EC centrifugal fan takes in the fresh air, which then flows through the motorised shut-off damper, the F7 fine dust filter and the secondary air damper.

Once the fresh air has passed the fan, it flows through the plate heat exchanger for heat recovery and through the heat exchanger for heating and/or cooling.

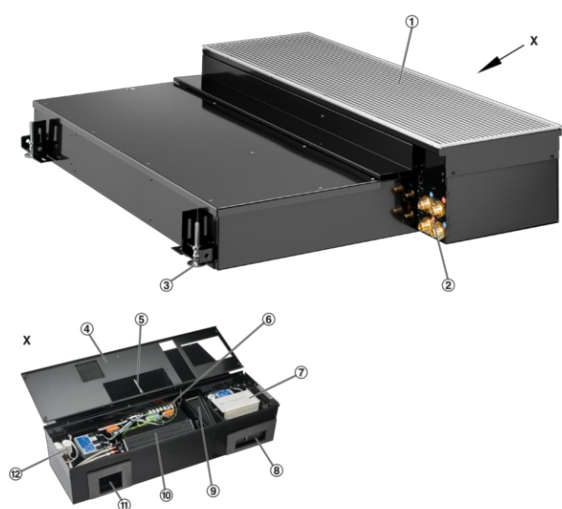
The supply air is discharged to the room as an inducing displacement flow.

The secondary air damper opens such that secondary air is added to the fresh air in order to increase the supply air flow rate and hence the thermal output.

The extract air first passes a G3 coarse dust filter, then flows through the plate heat exchanger, the extract air fan and a motorised shut-off damper before it is discharged to the outside as exhaust air.

For night purging a motorised shut-off damper opens an alternative extract air duct such that the extract air is led to the extract air fan, thereby bypassing the plate heat exchanger.

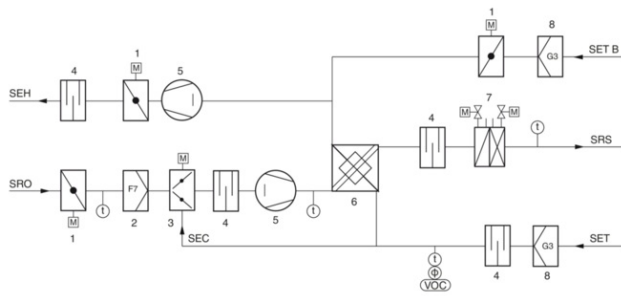
## Schematic illustration of FSL-U-ZAS



- ① Ventilation grille (optional)
- ② Water connections
- ③ Levelling foot

- ④ Inspection access panel
  - ⑤ Supply air temperature sensor
  - ⑥ Internal wiring
  - ⑦ F7 fresh air filter
  - ⑧ Fresh air opening
  - ⑨ G3 extract air filter
  - ⑩ Heat exchanger
- Exhaust air opening  
Control valves

Ventilation diagram for FSL-U-ZAS



- SEH Single room exhaust air
- SRO Single room fresh air
- SRS Single room supply air
- SET Single room extract air
- SET B Single room extract air, night purge
- SEC Secondary air

- 1 Shut-off damper with actuator
- 2 F7 Fresh air filter
- 3 Secondary air damper
- 4 Sound attenuator
- 5 EC fan
- 6 Plate heat exchanger
- 7 Heat exchanger
- 8 G3 extract air filter

<b>Width</b>	1100 mm
<b>Height</b>	150 mm below the raised floor, total height including ventilation grille at least 196 mm
<b>Depth</b>	860 mm
<b>Depth of ventilation grille</b>	340 mm
<b>Fresh air flow rate</b>	0 – 33 l/s or 0 – 120 m <sup>3</sup> /h
<b>Supply air flow rate</b>	150 m <sup>3</sup> /h
<b>Cooling capacity</b>	427 W
<b>Heating capacity</b>	1460 W
<b>Max. operating pressure, water side</b>	6 bar
<b>Max. operating temperature</b>	60 °C
<b>Sound power level</b>	43 dB(A) at 33 l/s or 120 m <sup>3</sup> /h
<b>Supply voltage</b>	230 V AC ±10 %, 50/60 Hz

