



# HYBACO®

Hybrid Recooler



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FHNW, MuttENZ

# HYBACO

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Mountair have been designing and producing hybrid recoolers for over fifteen years now. Each project carried out is unique and was designed, manufactured and assembled exactly according to customer requirements. Be it an individual hybrid recooler with a capacity of 200 kW or a connected circuit plant of 6 MW, Mountair puts your individual needs into practice.

The know-how and service experience of Mountair enables us to react to events rapidly. Replacement of wear and tear parts, converting plants to meet changing circumstances in the operating parameters, repairs of plant components as a result of faults, or adaptations in the ICA (Instrumentation, Control and Automation) area of the controls – Mountair is your competent partner.



PGS Petroleum Global Survey Datacenter, London

## Application

In most cases, hybrid recoolers are installed in combination with refrigerating machines. Here the recooler provides the cooling source for the refrigerating machines to which the thermal energy can be delivered at a higher temperature level. In case of hybrid recoolers, the air required to cool the medium (water or water-glycol mixture) is loaded with signi-

ficantly more thermal energy than in case of other recooling systems. Hybrid recoolers manage with less air volume than dry recoolers. This means fewer fans, which has a positive effect on noise levels and on the overall power consumption.

## Benefits

Compared to dry recoolers and adiabatic recoolers, hybrid recoolers show some marked benefits. The main advantage is that significantly lower recooling temperatures can be achieved. This substantially improves the COP of the refrigerating machine. As a result, the power requirement drops and thus the operating cost of the whole refrigeration plant as well.

Furthermore, evaporation means that markedly more thermal energy can be transferred to the air flow than is possible in case of dry recoolers or adiabatic recoolers (see HX diagram).

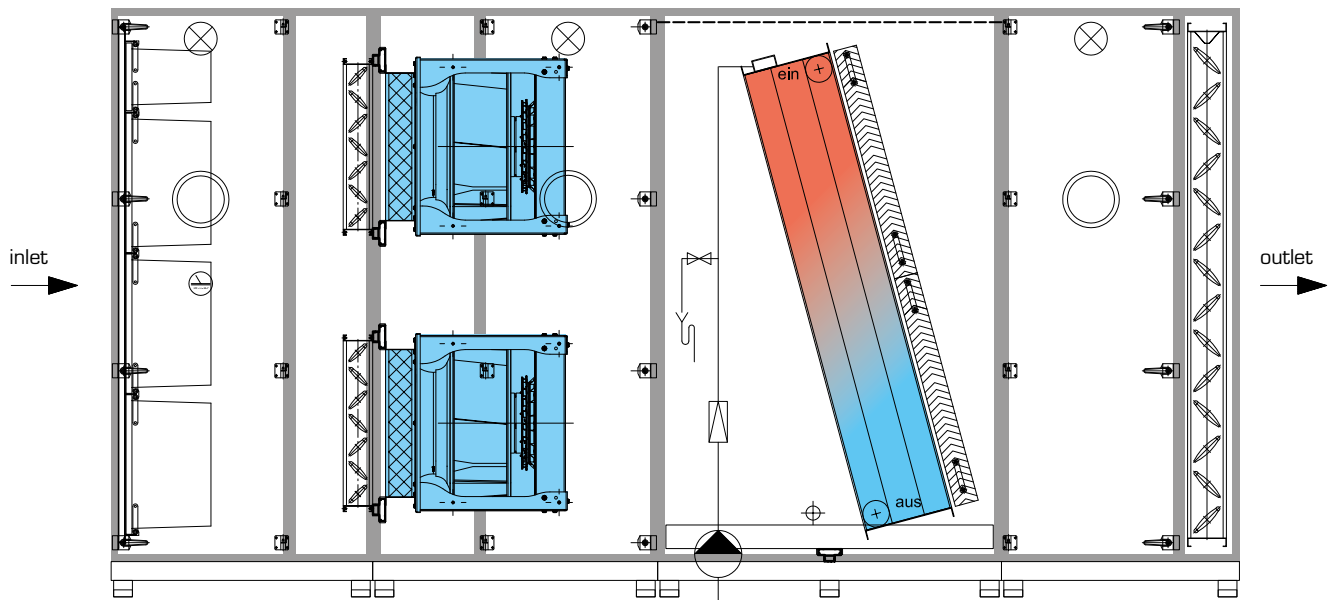
Hybrid recoolers are extremely compact, which means it is possible to provide higher performance in less space.

## Designs

### H model

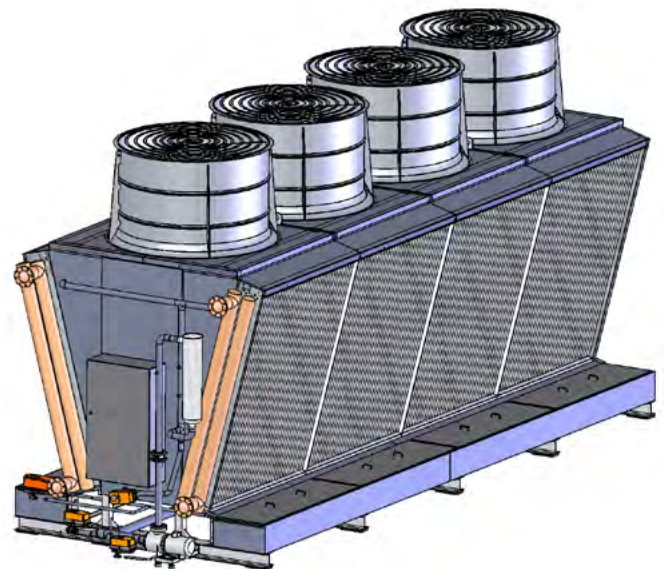
The HYBACO® H model is an integrated hybrid recooler in an insulated housing. The housing is comparable with those of conventional HVAC plants/AHU and demonstrates the same properties. The advantage of this version is that such plants can also be installed indoors. The intake and exhaust

ducts can be connected to the unit as with AHU plants and be introduced or led away as required. Similarly in this version, the sound pressure can be reduced with sound attenuators on any planning specification.



### V model

The HYBACO® V model corresponds to the familiar recooler model for outdoor installation (usually intended for use on a roof area). The two to one 'V' angled heat exchanger forms a compact unit. It is therefore possible to discharge large capacities using a smaller installation space with the V shaped coolers. With the patented HYBACO® wetting system, the finned coil heat exchanger is evenly wetted and the air humidified.



