MOUNTAIR

HUMIDOS

Adiabatic, atomizing humidifier

Hygiene-certified according to VDI 6022

Contents

Cantonal pharmacy, Zürich

HUMIDOS

Air humidification belongs to one of the fundamental air conditioning types. There are various processes that can be used for this. Traditionally, but no longer very relevant, humidification was performed through a contact humidification process. Humidification of the air (supply air flow) through comb humidifiers no longer corresponds to the current hygiene standards. However, comb humidifiers are still used for adiabatic exhaust air humidification. The maintenance of these systems is however relatively high and this type of humification is used less and less.

A second process is air humidification through steam. Hygienically advantageous and without temperature losses. This process is however very energy-intensive during the humidification. The steam has to be produced (> 100 °C), and much electrical energy is used for this. If steam is already present in a process chain, this process is very appropriate and is simple to implement.

The third process is air humidification through high-pressure atomizers. This process is very up to date and is often used. The standards have changed enormously, and the useful life has increased considerably. Many older models were replaced due to their lacking functional safety. In this process, high-pressure pumps bring (osmosis) water to a high level of pressure (for ex. 70 bar) and spray nozzles inject it into the air flow. This creates a fine mist that humidifies the air flow up to the saturation limit.

Humidos system, botanical garden, Zürich

Application area

Adiabatic, atomizing humidifier can be implemented in supply air and exhaust air devices. When implemented as supply air humidification, the aim is to achieve optimum humidity for laboratory rooms, clean rooms, production rooms, office areas, conference rooms etc. The supply air humidity must be reliably kept in a narrow band, regardless of the air volume. Operation periods mostly span the winter months, when cold outdoor air with low absolute humidity is prepared and blown in. When the high-pressure atomizers are implemented as exhaust air humidifiers, the goal is to recover cold in the summer in conjunction with a CCS heat recovery system. To a certain extent, exhaust air humidifiers are recoolers for the glycol circuit or are implemented directly as recoolers for cooling systems. Humidos humidifiers can also be implemented as exhaust air humidifiers with plate exchanger or rotor exchanger HR. The proper materialisation of the components is to be observed in all cases (high material requirements).

Functional description

Mountair Humidos Humidification system with central pump

With the high-pressure atomizer (HPV) humidification system with central pump, the humidification of several systems – supply air as well as exhaust air – is enabled by a single central pump.
The osmosis water delivered to the construction is thereby brought to a constant pressure by a high-pressure pump. A large performance range can be covered thanks to the frequency inverter for the pump motor and a minimal circulating amount in the pump unit.
In the individual zones, the necessary amount of water is injected into the air to be humidified via several zone valves (digital circuit) and the nozzles. With four stage valves, 15 performance levels can be run 6.7% performance difference per level. Each zone valve is assigned to a drain valve. As soon as the humidifier switches off due to decreasing requirements, the drain valves are opened and the water can flow out of the spray bars. This means that no stale water can be injected into the air. This process is controlled by the slave controller that is located outside the Monobloc.
The humidification is performed adiabatically, which leads to a cooling of the air by the humidification. The main control is performed at the pump station. The current actual values can be viewed, and all ideal values can be entered and changed on a touch screen. From this central controller (master), all sub-stations (slave) at the spray bars with the humidifier racks and the individual zone valves in the Monobloc are connected via ethernet. The information from the slave stations is collected and processed in the central unit.
A Modbus connection to the building management system transmits the switching on orders, the values of the performances required and the current actual values of the system.

Norms and certificates

Hygiene requirement standards for supply air humidifiers have constantly increased. Past problems and the always higher requirements for fresh air in rooms have led to the products needing to distinguish themselves via certificates. In the field of air humidification, there are many brands, however not all of them will fulfil the currently required standards for long – for adiabatic, atomizing humidifier, these standards are defined as hygienic harmlessness according to VDI 6022.

The materials used must be microbially inert, the components must all be accessible, easily cleanable and upgradable. The humidifier system must also be able to be easily and completely emptied (area in the air flow with the atomizer nozzles), remaining water must be fully drained and must not be injected back into the air flow.

Mountair AG has launched its own high-pressure humidifier. Mountair Humidos is hygiene-certified according to VDI 6022. This enables the flexible use of our own humidifier system, in new installations or renovations.

INSTITUT FÜR LUFTHYGIENE
Luft und Wasser: Planung, Analysen, Sanierungskonzepte

ILH BERLIN

Zertifikat

Hygiene – Konformitätsprüfung

Geprüftes Baumuster	Hybrider Luftbefeuchter Humidos siehe Anlage 1
Auftraggeber / Hersteller	Mountair AG, Sonnenwiesenstr. 14, 8280 Kreuzlingen, Schweiz
Prüfdatum /-ort	20.-21.08.2014, 18.02.2015 Mountair AG, Sonnenwiesenstr. 14, 8280 Kreuzlingen, Schweiz
Prüfingenieur	Dipl. Ing. (FH) Jacob Kornack
Prüfkriterien	Im Rahmen der Hygiene-Konformitätsprüfung wurden die hygienerelevanten Anforderungen* der nachfolgend mit „✓" markierten Regelwerke geprüft:

Allgemeine Raumlufttechnik		Krankenhausbereich	
VDI 6022, Blatt 1 (07/2011)	☑	DIN 1946 Teil 4 (12/2008)[1]	☑
SWKI VA104-01 (04/2006)	☑	SWKI 99-3 (05/2003)	☑
VDI 3803, Blatt 1 (02/2010)	☑		
ÖNORM H 6021 (09/2003)	☑		
DIN EN 13779 (09/2007)	☑		

Prüfergebnis	**Die Konformität des geprüften Gerätes mit den hygienerelevanten Anforderungen der o. g. Regelwerke wird bestätigt.**
Gültigkeitszeitraum	5 Jahre: 10.2015 – 10.2020
Registriernummer	HKP 08/14 - 01

Konstruktive Hygienemerkmale
VDI 6022 Blatt 1 (D)
VDI 3803 Blatt 1 (D)
ÖNORM H 6021 (A)
SWKI VA104-01 (CH)
DIN EN 13779 (EU)
DIN 1946 Teil 4 (D)
SWKI 99-3 (CH)

Dipl.-Ing. (FH) J. Kornack — ausgestellt am 19.10.2015, Berlin

[1] Gemäß DIN 1946 Teil 4 ist der Einsatz des geprüften Baumusters in OP-Abteilungen nicht zulässig.