**FSL-U-ZAS (sizing examples)**

Fresh air flow rate	l/s	25	25	33
	m <sup>3</sup> /h	90	90	120
Supply air flow rate	l/s	25	42	42
	m <sup>3</sup> /h	90	150	150
Total cooling capacity	W	299	414	427
Room cooling capacity	W	225	311	306
Air temperature following heat recovery	°C	28.6	28.2	28.6
Relative air humidity following heat recovery	%	49.0	51.0	49.1
Water content	g/kg	11.9	11.9	12.0
Supply air temperature	°C	18.5	19.8	19.9
Condensation	g/h	0	0	0
Water flow rate	l/h	70	80	80
Water temperature, inlet	°C	16.0	16.0	16.0
Water temperature, outlet	°C	19.7	20.4	20.6
Pressure drop – water side	kPa	6.7	8.4	8.4
Total heating capacity	W	844	1290	1460
Room heating capacity	W	445	631	651
Air temperature following heat recovery	°C	9.0	9.0	6.5
Supply air temperature	°C	35.8	33.6	34.0
Water flow rate	l/h	30	50	60
Water temperature, inlet	°C	50.0	50.0	50.0
Water temperature, outlet	°C	25.7	27.7	29.0
Pressure drop – water side	kPa	1.3	3.3	4.6

Decentralised supply and extract air units with secondary air addition, for installation into raised floors. For the controlled ventilation of rooms and to maintain a comfortable room air temperature and room air quality.

Ready-to-operate unit which consists of a casing, air conditioning components, electric components and control components.

The units include energy-efficient EC fans for supply and extract air, a cross flow plate heat exchanger for heat recovery, an air-to-water heat exchanger for two-pipe or four-pipe systems, an F7 fine dust filter for supply air and a G3 coarse dust filter for extract air, shut-off dampers and a secondary air damper, each with an actuator.

Electric components and control components with factory integral wiring. Separate terminal box for the connection of external control components, including cable (approx. 1 m) for the connection to the ventilation unit.

Water connections with G½" union nut and flat seal.

Meets hygiene requirements of VDI 6022. Energy-efficiency class A according to Directive 2009/125/EC on energy-related products.

### Special characteristics

- 2 energy-efficient and acoustically optimised EC fans with low specific fan powers, category SFP 1 according to EN 13779
- Increased capacity due to secondary air addition
- Supply air discharge as inducing displacement flow
- Hygiene tested and certified to VDI 6022
- Compact construction, hence particularly suitable for refurbishment projects
- No additional heating or cooling system required
- Demand-based ventilation and extract ventilation is possible by means of monitoring the room air quality

### Materials and surfaces

- Casing, filter chamber cover, fans and levelling feet are made of galvanised sheet steel
- Heat exchanger with copper tubes and aluminium fins
- Plate heat exchanger made of aluminium
- F7 supply air filter made of synthetic fibres, frame made of non-woven fibres
- G3 extract air filter made of chemical fibres
- Closed cell seals
- Lining is mineral wool
- Casing powder-coated RAL 9005, jet black

### Mineral wool

- To EN 13501, fire rating class A1, non-combustible
- RAL quality mark RAL-GZ 388
- Biosoluble and hence hygienically safe according to the German TRGS 905 (Technical Rules for Hazardous Substances) and EU directive 97/69/EC
- Faced with glass fibre fabric as a protection against erosion through airflow velocities of up to 20 m/s
- Inert to fungal and bacterial growth

### Technical data

- Width: 1100 mm
- Height: 150 mm below the raised floor, total height including ventilation grille at least 196 mm
- Depth: 860 mm
- Depth of ventilation grille: 340 mm
- Fresh air flow rate: 0 – 33 l/s or 0 – 120 m<sup>3</sup>/h
- Supply air flow rate: 42 l/s or 150 m<sup>3</sup>/h max.
- Cooling capacity: 730 W max.
- Heating capacity: 1980 W max.
- Flow temperature – heating: 60 °C max.
- Max. operating pressure, water side: 6 bar
- Sound power level: 43 dB(A) at 33 l/s or 120 m<sup>3</sup>/h
- Supply voltage: 230 V AC ±10 %, 50/60 Hz

### FSL-CONTROL II

Modular single room control system for decentralised ventilation units. The system controls valves, actuators and fans of ventilation units such that the comfort parameters for the room are achieved, energy efficiently and based on demand. The many functions, sensors and expansions allow for individual control strategies. This includes integration with the central BMS.

