



# AIRSOL<sup>®</sup>

Circuit connected system



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GHZ Schlieren

# AIRSOL<sup>®</sup> CCS-HR

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Ventilation systems in large buildings (total air volume > 100 000 m<sup>3</sup>/h) are often equipped with circuit connected systems with heat recovery (CCS-HR), as air intake and output systems can be installed in different places and are not physically linked to each other. Plate and rotation heat exchangers for large air volumes per unit are difficult to implement (spatial conditions).

The application field of circuit connected systems is extensive. From primary ventilation systems for supplying building room areas to hospital buildings, laboratory buildings, chemistry, pharmacies, undercutting, pressing facilities, gantries, stores, trade fair halls, kitchens, restaurants, office buildings, biological laboratories, university buildings, administrative buildings, theatres, museums, fine mechanics production rooms and process technical room ventilation or renovations where the air intake and output cannot be installed together.





DSM Campus, Bau-245, 4303 Kaiseraugst

## Advantages

### Functional description

AIRSOL® high-performance CCS-HR systems work with maximum exchange degrees. On the exhaust air side, the water-glycol mixture (intermediary medium) is warmed as close as possible to the exhaust air temperature. The warmed medium then circulates to the outdoor air systems and can warm up the air from outdoors. The AIRSOL® heat exchanger also has a maximum exchange degree in this area. The correctly regulated water-glycol amount in the intermediary circuit guarantees the maximum temperature difference.

In the summer mode, the exhaust air can be humidified adiabatically, the intermediary circuit cools down and a supply air cooling is generated. The effect is maximised through the use of Mountair hybrid cooling elements.

The lacking heat (additional heating) or cold (additional cooling) can be supplied by plate heat exchangers in the water-glycol circuit. This makes additional heat exchangers in the airflow unnecessary, and the ventilation requires less energy.

In network systems, one or more air handling units are connected. The AIRSOL® controller calculates and provides the ideal volumes of fluid and guarantees the maximum annual efficiency.

The system optimisation is ensured in all operating states. A better exchange degree also means a higher pressure drop. If the additionally spent energy reserve is more valuable than the recovered heat, the system is "maxed out". The annual efficiency shows what percentage of the total heating energy is recovered by the CCS-HR. The consideration of the energy used for humidification and cooling is essential.

### Customer uses

- Maximum heat recovery with separated intake and exhaust air flows
- Network systems to use decentralised exhaust heat sources
- Controller for system optimisation and energy monitoring
- Simple subsequent equipment of existing air conditioning stations for energy saving
- Cost and benefit simulation
- Defroster circuit for the outdoor air filter
- Adiabatic cooling
- Heat and cold supply in the circuit. No additional heaters or coolers needed.
- Less pressure drop, better SFP (Specific Fan Power)
- Annual efficiency (AE) and electrothermic amplification factors (EAF) in accordance with the energy ordinances.

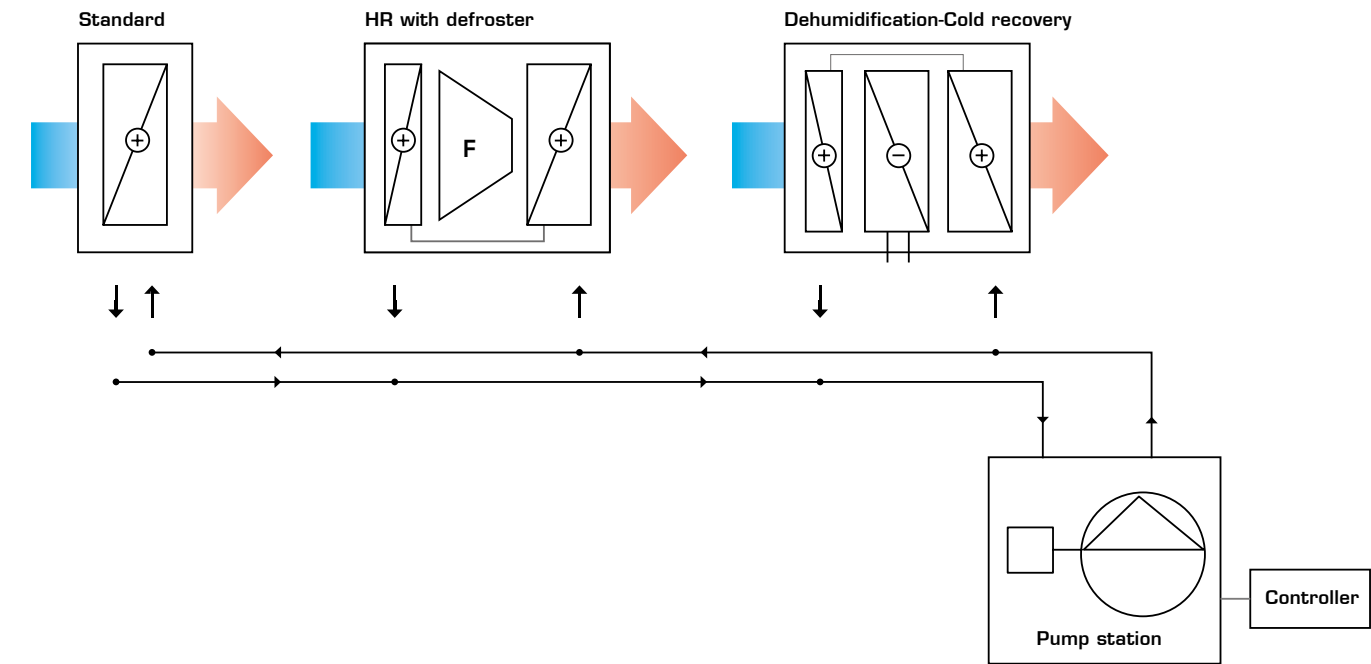
### Material and quality

The material and production quality is in accordance with the AIRSOL® standard, i.e.:

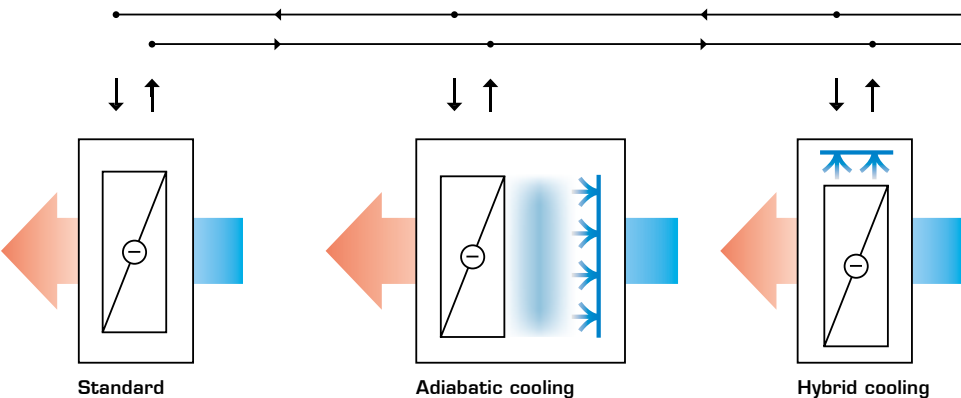
- Pipe wall thickness Cu 0.4 mm
- Hydraulically widened (less pressure loss than with mechanical widening)
- Fin thickness min 0.2 mm
- Exchanger solely out of non-ferrous metals
- Exchanger can be fully ventilated and emptied
- Optimised AIRSOL® circuit for maximum counter flow
- Pressure: PN 16
- Design according to Eurovent, consideration of hygienic aspects regarding cleaning
- External piping in steel, copper and chrome steel

# Schematic diagram

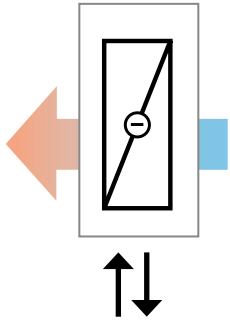
## Air intake system energy supply/load)



## Air output system (energy source/generator)

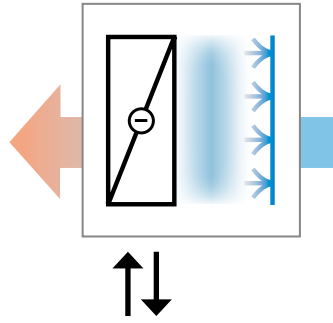


## Air output systems



### Standard

On the exhaust air side, the water-glycol mixture is warmed as close as possible to the exhaust air temperature. (Heat is removed from the exhaust air and transported to the supply air via the water-glycol mixture).

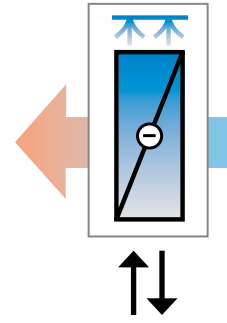


### Adiabatic cooling

Adiabatic cooling via exhaust air humidification. The following humidification systems are used for this:

- Contact humidifier for operating with soft water. Circulating water with automatic desalination.
- Atomizing humidifier (high/low pressure systems). Operation with desalinated water. Sensible use with simultaneous supply air humidification in winter with the same pump.

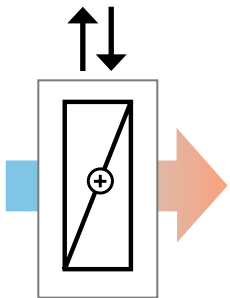
Connection of the recooling/humidification and control of the maximum exhaust air humidity.



### Hybrid cooling/recooling

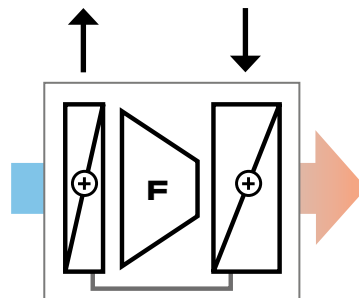
On the exhaust air side, the water-glycol mixture is cooled as close as possible to the wet bulb temperature. High power density! Use of Mountair Hybaco® elements, using desalinated water.

## Air intake systems



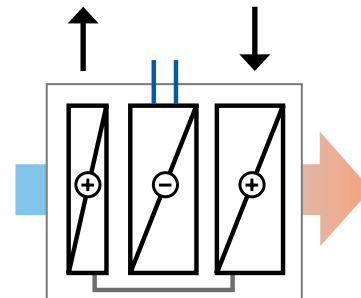
### Standard

AIRSOL® High-performance CCS-HR systems work with maximum exchange degrees. The standard consumer is an air intake system. The cold outdoor air is heated with heat recovery.



