FAHRENHEIT
Cooling Innovation.

General Operating Manual (GOM)
for Adsorption Chillers
We work continuously on our documents to keep them up-to-date and error-free. Despite all efforts, mistakes can never be ruled out completely. Any hint is welcome.

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Warranty

In accordance with the Machinery Directive 2006/42/EC, the adsorption chiller (AdKA) of Fahrenheit GmbH are treated as incomplete machines.

Fahrenheit GmbH assumes no warranty or other liability towards the operator or third parties if personal injury or damage to property is attributable to one or more of the following causes by the operator or a third party:

» Improper use of AdKA (Chapter 2.7)
» Non-compliance with the instructions in the operating and installation manuals
» Non-compliance with the specified operating limits and condition (Chapter 2.3)
» Improper installation, commissioning, operation or maintenance of AdKA
» Unconventional changes in AdKA
» Use of unauthorized accessories or prohibited spare parts
» Use of unauthorized working fluid (Chapter 4.7)

During initial commissioning, AdKA is adapted to the system in which it is to be integrated. Therefore, initial commissioning must be carried out by a certified service technician or an employee of Fahrenheit GmbH. Fahrenheit GmbH does not accept any liability for damage resulting from failure to comply with this requirement.

AdKA has undergone numerous tests and validation procedures. Nevertheless, deviations from the specified values may occur with regard to the cooling capacity and efficiency.
Safety and Warnings Information

If AdKA is used as intended (Chapter 2.7) and the general safety measures are followed, there is not danger potential for the user.

All the operations on AdKA must be carried out only by qualified personnel and in compliance with the complete Operating & Mounting Instructions (Chapter 1).

The following symbols are used in this General Operating Manual to draw attention to dangers and their prevention when working on AdKA.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Actions to be observe</th>
</tr>
</thead>
</table>
| ![WARNING Electric shock!](electric-shock.png) | Exposed live electrical parts due to improper connection. | » Work on the system should only be carried out when it is de-energized.  
   » Even after the system has been de-energized, residual energy may be present.  
   » Please read the TDI before starting with the power wiring. |
| ![WARNING burns or scalding!](burns.png) | Hot water may be spilled in case of leakage. Hot uninsulated components inside the device. | » Check the hydraulics carefully for leaks before starting any work.  
   » Avoid contact with hot surfaces.  
   » Wear suitable protective gloves.  
   » Repair damaged insulation. |
| ![WARNING cutt injury!](cut.png) | Sharp and pointed edges on housing parts or tube ends. | » Wear suitable protective gloves. |
| ![WARNING bruises!](bruises.png) | Hard to mount or move housing parts. | » Open or dismount housing parts with extreme caution.  
   » Only place AdKA on level and stable surfaces.  
   » Use suitable safety devices and technical aids during transport. |
| ![WARNING destruction by frost!](frost.png) | Freezing fluids can destroy parts of the system. | » Installation and storage of AdKA has to be in a frost-free room.  
   » All the system components must be protected against frost by suitable measures. |
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Actions to be observe</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="DANGER" /></td>
<td><strong>environmentally hazardous substances!</strong>&lt;br&gt;Environmentally hazardous heat transfer mediums or refrigerants.</td>
<td>» Wear suitable protective gloves&lt;br&gt;» Do not allow heat transfer mediums or refrigerants to leak into the environment!&lt;br&gt;» Avoid inhalation of vapours and direct contact with the material. Wear breathing protection if necessary.&lt;br&gt;» After contact with skin or eyes, rinse gently with clear water for several minutes.&lt;br&gt;» Please follow the instructions of the regional authorities.&lt;br&gt;» Follow safety data sheets!</td>
</tr>
<tr>
<td><img src="image" alt="DANGER" /></td>
<td><strong>pressurised gases!</strong>&lt;br&gt;The system works in overpressure.</td>
<td>» Avoid damage under all circumstances!&lt;br&gt;» Never use a flame or electric heaters to increase the pressure.&lt;br&gt;» Follow safety data sheets!</td>
</tr>
<tr>
<td><img src="image" alt="DANGER" /></td>
<td><strong>flammable substances!</strong>&lt;br&gt;Use of flammable substance.</td>
<td>» Extinguish all open flames, eliminate ignition sources, and avoid sparking.&lt;br&gt;» Do not smoke.&lt;br&gt;» Follow safety data sheets!</td>
</tr>
<tr>
<td><img src="image" alt="DANGER" /></td>
<td><strong>explosive substances!</strong>&lt;br&gt;Use of explosive substances.</td>
<td>» Extinguish all open flames, eliminate ignition sources, and avoid sparking.&lt;br&gt;» Do not smoke.&lt;br&gt;» Follow safety data sheets!</td>
</tr>
</tbody>
</table>

Tab. 1: Safety instructions and appropriate procedures

In addition to the information given in this general operating manual, the universally applicable, legal and other mandatory regulations for accident prevention and environmental protection must also be followed.