*Regelwerke bzw. Anforderungen aus Regelwerken, auf die in den zu dieser Hygiene-Konformitätsprüfung (HKP) herangezogenen Regelwerken verwiesen wird, wurden nicht berücksichtigt.
Die HKP beinhaltet keine toxikologischen Prüfungen oder Bewertungen der in dem geprüften Baumuster eingesetzten Materialien.

Allgemeine Raumlufttechnik		Krankenhausbereich	
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Die Konformität des geprüften Gerätes mit den hygienerelevanten Anforderungen der o. g. Regelwerke wird bestätigt.

Advantages

Humidifier rack

- Hygienie certified VDI 6022
- Partialized into four levels
- Turbulence generator
- Aerosol separator
- Droplet separator
- Post evaporation unit
- Fully emptiable

The humidifier rack is important. It creates turbulence and is fixed onto the wall (not installed in the tank), making it easy to clean. The spray bar is partialized into four levels.
This is a Mountair solution, tailored to your needs.

Regulation

- Master-slave option
- Industrial standard
- Quasi constant

This requires a standard control that accepts all functions and can communicate with the BMS (Building Management System).
A water-lubricated Danfoss HP pump with wash plate is used in the Mountair Humidos humidifier. The control is performed through the regulation of the pump speed.

The standard controlling includes safety functions (pressure and temperature monitoring), has a pressure reduction valve, pump power regulation, a complete control function for the valves in the spray bar, a communication interface and a display which shows when a failure occurs on site.

Cantonal pharmacy, Zürich

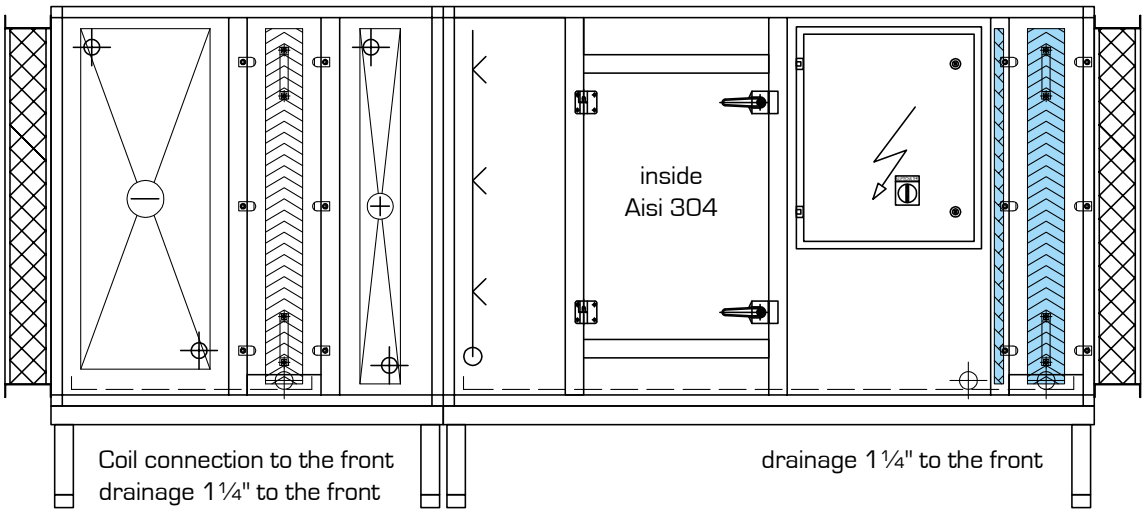
Pump

- Inexpensive maintenance
- Oil-free pump
- Safety technical monitoring

The Danfoss pump is comparable with a chrome steel HP piston pump. The water lubrication is the impressive part. With correct handling, the Danfoss pump has an advantage with regard to the maintenance intervals.

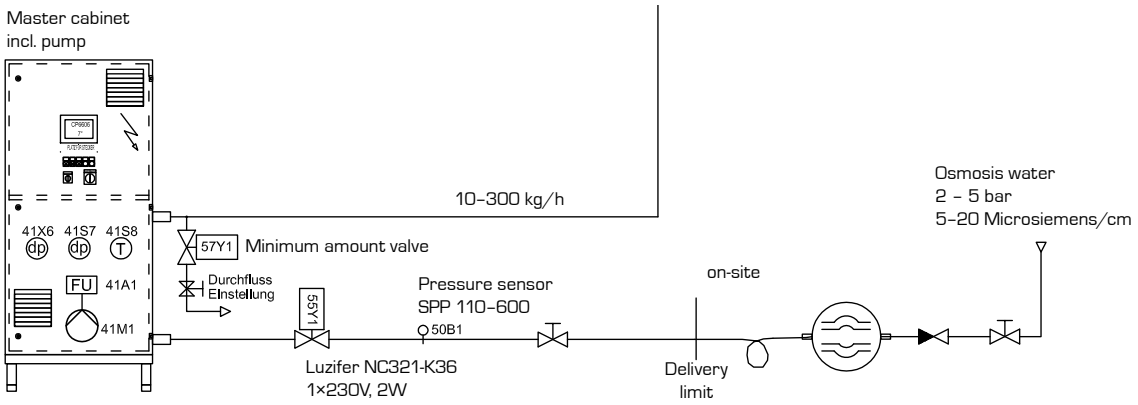
Construction form / design

The Mountair HUMIDOS high-pressure humidifier is implemented in room ventilation technology, regardless of the manufacturer of the AHU (air handling unit). For the choice of position in the AHU, care is to be taken that none of the subsequent parts are exposed to a high degree of humidity; a position at the end of the AHU-internal air flow is ideal (after the fan in overpressure, after filter stages, no humid filters and thus higher air pressure loss).