### HR with defroster

Weather changes can lead to ice on the fresh air filters. It is therefore recommended to split the CCS heat exchanger in the fresh air between a defroster (few pipe rows, wide fin spacing) and an air heater (many pipe rows, small fin spacing) and pass the glycol through them serially (hygiene guideline). The heating in the defroster is sufficient to prevent any ice on the filter. The defroster installed in front of the filter with wide fin spacing can be cleaned without problems.



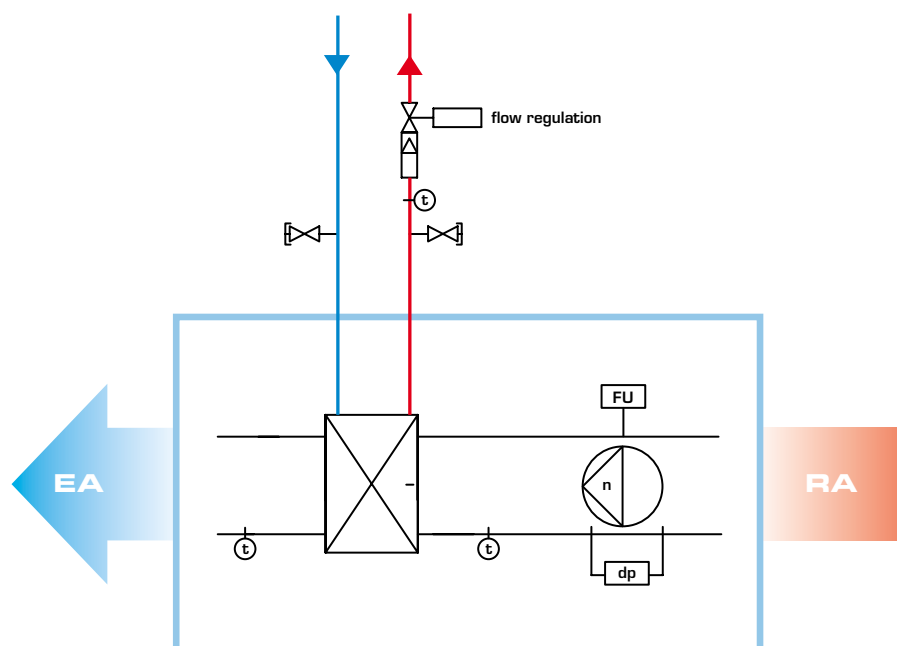
### Dehumidified cold recovery

CCS3 means that the large HR battery is split into two coils. In the summer, in the drying mode, the glycol mixture circulates serially through the exchangers. In-between, the cooler is set to condensation dehumidification.

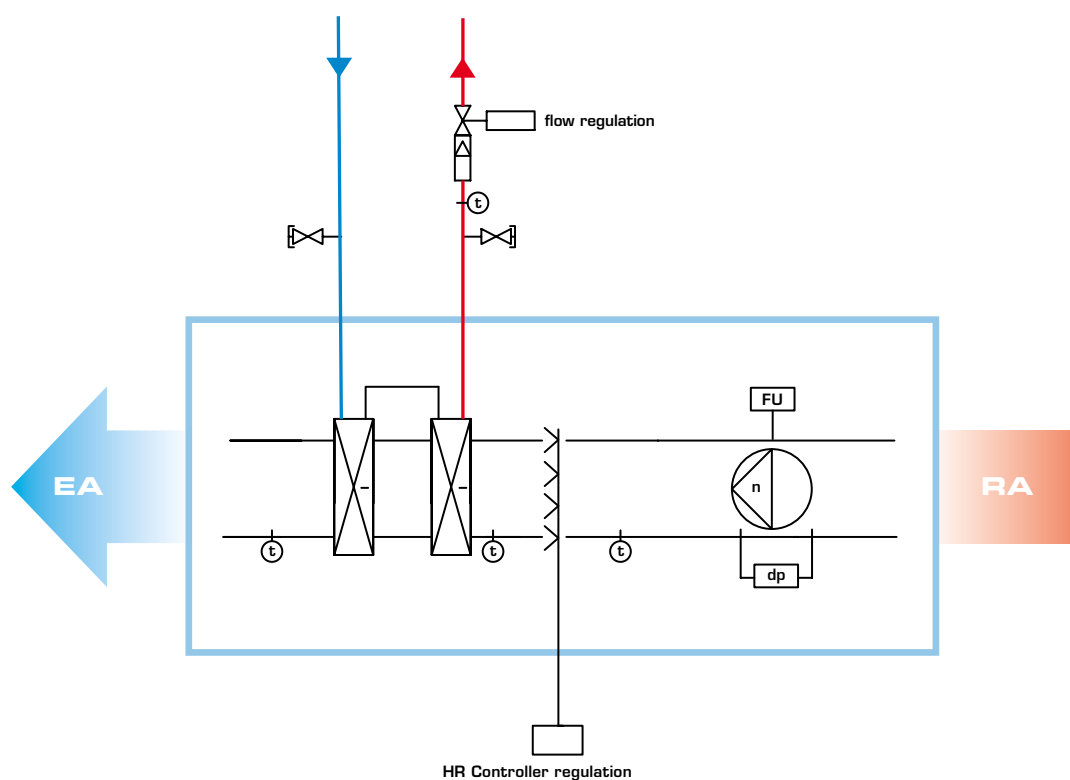
The necessary additional heating is thus used for pre-cooling. The power requirement of the cooler is significantly reduced. The cooler is supplied by external refrigerating machines. Triple splitting with additional defroster.