There is always a possible residual risk, even if all safety measures are followed. Always work with extreme caution on machinery.

The owner or the operator is obliged to determine measures for emergencies. He is responsible for the safe operation.
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List of Abbreviations

AdKA ......................................................................................................................................................... Adsorption Chiller
COM ............................................................................................................................................................ Controller & Operation Manual
GOM ............................................................................................................................................................... General Operating Manual
HT ................................................................................................................................................................. High Temperature
IFC ............................................................................................................................................................... Instructions for Commissioning
LT ................................................................................................................................................................. Low Temperature
MT ............................................................................................................................................................... Middle Temperature
TDI ............................................................................................................................................................... Technical Data & Installation Manual
1 Usage of Documents

The operating and installation manuals include all information regarding the proper installation and use of an adsorption chiller (AdKA) from Fahrenheit GmbH.

The operating and installation manuals for AdKA consist of several parts:

- **General Operating Manual - GOM**
  General information about planning, installation and maintenance of the system. Additionally, this document includes a general description of the working principle and operation of AdKA from Fahrenheit GmbH.

- **Technical Data & Installation Manual – TDI**
  Detailed technical information about the specific model of AdKA. This document provides information about dimensions, weight and space requirements as well as more detailed installation instructions.

- **Controller & Operation Manual - COM**
  Operating manual for the controller of AdKA. This manual provides information on how to change the settings and configure the system to meet user-specific requirements. Furthermore, it explains the meaning of the measured and calculated values displayed on the control panel.

Additional documents such as the system recommendation, circuit diagrams and data point lists for various communication protocols, are created specifically for the project and, if available, are also part of the operating and installation manuals. For the proper planning and exploitation of the system, refer to the operating and installation instructions of the re-cooler as well.

Make sure that all parts of the operating and installation manuals for your system are available. If the operating and installation manuals are incomplete, please contact Fahrenheit GmbH.

These operating and installation manuals are intended for trained personnel of the device distributor and/or the company performing installation works.

The operating and installation manuals are an integral part of AdKA and must be kept at the installation site throughout its lifetime, at a location accessible and recognizable to the user. If AdKA is handed over to a new owner, these manuals must be included as well.

Proper commissioning is required for trouble-free operation of the system. The minimum requirements and the most important steps are described in the optional document “Instructions for Commissioning” - IFC. The commissioning performed by a non-certified person may cause damage and will void the warranty.

AdKA should only be operated if all parts of the operating and installation manuals are available to the user and they have been read and understood completely.
2 General Information about Adsorption Chillers

2.1 Product identification

Each AdKA from Fahrenheit GmbH contains a nameplate, which is located on the casing. In addition to some technical data, you will also find the product name and the product key. Before you contact a Fahrenheit GmbH employee, please make sure that you know the product key of your system. Explanations on the product key can be found in chapter 12.4.

Abb. 1: Example of a nameplate

2.2 Application fields

AdKA utilizes waste heat, for example solar plants, combined heat and power plants (CHP), district or process heat, in order to generate cold in an environmentally friendly and cost-effective way. This is also possible in the small capacity range.

There are no moving parts in the process modules, since neither steam flaps nor the circulation of process water is required due to the patented dual-chamber principle. Moreover, operation at low drive temperatures is possible (Chapter 2.3).

Combined with a CHP - then as a trigeneration unit - you will not only have cheaper electricity and heat in winter, but also electricity and cooling in summer.

The adsorption chillers from Fahrenheit GmbH can be upgraded at any time with other Fahrenheit products.

2.3 Product description

In general, AdKA of Fahrenheit GmbH consist of the following components:

- At least one module pair, consisting of two process modules
General Information about Adsorption Chillers

- A hydraulic group with high efficiency pumps and connections for the drive circuit (HT), the recooling circuit (MT) and the chilled water circuit (LT)
- A controller
- Casing

In addition, the following components can be integrated optionally:

- A circuit separation
- An energy balancing set
- A compression chiller

The Fahrenheit AdKA are characterized by the patented dual-chamber process modules without moving parts. A process module is a vacuum-tight, welded chamber made of stainless steel. Inside the process module there are two heat exchangers which are called evaporator and adsorber or condenser and desorber depending on the operating phase. Furthermore, a precisely defined quantity of process water is contained in a process module which carries out the heat transfer between the two heat exchangers by evaporating and condensing again and again. Each process module thermally insulated.

