

1. External appearance



Photograph1 High-efficiency hot-water heat pump HEM-HR90

2. Image of system

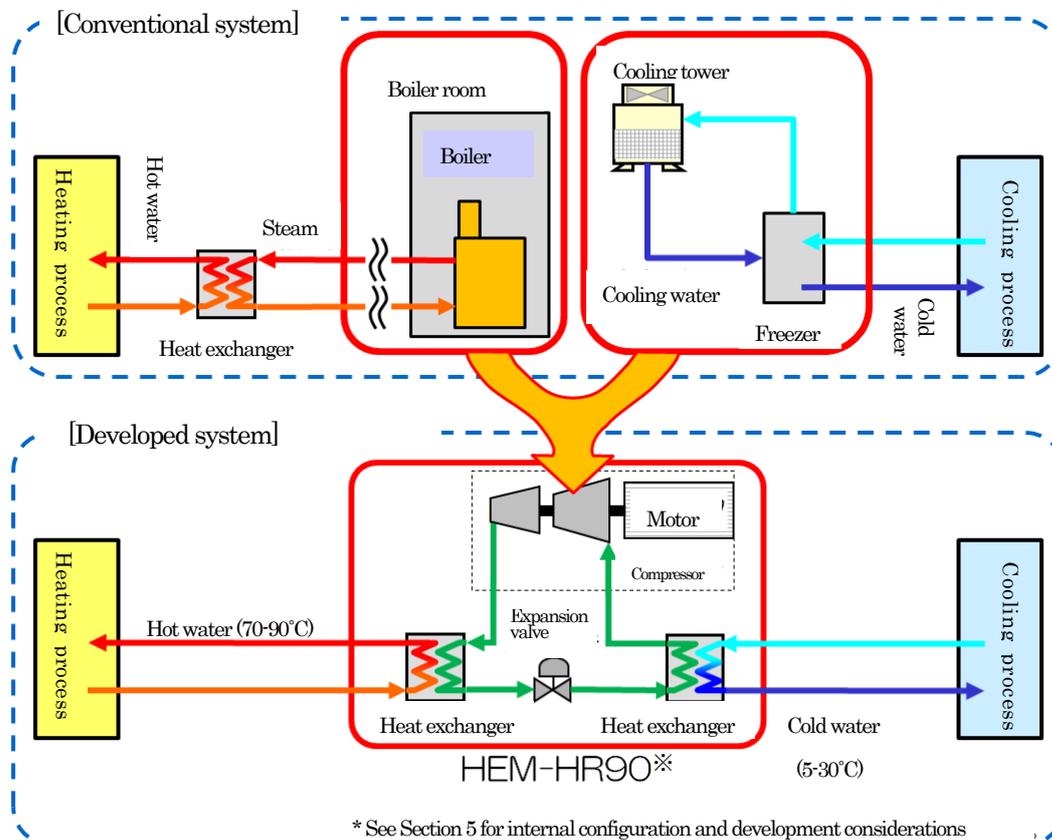


Figure 1 Image of conventional system and HEM-HR90

### 3. Specifications

Table 1 HEM-HR90 specifications

Unit dimensions	D 2.6 m × W 1.2 m × H 2.1 m
Weight*1	Shipped weight: 2,700 kg (Operating weight: 2,830 kg)
Refrigerant	R134a and R245fa mixed refrigerant
Compressor	Inverter-drive two-stage screw-type
Legal refrigeration ton	6.5 metric tons*2
Performance (Temperature conditions 1)	Hot water inlet/outlet: 80/90°C; cold water inlet/outlet: <u>17/7°C</u>
Performance	Heating performance: 272 kW; cooling performance: 173 kW
Energy consumption	99 kW
Total COP	4.5
Performance (Temperature conditions 2)	Hot water inlet/outlet: 80/90°C; cold water inlet/outlet: <u>35/30°C</u>
Performance	Heating performance: 357 kW; cooling performance: 252 kW
Energy consumption	105 kW
Total COP (heating COP*3)	5.8 (3.4)

\*1 Because the HEM-HR90 operates with both hot and cold water in the unit, the unit's operating weight is increased against the shipped weight by the weight of this water.

