38 × 38 × 28 mm *San Ace 38* 9HVA Type DC Fan

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1. Introduction

As the information society continues to evolve, communication devices are increasingly essential in supporting our society and economy. Servers and ICT equipment are becoming more compact and generating more heat, requiring smaller, higher-performance cooling fans.

To meet this demand, we have offered the 38 × 38 × 28 mm *San Ace 38* 9GA type DC Fan (hereinafter, "current product"), which has since become obsolete. Accordingly, we have recently developed and launched the *San Ace 38* 9HVA type DC Fan (hereinafter, "new product"), maintaining the same dimensions.

This article introduces the features and performance of the new product.

2. Product Features

Figure 1 shows the new product.

The new product delivers higher airflow and static pressure than the current product, without changing the dimensions.

It is also capable of cooling a wider range of applications, previously considered unfeasible.

Fig. 1 38 × 38 × 28 mm *San Ace 38* 9HVA type

3. Product Overview

3.1 Dimensions

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

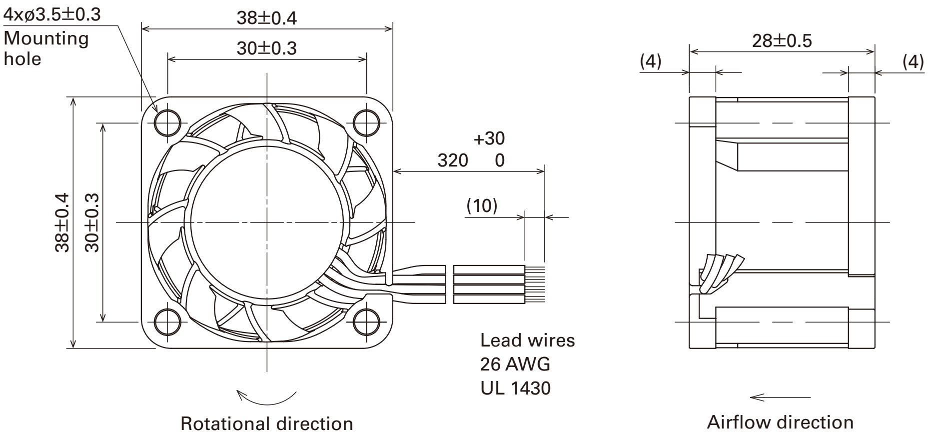


Fig. 2 Dimensions of 38 × 38 × 28 mm *San Ace 38* 9HVA type (Unit: mm)

3.2 Specifications

3.2.1 General specifications

Table 1 shows the general specifications of the new product.

Table 1 General specifications of 38 × 38 × 28 mm *San Ace 38* 9HVA type

Model no.	Rated voltage [V]	Operating voltage range [V]	PWM duty cycle* [%]	Rated current [A]	Rated input [W]	Rated speed [min^{-1}]	Max. airflow [m³/min]	Max. airflow [CFM]	Max. static pressure [Pa]	Max. static pressure [inchH₂O]	Sound pressure level [dB(A)]	Operating temperature range [ºC]	Expected life [h]
9HVA0312P3K001	12	10.8 to 13.2	100	2.1	25.2	38,500	0.91	32.2	2,100	8.40	69	-20 to +70	30,000 at 60ºC (53,000 at 40ºC)
			20	0.06	0.72	6,000	0.14	4.9	51	0.204	29		
9HVA0312P3G001			100	1.1	13.2	30,000	0.71	25.1	1,300	5.20	64		40,000 at 60ºC (70,000 at 40ºC)
			20	0.05	0.60	5,000	0.11	3.8	35	0.140	25		

* PWM input frequency is 25 kHz. Speed is 0 min^{-1} at 0% PWM duty cycle only for models that have no speed ratings at 0% listed. When the control terminal is open, the fan speed is the same as the speed at 100% PWM duty cycle.

3.2.2 Airflow vs. static pressure characteristics

Figure 3 shows the airflow vs. static pressure characteristics of the new product.

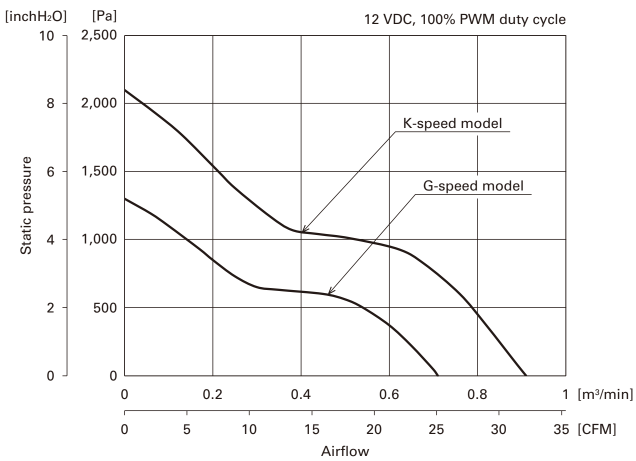


Fig. 3 Airflow vs. static pressure characteristics of the new product

3.2.3 PWM control

The new product comes with PWM control for controlling fan speed.