Abb. 2: Representation of process modules
2.4 Operation principle

Heat is extracted from the space or process to be cooled by means of a heat exchanger through which chilled water flows. This cools the space or process and simultaneously heats the chilled water. Via the hydraulic group of the adsorption unit, the heated chilled water reaches the evaporator of the adsorbing process module, where it is cooled down again and can thus be fed back into the cooling circuit.

The process module contains an adsorber and an evaporator with water (R718) as the refrigerant on its surface. Due to the low pressure in the process module, the refrigerant evaporates at temperatures as low as 6°C. Evaporation heat is supplied from outside during evaporation. This heat transfers part of the refrigerant into the vapour phase. The heat extracted from the warm chilled water and the liquid refrigerant during evaporation is now contained in the refrigerant vapour. Due to the physical characteristics of adsorption, the refrigerant vapour flows in the direction of the adsorber.

The surface of the adsorber is coated with an adsorbent (strong hygroscopic substance, e.g. silica gel or zeolite). The refrigerant vapour accumulates on this adsorbent (Abb. 3), whereby the heat is released exothermically. In order to dissipate this heat, a re-cooling water circuit flows through the adsorber. The re-cooling water heats up and dissipates the heat from the adsorption unit to the environment via a re-cooler.

If the adsorbent is saturated with refrigerant vapour, the water molecules must be dissolved or expelled from the adsorbent so that adsorption can start again. The controller switches over the circuits of the integrated hydraulic group so that the hot water of the drive circuit flows through the adsorber and thus becomes the desorber. At the same time, the evaporator becomes a condenser, as water from the recooling circuit now flows through it.

The hot water is cooled by the heat input via the drive circuit into the desorber. The dissipated heat is added to the drive circuit outside the adsorption unit by a heat source. The bound water molecules on the adsorbent are dissolved via the desorber (Abb. 4). The superheated refrigerant vapour flows to the condenser. The cooler surface of the condenser withdraws heat from the refrigerant vapour, causing it to condense and precipitate on the surface. The heat released during condensation is transferred to the re-cooling water and dissipated to the environment via an external re-cooler. The condensed and cooled refrigerant is available for the next adsorption process.

In order to continuously extract heat from the chilled water circuit and maintain continuous cooling, two process modules are operated cyclically. While an adsorber absorbs refrigerant vapour from the evaporator (adsorption), the desorber releases refrigerant vapour to the condenser (desorption). This cyclic process causes the periodic temperature fluctuations typical for adsorption chillers, which can be smoothed out by buffer storage. The valve switching of the hydraulic group is controlled by adjustable parameters. In addition, the controller can influence the volume flows of the three circuits.
General Information about Adsorption Chillers

The two process modules with the heat exchangers and the adsorption, desorption, evaporation and condensation processes are referred to as thermal compressors.

The temperatures, flow rates and working mediums of the three circuits have a direct effect on the cooling capacity and the thermal COP. The desorption process is influenced by the drive circuit, the adsorption and condensation process by the re-cooling circuit and the evaporation process by the chilled water circuit.
2.5 General operating limits

Unless described otherwise in the TDI, the following operating limits apply:

<table>
<thead>
<tr>
<th>Description</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximal operating pressure</td>
<td>4 bar</td>
</tr>
<tr>
<td>Drive temperature (HT)</td>
<td>55 ... 95°C</td>
</tr>
<tr>
<td>Re-cooling temperature (MT)</td>
<td>&lt;45°C</td>
</tr>
<tr>
<td>Chilled water temperature (LT)</td>
<td>&gt;8°C</td>
</tr>
<tr>
<td>Surrounding temperature</td>
<td>&gt;5°C</td>
</tr>
</tbody>
</table>

Tab. 2: Operating limits

Operation outside the operating limits requires the prior approval of Fahrenheit GmbH!

2.6 Operating status

2.6.1 Active cooling

Active cooling is the main task of AdKA. The process during active cooling is described in detail in Chapter 2.4.

2.6.2 Free cooling

With free cooling, the ambient temperature level is used. The working medium is cooled sufficiently from the environment via the recooler in order to be fed directly to the chilled water circuit.

To use free cooling, an optional outdoor temperature sensor or a signal from a master controller is required!
2.7 Intended use

AdKA may only be used for the purpose for which it was developed and tested. This includes use as a chiller for cooling of approved working mediums (Chapter 4.7).

