INFO

HTK-SE

Hybrid dry cooler
with self-draining function

- The alternative to a cooling tower
- For glycol-free systems

100 – 2,000 kW

JÆGGI Hybridkühler Hybridcoolers

JAEGGI – The Original

Since 1929, JAEGGI has been engaged in the development, production and sale of heat exchangers. Since 1995, the company has been part of the Güntner Group, a worldwide established manufacturer of components for refrigeration, air-conditioning technology and industrial applications with a total workforce of 2,600 people. Our production centres in Europe, America and Asia secure us direct market access and spare parts service worldwide.

JAEGGI places efficiency and eco-friendliness on an equal footing. Our products and services make an active contribution to lowering your operating costs and conserving resources.

Our heat exchanges carry hygiene certificates and are tested for no aerosol emissions. The ISO 9001 quality management system guarantees our customers premium quality and maximum reliability anywhere in the world.

Hybrid dry coolers from JAEGGI

JAEGGI is not only the inventor of the hybrid dry cooler, the company is also the technology and market leader.

Innovative, technological details show: JAEGGI is consistently developing its intelligent technologies. As an expert in hybrid heat exchangers with a high level of system competence, JAEGGI delivers premium quality and outstanding service.

Hybrid dry coolers

The hybrid dry cooler is a combination of air-cooled dry coolers and closed evaporative cooling towers, thus combining the advantages of conventional dry and wet cooling in a single product.

Designing hybrid dry coolers

Design software optimises the dry cooler for each individual application – taking into account the annual temperature variation at the site and the plant's expected load profile.

The result: Plume-free hybrid dry coolers with minimal noise emission and low water and energy consumption. Thanks to its lower operating costs, the payback period is quite short.

Operating characteristics of hybrid dry coolers

JAEGGI hybrid coolers can be operated like conventional dry coolers without wetting the heat exchangers. The energy is then dissipated to the ambient air via convection.

At high external temperatures or higher plant loads, wetting the heat exchangers increases the hybrid cooler's performance by a factor of two or three compared to dry operation: The system is then cooled by a combination of convection and evaporation.

Both modes offer an excellent dry cooler performance with a small footprint and low operating costs. The cooling limit, i.e. the theoretically best return temperature possible for the hybrid dry cooler is 4 Kelvin higher than the wet bulb temperature of the ambient air.

When it needs to be quiet:
JAEGGI – The Original

Modular system for easy on-site assembly

- Pre-assembled unit
- Large-scale units are delivered with unmounted fan units
- Delivered on a low-bodied vehicle
- In inclement weather, the unit may be delivered in a plastic film wrapping
- Ready for single crane lift off truck into position on the site

Wet or dry operation

JAEGGI hybrid dry coolers can be used either wet or dry.

Dry operation

– With no wetting of the heat exchanger it operates like a conventional finned dry cooler
– Energy is dissipated to the ambient air by convection

Wet operation

– For high external temperatures or higher cooling loads
– Two or three times the performance by wetting the heat exchangers
– Energy dissipated by convection and evaporation

Both modes can provide excellent dry cooler performance with a small footprint and low operating costs. The laws of physics constrain the achievable coolant outlet temperature of the HTK Hybrid High Performance® to approximately 4 Kelvin above the wet bulb temperature of the ambient air.

Benefit from our experience

Our experts will design the hybrid dry cooler specifically for your application and optimise it for its intended operation in the plant.

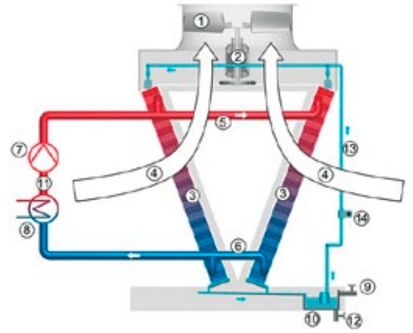
This takes into account:
– The climatic situation at the site,
– the annual temperature variation, and
– the plant's expected load characteristics.

This is the only way of ideally dimensioning the dry coolers and minimising the cost of operating the entire plant. If you wish we can also supply you with an efficiency calculation.

When it needs to be efficient:
JAEGGI – The Original

View of a standard hybrid cooler system (without self-draining function)

1. Fan
2. Fan drive
3. Heat exchanger
4. Air flow
5. Flow
6. Return
7. Pump for primary circuit
8. Heat source
9. Make-up water
10. Low volume basin (used only in wetted mode)
11. Primary circuit
12. Blowdown
13. Wetting water circuit
14. Conductivity measurement



Hybrid dry cooler instead of open cooling tower

Optimised for water as heat carrier
– With JAEGGI self-draining function
– Purely mechanical solution
– Special coil geometry
– The primary circuit can be drained without activating any electrical or mechanical components.

