chillii® Cooling Kit
thermal cooling

SOLARNEXT
clean energy for you
Company outline

- Founded in 2000, Pioneer of the 'Cooling Kit' solution
- Specialist for system solutions & systems integrator in the field of thermal cooling
- Design, engineering and sales as well as maintenance of thermal cooling solutions from 3 RT to 3,000 RT (10 kW to 10 MW) cooling capacity
- more than 100 systems realised worldwide
- ISO 9001 certified
- Continually awarded by the Stifterverband for R&D since 2014

Headquarter at Bernau am Chiemsee
## Compression chiller vs. Absorption chiller

<table>
<thead>
<tr>
<th></th>
<th><strong>Compression chiller</strong></th>
<th><strong>Absorption chiller</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Refrigerant</strong></td>
<td>Mainly HFCs (Hydrofluorcarbons) now also CO2 (only small capacity)</td>
<td>Water with LiBr or NH3 as absorbents</td>
</tr>
<tr>
<td><strong>Cooling capacity</strong></td>
<td>1 kW – 20 MW (per module) 3 RT - 150 RT (per module)</td>
<td>18 kW – 10,000 kW (per module) 5 RT – 2,850 RT (per module)</td>
</tr>
<tr>
<td><strong>Chilled water temperatures</strong></td>
<td>-40°C to +20°C (flow temperature)</td>
<td>+4°C to +20°C (LiBr-chiller) -20° to +20°C (NH3-chiller)</td>
</tr>
<tr>
<td><strong>COP (th)</strong></td>
<td>2 - 5</td>
<td>0.65 – 1.5</td>
</tr>
<tr>
<td><strong>COP (el)</strong></td>
<td></td>
<td>15 - 20</td>
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</tbody>
</table>
Advantages of absorption chillers compared to compressor-based cooling systems

- less electricity consumption ( > 75% of savings regarding electricity costs)
- lower operating costs (because of very few mechanical components)
- non-usage of refrigerants as CFCs and HCFCs for cooling that are typically associated with ozone layer damaging greenhouse gas emissions
- lack of issues related to mechanical vibrations
- stable coefficient of performance (COP)
- easy maintenance and longer life time
- environmental-friendly solution
### Basis of the adsorption and absorption chiller

<table>
<thead>
<tr>
<th></th>
<th>Adsorption chiller</th>
<th>Absorption chiller</th>
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<tbody>
<tr>
<td>Physical cooling effect</td>
<td>Evaporation of refrigerant (vapour compression cycle)</td>
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<tr>
<td>Compression principle</td>
<td>Thermal (Adsorption of water vapour)</td>
<td>Thermal (Absorption cycle)</td>
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<tr>
<td>Driving energy</td>
<td>Thermal energy 55°C - 95°C</td>
<td>Thermal energy 70°C - 95°C</td>
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<tr>
<td>Refrigerant</td>
<td>Water with solid adsorbents (silica gel, zeolith)</td>
<td>Water with LiBr or NH3 as absorbents</td>
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<td>Cooling capacity</td>
<td>8 kW - 500 kW (per module) 3 RT - 150 RT (per module)</td>
<td>18 kW - 5,000 kW (per module) 5 RT - 1,500 RT (per module)</td>
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<tr>
<td>Chilled water temperatures</td>
<td>+6°C to +20°C (flow temperature)</td>
<td>+4°C to +20°C (LiBr-chiller)</td>
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<td></td>
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<td>-20°C to +20°C (NH3-chiller)</td>
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<tr>
<td>COP (th)</td>
<td>0.5 - 0.65</td>
<td>0.65 - 0.85</td>
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<tr>
<td>COP (el)</td>
<td>8 - 10</td>
<td>10 - 20</td>
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</table>
System principle of a single-effect absorption chiller
Heat sources for sorption cooling

- CHP - Cogeneration
- Solar thermal system
- Waste heat from compressed air
- Process heat
- ORC technology

Adsorption and absorption technology

Cooling
How to distribute chilled water?

Cold water distribution

- Fancoil
- Cooling ceiling
- Cooling surface
- Cooled floor

Cold water temperatures °C

7/12  10/15  15/18  17/20  19/22

thermal cooling - with chillii® technology
Installation Principle – Hydraulic System

- **Heat Source**

- **Backup System**

- **Heating Circuit**

- **Chillii® Absorption Chiller**

- **Cooling Circuit**

- **Cold Water Reservoir**

- **Cooling Tower**

- **Buffer Reservoir**

- **Warm Water Reservoir**

**Thermal Cooling - with Chillii® Technology**
Installation Example – Hydraulic System
Components of a chillii® Cooling Kit