#### Control module (main PCB)

The control module controls valves, actuators and fans of the ventilation unit based on the parameters set on the room module.

- One control module per ventilation unit
- Integral part of the ventilation unit, pre-wired
- Cascade control of room temperature and supply air temperature while the required fresh air minimum volume flow rate is maintained
- Three operating modes: Occupied, Standby, Unoccupied
- Frost protection is achieved by switching off the fans, closing the shut-off dampers and opening the heating valve
- The configuration is stored in the memory and hence safe in case of a power failure
- Up to five supply air and extract air fan stages
- 3 digital inputs
- 2 temperature inputs
- 5 digital outputs
- 4 analog outputs
- 2 PWM outputs

#### Room module (master PCB)

The room module is the central control unit for a room. Room temperature, air quality and operating mode are signalled to the room module. The room module

controls the control modules of at least one ventilation unit.

- At least one room module per room
- 4 digital inputs
- 2 analogue inputs
- 2 temperature inputs
- 2 digital outputs
- 2 analog outputs
- Port for the connection of a humidity sensor
- Port for the connection of an air quality sensor (VOC)
- Port for LonWorks LON-FTT10, BACnet MS/TP or Modbus RTU interface module
- Port for the connection a real time clock module (RTC)

#### Temperature sensor

Temperature sensor for measuring the supply or extract air temperature.

- Master: 3 temperature sensors; slave: 2 temperature sensors
- Sensor head: NTC
- Measuring range: 0 – 40 °C
- Resistance: 10 kΩ at 25 °C

#### Air quality sensor

Air quality sensor for the demand-based fan control.

- Master: 1 air quality sensor
- Sensor: Micro semiconductor, metal oxide, for measuring the concentration of volatile organic compounds (VOC)
- The VOC concentration correlates with the CO<sub>2</sub> concentration of the room air
- VOC includes alcohols, aldehydes, ketones, esters, terpenes, aromatic compounds, alkenes and others
- Measuring range: 0 to 2000 ppm
- Increased detection rate
- Self test
- Automatic zero point correction
- Operating temperature: 0 to 50 °C

#### Valve with actuator

Straight-way valve with thermoelectric actuator for controlling the water flow through the heat exchangers based on demand.

Valve

- Nominal size: DN 10
- Nominal pressure: PN 16
- kVs value: 0.25, 0.40, 0.63 or 1.0
- Maximum differential pressure: 100 kPa
- Maximum operating fluid temperature: 110 °C
- Casing made of red brass (RG5)
- Valve cone and valve seat made of brass

Actuator

- Actuator force: 100 N
- Nominal stroke: 4 mm
- Actuation time: 30 s/mm
- Valve adapter 10 VA

#### Control panel

Control panel with fan stage selector.

- Master: 1 control panel
- Includes room temperature sensor, setpoint value adjuster, push button, indicator light, fan stage selector switch (3 stages), operating mode selector switch (Automatic, Off)
- Sensor head: NTC, 20 kΩ at 25 °C
- Dimensions: 99 × 104 × 30 mm (B × H × T)

#### Real time clock (RTC)



Real time clock module to expand the function range of the room module.

- Master: 1 real time clock
- Can be connected to one of the ports of the room module
- Allows for defining schedules for seven days, with five switching points each
- Automatic switching between summer time and winter time
- Night purge control
- Battery

#### **LonWorks LON-FTT10 interface module**

LonWorks interface for integrating the room module with higher-level systems.

- Master: 1 interface
- Can be connected to one of the ports of the room module
- With indicator lights (for service, sending data, receiving data), service push button, and internally connected double stack terminals
- Interface: LonWorks LON-FTT10
- Network: Free topology, twisted pair
- Data interface: Standard network variables (SNVT)

#### **BACnet MS/TP or Modbus RTU interface module**

BACnet MS/TP or Modbus RTU interface for integrating the room module with higher-level systems.

