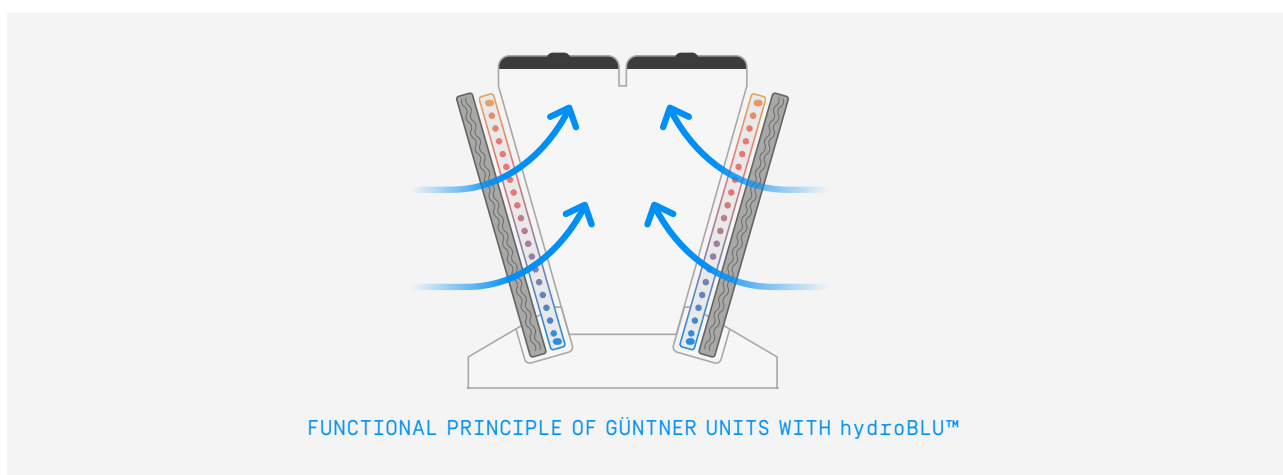


FUNCTIONAL DESCRIPTION

OF GÜNTNER UNITS WITH hydroBLU™

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With Güntner units equipped with hydroBLU™ pre-cooling, the air flow is used to cool the liquid fluid carried in the pipe coils of a finned heat exchanger. The functional principle of this system uses the effect of evaporative cooling to cool the intake air in a first step, and then cools the fluid itself (e.g. water, glycol or refrigerant) in a second step. Evaporation takes place, without any additional heat source, in the humidification pads that are attached to the air inlet sides of the unit.



FUNDAMENTAL PRINCIPLE

The unit operates either in dry or in wet mode, switching between these two (intended) operating modes takes place automatically via the unit's control device.

Both processes of wet operation:

1. Cooling of the air by evaporative cooling and
2. Cooling of the fluid by heat transfer (convection) take place separately from each other in terms of time and space.

The increased capacity due to the pre-cooling unit and the utilisation of evaporative cooling respectively allows the fluid temperature to be cooled below the ambient temperature. The theoretical cooling limit is the wet bulb temperature. This ensures low fluid temperatures also at high external temperatures, which in turn ensures energy-efficient operation of the plant as a whole.

For most of the operating time (presumably October to May), dry plant operation is possible depending on the design, i.e. evaporative cooling is not required during this period. The heat is dissipated purely convectively to the ambient air taken in. Wetting activation is required only from external temperatures of about 20 °C to 25 °C, depending on the design, fluid temperatures, plant load and ambient conditions (temperature and humidity of the ambient air).