## Hydraulic diagrams

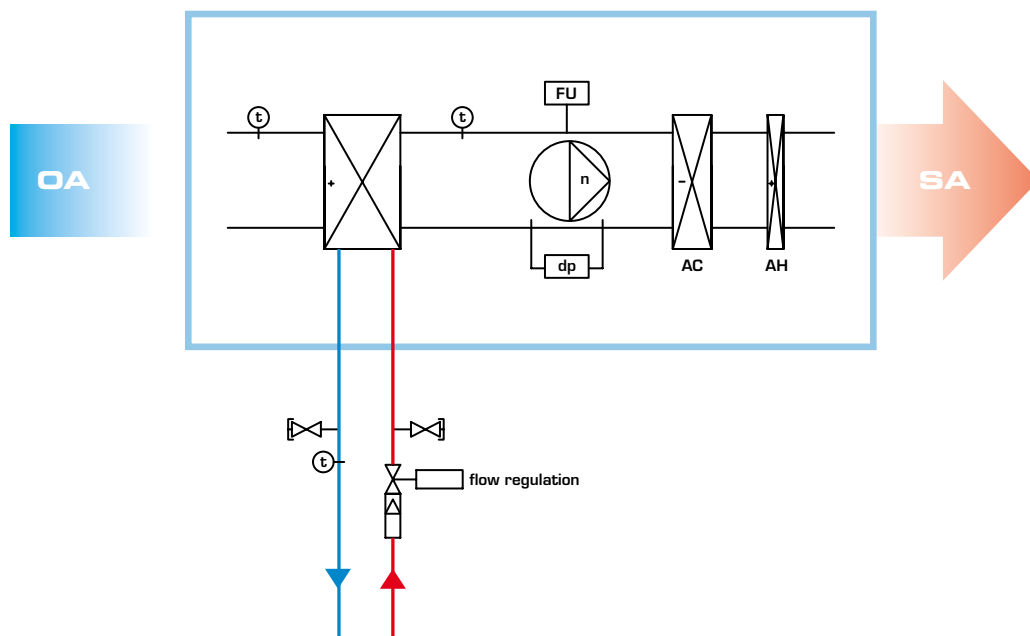
### Exhaust air standard



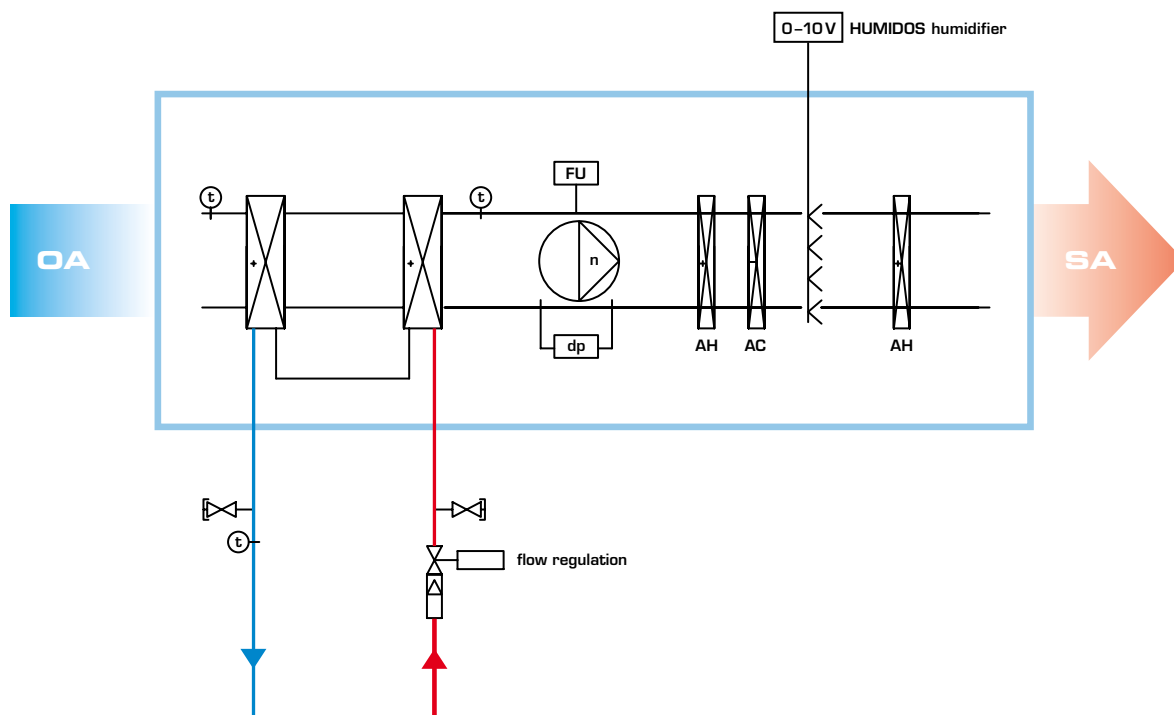
### Exhaust air with adiabatic cooling



## Supply air standard

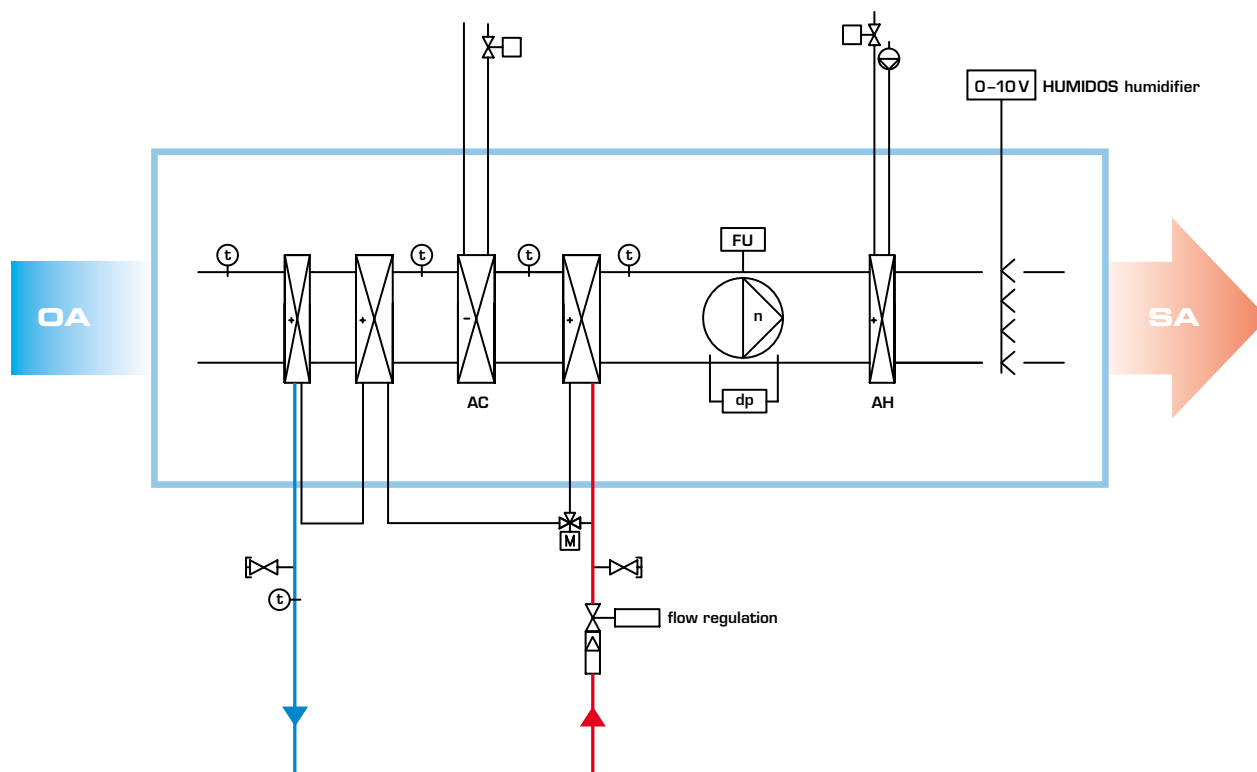


## Supply air split with defroster

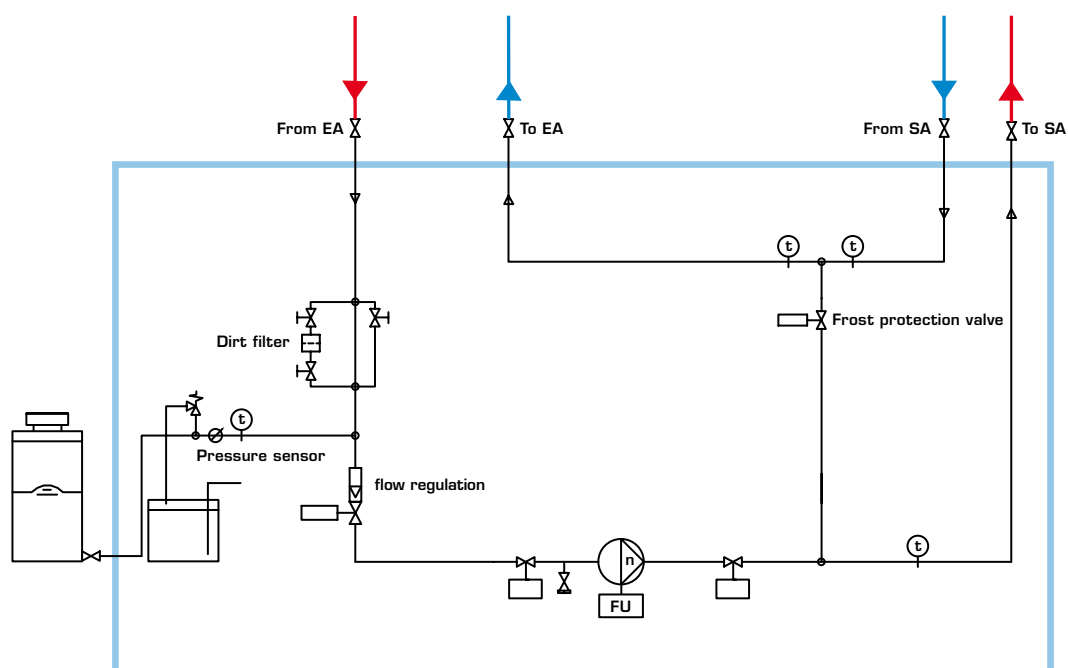




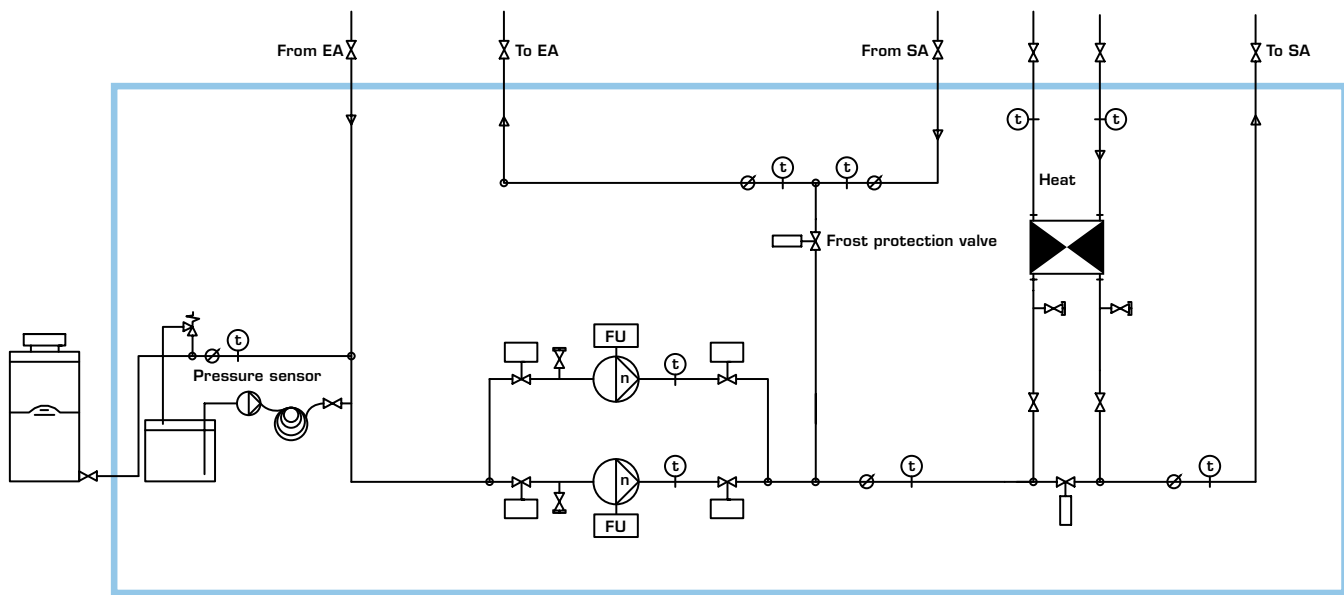
## Supply air split multiple times with defroster and dehumidification and cold recovery



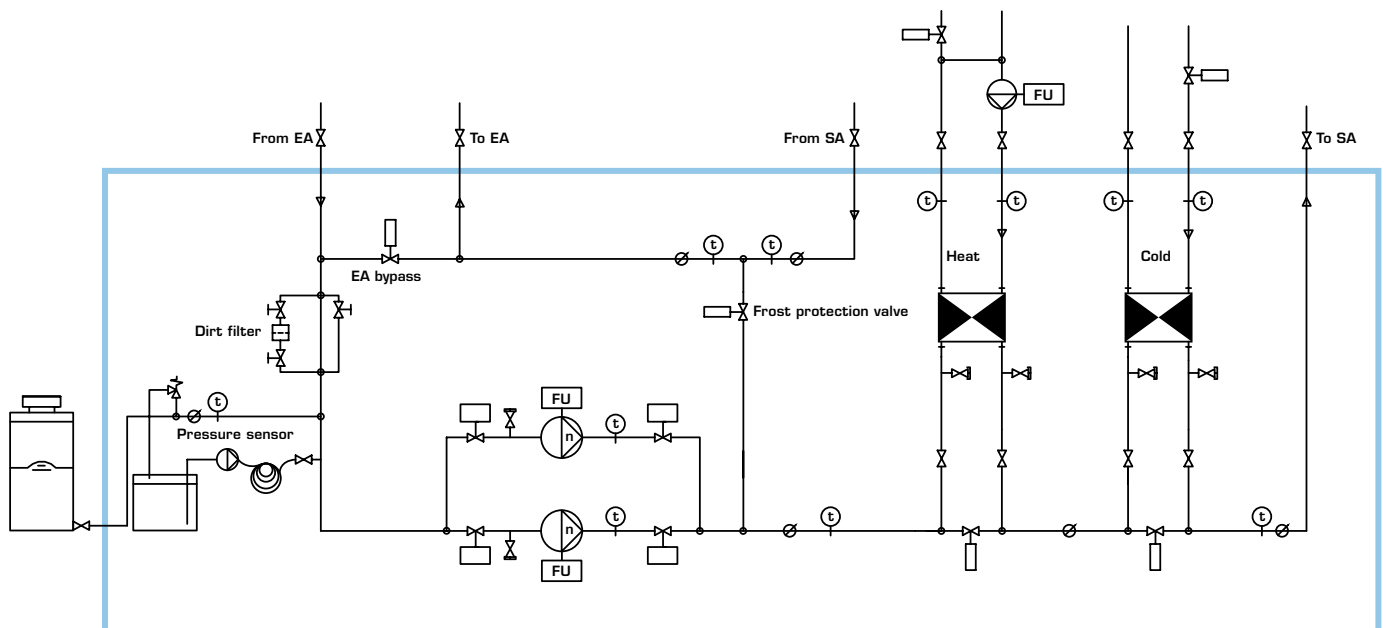
## Hydraulic station with frost protection bypass



