

# “Voxcel” Air-Cooled Heat Pump Module Chiller featuring Industry’s Top-Class COP in Both Cooling and Heating Mode



Centrifugal & Absorption Chiller  
Department, Air-Conditioning &  
Refrigeration Systems

With the increase in the need for CO<sub>2</sub> reduction, energy saving and high efficiency in the air-conditioning heat source equipment market, shipments of centrifugal chillers have been increasing for use as high-capacity heat source equipment for cooling, while shipments of air-cooled heat pumps have been increasing for use as large-capacity heat sources for heating. The centrifugal chiller is far superior to others in cooling performance, and the air-cooled heat pump is attracting attention because of its superiority in heating capacity. Many conventional air-cooled heat pumps were developed with a focus on cooling performance. Under this circumstance, Mitsubishi Heavy Industries, Ltd. (MHI) developed the “Voxcel” air-cooled heat pump with a focus on heating capacity, in response to market demand.

## 1. Specifications

Table 1 shows the specifications.

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Model		MVCP85	MVCP118	MVCP150	MVCP180				
Nominal horsepower		30 HP	40 HP	50 HP	60 HP				
Number of modules		4							
Power source (rated voltage, frequency)		3-phase 200V 50/60Hz							
Capacity	Rated cooling capacity	67	85	106	118	132	150	160	180
	Rated heating capacity	67	85	106	118	132	150	160	180
Power consumption	Cooling *1	16.2	21.4	28.4	32.8	38	45.8	50.4	63.4
	Heating *1	16.0	21.0	26.4	30.7	35.1	40.8	44.5	52.3
COP	Cooling *1	4.13	3.97	3.72	3.59	3.47	3.27	3.17	2.84
	Heating *1	4.18	4.04	4.01	3.84	3.75	3.67	3.59	3.43
Outer dimension	Height x width x depth	mm 2624×1618×3820							
Mass		kg 2400							
Refrigerant		R410A							
Operation noise (front/back) (Rated value) *2		db(A) 58/59	61/62	66/67	68/69				
Water piping	Design pressure	MPa (G) 1.0							
	Rated flow *1	m <sup>3</sup> /h 8.2	10.4	13.0	14.5	16.2	18.4	19.7	22.1
Condition	Leaving temperature of cold/hot water	°C Cooling: 5 – 15 (rated value: 7), Heating: 35 – 55 (rated value: 45) *3							
	Difference between leaving and entering temperatures of cold/hot water (at rated capacity)	°C 4.5 – 10 (5.1 – 10 at 180kW) *4							
	Temperature of air drawn from outdoor	°C Cooling: 5 - 43°C DB, Heating: -20 - 16°C WB (standard)							
Legal refrigerant tons (per module)		tons 4.9	5.9	7.5	7.5				
Multiple unit control board		Power source Single-phase 200V 50/60Hz							

- \*1: The capacity and power consumption are based on a temperature difference of 7°C between the leaving temperature and the entering temperature of cold/hot water. (Outdoor temperature in cooling: 35°C DB, the entering temperature: 14°C, the leaving temperature: 7°C, outdoor temperature in heating: 7°C DB, 6°C WB, the entering temperature: 38°C, the leaving temperature: 45°C)
- \*2: The operation noise indicates the total of the values obtained by measuring each module in an anechoic chamber that minimizes echoes according to the Japanese Industrial Standards.  
Values measured at a position 1 m from the center of the front side (back side) of the unit, at a height of 1.5 m.
- \*3: The ranges of cool/warm water are based on the rated outdoor air, and the ranges are limited if outdoor air is not at the rated value.
- \*4: The temperature difference between the leaving temperature and entering temperature of cold/hot water as well as the rated flow range varies depending on the outdoor air temperature condition.

## 2. Characteristics

### 2.1 Ensures adequate heating capacity in low outdoor temperatures below 0°C

The heating capacity of general air-cooled heat pumps declines in response to a drop in outdoor temperature. Meanwhile, the Voxcel, which incorporates the optimum compressor, achieves a rated heating capacity at 150% of conventional units at an outdoor temperature of -10°C, something never achieved by conventional air-cooled heat pumps. Because of these characteristics, the number of units required to achieve a certain level of heating capacity is smaller, compared with general air-cooled heat pumps, if Voxcel units are used within the maximum load specified by the low outdoor temperatures standard. **Figure 1** shows the characteristics of the heating capacity.

The specifications of the components were determined with a focus on the operating point where high output is required.

