High Static Pressure Fan “San Ace 60” CRA Type

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1. Introduction

In recent years, information equipment and communications equipment have become faster, higher capacity, and higher density, which also tends to increase heat generation of the equipment.

Therefore, higher cooling performance has been demanded for fan that are used for cooling in high density environments.

Furthermore, by growing interest about global environmental protection, so various industries are attaching more importance to energy conservation. Even for cooling fans, low power consumption during operations has become important.

In other words, there is demand for cooling fans with both high cooling performance and low power consumption during operations.

This document introduces the features and performance of the high static pressure 60 mm sq., 76 mm thick counter rotating fan “San Ace 60” CRA type that was developed to meet these market demands.

2. Background of the Development

Sanyo Denki has produced and sold a 60 mm sq., 76 mm thick counter rotating fan “San Ace 60” CR type product.

However, as information equipment and communications equipment become faster, higher capacity, and higher density as noted above, demand has grown for cooling fans with high cooling performance in high static pressure ranges that could not be achieved with the conventional model.

Furthermore, there was demand that the cooling fans installed in this equipment have low power consumption during operations, as well as demand for PWM controls that could be performed from the equipment.

To meet this demand, feature for PWM control was added and the high static pressure fan 60 mm sq., 76 mm thick “San Ace 60” CRA type was developed with high cooling performance at the high static pressure range.

3. Product Features

Fig. 1 shows the appearance of the “San Ace 60” CRA type (hereinafter referred to as the “new model”).

The features of the developed product are as follows:

(1) High static pressure
(2) Low power consumption
(3) Low SPL (Sound Pressure Level)
(4) PWM control function

With the newly designed impeller and frame, the new model achieves dramatically higher static pressure compared to the conventional model.

Furthermore, with the newly designed circuit and motor, it achieves dramatically reduced power consumption and low SPL compared to the conventional model at the same cooling performance.

Fig. 1: “San Ace 60” CRA type

4. Product Overview

4.1 Dimensions

Fig. 2 shows the dimensions of the new model.

The new model has the same mounting dimensions as the conventional model, making it compatible.

4.2 Characteristics

4.2.1 General characteristics

There are two models with 12 V DC rated voltage, and the models have rated speeds of:

9CRA0612P0G001 (Inlet: 16,500min^{-1}, Outlet: 13,000min^{-1}),

9CRA0612P0S001 (Inlet: 14,000min^{-1}, Outlet: 11,000min^{-1})

Table 1 shows the general characteristics for the new model.

4.2.2 Air flow vs. static pressure characteristics

Figs. 3 and 4 show the comparison of air flow versus static pressure characteristics for the new models 9CRA0612P0G001 and 9CRA0612P0S001.

4.2.3 PWM control function

The new model has a PWM control function that can control speed of the cooling fan from external source.

The demand for cooling fans with PWM speed control functions have become extremely large in recent years. By controlling speed of the cooling fan depending on the heat generation of the equipment instead of always running the fan at full speed, whole equipment can achieve even lower power consumption and SPL.

Figs. 5 and 6 show the air flow versus static pressure characteristics at individual PWM duty cycle of the new models 9CRA0612P0G001 and 9CRA0612P0S001.

4.3 Expected life

The new model has a expected life of 40,000 hours at 60°C (survival rate of 90% with continuous operation at the rated voltage under free air conditions and at normal humidity).