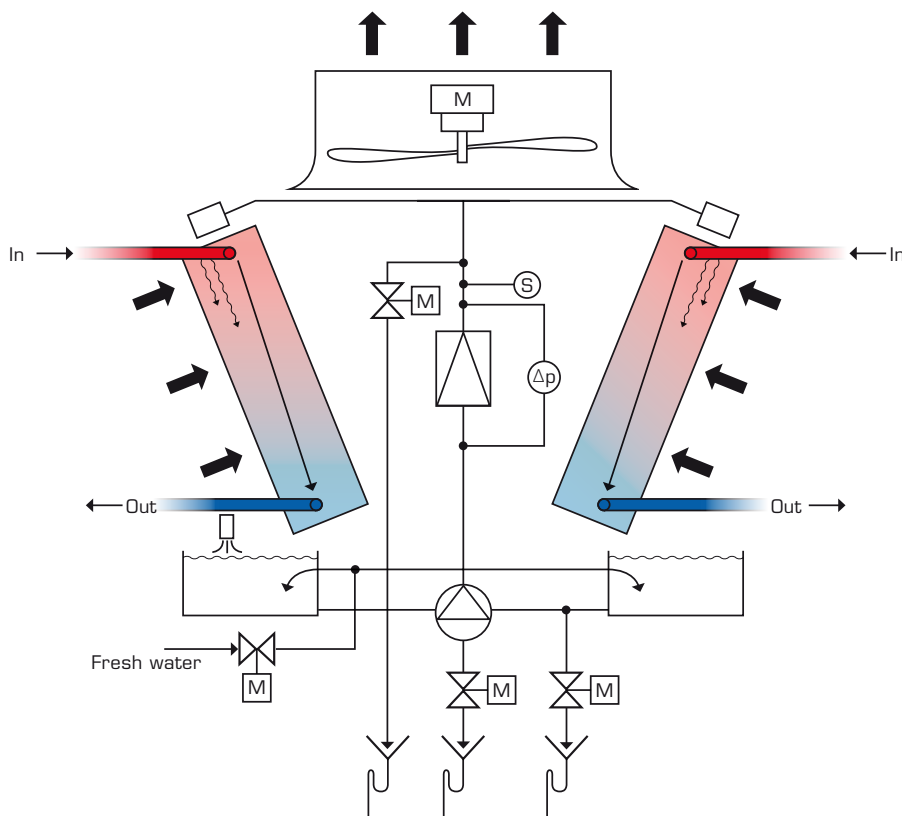


Hospital cantonal of Thurgau, Münsterlingen

## HYBACO® V model

### Principle scheme

- Heat exchanger in V arrangement
- Quiet running axial fans
- High efficiency EC drive motors
- HYBACO® wetting equipment
- Water pans
- Circulation pump (1 pc./recooler)
- Water level/measurement
- Conductivity measurement
- Water filter system
- Fresh water and drain valves



## Components

### Heat exchanger

The core element of coolers must meet the highest demands. High quality materials are used so that the HYBACO® coolers are "sea water resistant". Hydrophilic AlMg3 fins and tin-plated copper tubes have the best properties with regard to heat transfer, in addition to outstanding corrosion resistance.

Properties in overview:

- Fin material: AlMg3
- Tube material: Cu, tin plated
- Frame material: V2A steel – AlMg3
- Connection flange
- Circuits: as requested
- Construction according to project-specific layout

### Pump

HYBACO® coolers work with only a single circulation pump. When selecting the pump, the properties of the circulating water to be conveyed are crucial. Mountair uses stainless steel block pumps.

Properties in overview:

- 1 x pump/cooler
- Standard block pump in stainless steel
- Flange connection
- Frequency inverter operation

### Fans

The decisive factor. Today's often very high noise reduction requirements can only be achieved with the best fans. Mountair relies on continuity and installs quiet running axial fans in glass reinforced plastic (GRP). These fans are designed precisely for such applications: high volumes of air flow, low pressure loss, impressive sound level credentials and an excellent level of efficiency. Our reliably strong partner – Howden.



Properties in overview:

- Quiet running axial fans
- Material: GRP
- Direct drive
- Speeds: depending on design, between 300 to 500 rpm
- Outstanding sound level values
- High efficiency

### EC motors

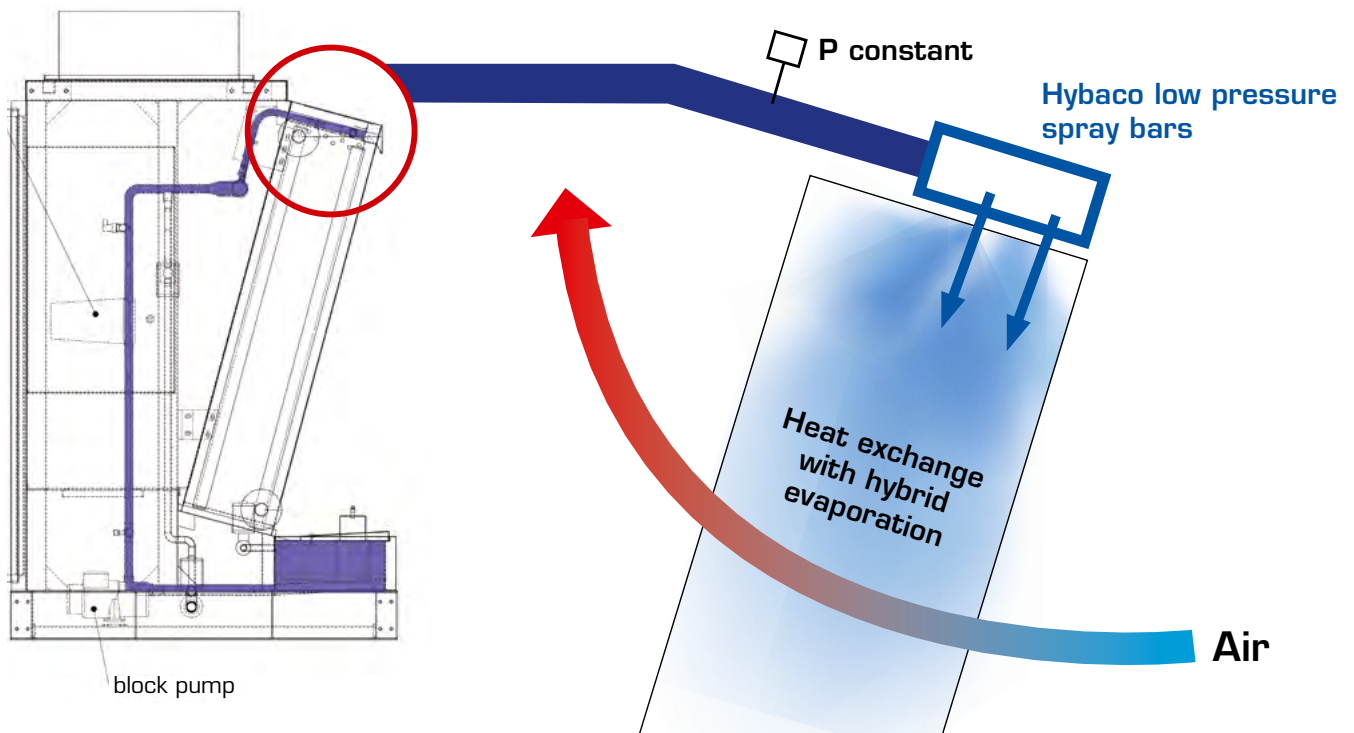
Mountair hybrid coolers are designed with motors using the latest technology. Mountair is completely committed to EC motors. These are very efficient (equivalent to Class IE4). EC motors are also particularly efficient in the partial load range. In addition they have a large adjustment range and can be operated without an external frequency inverter infinitely variable at between 5 % and 100 %. Fans are flange mounted directly on the motor shaft and do not require auxiliary drives (belts). The motor bearings are designed for long life and achieve 100 000 operating hours.