## Hydraulic station with redundancy pump and heat supply



## Hydraulic station with heating and cooling supply



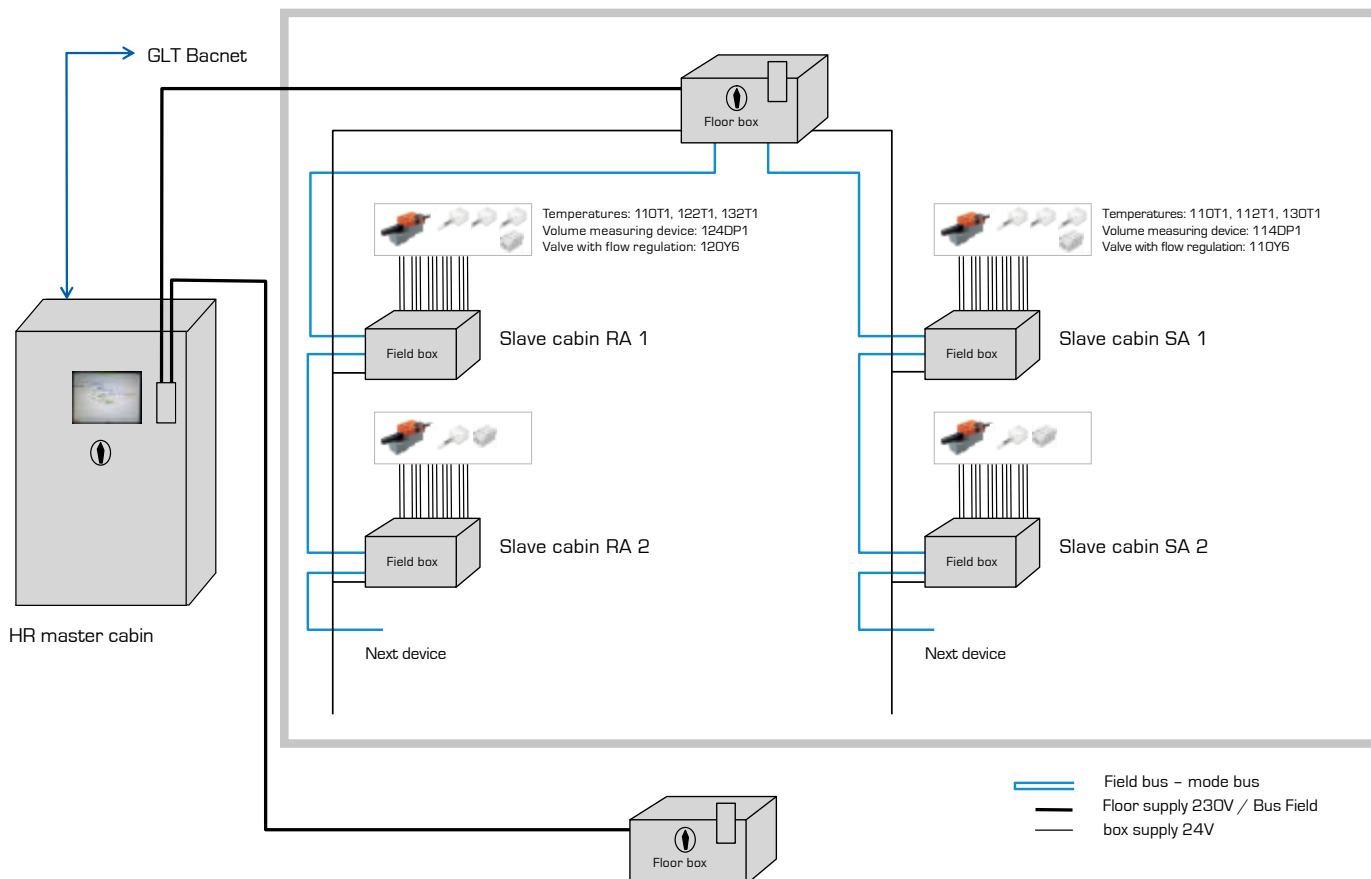
## Hydraulic stations







## Network systems with master-slave principle



The systems are coupled to each other via a medium [circuit connected system]. The number of systems that are connected in one network is determined by the use of the ventilation system (for example: conference rooms, sports halls, restauration). The common point between all the designs is a central hydraulic station per network that conveys the medium from the exhaust air to the supply air systems.

The HR controller is usually installed with the hydraulic station. All the ventilation systems included in the network must also be connected to each other electrically (sensors, ideal values, alarms etc.).

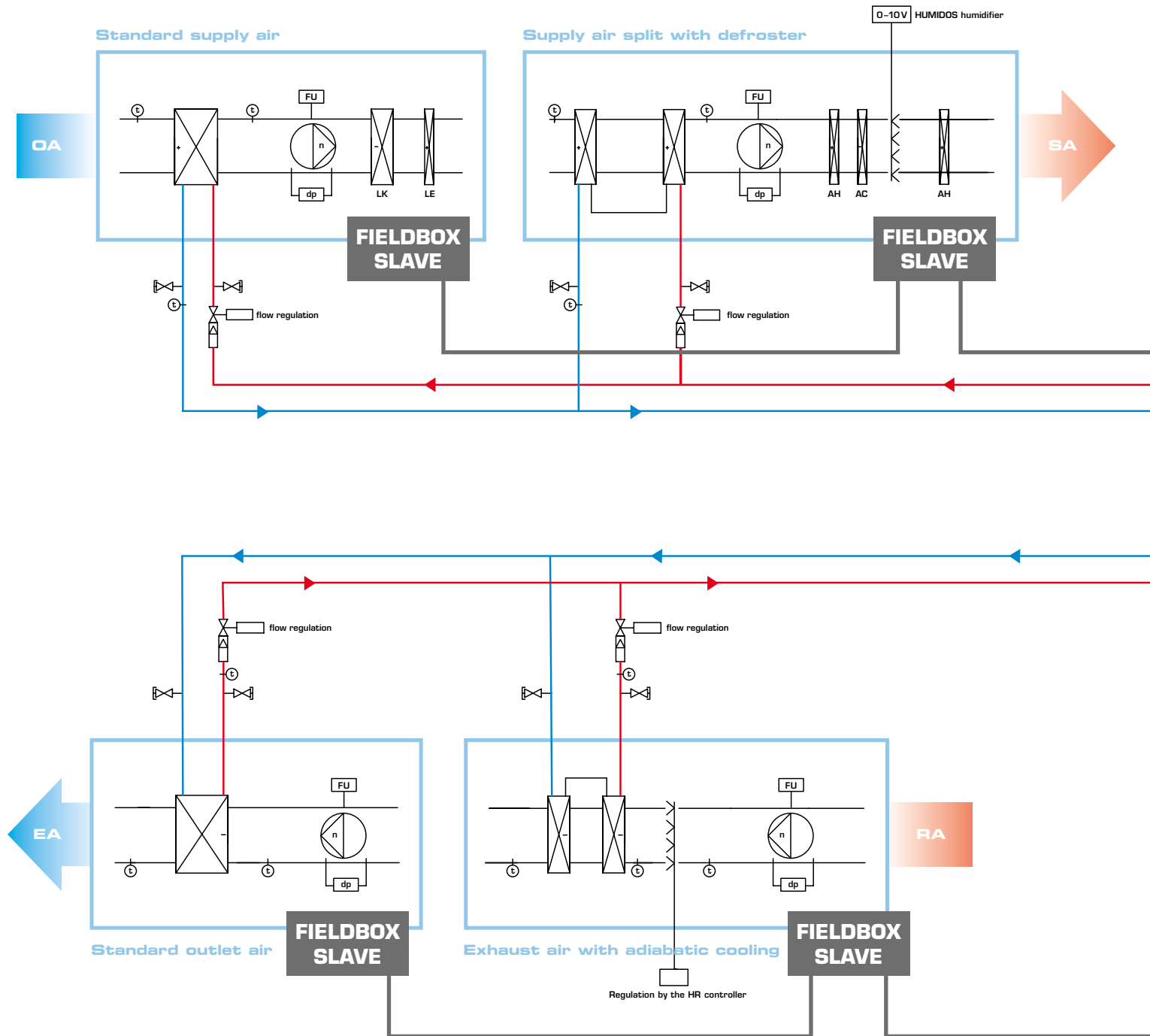
Mountair further developed the master-slave principle, so that the field devices can be wired directly to a cabinet at the Monobloc.