Any other use of AdKA is not permitted and requires the explicit approval and clearance from Fahrenheit. The following also fall within the scope of intended use:

» Compliance with safety regulations in the country of use,
» Compliance with the operating manual and all safety instructions,
» Regular inspection and maintenance work (Chapter 5),
» Availability and proper operation of all safety equipment in accordance up-to-date technologies,
» Compliance with the operating limits of AdKA (Chapter 2.5).

Any alternative or more extensive use is considered as improper use, in particular:

» Operation outside specified operating limits (Chapter 2.5),
» Use of a working medium that does not comply with the specifications (Chapter 4.7),

Improper use may result in injuries, property damage and loss of warranty. This is the sole responsibility of the operator or user.

Use the system only as intended!

Fahrenheit GmbH is not responsible for damage or errors in AdKA resulting from improper use or disregard of the information in the operating & installation manual.

2.8 Prohibition of operation

If it can be assumed that safe operation is no longer possible, AdKA should not be commissioned or it should be switch off and secure against unintentional commissioning. A safe operation can not be guaranteed, among other things, if one of the following points applies:

» Significant damage to the casing
» Improper transport or installation
» Liquid leakage from inside AdKA
» Improper storage (Chapter 8)
3 Project Planning

The project planning for the integration of AdKA has to be carried out by a specialized company.

Before any planning, it must be checked whether the operating limits (Chapter 2.5) are maintained at all times. If this cannot be guaranteed, suitable measures must be taken to ensure operation within the operating limits.

Fahrenheit GmbH sizes each system according to project-specific parameters. Check the sizing to ensure that no incorrect data has been transmitted. The design also indicates the required drive power. Make sure that this drive power is available during the operating time of AdKA.

AdKA is only suitable for installation in frost-free rooms. Please also refer to the storage and installation conditions (Chapter 8). In addition, sufficient installation, operating and maintenance clearance must be maintained around the unit. Refer to the relevant information in the TDI.

Ask Fahrenheit GmbH for a system recommendation as a basis for your planning. Alternatively, you can find a general template in the appendix (Chapter 12.3).

For re-cooling systems, only FI protective devices (type B or B+) which are sensitive to universal currents are permitted.

We recommend residual current circuit-breakers with a triggering threshold of 300 mA and delayed triggering (super resistant, characteristic K).

Dimension the pipelines according to the current standards. Also, note the available delivery heads of the internal pumps (TDI).

To protect AdKA, a strainer should be installed at all circuit inlets.

Inside the building, chilled water and re-cooling pipes must be insulated impermeably to diffusion. Pipelines of the drive circuit should be insulated with aluminium-laminated mineral wool.

Outside the building, it is not necessary to insulate the re-cooling pipes. Prevent frost damage to the re-cooling circuit (Chapter 4.7.3)

Secure all circuits against excessive pressure in accordance with the most up-to-date technology.

Provide a water connection for filling the system and comply with the permissible working media (Chapter 4.7).

Follow regional regulations in particular when using wet re-cooling systems and monoethylene glycols.

Provide a drain into the sewer system for draining the system. Follow the regulations of the regional authorities responsible.

Ensure that there is sufficient electrical power for AdKA, the circuit separation, and re-cooler at the respective installation locations. Pay particular attention to the electrical specifications in the TDI for units with integrated compression chillers.

Start planning only if you have read and understood all the parts of the operating and installation manuals completely.
4 Installation

4.1 Qualifications of the personnel

Work on the transport and connection of AdKA may only be carried out by expert personnel. Service training from Fahrenheit GmbH with certification is required for commissioning AdKA and for its maintenance and repair.

⚠️ Do not carry out any work on AdKA until you have received all parts of the operating and installation manuals and have read and understood them completely.

4.2 Personnel protection equipment

Please note the safety & warning instructions at the beginning of this document!

4.3 General instructions for installation

Please note the safety & warning instructions at the beginning of this document!

Setting up

» Note the requirements for transport (chapter 9) and installation location (chapter) of AdKA
» Remove the packaging completely and dispose of it in an environmentally friendly manner (Chapter 11)
» If necessary, you can use parts of the packaging to protect the housing from damage
» Fixing AdKA to the ground is not mandatory
Hydraulic connection

» Check the connection nozzle for impurities before connecting a pipeline
» The hydraulic connection must be free of tensile, torsional and compressive forces.

Electrical connection

» Read the electrical wiring diagram before starting installation
» During work on the control cabinet, it must be kept voltage-free via the main switch. Protect it against unintentional switching on.
» Insert cables into the control cabinet only via the cable glands provided.
» Observe and check the current and voltage of the respective connections before clamping them.

