



# PROCESS HEAT PUMPS

For industry, power stations and process engineering



# INNOVATIVE TECHNOLOGY



## Experience counts

For centuries, we have been building high-capacity heat pumps, with highest energy efficiency and best operational safety. Our reference objects for deployment in the heating and cooling of buildings, industrial heat recuperation as well as process engineering are proof of this.

### Energy efficiency is required

For reasons of economy, environmental protection and, last not least, the implementation of the EU-energy efficiency guidelines, as well as national energy efficiency guidelines, industry and administration are required to use existing heat energy efficiently. We have re-engineered its high-capacity heat pumps series continuously in recent years. The aim of this research and development programme was especially:

- » the increase of the flow temperatures up to 95 °C
- » the re-design of control and regulation systems

### Control

- » Micro-processor control 10" Touch Panel, with which the desired system values are entered and the actual values clearly displayed. The system is visualised by means of an hydraulic schematic, including status display. Pop-up menus show the operational conditions/data points of the system components and of the compressors. All measured values are recorded and regulated continuously and in real time. Interfaces are integrated for tele-monitoring purposes. Any alarms are displayed optically.
- » SmartGrid-application for the use of low-tariff times and heat storage.
- » Communication-capable control for a simple integration into the building's management engineering system for networking by MODBUS®.
- » Continuous tele-monitoring and recording of the operational conditions possible via LAN or Internet. Remote technology for access via the internet.





- » The control has been developed especially for the high-performance compressor with Economizer in heat pump operation as well as for the two-stage high-temperature refrigerant circuit.
- » Periphery control allows the control of circulation pumps and valves as well as the switching of heating, active and passive cooling and buffer management.

#### **In-house test bench for high-capacity heat pumps**

The basis for the development of cutting-edge technology is the in-house test bench.

We operate a testing laboratory especially for high-capacity machines, on which full-load tests up to 800 kW capacity according to EN14511, as well as under field conditions can be carried out.

This ensures trust and safety for the customer. If they wish, they can be present during testing.

## Safety working fluid

**Using its long-term experience in process use as well, We has developed high-temperature machines with safety working fluid. This represents a real breakthrough in high-temperature heat pump technology.**

Comparable temperatures have up to now only been reachable by use of CO<sub>2</sub> as refrigerant, however leading to restrictions on the heat use side.

The high-temperature refrigerants of ours, such as ÖKO1 are non-flammable safety refrigerants. Therefore, extensive safety and maintenance work is not necessary. Due to the low pressure system and further thermo-dynamic properties of ÖKO1, a complex high-pressure circuit can be avoided as well as a high temperature spread on the heat use side.

ÖKO1 is furthermore, due to the low greenhouse effect potential GWP, both future safe and ecologically sound.

# HIGH TEMPERATURE



## Series mid-temperature Industrial heat pumps with screw compressors

75°

### Compressor

- » Screw compressors for continuous industrial use.
- » These have no oscillating components and thus have a low vibration as well as wear-free operation.
- » The performance regulation is by means of the regulation piston in the compressor.
- » Electronic OeCC injection technology, dependent on the source temperature.

### Series IWWS, single stage cooling circuit

- » Refrigerant R134a
- » Ratings from 110 to 665 kW
- » Heat source temperature between 8°C and 32°C
- » Heat use flow temperatures up to 75°C
- » Shell and tube heat exchanger for evaporator and condenser

## Series high-temperature Process heat pumps with screw compressors

95°

### Compressor

- » Screw compressors in special version for high-temperature use.
- » These do not have any oscillating components and therefore have a low vibration as well as wear-free operation.
- » Oil cooling provides a correct bearing lubrication at high operating temperatures.
- » The performance regulation is by means of the regulating piston in the compressor.

### Electronic OeCC injection technology

- » Own injection nozzle for evaporator and Economizer.
- » Highest COPs can be achieved by means of the precise overheat regulation
- » The stable overheat across the complete range of use allows a high evaporator utilization.
- » High operational safety due to the permanent monitoring of the compressor.