Construction can be modified to suit your particular premises
– Modular series with a variety of dimensions and heights
– Height: 3 – 5 m
– Length: 3 – 6 m
– Power range: 200 – 2,000 kW

Unique JAEGGI self-draining function
– The coils of the self-draining HTK SE dry cooler are angled to ensure complete drain.
– To protect the system from corrosion, the drain into an existing frost-proof storage tank is necessary.

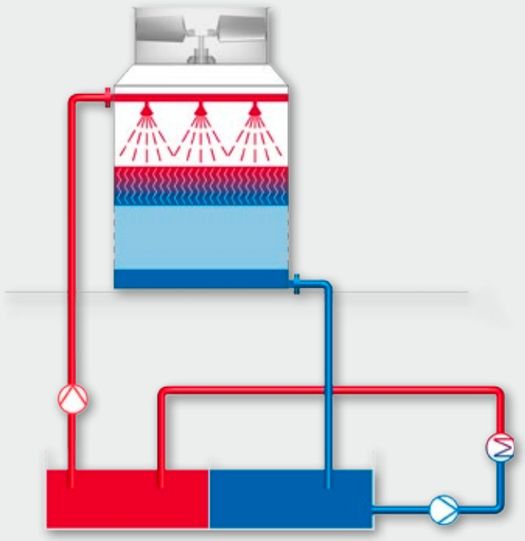
System comparison: Replacing an open cooling tower by the HTK-SE

	Open cooling tower	Hybrid self-draining dry coolers	
Total power	1,000 kW	1,000 kW	
Medium temperature	34/29 °C	34/29 °C	
Design state, wet	34 °C/31,3 %	34 °C/31,3 %	
Design state, dry	-	16.8 °C	
Concentration factor	3	3	
Power consumption in kWh per year	58,465	58,465	
Additional water costs in €/m³	3	3	
Wastewater costs in €/m³	1	1	
Electricity contract price in €/kWh	0.1	0.1	
Investment costs	€30,000	€101,555	**3.4 times the investment**
Water costs in € per year	50,703	7,968	**84 % saved**
Operating costs in € per year	63,763	27,922	**56 % saved**

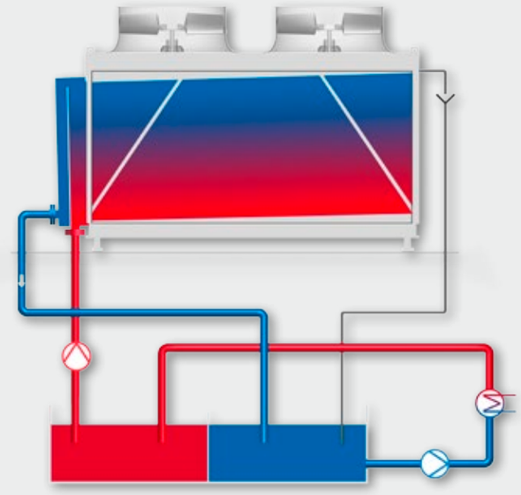
Replacing an existing open cooling tower

– Plant remodelling effort
– No contamination of the primary system
– Hygienic operation with low maintenance costs
– Enormous reduction in water consumption and cost (sample design uses about 84 % less water)
– Enormous reduction in operating costs (sample design has about 56 % lower operating costs)
– Significant reduction in the use of chemicals (biocides, stabilisers, inhibitors)
– Much quieter operation

Conventional cooling tower system → **Can be replaced with little effort** → **JAEGGI's hybrid dry coolers**



Cooling circuit with a conventional open cooling tower



Cooling circuit with a semi-open hybrid dry cooler

HTK-SE optimised for glycol-free operation

Exhibits the following advantages compared to a conventional system with 30/70 % glycol/water mixture:

– 10 % higher heat capacity
– Lower temperature level, enabling higher EER
– Requires less dry cooler performance
– Permits smaller pumps and pipework
– Eco-friendly operation using pure water, no need for water-polluting substances such as glycol
– No glycol collection basin required
– No deterioration of the glycol charge
– No need for plate heat exchangers to segregate systems
– Dry cooler can be drained and is therefore frost-proof

Comparison between a dual-circuit system with a glycol circuit, and a semi-open system with HTK-SE

