120 × 120 × 25 mm *San Ace 120W* 9WPA Type Splash Proof Fan

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1. Introduction

Our 120 × 120 mm sized cooling fans are used in various applications, including EV chargers, storage battery systems, PV inverters, digital signage, and plant factories. These applications require highly durable fans that offer water and dust resistance to protect live parts from fine dust and humid environments. As these systems are often powered by renewable energy sources, fans are also required to be compact, energy-efficient, and low-noise.

To better meet these market demand, we have developed and launched the slim 120 × 120 × 25 mm *San Ace 120W* 9WPA type Splash Proof Fan, expanding the lineup of Splash Proof Fans.

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

2. Product Features

Figure 1 shows the new product.

The new product has a slimmer profile, lower noise, and lower power consumption than the current 120 × 120 × 38 mm 9WP type fan while maintaining the same 120 × 120 mm frame size and cooling performance.

Fig. 1 120 × 120 × 25 mm *San Ace 120W* 9WPA type

3. Product Overview

3.1 Dimensions

Figure 2 shows the dimensions of the new product. The new product is designed to be compatible with the current product in frame size and mounting while being slimmer.

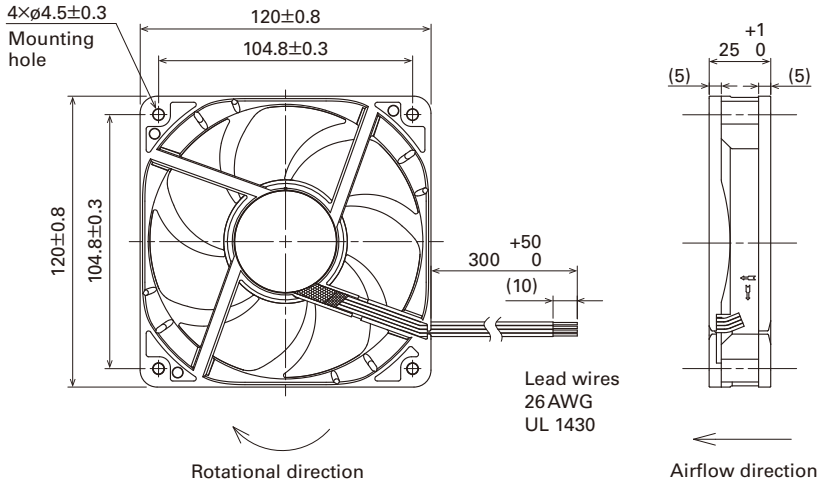


Fig. 2 Dimensions of the *San Ace 120W* 9WPA type (Unit: mm)

Table 1 General specifications of the *San Ace 120W* 9WPA type, models with pulse sensor and PWM control

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 life [h]
9WPA1212P4J001	12	10.8 to 13.2	100	1.0	12.0	5,400	4.20	148	210	0.84	53	-20 to +60	40,000 at 60°C (70,000 at 40°C)
			20	0.07	0.84	1,600	1.24	43.8	24.0	0.10	25		
9WPA1212P4G001			100	0.50	6.0	4,250	3.30	117	135	0.54	46	-20 to +70	
			20	0.06	0.72	1,300	1.00	35.3	16.0	0.06	20		
9WPA1224P4J001	24	21.6 to 26.4	100	0.50	12.0	5,400	4.20	148	210	0.84	53	-20 to +60	
			20	0.05	1.20	1,600	1.24	43.8	24.0	0.10	25		
9WPA1224P4G001			100	0.25	6.0	4,250	3.30	117	135	0.54	46	-20 to +70	
			20	0.04	0.96	1,300	1.00	35.3	16.0	0.06	20		

* 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.

Table 2 General specifications of the *San Ace 120W* 9WPA type, pulse sensor models

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]	Sound pressure level [dB(A)]	Operating temperature range [°C]	Expected life [h]
9WPA1212J4001	12	7 to 13.2	1.0	12.0	5,400	4.20	148	210	0.84	53	-20 to +60	40,000 at 60°C (70,000 at 40°C)
9WPA1212G4001		7 to 13.8	0.50	6.00	4,250	3.30	117	135	0.54	46	-20 to +70	
9WPA1212H4001		10.2 to 13.8	0.12	1.44	2,400	1.85	65.0	47.0	0.19	30	-20 to +70	
9WPA1224J4001	24	14 to 26.4	0.50	12.0	5,400	4.20	148	210	0.84	53	-20 to +60	
9WPA1224G4001		14 to 27.6	0.25	6.00	4,250	3.30	117	135	0.54	46	-20 to +70	
9WPA1224H4001		20.4 to 27.6	0.06	1.44	2,400	1.85	65.0	47.0	0.19	30	-20 to +70	

3.2 Specifications

3.2.1 General specifications

Tables 1 and 2 show the general specifications of the new product.

To support a wide range of markets, we launched a lineup of models in two rated voltages of 12 and 24 V and three speeds of high, medium, and low.