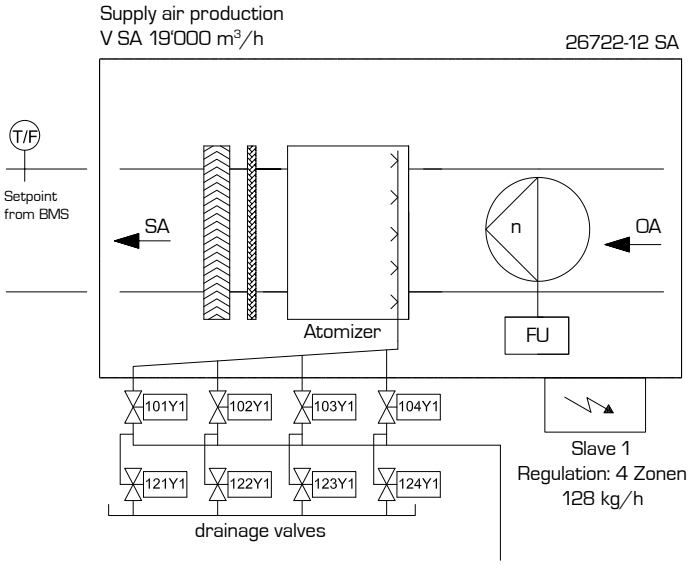


Principles diagram

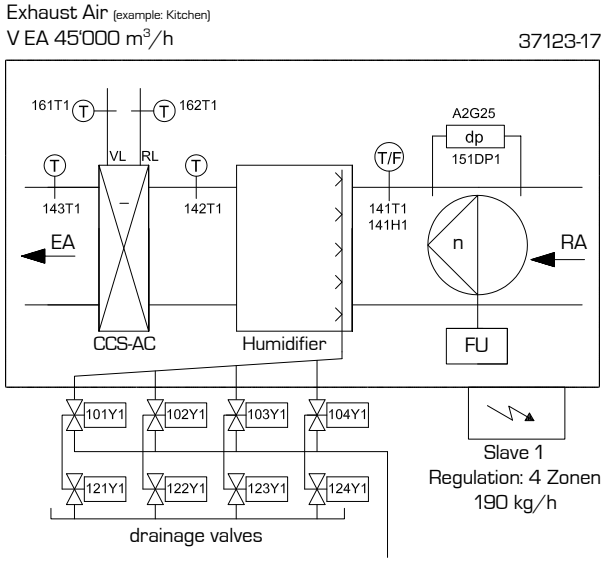
Humidos master pump station



SA humidifier



EA humidifier



Components

Pump

The axial piston pump is the core of the Mountair Humidos high-pressure humidifier. The pump is water-lubricated, 100 % maintenance-free and fulfils the hygiene regulations, as no lubricant or other chemicals are used.

Frequency converter

The combination of converter and motor for the variable speed enables an adjustment of the flow rate according to the actual need.

Pressure transmitter

The pressure transmitter is connected to the internal PID controller in the frequency inverter. This keeps the pump under a constant pressure.

Water filter

The pump station includes a 10 µm fine filter with a β-value > 5000 absolute. The filter prevents the pump from closing due to solids in the supply water and the narrow atomizer nozzles from being blocked.

Dry-run protection and temperature monitoring switch. If the water pressure of the supply were to be insufficient, the pump may start to dry-run and thus be damaged. The pressure switch (set to 1.6 bar) protects the pump. Simultaneously, the water temperature is monitored in order to prevent overheating. The protection switch is set to 50°C.

Zone valves

The zone valves are designed for use in high-pressure air humidification and adiabatic cooling. Each valve has an entry, a high-pressure exit and a drainage connection. When the valve is not active, the connection between the entry and exit is interrupted, while the connection between the exit and the drainage connection remains open. This immediately discharges the pressure in the system when use is interrupted. The valves are made of stainless steel AISI 304 (1.4301).

Master control cabinet with pump

Slave control cabinet

Aerosol and droplet separator

Optional equipment

Additional UV disinfection for feed water

The prepared osmosis water for the humidification can also be subject to UV disinfection. A UV reactor is installed for this purpose on the entry side of the Humidos pump station. The UV reactor has internal flow/temperature monitoring and regulates itself.

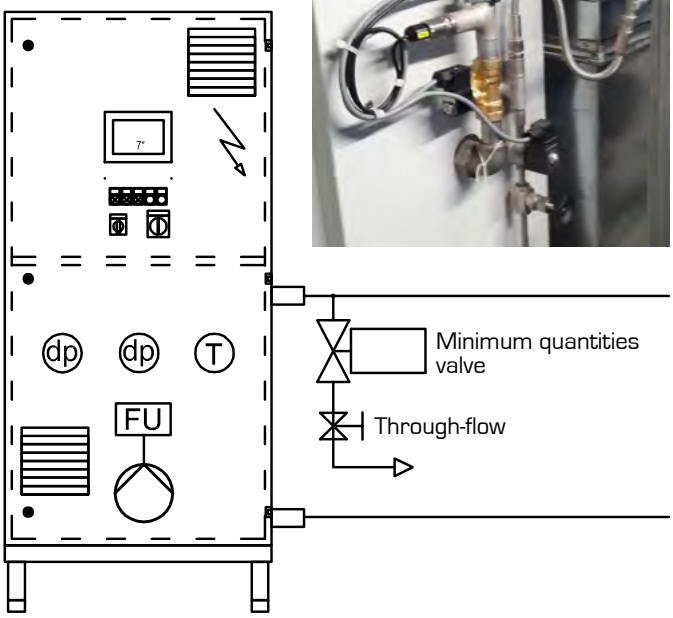
The UV pipes can simply be changed after they have reached the prescribed number of operation hours (8000 h).