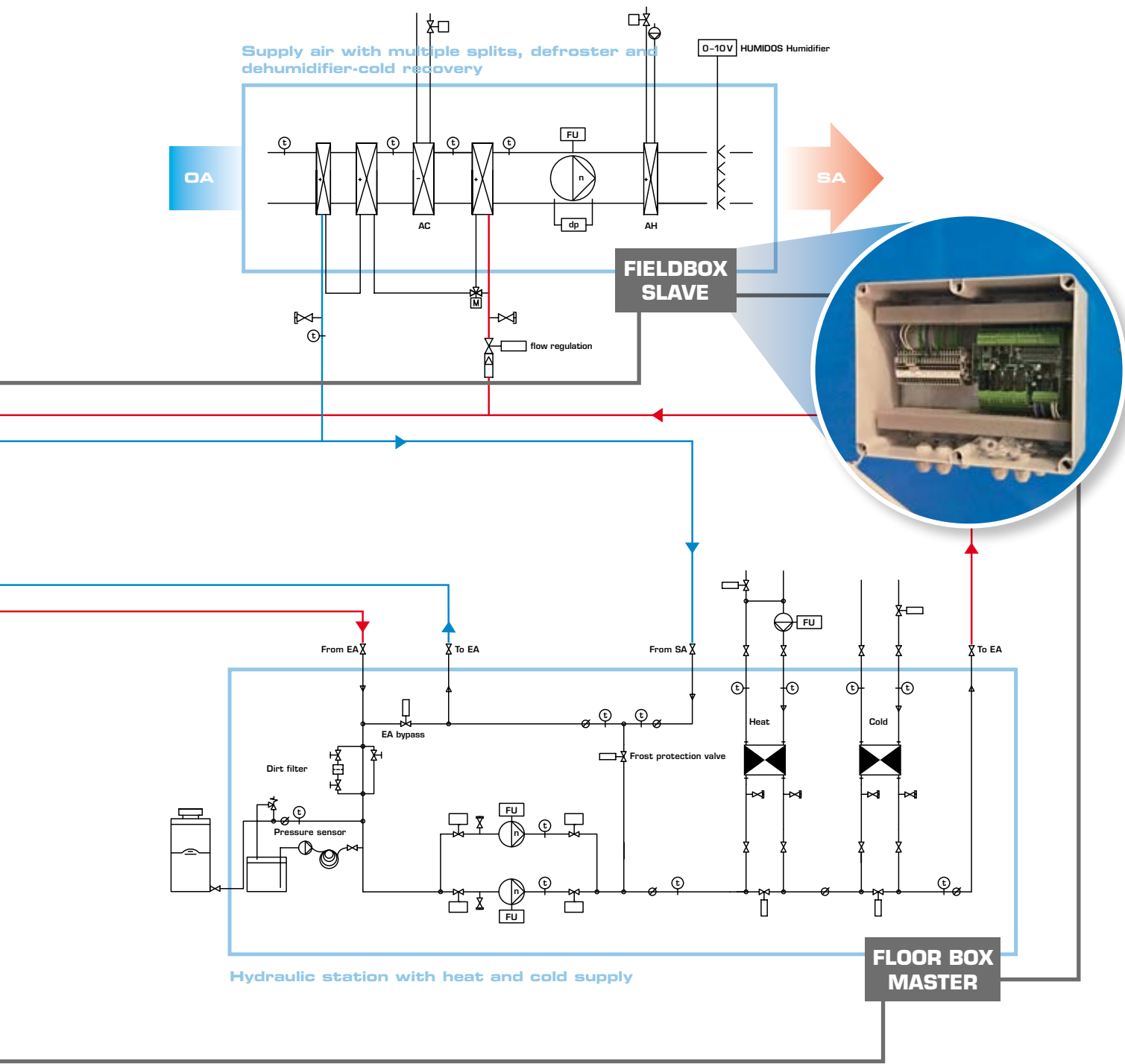
This means we can avoid long stretches of cables, which often cause problems. Communication is ensured via bus. This is not only advantageous for the electrical wiring, but also for problem analyses that may need to be conducted. The field boxes are unambiguously linked to one Monobloc, where the data points that are present in the unit are gathered.





# Hydraulic diagrams with network system





## Specifications text

### Heat recovery CCS

Brand: Mountair  
System: AIRSOL®

### System delivery scope

HR consisting of a network of 1 exhaust air with 1 supply air system

Heat exchanger built into the Monobloc

Supply air – Heat exchanger split into  
– 1 defroster as filter pre-heater  
– 1 HR heater in the supply air

Exhaust air – One-piece heat exchanger  
– 1 HR – cooler in the outlet air

### HR controller

HR regulation (HR controller) incl. commissioning, operation optimisation and operation monitoring. Includes control cabin, hardware, software, remote monitoring via modem/Internet. Proof of the guaranteed performances by the HR manufacturer.

### Hydraulic pump station

Hydraulic component group with circulation pump, redundancy pump, all necessary valves, expansion vessel, fittings etc.

### External piping

Connection pipes incl. glycol filling, rinsing, ventilation and adjustment of the circulation volumes. HR system completely installed and adjusted, incl. all necessary fastening materials and the flow volume measurement devices for an optimum operation.

### Engineering and design criteria

Engineering, dimensioning for an optimum operation, establishing the hydraulic diagram and control strategy, proper commissioning, operation optimisation in the first year of operation and proof of the guaranteed performances. Dimensioning of the HR to cover the annual use according to the SWKI and energy saving regulations.

Simulation of the annual progression under consideration of the internal loads. Profitability calculation under consideration of the fan and pump driving energy, energy costs and amortisation.

### Operation optimisation

HR operation optimisation in the 1st year of operation, with the following services:

- Observation of the dynamic system behaviour for full load and part load operation ("Day – night – weekend" or "Winter – transition time – summer")
- Interpretation of the measurement results
- Optimisation of the standard parameters
- Searching for and diagnosing disruptions in the HR system

- Remedying disruptions caused by components that were delivered by the HR manufacturer (in the first year of operation), customer counselling for remedying other disruptions.
- Delivery of a modem incl. communication software for data preparation and graphic representation of the dynamic and static operation of the entire HR system on the Internet.

Efficient operation optimisation for the HR regulation (HR controller) through remote monitoring of the HR system via the Internet/modem.

### Guarantee

Delivery of the CCS-HR as a whole system incl. the hydraulic station group and HR regulation (HR controller) for optimum and disturbance-free operation. The company/HR manufacturer provides a functional guarantee and bears the responsibility for the optimum and disturbance-free operation of the entire HR system (incl. heat exchanger). They are also responsible for the choice of the control strategy and hydraulic circuit, under consideration of the provisions and boundary conditions. The consumption figures determined by the defined boundary conditions form the basis for penalisation/contracting.

## System description and requirements

### High-performance circuit connected system

High-performance circuit connected system with heat recovery coils (CCS-HR) with hydraulically optimised heat exchangers between the air and the water-glycol mixture. Heat recovery for systems with fully separated supply and exhaust air flows. The heat recovery circuit can contain several connected units. Decentralised heat sources are connected to the circuit and use the waste heat to heat the air from outdoors. System controllers guarantee the optimum operation and maximum annual use across the entire year. The adiabatic exhaust air humidification allows a natural partial conditioning (supply air cooling) without a mechanical cooling system.

- Maximum heat recovery with separated supply and exhaust air streams
- Network systems to use decentralised waste heat sources
- Controller for system optimisation and energy monitoring
- Simple equipment of existing air handling unit for energy saving
- Cost and profit simulation
- Defroster system for the outdoor air filter
- Adiabatic cooling
- Heat and cold supply in the circuit. Additional heaters and coolers are not necessary. Less air pressure drop, better SFP (Specific Fan Power).
- Annual use (AU) and electro-thermal amplification factors (ETA) in accordance with the energy regulations.

AIRSOL® high-performance CCS-HR systems work with maximum exchange degrees. On the exhaust air side, the water-glycol mixture (intermediate medium) is warmed as close as possible to the exhaust air temperature. The heated medium then circulates to the outdoor air systems and can warm up the outdoor air. The AIRSOL® heat exchanger also has a maximum exchange degree in this area. The correctly regulated water-glycol amount in the intermediary circuit guarantees the maximum temperature difference.

In the summer mode, the exhaust air can be humidified adiabatically, and the intermediary circuit is cooled. An adiabatic supply air cooling is generated. The effect is maximised through the use of Mountair hybrid cooling elements.

Lacking heat or cold can be supplied by plate heat exchangers in the water-glycol circuit. This makes additional heat exchangers in the airflow unnecessary, and the ventilation requires less energy.

In network systems, one or more air output and intake units are connected. The AIRSOL® controller calculates and provides the ideal volumes of fluid and guarantees maximum heat recovery.

The entire system is optimised. A better exchange degree also means a higher air pressure drop. If the additionally spent energy reserve is more valuable than the recovered heat, the system is "maxed out". The annual efficiency shows what percentage of the total heating energy is recovered by the CCS-HR. It is to be noted that systems with humidification are subject to a different calculation!

### Construction characteristics

AIRSOL® heat exchangers are characterised by a high production quality, robustness and a long useful life. The heat exchangers are fully manufactured from non-ferrous metals, so that no corrosion can occur even if no maintenance is performed (the glycol becomes acidic). The copper pipes have a wall thickness of 0.4 mm and are hydraulically widened, which leads to low pressure losses with regard to the liquid. The heat exchangers are completely ventilatable and emptyable. Fin thicknesses 0.2 – 0.25 mm, minimum fin spacing 4.0 mm (defroster), 2.4 mm (SA), 2.8 mm (RA coil). The frames are in AlMg3, V2A or V4A, the connection thread in red brass. The layering for QS4 is performed with Heresite®, which guarantees the highest degree of corrosion protection. The geometry used (40/35) is ideal for low air pressure drops with maximum performance. All laminated heat exchangers are PN16 pressure-tested by the manufacturer. The hydraulic circuit is set to the maximum counter-flow proportions (AIRSOL® circuitry). Consideration of the applicable hygiene guidelines in accordance with VDI 6022 and SWKI 2003-5. Division of deep heat exchange blocks with intermediate empty spaces for impeccable cleaning. A high degree of corrosion protection through galvanised pipes (CuSn) and saline water-resistant fins (Al Mg3). Corrosion protection in accordance with the material quality SWKI QS 1–4. Dimensioning of the heat exchangers for a sufficient degree of turbulence, for an ideal partial load behaviour.

### Use-dependent HR system regulation

The entire HR system is regulated depending on the usage by the HR regulation (HR controller), under consideration of the operating conditions of the ventilation system (air volume flows, heat requirements, internal and external heat loads) and the operating maps of the HR exchanger. The power transferred should be ideal at every point in time. The HR controller regulates the transition from winter mode to summer mode.

The HR controller has a modem and the corresponding communication software. All the important data is measured, prepared and optionally graphically represented on the Internet. This makes it possible to constantly monitor the dynamic functioning of the HR. Furthermore, statistical operating states can be consulted.

The building management system (BMS) does not perform any regular tasks for the HR system.

