BerlinerLuft.

Air conditioning.

EcoCond | EcoCond+

The right climate for everyone.
BerlinerLuft. Central air handling units combine efficient air conditioning with the objectives of environment and climate protection.

Energy-efficient.
Climate-friendly.
Sustainable.

OPTIMAL SITE CLIMATE FOR YOU.

Not least because of cost and management reasons, challenges for advanced central air handling units include energy efficiency, resource-saving, climate-friendliness and environmental compatibility. Tailored to these requirements and geared to our customers' needs, BerlinerLuft. develops and manufactures central AHUs that meet the highest functional and aesthetic requirements.

BEST ENVIRONMENTAL CLIMATE FOR ALL.

Pharmaceutical production facilities, exhibitions or datacentres – each process and each environment requires specific climatic conditions. We provide them using innovative technology, decades of expertise and and the highest quality standards for an optimal climate.

With this philosophy in mind, we develop high-performance components and manufacture them as complete system solutions customized to your specific needs.

Qualified. Certified. Climate-friendly.

EcoCond | EcoCond+

AIR CONDITIONING WITH SYSTEM.

EcoCond I EcoCond+ is an energy-efficient heat recovery system for heating and cooling. The economical operation of the system sustainably promotes the reduction of the life cycle costs of HVAC systems.

The basic principle: The combination of high-performance counter-flow heat exchangers in conjunction with an individual hydraulic system configuration.

The system responsibly implements the criteria of applicable regulations and laws (VDI6022, EN308, VDI 3803, EnEV, EEWärmeG, (EU) No.1253/2014), while meeting the requirements of professional air conditioning. Thus, the sustainable operation of EcoCond I EcoCond+ is characterised not only by high temperature transfer efficiency but also demonstrably by the highest energy efficiency as per DIN EN 13053.

Energy efficient. Compliant with the standards. Resource-efficient.

FLEXIBLE, SAFE AND MULTIFUNCTIONAL.

EcoCond I EcoCond+ makes heat recovery for locally separated air flows possible, while satisfying the need for enhanced functionality. Due to the complete separation of the air flows, material and fire transfer are impossible, even in the event of a malfunction. This makes the system suitable for preventive smoke and fire protection and for use in systems in which no germs, odours, moisture, pollutants or other contaminants may be transferred. This also applies to environments in which aggressive media or process waste heat are present.

EcoCond I EcoCond+ makes flexible and space-saving solutions possible. Due to the individual adaptation to local conditions, the system is ideally suited for energetic refurbishment, or if you wish to retrofit an existing plant system.

EcoCond+
Mousonturm, Frankfurt a.M.

Design variants

EcoCond Basic version	**EcoCond** Full version	**EcoCond+**
Temperature transfer efficiency **$\eta_t \leq 80\%$**	**Temperature transfer efficiency** **$\eta_t \leq 80\%$**	**Temperature transfer efficiency** **$\eta_t \leq 92\%$**
Speed-regulated high pressure centrifugal pump	Speed-regulated high pressure centrifugal pump	Speed-regulated high pressure centrifugal pump
Heat recovery controller with operating element	MSR switch cabinet with touch screen	Reversible heat pump technology
Continuous operating point adjustment incl. safety functions	Optimum operating point and operating mode adjustment incl. safety functions	MSR switch cabinet with touch screen
Continuous anti-icing protection	Twofold continuous anti-icing protection	Optimum operating point and operating mode adjustment incl. safety functions
Plug and play	Coupling and decoupling of heat or cooling	Twofold continuous anti-icing protection
Proof of energy efficiency as per DIN EN 13053	Heat recovery coupling of several air handling units	Coupling and decoupling of heat or cooling
	Overall control for air handling units incl. control of networked systems (heating, cooling, steam generation, etc.)	Heat recovery coupling of several air handling units
	Proof of energy efficiency as per DIN EN 13053	Overall control for air handling units incl. control of networked systems (heating, cooling, steam generation, etc.)
		Proof of energy efficiency as per DIN EN 13053

Technical parameters

Construction size	Air volume AHU [m³/h]	Water volume [m³/h]	EcoCond Basic version[1]	EcoCond Full version[2]	EcoCond+
			Dimensions: L x W x H [m]		
DN 20	≤ 6,000	≤ 1.9	1.0 x 0.5 x 1.4	1.2 x 0.8 x 2.0	1.8 x 1.0 x 2.0
DN 25	≤ 12,000	≤ 3.8	1.0 x 0.5 x 1.4	1.2 x 0.8 x 2.0	1.8 x 1.0 x 2.0
DN 32	≤ 18,000	≤ 5.7	1.0 x 0.6 x 1.5	1.2 x 0.8 x 2.0	2.0 x 1.0 x 2.0
DN 40-1	≤ 25,000	≤ 7.8	1.0 x 0.6 x 1.5	1.5 x 1.0 x 2.0	2.0 x 1.3 x 2.0
DN 40-2	≤ 30,000	≤ 9.4	1.0 x 0.6 x 1.5	1.5 x 1.0 x 2.0	2.0 x 1.3 x 2.0
DN 50-1	≤ 40,000	≤ 12.5	1.2 x 0.9 x 1.5	1.5 x 1.0 x 2.0	2.2 x 1.3 x 2.0
DN 50-2	≤ 50,000	≤ 15.7	1.2 x 0.9 x 1.5	1.5 x 1.0 x 2.0	2.2 x 1.3 x 2.0
DN 65-1	≤ 60,000	≤ 18.8	1.2 x 0.9 x 1.5	1.8 x 1.2 x 2.0	2.4 x 1.6 x 2.0
DN 65-2	≤ 90,000	≤ 28.2	1.6 x 1.0 x 1.7	1.8 x 1.2 x 2.0	2.4 x 1.6 x 2.0
DN 80	≤ 110,000	≤ 34.5	1.6 x 1.0 x 1.7	1.8 x 1.2 x 2.0	2.4 x 1.6 x 2.2
DN 100	≤ 130,000	≤ 40.8	1.6 x 1.0 x 1.7	1.8 x 1.2 x 2.0	2.4 x 1.6 x 2.2

[1] Information incl. adjustable feet and shut-off valves

[2] Information incl. base frame and shut-off valves, as well as multi-functional extensions, without consideration of system upgrades (e.g. double pump, integrated cooling)

EcoCond
Basic version

EcoCond basic version

SYSTEM CONCEPT AND FUNCTIONAL PRINCIPLE

EcoCond basic version is a full featured, high performance run-around coil system, specifically designed for standard applications with temperature transfer efficiencies of. $\eta_t \leq 80\%$ (e.g. fresh air conditioning, process waste heat, etc.).

The system essentially consists of a counter-flow air-to-water heat exchanger, a speed-regulated high pressure centrifugal pump, hydraulic connections and a heat recovery controller for optimum operating point adjustment.

HYDRAULIC UNIT

The hydraulic unit of the EcoCond basic version is supplied in a compact design with adjustable feet, a drip pan, and an external frame construction.

ESSENTIAL COMPONENTS

- Speed-regulated high pressure centrifugal pump
- Shut-off fittings
- Continuous control valve
- Diaphragm expansion vessel with safety assembly
- Dirt trap
- Flow rate measuring device
- Immersion temperature sensor
- Heat recovery controller with operating panel

The hydraulic unit combines the heat transfer medium in a compact unit and continuously optimises the mass flow according to the airflow volume as well as the specific requirements of an on-site control system.

The higher the temperature transfer efficiency, the more important it is to precisely match the heat transfer medium to the air mass flow (VDI3803 Sheet 5). By using an adapted control strategy, in conjunction with a speed-regulated high-pressure centrifugal pump and electrical control elements, EcoCond basic version enables continuous optimisation under variable operating conditions.

