Low Power Consumption Fan "San Ace 120" 9GA Type

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1. Introduction

The 120 × 120 × 25 mm sized fan is one of the most standard sizes and is used in all kinds of market applications. However, there is an increasing demand from the market for this size fan to achieve even lower power consumption while maintaining a high cooling performance.

In response, SANYO DENKI developed and released the "San Ace 120" 9GA type 120 × 120 × 25 mm fan (hereinafter, "new model") which achieves one of the lowest power consumptions in the industry*.

The new model has a newly designed impeller, frame, and motor and maintains compatibility in size, mounting holes, etc. with the current model, the 120 × 120 × 25 mm "San Ace 120" 9GV type fan (hereinafter, "current model"). In the performance aspect, the new model accomplishes high static pressure and low power consumption in the actual operating area.

This article provides a detailed introduction of this new product.

2. Product Features

Figure 1 shows a photograph of the new model.

The features of the new model are as follows:

(1) High static pressure
(2) PWM speed control function
(3) Low power consumption
(4) An abundant product lineup

The new model features a newly designed impeller, frame, and motor and accomplishes high static pressure and low power consumption in the actual operating area.

Fig. 1: 120 x 120 x 25 mm "San Ace 120" 9GA type

3. Product Overview

3.1 Dimensions

Figure 2 shows the dimensions of the new model.

The new model has the same mounting dimensions as the current model, therefore compatibility is maintained.

3.2 Characteristics

3.2.1 General characteristics

There are three rated voltages to choose from (12 V, 24 V, 48 V), and each of these offers two rated speeds of either 6400 min^{-1} (G speed), or 5400 min^{-1} (S speed). Moreover, the lineup features models with a PWM control function enabling speed variation in accordance with an external PWM signal, as well as models without the PWM control function capable of supporting a wider operating voltage range.

Table 1 and Table 2 show the general characteristics of the models with a PWM function and the models without a PWM function, respectively.

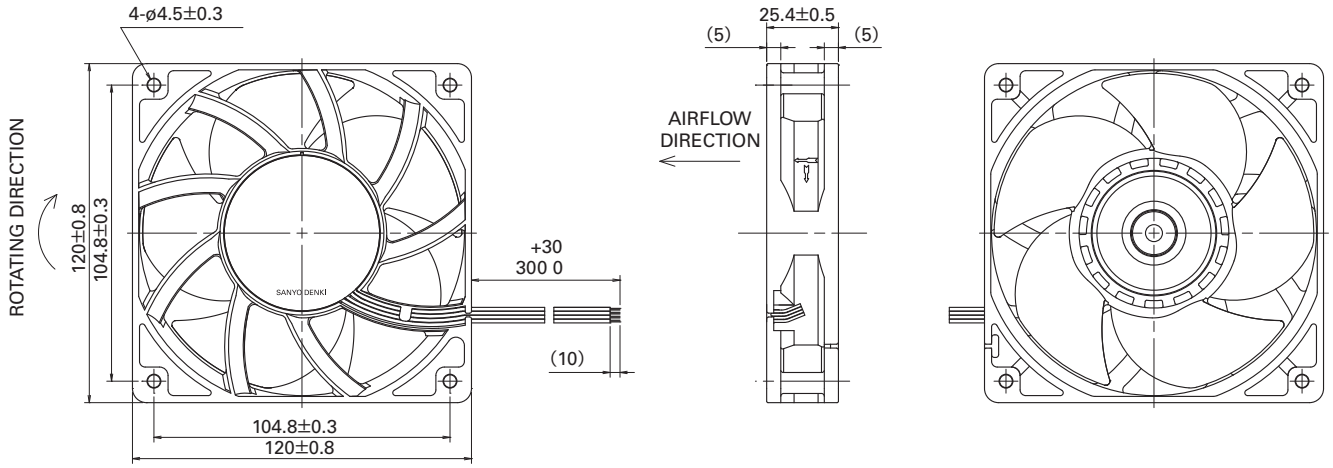


Fig. 2: Dimensions of the new model (unit: mm)

Table 1: General characteristics of the "San Ace 120" 9GA type (with PWM function)