3.2.2 Airflow vs. static pressure characteristics

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

3.2.3 PWM control

The high-speed model and medium-speed model come with PWM control for controlling the fan speed.

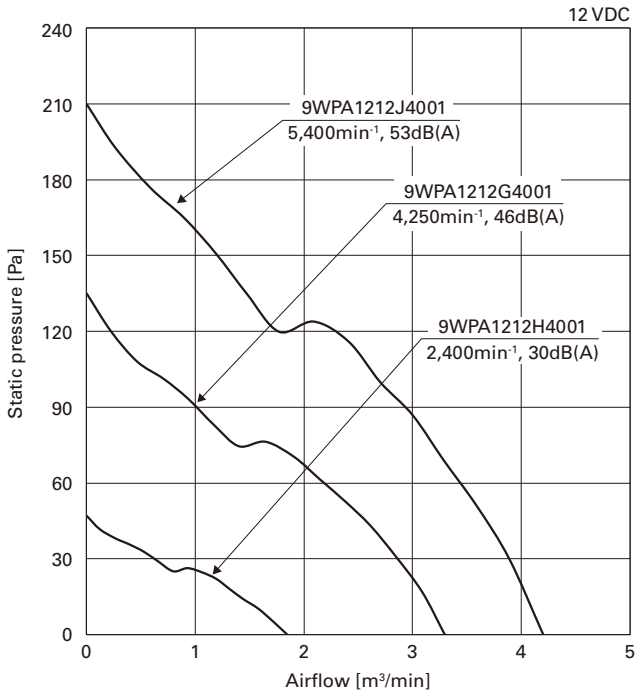


Fig. 3 Airflow vs. static pressure characteristics of the *San Ace 120W* 9WPA type

4. Key Points of Development

While being slimmer, the new product delivers greatly improved performance than the current product (120 × 120 × 38 mm 9WP type). It also achieves lower noise and lower power consumption when operated with the same cooling performance.

The key points of development are described below.

4.1 Motor and circuit design

To improve the cooling performance of the current product, we increased the fan's vent area by using a smaller, more efficient motor.

To that end, we replaced the unipolar motor driver with a more efficient bipolar one. Moreover, we used a stronger magnet to optimize the motor output against the impeller load, successfully reducing heat generation and power consumption.

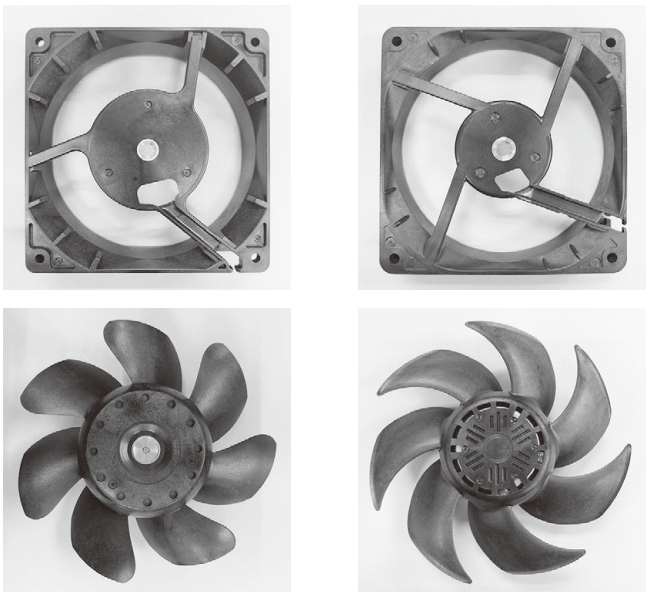
4.2 Structural design

We achieved IP68-rated water and dust protection by enclosing all live parts with a highly water-resistant resin coating. Figure 4 shows the coating on the live parts.

Fig. 4 Coating of live parts

The frame and impeller were designed to be rigid enough to support the increased fan speed while offering low power consumption and low noise. To mitigate motor temperature rise due to the increased fan speed, the frame and impeller shapes were optimized through simulations and evaluation on actual equipment, successfully completing the product development.

Figure 5 compares the shapes of the new and current products.



Current product　　New product

Fig. 5 Shape comparison of the new and current products

5. Comparison of New and Current Products

5.1 Comparison of the airflow vs. static pressure characteristics and noise levels of new and current products

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

Compared to the current 120 × 120 × 38 mm 9WP type fan, the new product achieves 1.26 and 2.1-times greater maximum airflow and static pressure, respectively.

Figure 7 compares the airflow vs. static pressure vs. power consumption characteristics and load vs. noise characteristics of the new and current products at equivalent cooling performance. The new product achieves a 28% reduction in power consumption at the assumed operating point while maintaining the same airflow vs. static pressure characteristics as the current product. In addition, its noise level has been reduced by 6 dB(A).