Do not carry out any work on AdKA until you have received all parts of the operating and installation manuals and have read and understood them completely

4.4 Identifying the hydraulic connections

Please note the safety & warning instructions at the beginning of this document!

The positions of the hydraulic connections can be found on the technical drawing in the appendix of the TDI. In addition, the hydraulic connections on the housing are marked with the following abbreviations:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT_IN</td>
<td>Drive circuit inlet (HT)</td>
</tr>
<tr>
<td>HT_OUT</td>
<td>Drive circuit outlet (HT)</td>
</tr>
<tr>
<td>MT_IN</td>
<td>Re-cooling circuit inlet (MT)</td>
</tr>
<tr>
<td>MT_OUT</td>
<td>Re-cooling circuit outlet (MT)</td>
</tr>
<tr>
<td>LT_IN</td>
<td>Chilled water circuit inlet (LT)</td>
</tr>
<tr>
<td>LT_OUT</td>
<td>Chilled water circuit outlet (LT)</td>
</tr>
</tbody>
</table>

Tab. 3: Identifying the hydraulic connections
Some of Fahrenheit AdKA have an integrated circuit separation. Refer to the TDI and chapter 4.7.2 of this document.

4.5 Marking on the electric connections

Please note the safety & warning instructions at the beginning of this document!

All power and control cables must be routed through the openings provided for this purpose to the control cabinet of AdKA. The position of the cable entries can be seen in the wiring diagram.

The following markings are used for the electrical connection of all Fahrenheit GmbH products:

<table>
<thead>
<tr>
<th>Clamp</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Neutral conductor</td>
</tr>
<tr>
<td>L1</td>
<td>Outer conductor 1</td>
</tr>
<tr>
<td>L2</td>
<td>Outer conductor 2</td>
</tr>
<tr>
<td>L3</td>
<td>Outer conductor 3</td>
</tr>
<tr>
<td>PE</td>
<td>Protective conductor</td>
</tr>
</tbody>
</table>

Tab. 4: Marking on the electrical connections

Read the TDI for information on electrical connection data!

4.6 Filling the system

Please note the safety & warning instructions at the beginning of this document!
AdKA must only be used for operation with approved working mediums (chapter 4.7). Ensure material compatibility in all circuits and that the working medium is free of limescale and corrosive components!
After filling the system, proper venting of all circuits must be carried out.
In order to minimise the probability of corrosion damage, algae and sludge formation, the chemical and physical properties of the working medium must be taken into account during planning, commissioning and operation. We recommend checking the condition of the working medium in accordance with the maintenance instructions (Chapter 5).

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Note the operating limits – Chapter 2.3!

### 4.7 Permitted working mediums

#### 4.7.1 General specifications
These guidelines are based on empirical values and data from EN-12502 to estimate the corrosive ion probability. Due to the complex interactions between the materials used and the working medium as well as the different chemical and physical boundary conditions, it is not possible to define general specifications.

#### 4.7.2 Internal Circuits

Please note the safety & warning instructions at the beginning of this document!

Please note that the internal circuits of AdKA are hydraulically connected to each other and thus all circuits are mixed during operation. It is therefore necessary that the same working medium is used in all circuits and that the operating pressure is identical in all circuits.

Some AdKA have internal circuit separations. With these units, the corresponding circuit can be filled with a different permitted working medium and operated at a different working pressure than the other circuits. After filling, also make sure to vent the internal circuits between the process modules and the circuit separation. Please refer to the TDI for information on whether your AdKA has an internal circuit separation.

In general, the system may be filled with tap water within the EU. If necessary, the water quality must be assessed according to EN50930-6.
### Installation

<table>
<thead>
<tr>
<th>Characteristic / Component</th>
<th>Permitted value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH-level at 20°C</td>
<td>7.5 ... 9.0</td>
</tr>
<tr>
<td>Electrical conductivity at 25°C</td>
<td>80 ... 500 µS/cm</td>
</tr>
<tr>
<td>Water hardness</td>
<td>6.0 ... 10.0°dH</td>
</tr>
<tr>
<td>Hydrogen carbonate</td>
<td>120 ... 300 mg/l</td>
</tr>
<tr>
<td>Sulphate</td>
<td>&lt;70 mg/l</td>
</tr>
<tr>
<td>Total count of bacteria at 22°C</td>
<td>&lt;1,000 KBE/ml</td>
</tr>
</tbody>
</table>

Tab. 5: Water quality for filling AdKA

It is also possible to operate the internal circuits of AdKA with mixtures of the monoethylene glycols Antifrogen N (manufacturer: Clariant), Tyfocor L (manufacturer: Tyfo) or Glysofor N (manufacturer: Glysofor). However, a project-specific release from Fahrenheit GmbH is always required. The use of monoethylene glycol results in a lower cooling capacity of AdKA due to the lower specific heat capacity.