- Master: 1 interface
- Can be connected to one of the ports of the room module
- With indicator lights (error, data transmission) and internally connected double stack terminals
- Interface: BACnet MS/TP or Modbus RTU, configurable switch for switching between the interfaces
- Network address and transmission parameters can be configured
- Indicator light for status and data transmission

#### **Lockshield**

Lockshield for preventing water from flowing through the heat exchangers.

- Nominal size: DN 15
- Nominal pressure: PN 10
- Maximum operating fluid temperature: 110 °C
- Casing and protective cover made of brass, nickel-plated
- Valve seat made of brass
- O-ring seal made of EPDM

#### **Sizing data**

Fresh air

- $V$  \_\_\_\_\_ [m<sup>3</sup>/h]

Supply air

- $V$  \_\_\_\_\_ [m<sup>3</sup>/h]

Room cooling capacity

- $Q$  \_\_\_\_\_ [W]

Room heating capacity

- $Q$  \_\_\_\_\_ [W]

- $L_{WA}$  \_\_\_\_\_ [dB(A)]

Decentralised ventilation units are technically advanced products of high quality; they offer a wide range of configuration options. For specification details regarding your project please contact your nearest TROX branch or subsidiary.

**FSL-U-ZAS-4-AR-S / R / MA-T / B / V / Z / A / HV-R-0,4 / KV-R-0,4**



- |  |  |
|--|--|
| <p><b>1</b> Type</p> <p>FSL-U-ZAS Underfloor unit</p>  | <p><b>9</b> Supply air temperature sensor</p> <p>Z With</p>                                    |
| <p><b>2</b> Heat exchanger</p> <p>2 2-pipe<br/>4 4-pipe</p>  | <p><b>10</b> Fresh air temperature sensor</p> <p>No entry: none<br/>master only<br/>A With</p> |
| <p><b>3</b> Arrangement of water connections</p> <p>AR Right-hand version<br/>AL Left-hand version</p>                             | <p><b>11</b> Heating valve</p> <p>HV With</p>  |
| <p><b>4</b> False floor pedestal</p> <p>No entry: none<br/>S with (pipe sleeve for false floor pedestal with M16 threaded rod)</p> | <p><b>11</b> Lockshield – heating circuit</p> <p>R With</p>                                    |
| <p><b>5</b> Control equipment</p> <p>R FSL-CONTROL II</p>  | <p><b>13</b> kVS value – heating valve</p> <p>0,25<br/>0,40<br/>0,63<br/>1,00</p>              |
| <p><b>5</b> Control function</p> <p>MA Master (room module and control module)<br/>SL Slave (control module)</p>                   | <p><b>15</b> Cooling valve</p> <p>For 4-pipe systems only<br/>KV with</p>                      |
| <p><b>6</b> Real time clock</p> <p>No entry: none<br/>master only<br/>T With</p>   | <p><b>15</b> Lockshield – cooling circuit</p> <p>R With</p>                                    |
| <p><b>7</b> Interface</p> <p>No entry: none<br/>master only<br/>B BACnet MS/TP or Modbus RTU<br/>L LonWorks LON-FTT10</p>          | <p><b>16</b> kVS value – cooling valve</p> <p>0,25<br/>0,40<br/>0,63<br/>1,00</p>              |
| <p><b>8</b> Air quality sensor</p> <p>No entry: none<br/>master only<br/>V VOC sensor</p>  |  |

Installation examples, Installation details, Basic information and nomenclature



Installation example



#### Installation and commissioning

- Installation into raised floors
- Installation and connections to be performed by others; fixing, connection and sealing material to be provided by others
- Use the four levelling feet to adjust the position of the unit (adjustment range: 45 mm)
- Required openings in the façade or external wall should be sloped to the outside and are to be provided by others
- Weather protection for the fresh air and exhaust air openings by others
- Vents and drainage by others

