

40 × 40 × 56 mm *San Ace 40* 9CRJ Type Counter Rotating Fan

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1. Introduction

In the 1U server, ICT equipment, and power supply market, there has been increasing demand for high-performance and compact fans for cooling today's advanced and high-density equipment. As a cooling solution for this market, we have developed and offered 40×40×56 mm Counter Rotating Fans since quite a while. However, today's high-density equipment has required even higher cooling performance. Moreover, in recent years, many customers have also put an importance on eco efficiency for environmental conservation, which has become another target in our product development.

To meet these requirements, we developed and released the *San Ace 40* 9CRJ type Counter Rotating Fan (hereinafter, "new model"). It comes with a newly designed impeller and frame and features high performance and low power consumption.

This article will introduce the features and performance of the new model.

2. Product Features

Figure 1 shows the appearance of the new model. The features of the new model are:



Fig. 1 40 × 40 × 56 mm *San Ace 40* 9CRJ type

- (1) High static pressure
- (2) High airflow
- (3) Low power consumption

The new model achieves improved performance with the same size as the current model.

3. Product Outline

3.1 Dimensions

Figure 2 shows the dimensions of the new model. The external dimensions and mounting hole dimensions are unchanged and compatible with the current model.

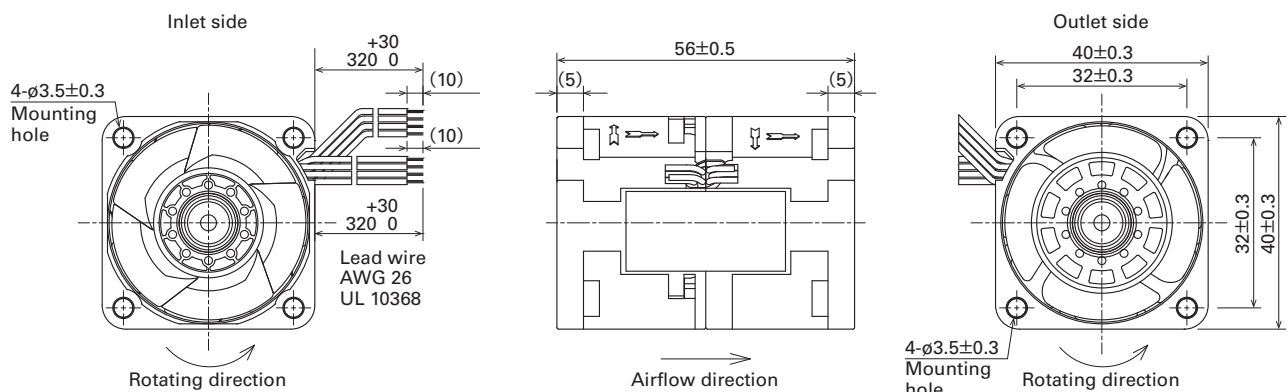


Fig. 2 Dimensions of the new model (unit: mm)

3.2 Specifications

3.2.1 General specifications

Table 1 shows the general specifications for the new model.

The rated speed is 36,200 min⁻¹ on the inlet side and 32,000 min⁻¹ on the outlet side.

Table 1 General specifications for the new model

Model no.	Rated voltage [V]	Operating voltage range [V]	PWM duty cycle* [%]	Rated current [A]	Rated input [W]	Rated speed [min ⁻¹]	Max. airflow		Max. static pressure		Sound pressure level [dB(A)]	Operating temperature range [°C]	Expected life [h]
							[m ³ /min]	[CFM]	[Pa]	[inchH ₂ O]			
9CRJ0412P5J001	12	10.8 to 12.6	100	3.1	37.2	36,200/32,000	1.06	37.4	2,400	9.64	72	-20 to +70	30,000 at 60°C (53,000 at 40°C)
			20	1.2	1.2	4,500/4,000	0.11	3.9	40	0.16	28		

* The PWM input frequency is 25 kHz; the fan speed at 0% PWM duty cycle is 0 min⁻¹.