RANGE OF SERVICES

- Hydraulic dimensioning of the heat recovery system
- Factory test run

OPTIONAL AND EXTENSIONS

- Performance measurement and proof of energy efficiency (as per DIN EN 13053)
- Insulation (incl. corrosion protection according to AGI-Q151)
- Double pump extension
- Enclosure of the hydraulic unit for outdoor installation
- Extended commissioning and on-site instruction

EcoCond basic version

SCOPE OF SERVICES ICE

The heat recovery controller is wired entirely internally with all switching devices required for operation

Control panel

Creation of control and wiring diagram

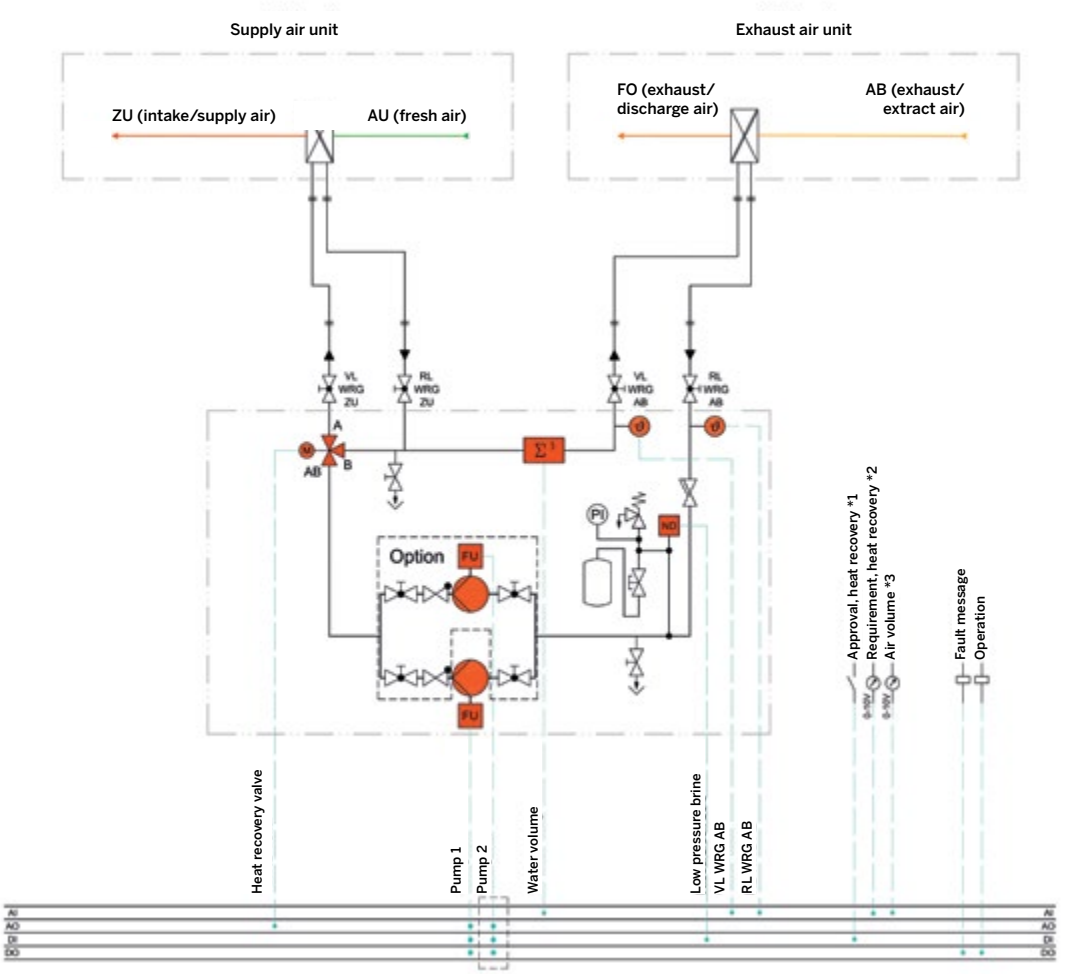
Internal cabling of hydraulic unit

Documentation

Communication via BACnet IP (B-ASC), Modbus IP/RTU

OPTIONAL EXTENSIONS

Supply air temperature control extension



Standard control diagram
EcoCond basic version

BerlinerLuft.

Proof of energy efficiency

TEMPERATURE TRANSFER EFFICIENCY

The determination of the dry heat recovery coefficient η_t is carried out for a high performance run-around coil system in reference mode as per DIN EN 308 corresponding to category IIa under dry conditions (t_{AUL}=5 °C, t_{ABL}=25 °C at a wet-bulb temperature < 14 °C) and with the following equation:

$$\eta_t = \frac{t_{ZUL} - t_{AUL}}{t_{ABL} - t_{AUL}}$$

Therefore, an outlet temperature of 21 °C in reference mode results in a temperature transfer efficiency of η_t = 80%.

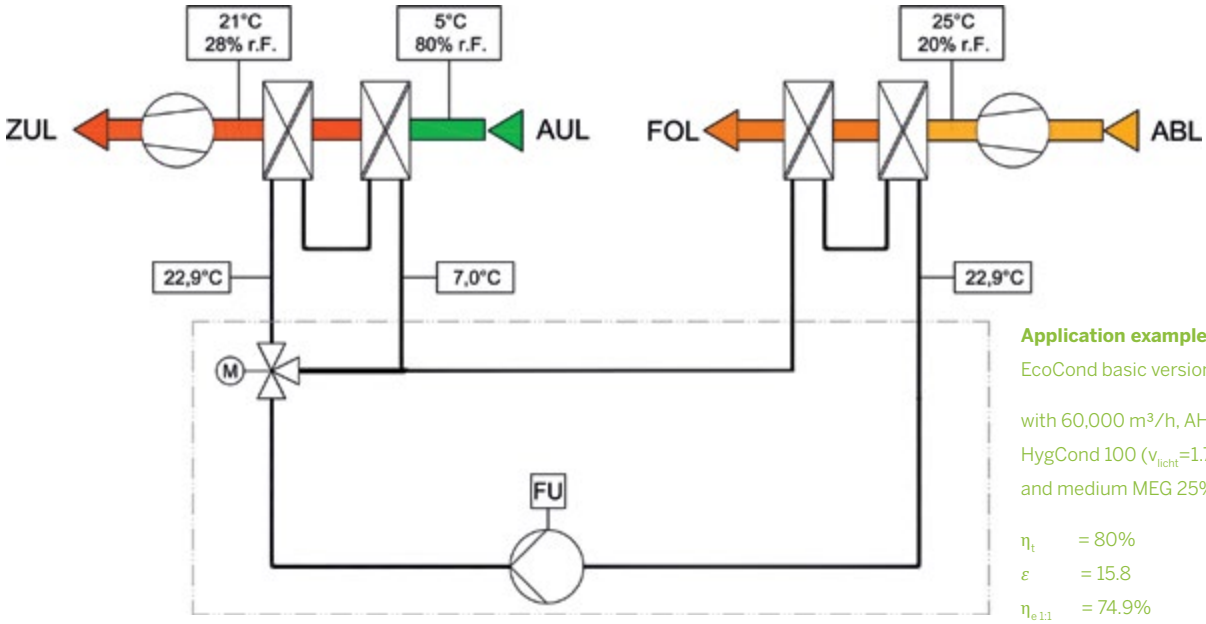
PROOF OF ENERGY EFFICIENCY

Energy efficiency η_e is the most important parameter for evaluating and classifying a heat recovery system. In addition to the thermal performance, it also takes into account the necessary expenditure of auxiliary energies (fan, pumps, etc.) for heat recovery. The classification of DIN EN 13053 is a criterion for the requirements for air handling units (RLT-Guideline 01) and describes minimum requirements in laws and regulations.

To determine the energy efficiency η_e, the dry heat recovery coefficient is extended by the coefficient of performance ε. For equal mass flows, the energy efficiency is given by:

$$\eta_e = \eta_t \cdot (1 - \frac{1}{\varepsilon}) \quad \text{with} \quad \varepsilon = \frac{Q_{WRG}}{P_{el}}$$

The EcoCond basic version, with a dry heat recovery coefficient of η_t = 80%, results in an energy efficiency of ηe1:1=74.9%, taking into account all auxiliary energies. This corresponds to the highest heat recovery class H1 as per DIN EN 13053:2017:06.



Application example

EcoCond basic version DN65-1

with 60,000 m³/h, AHU size HygCond 100 (v_{licht}=1.77 m/s) and medium MEG 25%

η_t = 80%
ε = 15.8
$\eta_{e\,1:1}$ = 74.9%

EcoCond full version

EcoCond full version

FUNCTIONALITY AND NEW POSSIBILITIES

EcoCond full version is the extension of the basic version for multi-functional heat recovery on the basis of a high-performance run-around coil system.

A freely programmable DDC control system with powerful counter-flow heat exchangers and a hydraulic concept adapted to the application create a system for the highest demands of heat and cooling recovery.

EcoCond full version can be individually extended according to VDI 3803 sheet 5/chap. 6.4, or used beyond the system limits with multiple functions. One option is the coupling and decoupling of heat or cold with liquid-liquid heat exchangers. This eliminates the need for air-side reheaters or aftercoolers. This reduces pressure losses (=electrical fan power) and minimises the installation space of air handling units.

The liquid-liquid heat exchangers for the supply of pumped warm water (PWW) or pumped cold water (PKW) are dimensioned in-house and according to project requirements. Whatever the media, the energy can be used in a flexible and multi-functional way, whether it is from regenerative energy sources (such as solar), or waste heat from cooling processes, block-type thermal power stations and industrial processes.

REDUCTION OF INTERFACES

Each multi-functional use of EcoCond is realised by system extensions in conjunction with a freely programmable DDC control. This increases the energy efficiency of the entire HVAC system and reduces on-site interfaces.