\*2 Because the Japanese refrigeration ton of the unit is less than 20 metric tons, under the High Pressure Gas Safety Law, it is not necessary to inform the local authorities when a unit is situated, or to nominate a unit supervisor. Japanese refrigeration ton is a measure of the size of heat pump equipment.

\*3 It is assumed that when the unit is operating in Temperature conditions 2, there will be cases in which the unit will be used only for heating without cooling, and therefore the heating COP, representing the unit's heating performance in kW divided by the power consumption during operation in kW, is also shown.

### 4. Standard range of operation

The temperature at which the HEM-HR90 can supply hot water has been increased against the HEM II-HR, the previous unit manufactured by Kobe Steel, at the same cold water temperatures.

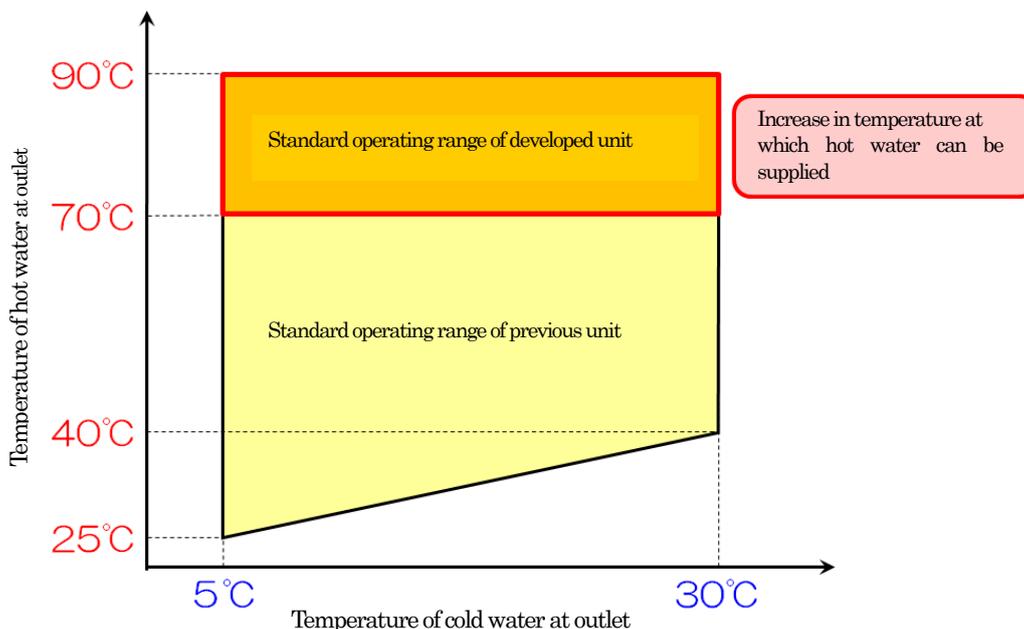


Figure 2 Standard operating range of HEM-HR90 and previous unit manufactured by Kobe Steel (HEM II-HR)

## 5. Development considerations for the HEM-HR90

The HEM-HR90 is the industry's first water heater heat pump to employ a high-compression ratio two-stage screw compressor. The compressor motor has been adapted to high temperatures, and the optimum refrigerant has been selected, enabling the temperature of hot water supply by the unit to be increased. The HEM-HR90 is able to circulate and utilize hot water (adapted to circulation and heating), and is the industry's first hot water heat pump that is able to efficiently and simultaneously supply hot water at 90°C and cold water at 7°C.

