High Static Pressure Fan *San Ace 36* 9HV Type

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1. Introduction

Recently, 1U servers and ICT equipment are processing greater volumes of data. This results in greater heat generation that needs to be properly handled. Moreover, due to higher functionality of the equipment itself, there is less internal space available for power supplies.

As such, fans mounted in such equipment need to be small yet offer high cooling performance.

To satisfy these requirements, SANYO DENKI developed and launched the High Static Pressure Fan *San Ace 36* 9HV type (hereinafter, new model) with an equivalent or better cooling performance than our 38 × 38 mm and 40 × 40 mm fans.

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

2. Product Features

Figure 1 shows the appearance of the new model.

Fig. 1 36 × 36 × 28 mm *San Ace 36* 9HV type

The features of the new model are:

(1) High static pressure
(2) Low power consumption
(3) Space saving

3. Product Overview

3.1 Dimensions

Figure 2 shows the dimensions of the new model.

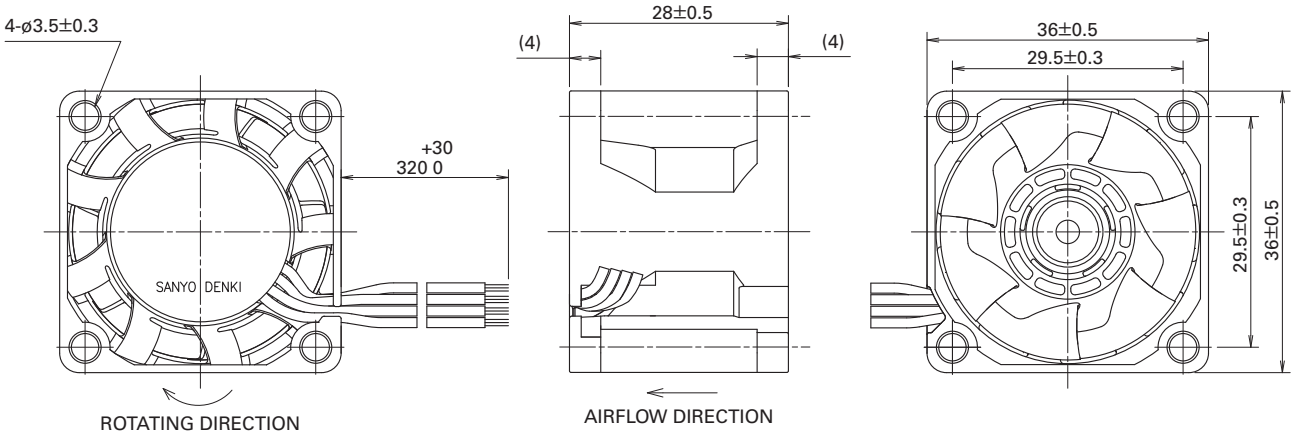


Fig. 2 Dimensions of the new model (unit: mm)

3.2 Characteristics

3.2.1 General specifications

Table 1 shows the general specifications for the new model.

It is available in 12 VDC rated voltage only and its rated speed is 32,500 min^{-1}.

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 [m^3/min]	Max. airflow [CFM]	Max. static pressure [Pa]	Max. static pressure [inch H_2O]	SPL [dB(A)]	Operating temperature range [°C]	Expected life [h]
9HV3612P3K001	12	10.8 to 13.2	100	1.75	21	32,500	0.72	25.4	1,400	5.62	67	-20 to +60	30,000/60°C
			20	0.05	0.6	6,000	0.12	4.2	47.2	0.19	26		

Note: Speed is 0 min^{-1} at 0% PWM duty cycle
* Input PWM frequency: 25 kHz

3.2.2 Airflow vs. static pressure characteristics

Figure 3 shows the airflow vs. static pressure characteristics for the new model.