The options for system extension are as diverse as the air conditioning options themselves. All versions are possible, from simple control of indirect evaporative cooling, hydraulic extensions for dehumidification cooling recovery, to overall control and regulation functions for individual air handling units or several air handling units in a network (heat recovery coupling).

As an option, the EcoCond full version is also capable of completely dispensing with the necessity of feeding in pumped cold water (PKW) in cooling mode. To achieve this, just the hydraulic unit is extended by a refrigeration system in which the necessary refrigeration is generated internally and discharged via an additional condenser into the exhaust air.

EcoCond full version

HYDRAULIC UNIT

The hydraulic unit of the EcoCond full version is available in a compact design with a stable base frame, an internal drip pan with a slope on all sides, including a lockable drain, and an external frame construction.

ESSENTIAL COMPONENTS

- Speed-regulated high pressure centrifugal pump
- Shut-off fittings
- Continuous control valve(s) for capacity adjustment
- Diaphragm expansion vessel with safety assembly
- Dirt trap
- Flow rate measuring device
- Immersion temperature sensor
- Instrumentation and control engineering switch cabinet with high quality DDC control and touch screen for continuous efficiency optimisation and monitoring

RANGE OF SERVICES

- Hydraulic dimensioning
- Instrumentation and control engineering project planning
- Commissioning and adjustment

OPTIONS AND EXTENSIONS

- Performance measurement and proof of energy efficiency (as per DIN EN 13053)
- Insulation (incl. corrosion protection according to AGI-Q151)
- Double pump extension
- Liquid-liquid heat exchanger extension for coupling and decoupling of heat or cooling (PWW/PKW)
- Dehumidification cooling recovery
- Integrated cooling with additional condenser in the exhaust air flow
- For heat recovery, coupling of several air handling units to form a network
- Enclosure of the hydraulic unit for outdoor installation

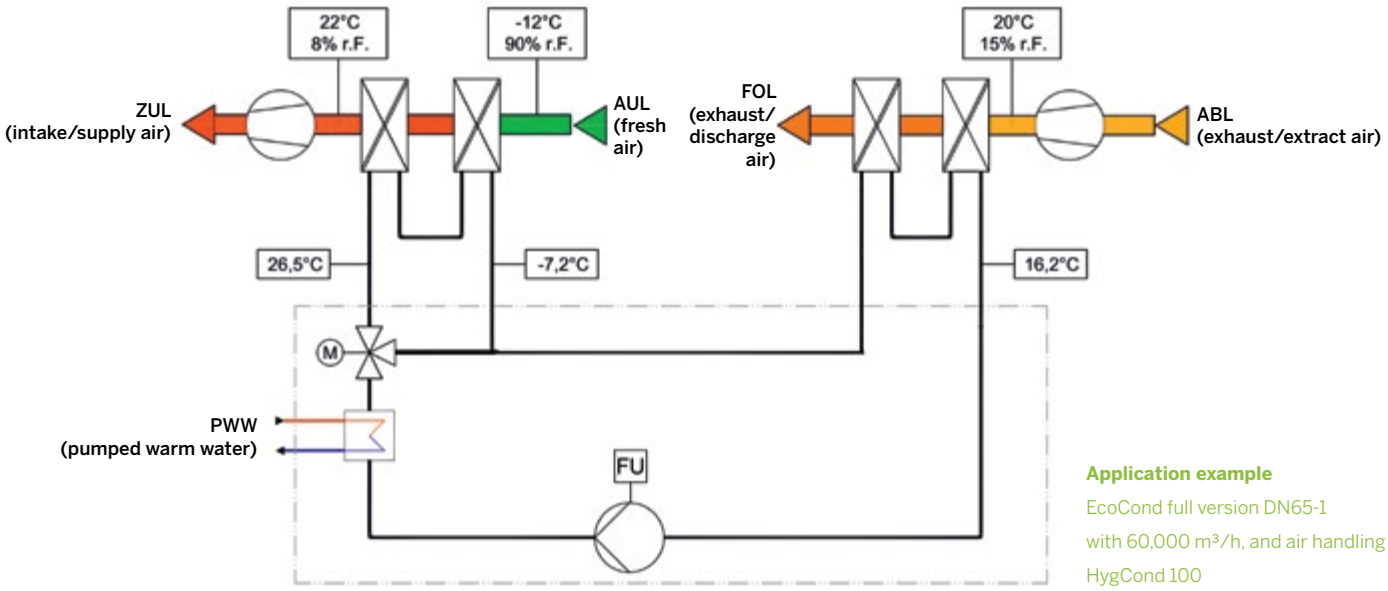
“HEATING” MODE WITH REHEATING

To supplement the heat recovery capacity, the hydraulic unit of the EcoCond full version can be extended with an additional liquid-liquid heat exchanger.

This means that heat generated from, for example, the heating system, the solar panels, the machines or from system processes can be indirectly fed into the system. This increases the flow temperature in the heat recovery circuit, and the required supply air temperatures can be achieved in heating mode – even without an air-side reheater in the air handling units.

At the same time, the mass flow in the heat recovery circuit is optimised to ensure efficient heat recovery.

In heating mode, the DDC control has fully automatic control of the frost protection functions in the heat recovery circuit and of the air-side anti-icing protection of the exhaust air heat exchanger, depending on the air quantities and on pressure losses.



Application example
EcoCond full version DN65-1
with 60,000 m³/h, and air handling size
HygCond 100

EcoCond full version

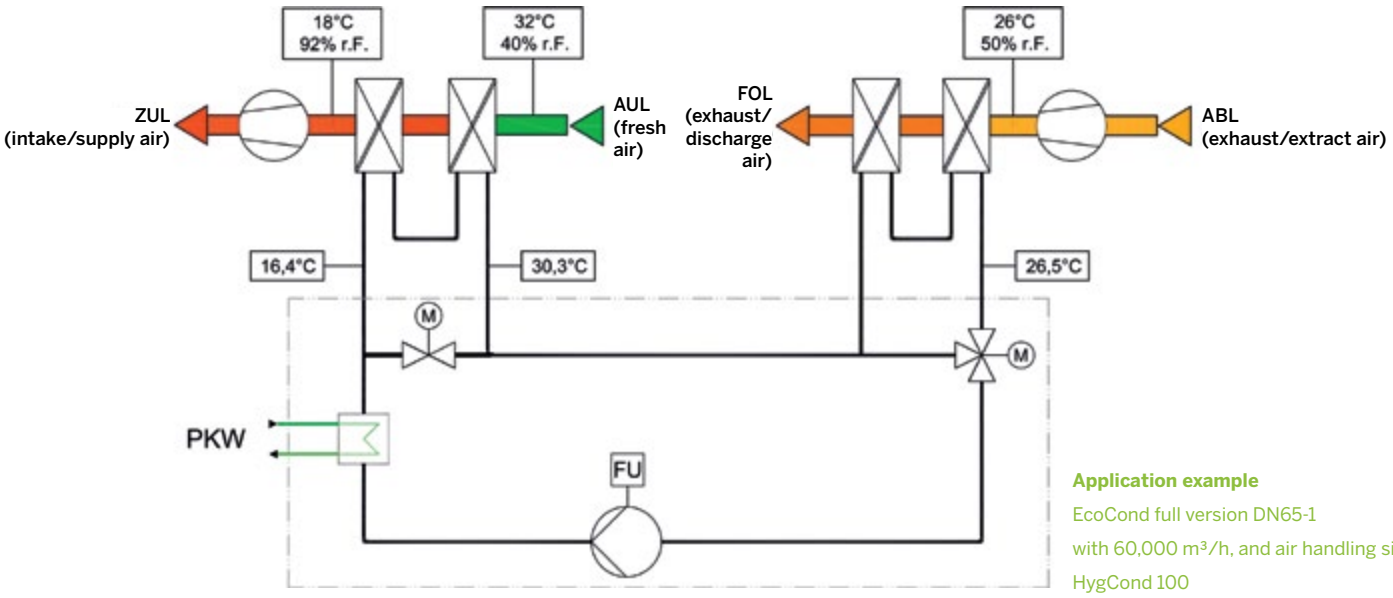
"COOLING" OPERATION MODE WITH AFTERCOOLING

To supplement the cooling recovery capacity, the hydraulic unit of the EcoCond full version can be extended with an additional liquid-liquid heat exchanger.

As a result, cooling from the refrigeration system, ground cold, or similar, can be indirectly fed into the system in the form of pumped cold water (PKW). This reduces the flow temperature in the heat recovery circuit, so the required supply air temperatures can be achieved in cooling mode, even without an air-side aftercooler in the air handling units.

In cooling mode at low fresh air temperatures ($t_{AU} < t_{AB}$), the exhaust air heat exchanger is bypassed by a continuous control valve. The required cooling of the heat transfer medium then takes place exclusively via the liquid-liquid heat exchanger in the heat recovery circuit.