Model No.	Rated voltage [V]	Operating voltage range [V]	PWM duty cycle [%] Note 1,2	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]	SPL [dB(A)]	Operating temperature [°C]	Expected life [h]
9GA1212P4G001	12	10.2 to 13.8	100	0.93	11.16	6400	3.8	134	365	1.47	57	-20 to +70	40000 / 60°C
			25	0.16	1.92	2550	1.5	53	60	0.24	34		
9GA1212P4S001			100	0.61	7.32	5400	3.2	113	260	1.04	54		
			25	0.16	1.92	2550	1.5	53	60	0.24	34		
9GA1224P4G001	24	20.4 to 27.6	100	0.47	11.28	6400	3.8	134	365	1.47	57		
			25	0.10	2.40	2550	1.5	53	60	0.24	34		
9GA1224P4S001			100	0.31	7.44	5400	3.2	113	260	1.04	54		
			25	0.10	2.40	2550	1.5	53	60	0.24	34		
9GA1248P4G001	48	40.8 to 53	100	0.24	11.52	6400	3.8	134	365	1.47	57		
			25	0.08	3.84	2550	1.5	53	60	0.24	34		
9GA1248P4S001			100	0.16	7.68	5400	3.2	113	260	1.04	54		
			25	0.08	3.84	2550	1.5	53	60	0.24	34		

Note 1: Input PWM frequency: 25 kHz, Note 2: Speed is 0 min^{-1} at 0% PWM duty cycle

Table 2: General characteristics of the "San Ace 120" 9GA type (without PWM function)

Model No.	Rated voltage [V]	Operating voltage range [V]	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]	SPL [dB(A)]	Operating temperature [°C]	Expected life [h]
9GA1212G4001	12	7 to 13.8	0.93	11.16	6400	3.8	134	365	1.47	57	-20 to +70	40000 / 60°C
9GA1212S4001			0.61	7.32	5400	3.2	113	260	1.04	54		
9GA1224G4001	24	14 to 27.6	0.47	11.28	6400	3.8	134	365	1.47	57		
9GA1224S4001			0.31	7.44	5400	3.2	113	260	1.04	54		
9GA1248G4001	48	36 to 53	0.24	11.52	6400	3.8	134	365	1.47	57		
9GA1248S4001			0.16	7.68	5400	3.2	113	260	1.04	54		

3.2.2 Airflow vs. static pressure characteristics

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

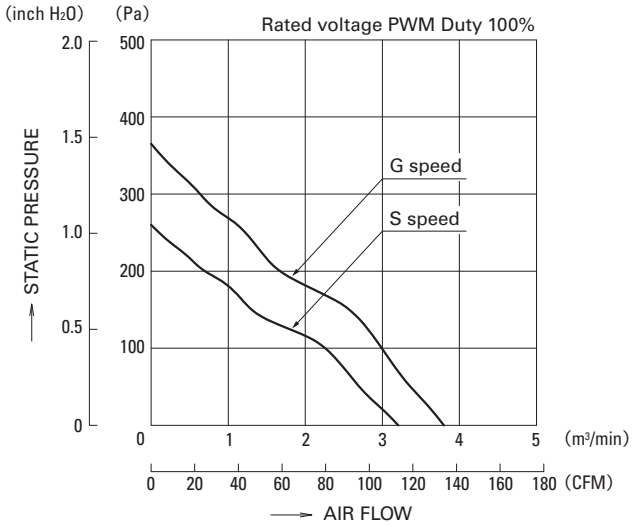


Fig. 3: Airflow vs. static pressure characteristics of new model

3.2.3 PWM control function

Figure 4 shows an example of the airflow vs. static pressure characteristics for different values of PWM duty cycle. The new model has a PWM control function that enables external control of fan speed.

By controlling the fan speed to suit the device’s heat generation state rather than operating it at full speed constantly, both the overall device power consumption and noise can be reduced. Therefore, the demand for fans with a PWM speed control function has increased significantly in recent years.

3.3 Expected life

The new model has an expected life of 40,000 hours at 60˚C (survival rate of 90%, run continuously at rated voltage and normal humidity in a free air state).