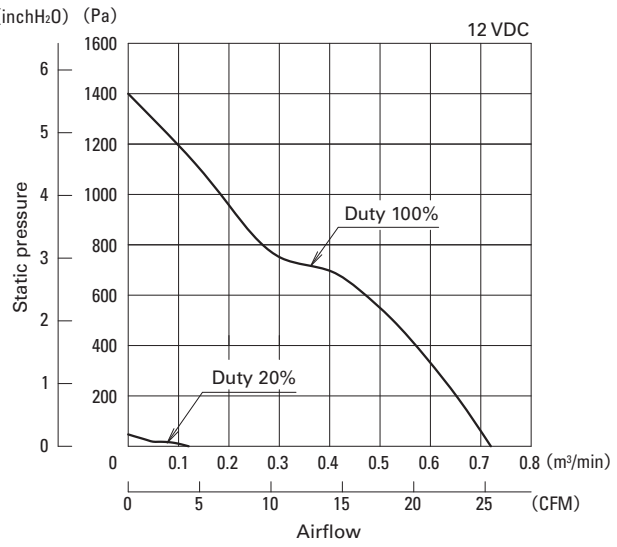


Fig. 3 Airflow vs. static pressure characteristics of the new model

3.2.3 PWM control function

The new model has PWM control function that enables external control of the 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).

4. Key Points of Development

The new model offers significantly improved static pressure performance compared to the current model. To achieve an equivalent or better cooling performance than our 38 × 38 mm and 40 × 40 mm size products, we needed to improve overall static pressure performance. Increased fan speed is essential to improve cooling performance, and this is our first product exceeding 30,000 min^{-1}.

To develop a product with high speed, we newly designed the impeller and frame, and changed to a 3-phase motor.

Below, we explain the key development points as well as the differences between the new model and the current model, the *San Ace 36* 9GX type.

4.1 Impeller and frame design

For the new model, to achieve high static pressure, we used our simulation technology, and combined various parameters such as blade number, length, angle, and frame static blade shape to find optimal impeller and frame shapes. Then, based on these optimal shapes, we performed repeated product evaluations and simulations to determine the final shape.

Moreover, to increase fan speeds, the impeller design must be strong enough to withstand the generated stress. As such, we made sure to maintain sufficient strength by using our stress simulation technology.

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

Figure 5 shows a comparison of the frame shape for the new and current models.

Current model　　New model

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

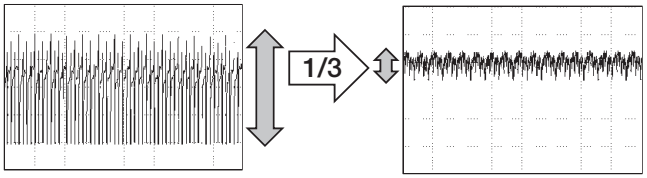
Current model　　New model

Fig. 5 Comparison of the frame shape for the new and current models

4.2 Motor and circuit design

Power consumption increased in line with the increased fan speed, so we changed to a 3-phase motor. By doing so, we successfully minimized peak fluctuation of the current waveform and lightened the load on the motor.

Figure 6 shows the comparison of current waveforms during steady operation.



Current model
9GX3612P3K001
Steady-state current waveform

New model
9HV3612P3K001
Steady-state current waveform

Fig. 6 Comparison of current waveforms during steady operation

5. Comparison with Current Model

5.1 Comparison of airflow vs. static pressure characteristics

Compared to the current model, the new model's maximum static pressure has increased by 67%.

Figure 7 shows the comparison of the airflow vs. static pressure characteristics of the current and new models.