If the temperature difference between the outdoor and extract air temperature increases, the "cooling" operation mode with cooling recovery is activated. In this state, part of the absorbed heat energy from the fresh air is discharged to the exhaust air via the exhaust air heat exchanger.



Application example
EcoCond full version DN65-1
with 60,000 m³/h, and air handling size
HygCond 100

BerlinerLuft.

The system extensions of indirect evaporative cooling and dehumidification cooling recovery enable an additional increase in efficiency of the entire HVAC system.

DEHUMIDIFICATION COOLING RECOVERY

In the case of higher air conditioning demands (temperature and humidity), a considerable part of the operating costs can be saved with the help of dehumidification cooling recovery.

The extension includes an additional control valve in conjunction with a heat exchanger in the air handling unit. When cooling with dehumidification is required, the control valve opens continuously and the additional heat exchanger takes over the reheating of the dehumidified air. This saves the total amount of heat that, without a system expansion, would have been required by a feed of pumped warm water (PWW).

With dehumidification cooling recovery, the requirement for pumped cold water for the purpose of dehumidification to dew point temperature is reduced by approx. 30%. Reheating lowers the flow temperature of the fresh air heat exchanger in the air handling unit, which means that the pumped cold water cooler in the air handling unit only has to provide latent heat output.

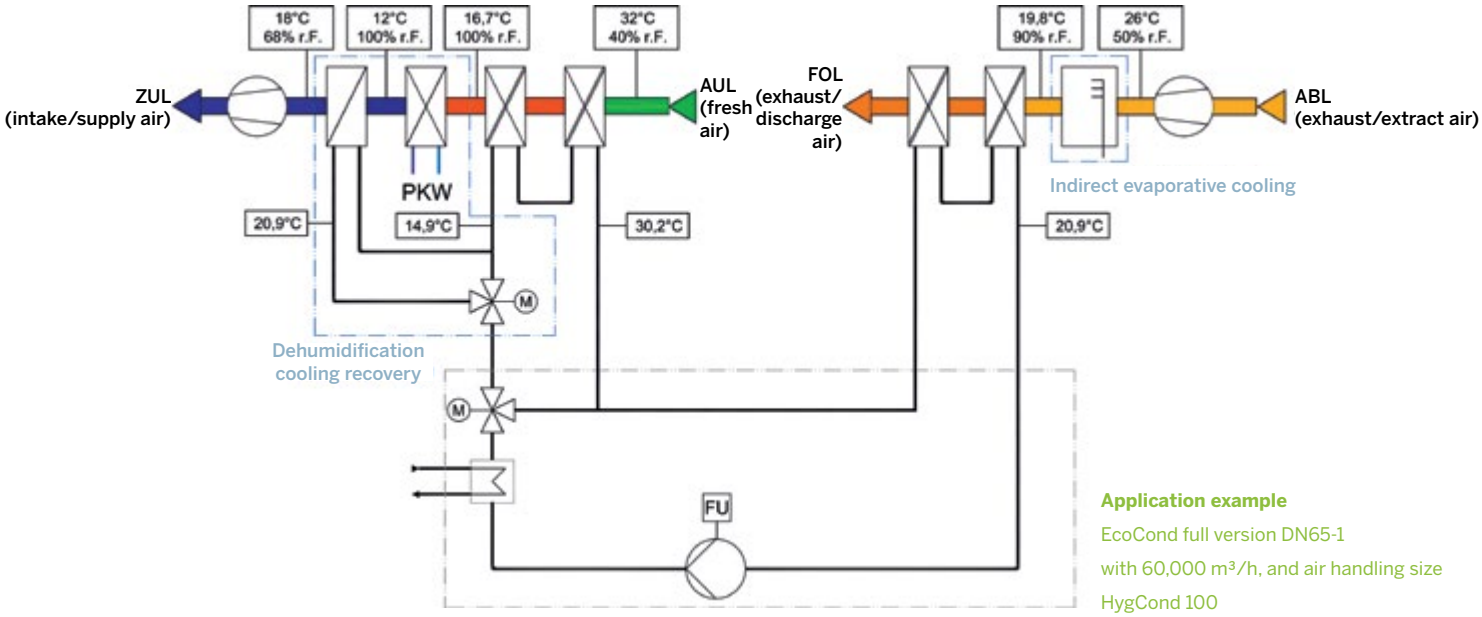
Furthermore, the additional heat exchanger also means an increase in efficiency in heating mode, as more surface area and therefore less temperature difference is required to achieve the desired supply air target value.

INDIRECT EVAPORATIVE COOLING

Indirect evaporative cooling from the exhaust air enables reliable base load coverage in cooling mode, while simultaneously reducing the external cooling feed (PKW) by up to 55% (at factory conditions).

Humidification reduces the inlet temperature into the exhaust air heat exchanger (approx. 2.5 K per 1 g/kg humidification), which means that more heat can be transferred from the heat recovery circuit to the exhaust air in cooling mode.

Using the exhaust air condition and the efficiency of the humidifier, the DDC control system calculates the inlet temperature into the exhaust air heat exchanger. However, the humidifier is only activated when a certain difference between the inlet of the exhaust air heat exchanger and the fresh air temperature has been reached. This saves valuable resources and ensures that the humidifier is not operated uneconomically.



Application example

EcoCond full version DN65-1
with 60,000 m³/h, and air handling size
HygCond 100

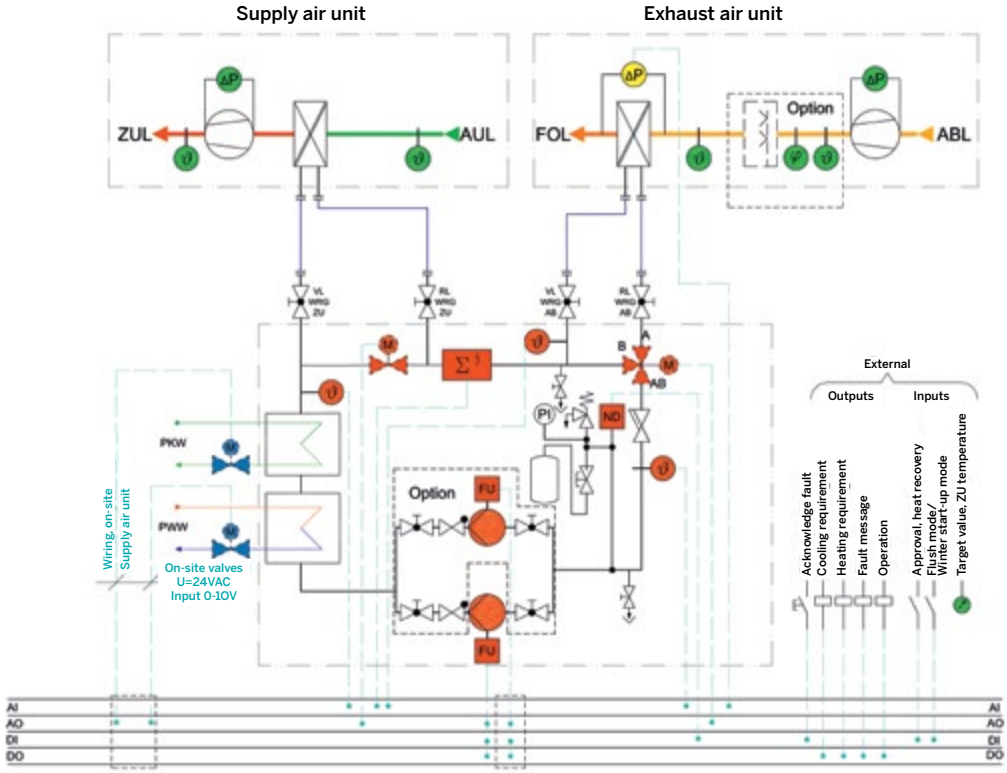
EcoCond full version

INSTRUMENTATION AND CONTROL ENGINEERING SCOPE OF SUPPLY

- The ICE switch cabinet is wired entirely internally with all switching devices required for operation
- DDC control, freely programmable and can be upgraded
- Touch screen operation and WEB technology
- Internal unit wiring
- Engineering project management
- Creation of control diagrams, circuit diagrams
- Commissioning by in-house specialists
- Documentation
- Electrical connections for the customer's wiring
- Transmission of the measured values of the unit sensors using standard signals (0-10 V or 4-20 mA)
- Other communication options: Modbus, BACnet, (others on request)

OPTIONAL EXTENSIONS

- BACnet for the building management system connection
- Temperature measurement (air handling unit)
- Air volume measurement (air handling unit)
- Supply, installation, and connection of unit sensors (air handling unit)
- Overall transfer of control and regulation equipment of the air handling units incl. control of networked systems (heating, cooling, humidifier, steam generation, etc.)



Example control diagram
EcoCond full version

BerlinerLuft.