# PROCESS HEAT PUMPS



## Series IWWHS / ISWHS Single stage refrigerant circuit

45° > 95°

- » The direct use of heat source temperatures between 35°C and 55 °C allows the generation of up to 95°C flow temperatures with high COPs.
- » Brine or water as heat source
- » Use of shell and tube heat exchangers for evaporator and condenser
- » Refrigerant: ÖKO1 (HFKW / HFC) with low GWP

### Range of performance

- » 60 kW to 640 kW

## Series IWWHSS Two-stage refrigerant circuit

10° > 95°

- » Heat source temperatures between 8 and 25°C allow the generation of up to 95°C flow temperatures
- » Use of shell and tube heat exchangers for evaporator and condenser
- » Use of plate or shell and tube heat exchangers for interim heat exchanger
- » Refrigerant in the first stage R134a
- » Refrigerant in the second stage ÖKO1 (HFKW / HFC) with low GWP
- » Specially developed start-up control

### Range of performance

- » 190 to 750 kW





# USE

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## Use of geothermal energy or low-temperature waste heat

- » from 8°C to 32°C for the generation of space or process heat up to 75°C (IWW5 Series)
- » from 4°C (brine) resp. 6°C (water) up to 25°C for the generation of space or process heat up to 95°C (IWWHSS Series)

The heat source ground water is suitable for reaching heat use temperatures up to 75°C and 95°C respectively. With simultaneous cooling and heating loads, the cooling network is used as the heat source, thus achieving a double usage.

## Use of medium-temperature waste heat

- » from 35°C to 55°C for the generation of process heat up to 95°C (IWWHS / ISWHS Series)

In power station engineering, in mechanical processes or especially for cooling processes in the chemical, pharmaceutical and food-stuffs industries, medium-temperature waste heat is in abundance and free-of-charge, but cannot be further exploited using conventional heat exchangers. Using heat pumps, this medium-temperature waste heat can be brought up in efficient fashion to a usable temperature level.

For the first time, heat flows at these temperature levels can be directly used with high efficiency by heat pumps using safety working fluids, and flow temperatures of up to 95°C can be reached economically.

In many cases, the cooling function on the heat source side can be used simultaneously with the heating function.

## Heat pump circuit as cooling process/ cooling water heat recuperation

The heat pump circuit as a cooling process can in many cases be a useful substitute for cooling towers and "energy destruction systems" and/or recover heat from cooling water of every kind. When at the same time heat (up to 95°C) is needed elsewhere in the process, the highest COPs and thus highest efficiencies can be achieved.



