

# "Hyper Inverter" Compact and Lightweight Packaged Air Conditioner



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Recently, the reduction of carbon dioxide emissions has been required to prevent global warming, and in the case of packaged air conditioners, it is necessary to convert to a refrigerant with a low global warming coefficient and improve efficiency to reduce power consumption. On the other hand, there is strong request for downsizing and weight reduction of the outdoor unit due to restrictions of installation locations and ease of transportation and carry-in, which must be balanced with improvements in efficiency.

Mitsubishi Heavy Industries Thermal Systems, Ltd. has developed the Hyper Inverter series of packaged air conditioners, which are compact, lightweight and highly efficient. This paper introduces the characteristics and specifications of the outdoor units.

## 1. Product characteristics

### 1.1 Improved transportation and carry-in characteristics through downsizing and weight reduction

**Figure 1** shows a comparison of the unit height and weight with those of the conventional unit. The height of the newly-developed unit has been reduced from 1300 mm to 1050 mm and the unit weight has been reduced from 98 kg to 86 kg. In addition, by arranging transportation handles near the four corners as shown in **Figure 2**, we have realized the improvement of transportation and carry-in characteristics, including the ability to load the units into small vans and carry them up and down stairs. Serviceability improvements, such as the addition of a rain protection cover, were also realized to meet market requests.

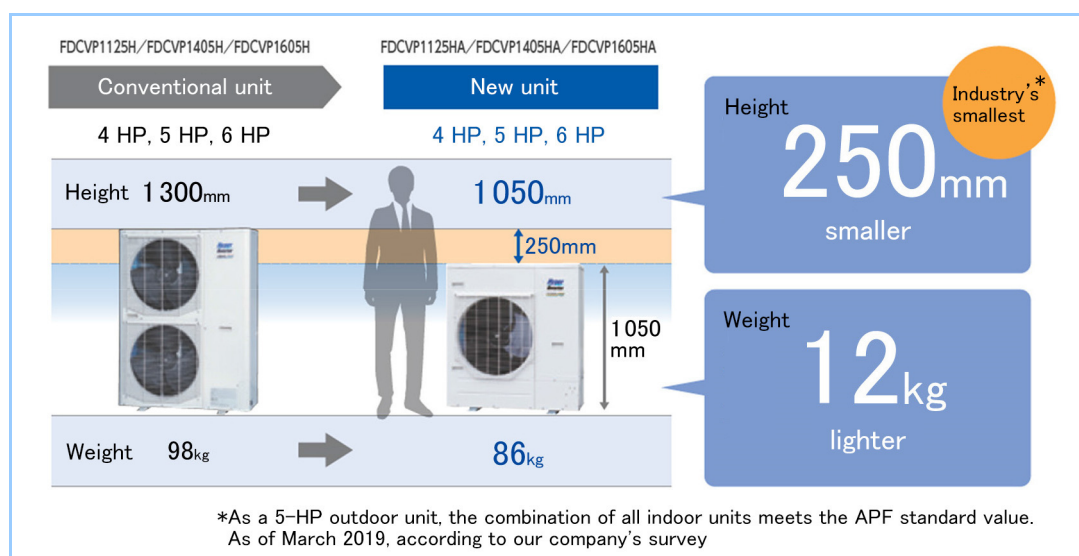
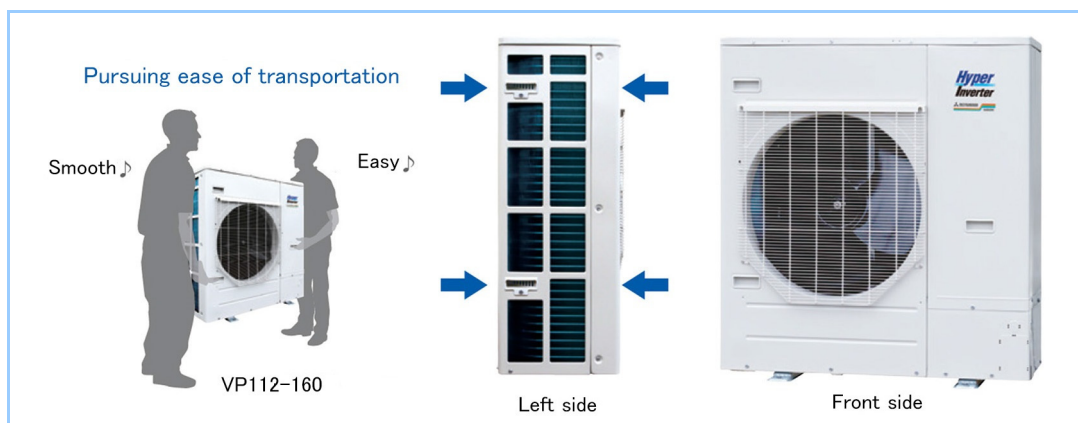