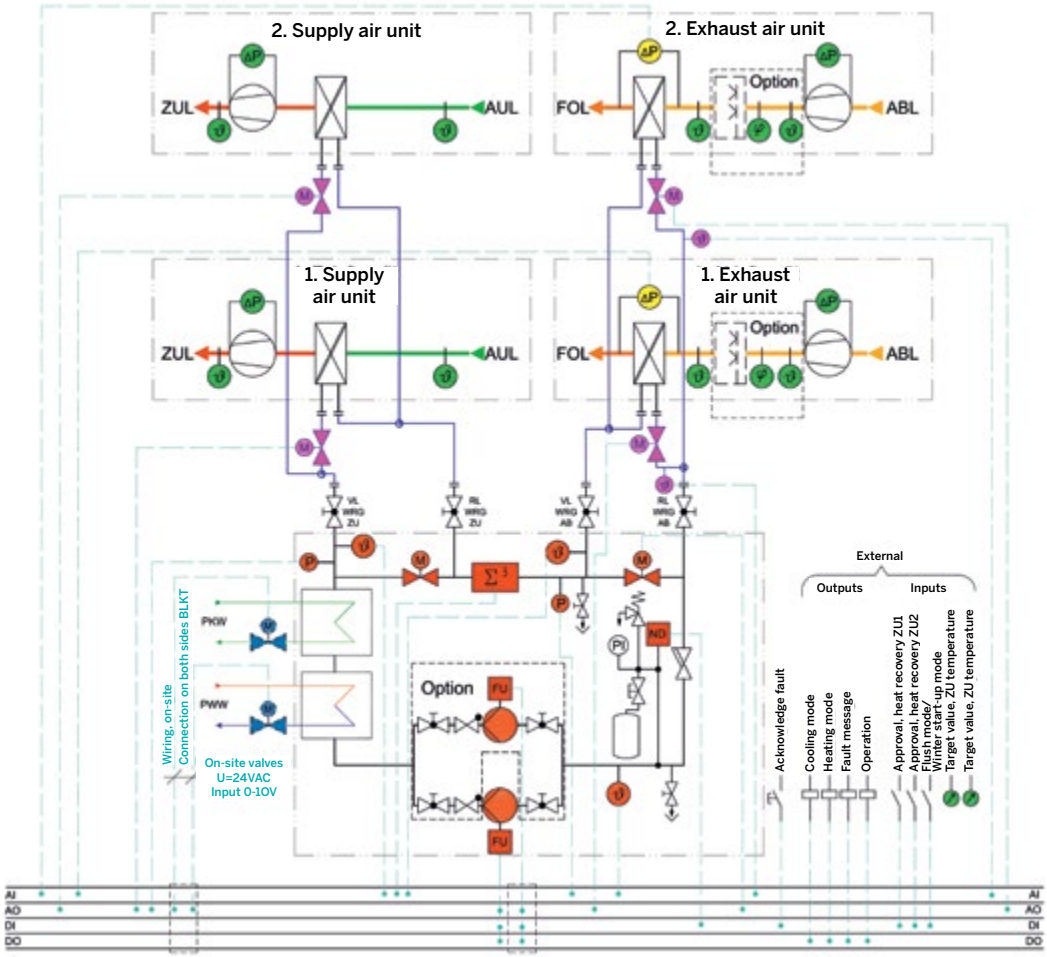
ENERGY BALANCE BOUNDARIES OF HEAT RECOVERY

For the energetic and economic consideration of heat recovery systems, the energy balance boundary is of crucial importance. It must be defined in such a way that the heat recovery and all the energy flows, system components, and structural framework conditions influenced by it are included. Only in this way is a consistent consideration possible with regards to key figures, and investment, substitution and operating costs (VD3803 sheet 5).

In all, it is the individual project planning with in-house software creation and commissioning that form the basis for an energy-efficient overall consideration of all components and the specific areas (building services, heating, cooling, electrical and energy supply, etc.). Only when the air handling unit, heat exchanger, and hydraulic unit are combined with a control strategy that is matched to the overall system can a multifunctional, high-performance run-around system be created.

SMART THERMAL GRID

The interconnection of several air handling units, with EcoCond as the central energy unit, opens up possibilities for the user to develop a decentralised "smart thermal grid". A network of heat sources and heat sinks that intelligently distribute and reliably provide thermal energy according to demand.



Example control scheme
EcoCond full version and heat recovery coupling of several air handling units

EcoCond+

EcoCond+

MAXIMUM HEAT AND COOLING RECOVERY

EcoCond+ is the extension of the EcoCond system to a multi-functional high performance RAC with temperature transfer efficiencies of $\eta_t \leq 92\%$.

"The third generation of heat and cooling recovery" improves the hydraulic concept including high-performance counter-flow heat exchangers by integrating a reversible heat pump.

This creates a targeted and demand-dependent heat displacement with high performance coefficients in the heat recovery circuit. As a result, the heat recovery at the exhaust air heat exchanger increases, enabling EcoCond+ to require significantly less additional feed (PWW, PKW) compared to conventional systems without heat pumps in heating or cooling mode.

Despite the additional electrical energy required for the heat pump, the energy efficiency of a high-performance run-around coil system can be increased by almost 13% as a result. This significantly reduces operating costs and helps EcoCond+ to achieve short payback-periods.

SYSTEMERWEITERUNG 2.0

EcoCond+ is based on the proven hydraulic design of the EcoCond full version, including a freely programmable DDC control system. This allows customer-specific system extensions to be implemented, in which each multi-functional use for the system further increases the energy efficiency of the entire HVAC system.

The possible system extensions are diverse and can contribute to the reduction of interfaces for all maintenance groups. All versions are possible, from simple control of indirect evaporative cooling, to hydraulic extensions for dehumidification cooling recovery, to overall control and regulation functions for individual air handling units or several air handling units in a network (heat recovery coupling).

As an option, the EcoCond+ can completely dispense with fed-in pumped cold water (PKW) in cooling mode. To achieve this, just the hydraulic unit is extended by a refrigeration system in which the necessary refrigeration is generated internally and discharged via an additional condenser into the exhaust air.

EcoCond+

HYDRAULIC UNIT

The hydraulic unit of the EcoCond+ is available in a compact design with a stable base frame, an internal drip pan with a slope on all sides, including a lockable drain, and an external frame construction.

ESSENTIAL COMPONENTS

- Speed-regulated high pressure centrifugal pump
- Reversible heat pump with associated plate heat exchanger and refrigeration accessories
- Shut-off fittings
- Continuous control valve(s) for capacity adjustment
- Diaphragm expansion vessel with safety assembly
- Dirt trap
- Flow rate measuring device
- Immersion temperature sensor
- Instrumentation and control engineering switch cabinet with high quality DDC control and touch screen for continuous efficiency optimisation and monitoring

RANGE OF SERVCE

- Hydraulic dimensioning
- Instrumentation and control engineering project planning
- Commissioning and adjustment

OPTIONS AND EXTENSIONS

- Performance measurement and proof of energy efficiency (as per DIN EN 13053)
- Insulation (incl. corrosion protection according to AGI-Q151)
- Double pump extension
- Liquid-liquid heat exchanger extension for coupling and decoupling of heat or cooling (PWW/PKW)
- Dehumidification cooling recovery
- Integrated cooling with additional condenser in the exhaust air flow
- Enclosure of the hydraulic unit for outdoor installation

Functional description of EcoCond+

Point 1

At an fresh air temperature of 5 °C, the heat transfer medium exits the heat exchanger of the supply air section at 7.3 °C.

Point 2

The medium reaches the hydraulic unit where it is cooled down to 4.8 °C by the evaporator of the heat pump.

Point 3

In the exhaust section, the medium cools the exhaust air and is heated from 4.8 °C to 22.6 °C.

Point 4

In the condenser of the heat pump, the heat transfer medium is heated further from 22.6 °C to 25.5 °C.

Point 5

When the medium is at a temperature of 25.5 °C, it reaches the supply air section of the air handling unit again and causes the fresh air to be heated from 5 °C to 23.4 °C. This causes the medium to cool down to 7.3 °C and the cycle starts again.

IN REFERENCE MODE AS PER DIN EN 308

At a supply air temperature of 23.4 °C in reference mode, EcoCond+ achieves a temperature transfer efficiency of η_t = 92%.

Taking into account all auxiliary energies (incl. the drive energy of the refrigerating compressor), the energy efficiency of the application example with EcoCond+ results in η_e 1:1 = 84%.