Properties overview:

- State-of-the-art EC technology
- High efficiency (equivalent to Class IE4)
- Drive power up to 6kW
- No external frequency inverter required
- Simple 0 – 10V signal



## HYBACO® Wetting Equipment



The circulating water required for air humidification is deposited on the heat exchanger from above. The spray bars are operated under constant overpressure so that the water is evenly applied to the fins and ensures an even contact humidification.

The water runs along the heat exchanger – down the fins across the direction of the air flow. This means that it is not pulled into the inside by the air flow. The operating parameters are set that no drop flow occurs (vapour free) and all of the water flows into the pans located underneath. The pans also serve as storage for the recirculation water and are monitored by ultrasonic sensors. The water returns via pipelines, pumps and water filters to the HYBACO® spray bars and from there is sprayed again as described above.

To ensure proper operation, the water quality and the water level are permanently monitored. If the quality no longer meets the specification, it is de-sludged and at the same time fresh water is added. This is also the case if the level falls below the minimum due to evaporation water.



## Control

HYBACO® recoolers are equipped with their own control. All system parameters are monitored, and the system is regulated in accordance with the prescribed values. The operation mode is adjusted according to the exterior temperatures, return temperatures or other external signals. The automatic regulation is performed in stages, first through an increase of the air volume, then through the starting of the humidification. Standard day and night programs are included. There is the possibility of implementing a remote maintenance. The hybrid recooler control is equipped with a BUS interface.

### Characteristics

- Regulation: Siemens S7, Beckhoff
- Autonomous control unit per recooling system (master-slave)
- Standard design with potential-free contacts
- BUS interface for master-slave function and connection to the BMS

### Messages from external (standard):

- Set point temperature cooler outlet (continuous)
- Enable dry operation
- Enable wet operation
- Water feed line closed



### Messages from internal (standard):

- Operating message – control
- Operating message – pump (humidification)
- Collective alarm
- Status message – power on
- Request for water
- Manual operation

## Accessories and Options

Mountair HYBACO® recoolers include all parts necessary and can be operated without any further components. In addition there are various accessories and plant extension options. These are mostly customer-specific and are designed, manufactured and assembled accordingly.

These can include the following additional options for example:

- Air separation dampers
- Louvres/roller shutters
- UV disinfection plant
- Frost protection equipment (for 100 % water operation)
- Damage equipment
- Dosing plants
- Sound attenuators for fans
- Integration in the building management system via BUS interface



## Design Principles

Several factors are essential in designing customer-specific hybrid recoolers. The more information that can be given to the manufacturer, the more appropriately the initial designs and quotations can be prepared. Essential design factors are listed below.

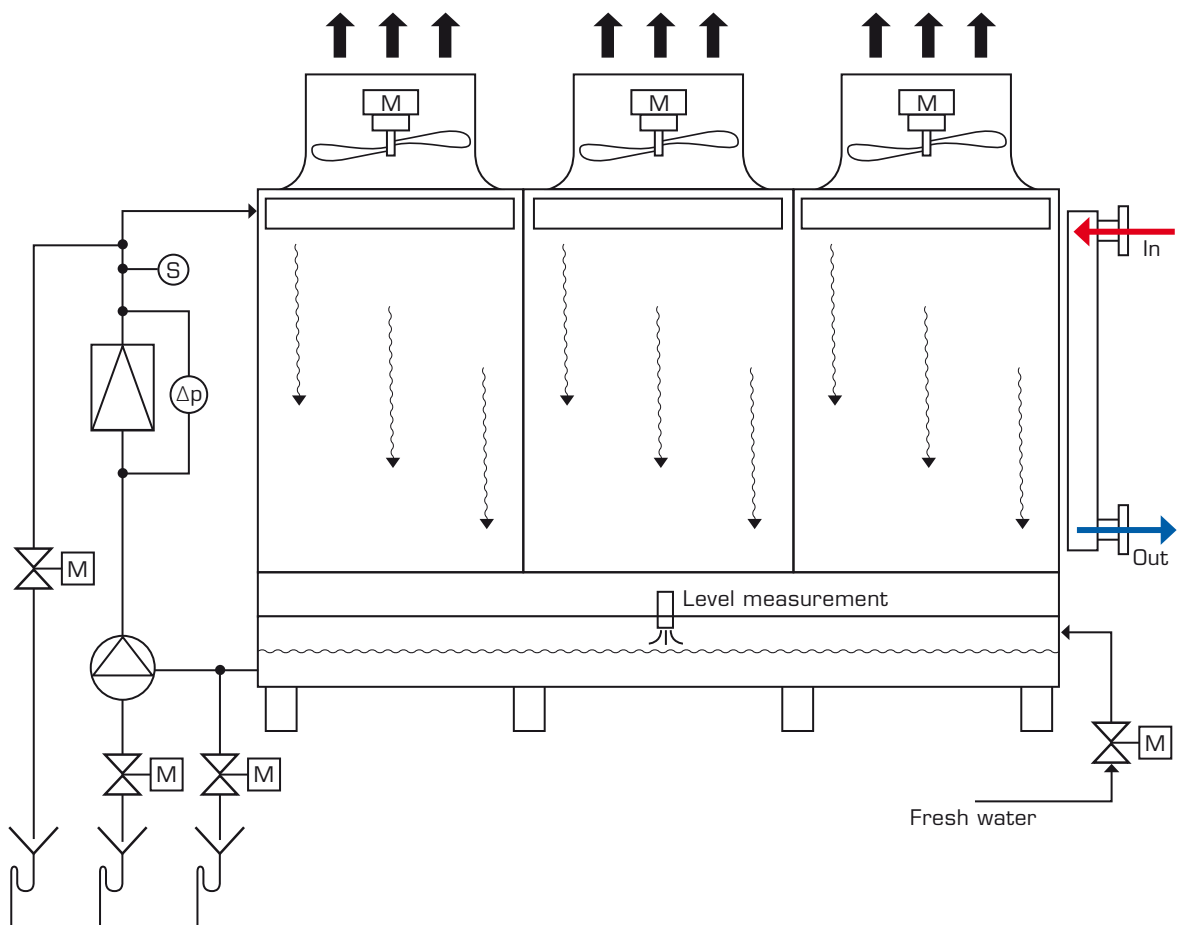
### Vital information required:

- Height above sea level
- Wet bulb temperature (outside air at maximal load/ capacity, temperature and humidity)
- Recooling capacity [kW]
- Temperatures flow/return
- Medium (glycol concentration)

### Other essential characteristics:

- Permissible noise output (sound pressure at 10 m distance)
- Hydraulic pressure loss
- Installation area desired/maximum
- Plant height, maximum
- Plant weight

The lower the wet bulb temperature, the more capacity can be dissipated by a structurally identical recooler. The mean logarithmic temperature difference between wet bulb and flow/return temperature is crucial. The lower the flow/return temperatures, the higher the COP of the refrigerating machine. Larger recoolers are therefore required to achieve lower temperature levels; although this will generate higher investment costs, the operating costs over the whole life cycle of plant will be lower. An investment for the future.



## Technical data, design examples

Mountair HYBACO® recoolers have their strength in performance ranges of between 400 kW and 2.5 MW. The designs and components used achieve the best results in this performance range. Naturally the capacities are dependent on the design principles described and can vary between equal sized plants. For this reason Mountair does

not follow the philosophy of offering standard recoolers and of manufacturing them according to a catalogue. No, each HYBACO® is designed, manufactured and assembled according the requirements specified by the customer. Three designs are shown below as examples.

### HYBACO® recooler 800 kW

#### Design

Cooling capacity	800 kW
Height above sea level	460 m
Outside air temperature	34 °C
Outside air humidity	35.5 % relative humidity
Wet bulb temperature	22 °C
Medium	70 % water 30 % ethylene glycol
Recooling temperatures	flow recooler 34 °C return recooler 28 °C

#### Data per recooler (electrical)

Connected load	15 kW
Rated current	25 A

#### Hydraulic

Medium flow rate	122.5 m <sup>3</sup> /h
Pressure loss	50 kPa
Velocity of flow	1.27 m/s
Hydraulic circuit	6 pass
Battery connections	2 pieces
Connection flange	DN 125
Operating/test pressure	6 / 8 bar

#### Air flow rate

##### Hybrid operation

Air volume (100 %)	32.9 m <sup>3</sup> /s
Pressure loss	100 Pa
Air outlet temperature	28.4 °C
Air outlet humidity	90 %

##### Dry operation

Air volume (100 %)	35.5 m <sup>3</sup> /s
Pressure loss	80 Pa
Outside air temperature (= switch-over point)	12.1 °C
Air outlet temperature	31.7 °C

#### Wetting

Amount of evaporation	1.6 m <sup>3</sup> /h
Amount of clarification	0.5 m <sup>3</sup> /h
Water consumption	2.1 m <sup>3</sup> /h

#### Heat exchanger

Material fins	AlMg3
Material tubes	Cu, tin plated
Material frame	inox 1.4301
Fin thickness	0.2 mm
Fin spacing	2.8 mm
Tube wall thickness	0.4 mm

#### Fans

Number of fans per recooler	2 pieces
Fan speed (100 %)	475 rpm
Power consumption maximum	3.9 kW

#### Noise levels

Sound power level individual fan (100 %)	78 dB(A)
Sound power level recooler	81 dB(A)
Sound pressure at 10 m distance	49 dB(A)

#### Dimensions

Length over support beams	3880 mm
Length over connection flange	4200 mm
Width over support beams	2800 mm
Height (excluding mechanical vibration plates)	4000 mm
<i>Dimensional tolerance ± 20 mm</i>	

#### Weight

Weight empty	4200 kg
Medium filling heat exchanger	800 kg
Filling wetting water max.	700 kg
Operating weight max.	5700 kg
<i>Weight tolerance ± 100 kg</i>	

## HYBACO® recoolers 1200 kW

### Design

Cooling capacity	1200 kW
Height above sea level	420 m
Outside air temperature	32 °C
Outside air humidity	42 % relative humidity
Wet bulb temperature	22 °C
Medium	70 % water 30 % ethylene glycol
Recooling temperatures	flow recoolers 36 °C return recoolers 28 °C

### Data per recoolers (electrical)

Connected load	21 kW
Rated current	30 A

### Hydraulic

Medium flow rate	138 m <sup>3</sup> /h
Pressure loss	32 kPa
Velocity of flow	1.00 m/s
Hydraulic circuit	4 pass
Battery connections	1 piece
Connection flange	DN 125
Operating/test pressure	6 / 8 bar

### Air flow rate

#### Hybrid operation

Air volume (100 %)	45.3 m <sup>3</sup> /s
Pressure loss	95 Pa
Air outlet temperature	29.1 °C
Air outlet humidity	88 %

#### Dry operation

Air volume (100 %)	48.7 m <sup>3</sup> /s
Pressure loss	70 Pa
Outside air temperature (= switch-over point)	11.5 °C
Air outlet temperature	32.8 °C

### Wetting

Amount of evaporation	2.3 m <sup>3</sup> /h
Amount of clarification	0.7 m <sup>3</sup> /h
Water consumption	3.0 m <sup>3</sup> /h

### Heat exchanger

Fin material	AlMg3
Tube material	Cu, tin plated
Frame material	inox 1.4301
Fin thickness	0.2 mm
Fin spacing	2.8 mm
Tube wall thickness	0.4 mm

### Fans

Number of fans per recoolers	3 pieces
Fan speed (100 %)	450 rpm
Power consumption maximum	3.4 kW