Note: The expected life at an ambient temperature of 40°C is for reference purposes only.

3.2.2 Airflow vs. static pressure characteristics

Figure 3 shows the airflow vs. static pressure characteristics for the new model. Shown are examples at PWM duty cycles 100% and 20% at a rated voltage of 12 V.

3.2.3 PWM control function

The new model has a PWM control function that enables external control of fan speed.

3.3 Expected life

The new model has an expected life of 30,000 hours at 60°C (survival rate of 90%, run continuously at rated voltage and normal humidity in free air).

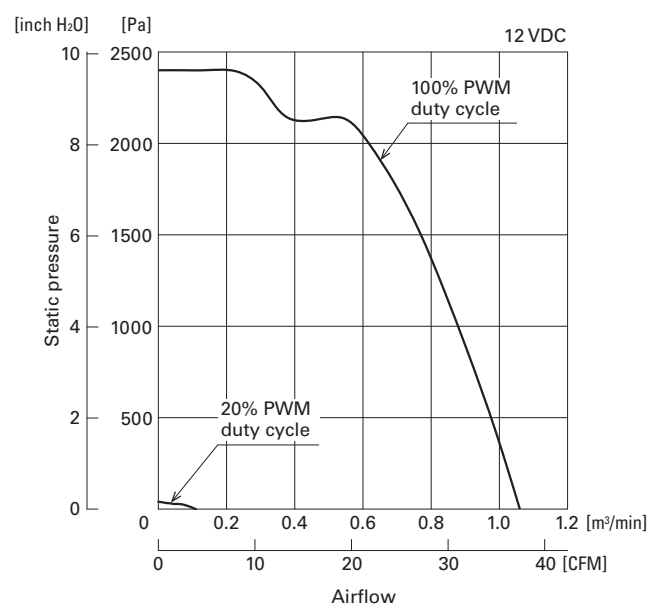


Fig. 3 Airflow vs. static pressure characteristics of the new model

4. Key Points of Development

The new model offers significantly improved airflow and static pressure. To achieve higher performance, we newly designed the impeller and frame.

In the following sections, we'll explain the key points of the development and the differences between the new model and the *San Ace 40 9CRH* type fan (hereinafter, "current model").

4.1 Impeller and frame design

A Counter Rotating Fan has an inlet fan and an outlet fan, and the combination of their shapes, blade angles, and rotational speeds significantly varies the product's airflow vs. static pressure characteristics. To achieve the target performance, we used 3D printing and simulations to optimize the blade angle and the shape of the impeller and frame.

Figure 4 shows a comparison of the impeller shape for the new and current models.

We increased the blade surface area by 10% on the inlet side and 3% on the outlet side compared to the current model, thereby achieving high airflow and high static pressure. Although power consumption usually increases in proportion to the increase in blade surface area, we were actually able to reduce power consumption by optimizing the blade shape.



