# 60 × 60 × 38 mm *San Ace 60* 9HVA Type High Static Pressure Fan

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## 1. Introduction

As the IT market continues to grow rapidly in recent years, data processing equipment such as servers, storage devices, and routers has become increasingly sophisticated with high density and high-heat generation, requiring cooling fans with even higher cooling performance. Furthermore, there is an increasing demand to reduce power consumption as the world moves toward a decarbonized society.

Fans with high static pressure performance are required for such equipment. We developed and offered the *San Ace 60* 9HV type High Static Pressure Fan in 2015, but it has become obsolete and is unable to meet the latest performance requirements.

Against such a backdrop, we newly developed and launched the *San Ace 60* 9HVA type (hereinafter, "new product") with high performance and low power consumption.

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

## 2. Product Features

The new product provides higher static pressure, higher airflow, lower power consumption, and lower noise compared to the 60 × 60 × 38 mm *San Ace 60* 9HV type fan (hereinafter, "current product").

Figure 1 shows the appearance of the new product.

The features of the new product are as follows:

(1) High static pressure and high airflow
(2) High energy efficiency and low noise

The new product's maximum static pressure and airflow are 2,000 Pa and 2.39 $m^3$/min, respectively, achieving higher static pressure and airflow compared to the current product.

The new product consumes 33.6 W at maximum airflow, which is approximately 1.27 times higher compared to the current product, while maintaining the same power consumption and noise level.


Fig. 1 60 × 60 × 38 mm *San Ace 60* 9HVA type

The details are provided below in "4. Comparison of the New and Current Products".

## 3. Product Overview

### 3.1 Dimensions

Figure 2 shows the dimensions of the new product.

The external dimensions, mounting hole pitch, and mounting hole size are the same as those of the current product.

### 3.2 Specifications

#### 3.2.1 General specifications

Table 1 shows the general specifications of the new product. It has a rated voltage of 12 VDC and a rated speed of 24,800 $min^{-1}$.

#### 3.2.2 Airflow vs. static pressure characteristics

Figure 3 shows the airflow vs. static pressure characteristics of the new product. It shows the characteristics at 100% and 20% PWM duty cycles and a 12 V rated voltage.

### 3.2.3 PWM control function

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

### 3.2.4 Expected life

The new product has an expected life of 40,000 hours at 60°C (survival rate of 90%, run continuously at rated voltage and normal humidity in free air), which is the same as the current product.

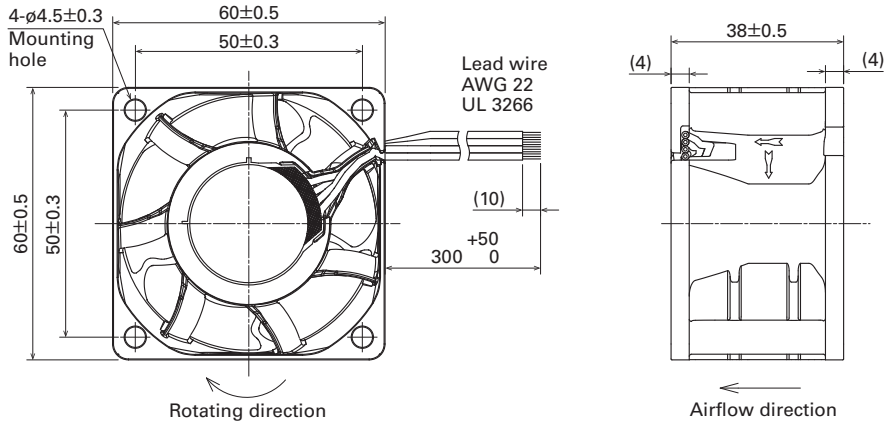


Fig. 2 Dimensions of the new product (unit: mm)