Figure 1 Comparison of unit height and weight with conventional unit



**Figure 2** Handle layout of outdoor unit

## 1.2 High performance and efficiency

Refrigerant R 32 and a new outdoor fan were adopted in order to clear the APF (Annual Performance Factor) standard value regulated by the Revised Energy Conservation Act, and the APF standard value was achieved by the combinable indoor unit\*<sup>1</sup>.

\*<sup>1</sup>: FDFV 1605 HA5S is excluded

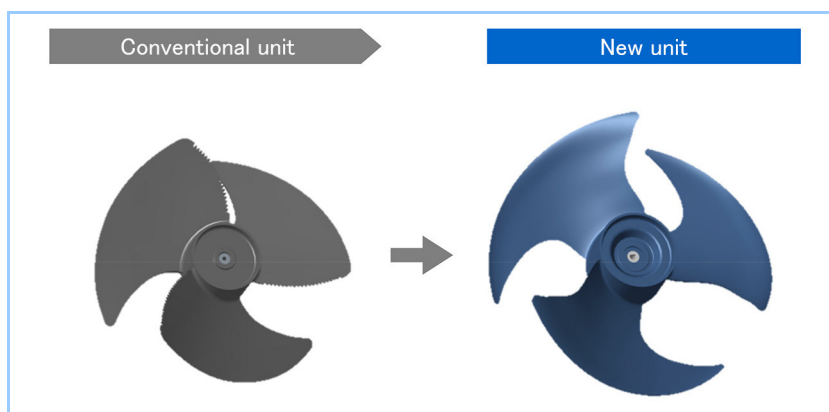
### (1) Adoption of R32 refrigerant

To prevent global warming, the Kigali Amendment to the Montreal Protocol required reductions in the use of HFCs (Hydro Fluorocarbon, a substitute CFC). For this reason, R32 refrigerant, in which the GWP (Global Warming Potential) is about 1/3 of that of the R410A used in conventional air conditioners, was adopted. By downsizing the outdoor unit, the amount of charged refrigerant can be reduced by about 13% compared with conventional units, thereby contributing to the control of global warming.

In addition, by improving the refrigeration performance by changing the refrigerant, the power consumption required to achieve the same performance as the conventional model was reduced. This effort also contributed to improving efficiency.

### (2) Adoption of new outdoor fans

In the conventional unit, two outdoor fans were used to send air to the heat exchanger to exchange heat with the outside air. However, in the newly-developed unit, in order to reduce the unit height, it was necessary to reduce the number of outdoor fans from two to one. Therefore, a large-diameter fan was adopted for the outdoor fan, and the fan diameter was increased by 8% compared with the conventional fan illustrated in **Figure 3**. For the improvement of fan efficiency, we optimized the fan shape using computational fluid dynamics and equalized the flow of air through the fan. As a result, the power consumption of the outdoor fan at the same air volume was reduced by about 12% compared with the conventional fan, contributing to the improvement of APF.



**Figure 3** Comparison of new and old fan shapes

## 2. Product Specifications

Table 1 lists the specifications of the “Hyper Inverter Series.”

**Table 1 Specifications of “Hyper Inverter Series”**

Model	FDCVP1125HA	FDCVP1405HA	FDCVP1605HA
Cooling capacity (kW)	10.0	12.5	14.0
Heating capacity (kW)	11.2	14.0	16.0
APF2015	6.3	6.0	5.8
APF2006	6.2	5.7	5.5
Dimensions (mm)	Height	1050	
	Width	970	
	Depth	370	
Weight (kg)	86		
Refrigerant	R32, 3.3kg		
Sound Power Level (dB (A))	72	72	73

## 3. Conclusion

A compact, lightweight and highly-efficient packaged air conditioner was developed and launched in September 2018, taking into account various customer requests such as improvements in installation and serviceability and additional functions. We will continue to develop and provide packaged air conditioners while meeting market needs and customer requirements.