Fig. 4 Comparison of the impeller shapes for the new and current models

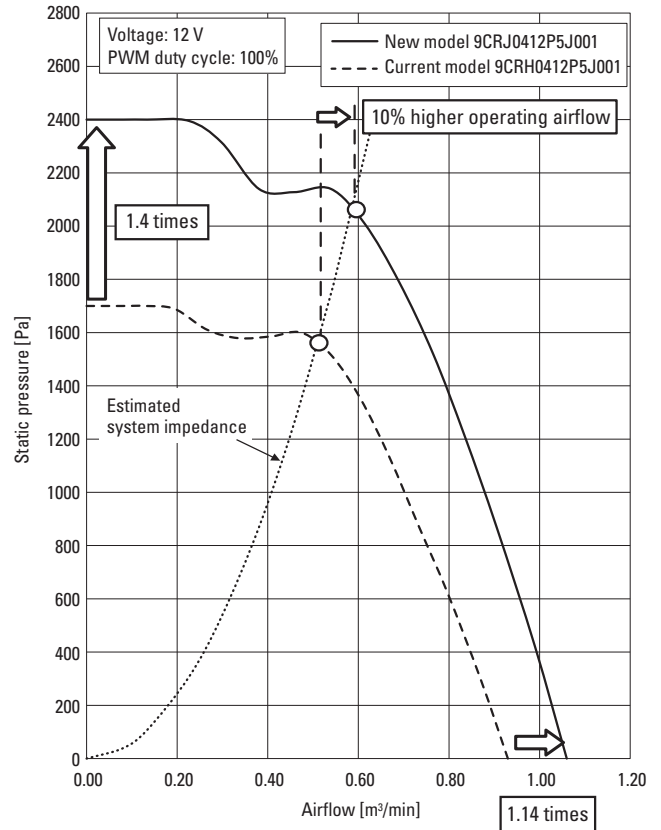


Fig. 5 Airflow vs. static pressure characteristics (Compared with the current model)

5. Comparison with Current Model

5.1 Comparison of airflow vs. static pressure characteristics

Figure 5 compares the airflow vs. static pressure characteristics of the new and current models. Maximum airflow and maximum static pressure are, respectively, 1.14 times and 1.4 times that of the current model. The figure shows that the operating airflow of the new model is 10% higher than that of the current model at the estimated system impedance (ventilation resistance) shown in the figure.

5.2 Power consumption comparison with the current model at equivalent performance

Figure 6 compares the power consumption between the new model and current model at the same maximum airflow. When the speed of the new model is lowered by PWM control and cooling performance is equivalent to that of the current model, the new model consumes up to 20% less power than the current model in the estimated operating range.

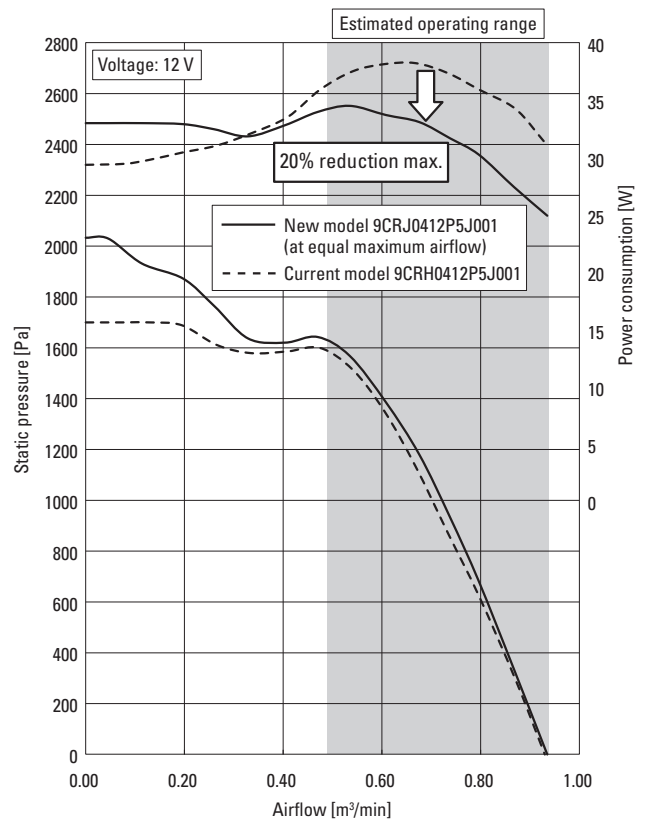


Fig. 6 Power consumption comparison with the current model

6. Conclusion

This article has introduced the features and performance of the 40 × 40 × 56 mm *San Ace 40 9CRJ* type Counter Rotating Fan with high performance and low power consumption.

The new model outperforms our current model. Furthermore, the new model consumes much less power than the current model when maximum airflow is equivalent to that of the current model.

We believe the new model's features will greatly contribute to the cooling of high heat-generating, high-density equipment that are expected to become increasingly common in the future.

We will continue developing products that meet market needs to contribute to creating new value for our customers.

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