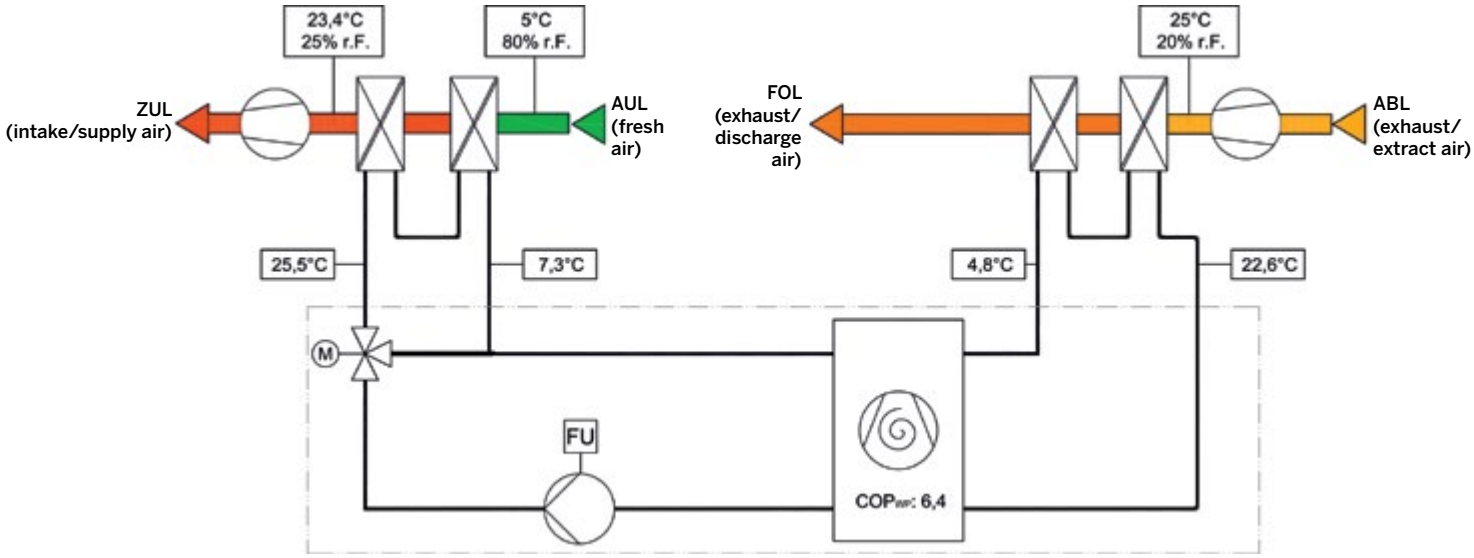
This by far exceeds the current highest requirements for heat recovery systems (class H1 ≥ 74% as per DIN EN 13053-2017-06), and that is without taking into account possible system extensions, which in their entirety further optimise the system.

Application example

EcoCond+ DN65-1

with 60,000 m³/h, AHU size
HygCond 100 (v_{licht}=1.77 m/s)
and medium MEG 25%

η_t = 92%
ε = 12.1
$\eta_{e\,1:1}$ = 84%



Energetic system comparison

LIMITS OF INCREASED EFFICIENCY

The development of run-around coil systems with efficiencies from 45% to about 80% (EcoCond) is mainly based on an increase of the heat transfer surface in combination with an improved internal hydraulic circuit (counter-flow principle). More powerful heat exchangers form the basis for a multi-functional use of high-performance run-around coil systems. However, an increase in the heat transfer surfaces has structural limits, in part due to hygienic reasons (VDI6022).

In addition, feeding in pumped warm water or pumped cold water causes a reduction in the efficiency of the system. For example, in heating mode, the supply of pump warm water leads to higher flow temperatures at the exhaust air heat exchanger. This results in lower temperature differences and a reduction in heat recovery from the exhaust air.

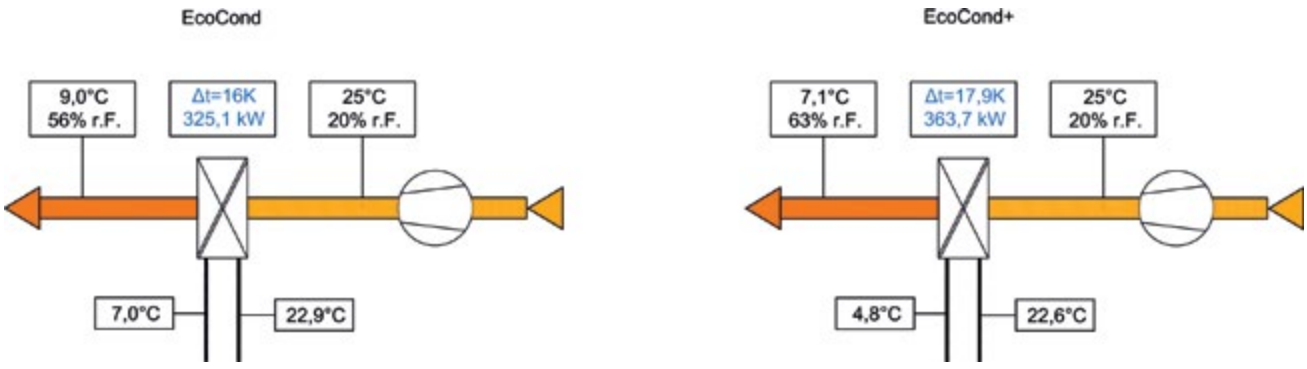
SOLUTION: REVERSIBLE HEAT PUMP TECHNOLOGY

This is exactly where EcoCond+ comes in. The integration of the reversible heat pump increases the temperature differences at the exhaust air heat exchanger in every operating state of the system. This increases the recovered power from the exhaust air and also reduces the required feed (= operating costs). The application example shows the increase in performance from EcoCond to EcoCond+ in reference mode.

ADVANTAGES OF ECOCOND+ AT A GLANCE

- Increased recovered heat output at the exhaust air heat exchanger
- Possibility of smaller heat exchangers in the supply and extract air sections with the same temperature transfer efficiency (= reduction of air-side resistances)
- Additional costs due to the refrigerating compressor (electrical energy) can be compensated by up to 96% by reducing the area of the heat exchanger.
- Greatly reduced installation space for the air handling units
- Reversible heat pump with high coefficients of performance in cooling and heating mode (COP/EER)
- Low refrigerant charge
- Environmentally friendly refrigerant with low global warming potential (GWP)
- Optimum adaptation to the annual temperature curve
- Intelligent anti-icing protection: Little to no excess output at low outside temperatures
- Optimal adaptation and increase of system efficiency with variable air volumes

Energetic system comparison
of EcoCond and EcoCond+
in reference mode using an application example with 60,000 m³/h



“HEATING” MODE WITH REHEATING

To supplement the heat recovery capacity, the hydraulic unit of the EcoCond+ can be extended with an additional liquid-liquid heat exchanger.

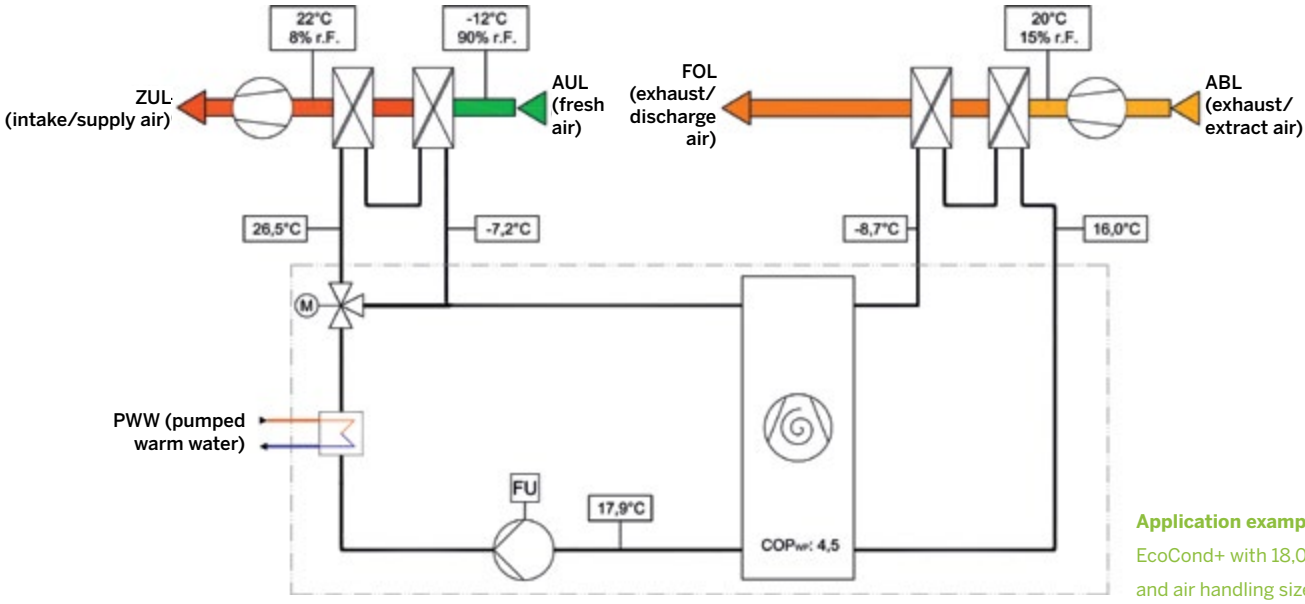
This means that heat generated from, for example, the heating system, the solar panels, the machines or from system processes can be indirectly fed into the system. This increases the flow temperature in the heat recovery circuit, so the required supply air temperatures can be achieved in heating mode, even without an air-side reheater in the air handling units.