Supply	230 V
Total performance	30 Watt
OK performance	5,7 Watt
Max. pressure	10 bar

Minimal quantities function (for very small performance requirements)

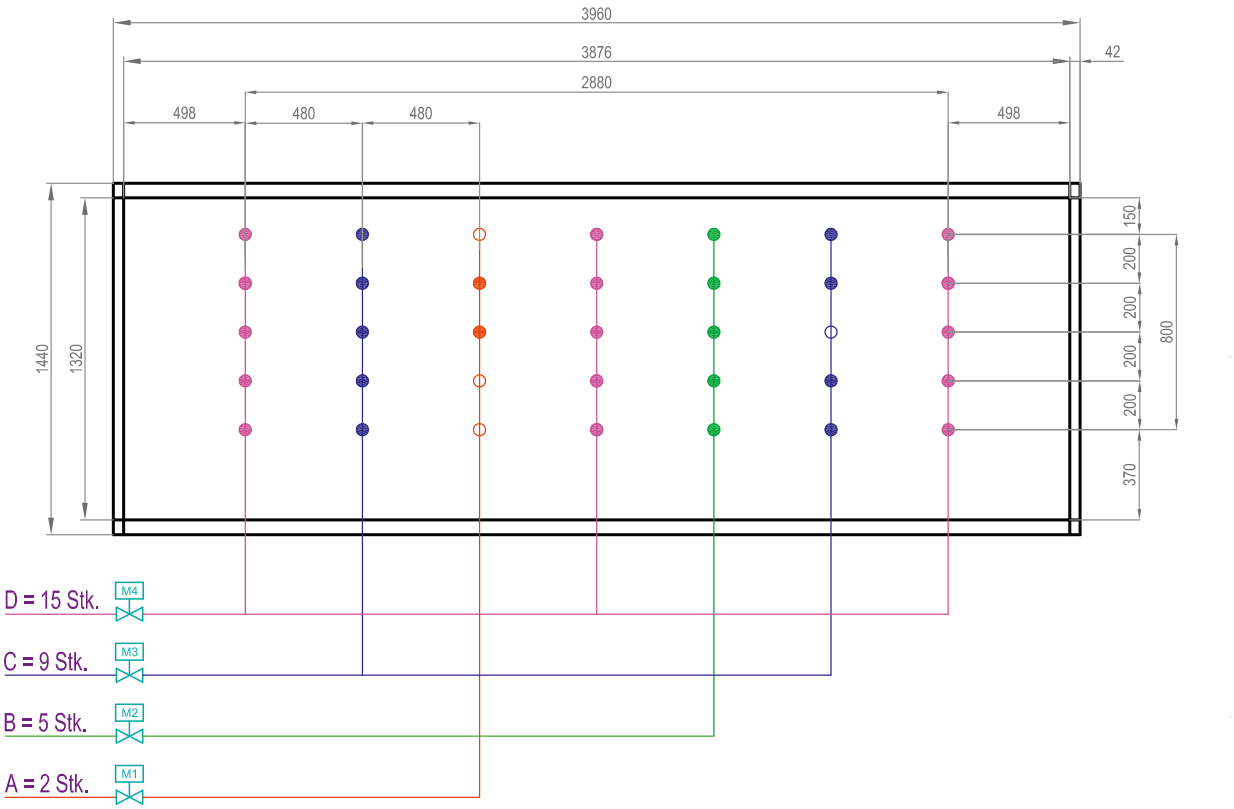
For systems with very small humidification amounts in individual operation, it can occur that the high-pressure pump reaches its lowest performance limit (7 kg/h). This can be remedied by introducing at least the minimum required amounts on the high-pressure side. If the humidifier only need to humidify 4 kg/h for example, the remaining 3 kg/h will be drained via the minimum quantities valve. This is necessary to avoid the pump overheating.

This function is active as long as the humidifier is set to the minimum level (0-10V signal from the control system or HR controller in the case of adiabatic EA humidification). The high-pressure valve is driven by the controller and the excess water is slowly drained via the installed needle valve. If the humidifier drive is increased and exceeds the minimum 7 kg/h, the minimum quantities valve is no longer driven, and the full amount is atomized via the spray bar.
For humidifiers that are connected in a network (1 pump station for several humidifier stations), the minimum quantities valve drive is controlled by the summation of the individual humidification amounts. The minimum quantities valve is only active, in practise, when individual systems are run at the lowest level (typically in the autumn spring seasonal transition periods).



Humidifier racks

Example of spray bar with four zones

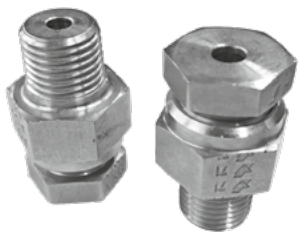


EA humidifier nozzle division in 4 zones
124 kg/h, 4 kg/h = 31 nozzles

Level 1	A	=	2	8 kg/h
Level 2	B	=	5	20 kg/h
Level 3	A + B	=	7	28 kg/h
Level 4	C	=	9	36 kg/h
Level 5	C + A	=	11	44 kg/h
Level 6	C + B	=	14	56 kg/h
Level 7	D	=	15	60 kg/h
Level 8	C + A + B	=	16	64 kg/h
Level 9	D + A	=	17	68 kg/h
Level 10	D + B	=	20	80 kg/h
Level 11	D + B + A	=	22	88 kg/h
Level 12	D + C	=	24	96 kg/h
Level 13	D + C	=	26	104 kg/h
Level 14	D + C + B	=	29	116 kg/h
Level 15	D + C + B + A	=	31	124 kg/h

High-pressure nozzles

The dimensioning of the rack division and atomizer nozzles is defined by the device cross-section and the humidifier quantity. Various nozzles are available; from 1.5kg/h to 10kg/h. The standard corresponds to 4.0 kg/h nozzles. Deviating sizes are only used in case of special requirements (particularly small/large humidification amounts).
The nozzles are equipped with a thread and an O ring, which makes it possible to exchange them simply and quickly.