Read the TDI for further information on the permissible working mediums and working pressures!

Note the operating limits – Chapter 2.3!

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### 4.7.3 External circuits

Please note the safety & warning instructions at the beginning of this document!

To protect the re-cooler from frost damage, always fill the re-cooling system with a suitable mixture of water and antifreeze when outside temperatures below 5°C are to be expected. Please only use one of the following monoethylene glycols for this purpose:

- Antifrogen N, manufacturer: Clariant
- Tyfocor L, manufacturer: Tyfo
- Glysofor N, manufacturer: Glysofor

The concentration of the mixture must be adjusted to the lowest ambient temperature to be expected at the installation site. Should you require assistance in determining the mixing ratio, please contact the manufacturer of the respective antifreeze agent.

If it is necessary to fill the external circuit with antifreeze, AdKA must be equipped with a circuit separation on the re-cooling side!
A piping system must always be filled with a premixed working medium! If you use concentrated antifreeze, you must prepare a mixture with the required concentration in a suitable container. This also applies to refills!

4.7.4 Water spray system

Fahrenheit GmbH also offers re-coolers with a spraying system. This is intended to compensate for high ambient temperatures and is only recommended to a limited extent, especially when operating with water of unknown quality. The following are the minimum requirements for the spraying system:

<table>
<thead>
<tr>
<th>Component / Property</th>
<th>Permissible value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH value at 20°C</td>
<td>6.5 ... 8.0</td>
</tr>
<tr>
<td>Electric conductivity at 25°C</td>
<td>&lt;1200 µS/cm</td>
</tr>
<tr>
<td>Water hardness</td>
<td>&lt;2,0°dH</td>
</tr>
<tr>
<td>Chloride</td>
<td>&lt;75 mg/l</td>
</tr>
<tr>
<td>Sulphate</td>
<td>&lt;250 mg/l</td>
</tr>
</tbody>
</table>

Tab. 6: Water quality for spray systems

The spray pressure at the nozzle should be at least 3.5 bar.

If the re-cooling system is not a standard product of Fahrenheit GmbH (e.g. adiabatic or hybrid re-cooling systems, cooling towers) their separate specifications must be taken into account, even if supplied by Fahrenheit GmbH.

For protection against Legionella, the spray systems may be subject to a reporting obligation according to the local regulations!

4.7.5 Flammable refrigerants

Please note the safety & warning instructions at the beginning of this document!

For AdKA with an integrated compression chiller that uses a flammable refrigerant, the requirements of EN 378 or other relevant national regulations must be taken into account! When handling refrigerant, the legal regulations and guidelines must be followed. The handling of refrigerants is reserved exclusively for qualified personnel. The refrigeration equipment contains components whose operating pressures require the application of the Pressure Equipment Directive 2014/68/EU and EN 378 (Part 1 - 4, as of September 2000).
4.7.6 Non-flammable refrigerants

Please note the safety & warning instructions at the beginning of this document!

For AdKA with an integrated compression chiller that uses a non-combustible refrigerant, the requirements of EN 378 or other national regulations must be taken into account! The legal regulations and guidelines must be observed when handling refrigerant. The handling of refrigerant is reserved exclusively for qualified personnel. The refrigeration units contain components whose operating pressures require the application of the Pressure Equipment Directive 2014/68/EU and EN 378 (Part 1 - 4, as of September 2000).
For a long-lasting and undisturbed operation of AdKA, we recommend regular inspections and maintenance of the entire system. Maintenance work may only be carried out by qualified personnel. Below you will find an overview of the various stages for inspection and maintenance work as well as their intervals.

**Inspection of the system**

*Interval: every six months*

*Execution: trained personnel*

**Measures:**

- Visual inspection of the system for damaged insulation, leaks and defects in the electrical wiring
- Checking the operating pressure of all hydraulic circuits, if necessary a permitted working medium (chapter 4.7) must be refilled. Inform yourself which permitted working medium has been filled in the corresponding circuit
- Inspection of the fans of the re-cooler and cleaning of the heat exchanger block, especially on the suction side
- Function test of the pumps
- Read the last error message and take appropriate measures. Use the operating manual (COM) for this purpose.