### Noise levels

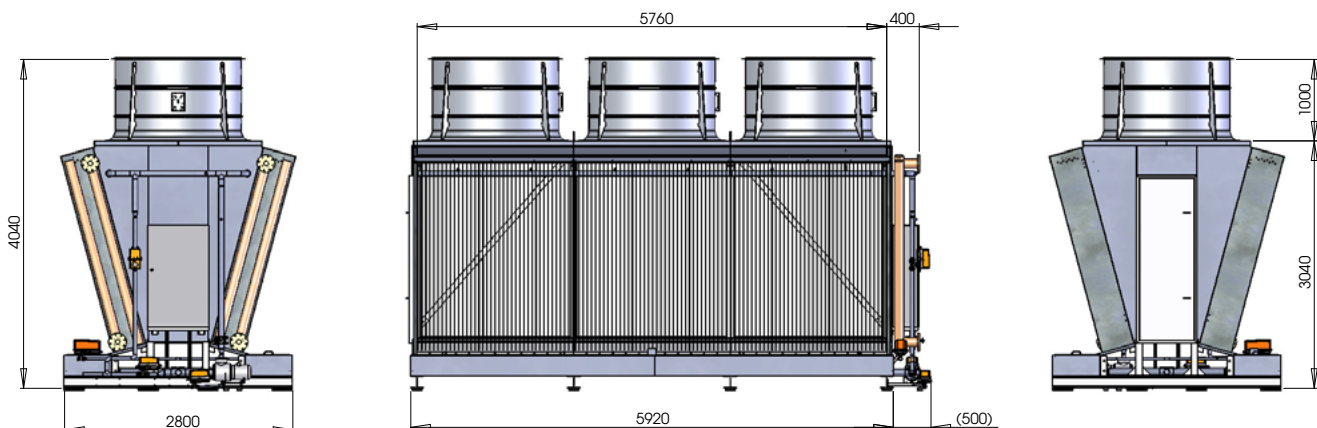
Sound power level individual fan (100 %)	77 dB(A)
Sound power level recoolers	81 dB(A)
Sound pressure at 10 m distance	50 dB(A)

### Abmessungen

Length over support beams	5920 mm
Length over connection flange	6240 mm
Width over support beams	2800 mm
Height (excluding mechanical vibration plates)	4040 mm
<i>Dimensional tolerance ± 20 mm</i>	

### Weight

Weight empty	6500 kg
Medium filling heat exchanger	1100 kg
Filling wetting water max.	1300 kg
Operating weight max.	8900 kg
<i>Weight tolerance ± 100 kg</i>	



**HYBACO® recoolers 1600 kW****Design**

Cooling capacity	1600 kW
Height above sea level	440 m
Outside air temperature	34 °C
Outside air humidity	35.5 % relative humidity
Wet bulb temperature	22 °C
Medium	70 % water 30 % ethylene glycol
Recooling temperatures	flow recoolers 36 °C return recoolers 30 °C

**Data per recoolers (electrical)**

Connected load	27 kW
Rated current	37 A

**Hydraulic**

Medium flow rate	245 m <sup>3</sup> /h
Pressure loss	27 kPa
Velocity of flow	1.13 m/s
Hydraulic circuit	2 pass
Battery connections	4 pieces
Connection flange	DN 125
Operating/test pressure	6 / 8 bar

**Air flow rate****Hybrid operation**

Air volume (100 %)	69.4 m <sup>3</sup> /s
Pressure loss	90 Pa
Air outlet temperature	28.2 °C
Air outlet humidity	90 %

**Dry operation**

Air volume (100 %)	73.4 m <sup>3</sup> /s
Pressure loss	65 Pa
Outside air temperature (= switch-over point)	12.3 °C
Air outlet temperature	31.2 °C

**Wetting**

Amount of evaporation	3.3 m <sup>3</sup> /h
Amount of clarification	1.0 m <sup>3</sup> /h
Water consumption	4.3 m <sup>3</sup> /h

**Heat exchanger**

Fin material	AlMg3
Tube material	Cu, tin plated
Frame material	inox 1.4301
Fin thickness	0.2 mm
Fin spacing	2.8 mm
Tube wall thickness	0.4 mm

**Fans**

Number of fans per recoolers	4 pieces
Fan speed (100 %)	480 rpm
Power consumption maximum	3.9 kW

**Noise levels**

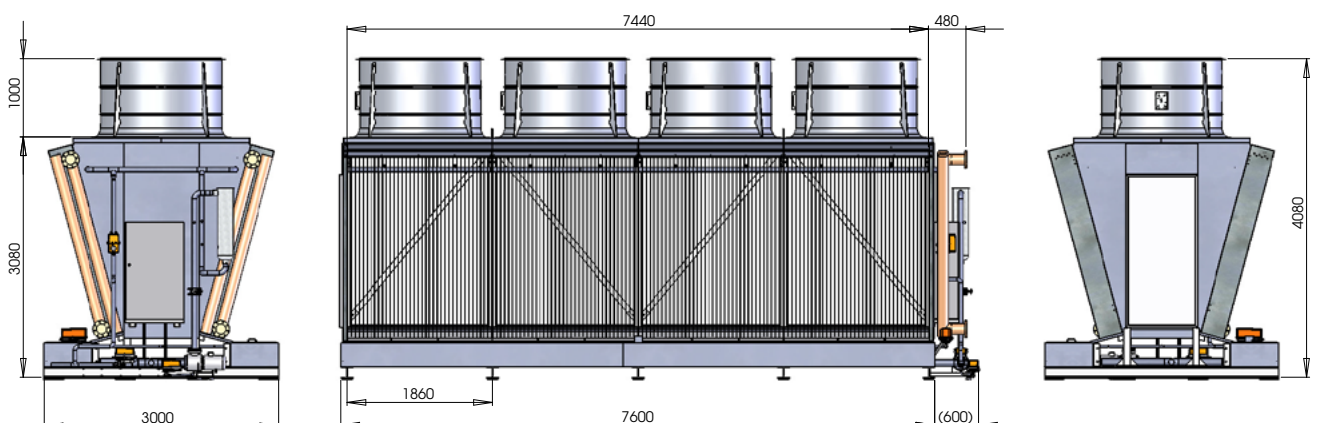
Sound power level individual fan (100 %)	78 dB(A)
Sound power level recoolers	84 dB(A)
Sound pressure at 10 m distance	53 dB(A)

**Dimensions**

Length over support beams	7600 mm
Length over connection flange	8000 mm
Width over support beams	3000 mm
Height (excluding mechanical vibration plates)	4080 mm
<i>Dimensional tolerance ± 20 mm</i>	

**Weight**

Weight empty	7400 kg
Medium filling heat exchanger	1100 kg
Filling wetting water max.	1300 kg
Operating weight max.	9800 kg
<i>Weight tolerance ± 100 kg</i>	



## Transport, unloading, installation, commissioning

The recoolers are transported according to their height. It is occasionally necessary to dismantle the axial fans and to reassemble them on site, as otherwise the maximum height for transporting on motorways would be exceeded. The dismantling of the fans is carried out directly before loading and reassembly straight after unloading on site.