High-pressure check valves (ventilation for drainage)

High-pressure check valves are used in order to guarantee a complete, hygienic drainage of the spray bar in the Monobloc interior (VDI-6022). These are installed on the nozzle tubes and designed for 100 bar. The balls are tightly pressed by the atomization pressure. If the humidifier is out of order, the pressure falls and the balls let air flow into the nozzle pipes, so that the water columns in the pipes can be completely drained. The drainage valve in the valve block is opened and the standing water flows out in a controlled manner.

Regulation

Humidos high-pressure humidifiers are equipped with a controller. There is a master (high-pressure pump) and at least one slave (actual humidifier in the air flow) per Humidos humidifier. The master control cabinet is equipped with a touch panel and visualises the entire system. If several slaves are connected, they are represented on the touch panel according to the project. A slave control cabinet ensures the system-specific connection: zone valve control, assessment, air flow volume (fan), sensors and the ideal values indication from the BMS (0-10V signal).

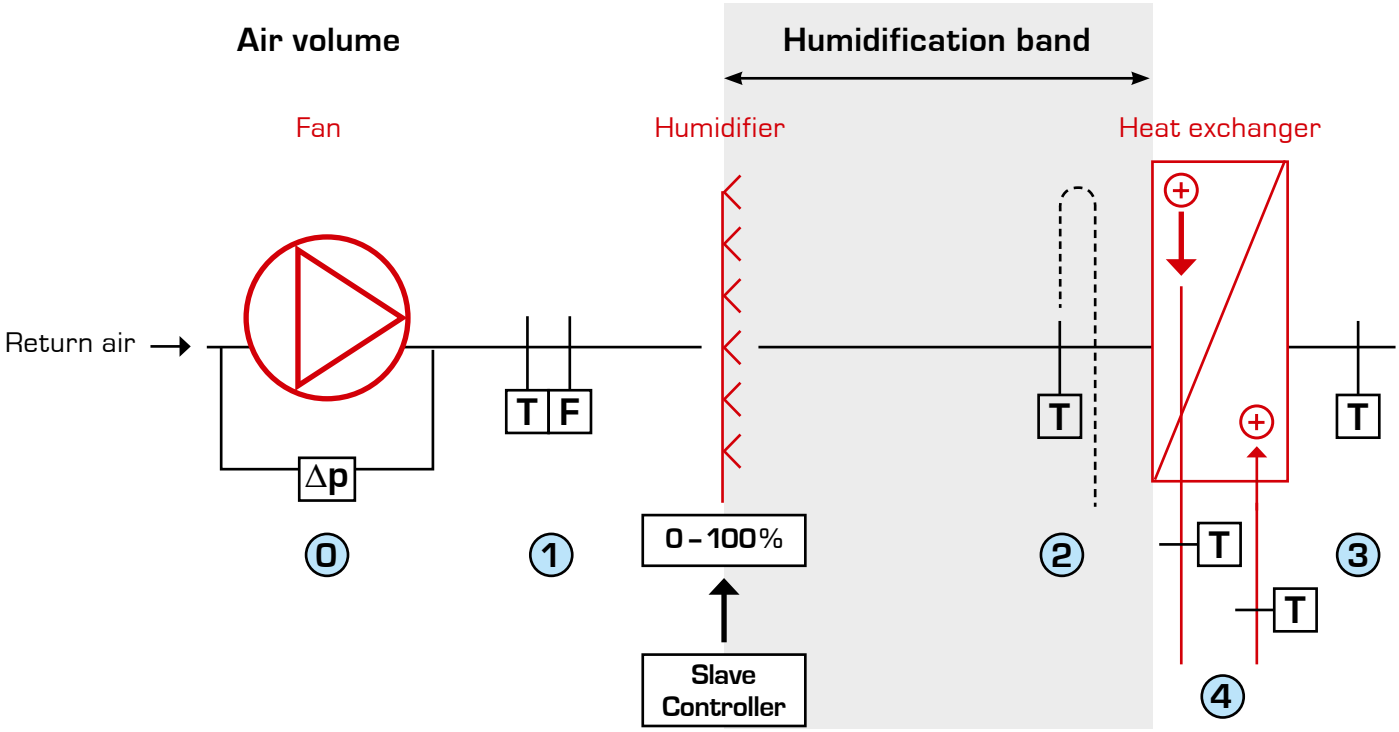
Slave station EA

The wet bulb temperature and the possible humidification before the saturation limit are calculated from the actual values of the RA temperature and RA humidity sensor. This humidification difference is multiplied by the air volume recorded on the fan by the ring gauge, which gives the water amount to be atomized. The humidifier performance is regulated according to the wet bulb temperature (sensor at the air entry of the heat exchanger).
As the wet bulb temperature can only be reached in theory, the ideal value of 0.5 K is set higher. The water amounts of the individual valves recorded in the programming make it possible to monitor the remaining water amount.
The maximum atomization amount is limited by the calculated value. A minimum water amount is defined per system, under which the humidification is stopped.
Whether the HR system is registered as in operation and whether the theoretical saturation limit is also 2° Kelvin under the entry temperature of the glycol are set as clearance criteria.
The efficiency of the adiabatic cooling is also monitored and evaluated by the entry and exit measurements of the glycol flow volume. The calculated emitted water amount is cumulated per zone.

SA slave station

The constant control input from the building management system of the ventilation control for the supply air humidification is implemented on the digital switching of the zone valves. Above the effectively measured air volume, the signal is reduced to the measured air volumes according to the percentual difference of the indicated maximum air volumes. A minimum water amount is defined per system, under which the humidification is stopped. The theoretically emitted water amounts are cumulated per zone on the basis of the zone valve assignment.