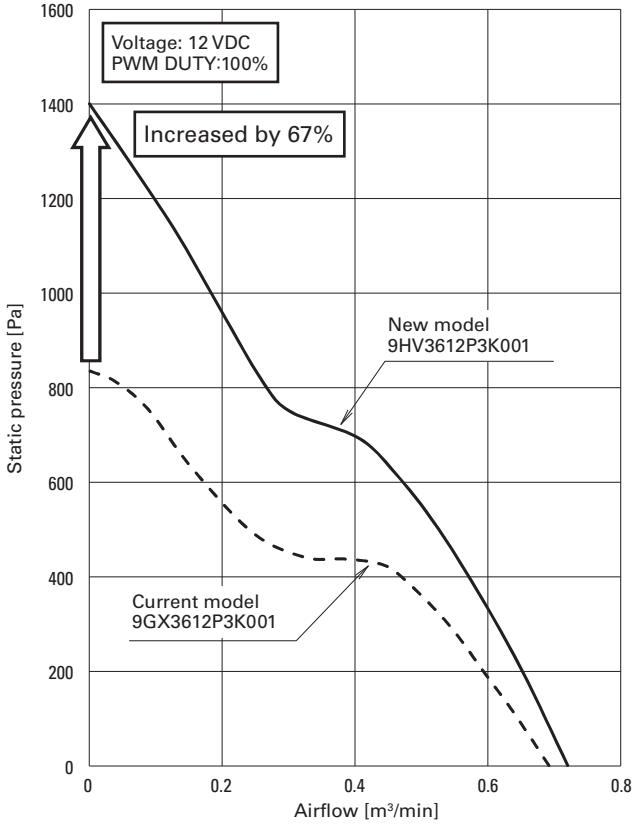


Fig. 7 Airflow vs. static pressure characteristics of current and new models

5.2 Power consumption comparison

Figure 8 gives a comparison of the power consumption for the airflow vs. static pressure characteristics of the current and new models at equivalent cooling performance.

This graph compares airflow vs. static pressure characteristics when the speed of the new model is reduced to match the cooling performance of the current model. It is evident that, overall, the new model has a lower power consumption than the current model, and we have succeeded in reducing power consumption by up to 10% in the high load area.

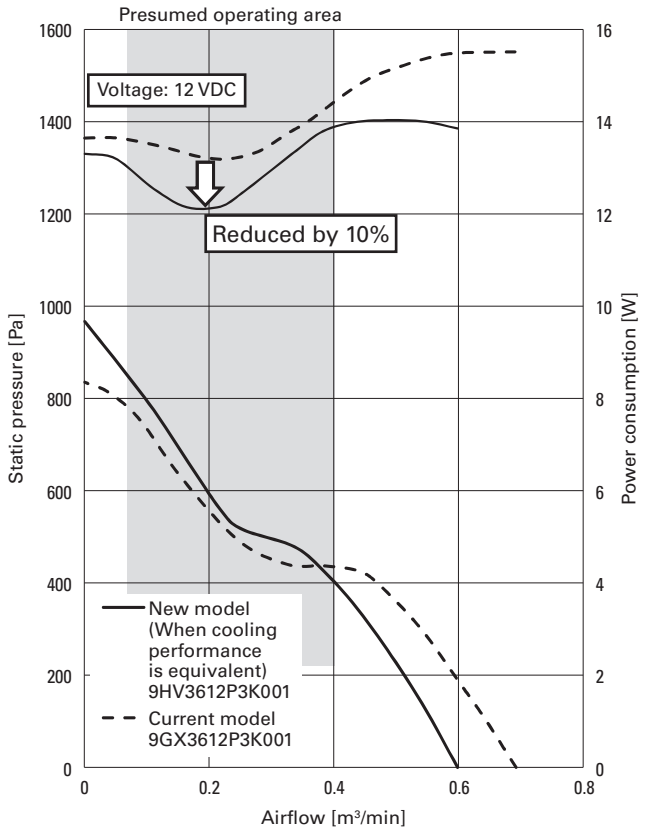


Fig. 8 Example of the airflow vs. static pressure characteristics (comparison with current model)

