Eco-Cute CO₂ High Temperature Heat Pumps

A Sustainable Technology

Regardless of political agendas or incentives, consumers worldwide are increasingly pursuing sustainable, cost effective alternatives to traditional fossil fuelled equipment for their hot water and space heating requirements. Using natural CO₂ as the refrigerant and achieving a high coefficient of performance (COP), CO₂ heat pumps offer both ecological and financial benefits.

The unique capacity of the Eco-Cute CO₂ Heat Pump to produce 90°C hot water makes it suitable for use in a wide range of industrial, commercial and residential projects, including food processing plants, dairies, shopping centres, apartments, hotels, restaurants, hospitals, aged care, recreational and educational facilities. Eco-cute can also be adopted with a high level of safety as the absence of combustion reduces the risk of fire.

Instead of the more conventional ammonia or haloalkane (R134A) refrigerant gases, Eco-Cute CO₂ Heat Pumps use supercritical carbon dioxide as the refrigerant.

The technology offers a means of energy conservation and reduces the emission of greenhouse gas.

From the energy output side, the operational characteristics of the heat pump are different to conventional systems (such as electric/gas/oil boilers or electric heaters). With conventional systems, 1kW input of energy provides less than 1 kW of output energy or heat. With a CO₂ heat pump system, every 1kW of input energy consumed produces an average of 3.9 x the input as output energy or heat by extracting heat from the outside air.

Summary

Producing 90°C hot water with an average COP of 3.9, makes Eco-Cute CO₂ Heat Pumps an ideal energy efficient domestic hot water and space heating system for industrial, commercial and residential applications. This ability to convert 1kW of input energy into 3.9kW of output energy represents an ongoing economical and sustainable water heating solution.

About Itomic Nihon

Itomic Nihon has been a leading manufacturer of hot water heaters in Japan since 1948. With over 2500 Itomic Eco-Cute CO₂ Heat Pumps installed globally, this product continues to demonstrate its worth as a proven and reliable non-fossil fuel water heating system.
Eco-Cute CO₂ Heat Pump Features & Advantages

Heats up to 90°C - Due to its innovative design, the Eco-Cute CO₂ Heat Pump can produce hot water up to 90°C at low and high ambient temperatures (-20°C to 43°C)
Flexible - The same system can be simultaneously used for Space Heating & Domestic Hot Water
Ultra quiet operation – 60dBa
No combustion - reduces fire risk
Suitable for up to 60°C ΔT (flow 90°C, return 30°C)
Ambient operating temperatures from -5°C to 43°C (Special unit available for -15°C or -20°C)
Safe - Non-flammable CO₂ refrigerant
Can be set to operate during off peak times to benefit from low cost power
30% Space Saving due to Y Frame design (CHP-80)
Versatile - Suitable for a wide range of purposes, from small facilities to large buildings where hot water or heating is required.
Eco friendly - The Eco-Cute CO₂ Heat Pump uses natural CO₂ refrigerant. This refrigerant has a global warming potential (GWP) of about 1/1700 that of R410 and zero ozone-depleting potential (ODP).
Energy efficient - Under optimal conditions, Eco-Cute CO₂ Heat Pumps achieve an exceptional coefficient of performance (up to 4.2) which equates to higher energy efficiency. Compared to the traditional electric hot water heater, the CO₂ hot water heat pump can save up to 75% heating energy. Further energy cost savings can be achieved through operation during off peak hours, subject to off-peak electrical power supply.

Anti-freeze/Cold Area Units - the heat pump is fitted with a defrost solenoid valve which will open when the evaporator ices up. The hot gas will then flow through the evaporator and melts the ice. Water cannot be stored during defrosting.
One pass heating - It is suitable for heating water from low to high temperatures (large temperature difference) in one pass.
Reduces storage requirements - Since this hot water heat pump can heat water up to 90°C, the size of the storage tank can be reduced.

Energy Saving Function - This function is an energy-saving function that learns operation patterns from the four previous weeks to prevent unnecessary heating and temperature decreases in stored water through natural heat loss. The use of this function based on operation data stops the unit from boiling water unnecessarily.

Running Cost Comparison

<table>
<thead>
<tr>
<th>Cost / kwH</th>
<th>Eco-Cute CO₂ Heat Pump</th>
<th>Electric Water Heater</th>
<th>LPG Fueled Boiler</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Eco-Cute offers significantly lower running costs & CO₂ emissions
How It Works

The Eco-Cute CO₂ Hot water heat pump is an energy efficient electric heat pump that uses heat extracted from the air to heat water for industrial, commercial and residential applications. A hot water heat pump removes energy from a low temperature source (ambient air or waste water) and moves it to a high temperature hot water tank.