The BMS determines and transfers the following data:

- Fan operating notifications
- Current ideal values for the supply air temperature

If desired by the owner, all HR controller data can be transferred via a standard interface to the BMS (optional, to be represented as an additional cost).

The HR controller is to determine and display (locally and via the Internet):

- Energy requirements for warming the outdoor air
- Heat recovered by the HR system
- Raw degree of use
- Efficiency/Heat recovery figures

Establishing the control strategy according to the engineers specifications:

- Creating the data point diagram
- Creating the electrical diagrams for the HR controller
- Establishing the interface definition for the connection with the building management system (in agreement with the planner)

### Serial interface to the building management system (BMS)

Extra charge for serial interface to BMS: TCP/IP mode

### Operation monitoring

The operation monitoring data are provided in graphical form as a 24-hour diagram.

Further data is archived, so that it can be used to prove performance or provided upon request of the operators/owners. The cost of this remote monitoring for the first year can be included in the HR controller price.

### Emergency mode

Emergency mode for the system or important devices in the electrical cabinet, even if the automation station is not available. The emergency mode is built into the control cabinet and not operable from the exterior. The positioning of the emergency mode devices (manual/automatic) is assessed from the controller.

The emergency mode also includes a watchdog function, which automatically switches to pre-defined values in case of a failure of the control system. The emergency mode is hereby given highest priority.

Hydraulic assembly

Mountair S2 Monobloc housing construction. Housing design without welded joints and thus completely demountable. Removable covering panels. Panels completely powder-coated after production. Layer thickness min. 60 µm, RAL 5012. Galvanised or powder-coated base frame with openings for crane transport. Hydraulic station base made of 1.4301 stainless steel panels. Door closing via lockable hand lever. Oval light made of a plastic lower part, self-extinguishing and halogen-free. Fittings for 1 × E27, max. 40-watt lightbulb. Cable entry with clamping gland. Transparent upper part made of shock-resistant plastic. Hinged and galvanised wire guard. Protection class IP 44. Lamp wired to the interior 230-volt switch/socket combination.

Centrifugal pump

For the water/glycol pumping medium. Vertical, multiple-layer centrifugal pump with glycol-resistant seals. Impellers and intermediate chambers in chrome-nickel-steel 1.4301. Head and base part in grey cast iron. Mechanical seal with installation dimensions according to DIN 24960. Maximum conditions: 16.0 bar/80 °C. Directly flanged IEC motor with built-on frequency inverter, with cold-conductor thermometer probe. Protection class IP 55.

Frequency inverter

Fully digitised with voltage vector control and variable tract frequency. Housing IP 54. Integrated radio control filter.

- Functions:
- Current limitation
  - Voltage monitoring
  - Electronic full motor protection
  - Ramp function
  - Frequency bypasses
  - DC brake
  - Integrated PID controller

Redundancy pump

- Consisting of:
- 1 Centrifugal pump – pump constantly regulated with frequency inverter
    - FI preset (ext. Setpoint 0 – 10 V, ext. FI release)
    - Incl. Inspection switch for HR pump
  - 2 Butterfly valves – with integrated one-way valves incl. installation, piping and cabling within the component group

Control valve

2 or 3 way control valve for frost protection or power regulation with constant operation.

Safety devices

Expansion tank for closed systems, muff, brass cap valve, diaphragm safety valve with exterior output, pressure gauge, pressure gauge tap, ball valve with spindle sealing, bi-metal thermometer, filling and emptying system.

Inner piping and additional components

Complete piping within the hydraulic station, adjusted to the flow volume, including an Armflex sleeve insulation of all pipe parts endangered by condensation water. The media connections and the outlet of the safety valve lead out of the hydraulic station. All components used are glycol resistant. Pressure gauge for aspiration from and pressure on the medium pump. The pump connection to the piping system is decoupled, to absorb vibration and flow noises, as well as to compensate for expansion. All electrical components are wired into a terminal box, incl. the isolator for the HR pump.

Flow measurement and regulation – Monobloc

1 measurement and control valve per system delivered unmounted.  
EP valve with integrated volume-flow measurement. Connection to the building piping at the monobloc.

External piping

Piping and connection work between the ventilation units and the hydraulics cabin, incl. pipe insulation. Rinsing, glycol filling, ventilating and hydraulic balancing. Cabling between the control cabin, the hydraulics cabin and the power supply.

Engineering and design

Design according to the annual use SWKI (AU > 75%), minimum requirements according to SIA 382.1 (dry > 70%), SFP (Specific Fan Power) minimum requirements, ETA (electro-thermal amplification factor) minimum requirements.

System 00 example:

	Air flow volume m³/h	Air intake °C /% r. F.	Air output °C	Power kW
Filter pre-heater	45 000	-11 /90	-8.2	40
HR air heater	45 000	-8.2 /70	11.1	282
HR air cooler	40 000	22 /30	0.3	322



**System 01 example:**

	<b>Air flow volume</b> m <sup>3</sup> /h	<b>Air in-take</b> °C /% r. F.	<b>Air output</b> °C	<b>Power</b> kW
<b>Filter pre-heater</b>	20 000	-11/90	-7.9	20
<b>HR air heater</b>	20 000	-7.9/68	12.1	130
<b>HR air cooler</b>	20 000	22/30	1.3	150

The legal provisions are to be observed.

Planning brand: Mountair AG, Kreuzlingen

Type: AIRSOL®

Alternatives of equal value can be offered separately. The installation company is to provide the proof of equal value. The HR manufacturer bears the responsibility for the functionality and proper operation of the HR system.

They are therefore responsible for the correct choice of the hydraulic system and are to establish a proposition for the control strategy. The cost of the engineering is included in the prices of the HR exchanger.

**Hydraulics**

The HR manufacturer provides a proposition for the hydraulic diagram. This dimensions the conveyor pump and all the valves for the HR system.

**AIRSOL® operation optimisation**

The ideal water / glycol conveyed volume of a CCS-HR depends on the operation conditions of the ventilation technical system (air flow volumes, exterior temperature, internal and external heat loads) and on the exchanger characteristics. Variable air flow volumes require an adjustment of the water / glycol conveyed volume, under consideration of these influence factors. A constant adjustability of the pump with the help of a frequency inverter is a precondition for operation optimisation.

- The HR controller starts the HR pump and regulates the conveyed volume (pump rotation speed), so that an ideal heat recovery is constantly achieved.
- The HR controller minimises the pump energy: the conveyed volume is only increased until the additional energy requirement of the pump exceeds the additional power to heat the outdoor air.
- Once the maximum supply air temperature (limit value) has been achieved, the HR power is reduced.
- The HR controller prevents the condensation from the exhaust air from freezing.
- For ventilation systems with cooling or adiabatic humidification of the exhaust air, the HR controller regulated the HR (summer mode).
- For network systems (several supply and/or exhaust air units), the water / glycol flow volumes are distributed as required. This ensures that the energy is always collected where it is present and brought to where it is needed.

- For HR systems with cold-heat and/or exhaust heat supply, the HR controller completely regulates the supplies.

**Guarantees****Measurement**

The air conditions and pressure losses are recorded via the system-relevant elements and the overall system.

The air volumes, water-glycol volumes and the drive performances are measured.

**Calculating**

The performances are calculated from the air volumes and air conditions. The performances are calculated from the pressure losses proportionately for the HR and the overall system.

**Regulating**

The heat values of the air flow volumes and the glycol flow volumes are optimised through adjustment of the glycol flow volume. In network systems, the supply air volumes are regulated according to the effective requirements. On the exhaust air side, the maximum glycol volumes depend on the air flow volume.

**Evaluating and representing**

The summation per intervals shows the total energy requirements in heat, cold and optional humidification or dehumidification. The proportion of heat recovery in the total required energy is represented as the degree of use. The summation of the reserve energy serves to calculate the electro-thermal amplification factor.

**Monitoring**

The system is monitored through plausibility checks and corrections are required in case of errors. This is based on the comparison between the theoretical ideal values and a tolerance threshold. On the basis of the measured values, sensor and component failures are monitored. The measured values for performances and energy quantities must be within the pre-defined range.

**Proof of the guaranteed performances**

The installation company/HR manufacturer is to prove the guaranteed performances after the first year of operation. To this purpose, the air flow volumes, the important temperatures (OA, SA depending on the HR, RA, EA, water / glycol temperatures), the operating conditions and any alarm notifications are to be measured, recorded and graphically represented. The entire area of the exterior temperatures and air flow volumes must thereby be recorded. This proof replaces the performance measurements upon acceptance. In the acceptance record, a corresponding note is to be added. The measured and prepared data should be graphically represented.

## The standardized AIRSOL® CCS-HR in the Mountair S2 Monobloc

### Calculation basis

HR design example	450 a. s. l.
SA/RA air flow volume proportions	1 / 1
velocity on the ribbed exchanger surface	1,8 m / s
OA dry temperature efficiency level (SIA 382)	70 %
OA entry	- 11 °C / 90 % r.H.
SA exit	12.1 °C / 15 % r.H.
RA entry	22 °C / 18 % r.H.
EA exit	- 1 °C / 83 % r.H.
Glycol proportion, anti-freeze N	25 %
Net annual use rate (legal requirement = 75 %)	80 %
Electrical amplification factor (legal requirement = 15)	23

### AIRSOL® CCS-HR construction characteristics

Maximum counter-flow circuit	Type: AIRSOL®
Pipe geometry, fully ventilatable/emptiable	40 / 35 mm
Pipe wall thickness	Cu 0,4 mm
Pipe expansion	hydraulic
Fin thickness	0,2 mm
Fin division OA/RA	2.5 mm / 3 mm
Quality level 2 (according to SWKI)	Cu / Alu / Alu / RG7
Quality level 3 (CuSn / AlMg3 / AlMg3 / RG7)	
Quality level 4 (Heresite® dip coating)	