Ad- or Absorption chiller

Re-cooling system

Optional: Cold and hot water storage

Pumps and mixer

System Controller and electric cabinet

Other components (e.g. temperature sensors)

thermal cooling - with chillii® technology
chillii® Cooling Kits < 1 MW Cooling Capacity

Adsorption chillii® Cooling Kit

- optimally harmonized system components
- system solution for your application
- ready-to-install solution
- no layout and dimensioning required by customer

Absorption chillii® Cooling Kit
chillii® Cooling Kits (water-fired chiller) > 1 MW Cooling Capacity

Absorption chillii® Cooling Kit

- optimally harmonized system components
- system solution for your application
- ready-to-install solution
- no layout and dimensioning required by customer
chillii® Cooling Kits (steam-fired chiller) > 1 MW Cooling Capacity

Absorption chillii® Cooling Kit

- optimally harmonized system components
- system solution for your application
- ready-to-install solution
- no layout and dimensioning required by customer
chillii® Cooling Kits (direct-fired chiller) > 1 MW Cooling Capacity

Absorption chillii® Cooling Kit

- optimally harmonized system components
- system solution for your application
- ready-to-install solution
- no layout and dimensioning required by customer
chillii® System Controller

- different heat sources
- back-up system for heat
- thermal cooling machine
- additional system for cooling
- heat and cold air reservoir management
- domestic water heating
- heat rejection system
- heating and cooling circuit

thermal cooling - with chillii® technology
chillii® System Controller – State of the Art

- system adaptation by parameterisation
- multi user levels
- data logging
- remote access
- remote maintenance
- external interface (GLT integration)
Installation principle – Hydraulic / sensor

chilli® Solar Cooling System

Hydraulic Version 1

installation principle – hydraulic / sensor
chillii® System Controller – Output data logging to SD card

Log file:

- Measurements are saved on the **SD card**. (csv format)
- **Data can be imported** into spreadsheets (e.g.: Microsoft Excel)
- Actively switching the data logger → permanent recording
- **Measurement time frame** (adjusted by the operator) of one day (e.g. 7 a.m. to 11 p.m.)
- **Measurement interval** individually selected (starting from: 1.5 s → e.g. 60 min.).
- Recording of **instantaneous values**.
- Data points with **date and time** recorded
- **Fixed range** of relevant **measurement and operational data**.

Excerpt of possible measurements:

**Temperatures:**
- Hot water storage as a buffer
- Cold water storage as a buffer
- Inlet and outlet flow of cooling unit
- Inlet and outlet flow of unit circuit

**4 volume flows**
- Pump output
- Solar thermal collector
## Imported and formatted log file

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<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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<th>G</th>
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<td>TSPI</td>
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<td>°C</td>
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</tbody>
</table>
Representation over a period of time (example time frame)

Collector temperature and pump control

- **temperature °C** / pump capacity %

- **time:** 14:27 to 15:16

- **Graph lines:**
  - TSOC_1
  - TSOC_2
  - PSOP
  - TDSH

**thermal cooling** - with chillii® technology
Conclusion
Advantages of Sorption Cooling

**Active Climate Protection**

- Energy saving / increased energy efficiency
- Significant CO₂-reduction
- Reduction of the Global Warming Potential (GWP) by 99.9% because no F-Gases and therefore no environmentally harmful refrigerants instead water as refrigerant

**Cost savings**

- Reduction of electricity consumption and energy costs (Ø 75% less electrical power compared to compression cooling)
- Increased autonomy regarding energy suppliers
- No peak shaving
- Lifetime extension of CHP
- Less maintenance costs
- Significant reduction of total costs

Cost savings with simultaneous improvement of the eco-balance
Excerpt of References
chillii® Cooling Kit WFC35
Air-conditioning of an office building, Bavaria, 2014

- Energy source: industrial waste heat
- Absorption chiller: chillii® WFC35 (water / lithium bromide), 35 kW nominal capacity
- Wet cooling tower with performance control and automatic draining in danger of frost
- Cooling distribution by underfloor cooling and floor convectors
- High-efficiency circulating pumps, energy label A
- System controlled by superior control unit: chillii® System Controller
chillii® Cooling Kit WFC175

Process Cooling of a factory, Baden Wuerttemberg, 2019

chillii® Cooling Kit WFC175

- Energy source: combined heat and power unit (CHP) + heat from air compressors
- Chiller: chillii® WFC175 (water / lithium bromide), 175 kW nominal capacity
- Adiabatic recooling unit with performance control
- High-efficiency and energy saving circulating pumps, energy label A
- System controlled by the chillii® System Controller
chillii® Cooling Kit WFC175
Process Cooling of a factory, Baden Wuerttemberg, 2019
chillii® Cooling Kit WFC175
Process Cooling of a factory, Baden Wuerttemberg, 2017

