

New Multi-split Inverter System Building Air Conditioners (KXZ series) for Overseas Markets with Top-level Energy Efficiency and Expanded Product Line-up



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Targeting overseas markets, Mitsubishi Heavy Industries, Ltd. (MHI) has developed the KXZ series of new multi-split inverter system building air conditioners, and has commercialized them since June 2014. These new models exhibit excellent energy-saving capability owing to enhanced efficiency and diversified operational control, with improved basic performance and a significantly expanded product line-up. The features and specifications of the new models are introduced below.

1. Product features

(1) Enhanced efficiency

In the KXZ series, the flow-path configuration of the outdoor unit heat exchanger was reviewed. For the liquid-refrigerant distribution system, distributors were used instead of conventional headers. As a result, the improved performance in refrigerant distribution allows the heat exchanger to exhibit the maximum capability, thus significantly elevating efficiency.

In the compressor, concentrated winding motors^{*1} were installed to reduce power loss in motor coils. A multi-discharge port system was adopted for the compressor scroll mechanism to prevent the power loss resulting from excessive compression. Thus, superior energy-saving performance has been made possible, especially in the seasonal efficiency rating.

Consequently, compared with the previous models, the cooling efficiency (when expressed as EER^{*2}) has been increased by nearly 40% and the heating efficiency (COP^{*3}) by nearly 8% (in the case of 24-horsepower (HP) models). Based on the single-unit specifications, the standard models of the KXZ series (10 to 20 HP, with the exception of the 16 HP model) exceed comparable models of other companies in terms of the average COP in both cooling and heating operations.^{*4}

(2) Significantly expanded product line-up

Owing to the technological developments and improvements for the combined use of more than one outdoor unit, the number of combined outdoor units has been increased to three from the conventional two. Accordingly, the possible maximum power output of the KXZ series has also been increased from the previous 48 HP to 60 HP, which is the top level in the industry. In the KXZ series, in addition to standard models, we can offer Hi-COP models with substantially improved EER and COP values. Also available are derivatives of standard large connection models in which the allowable indoor-unit connection capacity has been expanded to 200%^{*5} in comparison with the outdoor unit capacity. The product line-up has been increased significantly, which enables us to serve the increasingly diversified needs of our customers.

(3) Improved basic performance

The outdoor unit retains the basic configuration of previous models, which have established a solid position in the market for their robust reliability. Therefore, the outdoor units of the KXZ series have well-proven features (i.e., structurally-separated heat exchanger and mechanical compartments, and a control-box opening/closing mechanism with hinges), thus

ensuring superior maintainability. Furthermore, the spatial requirement for installation was reviewed based on an analysis of the airflow around the outdoor unit, and the refrigerator oil recovery system was also improved. Such refinements have resulted in better basic air conditioning performance, expanding the operable outside-temperature upper limit for cooling operations to the dry-bulb temperature (DBT) of 46°C from the conventional DBT of 43°C. In terms of installation flexibility, when the outdoor unit is placed above the indoor unit, the maximum vertical distance between these two units has been increased from 50 m to 70 m, allowing the KXZ series to be used in skyscrapers.

(4) Introduction of high capacity (wide range) compressors

We have developed high capacity inverter control technology and a refrigerator oil separation system for use with high capacity compressors, whereby a single high capacity compressor can suffice for outdoor units of a certain capacity (for which two compressors were typically installed). Thus, the number of compressors and inverter circuit boards to be mounted has been reduced. As a scroll DC inverter compressor, which is used in multi-split inverter air conditioning systems that aren't coupled with other compressors, our high capacity compressor boasts one of the largest capacities in the world. Furthermore, by improving our original technology for compressor capacity control, the compressor controllability when connected to small-capacity indoor units, an issue when using high capacity compressors for outdoor units, was secured. The introduction of high capacity compressors can decrease the total weight of the compressors to be installed by approximately 16 kg.

(5) MHI's new original energy-saving control system

The KXZ series has adopted our new and original energy-saving control system (patent pending), in which the number of compressor rotations is optimized while monitoring the temperature in the room. With this new system, the expected effect of power consumption reduction is roughly estimated as a maximum of 34%. Other various attempts for energy conservation were also made, including demand controllers with a three-stage power demand control system (improved from the two-stage control system).