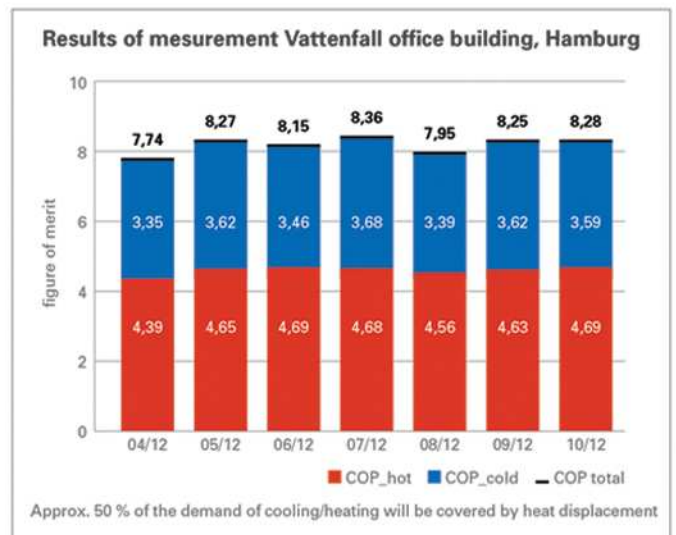
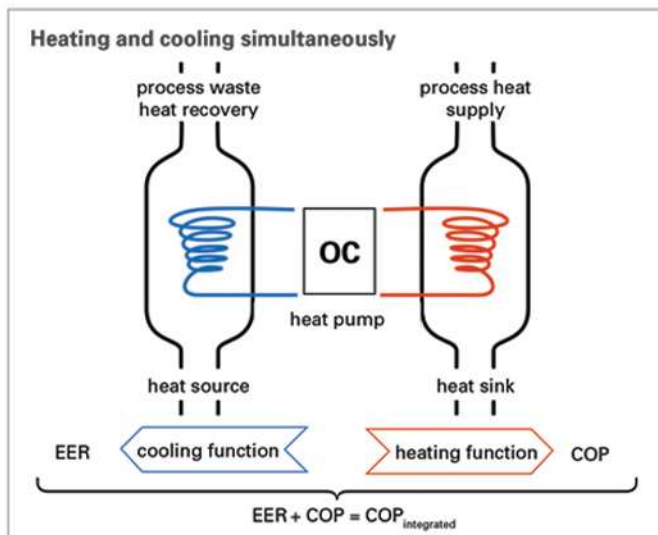
# PROCESS HEAT



Vattenfall office building, Hamburg

## Heating and cooling simultaneously

When using the heat pump's cooling and heating function simultaneously, the performance factors of the heating (COP) and cooling (EER) operation can be added together. Doing this, phenomenal energy efficiency and economy is achieved.  
 (COP heating + EER cooling = COP integrated)





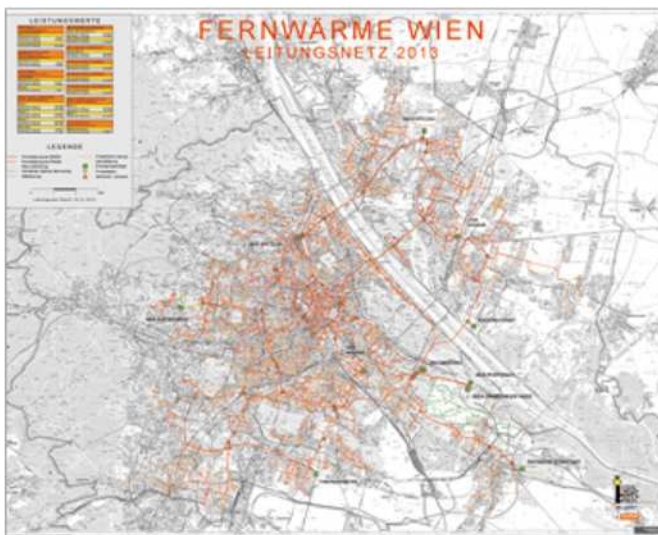
# DISTRICT HEAT



High-temperature heat pumps as District-Boost in the district heating system, Vienna

## Increasing the district heating performance and efficiency

High-temperature heat pumps can raise the low return temperatures in district heat networks to a useful level and thus increase the capacity of the network without having to extend it. If cooling of the return temperatures is desired, the heat pump will increase the system efficiency.



Heat pump utilization as District Boost, also for the exploitation of regulation energy/minute reserve for heat feed into an existing store in the form of a district heat network.