Adiabatic cooling control principle



0 Air volume
Measurement via inlet nozzle at the fan

1 Air condition
Humidifier entry
Temperature measurement T1
Humidity measurement F1

2 Air condition
Humidifier exit
Temperature measurement T2
Average temperature

3 Air condition
After heat exchanger
Temperature measurement T3

4 Water temperature
Heat exchanger
Measurement entry/exit T4

Design principles

If a high-pressure humidifier is implemented, there are various preconditions that must be fulfilled. You will find a short overview of the most important points below.

- Provision of osmosis water for the pump station with >= 2.0 bar network pressure
- Connection of the supply circuit to the Humidos pump station
- Wiring of the master pump station to the BMS and supply
- Wiring of the slave station to the BMS and supply
- Wiring of the master-slave communication (ethernet)
- Connection of the drainage pipes of the slave stations (valve block)
- Connection of the drains (pan connection) with siphon
- Optional: integrating the UV system between the osmosis water connection and the Humidos pump station
- Optional: wiring the UV system to the Humidos slave (supply and communication)

Design examples

Supply air humidifier

Air heater	South zone + North zone each 55'000 m³/h										
Brand **Mountair**	Air entry	**12.0**	°C	Medium **Water**			Number of pipe rows	**3**	RR	Accessories	
Type **AIRSOL®**			%r.F.	Flow temperature	**50**	°C	Pipe volumes	2x123	l	**Piping lead out**	
	Air exit	**34.0**	°C	RFlow temperature	**40**	°C	Connections	Thread(Rg)			**34**
			%r.F.	Flow volume	**2x33.4**	m³/h	Flow 2x 3"	R Flow 2x 3"			
	Heating power	**2x 384**	kW	Pressure loss	**12.2**	kPa	Pipe material	**Cu**			
	$c_{Net\ cross\text{-}section}$	**2.3**	m/s	PN nominal pressure	**16**	bar	Fin material	**Al**			

Frost protection grate, fixed	2 pc.	Frame material	Aluminium raw	Grate material	svz	1

Revision segment	With connection doors in the back chamber				
Length mm					

High-pressure humidifier	South zone + North zone each 55'000 m³/h										
Brand **Mountair**	Air entry	**34.0**	°C	Humidification	**2x300**	kg/h	Zulaufvordruck	2.5-5	bar	Accessories	
Type **Humidos**	**6.0**	%r.F.	**2.0** g/kg	Nozzle pressure	**80**	bar	Humidification			**Condensation pan V2A, AISI304**	
Water-lubricated pump	Air exit	**22.0**	°C	Number of nozzles	**2x75**		Carbonate hardness	<3	°fH	**Condensation drain, 4/5"**	
incl. control cabinet	**40.0**	%r.F.	**6.9** g/kg	Pump	**3.0** kW	**6.2** A	PH value min.	6.5	max. 8	**Condensation pan gradient: %2**	**35**
incl. 2 pc. slave controller	Difference	**4.9**	g/kg			**3x400** V	Conductance min.	0	µS/cm		
	Efficiency	95%						max. 100	µS/cm		

Air cooler	South zone + North zone each 55'000 m³/h										
Brand **Mountair**	Air entry	**32.0**	°C	Medium **Water**			Number of pipe rows	**5**	RR	Accessories	
Type **AIRSOL®**		**40**	%r.F.	Flow temperature	**8**	°C	Pipe volumes	2x189	l	**Condensation pan V2A, AISI304**	
	Air exit	**17.0**	°C	RFlow temperature	**14**	°C	Connections	Thread (Rg)		**Condensation drain, 4/5"**	
		82	%r.F.	Flow volume	**2x49.25**	m³/h	Flow 2x 4"	R Flow 2x 4"		**Condensation pan gradient: %2**	**61**
	Cooling power	**2x344**	kW	Pressure loss	**14.1**	kPa	Pipe material	**Cu**		**Piping lead out**	
	Condensation quantity	2x110	kg/h				Fin material	**Al**			
	$c_{Net\ cross\text{-}section}$	**2.6**	m/s				PN nominal pressure	**16**	bar		

Exhaust air humidifier (summer)

Summer operation adiabatic cooling											
Brand **Mountair**	Air entry	**25.0**	°C	Humidification	**190.0**	kg/h	Hygiene guideline	**VDI 6022**		Accessories	
Type **HUMIDOS / Slave**	**43.0**	%r.F.	**8.9** g/kg	Nozzle pressure	75	bar	Slave control cabinet at the device			Condensation pan V2A, AISI304	
WB-demineralised Water	Air exit	**16.6**	°C	Number of nozzles	48 Stk. à 4 kg/h		Zone valve internal wiring			Condensation drain, 1¼" below	
Supply water quality:	**100.0**	%r.F.	**12.4** g/kg	Partialized spray bar			Decentralised master pump station			Lighting/inspection glass (cover)	**65**
Conductance min. 0µ S/cm	Difference	**3.5**	g/kg	15 pipe levels			Master-slave HP piping			Inner panels V2A	
max. 20µ S/cm				4 zone valves			Master-slave wiring			Layered profile RAL 9010	