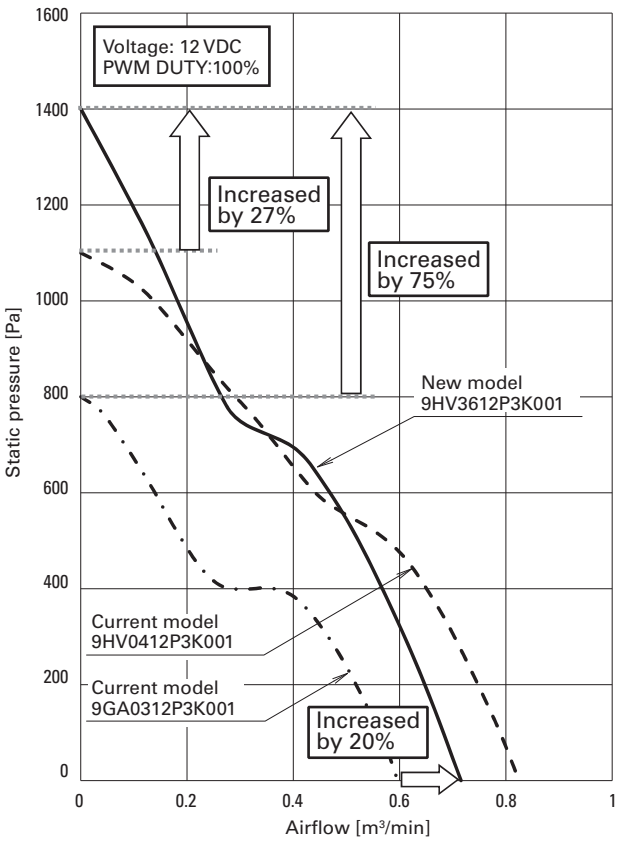


Fig. 9 Example of the airflow vs. static pressure characteristics (comparison with 38 × 38 mm and 40 × 40 mm fans)

5.3 Comparison with 38 × 38 mm and 40 × 40 mm size products

Figure 9 shows a comparison of the airflow vs. static pressure characteristics for our two current models (38 × 38 mm and 40 × 40 mm sizes), and the new model.

Compared with the 38 × 38 mm model, 9GA0312P3K001, the new model has a 20% higher maximum airflow and 75% higher maximum static pressure.

Furthermore, compared with the 40 × 40 mm model, 9HV0412P3K001, the new model has a 27% higher maximum static pressure, achieving an equivalent or better cooling performance in the presumed operating area.

In this way, the new model is capable of providing the cooling performance offered by the 38 × 38 mm and 40 × 40 mm models.

Figure 10 shows a comparison of the sound pressure level (SPL) when cooling performance is equivalent (operating airflow 0.22 m³/min). When cooling performance is equivalent, the new model is 4dB(A) quieter than 9HV0412P3K001, contributing to a lower SPL for the equipment overall.

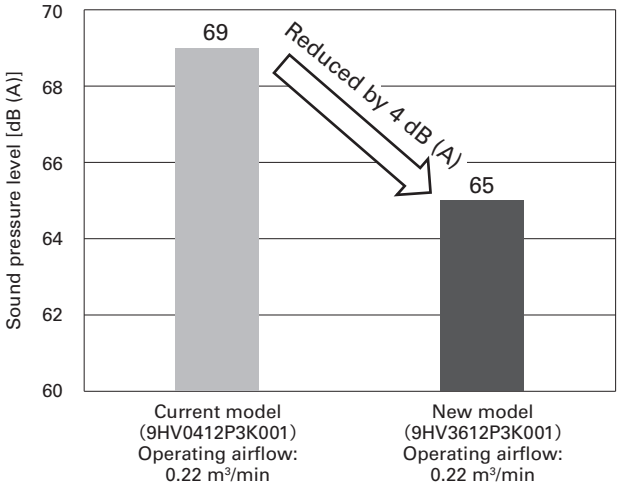


Fig. 10 SPL comparison when operating airflow is equivalent

6. Conclusion

This article has introduced some of the features and performance of the 36 × 36 × 28 mm High Static Pressure Fan *San Ace 36* 9HV type we developed.

Although the new model is 36 × 36 mm in size, it achieves a cooling performance equivalent or better than the 38 × 38 mm and 40 × 40 mm models, and offers significantly higher static pressure.

Reducing the size of the fan allows our customers greater freedom regarding equipment design. We believe the features of the new model will significantly contribute to the cooling of equipment that will have even higher mounting density and heat generation in the future.

We will continue developing products in response to various market needs and offering products which contribute to the creation of new values for our customers to help make their dreams come true.

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