The complete HYBACO® recoolers are lifted in one piece and are installed according to the planner's specifications. Readjustment and final assembly are carried out after the final installation of the plants. The levelling of the plants at their final location must be carried out prior to any other activity and work in and around the recoolers.

The final commissioning is carried out after the plants are connected on site and provided with power. All functions are tested and the defining water state and level for the recirculating water circuit are set and recorded.



## Specification text

The recooling of the medium is carried out in a closed circuit in the fin coil heat exchangers. The evaporation on the outer surface causes the critical temperature to drop and the heat transfer to the air to be increased. The air exiting is odour-free and is transported sensible and latent to the surroundings. The automatic control takes place in stages, first by increasing the air volume and then by the humidification being switched on.

### **Design: HYBACO® V model recoolers**

V model hybrid recoolers are suitable for installation outdoors. Their compact construction means that high loads can be discharged from an installation on a small area. The free air flow and the free air outlet upwards result in minimum installation costs. The plants are built, delivered and installed on site in one piece. HYBACO® V model recoolers are equipped with the patented HYBACO® wetting system, which precipitates the required water for air humidification directly onto the heat exchanger fins and this therefore gives even wetting.

### **Supporting structure**

Recooler modules consist of welded steel/supporting structures. Load bearing components are completely hot-dip galvanised in the immersion tank.

### **Access space**

The lockable access doors with integrated door security switch (door contact) give access to the interior space of the recoolers. The walkable floor is made of aluminium tread plates. These ensure a controlled run off of incidental (rain) water and also give a sure grip in damp/wet conditions.

The Mountair HYBACO® wetting equipment is accessible through this access space. The spray bars used for wetting can be dismantled from inside, they can be cleaned and replaced if necessary.

For all maintenance and repair work, there is also, in addition to the access doors, an isolation switch installed for each fan.

### **Cladding**

The airtight cladding used for the recoolers is corrosion resistant. This can be powder coated in the required RAL colour.

### **Water pans**

The recirculation water required for the heat exchanger wetting (air humidification) is collected in two pans (one pan per heat exchanger). These pans serve at the same time as the storage (tank) and are sized accordingly. The recirculation water is fed to the HYBACO® wetting equipment via pipeline, pump and water filter and runs back into the water pans after the wetting process.

The pans and associated components are in stainless steel and pickled in an immersion bath.

Protective grids for pans are made of perforated plate. This acts as protection against contamination. Protection grids are designed to be removable.

### **Pipework**

The complete recoolers internal pipework is fitted with connections for draining and for fresh water.

Drainage, clarification and fresh water lines are in stainless steel and pickled in an immersion bath. Cleaning nozzles for removing dirt are integrated into the pipework system.

### **Water filter**

HYBACO® recoolers are equipped with a water filter unit. Contamination which may occur is filtered out continuously. The filter bag or cartridge can be changed periodically depending on the amount of dirt (dp).

### **Wetting**

Mountair hybrid recoolers are equipped with the patented HYBACO® wetting system. The system works with a constant overpressure. Perfect wetting of the fin coil heat exchanger is ensured.

The HYBACO® wetting spray bars are geometrically arranged so that the heat exchanger fins are evenly wetted.

### **Heat exchangers**

The fin coil heat exchangers have AlMg3 fins and tin-plated copper tubes. Fin coil heat exchanger components are made of stainless steel (or AlMg3). The frame heat exchanger is thus "sea water resistant" and meets corrosion as well as electrochemical requirements.

### **Fans**

HYBACO® recoolers are equipped with quiet running axial fans in glass reinforced plastic (GRP). The optimal blade design and the low weight mean that the output of the fans results in low noise levels and record very low power consumption.

### **Motors**

The axial fans are driven by direct flanged EC motors. EC motors achieve efficiency values equivalent to Class IE4 and can, above all, be operated in the partial load range with very high efficiency.

Speeds can be adjusted without steps and operated without an external frequency inverter.

### **Pumps**

Standard block pumps according to EN 733 in stainless steel with thermistor protection are used. The pumps can be controlled without steps using a frequency inverter.

### **Control valves**

The fresh water requirement as well as clarification and drainage of the system is controlled through motor driven 2-way ball valves.

The fresh water valve is equipped with a spring return function so that the fresh water flow can be stopped in case of a power outage.

All ball valves are provided with a protective housing and meet protection type IP 66 requirements.

### **Water level**

The water level in the pans is measured by ultrasonic sensors. Six levels can be programmed (pan empty, rub dry protection, bottom, upper working level, overflow, pan full).

The measurement equipment is designed so that it is protected against UV radiation (measurement error) and environmental influences (waves caused by wind).

### **Water quality**

The circulation water quality is measured after the filter and before the wetting system using a conductivity measuring sensor. If the water quality exceeds a limit value, the clarification valve is opened, and fresh water is added.

### **Control cabinet**

Mountair HYBACO® recoolers are provided with a control cabinet. This is mounted on the recooling unit and contains all components necessary for independent operation.

Control cabinets are equipped with heating, ventilation and lighting. Colour RAL 7032, protection class IP65. Manufactured according to Low Voltage Regulations (NIV).

### **Control**

Control components are integrated into the control cabinet. Messages to and from external sources are exchanged by means of potential-free contacts.

A bus interface integrating the recooling unit into the building management system is available as hardware.

### **Wiring**

Electrical components (e.g. fans, pumps, valves) conform to CE are wired into the control cabinet.

### **Commissioning**

The recooling units are commissioned in factory. Adjustments and parameter settings are made on site, as soon as the plant is connected to the recooling refrigeration network and it has been electrically connected. Water level and switching times are coordinated and set on site.

### **Transport**

The recooling units are transported in one piece. Should this not be possible for various reasons (height or width of load), the fans may have to be dismantled for transport and reassembled and connected on site.

### **Installation**

The plants are positioned using a mobile crane or a building crane. The recooling units are levelled at their final position. Vibration damping panels are used for mechanical vibration-reduced installation.



## Quality of make-up and circulation water

Mountair HYBACO® recoolers can be operated with various water qualities. Rainwater, fully desalinated water, prepared by reverse osmosis, or fully softened water can be used for wetting in hybrid recoolers. Each kind of water supply has its advantages.