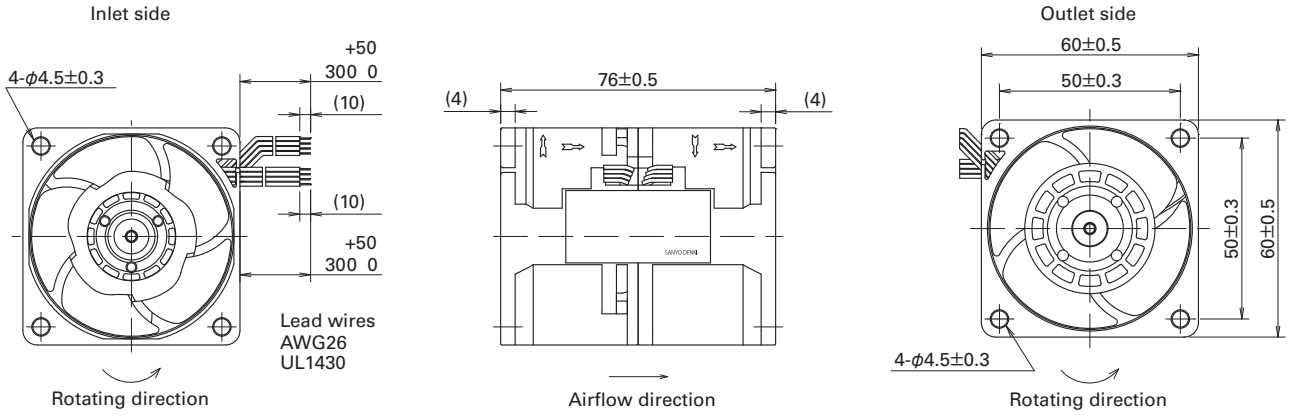

Fig. 2: "San Ace 60" CRA type dimensions (unit: mm)

Table 1: "San Ace 60" CRA type general characteristics

Model No.	Rated voltage [V]	Operating voltage [V]	PWM duty cycle* [%]	Rated current [A]	Rated input [W]	Rated speed [min^{-1}]		Max. air flow		Max. static pressure		SPL [dB(A)]	Operating temperature [°C]	Expected life [h]
						Inlet	Outlet	[m^3/min]	[CFM]	[Pa]	[inchH$_2$O]			
9CRA0612P0G001	12	10.8 to 13.2	100	2.3	27.6	16500	1300	2.0	70.6	1000	4.0	66	-10 to +70	40,000/60°C (70,000/40°C)
			0	0.22	2.6	3600	2800	0.43	15.1	47.6	0.19	32		
9CRA0612P0S001	48	10.8 to 13.2	100	1.5	18.0	14000	11000	1.7	60.0	720	2.89	63		
			0	0.17	2.0	3200	2500	0.38	13.4	37.6	0.15	29		

Note: The expected life at 40°C is just reference value.

*Input PWM frequency: 25 kHz

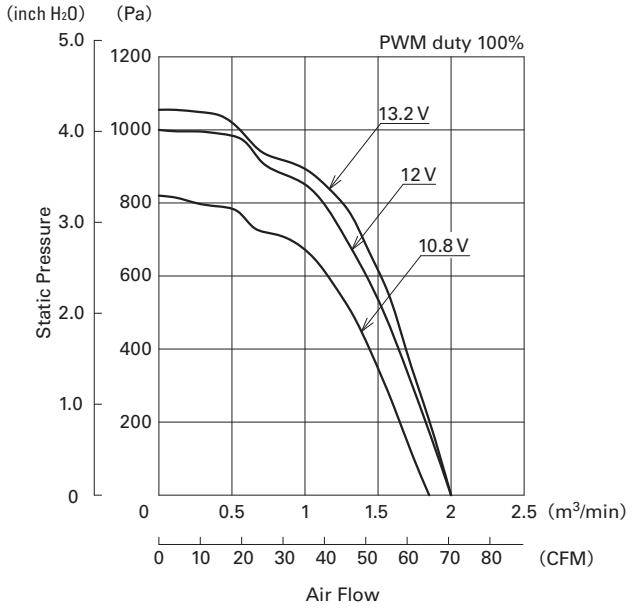

Fig. 3: Air flow vs static pressure characteristics (9CRA0612P0G001)