**Maintenance of AdKA**

*Interval: annually*

*Execution: certified personnel*

**Measures:**

- Leakage and functional testing of all the valves and pumps of AdKA and the circuit separation
- If necessary, update the software
- Checking all the set parameters
- Evaluation of error message
- General function test
- When a mixtures of water and mono ethylene glycols is used (Chapter 4.7), its concentration is checked with a refractometer and if necessary, further measures are taken to exclude damage caused by frost
Maintenance of the Process Modules  

Interval: every 2 years  
Execution: certified personnel

Activities:

» Checking the vacuum stability of all process modules and restoring the vacuum if necessary

⚠️ Special training and a service kit from Fahrenheit GmbH are required for maintenance of the process modules! Improper maintenance of the process module can lead to the destruction of the module!
6 Decommissioning & Shutdown

Please note the safety & warning instructions at the beginning of this document!

If AdKA is to be left out of operation for an indefinite period of time, a proper shutdown of the system is recommended in order to avoid damage. Before you carry out any further work, AdKA must be switched off and de-energised - please note the COM of your AdKA.

During decommissioning, the storage and installation conditions must be followed (Chapter 8)

If the storage location differs from the installation location after decommissioning, please observe the instructions for transporting an adsorption chiller (Chapter 9)!
7 Recommissioning

Please note the safety & warning instructions at the beginning of this document!

After decommissioning, the system must be recommissioned to ensure proper and trouble-free operation. For this purpose, all steps of the commissioning instructions (IFC) must be carried out by a certified service technician.
8 Storage & installation conditions

Please note the safety & warning instructions at the beginning of this document!

Make sure that the following storage & installation conditions are maintained at all times:

» The installation/storage room should be reachable and easily accessible for transport using technical aids
» Installation/storage on a flat horizontal surface with a maximum inclination of 2°; if necessary, a balance must be created with suitable supports
» The bearing capacity of the installation/storage area must be at least 1,000 kg/m²
» Frost-free and dry installation/storage at temperatures between 5 ... 60°C
» A condensation-free atmosphere is required for installation/storage
» Before storage, all hydraulic connections must be drained with a suitable wet aspirator
» For storage, AdKA must be wrapped with a protective film
» For mounting at the installation site, the operating, maintenance and installation distances in accordance with TDI must be followed.
» The installation/storage of AdKA with compression chillers must be carried out in accordance with the requirements of EN 378. Sufficient room space and ventilation measures are required to protect persons.

In case of improper installation or storage, the warranty becomes void!
9 Transport of an Adsorption Chiller

Please note the safety & warning instructions at the beginning of this document!

Please note the following points when transporting AdKA:

» Use adequate and suitable protection during transport
» Pay attention to the balance point of the machine to avoid overturning
» Use only approved technical aids for transport
» Extreme care must be taken during transport
» To protect the housing, it must be wrapped with protective film during transport.
» Avoid shocks or impacts to AdKA
» Do not tilt AdKA over an angle of 40° and transport it as upright as possible
» The storage and installation conditions (Chapter 8) must also be complied with during transport.
» Installations with a compression chiller whose refrigerant filling quantity is over 12 kg are subjected to the dangerous goods (UN 2857)
10 Disassembly

10.1 Disconnecting electrical connections

Please note the safety & warning instructions at the beginning of this document!

Carry out the following steps before you start to disassemble the electrical connections:

» Shut the system down properly (Chapter 6)
» Disconnect the connecting cables from the power supply
» Disconnect all connection and control cables from AdKA controller and carefully pull the cables out of the housing

10.2 Disconnecting hydraulic connections

Please note the safety & warning instructions at the beginning of this document!

Carry out the following steps before you start to disassemble the hydraulic connections:

» Shut the system down properly (Chapter 6)
» Close all the cut-off valves of AdKA
» Depressurise all circuits
» Empty the circuits properly and in an environmentally friendly manner, following the instructions of the regional authorities responsible
» Disconnect the hydraulic connections of AdKA and intercept any leaking working medium with a suitable wet vacuum extractor
» Empty the hydraulic system of AdKA with a suitable wet vacuum extractor
» Close the connections to protect them from contamination
**11 Disposal**

When disposing of AdKA and/or its packaging materials, the environmentally relevant requirements for the recycling, reuse and disposal of operating materials and components must be complied with. The responsibility for the proper disposal of no longer usable operating materials and system components lies with the operator of the system.

Before disposing of AdKA, it must be properly dismantled (Chapter 10) and the process modules vented! All materials must be disposed of in accordance with local and current regulations. Recycling centres or other suitable collection points can be requested from the respective municipal administration. The following requirements for the disposal of all materials must be followed.