**$L_N$  [mm]**

Nominal length

**$L_{WA}$  [dB(A)]**

Sound power level

**$t_{Pr}$  [°C]**

Primary air temperature

**$t_{WV}$  [C°]**

Water flow temperature – cooling/heating

**$t_R$  [C°]**

Room temperature

**$t_R$  [C°]**

Room temperature

**$t_{AN}$  [C°]**

Secondary air intake temperature

**$Q_{Pr}$  [W]**

Thermal output – primary air

**$Q_{tot}$  [W]**

Thermal output – total

**$Q_W$  [W]**

Thermal output – water side, cooling/heating

**$V_{Pr}$  [l/s]**

Primary air volume flow rate

**$V_{Pr}$  [m<sup>3</sup>/h]**

Primary air volume flow rate

**$V_W$  [l/h]**

Water flow rate – cooling/heating

**$V$  [l/h]**

Volume flow rate

**$\Delta t_W$  [K]**

Temperature difference – water

**$\Delta p_W$  [kPa]**

Pressure drop, water side

**$\Delta p_t$  [Pa]**

Total pressure drop, air side

**$\Delta t_{Pr} = t_{Pr} - t_R$  [K]**

Difference between primary air temperature and room temperature

**$\Delta t_{RWV} = t_{WV} - t_R$  [K]**

Difference between water flow temperature and room temperature

**$\Delta t_{Wm-Ref}$  [K]**

Difference between mean water temperature and reference temperature

**$L_N$  [mm]**

Nominal length

#### **Inducing displacement flow**

The supply air is discharged near the external wall and with a medium velocity between 1.0 and 1.5 m/s. Due to the induction effect the supply air velocity is rapidly reduced such that, in cooling mode, the supply air displaces the room air over the entire floor area. The convection from people and other heat sources causes the fresh air from the pool to rise and create comfortable conditions in the occupied zone.

#### **Heat exchanger**

The maximum water-side operating pressure for all heat exchangers is 6 bar.

The maximum water flow temperature (heating circuit) for all heat exchangers is 75 °C; if flexible hoses are used, the water flow temperature should not exceed 55 °C. Units for other pressures and temperatures are available on request.

The water flow temperature (cooling circuit) should be at least 16 °C such that it does not permanently fall below the dew point. For units with a condensate drip tray the water flow temperature may be reduced to 15 °C.

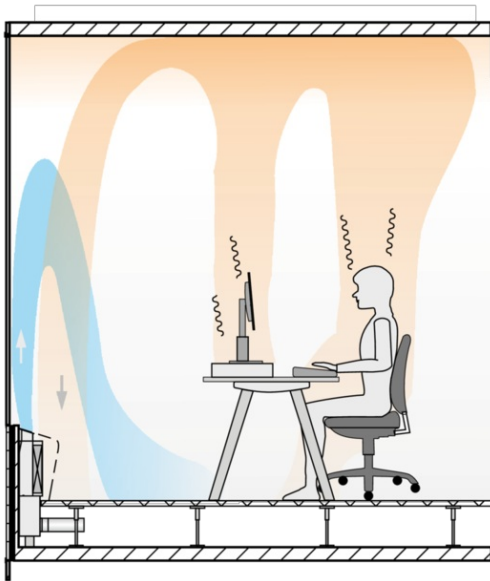
**Heat exchanger as 2-pipe system**

Air-water systems with a 2-pipe heat exchanger may be used for either heating or cooling. In changeover mode it is possible to use all units within a water circuit exclusively for cooling in summer and exclusively for heating in winter.

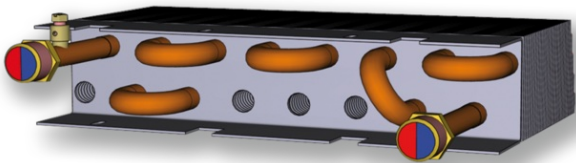
**Heat exchanger as 4-pipe system**

Air-water systems with a 4-pipe heat exchanger may be used for both heating and cooling. Depending on the season, i.e. especially in spring and autumn, it may be possible that an office has to be heated in the morning and cooled in the afternoon.

**Schematic illustration of inducing displacement flow ventilation**



**Heat exchanger as 2-pipe system**



**Heat exchanger as 4-pipe system**