### Requirements – general:

pH value 6.0 – 7.5

Clear and colourless

Without sediment and odourless

Raw water in Switzerland has a hardness of 15–20 °fH (urban regions such as central Zurich as well as lake-side regions such as Kreuzlingen) over 25–30 °fH (conurbations such as Schlieren) and up to 35 °fH (Swiss midlands). The water hardness is extreme in the Jura with up to 45 °fH.

	Water Hardness	Conductance
Lakeside, city	15.0 °fH/8.0 °dH	± 300 µS/cm
Conurbations	25.0 °fH / 14.0 °dH	± 500 µS/cm
Midlands	35.0 °fH/19.0 °dH	± 700 µS/cm
Jura	45.0 °fH/25.0 °dH	± 900 µS/cm

**Rainwater** has the great advantage of being freely available. It is similar to desalinated water and similar thickening can be expected (5–10 times). It is a disadvantage that a relatively large collection tank is needed in order to have enough water available. In case of acid rain (pH value <5.5), care must be taken to ensure that the overall pH value transcends >6.0 (mixture with raw water).

Hardness < 3.0 °fH / < 2.0 °dH

Chloride < 10 mg/l

Sulphate < 20 mg/l

Conductance < 30 µS/cm

**Fully desalinated water (reverse osmosis)** has the great advantage of low thickening/low clarification (10–12 times). The cleaning process is reduced and the period over which the heat exchanger remains clean is increased. Fully desalinated water is largely free of salts and other organic substances. The use of fully desalinated water, however, results in increased cost.

Hardness 0.0 °fH/0.0 °dH

Chloride < 2 mg/l

Sulphate < 3 mg/l

Conductance < 30 µS/cm

**Fully softened water** is more economical to supply. The overall salt content and conductance of fully softened water correspond to that of raw water. In softening water, calcium ions are replaced with magnesium ions. This reduces calcification (deposition of calcium carbonate). Less inspissation and improved clarification are to be expected (3–4 times).

Hardness 0.0 °fH/0.0 °dH

Chloride < 20 mg/l

Sulphate < 50 mg/l

Conductance Depending on region 300 – 700 µS/cm

**The limit values for the circulation water** are adjusted according to the quality of the fresh water. The following limit values must not be exceeded:

	Rain/fully desalinated water	Fully softened water
Hardness	< 7.5 °fH/< 4.0 °dH	< 7.5 °fH/< 4.0 °dH
Chloride	< 20 mg/l	< 60 mg/l
Sulphate	< 30 mg/l	< 150 mg/l
Conductance	< 400 µS/cm	< 1800 µS/cm

**Example of fully softened water.** Location: Münsterlingen. Water hardness: approx. 16 °fH. This corresponds to a conductance of about 300–350 µS/cm. If this raw water is then softened, fresh water (for wetting the hybrid recoolers) of 0 °fH and an unchanged conductance of 300–350 µS/cm are achieved. If thickening by a factor of 3 is expected, the clarification conductance value is set to around 1000 µS/cm. This procedure can also be used for other locations.

### Additional information regarding water quality

Mountair HYBACO® recoolers are equipped with water filters as a matter of course to filter out dirt and other growth-promoting impurities.

Water pans are provided with protective covers to protect against dirt (efflorescence) and UV rays from the Sun (microbial growth).

Additional dosing agents (Varidos, Nalco Stabrex, Genodos, etc.) to combat growth of microorganisms can be used. The need should be checked according to the situation. Mountair HYBACO® recoolers can be reliably operated without additional chemical dosing agents.

Alternative, chemical-free possibilities exist for disinfection. UV disinfection equipment for example can be installed in the water pans or equally well in the piping system.

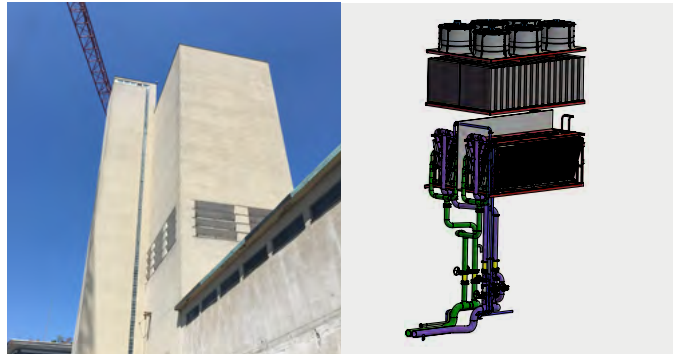
## References



2020

### WWZ Choller, data center, Zug

- Monoblocs with CCS, PHE, RHE and humidifier
- Data center cooling wall modules



2020

### ETH, ML – hybrid cooling tower, Zurich

- Hybrid recooling tower with a performance of 2 x 2280 kW each
- 2 x approx. 370 000 m<sup>3</sup>/h air volume



2019

### SBB Baufeld-D, Zurich

- 1 x V form with Q = 1400kW



2019

### AEMP central sterilisation, Schlieren

- Recooler, V form, 870 kW



2019

### Grabs hospital, St. Gallen

- 2 Anlagen mit je Q = 880kW



2019

### Hilti, new office building, Schaan

- 2 systems with Q = 620kW each; switchover point = 18°C



2018

**Kunsteinsbahn (KEB), Sissach**

- V form, Q = 660kW @ 34/28°C with Tf = 18°C



2018

**Plattenstrasse, university of Zurich**

- 1 x T2 roof devices with HYBACO, Q = 200kW



2018

**EKT Datacenter, Frauenfeld**

- Free cooling: 1 × 266 kW



2017

**Ivoclar Vivadent, cold generation, Schaan**

- Machine operation: 2 × 1000 kW
- Free cooling operation: 2 × 800 kW



2017

**FHNW, Muttenz**

- 2 × 1490 kW



2017

**Clinic of Bethanien, Zurich**

- Special design T2 hybrid coolers
- 1 × 460 kW



2016

**GH Schiffbauplatz, Zurich Hardbrücke**

- 2 × 580 kW



2016

**Biocentre of Basel**

- 2 × 3000 kW



2015

**Sika, Limmat, Zurich**

- 1 × 610 kW



2015

**Cantonal hospital of Fontana, Chur**

- Conversion - T2 recoolers in the building
- 1 × 380 kW



2015

**Omega AG, Biel**

- Recooler, H construction form, V = 90 000 m<sup>3</sup>/h, Q = 800kW



2013, 2018

**EWZ Zurich, cold generation Wagi 15**

- 2 × 1550 kW
- 1 × 1550 kW (extension)