4. Key Points of Development

For the new product, we newly designed the highly efficient 3-phase motor driver as well as the impeller and frame shapes for increased aerodynamic performance.

Furthermore, increasing speed is one of the important factors for achieving high airflow and high static pressure.

The key points of development are as follows.

4.1 Motor and circuit design

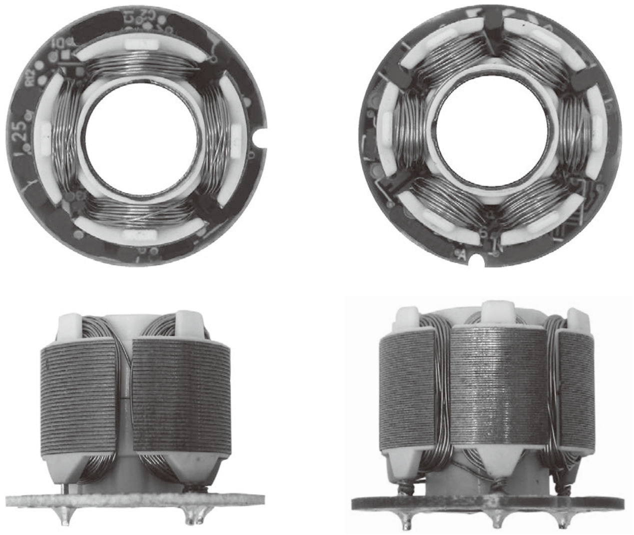
Figure 4 compares the motors of the new and current products.

To achieve a higher fan speed, it was necessary to develop a high-frequency motor current switching circuit and reduce motor vibration.

To achieve this, the new product uses a 3-phase motor driver instead of the predecessor's single-phase driver, reducing peak current during high-speed switching and enabling low-vibration operation due to lower cogging torque.

Also, increasing fan speeds generally leads to higher heat generated by electronic components, which can be a challenging issue to address because using a larger PCB narrows the vent area and negatively impacts the aerodynamic characteristics. Likewise, the use of multiple electronic components or large components with high current capacity is not applicable either.

To overcome these challenges, we optimized the component layout to maximize the passive cooling capability in combination with the impeller's vent holes. As a result, we achieved a high-speed fan circuit design while using the same PCB size as the current product.



Current product New product

Fig. 4 Motors of the new and current products

4.2 Impeller and frame design

Figure 5 shows a comparison of the impeller and frame shapes for the new and current products.

Faster fan rotation increases mechanical loads, including centrifugal force on the impeller and amplified vibration from rotating parts.

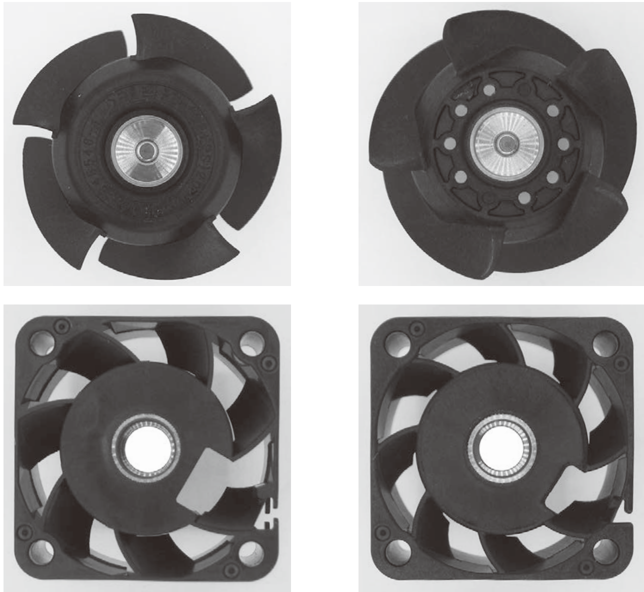
Therefore, we needed to newly design an impeller and frame shapes that offer both high durability and aerodynamic efficiency.

The impeller was designed so that the enlarged blades overlap as viewed from the inlet side, and the impeller boss shape was optimized to secure enough vent area, contributing to improved airflow and static pressure.

In addition, vent holes were introduced on the ceiling of the impeller boss to facilitate the motor's passive cooling, helping dissipate the heat generated by electronic components inside the motor.

The frame was also newly designed with vent holes, optimized thickness, and an adjusted number of stator blades to ensure sufficient rigidity for high-speed rotation.

In this way, the new impeller and frame designs enabled operation at high-speeds and enhanced aerodynamic performance.



Current product New product

Fig. 5 Comparison of the impeller and frame shape for the new/current model

5. Comparison of New and Current Products

5.1 Comparison of airflow vs. static pressure characteristics

Figure 6 compares the airflow vs. static pressure characteristics of the new and current products.