### 2.2 Quick start of heating

General office buildings cool down in the winter and on weekends, and the heating load is very high when air-cooled heat pumps are started on Monday morning. In conventional air-cooled heat pumps, the leaving temperature of the hot water was not maintained at a specified temperature when cooled water returns to the pump, making it difficult to heat the building quickly. In the Voxcel, which is capable of increasing the heating capacity up to 150% of the rated capacity, the temperature at the warm water outlet is maintained at a specified level even if the temperature of the returned water is lower, which means extremely quick starts and providing comfort to users in a shorter period of time. **Figure 2** shows the characteristics of the heating capacity.

### 2.3 Energy saving and high efficiency

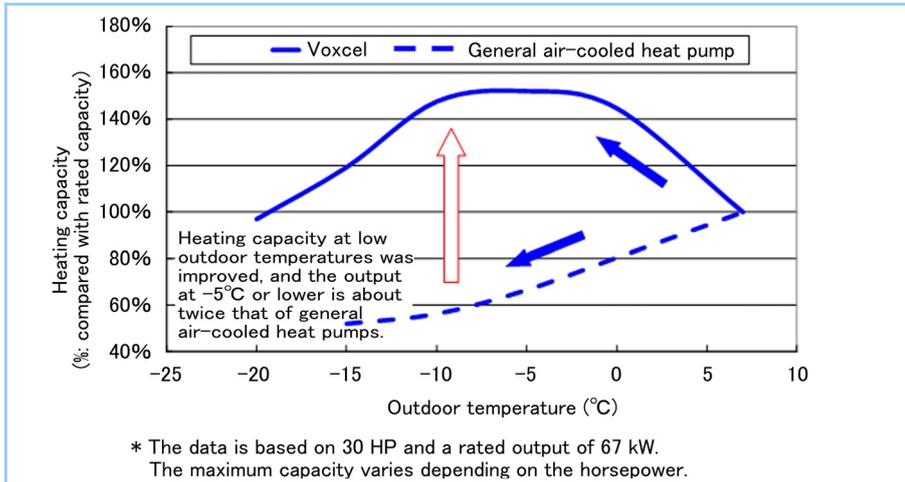
**Figure 3** shows the heating capacity. The heating capacity COP is 4.18, which is the highest in the industry. It features high efficiency in the entire range. The rated capacities are much higher than those set by other manufacturers and are suitable for a wide range of applications. **Figure 4** shows the cooling capacity. The cooling capacity COP is 4.13, which is also the highest in the industry. It also features high efficiency in the entire range. The rated capacities are also much higher than those set by other manufacturers. The high-performance air-cooled heat pump ensures high-efficiency operation throughout the year.

### 2.4 Advantages for equipment planning

The initial cost is reduced because the number of units to be installed can be reduced, which is made possible due to the quick start of heating operation and the high output under low outdoor temperatures.

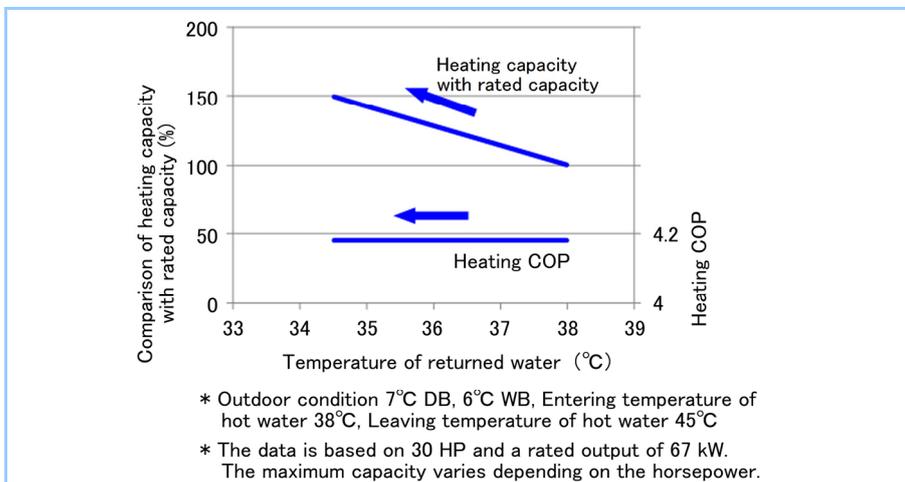
The annual running cost and CO<sub>2</sub> emissions will be reduced if a minimal number of the high-efficiency Voxcel units are installed, using a centrifugal chiller as the base unit, in case the cooling load is high.

MHI offers heat source units including centrifugal chillers and air-cooled heat pumps as well as technologies for optimal control of all types of heat source units such as cool/warm water pumps, cooling-water pumps and cooling towers. We offer the “Ene-Conductor,” which maximizes the characteristics introduced above. We will promote our marketing activities through various means including the suggestion of systems that incorporate a combination of the Voxcel featuring high heating performance and a centrifugal chiller featuring superior cooling performance.