<table>
<thead>
<tr>
<th>Element</th>
<th>Material</th>
<th>Type of disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipes and housing</td>
<td>Copper, steel</td>
<td>Scrap metal</td>
</tr>
<tr>
<td>Electronics</td>
<td>Mix of many materials</td>
<td>Electronic waste</td>
</tr>
<tr>
<td>Process modules</td>
<td>Copper, Aluminum, steel, Adsorbents</td>
<td>Take back and disposal by Fahrenheit GmbH</td>
</tr>
<tr>
<td>Packaging</td>
<td>Cardboard, paper, foiled</td>
<td>Paper container, composites</td>
</tr>
</tbody>
</table>

Tab. 7: Disposal of materials

Dispose of all materials and working fluids with additives (e.g. monoethylene glycol) in accordance with local guidelines. Consult your local municipal administration for suitable recycling centres and collection point.
12 Appendix

12.1 Assembly declaration

According to Machinery Directive 2006/42/EG, appendix II 1B

Hersteller: FAHRENHEIT GmbH
Siegfriedstraße 19
80803 Munich
Germany

Authorised representative for the compilation of the relevant technical documentation: Steffen Kühnert
FAHRENHEIT GmbH
Zscherbener Landstraße 17
06126 Halle/Saale
Germany

Products: Adsorption chillers „eCoo“ und „eCoo X“ incl. all offered product variants

The manufacturer declares that the above product is an incomplete machine within the sense of the Machinery Directive. The product is intended exclusively for installation in conjunction with additional units (e.g. recooling unit) and therefore does not yet meet all the requirements of the Machinery Directive.

The specific technical documentation set out in Part B of Annex VII has been prepared. The authorised representative responsible for compiling the technical file shall undertake to forward it to the national authorities at their request. The documents shall be sent by post on paper or in electronic form.

Commissioning of the product is prohibited until it has been established that the technical system in which the above product is incorporated complies with all the essential requirements of the Machinery Directive.

Halle, 01.04.2018

(Steffen Kühnert) Technical Director
12.2 EC-Declaration of conformity

According to the directive 2006/42/EG, Annex II A
Nach Maschinenrichtlinie 2006/42/EG, Anhang II A

The manufacturer: FAHRENHEIT GmbH
Der Hersteller: Siegfriedstraße 19
80803 Munich
GERMANY

The authorized person responsible for the documentation is: Steffen Kühnert
Die unterlagenbevollmächtigte Person ist: FAHRENHEIT GmbH
Zscherbener Landstraße 17
06126 Halle/Saale
Germany

herewith declares that the following products:
klärt hiermit, dass folgende Produkte:

“eCoo” und “eCoo X”
inkl. aller angebotenen Produktvarianten

meets the rules and regulations of the directive indicated above-including revisions valid at the time of the declaration.
den Bestimmungen der oben gekennzeichneten Richtlinie - einschließlich deren zum Zeitpunkt der Erklärung geltenden Änderungen - entspricht.

Applied standards:
Angewandte Normen:

<table>
<thead>
<tr>
<th>EN ISO 12100</th>
<th>EN 14276-2</th>
<th>EN 60204-1:2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 378-1-2-3-4</td>
<td>EN 388:2016</td>
<td>EN 61800-1-3-5</td>
</tr>
<tr>
<td>EN ISO 13732-1:2008</td>
<td>EN 55014-1-2</td>
<td>EN 60335-1-2-51</td>
</tr>
<tr>
<td>EN ISO 4413:2010</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Halle, 01.04.2018

(Steffen Kühnert) Technical Director
12.3 Example of a plant scheme
12.4 Composition of the Product key

Control
1 – Standard 50 Hz
2 – Special design 50 Hz
3 – Standard 60 Hz
4 – Special design 60 Hz

Controller
R – Resol
C – Climatix
7 – S7

Number of module pairs
Number of serial connected module pairs HT
Number of serial connected module pairs LT

AdSORBENTS
S – Silica gel
Z – Zeolite

Type of the Module
S1 – sika
S2 – sikaX
S3 – sikaS

Compression Chiller

Internal Pumps
0 – none
G – Grundfos
K – KSB
W – WILO
M – WILO MAXO

System separation
0 – not integrated
S – integrated

Glycol pump
0 – none
G – Grundfos
K – KSB
W – WILO
M – WILO MAXO

Number of housing

Type of housing
A – SG10
B – SG20
C – SG30
Y – Special design
Z – eCoo 2.0

Additional housing
0 – Standard
X – with 500 mm installation
S – shorter housing