- *1: Concentrated winding motors are installed in 10, 12, 17, 18 and 20 HP outdoor units of standard models and standard large connection models, as well as the 8 HP outdoor unit Hi-COP model.
- *2: EER stands for energy efficiency ratio, which is an indicator of performance calculated by dividing rated cooling capacity (kW) by consumed electricity (kW). A higher EER suggests better energy efficiency.
- *3: COP stands for coefficient of performance and is an indicator of performance. In the case of heating, it is calculated by dividing rated heating capacity (kW) by consumed electricity (kW). A higher COP suggests better energy efficiency.
- *4: Surveyed by MHI in November 2014 (European market models). The other companies referred to here are the top two Japanese manufacturers in terms of market share.
- *5: Among standard models, the allowable indoor-unit connection capacity is 130% in comparison with the outdoor unit capacity.

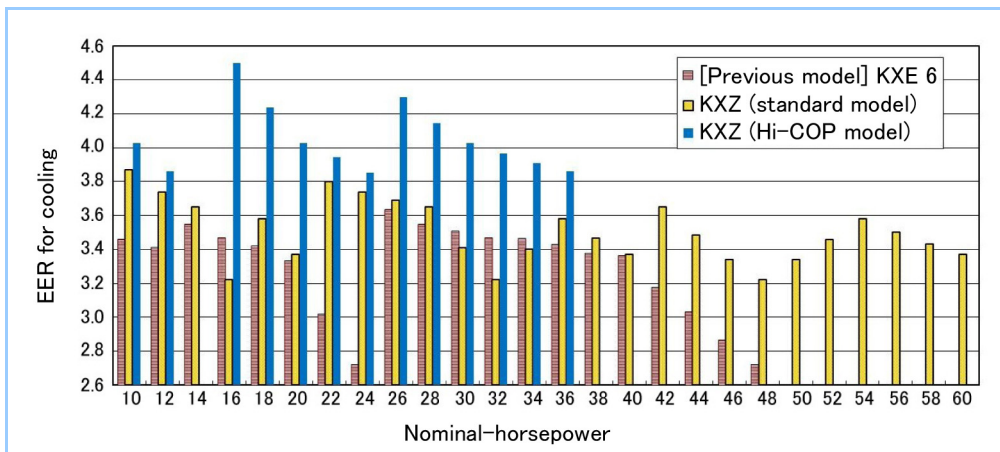


Figure 1 EER comparison for cooling (Standard and Hi-COP models)

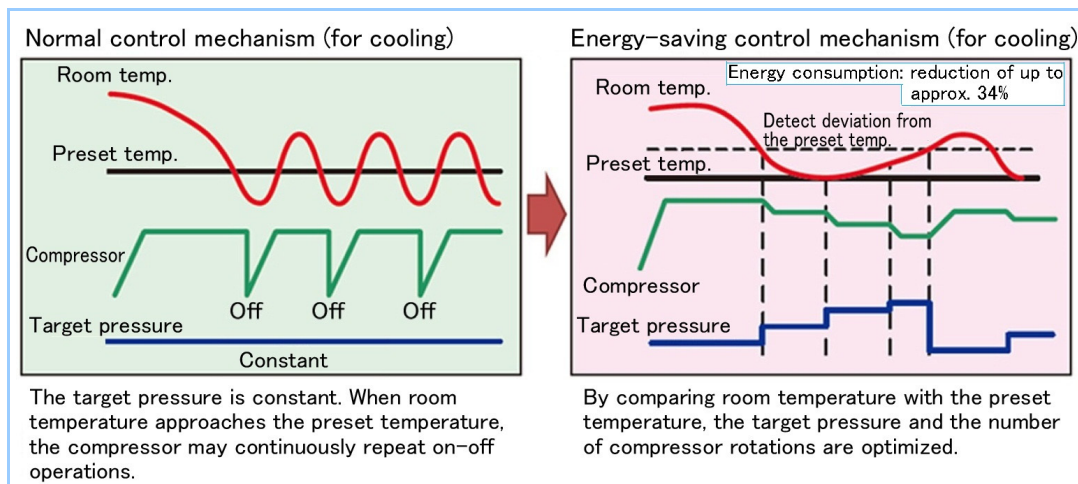


Figure 2 Summarized mechanism of energy-saving controls

2. Product specifications

Tables 1 to 3 show the specifications of the KXZ series.