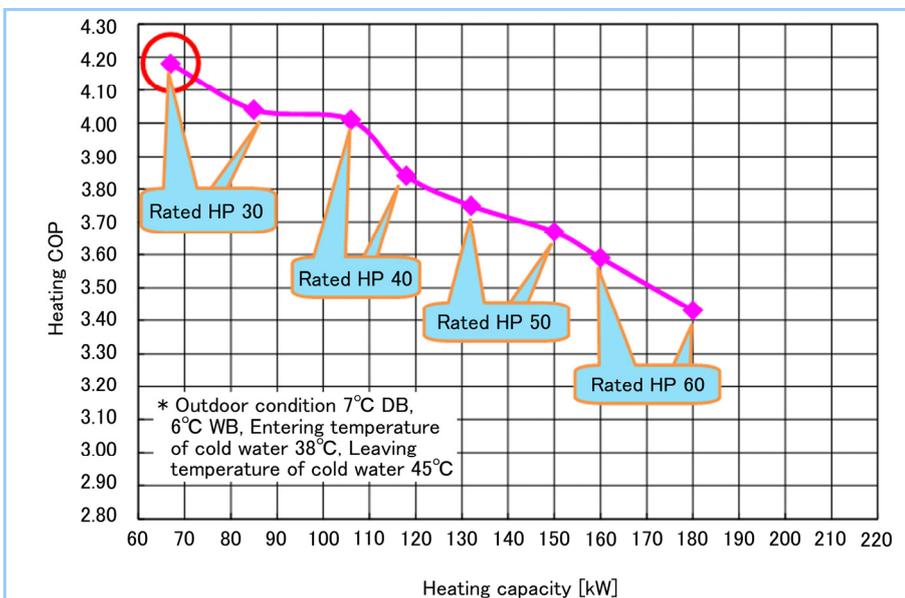
**Figure 1 Characteristics of thermal capacities**

The heating capacity normally declines in response to a drop in outdoor temperature. Meanwhile, the Voxel can realize an output of up to 150% by increasing the speed of the compressor to the maximum output level. The output reaches its peak at  $-10^{\circ}\text{C}$  and it declines at lower temperatures.



**Figure 2 Characteristics of heating capacity**

In general heat pumps, the leaving temperature of the hot water is not maintained at the specified level when the temperature of the returned water drops below the rated level. Meanwhile, the capacity of the Voxel can be increased up to 150% of the rated capacity, and the leaving temperature of the hot water remains constant until the difference between the entering temperature and leaving temperature reaches  $10.5^{\circ}\text{C}$  (return water temperature  $34.5^{\circ}\text{C}$ ), which is 1.5 times the temperature difference of  $7^{\circ}\text{C}$ .



**Figure 3 Heating capacity**

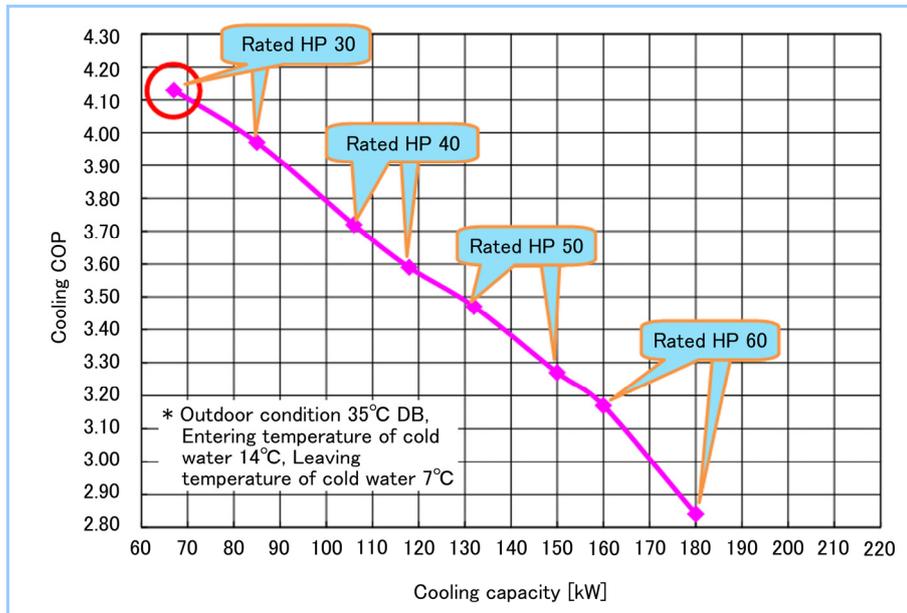


Figure 4 Cooling capacity