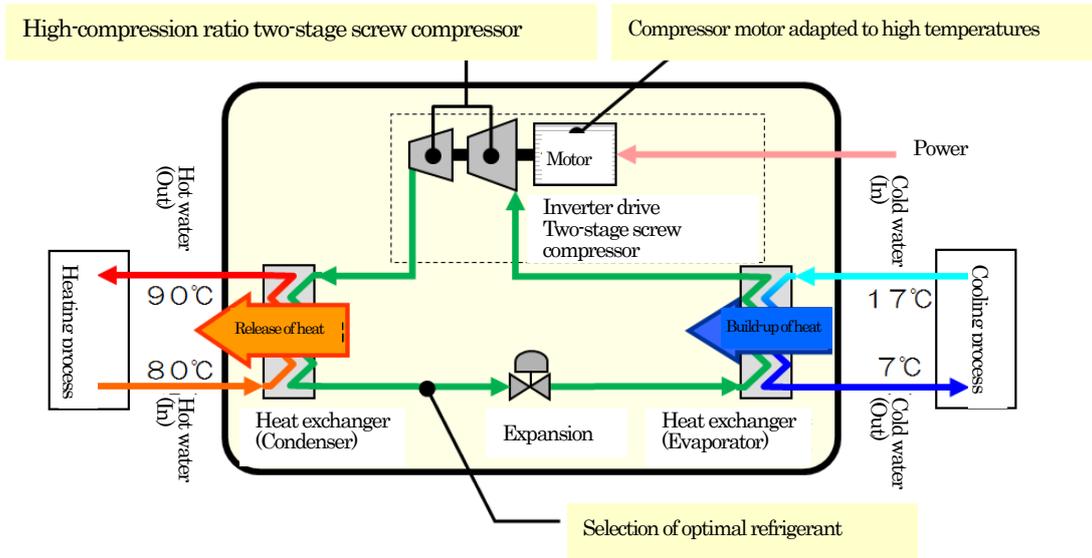


Figure 3 Internal configuration and functioning

## 6. Projected effects of introducing the system

The effects of introducing three HEM-HR90 units to produce 90°C hot water for a heating process and 7°C cold water for a cooling process were estimated. Below, the estimates are compared with figures for a system combining a boiler and a refrigeration unit, prior to equipment upgrade.

### Running cost

(Unit: Million yen/year)

	Tokyo Region	Nagoya Region	Osaka Region	Average for three regions
HEM-HR90	13.8	13.3	13.0	13.4
Conventional system (Boiler + refrigeration unit)	33.4	37.4	36.1	35.6
Rate of reduction	58.5 %	64.5 %	63.9 %	62.4 %

- Calculations assume an operating time of 12 hours on weekdays only.
- Calculations consider weather conditions and power, gas, and water fee schedules in the three regions.

### Energy consumption

(Unit: GJ/year)

	Tokyo Region	Nagoya Region	Osaka Region	Average for three regions
HEM-HR90	8,484	8,484	8,484	8,484
Conventional system (Boiler + refrigeration unit)	21,466	21,588	21,632	21,562
Rate of reduction	60.5 %	60.7 %	60.8 %	60.7 %

- For the calculation of energy consumption, the figure of 9,970 kJ/kWh stipulated by the Enforcement Regulations for the Law concerning Rational Use of Energy was used for power, and the figures officially stated in the standard gas supply contracts of city gas companies in each region were used for city gas.
- A joule (J) is a unit expressing the magnitude of energy. 1 GJ is 10<sup>9</sup> J. 1 GJ is approximately equivalent to the amount of energy in 26 liters of crude oil.

### CO<sub>2</sub> emissions

(Unit: ton-CO<sub>2</sub>/year)

	Tokyo Region	Nagoya Region	Osaka Region	Average for three regions
HEM-HR90	283	361	254	299
Conventional system (Boiler + Refrigeration unit)	1,043	1,081	1,039	1,054
Rate of reduction	72.9 %	66.6 %	75.5 %	71.6 %

- For the calculation of CO<sub>2</sub> emissions, figures officially published by the Ministry of the Environment were used for power, and figures officially published by city gas companies in each region were used for city gas.
- Here, ton-CO<sub>2</sub> is the volume of greenhouse gases emitted during energy use converted into the greenhouse effect of CO<sub>2</sub> and expressed in units of metric tons.