Table 1 Standard models (for a single unit)

Horsepower		10 HP	12 HP	14 HP	16 HP	17 HP	18 HP	20 HP	
Model code		FDC(S)280KXZE1	FDC(S)335KXZE1	FDC(S)400KXZE1	FDC(S)450KXZE1	FDC(S)475KXZE1	FDC(S)500KXZE1	FDC(S)560KXZE1	
Power source		3 phases 380-415V 50Hz/380V 60Hz							
Capacity	Rated cooling capacity	kW	28.0	33.5	40.0	45.0	47.5	50.0	56.0
	Rated heating capacity	kW	31.5	37.5	45.0	50.0	53.0	56.0	63.0
Electrical features	Power consumption under rated cooling condition	kW	7.24	8.96	10.96	13.98	13.98	13.97	16.62
	Power consumption under rated heating condition	kW	7.28	9.04	10.69	12.50	13.00	13.49	15.95
Dimensions (H x W x D)		mm	1690×1350×720			2048×1350×720			
Weight		kg	272		317		370		
Operating Sound Pressure Level (cooling/heating)		dB(A)	55/57	61/58	60/62	61/62	61/61	61/62	64/66
Refrigerant		Type	R410A						
Indoor unit	Connectable units	No. of units	1-24	1-29	1-34	1-39	1-41	1-43	1-48
	Connectable capacity range	—	P140~364	P168~435	P200~520	P225~585	P238~617	P250~650	P280~728

Table 2 Hi-COP models (for a single unit)

Horsepower		8 HP	10 HP	12 HP			
Model code		FDC224KXZXE1	FDC280KXZXE1	FDC335KXZXE1			
Power source		3 phases 380-415V 50Hz/380V 60Hz					
Capacity	Rated cooling capacity	kW	22.4	28.0	33.5		
	Rated heating capacity	kW	25.0	31.5	37.5		
Electrical features	Power consumption under rated cooling condition	kW	4.98	6.95	8.68		
	Power consumption under rated heating condition	kW	5.56	6.83	8.39		
Dimensions (H x W x D)		mm	1690×1350×720		2048×1350×720		
Weight		kg	280		325		
Operating Sound Pressure Level (cooling/heating)		dB(A)	56/57		56/56		62/57
Refrigerant		Type	R410A				
Indoor unit	Connectable units	No. of units	1-29		1-37		1-44
	Connectable capacity range	—	P180~448		P224~560		P268~670

Table 3 Standard large connection models (for a single unit)

Horsepower			10 HP	12 HP	14 HP	16 HP	17 HP	18 HP	20 HP
Model code			FDCL280KXZE1	FDCL335KXZE1	FDCL400KXZE1	FDCL450KXZE1	FDCL475KXZE1	FDCL500KXZE1	FDCL560KXZE1
Power source		—	3 phases 380-415V 50Hz/380V 60Hz						
Capacity	Rated cooling capacity	kW	28.0	33.5	40.0	45.0	47.5	50.0	56.0
	Rated heating capacity	kW	31.5	37.5	45.0	50.0	53.0	56.0	63.0
Electrical features	Power consumption under rated cooling condition	kW	7.24	8.96	10.96	13.98	13.98	13.97	16.62
	Power consumption under rated heating condition	kW	7.28	9.04	10.69	12.50	13.00	13.49	15.95
Dimensions (H x W x D)		mm	1690×1350×720			2048×1350×720			
Weight		Kg	280		325		378		
Operating Sound Pressure Level (cooling/heating)		dB(A)	55/57	61/58	60/62	61/62	61/61	61/62	64/66
Refrigerant		Type	R410A						
Indoor unit	Connectable units	No. of units	1-37	1-44	1-53	1-60	1-50	1-53	1-59
	Connectable capacity range	—	P140~560	P168~670	P200~800	P225~900	P238~760	P250~800	P280~896

We have developed multi-split inverter system building air conditioners, targeting overseas markets. The product line-up has thus been expanded significantly and these new models boast superior energy efficiency at the top level in the industry. We will continue to develop products that are considered to be more environmentally responsible and that satisfy the needs of our customers.