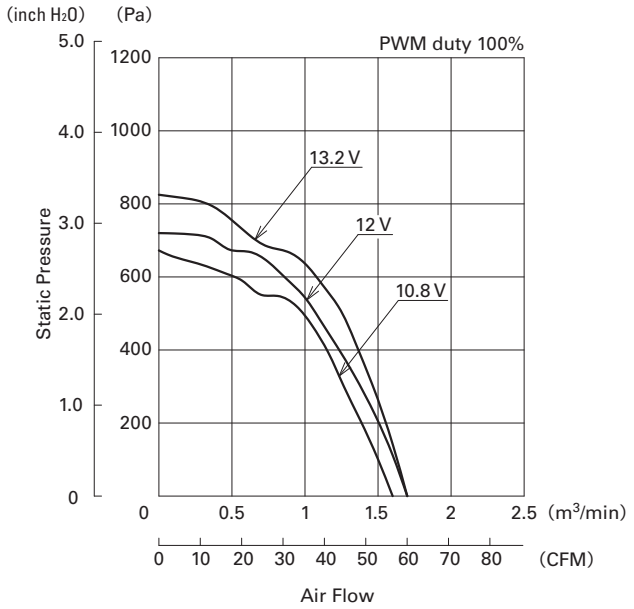

Fig. 4: Air flow vs static pressure characteristics (9CRA0612P0S001)

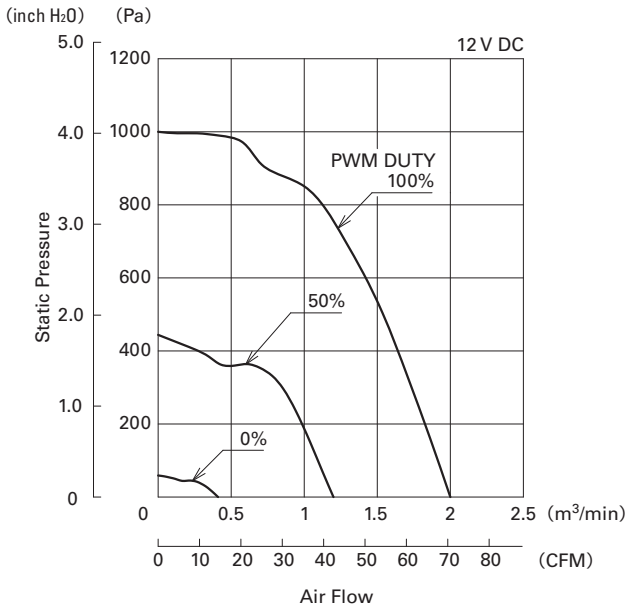

Fig. 5: Air flow vs static pressure characteristics at individual PWM duty cycle(9CRA0612P0G001)

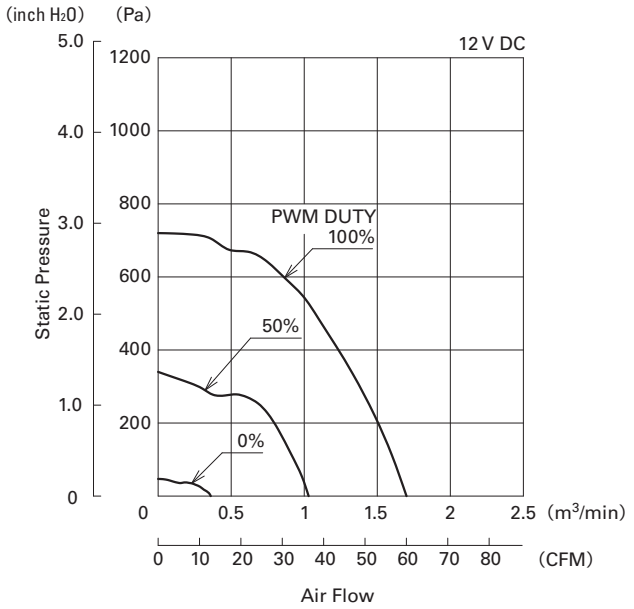

Fig. 6: Air flow vs static pressure characteristics at individual PWM duty cycle(9CRA0612P0S001)

5. Comparisons with Our Conventional Model

One of the major differences between the new model and the conventional model is the frame, with changes to the thickness ratio for the intake side and exhaust side frames and the corresponding new design for the venturi shape of the frame.