2014

**Cantonal hospital of Thurgau, Münsterlingen**

- 2 × 1200 kW



2014

**Hilti IC, Schaan**

- 1 × 2400 kW



2014

**Hotel Säntispark, Abtwil**

- Special T2 architecture
- Hybrid recooling 520 kW



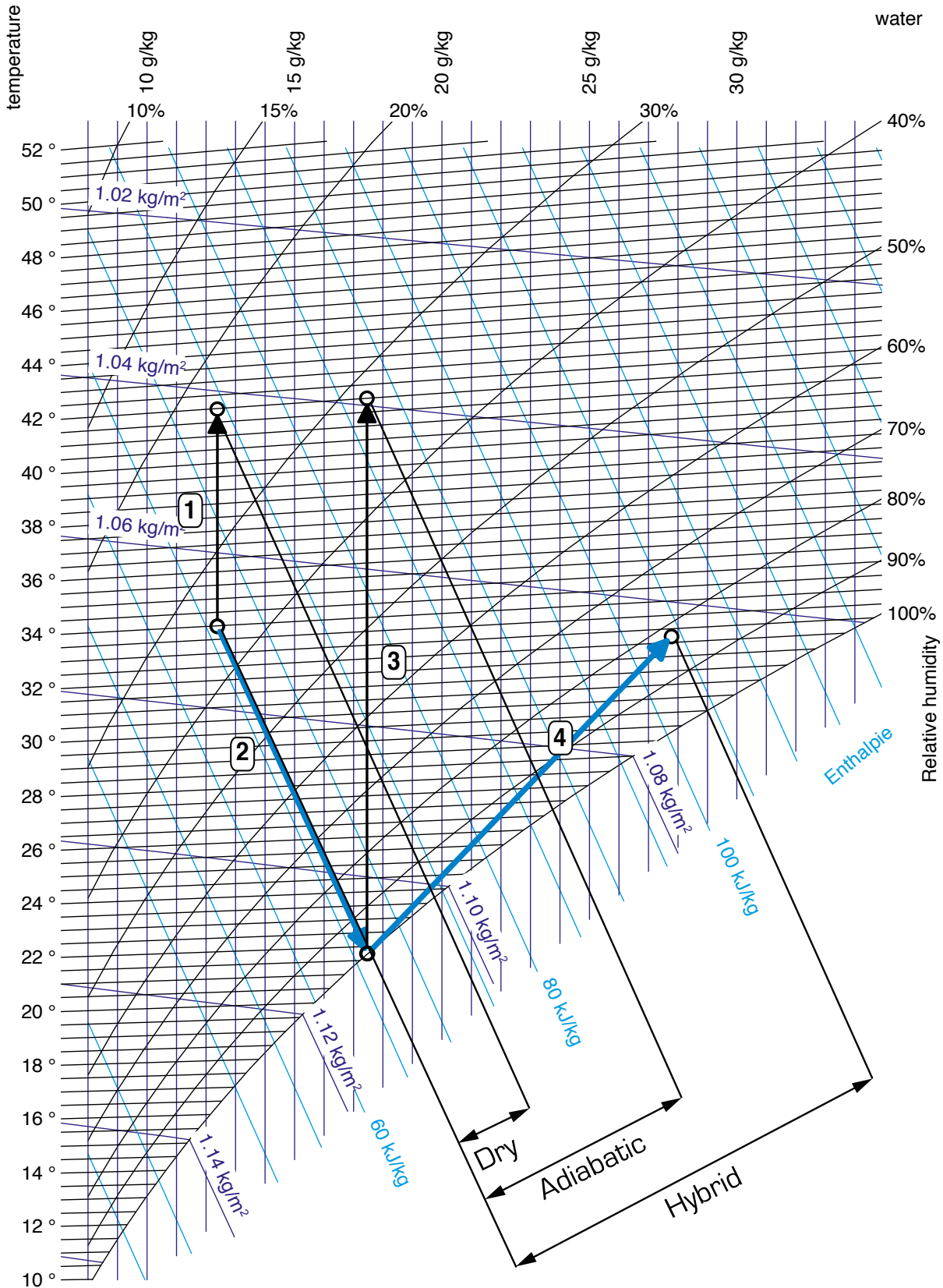
2004 / 2008

**Roche Kaiseraugst**

- 1st stage: 3 × 2200 kW, 2nd stage: 3 × 2200 kW

# Mollier h-x diagram

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



- 1 Dry recooling
- 2 Adiabatic cooling of the air on the wet bulb temperature
- 3 Dry recooling after adiabatic humidification
- 4 Hybrid recooling

# Quote Enquiry

Mountair HYBACO® Hybrid Recooler	Date
Company	Deadline
Contact person	
E-mail	Telephone
<b>Project name</b>	
Project address	

## TECHNICAL DATA

Height above sea level	m a.s.l.	Accessories	<input type="checkbox"/> Transport
Capacity per HYBACO®	kW		<input type="checkbox"/> Unloading
Number of plants			<input type="checkbox"/> Installation
Recooling medium	% [glycol concentration]		<input type="checkbox"/> Mobile crane: give height at which to be installed and layout
Recooling medium	<input type="checkbox"/> Ethylene glycol <input type="checkbox"/> Propylene glycol		
Recooling temperature	Flow °C		
	Return °C		
Sound power per HYBACO®	dB(A)	Plant options	<input type="checkbox"/> Air partitioning dampers
Sound pressure level at 10 m distance	dB(A)		<input type="checkbox"/> Roller shutters
Hydraulic pressure loss	kPa		<input type="checkbox"/> UV disinfection
Operating/test pressure	bar		<input type="checkbox"/> Dosing stati
Installation area max.	Length mm		
	Width mm		
Plant height maximum	Height mm		
Wetting water	<input type="checkbox"/> softened (0° fH) <input type="checkbox"/> desalinated		

AIR CONDITIONS	SUMMER/PEAK LOAD	2nd OPERATION/FREECOOLING
Outside air: temperature	°C	
Outside air: relative humidity	%	
Wet bulb temperature	°C	
Dry switchover point	°C	



**Mountair AG**  
**Lufotechnischer Apparatebau**  
Sonnenwiesenstrasse 11  
8280 Kreuzlingen

T +41 71 686 64 64  
F +41 71 686 64 76

**Mountair AG, Basel**  
Florenzstrasse 9  
4142 Münchenstein

T +41 61 841 09 74  
F +41 61 841 09 75

**Mountair AG, Suisse Romande**  
Route de Saint Julien, 275  
1258 Perly

T +41 (0)79 104 90 38

info@mountair.com  
www.mountair.com

