# Hot Air Circulation Heat Pump / Eco Circuit 100

## Mayekawa Mfg.

**Figure 1: External appearance**

## Summary of technology

Mayekawa commercialized a one way $CO_2$ air heater heat pump (Eco Sirocco) in 2009 and a hot air circulation heat pump (Eco Circuit) in 2018. Eco Sirocco is suitable for application in dry processes with large temperature glides at the heat sink, and supplies hot air up to 120°C. On the other hand, the Eco Circuit is suitable for application in dry processes with small temperature glides at the heat sink, and supplies hot air up to 85°C.

A new product Eco Circuit 100 was commercialized in 2021. This heat pump supplies hot air up to 100°C as a result of improving the existing Eco Circuit. The higher supply temperature expands application of the heat pump in more drying processes.

The Eco Circuit 100 targets applications such as paint drying of resin products which require about 95°C hot air and cannot be serviced the existing Eco Circuit which supplies air up to 85°C. The Eco Circuit 100 was newly developed for such customer needs.

The heat pump uses water or brine as the heat source medium (see Figure 2). The heat source temperature is of a wide range from 0°C to 40°C, which realizes two types of heat recovery from wastewater or chilled water. At the heat sink side, the heat pump heats return air from the dryer (with a small temperature glide) up to 100°C.

R1234ze(E), which has a small GWP below 1, is used as the refrigerant. The critical temperature is 109.4°C. The heat pump operates in the subcritical region.

The compressor is a reciprocating type. The heating capacity is about 100 kW. The heat pump is controlled so that supply hot air temperature is kept constant.

The condenser (air heater) consists of an aluminum-fin, copper-tube heat exchanger. The maximum air flow rate is 45,000 $m^3/h$.

The evaporator is a plate type heat exchanger. Wastewater from other processes, cooling water for chillers or air compressors can be used in the heat source. By lowering the evaporation temperature, both chilled water and hot air can be supplied from the heat source and heat sink sides simultaneously.

Performance of the heat pump is shown in Table 1. As shown in the table, the heat sink temperature glide is preferably about 10 K or less.

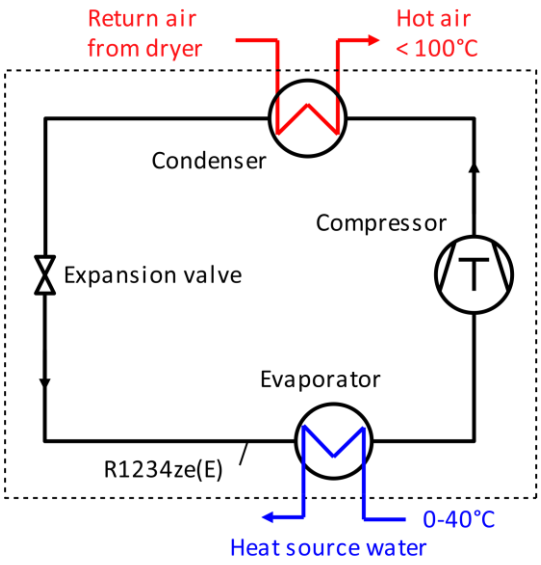


**Figure 2: System configuration**

**Table 1: Performance**

| $T_{source,in}$ [°C] | $T_{source,out}$ [°C] | $T_{sink,in}$ [°C] | $T_{sink,out}$ [°C] | $COP_{heating}$ [-] |
|---|---|---|---|---|
| 30 | 25 | 90 | 100 | 2.6 |
| 30 | 25 | 80 | 90 | 2.8 |
| 30 | 25 | 70 | 80 | 3.2 |

## Project example

Eco Circuit, which supplies hot air up to 85°C, was installed for high temperature aging process in Li-ion battery production. The heat pump is used for keeping the aging room temperature constant.

On the other hand, Eco Circuit 100, which heats air up to 100°C, has just been commercialized and has not been installed in any factory as yet. It is expected to be introduced in drying processes of resin products in the future. There is cooling every after a drying process, therefore, simultaneous heating and cooling can be realized.

## FACTS ABOUT THE TECHNOLOGY

**Heat supply capacity:** 100 kW

**Temperature range:** Heat source water (or brine) 0-40°C, Inlet air 50-100°C, Hot air <100°C

**Working fluid:** R1234ze(E)

**Compressor technology:** reciprocating type

**Specific investment cost for installed system without integration:**

**TRL level:** TRL 8-9

**Expected lifetime:** 15 years

**Size:** Weight 5,500 kg, Footprint 7 $m^2$

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