2 chillii® Cooling Kit WFC175
- Energy source: combined heat and power unit (CHP)
- Chiller: 2 chillii® WFC175 (water / lithium bromide), 350 kW nominal capacity
- Adiabatic recooling units with performance control
- High-efficiency and energy saving circulating pumps, energy label A
- System controlled by the chillii® System Controller
chillii® Cooling Kit WFC175
Process Cooling of a factory, Baden Wuerttemberg, 2017
chillii® Cooling Kit WFC175adb + WFC70adb

Air-conditioning of server rooms, Saxony-Anhalt, 2014

chillii® Cooling Kit WFC175adb + chillii® Cooling Kit WFC70adb

- Energy source: combined heat and power unit (CHP)
- Chiller: chillii® WFC175 (water/lithium bromide) + chillii® WFC70 (water/lithium bromide), 245 kW nominal capacity
- Heat rejection unit with adiabatic and speed controlled EC-motors
- High-efficiency circulating pumps, energy label A
- System controlled by the chillii® System Controller

Source: ORWO Net AG
chillii® Cooling Kit WFC175adb + WFC70adb
Air-conditioning of server rooms, Saxony-Anhalt, 2014
chillii® Cooling Kit WFC175
Process cooling and air-conditioning of a factory, Thuringia, 2012

2 chillii® Cooling Kit WFC175
- Energy source: process heat (by usage of industrial waste)
- Chiller: 2 chillii® WFC175 (water / lithium bromide), 350 kW nominal capacity
- Wet cooling tower with performance control and automatic draining in danger of frost
- High-efficiency and energy saving circulating pumps, energy label A
- System controlled by the chillii® System Controller

Source: VELUX
chillii® Cooling Kit WFC175
Process cooling and air-conditioning of a factory, Thuringia, 2012
chillii® Cooling Kit WFC70
Air-conditioning of a turkey production farm, Lower Saxony, 2012

- Energy source: biogas CHP unit
- Absorption chiller chillii® WFC70 (water / lithium bromide), 70 kW nominal capacity
- Chilled water storage: 8,000 l
- Wet cooling tower with performance control and automatic draining in danger of frost
- Chilled water distribution by a ventilation system
chillii® Cooling Kit WFC70
Air-conditioning of a turkey production farm, Lower Saxony, 2012

High efficiency and energy saving pumps
System controlled by the chillii® System Controller
chillii® Cooling Kit STC15wet
Energy source: waste heat of a paper machine
Adsorption chiller chillii® STC15 (water / silica gel), 15 kW nominal capacity
Wet cooling tower with performance control and automatic draining in danger of frost
Cooling water distribution by the existing ventilation system by means of a water/air heat exchanger
System controlled by superior control unit: chillii® System Controller
chillii® Cooling Kit WFC35
Air-conditioning of a factory, Bavaria, 2012

- chillii® Cooling Kit WFC35
- Energy source: industrial waste heat
- Absorption chiller: chillii® WFC35 (water / lithium bromide), 35 kW nominal capacity
- Wet cooling tower with performance control and automatic draining in danger of frost
- Chilled water distribution by cooling ceilings
- High-efficiency circulating pumps, energy label A
- System controlled by superior control unit: chillii® System Controller
chillii® Cooling Kit WFC18
Solar cooling system in a showroom, Mexico, 2010

- chillii® Cooling Kit WFC18
- Energy source: solar thermal collectors
- Absorption chiller: chillii® WFC18 (water / lithium bromide), 18 kW nominal capacity
- Wet cooling tower with performance control and automatic draining in danger of frost.
- Vacuum tube collectors
- Cold water distribution by a ventilation system
- System controlled by superior control unit: chillii® System Controller
chillii® Cooling Kit WFC18
Air-conditioning of a children’s hospital, Kabul, Afghanistan, 2010

Energy source: solar thermal collectors
Absorption chiller chillii® WFC18 (water / lithium bromide), 18 kW nominal capacity
Cold water storage: 5,000 l, hot water storage: 20,000 l, domestic hot water: 500 l
Wet cooling tower with performance control and automatic draining in danger of frost.
350 m² flat plate collectors
Heating and cooling water distribution through heating and cooling ceilings
High-efficiency circulating pumps, energy label A
System controlled by superior control unit: chillii® System Controller

Source: SolarNext
chillii® Cooling Kit ISC10
Solar cooling system in a public library, Australia, 2010

- Energy source: solar thermal collectors
- Adsorption chiller chillii® ISC10 (water / zeolite), 10 kW nominal capacity
- Dry heat rejection unit with speed controlled EC-motors and water sprinkling system
- Cooling water distribution by ventilation system
- High-efficiency circulating pumps, energy label A
- System controlled by superior control unit: chillii® System Controller
Thank you for your attention

Frank Molter (CEO)

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