Table 1 General specifications of the new product

| Model no. | Rated voltage [V] | Operating voltage range [V] | PWM duty cycle* [%] | Rated current [A] | Rated input [W] | Rated speed [min$^{-1}$] | Max. airflow [m$^3$/min] | Max. airflow [CFM] | Max. static pressure [Pa] | Max. static pressure [inchH$_2$O] | Sound pressure level [dB(A)] | Operating temperature range [°C] | Expected service life [h] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9HVA0612P1J001 | 12 | 10.8 to 13.2 | 100 | 2.8 | 33.6 | 24,800 | 2.39 | 84.3 | 2,000 | 8.0 | 68 | -20 to +70 | 40,000 at 60°C (70,000 at 40°C) |
| | | | 20 | 0.11 | 1.32 | 5,200 | 0.48 | 16.9 | 91 | 0.36 | 34 | | |

* Input PWM frequency: 25 kHz. Speed is 0 min$^{-1}$ at 0% PWM duty cycle.
Note: The expected life at an ambient temperature of 40°C is for reference purposes only.

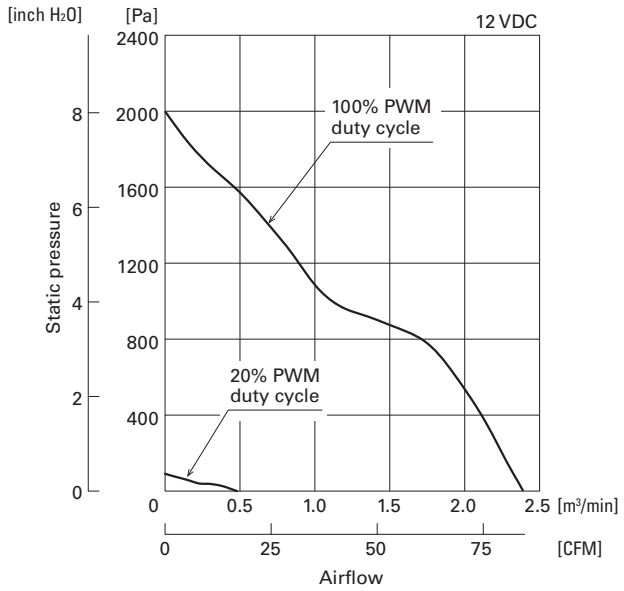


Fig. 3 Airflow vs. static pressure characteristics of the new product

## 4. Key Points of Development

The new product achieves higher performance compared to the current product. However, we faced the following challenges in the development process.

(1) Increase in fan speed would raise power consumption
(2) Increased power consumption over the entire range of the airflow vs. static pressure characteristics would require a greater number of electronic components and enlarged PCB
(3) Enlarged PCB would limit ventilation area, reducing the airflow vs. static pressure characteristics

To solve such issues for the new product, we redesigned the impeller and frame shapes and newly developed the motor and drive circuit.

The key points of development of these components are explained as follows.

## 4.1 Motor and drive circuit

The new product is our first 60 × 60 mm fan to use a 3-phase drive motor. Its reduced current ripple reduced the load on the drive circuit and the number of electronic components, securing the space to use the same PCB size as the current product.

This enabled the same motor space as the current product to be secured while increasing the fan speed and securing a greater degree of freedom in designing the impeller and frame.

## 4.2 Impeller and frame

To improve the fan performance, we made use of our fluid simulation and optimization calculations.

Figure 4 shows the frame outlet sides of the new and current products, while Figure 5 compares the new and current impeller shapes.

Due to the fan structure, the base outer surface and the casing inner surface act as a wall, blocking the air flow.

Therefore, we optimized the rotor and stator blade shapes with an emphasis on the mid-radial portion of the blades, which is less affected by the wall surface.

As shown in Figure 5, the new product's rotor blades have a distinct curved shape. We optimized the rotor blade shape by setting additional geometric parameters on the blade's mid-radial portion to achieve the best performance possible.