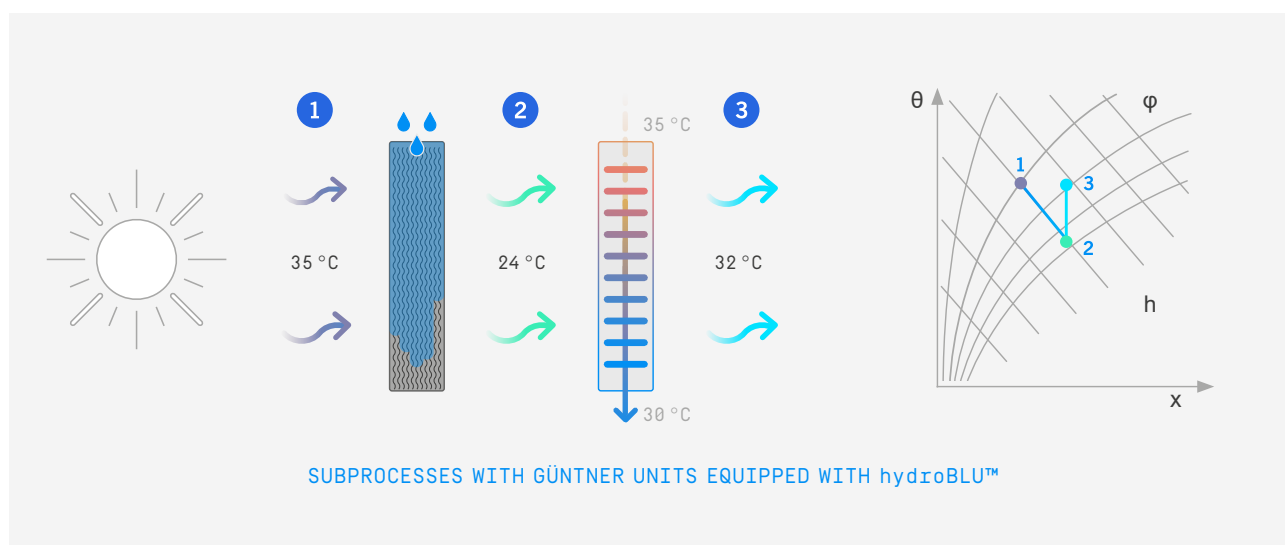
COOLING PROCESS

Humidification pads are installed at the air inlet sides of the unit. These pads consist of interconnected, corrugated cellulose sheets with additional impregnation to protect against decomposition and rotting. The water is distributed via distribution hoses arranged above the humidification pads. At the bottom of the pads, there is a drain channel and a drain connection respectively through which the non-evaporated residual water drains off. This water is not used again for distribution but fed to the wastewater instead. There is no recirculation.

Wetting takes place with excess water to minimise deposit effects and to ensure an additional cleaning effect.

The ambient air taken in by the fans, which is to be used to cool the fluid in the heat exchanger, absorbs the evaporating water as it flows through the humidification pads.

A 100 % saturation of the air is not achieved. The energy required for the change of state is taken from the air itself. This causes it to cool down adiabatically (isenthalpically) in front of the heat exchanger. The fluid is not directly cooled with water.



CONTROL

The automatic control of units with hydroBLU™ is based on the following principle: The fans compensate for fast and small capacity fluctuations via speed control. As soon as the capacity is no longer sufficient over a defined period of time (the fluid temperature setpoint increases), humidification or pre-cooling sets in.

When wetting starts, the integrated control (GMM/GHM water management) opens the control valve installed on the connection side and directs the water connected on-site (substances in water in accordance with installation instructions or water specification) to the water distributor above the humidification pads.

Smaller fluctuations are initially compensated for via the speed control of the fans. In case the capacity is insufficient, the control adjusts the humidification water volume. This principle ensures economical, resource-friendly use of energy and water. The fan speeds and the maximum air velocities respectively are adhered to in accordance with the specifications of the pad manufacturer.

To optimise water consumption, the temperature and humidity as well as the water volume are continuously measured and evaluated via the integrated control system. Based on the measured data and the specified target fluid temperature, the optimum water volume is calculated by the control system. After the calculated water volume has been applied to the humidification elements, the wetting switches off and the pads start to dry due to the continuous air flow. It is only when it is no longer possible to maintain the desired cooling temperature without additional water supply or without pre-cooling of the air that the pads are humidified again.

CLEANING

The pads and water distribution of the wetting system are easily accessible for inspection and cleaning work. Removable pads provide free access (of air) to the heat exchanger when required (for cleaning purposes as well as for dry operation at low external temperatures).