For the impeller, the shapes of inlet side and outlet side were greatly changed from the ones for the conventional model with a new design that improves the static pressure even further.

Furthermore, with the newly designed impeller shape, the combination of numbers of inlet side and outlet side impellers changed.

As a result, the new model achieved dramatically higher static pressure that could not be achieved with the conventional model.

Furthermore, at operation point at presumed system impedance, in addition to the newly designed frame and impeller shape, the optimal combination of impeller and frame achieves low SPL, and by optimizing the circuits and motor, the new model achieves dramatically reduced power consumption compared to the conventional model.

The following introduces a comparison of the characteristics for the new model "San Ace 60" CRA type and our conventional model "San Ace 60" CR type.

5.1 Comparison of air flow versus static pressure

Fig. 7 shows a comparison of the air flow versus static pressure characteristics between the conventional model 9CR0612S001 for the 60 mm sq., 76 mm thick CR type and the new model 9CRA0612P0G001, while Table 2 shows the general characteristics.

Compared to the conventional model, the new model 9CRA0612P0G001 has maximum static pressure 1.8 times higher.

Table 2: General characteristics of the conventional model 9CRA0612P0G001

	Max. air flow [m³/min]	Max. static pressure [Pa]	Power consumption [W]	Sound pressure level [dB(A)]
New model 9CRA0612P0G001	2.00	1000	27.6	66
Conventional model 9CR0612S001	2.26	550	38.4	66

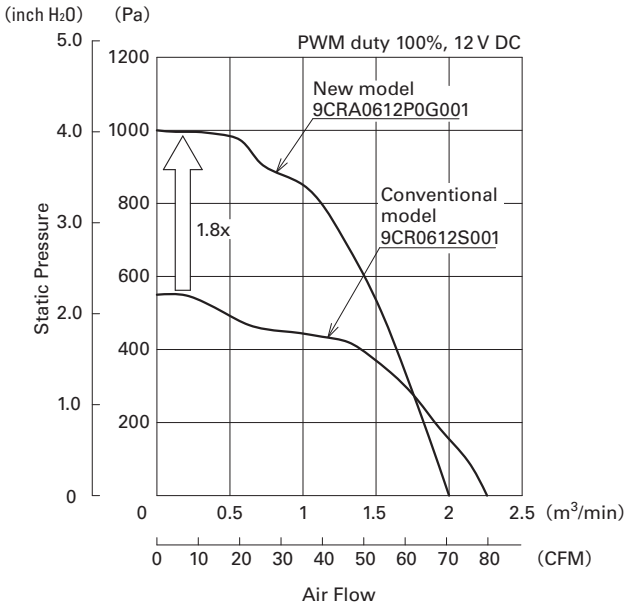

Fig. 7: Air flow vs static pressure characteristics (Comparison between the conventional model and 9CRA0612P0G001)

5.2 Comparison of power consumption

Fig. 8 shows a comparison of the air flow versus static pressure characteristics between the conventional model 9CR0612S001 and the new model 9CRA0612P0S001, while Fig. 9 shows comparison of the power consumption when operated at the presumed system impedance.

When comparing the operating point at the presumed system impedance for the conventional model, the new model 9CRA0612P0S001 reduces power consumption approximately 29%.