As shown in Figure 4, the new product's frame is connected to the casing and base via stator blades like the current product. The new stator blades are curved against the rotor blades' rotational direction. The shape of the stator

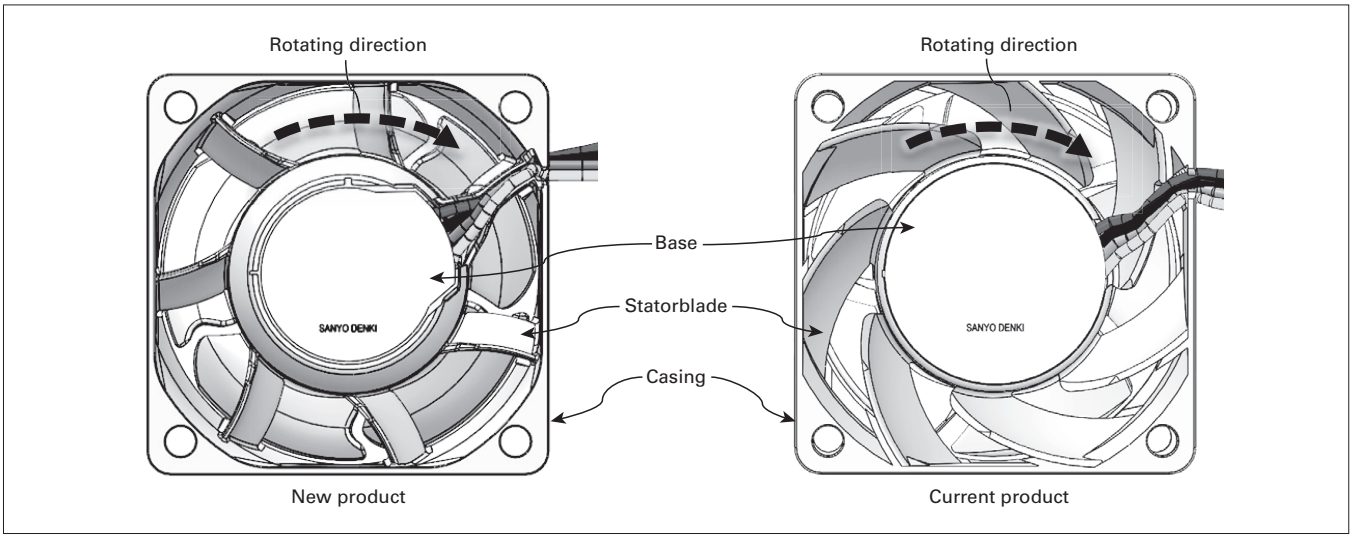


Fig. 4 Comparison between new and current products (outlet side)