At the same time, the mass flow in the heat recovery circuit is optimised to ensure efficient heat recovery.

In heating mode, the DDC control has fully automatic control of the frost protection functions in the heat recovery circuit and of the air-side anti-icing protection of the exhaust air heat exchanger, depending on the air quantities and on pressure losses.

INFLUENCE OF ECOCOND+ ON REHEATING

In this design, the reversible heat pump feeds additional heat energy into the heat recovery circuit. As a result, the heat transfer medium heats up from 16.0 °C to 17.9 °C. This means that EcoCond+ requires approx. 17% less pumped warm water (PWW) than a conventional high-performance run-around coil system with a heat recovery coefficient of η_t = 80% (at factory conditions).



Application example
EcoCond+ with 18,000 m³/h
and air handling size HygCond 30

EcoCond+

"COOLING" OPERATION MODE WITH AFTERCOOLING

To supplement the cooling recovery capacity, the hydraulic unit of the EcoCond full version can be extended with an additional liquid-liquid heat exchanger.

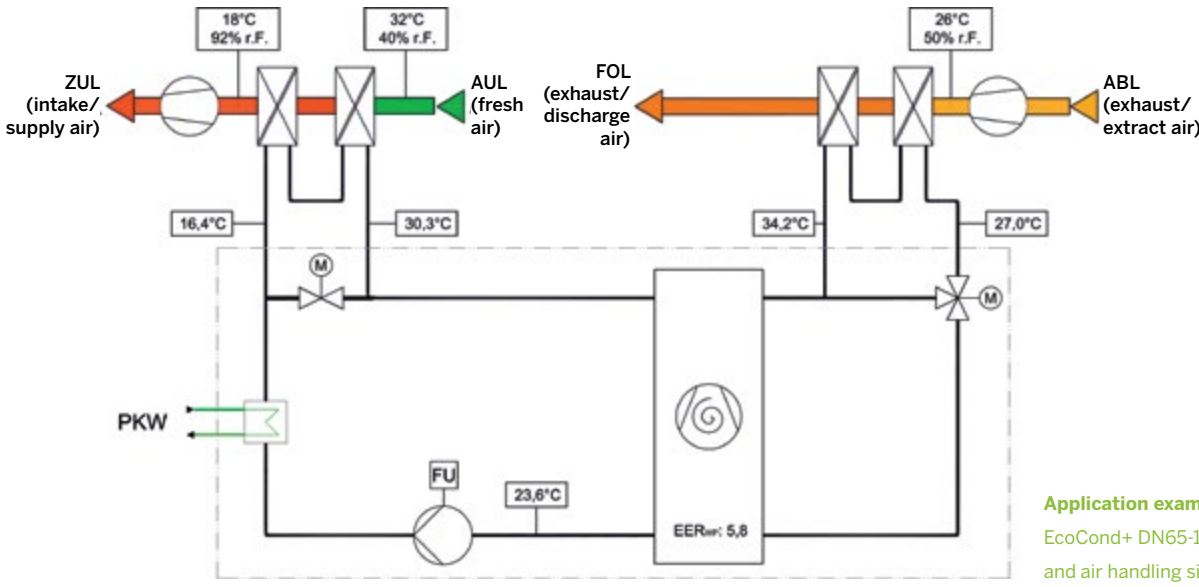
As a result, cold can be indirectly fed into the system from the refrigeration system or ground-cooled etc. in the form of pumped cold water (PKW). This reduces the flow temperature in the heat recovery circuit, so the required supply air temperatures can be achieved in cooling mode, even without an air-side aftercooler in the air handling units.

In cooling mode at low fresh air temperatures ($t_{AU} < t_{AB}$), the exhaust air heat exchanger is bypassed by a continuous control valve. The required cooling of the heat transfer medium then takes place exclusively via the liquid-liquid heat exchanger in the heat recovery circuit.

If the temperature difference between the outdoor and extract air temperature increases, the "cooling" operation mode with cooling recovery is activated. In this state, part of the absorbed heat energy from the fresh air is discharged to the exhaust air via the exhaust air heat exchanger.

EFFECT OF ECOCOND+ ON AFTERCOOLING

The reversible heat pump extracts additional heat energy from the heat recovery circuit. As a result, the temperature of the heat transfer medium drops from 27.0 °C to 23.6 °C and EcoCond+ requires about 28% less pumped cold water (PKW) than a conventional high-performance run-around coil system with a heat recovery coefficient of η_t = 80% (at factory conditions).



Application example
EcoCond+ DN65-1 with 60,000 m³/h and air handling size HygCond 100

The extension variants of indirect evaporative cooling and integrated cooling enable an additional efficiency of the entire HVAC system.

INTEGRATED COOLING

For integrated cooling, the hydraulic unit of EcoCond+ is extended with a refrigeration system. The liquid-liquid heat exchanger for feeding in pumped cold water is replaced by a refrigerant heat exchanger for direct evaporation. Furthermore, a condenser is integrated in the exhaust air section of the air handling unit in order to transfer the extracted heat energy from the heat recovery circuit to the exhaust air.

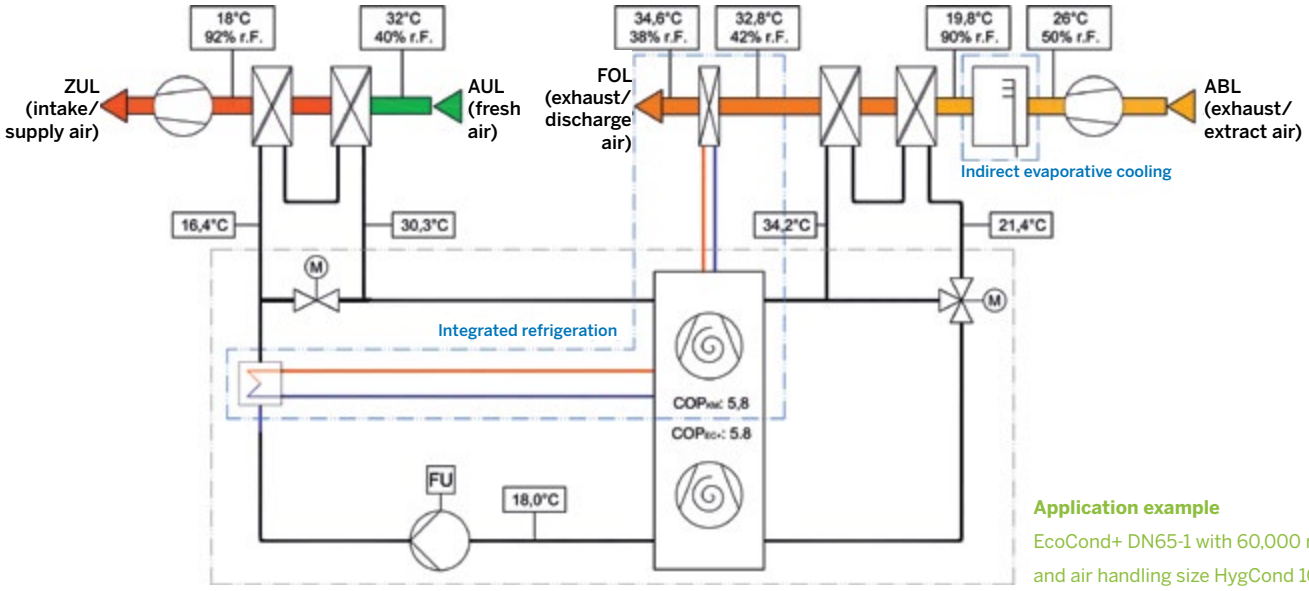
The integrated cooling decentralises the cooling supply for each air handling unit. This provides a significantly higher level of reliability in cooling mode. A central cooling supply with pumps, a distribution network and recooling system can be dispensed with if necessary.

INDIRECT EVAPORATIVE COOLING

Indirect evaporative cooling from the exhaust air enables reliable base load coverage in cooling mode, while simultaneously reducing the external cooling feed (PKW) by up to 55% (at factory conditions).

Humidification reduces the inlet temperature into the exhaust air heat exchanger (approx. 2.5 K per 1 g/kg humidification), allowing more heat to be transferred from the heat recovery circuit to the exhaust air in cooling mode.