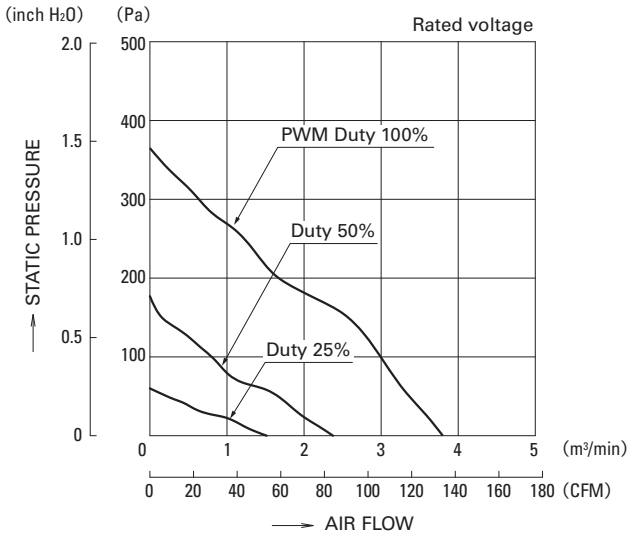


Fig. 4: Example of the airflow vs. static pressure characteristics for different values of PWM duty cycle.

4. Key Points of Development

The new model has a newly designed impeller, frame, and motor and has achieved lower power consumption and higher static pressure compared to the current model.

The key points of development are explained as follows.

4.1 Impeller and frame design

Generally speaking, a high static pressure can be easily obtained by increasing fan speed. However, higher speed also results in increased power consumption. To resolve this issue, SANYO DENKI used 3D printing to optimize impeller shape and angle, as well as frame shape in order to achieve low power consumption and high static pressure.

Figure 5 shows the shape of the impeller and frame for both the new and current models.

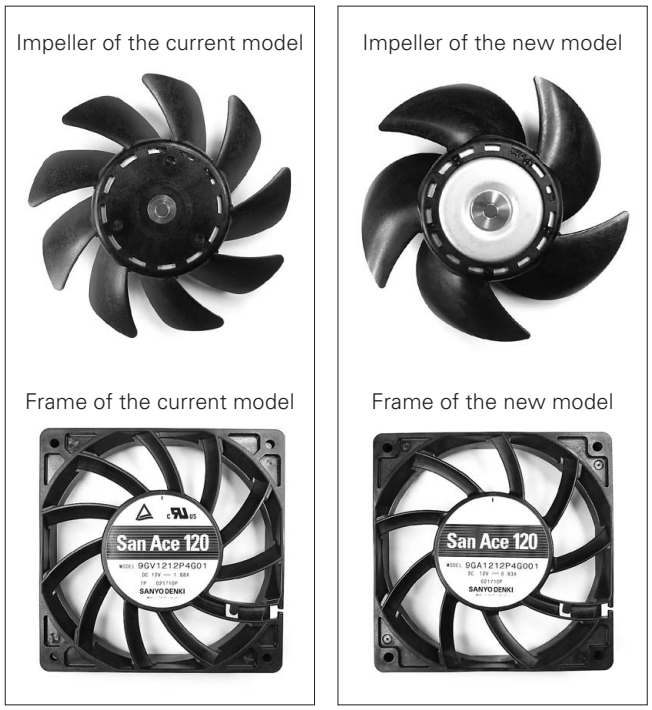


Fig. 5: Comparison of the impeller and frame shape for the new/current model

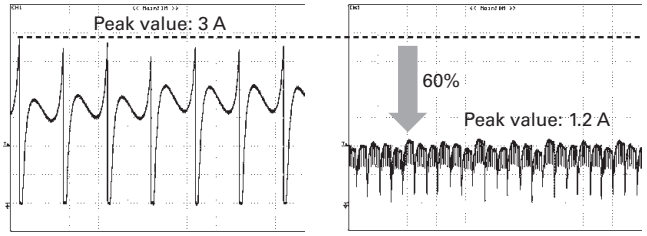
4.2 Motor and circuit design

Regarding the design of the motor and circuit, the motor drive method was changed from the single-phase adopted on the current model to a three-phase drive. This change has reduced the peak value of the electric current waveform during regular rotation by 60%.

Figure 6 compares the motors of the current model and new model, while Figure 7 compares the current waveforms during regular rotation.

