Operating principle

AdRef-Noa consists of two identical adsorption/desorption heat exchanging sections, one for each evaporative and condensing heat exchanger. Adsorption-desorption process, described below, is interchanged and repeated in these two sections.

**ADSORPTION**
Water as a refrigerant evaporates in the evaporative heat exchange section. AdRef produces chilled water by using evaporative latent heat. The vapor is then adsorbed by an adsorber A. The adsorber generates heat, but removing this heat by cooling water further enhances the evaporating process.

**DESORPTION**
Hot water (the heat source) is used to desorb the moisture that is adsorbed in the adsorber B. The released moisture enters the condensing section and is condensed for next evaporation.

Adsorbent: Zeolite is utilized instead of Silica gel.

---

**Standard specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling capacity</td>
<td>kW</td>
<td>315</td>
</tr>
<tr>
<td>Chilled water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outlet temperature</td>
<td>°C</td>
<td>15°C</td>
</tr>
<tr>
<td>Heat source</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inlet temperature</td>
<td>°C</td>
<td>68°C</td>
</tr>
<tr>
<td>Cooling water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inlet temperature</td>
<td>°C</td>
<td>27°C</td>
</tr>
<tr>
<td>Refrigerant pump</td>
<td>kW</td>
<td>1.1</td>
</tr>
<tr>
<td>Vacuum pump</td>
<td>kW</td>
<td>0.2</td>
</tr>
<tr>
<td>Dimensions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>mm</td>
<td>5600</td>
</tr>
<tr>
<td>W</td>
<td>mm</td>
<td>2200</td>
</tr>
<tr>
<td>H</td>
<td>mm</td>
<td>2350</td>
</tr>
<tr>
<td>Net weight</td>
<td>kg</td>
<td>11,000</td>
</tr>
</tbody>
</table>

---

**Performance for ADR-Z4520**

- **Hot water temperature 68°C**
- **IMM Efficiency Ratio**

---

**Outer Dimensions**

-Friendly to mankind and to the earth ———-AdRef-Noa

The more advanced AdRef-Noa makes the best use of unutilized heat source and renewable energy including solar heat.

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**Waste water at 60~80°C can produce chilled water.**

The 21st century business model

Examples of heat sources: Solar heat, hot spring, geothermal, Combined heat and power, fuel cells, vapor condensate, waste heat from industrial furnaces, distilling columns, reactor towers, district heating networks etc..

---

**Features**

**Minimizing Life Cycle Cost**

1. HCFC/HFC free using water
2. Energy-saving
3. Lower operation and maintenance costs
4. No noise and no vibration
5. No certified/qualified operator required

**Effects**

**Achieving COP 10**

**Renewable energy** (solar heat, hot spring, geothermal, etc.)

Use solar energy to achieve HCFC/HFC free air conditioning.

**Biomass energy** (Forest thinning, Scrap wood, Food waste, sewage sludge, etc.)

Convert industrial waste into biomass energy to realize zero-emission plants.

**Unutilized energy** (Waste heat from plants, Combined heat and power (CHP), waste heat from industrial furnace, etc.)

Produce chilled water from unused heat source alternative to existing HCFC/HFC chillers for green solution.

---

The ideal solution to reduce CO₂ emissions!

Unlimited application of renewable and unutilized energy!!

---

**Panel cooling**

**Biomass energy**

Wood pallets → Pellet boilers

**Unutilized energy**

Waste heat recovery

Heat exchanger

---

**The system comparison in 90USRT scale**

<table>
<thead>
<tr>
<th>Energy source</th>
<th>COPa</th>
<th>COPb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-cooled chiller</td>
<td>14.9</td>
<td>17.2</td>
</tr>
<tr>
<td>Adsorption chiller</td>
<td>10.0</td>
<td>12.4</td>
</tr>
</tbody>
</table>

(Air-cooled chiller)

Driving power: 90kW

Cooling power: 12.5kW

Cooling tower fan: 15kW

Cooling water pump: 14kW

Hot water pump: 18kW

Total: 120.5kW

(Adsorption chiller)

Driving power: 11.5kW

Cooling tower fan: 15kW

Cooling water pump: 11.5kW

Hot water pump: 3.5kW

Total: 32kW

---

**The comparison of cooling capacity**

| Heat source inlet temperature (˚C) | Inlet cooling water: 31˚C | Outlet chilled water: 9˚C |
|-----------------------------------|---------------------------|
| Zeolite                           |                           |
| Silica gel                        |                           |
| Absorption refrigeration          |                           |

(All temperatures in ˚C)