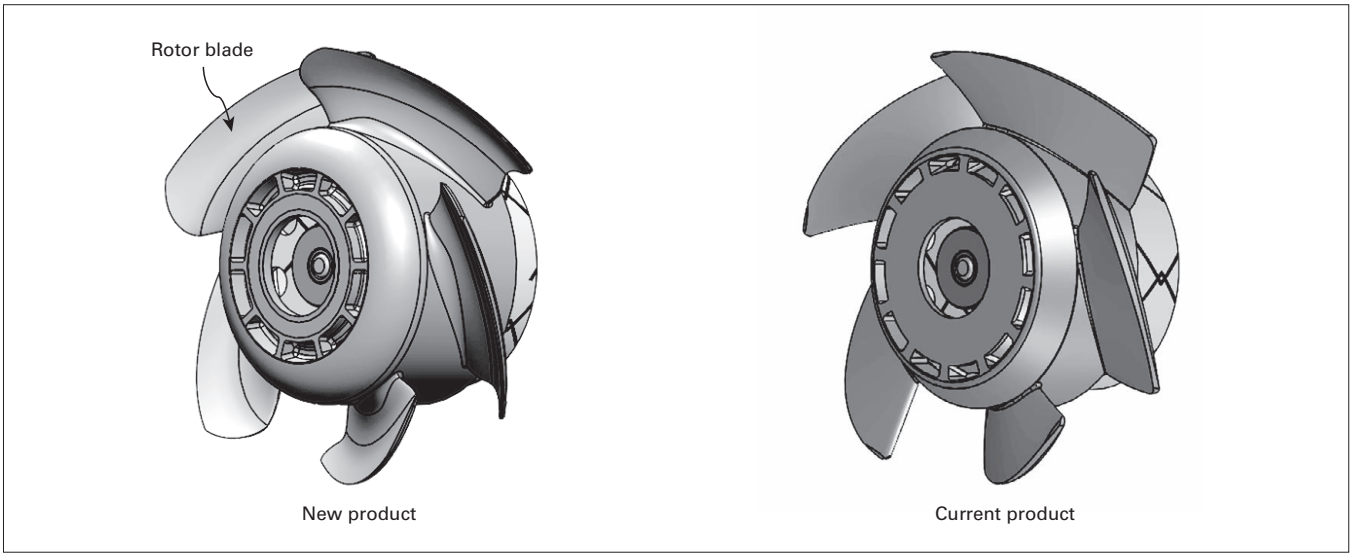


Fig. 5 Comparison of the impeller shapes for the new and current products

blade was designed to optimize the performance when the rotor and stator blades are combined.

In this way, we achieved a performance improvement from the current product by optimizing the shapes and combination of the rotor and stator blades.

## 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.

Airflow and static pressure have been improved 1.27 times and 1.14 times from the current product, respectively. This enables the new product to provide sufficient cooling performance for today's high-density and high-heat-generating devices.

### 5.2 Power consumption comparison with the current product at equivalent performance

Figure 7 compares the power consumption of the new and current products at equivalent cooling performance.

It shows that, when the fan speed of the new product is reduced using PWM control to match the cooling performance of the current product, the new product consumes about 20% less power in the estimated operating range, thus reducing the power consumption of equipment.

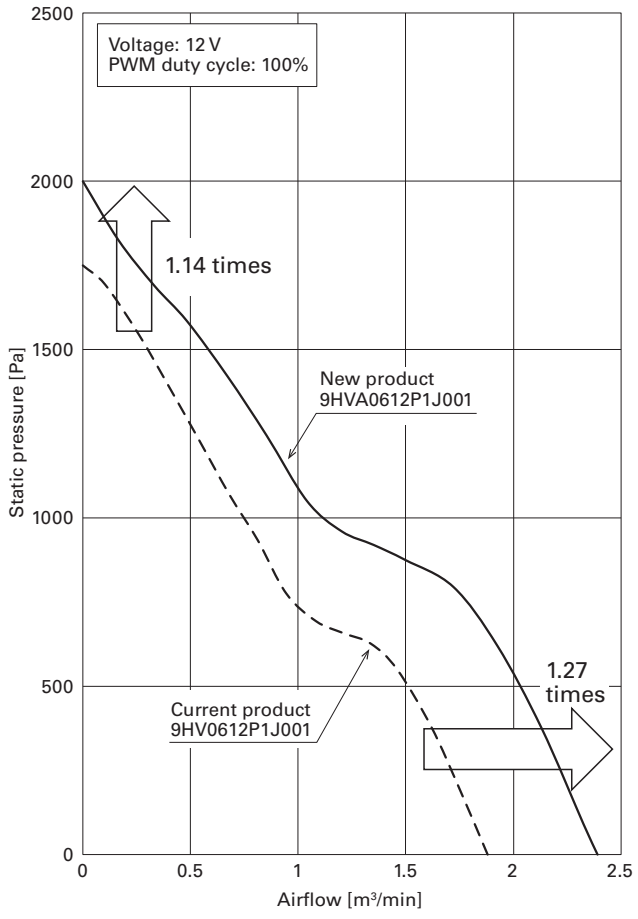


Fig. 6 Airflow vs. static pressure characteristics (Compared with the current product)