Advantages of using CO₂ as a refrigerant

This heat pump uses CO₂ as a refrigerant. CO₂ is a natural refrigerant and has an ozone depletion potential (ODP) of zero and a global warming potential (GWP) of 1. CO₂ refrigerant is a non HFC refrigerant. Traditional HFC refrigeration systems affect climate change in two distinct ways: direct and indirect contribution. Direct contribution results from the release of refrigerants into the atmosphere. Indirect contribution refers to the energy used to operate traditional refrigeration equipment. The less energy required to operate the equipment, the lower the impact on the environment.

Refrigerant Characteristics

<table>
<thead>
<tr>
<th>Refrigerant</th>
<th>Ozone depletion potential</th>
<th>Global warming potential</th>
<th>Combustible</th>
<th>Toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R410A</td>
<td>R407C</td>
<td>R744(CO₂)</td>
<td></td>
</tr>
<tr>
<td>Ozone depletion potential</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Global warming potential</td>
<td>1975</td>
<td>1653</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Combustible</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Toxicity</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td></td>
</tr>
</tbody>
</table>
### General Performance Data of a Standard Unit

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Power supply</th>
<th>Total power input @ 25°C ambient (kW)</th>
<th>Heating output @ 25°C ambient (kW)</th>
<th>Average COP</th>
<th>Dimension L x W x H (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHP-15F</td>
<td>3 phase 415V/50Hz</td>
<td>4.16</td>
<td>15</td>
<td>3.6</td>
<td>900 x 450 x 1850</td>
</tr>
<tr>
<td>CHP-26H4</td>
<td>3 phase 415V/50Hz</td>
<td>6.7</td>
<td>29.3</td>
<td>4.2</td>
<td>1300 x 890 x 1705</td>
</tr>
<tr>
<td>CHP-080Y2</td>
<td>3 phase 415V/50Hz</td>
<td>18.8</td>
<td>78.4</td>
<td>4.2</td>
<td>1790 x 1010 x 2000</td>
</tr>
</tbody>
</table>

CO2 heat pump system for DHW and space heating on skid frame.
Designed for Space and Energy Efficiency

With a heating performance of 80 kW, the CHP-080Y2 was developed to reduce high hot water supply costs and large space requirements that inevitably occur in facilities requiring a large hot water supply.

The structure of the Y-shaped frame reduces power consumption and allows units to be installed close together. The heating performance can be switched between three modes in order to adjust the energy to suit how you use hot water, and performance does not decrease* in temperatures down to -15°C.

This flexible system is suitable for a wide range of facilities that use large volumes of hot water, and is durable enough to provide a steady hot water supply for a long time.

* Energy-saving mode only

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**Product Quick Check**

<table>
<thead>
<tr>
<th>Type</th>
<th>CO₂ Heat Pump</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>12-80kW</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Average COP 3.9</td>
</tr>
<tr>
<td>Fuel Type</td>
<td>Electricity</td>
</tr>
<tr>
<td>Outdoor option</td>
<td>Yes</td>
</tr>
<tr>
<td>Cascadeable</td>
<td>Yes</td>
</tr>
<tr>
<td>Max Pressure</td>
<td>490 kPa</td>
</tr>
<tr>
<td>Zero Nox</td>
<td>Yes</td>
</tr>
<tr>
<td>Building J Code</td>
<td>2018 compliant</td>
</tr>
</tbody>
</table>
## Performance Data

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Constant Supply Hot Water at 65°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heating Ability (kW)</td>
</tr>
<tr>
<td>CHP-15F</td>
<td>15 / 15 / 15</td>
</tr>
<tr>
<td>CHP-26H4</td>
<td>24.0 / 26.3 / 29.3</td>
</tr>
<tr>
<td>CHP-080Y2</td>
<td>61.1 / 65.6 / 66.4</td>
</tr>
</tbody>
</table>

* Ambient Temperatures - A: DB7°C / WB6°C (Winter) - B: DB16°C / WB12°C (Intermediate) - C: DB25°C / WB21°C (Summer)

## Specifications

<table>
<thead>
<tr>
<th>Product Code</th>
<th>CHP-15F</th>
<th>CHP-26H4</th>
<th>CHP-080Y2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply</td>
<td>3 phase 415V 50Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design pressure at refrigerant side (MPa)</td>
<td>Low pressure side 8 / High pressure side 13.2</td>
<td>Low pressure side 7.5 / High pressure side 14</td>
<td></td>
</tr>
<tr>
<td>Compressor Type</td>
<td>Horizontal scroll compressor</td>
<td>Semi-hermetic reciprocating compressor</td>
<td></td>
</tr>
<tr>
<td>Compressor Motor Type</td>
<td>Three-phase induction motor</td>
<td>Inverter drive three-phase induction motor</td>
<td></td>
</tr>
<tr>
<td>Compressor Rated Output (kW)</td>
<td>1.9kW x 2</td>
<td>8.4</td>
<td>15.8</td>
</tr>
<tr>
<td>Crankcase Heater (W)</td>
<td>N/A</td>
<td>100</td>
<td>140</td>
</tr>
<tr>
<td>Fan</td>
<td>Propeller fan (47Wx2)</td>
<td>Propeller fan (110Wx2)</td>
<td>Propeller fan (300Wx2)</td>
</tr>
<tr>
<td>Pump</td>
<td>30</td>
<td>Seal-less, AC200V - 100W</td>
<td>Seal-less, DC282V - 140W</td>
</tr>
<tr>
<td>Air heat exchanger</td>
<td>Forced cooling cross fin</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Protection Devices