Current model (9GV type) New model

Fig. 6: Motors of new model and current model



Current model (9GV type) New model

Fig. 7: Example of current waveforms of the new and current models at normal operation

5. Comparison with the current model

With a newly and optimally designed impeller, frame, and motor, the new model achieves significantly higher static pressure and lower power consumption compared to the current model.

The followings are comparisons of the characteristics of the new and current models.

5.1 Comparison of airflow vs. static pressure characteristics

Figure 8 gives a comparison of the airflow vs. static pressure characteristics for the new model and 9GV1212P4G01, a current model of the same size. By newly and optimally designing the impeller, frame, and motor, maximum static pressure has increased by 1.63 times, marking a significant improvement.

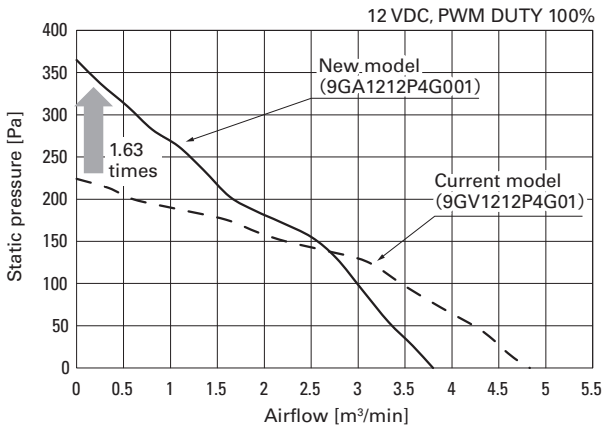


Fig. 8: Airflow vs. static pressure characteristics

5.2 Power consumption comparison

Figure 9 looks at the power consumption of the new model compared with that of the current model, 9GV1212P4G01.

The figure clearly shows that the new model has lower power consumption in all operating ranges.

Furthermore, the power consumption of the new model at the point of the same airflow and static pressure (airflow 2.7 m^3/min, static pressure 135 Pa) has been reduced by 22% from the current model, as shown in Figure 10.

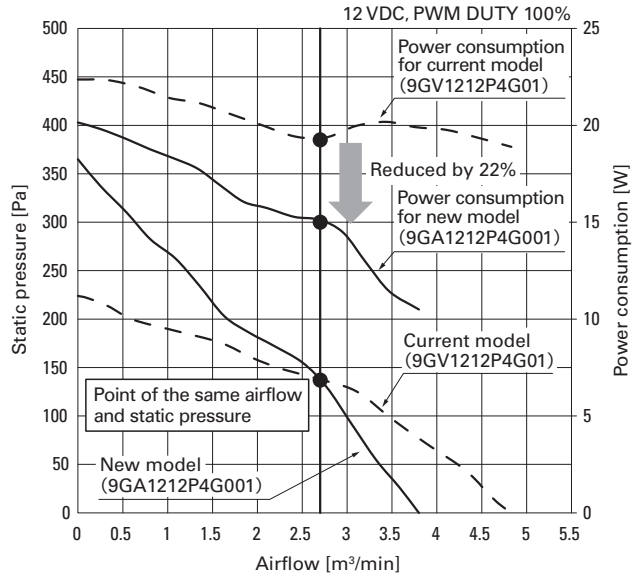


Fig. 9: Airflow vs. static pressure vs. power characteristics example

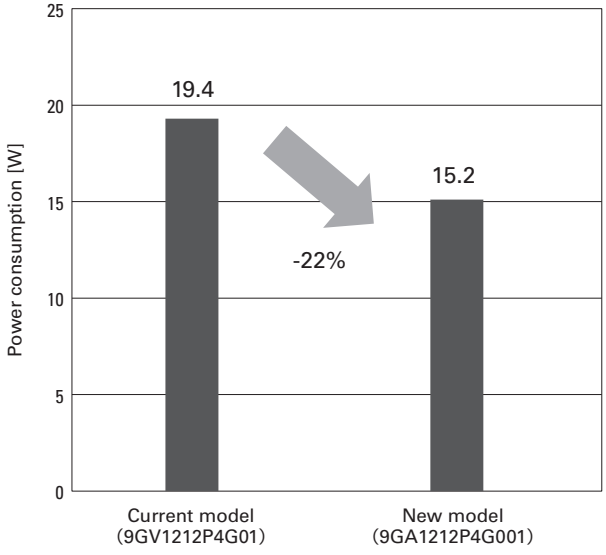


Fig. 10: Comparison of power consumption at the point of the same airflow and static pressure (airflow 2.7 m^3/min, static pressure 135 Pa)

5.3 Sound pressure level (SPL) comparison

Figure 11 compares the SPL of the new model to that of the current model, 9GV1212P4G01. In the same way as power consumption, the new model has reduced SPL by 4.5 dB(A) compared to the current model at the point of the same airflow and static pressure (airflow 2.7 m^3/min, static pressure 135 Pa).