The new fastest model, 9HVA0312P3K001, has 1.5-times maximum airflow and 2.6-times higher maximum static pressure, compared to the current product.

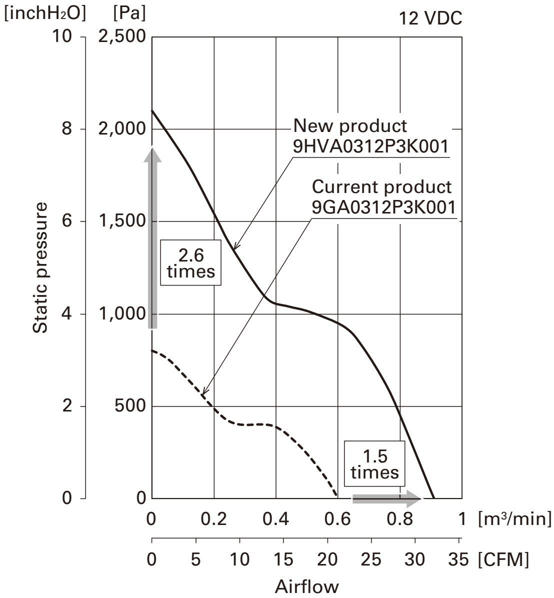


Fig. 6 Airflow vs. static pressure characteristics of the new and current products

5.2 Power consumption comparison

Figure 7 compares power consumption of the new and current products when operated to deliver the same airflow.

At the estimated system impedance (the ventilation resistance of equipment) shown in the figure, the new product consumes 10% less power than the current product.

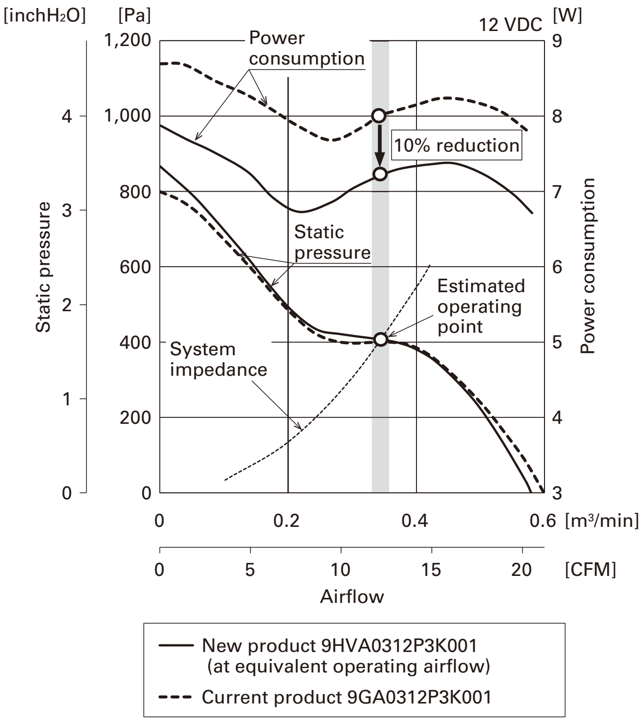


Fig. 7 Power consumption comparison between the new and current products

5.3 Environmental impact comparison

Figure 8 compares the CO_2 emissions of the new and current products over their life cycles.

Thanks to its reduced power consumption at the same operating airflow compared to the current product, the new product emits 10% less CO_2 over its product life cycle.

Compared to the current product, a single new product provides superior cooling performance than two current products operating in series, reducing the number of required cooling fans by 50%.

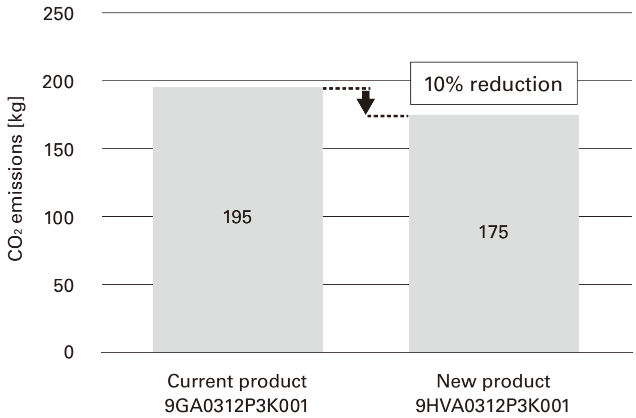


Fig. 8 CO_2 emissions comparison using an LCA calculation software (40,000 hours, when operated with the same operating airflow)

6. Conclusion

This article has introduced the features and performance of the newly developed 38 × 38 × 28 mm *San Ace 38* 9HVA type DC Fan.

The new product delivers higher airflow and static pressure than the current product while achieving lower power consumption when operated to deliver the same airflow.

It also contributes to saving space When mounted on equipment that requires high cooling performance, this fan saves space inside, giving flexibility to the equipment designer.

We will continue to help our customers create new value by swiftly meeting market demand and offering eco-friendly products.

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