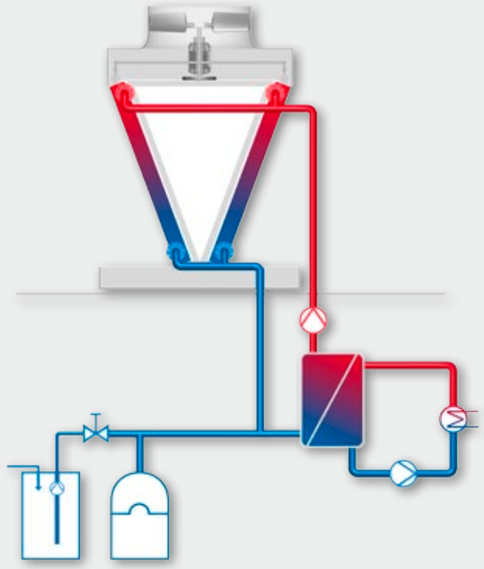
	HTK-SE 2.4/5.45	HTK 2.4/6.6	
Total power	1,000 kW	1,000 kW	
Medium	100 % water	30 % glycol/70 % water	
Medium temperature	34/29 °C	34/29° C	
Design state, wet	34 °C/31.3 %	34 °C/31.3 %	
Design state, dry	-	16.8 °C	
Investment costs	€96,790	€120,478	**20 % saved**
Unit size			**17 % lower**
Water consumption			**13 % saved**
Operating costs			**9 % saved**

Hybrid dry cooler with glycol

This schematic shows a conventional system with glycol circuit, plate heat exchanger and other necessary components. Using a plate heat exchanger to segregate the system broadens the temperature spread in the glycol circuit. Using glycol reduces the heat capacity, making it necessary to use a larger heat exchanger.

Conventional system:

– Closed glycol circuit, glycol filling station, pressure maintenance
– May need sizeable pumps and pipework
– Plate heat exchanger
– Separate primary and secondary cooling water circuits

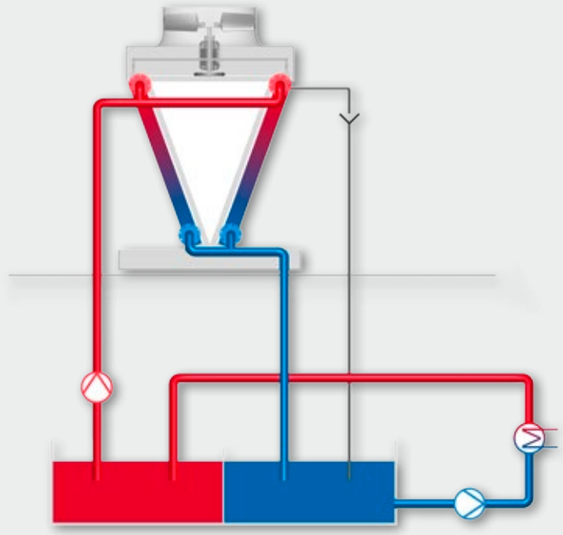


Hybrid dry coolers (self-draining)

This schematic shows an HTK-SE and a storage solution with hydraulic separation, which – due to the lower temperature difference and the absence of glycol – is thermodynamic and more cost-effective (elimination of built-in components, glycol, plate, generally smaller unit).

System with 100% water:

– Storage tanks for hydraulic separation
– Primary water circuit



HYBRIMATIC – Intelligent control saves operating costs

The efficient operation of hybrid dry coolers depends very much on the intelligence and strategy of their functional control. The built-in control continually controls all the significant parameters and automatically adapts the operating mode to the current system state. This guarantees a smooth and efficient unit operation and compliance with the predicted consumption values.

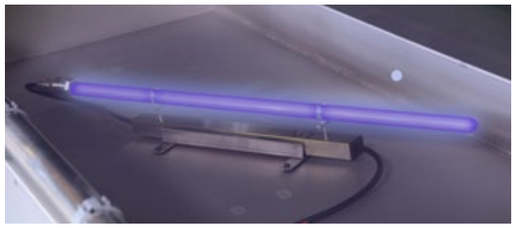
The HYBRIMATIC is designed as a programmable logic controller and allows for:
– Control the cooling water outlet temperature
– Wetting water management
– Output of operational and fault signalling
– Communication with building management systems

In addition, the Hybrimaster® controller, for hybrid coolers installed in parallel, also maximises energy efficiency and water conservation, thus contributing to reducing your operating costs.

Customer benefits from our controller

– Optimised operation of individual units
– Optimised joint operation of up to eight individual units
– Parameters can easily be set for ideal use in a variety of applications
– Low operating costs
– Easily integrated into your building management system by conveying operational messages via contacts or a bus system
– Easy to install, supplied ready for connection
– Compact, adaptable and expandable

Optional equipment for your HTK-SE



UV sterilisation

To minimise biological growth in the low volume basin, also includes basin covers. The alternative to biocides.