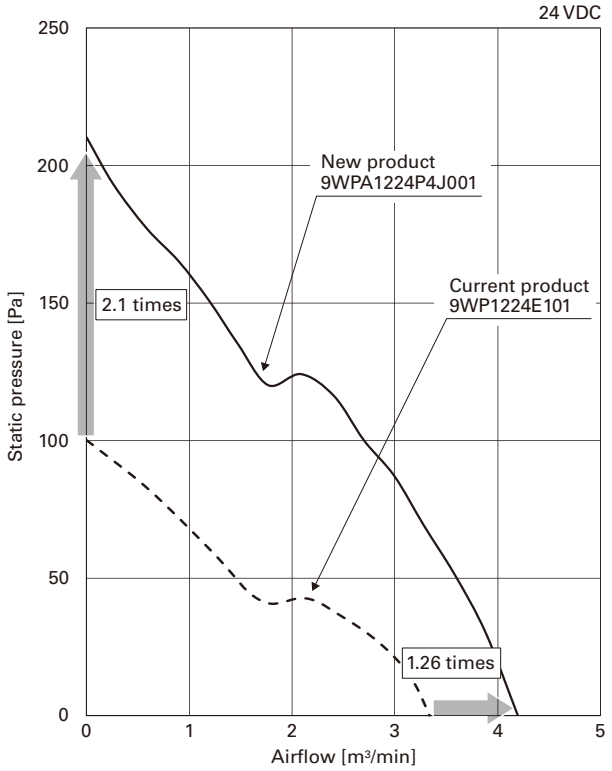


Fig. 6 Comparison of the new and current *San Ace 120W* products

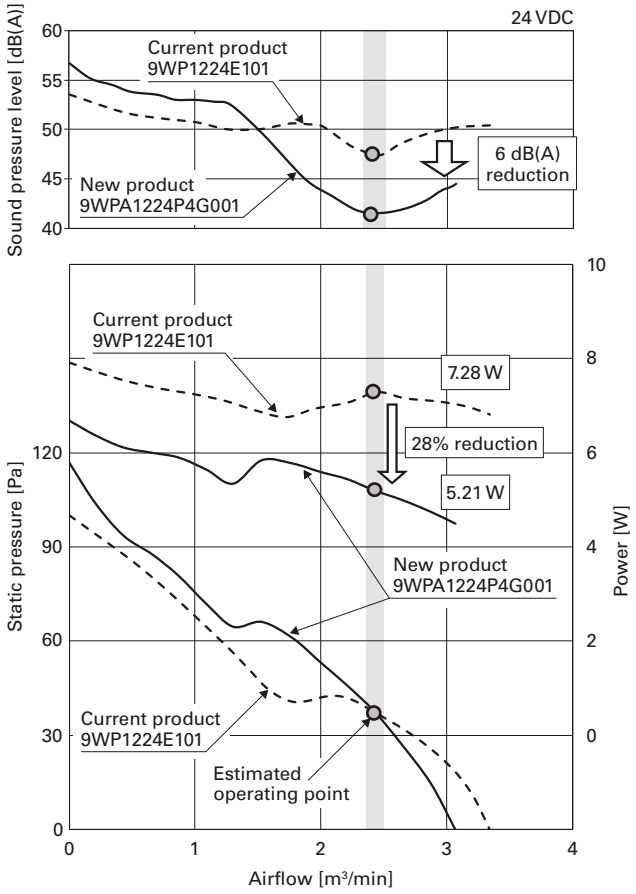


Fig. 7 Comparison of the new and current *San Ace 120W* products (at same cooling performance)

5.2 Environmental impact comparison

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

The new product produces 26% less CO_2 emissions over its product life cycle compared to the current product, thanks to its reduced power consumption.

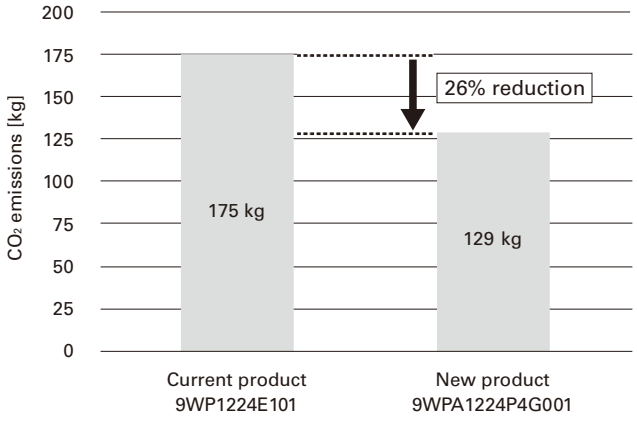


Fig. 8 CO_2 emissions comparison using an LCA calculation software (40,000 hours, when operated with the same operating airflow)

6. Conclusion

This article introduced the features and performance of the *San Ace 120W* 9WPA type fan.

The new product achieves lower noise, lower power consumption, and equivalent protection rating compared to the current product while also delivering significantly improved cooling performance. We expect it to contribute greatly to applications that require environmental durability, higher cooling performance, and improved energy efficiency over previous products.

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

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