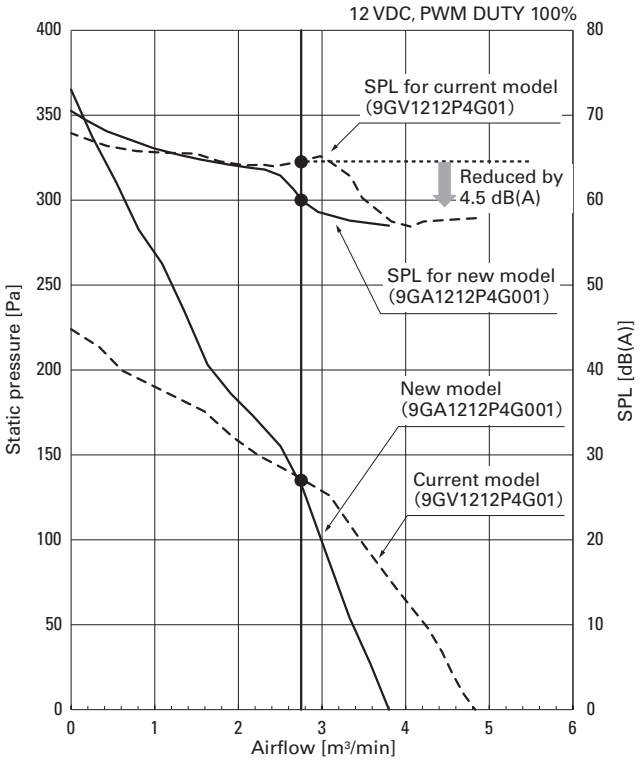


Fig. 11: Airflow vs. static pressure vs. SPL characteristics example

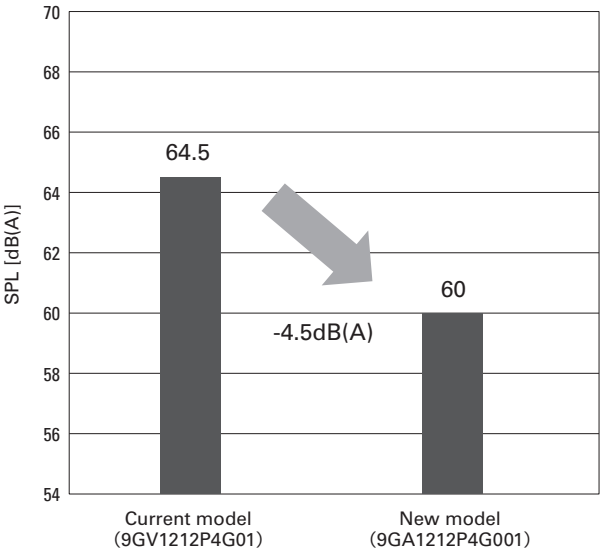


Fig. 12: Comparison of SPL at the point of the same airflow and static pressure (airflow 2.7 m^3/min, static pressure 135 Pa)

6. Conclusion

This article has introduced the features and performance of the “San Ace 120” 9GA type low power consumption fan developed by SANYO DENKI.

By adopting a newly designed impeller, frame, and motor, our new model has achieved significantly higher static pressure and lower power consumption compared with the current model.

The lineup of 120 × 120 × 25 mm sized fans, including the 9GV type high airflow fan and the 9S silent fan, has been expanded with the addition of the new model “San Ace 120” 9GA type low power consumption fan, which we introduced in this article.

SANYO DENKI is confident that these fans, each with their respective strengths, will provide effective solutions for the many requirements and issues which emerge due to changes in the market and significantly contribute to creating “new value” for our customers.

* Based on our own market research as of January 12, 2017 among axial fans of equivalent size.

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