# HEATING PLANT

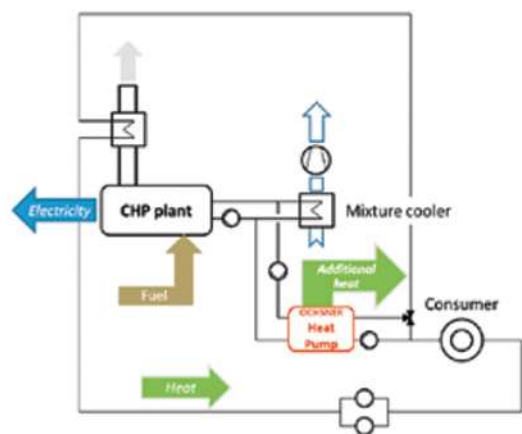


## Heat recovery in heating plants and CHPs/Thermal Power Stations TPSs

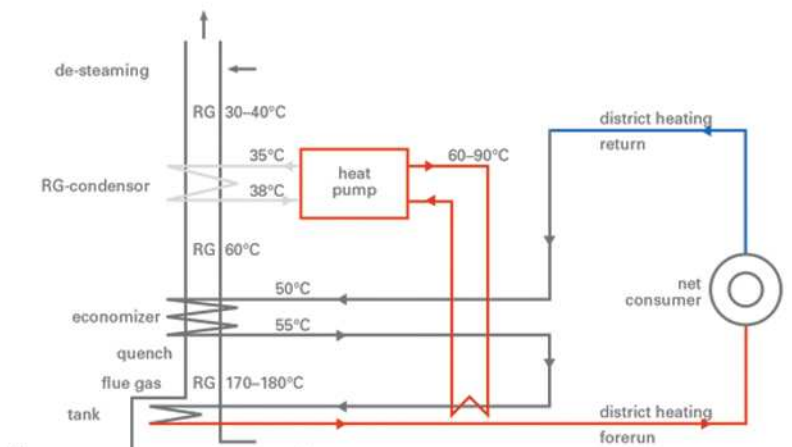
In spite of the installation of Economizers, there is normally unused latent heat still in the flue gasses. This can be recovered by using process heat pumps. Furthermore, additional heat of condensation will be set free. Increase in efficiency and reduction of the fuel consumption/biomass consumption are the main advantages for the operator.

In CHP/TPS systems, the cooling water (mixture coolant) can be used as the heat source. The cooling towers, and thus the "destruction of energy" can thus be eliminated. Instead, additional useful heat on a high temperature level will be generated. The exhaust air or exhaust gasses can also be used as a heat source.

**Simplified schemata for increasing the total efficiency of TPS/CHP systems by high-temperature heat pumps.**



**Simplified schemata for heat recovery from flue gases by means of high-temperature heat pumps.**





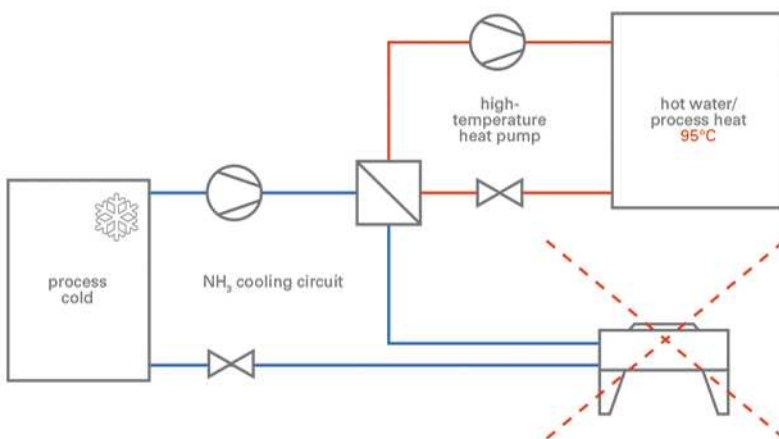
# COOLING SYSTEMS



## Heat recovery from $\text{NH}_3$ cooling systems for hot water generation

By using free waste heat from cooling systems, the load on the heat destruction system which is normally needed will be reduced (cooling tower, air reverse cooler) and thus costs saved. At the same time, hot water will be heated more or less free-of-charge up to 95°C, this water being required in large quantities in foodstuff plants, dairies, slaughterhouses and in the beverage industry.

**Simplified schemata for heat recovery from cooling plants by means of high-temperature heat pumps.**



# PROCESS HEAT



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