- High pressure switch
- High-low pressure sensor
- Compressor motor excessive temperature protection
- Compressor rupture disk
- Over current relay (compressor)
- High pressure switch
- High-low pressure sensor
- Compressor over heat cut out device
- Compressor pressure relief valve
- Over current relay (fan)
- Over current protection

## Supply hot water heat exchanger

- Forced circulation double-piping type

## Dimensional Data

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Dimensions (H x W x D)</th>
<th>Product mass / Operating weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHP-15F</td>
<td>1850 x 900 x 450</td>
<td>174 / 177</td>
</tr>
<tr>
<td>CHP-26H4</td>
<td>1705 x 1300 x 890</td>
<td>480 / 500</td>
</tr>
<tr>
<td>CHP-080Y2</td>
<td>2000 x 1790 x 1010</td>
<td>690 / 710</td>
</tr>
</tbody>
</table>
EcoCute CO₂ - High Temperature Heat Pumps

CHP-15F Dimensional Data and Installation Guide

Dimensions

- **Air suction inlet**
- **Air discharge outlet**
- **Heat pump outlet piping (B side) connection (R3/4)**
- **Heat pump inlet piping (A side) connection (R3/4)**
- **Drain piping connection for venting air (R1/2)**

**Operation output, Error output, External input terminal board**
- **Supply hot water stop valve terminal board**
- **Power source terminal board**
- **Grounding terminal** (Inside the electric device BOX)

- **91 for rear leg**
- **Drain hole (35 hole)**
- **Anchour bolt notch hole (M21 for bolt × 4 spots)**
- **20 hole**

**Anchor bolt position, Piping connection (Top view)**

- **Remote control cord & others lead-in position**
- **Connection for heat pump outlet piping (B side)**
- **Connection for heat pump inlet piping (A side)**

**Plan view showing clearance spaces required**

- **ARROW DENOTES AIR INPUT AND OUTPUT DIRECTION**

**Installation Guidelines**

- **This unit is not for indoor installation. Outdoor installation only.**
- **Consult your sales store when obstacles are at three directions, and for a built-in installation.**
- **Do not set this unit in a closed depression with all sides deeper than 1.0M**
EcoCute CO₂ - High Temperature Heat Pumps

CHP-26H4 Dimensional Data and Installation Guide

Dimensions

A  Anchor bolt fitting holes (4×15 holes)
B  Operation check window (front)
C  External signal connection port (sensor, etc., 24 holes)
D  Power source port (x39 hole)
E  Control board position (front)
F  Hot water outlet Rc3/4 (20 A, CAC 406)
G  Supply water inlet Rc3/4 (20 A, CAC 406)
H  Air heat exchanger room drain Rc1 (25 A, C360RD)
I  Drain outlet Rc3/4 (20 A, CAC 406)

Installation Guidelines

• Install the heat pump unit outdoors, with adequate ventilation
• Install in a location where cold air from the air outlets of the heat pump unit or operating sounds will not disturb neighbours, or take soundproofing measures.
• The diagram shows the space required for maintenance and inspections. It may not be possible to perform maintenance or inspections without the necessary space. Make sure to leave sufficient space when designing the layout.

Pipe Slot
Circuit Diagrams and Installation Guidelines

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Case Studies

Yarra’s Edge Tower 1

1 x Eco-Cute CO₂ Heat Pump

At Yarra’s Edge Tower 1, one of Melbourne’s finest waterside highrise apartments, Automatic Heating installed a new and improved hybrid system that features a high efficiency heat pump, high efficiency condensing boilers and twin coil storage tanks. Two atmospheric 500kW boilers used for domestic hot water were replaced with an Eco-Cute 15kW High Temperature CO2 Heat Pump, five Meridian 150kW condensing boilers and Plate Heat Exchangers. This hybrid solution ensures that the new system will run as efficiently, sustainably, and economically as possible.

Brown Brothers Milawa Winery

1 x Eco-Cute 76kW CO₂ Heat Pump

Brown Brothers Milawa Winery are now proving the environmental and financial benefits of using a CO₂ Heat Pump to heat hot water for a section of their wine processing plant.

With calculated energy cost savings of 75% compared to an LPG fired boiler, the CO₂ Heat Pump and 1500L Stainless Steel Tank provides a high efficiency, fossil-fuel-free solution to their needs.

Special Needs School

2 x Eco-Cute CO₂ Heat Pump

The Saitama Tokorozawa Special Needs School in Japan, installed 2 x Eco-Cute CO₂ Heat Pumps to supply hot water to the school kitchen which produces 220 meals per day.