### Annual energy calculation

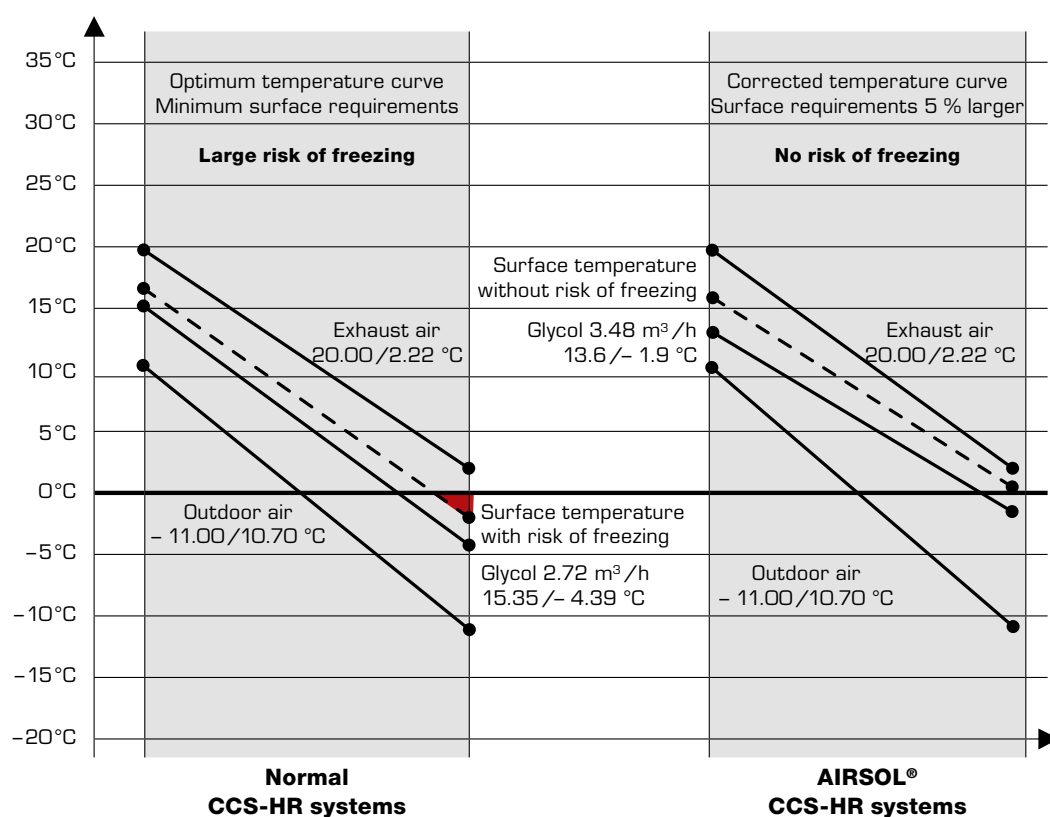
System example with air volume	20 000 m³/h
Pressure drop OA/RA	100 / 105 Pa
Hydraulic pressure loss OA/RA	126 / 126 kPa
Water/glycol mass flow [15.1 / - 4° C]	6,9 m³/h
K-value	30 W/m²K
Transfer surface OA/RA	1160 m² / 1160 m²
Weight/Contents	2 × 700 kg / 2 × 250 l

### Operation time

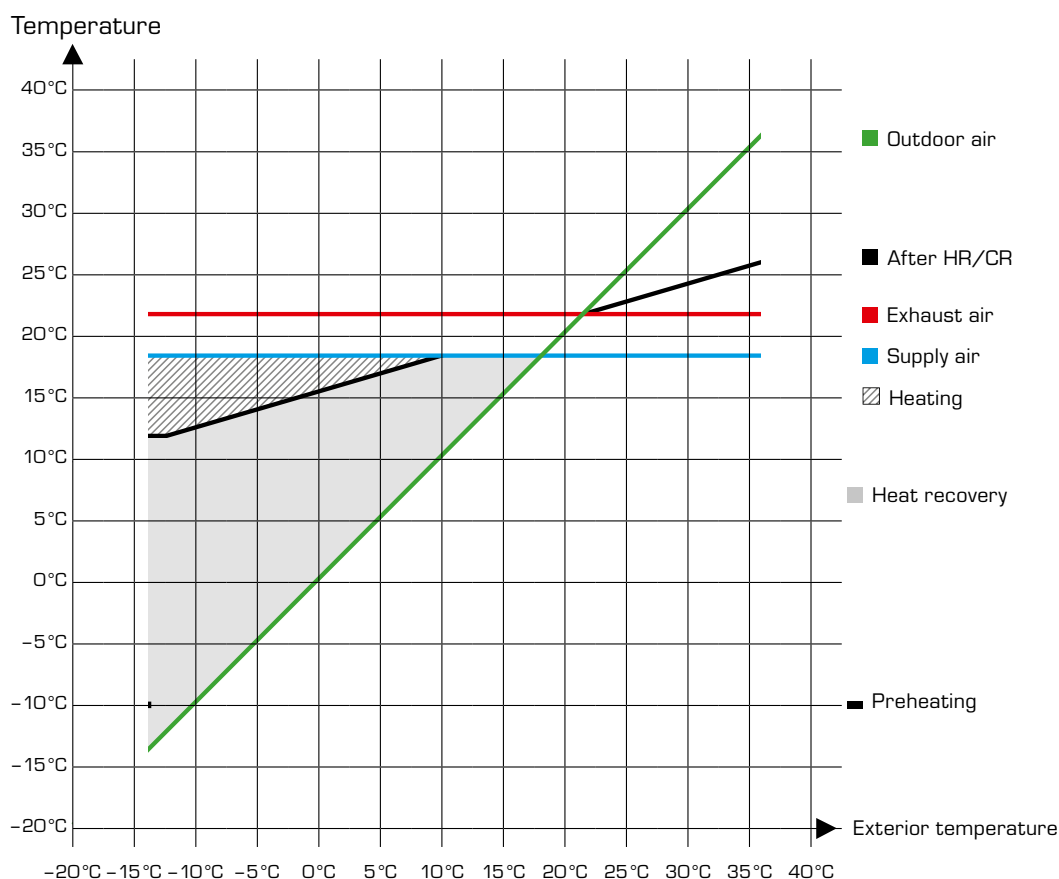
Constant SA/RA temperatures (no condensation)	18° C / 22° C annual
energy consumption Total heat without HR	493 MWh/a
Heat recovery	444 MWh/a
Energy reserve for HR (fans/pump)	19 MWh/a
Annual use level raw/net	84 % / 80 %
Amortisation times for 24h constant use	approx. 2 years
Amortisation times for normal office use	approx. 4.5 years

This calculation is an example. It is to be established according to the system.

## Water-glycol temperature curve



## Air temperature curve



## References



2023

### Dottikon ES, Gebäude A61

- New construction of active ingredient drying system A61 – HVAC planner = Hochstrasser, Glaus & Partner.
- LA10 Drying line 1, CCS-HR Monobloc 10 000 m³/h, EA in ATEX
- LA20 Drying line 2, CCS-HR Monobloc 10 000 m³/h, EA in ATEX
- LA30 Drying line 3, CCS-HR Monobloc 10 000 m³/h, EA in ATEX
- LA40 Drying line 4, CCS-HR Monobloc 10 000 m³/h, EA in ATEX
- LA90 aisle/ goods lift, CCS-HR Monobloc 22,500 m³/h, EA in ATEX
- LA91 Office/Cloakroom/ NR, CCS-HR Monobloc 12,500 m³/h
- LA92 MZR, KMT, CCS-HR Monobloc 18 200 m³/h, EA in ATEX
- LA93 Storage humid/dry prod, CCS-HR Monobloc 9 500 m³/h, EA in ATEX
- incl. Airsol CCS-HR system
- 4 × (1:1 system) CCS-HR pump station  
+ Controller for LA10/ LA20/LA30/LA40
- 1 × (4:4 system) CCS-HR pump station  
+ Controller for L90, L91, L92, L93



2022-2023

### GHZ Schlieren, Südstrasse 1, Schlieren

- Laboratory Office East unit, CCS-HR Monobloc 41 000 m³/h
- Laboratory Office West unit, CCS-HR Monobloc 41 000 m³/h
- Incl. CCS-HR pump station+controller to laboratory-office
- HR pump station P.80.2.0.0 incl. Redundancy pump



2022

### DSM Campus, Building-245, Kaiseraugst

- Monoblocs for the new DSM Campus Building-245 without HR controller, without HR pump station
- 4 units of SA-EA laboratory Monoblocs with 28 000 m³/h SA and 25 000 m³/h EA for each unit.
- CCS-HR incl. a defroster, Mountain Airsol CCS.
- The 4 SA systems are equipped with steam humidifiers (ESCO system, direct supply from the on-site steam network).
- 4 laboratory EA systems equipped with Mountain Humidos Adiabatic atomising humidifiers for optimised CR via CCS system (CR in summer).
- The office system (16 000 m³/h) is equipped with a rotary HR and humidification system.
- Other ancillary systems for air-conditioning rooms, post-treatment rooms, ancillary rooms, technical rooms and then above all various CCS devices (for EA) from the syn. laboratories, chemical processing rooms, solvent rooms for feeding the EA energy into the overall CCS-HR network.



2022

### KSSG Children's Hospital St. Gallen, Building 07A, 07B and OKS

- Batch 1 /07A: around 50 Monoblocs with air volume of around 182 000 m³/h
- Batch 2 /07B: around 28 Monoblocs with air volume of around 74 000 m³/h
- Batch 3 /OKS: around 40 Monoblocs with an air volume of around 117 000 m³/h, 2 × pumping station 50 – 1000 kg/h
- without HR controller, without HR pump station





2022

### Inficon AG, Balzers

- 24 Systems
- 2 units HR controller and CCS pumping station (Network NORTH + Network SOUTH)
- Air treatment for south network (SA 14 450 m³/h/EA 9500 m³/h)
- Air treatment for north network (SA 10 840 m³/h/EA 10 640 m³/h)
- Air treatment for storage (SA 6100 m³/h/EA 3100 m³/h)
- Air treatment for kitchen (SA 2700 m³/h/EA 3000 m³/h)
- Circulating air cooler (4500 m³/h) 05a-d
- Circulating air cooler (3000 m³/h) 06
- Circulating air cooler (5500 m³/h) 07a-l
- Circulating air cooler (12 000 m³/h) 08a-b
- Underground car park UG01 (SA 4700 m³/h/EA 5250 m³/h)
- Air treatment for Atrium South (6000 m³/h)



2021

### Huber + Suhner, FF1 Focus for One-L

- 7 Monobloc units with around 108 000 m³/h
- Production SA as roof unit 51 100 m³/h
- Production EA\_1 indoor monobloc 20 300 m³/h
- Production EA\_2 indoor monobloc 26 600 m³/h
- Common rooms – PHE-HR Monobloc 2400 m³/h
- EVA-10 EA\_3 as T2 roof monobloc 1800 m³/h and 2 × production EA as indoor units
- without HR controller, without HR pump station



2021–2022

### ZHAW Wädenswil, Ventilation – Building RD

- New “RD” laboratory building
- SA-EA Monobloc for “Labor Technika” with around 40 000 m³/h, CCS-HR system incl. hydraulic pump station and HR controller (CCS controller)
- Further Monoblocs for offices (rotary HR), car parks, ancillary rooms (PHE) and more
- Winning project “Building Award”, Kalt + Halbeisen



2021

### Paul Scherrer Institut, PSI, Park-innovaare

- Monoblocs for new cleanroom building
- 2 × SA Monoblocs with 27 000 m³/h each, CCS-HR system, double EC fans, preheater, air cooler, dehumidifying air cooler, Mountair Humidos low-pressure adiabatic atomising humidifier and reheater-air heater without HR controller, without HR pump station
- A total of 5 EA units of quality level QS4 with Heresite-coated CCS registers. Without fans – on site = plastic fans
- In addition, 2 Monoblocs with 9000 m³/h each for chemical gas rooms and circulating air.