Using the exhaust air condition and the efficiency of the humidifier, the DDC control system calculates the inlet temperature into the exhaust air heat exchanger. However, the humidifier is only activated when a certain difference between the inlet of the exhaust air heat exchanger and the fresh air temperature has been reached. This saves valuable resources and ensures that the humidifier is not operated uneconomically.



Application example
EcoCond+ DN65-1 with 60,000 m³/h and air handling size HygCond 100

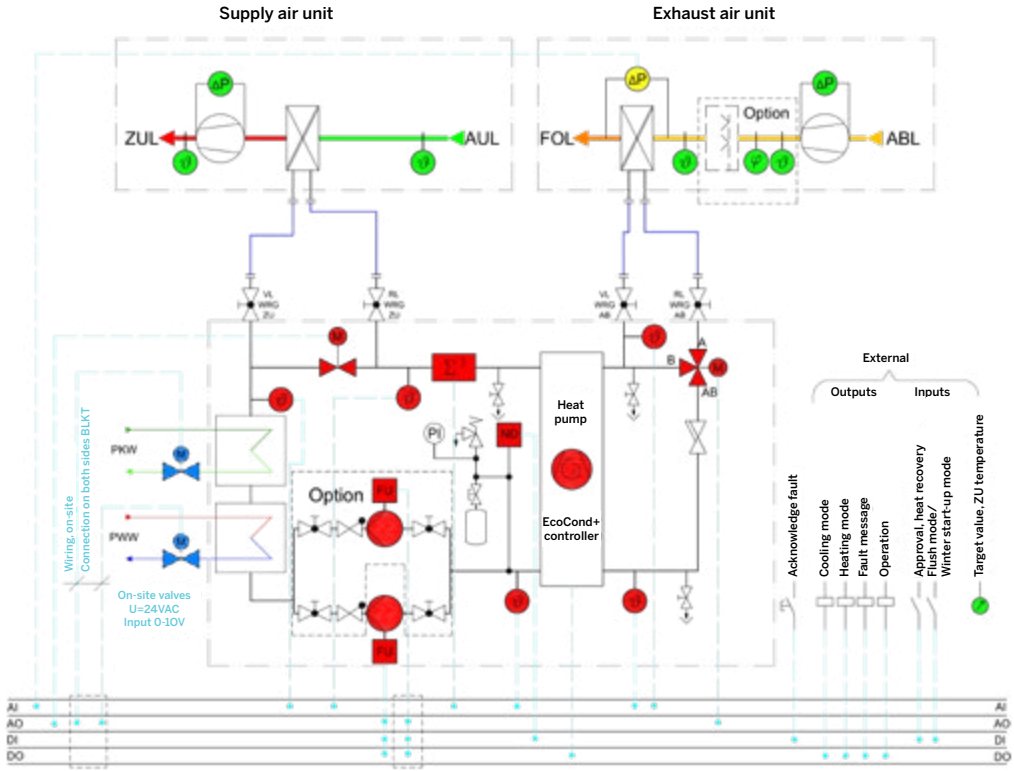
EcoCond+

INSTRUMENTATION AND CONTROL ENGINEERING SCOPE OF SUPPLY

- The ICE switch cabinet is wired entirely internally with all switching devices required for operation
- DDC control, freely programmable and can be upgraded
- Touch screen operation and WEB technology
- Internal unit wiring
- Engineering project management
- Creation of control diagrams, circuit diagrams
- Commissioning by in-house specialists
- Documentation
- Electrical connections for the customer's wiring
- Transmission of the measured values of the unit sensors using standard signals (0-10 V or 4-20 mA)
- Other communication options: Modbus, BACnet, (others on request)

OPTIONAL EXTENSIONS

- BACnet for the building management system connection
- Temperature measurement (air handling unit)
- Air volume measurement (air handling unit)
- Supply, installation, and connection of unit sensors (air handling unit)
- Overall transfer of control and regulation equipment of the air handling units incl. control of networked systems (heating, cooling, humidifier, steam generation, etc.)



Example control diagram
EcoCond+

BerlinerLuft.

Excerpt from the reference list

Location	Project[1]	Application	Variant	Amount	ε_t	SUP. total [m³/h]	ABL (exhaust/ extract air) total [m³/h]	Multi-functional use (according to VDI3803 sheet 5)			
								PWW PKW[2]	Ind. evap. cooling[3]	Comb.[4]	E-KRG[5]
Frankfurt a.M.	OMNITURM	Multi-function	Full version	6 pc.	75%	320,000	320,000	×	×	-	-
Luxembourg	Deloitte, Ban de Gasperich	Office	Full version, EcoCond+	4 pc.	Up to 74%	162,000	162,000	×	×	×	-
Hanover	Boehringer Ingelheim VRC	Clean rooms	Full version	1 pc.	79%	43,000	44,000	×	×	-	-
Kaiserslautern	Corning GmbH Halle 06-08	Process air	Full version	1 pc.	63%	100,000	100,000	-	-	×	-
Frankfurt a.M.	MARIENTURM	Multi-function	Full version EcoCond+	4 pc.	Up to 84%	270,000	270,000	×	×	-	-
Berlin	SGS-Gruppe	Lab	Full version	2 pc.	Up to 87%	50,500	95,700	×	-	×	-
Dassow	AqVida GmbH	Pharma	Full version	2 pc.	75%	48,000	46,000	×	×	-	×
Zschopau	Klinikum Mittleres Erzgebirge	OP area	EcoCond+	2 pc.	80%	66,000	66,000	×	-	-	-
Frankfurt a.M.	The Squaire	Office	Full version	36 pc.	76%	860,000	860,000	×	×	×	-
Lübeck	Uni-Kl. Schleswig Holstein	Operating theatre and social areas	Full version	22 pc.	75%	437,600	443,800	×	-	-	-
Warstein	Infineon Technologies AG	Clean rooms, social rooms	EcoCond+	3 pc.	88%	100,000	77,000	×	×	-	×
Köln	Stadtpalais Köln	Events, kitchen	Full version	2 pc.	Up to 75%	20,800	22,300	×	-	-	-
Darmstadt	Merck Q4	Process air	Full version	1 pc.	68%	14,000	18,350	×	×	×	-
Chemnitz	VW, Halle 100	Process air	Full version	1 pc.	70%	147,000	147,000	×	×	×	-
Reutlingen	Bosch Rt122	Kitchen	EcoCond+	1 pc.	78%	19,000	19,000	×	-	-	-
Hamburg	Albertinen Krankenhaus	OP area, adjoining rooms	Basic version	26 pc.	78%	130,000	130,000	-	-	-	-
Berlin	Bötzow Brauerei	Office	EcoCond+	1 pc.	>90%	11,000	11,000	×	×	-	×
Wiesbaden	Hess. Wirtschafts-ministerium	Conference room	EcoCond+	1 pc.	88%	9,000	9,000	×	-	-	-
Mainz	Sensitec	Process air	Full version, EcoCond+	5 pc.	85%	200,000	106,950	×	×	×	×
Mannheim	Das Quartier Q6 Q7	Multi-function	Full version	5 pc.	Up to 71%	64,000	63,140	×	×	-	-
Munich	HOFFSTATT	Multi-function	Full version	11 pc.	75	220,000	220,000	×	-	-	-

[1] Delivery of EcoCond I EcoCond+ incl. air handling units
[2] PWW/PKW = coupling and decoupling of heat (pumped warm water) or cold (pumped cold water)
[3] Ind. evap. cooling = indirect evaporative cooling from exhaust air
[4] Comb. = coupling of several supply air/fresh air units, with several discharge air/exhaust air units
[5] E-KRG = dehumidification cooling recovery (reheating with EcoCond I EcoCond+)

References

INFINEON TECHNOLOGIES AG, WARSTEIN

EcoCond+ incl. system extensions
PWW reheating, integrated cooling, dehumidification cooling recovery, indirect evaporative cooling, complete command of control and regulation functions for the air handling units

SCHÖNKLINIKEN VOGTAREUTH

EcoCond full version incl. system extensions
Double pump, reheating PWW, heat recovery coupling with 2 supply air and 2 exhaust air units, indirect evaporative cooling, complete command of control and regulation functions for the air handling units

MOUSONTURM, FRANKFURT AM MAIN

EcoCond+ incl. system extensions
PWW reheating, integrated cooling, dehumidification cooling recovery, indirect evaporative cooling, complete command of control and regulation functions for the air handling units

PWW reheating, integrated cooling, dehumidification cooling recovery, complete command of control and regulation functions for the air handling units, weatherproof version

JVA FRANKENTHAL

EcoCond full version incl. system extensions
reheating PWW, weatherproof version

GOETHE PLAZA, FRANKFURT AM MAIN

EcoCond full version incl. system extensions
reheating PWW, dehumidification cooling recovery, indirect evaporative cooling

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