CCS HR, exhaust air	Dry winter mode /Winter mode with supply										
Brand **Mountair**		Dry	with PHE			Dry	with PHE	Number of pipe rows	**10+8**	RR	Accessories
Type **AIRSOL®**	EA entry	**25.0**	**18.0**	°C	Medium	25%Ethylenglykol		Pipe volumes	315+256	l	Condensation pan V2A, AISI304
		10	**26**	%r.F.	VL	**7.7**	**-7.1**	°C	Connections	Thread(Rg)	Condensation drain, 1 ½" below
	OA exit	**9.9**	**-2.7**	°C	RL	**21.9**	**13.6**	°C	VL DN65	RL DN65	Condensation pan gradient: 2%
		25.9	**97.0**	%r.F.	V	**13.7**	**13.7**	m³/h	Pipe material	CuSN	Divided in depth **114**
	P	**215.5**	**313.7**	kW	Δp		**174.5**	kPa	Fin material	AlMg3	With internal piping
	Condensation quantity			kg/h					PN nominal pressure	**10** bar	Thread connections at back
	$c_{Net\ cross\text{-}section}$		**1.7**	m/s							
	Adiabatic summer mode / with CR										
		AD	**CR**			**AD**	**CR**				
	EA entry	**17.6**	**17.6**	°C	Medium	25%Ethylenglykol					
		90	**90**	%r.F.	VL	**32.0**	**29.8**	°C			
	OA exit	**30.1**	**28.1**	°C	RL	**20.0**	**19.8**	°C			
		42.4	**47.8**	%r.F.	V	**13.7**	**13.7**	m³/h			
	P	**182.1**	**152.2**	kW	Δp	**153.3**		kPa			
	Condensation quantity			kg/h							
	$c_{Net\ cross\text{-}section}$		**1.7**	m/s							

Specifications text

1. Central pump station

Brand Mountair
Type Humidos 300
Performance 10 – 300 kg/h

- High-pressure pump station with oil-free pump (low-maintenance)
- Drive motor with variable speed (frequency inverter)
- Completely automatic control with touch screen
- Electrical control cabinet with controller
- System unit with safety and monitoring components
- Electrical diagram and internal wiring

2. Connection to the controller

Modbus interface to the BMS
Connection of the humidifier system (Master, 1 × Slave) to the BMS controller
On-site interface definition and start-up

3. High-pressure vaporising unit for SA Monobloc

Brand Mountair
Air volume (ex.) 20'000 m^3/h
Monobloc interior mass W × H = (ex.) 1710 × 2290mm
Humidifier performance (ex.) 127 kg/h
Segment length 1500 mm

- Nozzle holder with turbulence generator, segmented into 4 sectors (= 15 levels)
- 4-part valve block with high-pressure check valves on the outside
- 8 magnet valves for supplying and draining the zones
- Turbulence generator full surface V2A
- Aerosol divider
- Drip divider that can be expanded with 5/4" drain below
- Post evaporation unit
- Inner tank with slot for aerosol divider and drip divider
- Master-slave high-pressure connection, material and assembly included
- Slave control cabinet included, built into the Monobloc
- Electrical diagram and internal wiring (valve block)
- Electrical cabinet with controller for quasi-constant performance regulation
- Bus module for the connection of the slave to the pump station included
- Water sparing control function through calculation of the necessary water quantity
- Binary valve control for ideal performance regulation
- Driven by 0-10 V signal (SA-humidity indications by BMS)
- Delivery and recording of the temperature/humidity measurement values by the BMS

Optionally, the measurement values can be recorded by Mountair and integrated into the program. The following signals can be connected:

- Delivery and integration of the temperature-humidity sensor at the entry
- Delivery and integration of the flow volume measurement fans
- Delivery and integration of the temperature-humidity sensor at the exit

4. Commissioning

System start-up
Commissioning protocol
Maintenance documentation

5. Subsequent control, maintenance for 1 year, operation control

One-day operation control and maintenance incl. all materials, work and expenses included in flat rate.

6. Optional: UV system for water disinfection

Performance: 1.1 m^3/h with 40 mW/cm^2
Flow monitor / temperature sensor included
Electrical connection 230 V / 50 Hz / 0.27 A

- Connection of the UV system to the Humidos humidifier unit
- Two relay exits, 4–20 mA
- Supply of the Humidos slave control cabinet (230 V)
- Connection of the hardware contacts to the slave
- Disturbance notifications are transmitted via the Humidos slave

Included

- System commissioning
- Functional testing
- Subsequent adjustment
- Operating staff instruction
- Hardness test set delivery
- Subsequent verification

References

2020

Novartis Pharma AG, WSJ-145

- Full air conditioning unit with 17'000 m³/h
- AIRSOL CCS-HR with dehumidification cold recovery
- CCS pump station and heat recovery controller
- SA with steam humidifier
- RA with adiabatic RA humidification to recover cold in the summer

2018

Geistlich Pharma AG

- 12 air handling units in total for head quartier and production building
- 1 central high pressure humidifier station to feed 4 SA units

2017

Givaudan ZIC, Kemptthal

- 2 × SA humidification 87 500 m³/h
- 2 × EA humidification 87 500 m³/h
- 1 × SA humidification 8 300 m³/h
- 2 × Pump stations 50–1 000 kg/h

2017

IWC Schaffhausen, Merishausen

- 3 × SA humidifiers (28 100 – 35 700 m³/h)
- 2 × Pump stations 10 – 300 kg/h
- 1 × Pump station 20 – 450 kg/h

2017

Vifor laboratory, Wagi-Areal Schlieren

- 1 × SA humidification 9 500 m³/h
- 1 × Pump station 10 – 300 kg/h

2016

Arts university of Zürich

- 4 × SA humidification (1 700 – 6 000 m³/h)
- 1 × Pump station (10 – 300 kg/h)

2015

Europaallee, Baufeld H, Zürich

- 20 × EA humidification HR systems
- 3 × PHE / 7 × ROT / 10 × CCS
- 4 × Pump stations to supply multiple EA humidifiers

2016

Konnex building, Baden

- Equipment of 15 ventilation units with high-pressure humidification
- 12 × 30 000 m^3/h, 1 × 20 000 m3/h, 2 × 5 000 m^3/h
- 8 × SA humidification, 7 × EA humidification
- 6 × Pump stations (10 – 300 kg/h)

2015

Witikonstrasse office building, Zürich

- Monobloc conversion with 32 900 m^3/h
- 1 × Pump station (10 – 300 kg/h)
- 1 × SA humidifiers (209 kg/h)