Anti-pollen filters

To minimise the introduction of biological contaminants into the low volume basin

Exhaust attenuators

To further reduce noise emissions

Overview of HTK options:

Fan optimisation	– To further reduce noise emissions – Air flow optimisation
Heater for low volume basin	– Allows for wet operation also during lower external temperatures
Winter curtains	– To minimise the introduction of contaminants when the equipment is unused for long periods
Insulated headers	– To reduce the heat required when re-filling the unit at low external temperatures

High-yield investment

Saves money, saves resources

In contrast to conventional, open cooling towers, choosing self-draining HTK-SE dry coolers from JAEGGI gives you a resource-efficient unit that rapidly pays for itself.

This unit uses around 70 to 90 % less water than a conventional open cooling tower, which represents a worthwhile saving – particularly for such a long-term durable product. A representative comparison between a wet cooling tower and a hybrid dry cooler from JAEGGI was compiled on the basis of a system in use at a production facility in Munich, operating three shifts for a year-round constant load of 1,000 kW. In this system the coolant temperature was cooled from from 38 °C to 28 °C.

During cooler periods or operation at partial load, the JAEGGI HYBRIMATIC controller operates the heat exchangers entirely dry, i.e. with convective heat transfer to the ambient air. Only when dry operation is unable to achieve the required cold water temperature, it switches automatically to the secondary wetted mode. In this particular example, the switchover point for dry operation is at an ambient temperature of 18 °C.

At the Munich site, the water consumption of the hybrid dry cooler (lost to evaporation and for blowdown at 3-fold concentration) over a period of one year was 1,210 m^3 with a wastewater volume of 403 m^3. If a wet cooling tower had been installed instead, this would have consumed 15,060 m^3 of fresh water and generated 5,020 m^3 of wastewater. As you see, in this example, using hybrid dry cooling reduced the water consumption by over 90 %.

Conclusion

Purchasing a hybrid dry cooler not only saves enormous operating costs, it also protects the environment and our dwindling resources such as water. In this example, investing in the HTK-SE has already paid for itself after 2 years.

