“Water heat source CO2 Heat Pump”
For energy saving technology
- SAKE Brewing -

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We are

Heat Pump & Thermal Storage Technology Center of Japan
HPTCJ Activities

◆ Foundation 1986
◆ Activities Public Dissemination/Promotion Technical Support International Activities
◆ Membership 99 companies / organizations (As of 2023)

Public Dissemination /Promotion
Technical Support
International Activities
HAKUTSURU SAKE BREWING CO., LTD.
Heat Recovery Heat Pump Technology in JAPAN
Welcome to Hakutsuru Sake
Nada Uosaki Factory
Nada Uosaki Factory
Factory Terrace Layout

Hot water
Chilled water

Water heat source CO2 Heat Pumps
Total 9 Set
Hot Water Tank
Heat Exchanger

Layout
Facility Overview

Usage of the building: Sake Brewing Factory
Total floor area: 24,163 m²
Constructed: 2012 (Newly built)

<table>
<thead>
<tr>
<th>Ice Storage System</th>
<th>188kW × 2 Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia Chiller</td>
<td></td>
</tr>
<tr>
<td>Ice Storage Tank</td>
<td>44.6 m²</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Water heat source</th>
<th>Heating capacity 74.9kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2 Heat Pumps</td>
<td>Cooling capacity 54.5kW</td>
</tr>
<tr>
<td></td>
<td>× 1 Unit</td>
</tr>
</tbody>
</table>

From the main factory

raw sake

Ice storage system with Ammonia chiller

Cooling
Sterilization
Cooling

Water heat source CO2 Heat Pumps
What is the Heat Pump?

1. Energy absorbed from water (Water temperature goes down)

2. CO₂ refrigerant is compressed to be supercritical fluid of high temperature and pressure.

3. Refrigerant (CO₂)

4. Hot water is supplied by using pumped heat from water and energy of compressor.

Heating energy

\[
\text{Heating energy} = \frac{\text{Heating energy}}{\text{Power used}} = \text{Heating COP}
\]

\[
\text{Heating COP} = \frac{4}{1} = 4
\]

Heating/cooling energy ÷ Power used = Total COP

\[
(4+3) ÷ 1 = 7
\]

4. Condition where heat can be given from water through expansion valve
## General Characteristics of Heating Equipment

<table>
<thead>
<tr>
<th>Item</th>
<th>Boiler</th>
<th>Water Source CO2</th>
<th>HFC Heat Pump</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>○</td>
<td>△</td>
<td>△</td>
<td>Depends on requirements</td>
</tr>
<tr>
<td>Instant Heating</td>
<td>×</td>
<td>○</td>
<td>△</td>
<td></td>
</tr>
<tr>
<td>Cooling</td>
<td>×</td>
<td>○</td>
<td>×</td>
<td>CO2 Discharge GWP</td>
</tr>
<tr>
<td>Environment</td>
<td>×</td>
<td>○</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>Initial Cost</td>
<td>○</td>
<td>×</td>
<td>△</td>
<td>Depends on fuel cost</td>
</tr>
<tr>
<td>Running Cost</td>
<td>△</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Supply temp 100°C and above</td>
<td>○</td>
<td>×</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>Hot Water disinfection</td>
<td>○</td>
<td>○</td>
<td>×</td>
<td>80°C and above</td>
</tr>
<tr>
<td>Legionella Measures</td>
<td>○</td>
<td>○</td>
<td>×</td>
<td>60°C and above</td>
</tr>
</tbody>
</table>

※Heat pump comparison is for Mayekawa Products
Heat Pump Technology in Japan

Energy conservation and CO2 reduction by "Natural refrigerant CO2" + "Heat pump technology"

Air heat source
- Hot water of 65 to 90°C
- Greatest possible in the industry!

Water heat source
- Hot water of 65 to 90°C
- First in the industry!
- + Cold water

Air heat source
- Hot air of 80 to 120°C
- First in the industry!
- + Cold water
Conventional system

Outline of heat source system

**Boiler**
- Hot Water Tank
- Water → Steam
- Hot Water

**Chiller**
- F-gas refrigerant Chiller
- Heat Exchanger

**Process Line**
- Filling and Loading
- Water spray cooling

**Outline of heat source system**
- Heat Exchanger
- Sake Tank
Proposed system

Energy Saving System using Heat Recovery Heat Pumps

- Hot Water
- Boiler
- Chiller
- Water heat source
- CO2 Heat Pumps
- Heat Exchanger
- Filling and Loading
- Sake Tank
- Process Line
- Water spray cooling
- High efficiency Natural refrigerant Chiller
Stability of capacity and efficiency in actual operation

Water heat source CO2 Heat Pumps (Total Capacity)
Running cost result

CO2 reduction: -34%

Running cost: -24%

Energy saving: 32%

※ Compared to conventional system

Water heat source CO2 Heat Pumps
Ministry of Economy, Trade and Industry
Agency for Natural Resources and Energy
Secretary Award in 2015

Tatsumi of Tokyo branch manager at that time (2015)
Summary

CO2 heat pumps are an effective technology for industrial sectors that require large amounts of heating and cooling, such as food and beverage plants.

1. This is one of the technologies that can contribute to carbon neutrality towards 2050.

1. This equipment can save energy and reduce CO2 emissions at the same time.

1. Heat recovery technology achieves high efficiency and reduces running costs.
Thank you for your attention!

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