2015

Cantonal pharmacy of Zürich, Schlieren

- 1 × Pump station (30 – 600 kg/h)
- 4 × Monobloc with adiabatic EA humidification

2015

Omega AG, Biel

- 2 × SA Monobloc production with 21 000 m^3/h
- 2 × Pump stations (10 – 300 kg/h)

2015

CSS Versicherungen, Luzern

- 1 × Monobloc with 50 000 m³/h and up to 600 kg/h humidification
- 1 × Pump station (30 – 600 kg/h)

2015

Cavelti printing plant, Gossau

- Conversion of the existing ventilation device
- Renewal of the entire humidifier Monobloc
- 1 × Pump station (10 – 300 kg/h)
- 1 × SA humidifier (17 000 m³/h and 154 kg/h)

2014

Botanical garden, Zürich

- Renewal of the SA Monobloc (110 000 m³/h)
- 1 × Pump station (30 – 600 kg/h)
- 2 × SA humidifiers with 55 000 m³/h

2014

Roche Bau 67, Grenzacherstrasse Basel

- 6 × Pump stations (10 – 300 kg/h)
- 11 × ventilation units with Humidos high-pressure atomizers
- 10 × adiabatic EA humidification
- 1 × SA humidifier

2014

Chur art museum

- 1 × Pump station (10 – 300 kg/h) for 5 slave systems
- 4 × SA humidifiers
- 1 × EA humidifiers

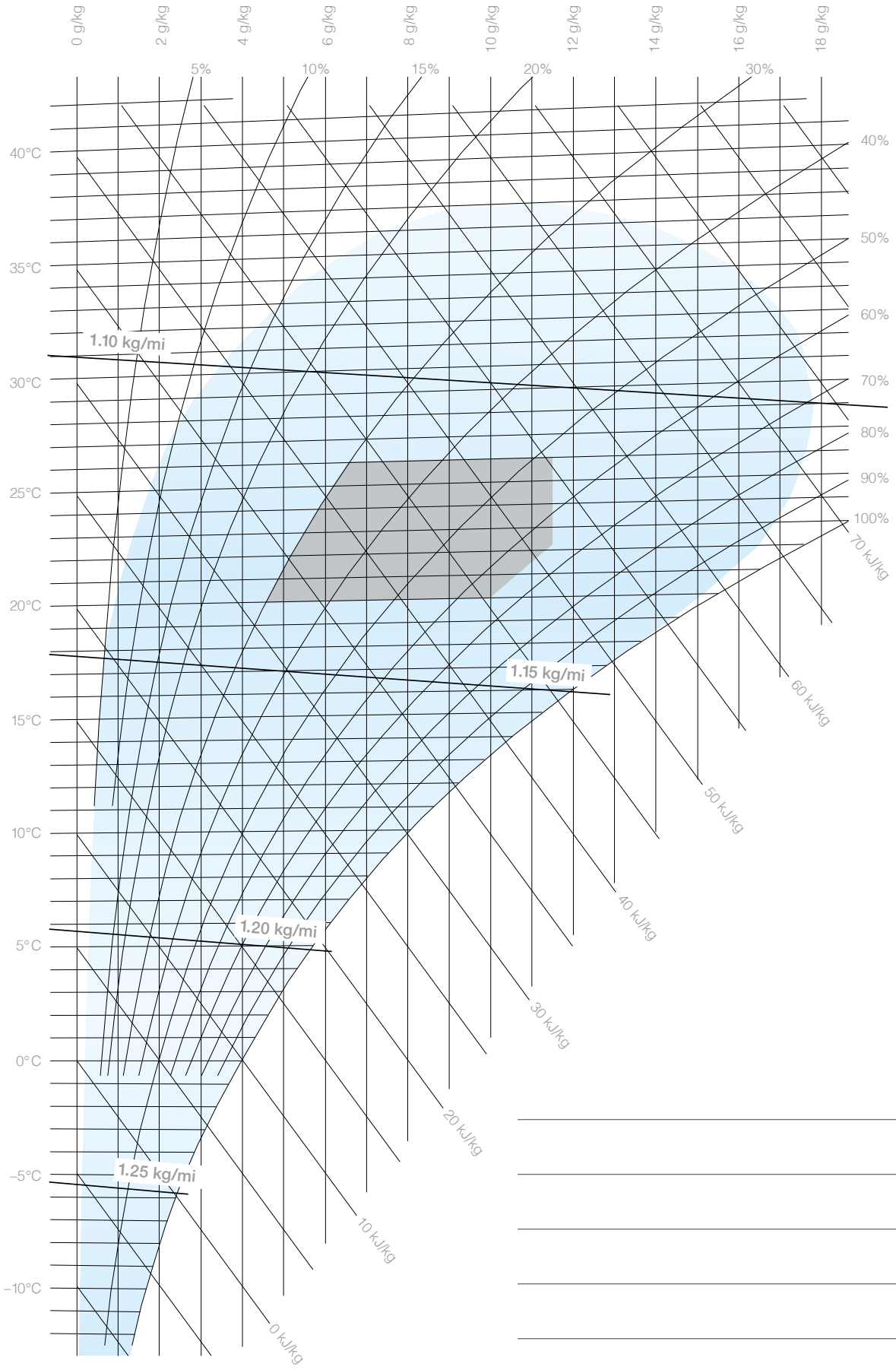
2015 + 2014

Endress + Hauser Flowtec, Reinach BL

- Renewal of the SA humidification of existing systems
- 1 × Pump station (10 – 300 kg/h)
- 2 × SA humidifiers (17 500 m³/h and 92 kg/h)
- 1 × Master pump station (20 – 450 kg/h)
- 3 × RLT device with slave humidifier

h-x Diagramm

Mollier-h-x diagram for damp air at 450 m a. s. l. (0.96 bar)



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