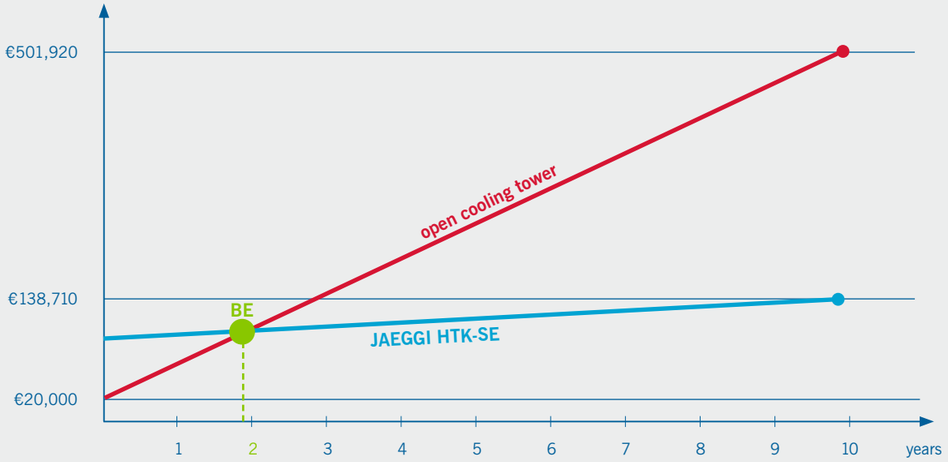
Operating characteristics over one year

Ambient air temperatures (operating state)			Cooler's operating mode		Fan speed	Water consumption		Total energy consumption	Operating hours	Cooling capacity	Coolant	
from [°C]	to [°C]	RH %	dry	wet	%	Fresh water [m^3]	Wastewater (E = 3) [m^3]	[kWh]	h	[kw]	Inlet [°C]	Outlet [°C]
-29	-20	0	1	0	28	0	0	2	5	1,000	38	28
-20	-17	0	1	0	30	0	0	7	16	1,000	38	28
-17	-14	0	1	0	31	0	0	19	38	1,000	38	28
-14	-11	0	1	0	34	0	0	47	77	1,000	38	28
-11	-8	0	1	0	36	0	0	97	129	1,000	38	28
-8	-5	0	1	0	39	0	0	257	276	1,000	38	28
-5	-2	0	1	0	42	0	0	649	552	1,000	38	28
-2	1	0	1	0	45	0	0	1,911	1,263	1,000	38	28
1	4	0	1	0	50	0	0	1,952	972	1,000	38	28
4	7	0	1	0	55	0	0	2,635	959	1,000	38	28
7	10	0	1	0	62	0	0	4,117	1,038	1,000	38	28
10	13	0	1	0	72	0	0	6,894	1,117	1,000	38	28
13	16	0	1	0	87	0	0	10,769	1,005	1,000	38	28
16	18	0	1	0	100	0	0	7,289	446	1,000	38	28
18	19	66	1/2	1/2	77	187	63	1,430	175	1,000	38	28
19	22	60	1/2	1/2	89	456	153	4,518	374	1,000	38	28
22	24.1	56	1/2	1/2	99	223	74	2,768	165	1,000	38	28
24.1	25	55	0	1	53	100	33	201	53	1,000	38	28
25	28	48	0	1	56	176	59	357	84	1,000	38	28
28	31	41	0	1	59	59	20	123	26	1,000	38	28
31	33	36	0	1	61	9	3	18	4	1,000	38	28
						1,210	**403**	**46,060**	**8,760**			

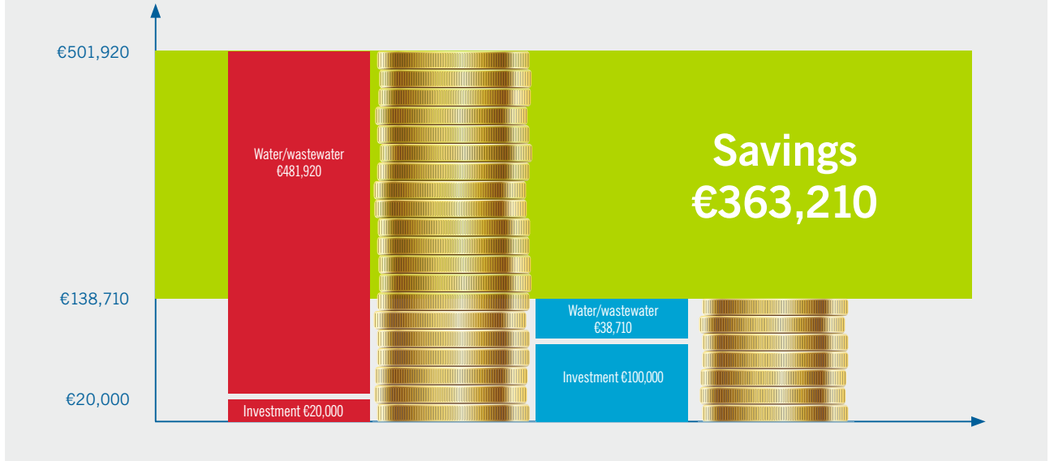
Operating characteristics: 1,000 kW, cooling from 38 to 28 °C with WBT = 21 °C

Cost of additional water €/m^3	3	3
Cost of wastewater €/m^3	1	1
Electricity contract price €/kWh	0.1	0.1

JAEGGI HTK-SE soon pays for itself

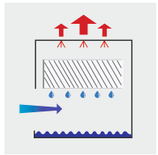


€363,210 saved in 10 years

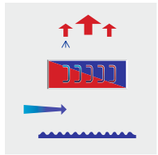


System comparison

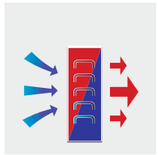
Comparison and evaluation of the available cooling technologies according to a number of criteria:



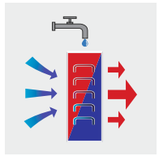
open cooling tower



closed cooling tower



dry cooler



JAEGGI HTK-SE

	open cooling tower	closed cooling tower	dry cooler	JAEGGI HTK-SE
Low cooling water temperature	●●●●	●●●○	●○○○	●●●○
No introduction of contamination	●○○○	●●●●	●●●●	●●●●
Low energy consumption	●●●○	●●●○	●●○○	●●●●
Low water consumption	●○○○	●○○○	●●●●	●●●○
No aerosols or plumes	●○○○	●○○○	●●●●	●●●●
Low sound level	●○○○	●○○○	●●○○	●●●○
Investment costs	●●●●	●●●○	●○○○	●○○○

●○○○ not so good ●●●● very good

JAEGGI Hybridtechnologie AG
Hirschgässlein 11
CH-401 Basel

www.jaeggi-hybrid.ch

Members of Güntner Group

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