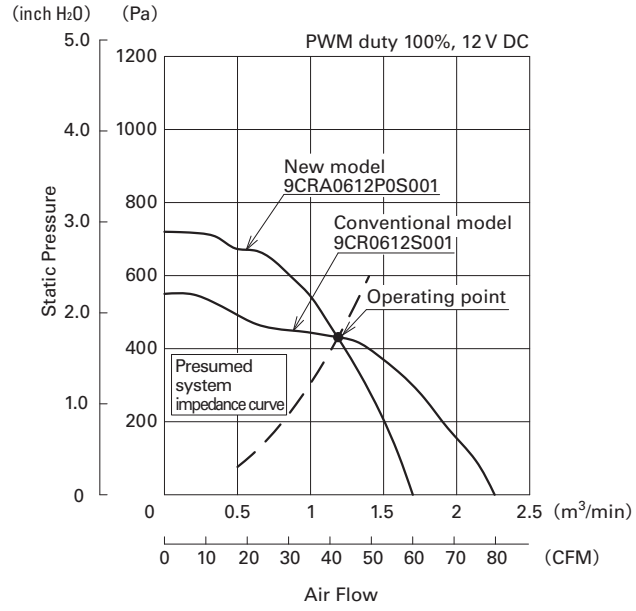

Fig. 8: Air flow vs static pressure characteristics (Comparison between the conventional model and 9CRA0612P0S001)

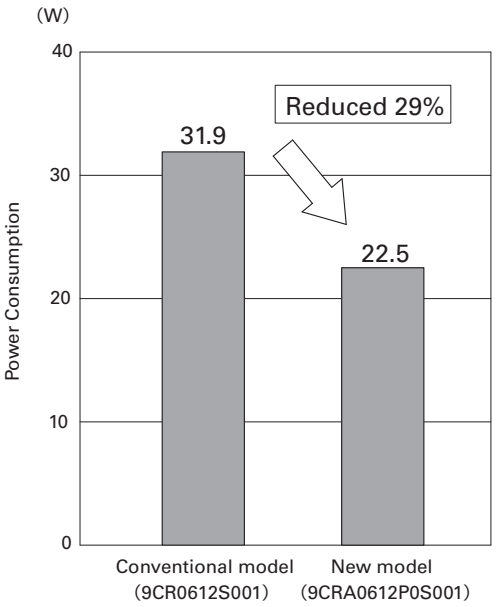

Fig. 9: Comparison of power consumption when operated at presumed system impedance

5.3 Comparison of sound pressure level

Fig. 10 shows a comparison of the sound pressure level when operated at the presumed system impedance in Fig. 8 between the conventional model 9CR0612S001 and the new model 9CRA0612P0S001.

When comparing the operating point at the presumed system impedance, the new model 9CR0612P0S001 reduces 4 dB(A) from 67 dB(A) for the conventional model to 63 dB(A) for the new model.

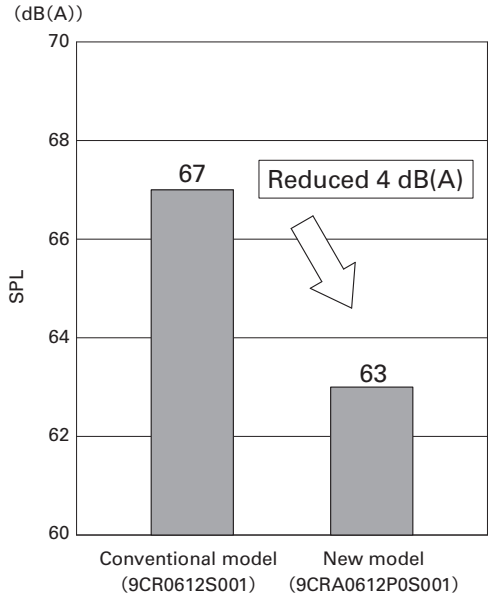

Fig. 10: Comparison of sound pressure level when operated at presumed system impedance

6. Conclusion

This document introduced some of the features and performances of the newly developed high static pressure “San Ace 60” CRA type fan.

The new model achieves dramatically higher static pressure compared to the Sanyo Denki conventional model, and at the operating point at presumed system impedance, it also achieves lower consumption power and lower SPL.

Therefore, the new model can greatly contribute as cooling solution for higher heat and higher density equipment that will likely continue to grow in the future while also contributing to lower power consumption and SPL for the entire device.

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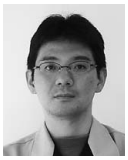

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