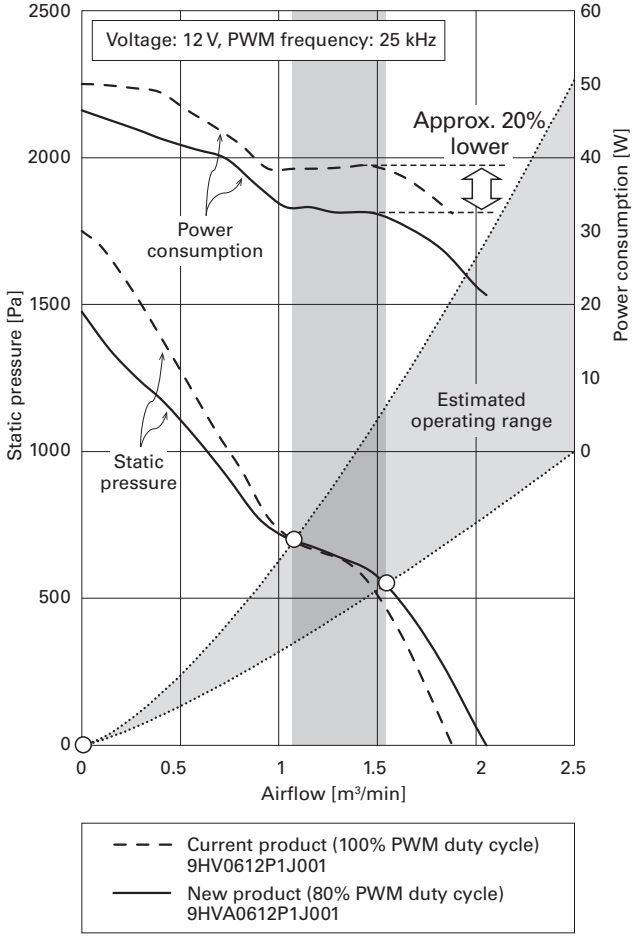


Fig. 7 Power consumption comparison with the current product

### 5.3 Noise level comparison with the current product at equivalent airflow

Figure 8 compares the noise level in free air in the airflow vs. static pressure characteristics shown in Figure 7.

It shows that, when the fan speed of the new product is reduced using PWM control to match the airflow of the current product, the new product produces 3 dB(A) less noise than the current product, reducing the noise of equipment.

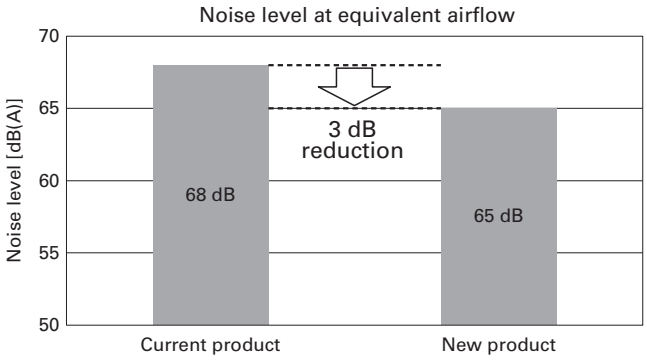


Fig. 8 Noise level comparison with the current product

## 6. Conclusion

This article has introduced the features and performance of the new 60 × 60 × 38 mm *San Ace 60* 9HVA type High Static Pressure Fan.

As the IT market continues to grow rapidly and the world moves toward a decarbonized society, there is a greater need for cooling fans with high performance and low power consumption like the new product.

In addition, as the market trend changes rapidly, it is expected that unprecedented and more diverse demands will be placed on cooling fans in the future. We will continue developing cooling fans to create new value in new and broad markets to meet the various needs of customers.

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