2021-2023

### Lake hospital Neo, Kempthal, Horgen

- New building/extension of lake hospital in Horgen, Wing 'D' and 'B'
- Monoblocs with a total air volume of around 110 000 m<sup>3</sup>/h
- Each wing (D/B) with a separate CCS-HR hydraulic station and the corresponding HR controller (CCS controller)



2021

### Valascia ice rink, Ambri

- Delivery of Monoblocs/ventilation systems for new ice rink in Ambri, incl. Run-around CCS-HR pumping station



2020

### Laboratory building, University of Zurich-Irchel

- 4 × SA/RA laboratory main systems, each 60 000 m<sup>3</sup>/h
- 6 CCS pump station units in total with redundancy pumps
- CCS controller with slave fieldboxes for the monoblocs



2021

### Klink Schloss Mammern, new park-view building

- Supply of equipment for the west and east park-view building, office/lobby (enthalpy PHE; with humidity recovery), ancillary rooms (aluminium PHE) and restaurant/kitchen (CCS-HR) incl. CCS-hydraulic module and HR controller (CCS regulation)



2020

### New build Swiss TPH Tropical Institute, Allschwil

- Total air volume around 200 000 m<sup>3</sup>/h
- Ventilation units with run-around CCS-HR incl. Pump stations/HR controllers for laboratories, biobanks and animal housing
- Ventilation units with plate/rotary heat exchanger heat recovery system for seminar rooms, offices, restaurants and adjoining rooms



2019

### Cantonal hospital Winterthur, new building

- Air volume SA approx. 283 000 m<sup>3</sup>/h
- 3 × heat recovery pumping stations with central heating and cooling
- Master-slave system with HR controller and field boxes



2019

### Adeline Favre, Winterthur

- HR network system with redundancy pumps, flow rate = 40 m<sup>3</sup>/h, total of 8 SA and 8 EA systems with a total air volume of SA = EA = 118 000 m<sup>3</sup>/h each



2018

### Plattenstrasse, University Zurich

- 1 × T2 roof unit with Hybaco, Q = 200 kW
- Air volume SA = RA = 17 000 m<sup>3</sup>/h
- CCS pump station, 5.4 m<sup>3</sup>/h with PHE heating and cooling



2017

### Givaudan ZIC, Kemptthal

- 2 SA and EA laboratory systems with 87 500 m<sup>3</sup>/h each
- Adiabatic EA humidification
- 2 hydraulics stations with redundancy pump
- 1 SA/EA system with separate hydraulics station



2017

### St. Jakobshalle, Basel

- Total air volume approx. 372 000 m<sup>3</sup>/h
- Divided into 3 compound systems
- 3 hydraulics stations with heat and cold supply
- Master-Slave with HR controller, floor boxes, field boxes



2017

### Campus clinic of Balgrist, SERI expansion

- 2 separate CCS network systems
- Each with 1 × SA/EA system
- Air volume per system 31 000 m<sup>3</sup>/h/h



2017

### Wagi skyscraper 2, Schlieren

- Total air volume approx. 106 000 m<sup>3</sup>/h
- Network system for laboratory, chapels, reception, conference room
- Hydraulics station 32 m<sup>3</sup>/h with redundancy pump





2016

### Zollikerberg hospital

- Total air volume approx. 32 000 m<sup>3</sup>/h
- Divided between 2 network systems (19 000/13 000 m<sup>3</sup>/h)
- 6 SA and 5 EA zones per network
- Each with hydraulics station with redundancy pump



2016

### Westlink Tower and Cube, Altstetten

Divided into 3 network systems (1 × Tower, 2 × Cube)

- Tower: 78 000 m<sup>3</sup>/h air and 23 m<sup>3</sup>/h water-glycol
- Cube-1: 16 000 m<sup>3</sup>/h air and 5 m<sup>3</sup>/h water-glycol
- Cube-2: 24 000 m<sup>3</sup>/h air and 7 m<sup>3</sup>/h water-glycol



2015

### Cantonal pharmacy of Zurich, Schlieren

- HR network system with 4 SA and EA systems
- Hydraulics station with heat supply and cold uncoupling
- Adiabatic, atomizing humidifier (Humidos) for cold recovery in summer
- 1 × pump station (30 – 600 kg/h)
- 4 × monobloc with adiabatic EA humidification



2015

### Europaallee, Baufeld H, Zurich

- Air conditioning systems for the hotel, cinema, service rooms, restaurant, kitchen
- Total air volume approx. 210 000 m<sup>3</sup>/h
- 11 CCS network systems (SA, EA)
- 11 hydraulics stations with HR controller
- EA systems with adiabatic humidification (CR in summer)



2014

### Botanical garden, University of Zurich

- Renewal of SA/EA systems
- Air volume per unit 110 000 m<sup>3</sup>/h
- Heat recovery station with heat supply



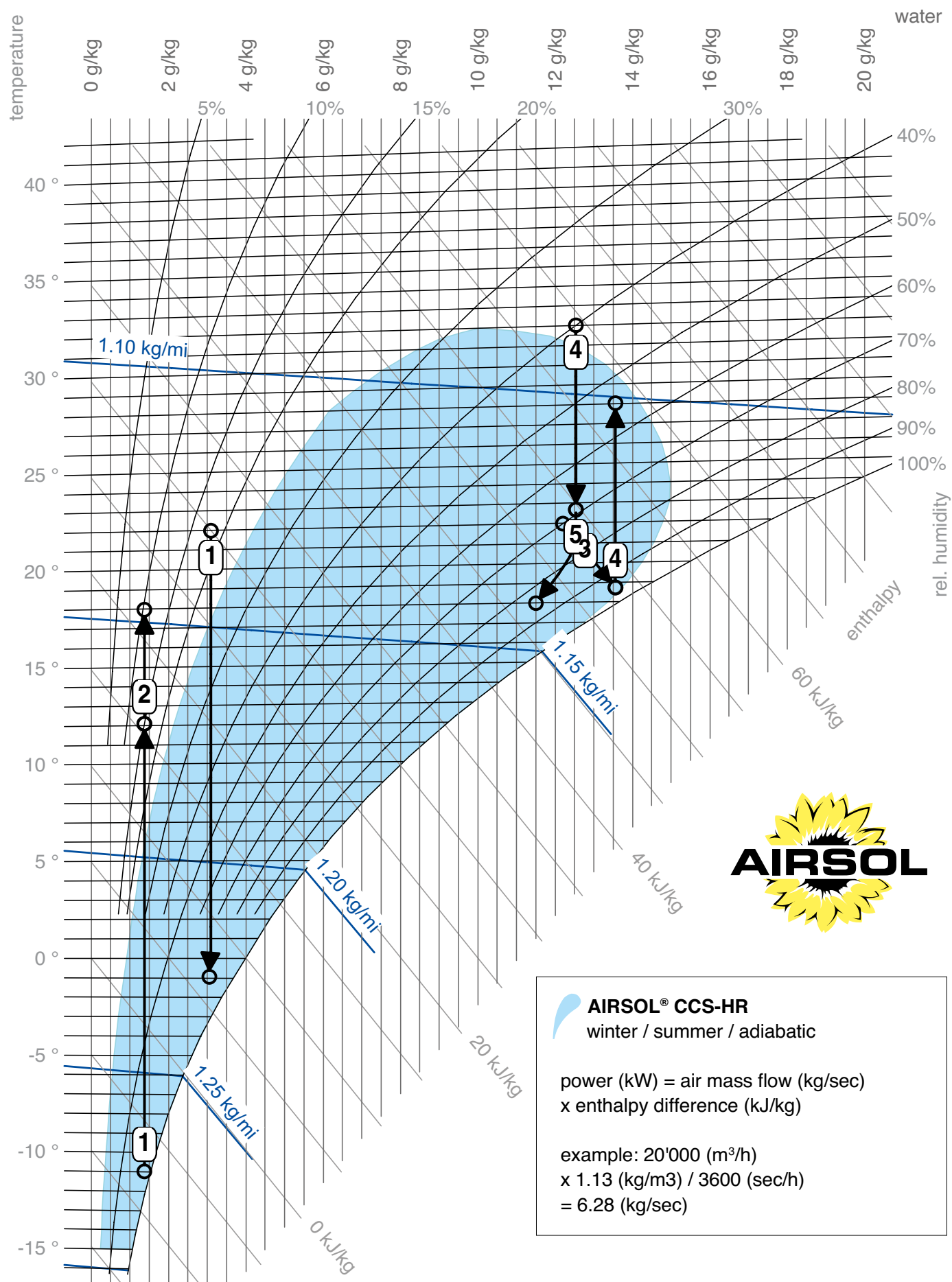
2013

### Triemli Hospital (construction phase B/C), Zurich

- S2 hygiene equipment is used. Equipment for primary air treatment, operating theatres with dehumidification, isolation rooms and various individual systems for the different medical areas.

# Mollier h-x diagram

Mollier-h-x diagram for humid air / pressure 0.960 bar (450.000 m / 10.000 °C / 80.000 % r. H.)







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