Heat pumps for industrial applications and district heating

Green electricity means lower heating rates
compHEAT

compHEAT is a large range of heat pumps for many different purposes. Advansor is one of the first companies in the world to develop a commercial heat pump perfectly adapted to North European conditions relating to district heating. The heat pumps are the result of more than 10 years of experience and development. The process is based on the natural refrigerant, CO₂, which allows achieving high coefficients of performance at high temperatures. The heat pumps are reliable and have low maintenance costs.

- Environmentally friendly refrigerant
- Based on more than 10 years’ experience
- High flow temperatures
- Reliable
- Advansor is the world’s largest producer of transcritical CO₂ systems

Why use CO₂?

compHEAT units from Advansor only use one single refrigerant - CO₂. CO₂ is neither flammable nor toxic, making it an attractive refrigerant, both in terms of production, installation and operation of the system. CO₂ meets all Danish and international requirements for refrigerants, present and future. By selecting a compHEAT Advansor unit, neither the installer nor the end user need worry about new laws and taxes in the future.

Reduced CO₂ emissions

Electric heat pumps can be used to reduce the proportion of heat production that is based on fossil fuels. When used as primary production, it is possible to reduce CO₂ emissions by 20% or more, depending on the optimal distribution of electricity demand over time.

Green electricity gives low heating prices

Green electricity may be based on wind power, wave power, solar cells or generators that run on biomass fuels. Using self-produced green electricity to power a heat pump allows taking advantage of some of the lowest heating prices on the market.

The advantages of compHEAT

- 100% environmentally friendly unit
- Non-toxic, non-flammable refrigerant
- Only one refrigerant
- No greenhouse effect, GWP = 1
- No ozone-depleting potential
- No zone classification needed
- Compact construction
- Low noise level
- Low installation requirements
- Easy to maintain
- Low energy consumption
- Low installation costs
- Low maintenance costs
- Future-proof solution
compHEAT S

A compHEAT S unit is designed as a simple heat pump. The discharge gas from the compressor flows directly to a gas cooler/condenser, where the gas is cooled by heat exchange with the water/liquid from the heat user. The cooled gas then flows to an expansion valve (high pressure valve), which keeps the pressure in the refrigerant at an optimal level, given the operating conditions. From the expansion valve, the gas flows through the evaporator, where it absorbs energy at low temperature. The unit is equipped with a low pressure receiver, rated to 90 bar pressure, preventing the refrigerant from leaking when the unit is not in operation.

All components of the control system for power, oil, and pressure regulation are placed on a control system where parameters can be monitored and controlled. This means that communication with, and supervision of, the unit can be made via a single network.

By default, at least one compressor is controlled by a frequency converter, thereby achieving optimal power control. This provides improved temperature control, especially on smaller systems.

The compHEAT S model is a heat pump of the standard model, with 1-3 compressors and a heat capacity of 100-400 kW.

compHEAT L and compHEAT XL

A compHEAT L/XL unit is designed as a simple heat pump. The discharge gas from the compressor flows directly to a gas cooler/condenser, where the gas is cooled by heat exchange with the water/liquid from the heat user. The cooled gas then flows to an expansion valve (high pressure valve), which keeps the pressure in the refrigerant at an optimal level, given the operating conditions. From the expansion valve, the gas flows through the evaporator, where it absorbs energy at low temperature. The unit is equipped with a low pressure receiver, rated to 80 bar pressure, preventing the refrigerant from leaking when the unit is not in operation.

All components of the control system for power, oil, and pressure regulation are placed on a control system where parameters can be monitored and controlled. This means that communication with, and monitoring of, the unit can be made via a single network.

By default, at least one compressor is controlled by a frequency converter, thereby achieving optimal power control. This provides improved temperature control, especially on smaller systems.

The compHEAT L model has between 4 and 8 compressors with a heat capacity of up to 1000 kW. The compHEAT XL model has between 9 and 16 compressors with a heat capacity of over 2000 kW.

### Table of Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Compressors</th>
<th>Heating capacity [kW]</th>
<th>Cooling capacity [kW]</th>
<th>Length [mm]*</th>
<th>Height [mm]*</th>
<th>Width [mm]*</th>
<th>Weight [kg]*</th>
</tr>
</thead>
<tbody>
<tr>
<td>compHEAT S</td>
<td>2-3</td>
<td>100-350</td>
<td>80-280</td>
<td>3500-5000</td>
<td>2000</td>
<td>800</td>
<td>1000-1200</td>
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<tr>
<td>compHEAT L</td>
<td>4-8</td>
<td>350-700</td>
<td>300-560</td>
<td>4000-6000</td>
<td>2500</td>
<td>2000</td>
<td>2000-4000</td>
</tr>
<tr>
<td>compHEAT XL</td>
<td>9-16</td>
<td>700-2000</td>
<td>560-1600</td>
<td>5000-7000</td>
<td>2700-3000</td>
<td>2500</td>
<td>4000-12000</td>
</tr>
</tbody>
</table>

* Dimensions and weights are approximate, they may vary slightly.
Using energy from the nature to power district heating

Transcritical heat pumps use electricity to produce heat at high temperatures, which can be used in district heating systems. Heat pumps can absorb energy from a low temperature environment and convert it into heat energy at high temperature. The ratio of the produced heat energy to the electrical energy used by heat pumps - which is called the coefficient of performance - is between 2.5 and 4.7, see table.

Performance and efficiency

Electric heat pumps absorb heat at a low temperature on the cold side and delivers hot water on the warm side. The temperature of the medium supplying heat to the cold side is in the range -5°C to 15°C. As with conventional heat pumps, the coefficient of performance is increased by increasing the evaporation temperature. The transcritical heat pump is different from condensing heat pumps in two important ways:

- The outgoing water temperature can be increased without a significant increase in energy
- Cooling down of the return water gives a significant increase in the coefficient of performance

Transcritical heat pumps are superior in applications where there are high temperature differences, but they are on the other hand not suited for applications with small temperature differences.

Industrial use

The advantageous characteristics of transcritical heat pumps at high temperatures can also be used in the industry for efficient heating of tap water. In the food processing industry, large quantities of hot water are often used for cleaning, while at the same time there is a great need for cooling.

In those cases, transcritical heat pumps are extremely attractive - either as a separate cooling system or as a condensing system in addition to the existing refrigeration system - generally one which has ammonia as coolant.

Temperature range
- Hot water temperature: 70 - 90°C
- Evaporation temperature: -5°C to +15°C
- Coefficient of Performance: 2.5 to 4.7
- Turnkey solution

<table>
<thead>
<tr>
<th>District heating</th>
<th>Tap water</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Evaporation temperature</strong></td>
<td><strong>Water in / out</strong></td>
</tr>
<tr>
<td><strong>Water in / out</strong></td>
<td><strong>30 / 70</strong></td>
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<tr>
<td>°C</td>
<td>°C</td>
</tr>
<tr>
<td>-5</td>
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<tr>
<td>0</td>
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<tr>
<td>10</td>
<td>3.8</td>
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<tr>
<td>15</td>
<td>4.2</td>
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