ø172 × 150 × 51 mm *San Ace 172AD* 9AD Type ACDC Fan and *San Ace 172AD* 9ADW Type Splash Proof ACDC Fan

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1. Introduction

AC-powered cooling fans are used in many applications, including air conditioners, inverters, and control panels. Re, there has been a growing need for reduced power consumption of devices in recent years. AC-powered fans have also been required to have a wider input voltage range for global use and water protection for use in more environments. We had offered the ø172 × 150 × 51 mm *San Ace 172* AC Fan (hereinafter, "current model"), but a new AC-powered fan that could meet these requirements had been needed.

In response, we developed *San Ace 172AD* 9AD type ACDC Fan, which features DC fan-level low power consumption despite its wide AC input voltage range, and *San Ace 172AD* 9ADW type Splash Proof ACDC Fan (hereinafter, "new models").

This article will introduce the performance and features of the new models as well as key points of development.

2. Product Features

Figures 1 and 2 show the appearance of the new products.

Figure 1 shows the appearance of the 9AD type, while Figure 2 is of the 9ADW type.

The features of the new products are as follows:

(1) Low power consumption
(2) High airflow and high static pressure
(3) Wide range of AC input supported

The 9ADW type also offers the following feature in addition to the above:

(4) IP56-rated* dust and water protection

Fig. 1 ø172 × 150 × 51 mm *San Ace 172AD* 9AD type

Fig. 2 ø172 ×150 × 51 mm *San Ace 172AD* 9ADW type

* IP56-rated protection
The IP Code, or Ingress Protection Code is defined by International Electrotechnical Commission (IEC) in the IEC 60529 standard "Degrees of Protection Provided by Enclosures (IP Code)" (IEC 60529:2001).

3. Product Overview

3.1 Dimensions

Figures 3 and 4 show the dimensions of the new models. The new models are compatible in size and mounting with the current model.

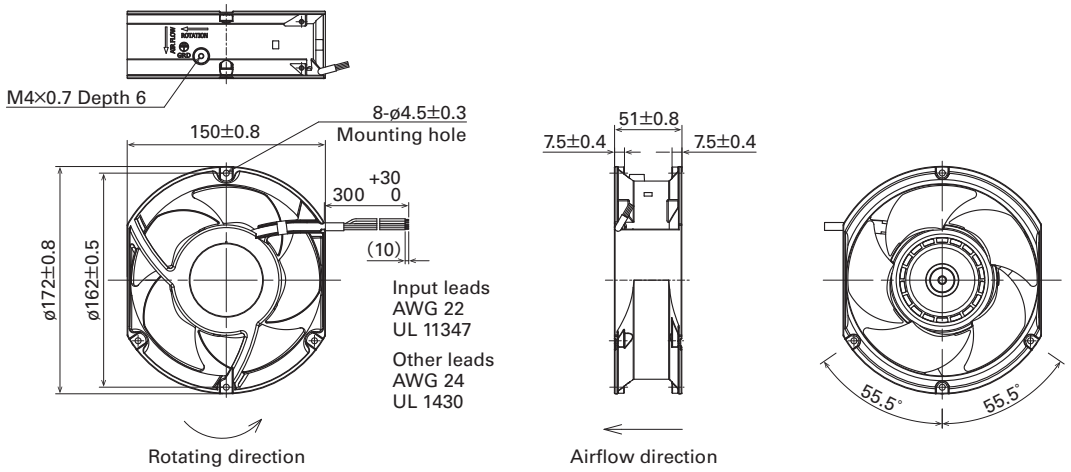

Fig. 3 Dimensions of the *San Ace 172AD* 9AD type (Unit: mm)

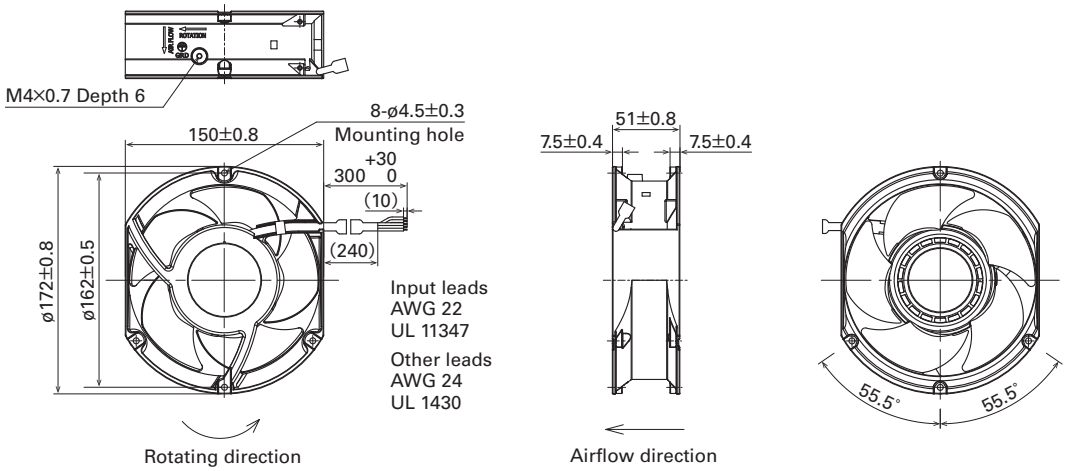

Fig. 4 Dimensions of the *San Ace 172AD* 9ADW type (Unit: mm)

3.2 Specifications

3.2.1 General specifications

Table 1 shows the general specifications of the new models. Both the 9AD type and 9ADW type share the same general specifications.

Table 1 General specifications of new models

Model no.	Rated voltage [V]	Frequency [Hz]	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]
9AD5701P5H003 **9ADW5701P5H003**	100 to 240	50/60	100	0.3	17	3800	6.7	236	195	0.78	54	-20 to +70	40000 at 60°C (70000 at 40°C)
			0	0.08	3.2	1500	2.64	93	40	0.16	31		

* Input PWM frequency: 25 kHz

Note: The expected life at an ambient temperature of 40°C is for reference purposes only.

3.2.2 Airflow vs. static pressure characteristics

Figure 5 shows the airflow vs. static pressure characteristics for the new models. The airflow vs. static pressure characteristics do not change over the input voltage range of 100 to 240 V.

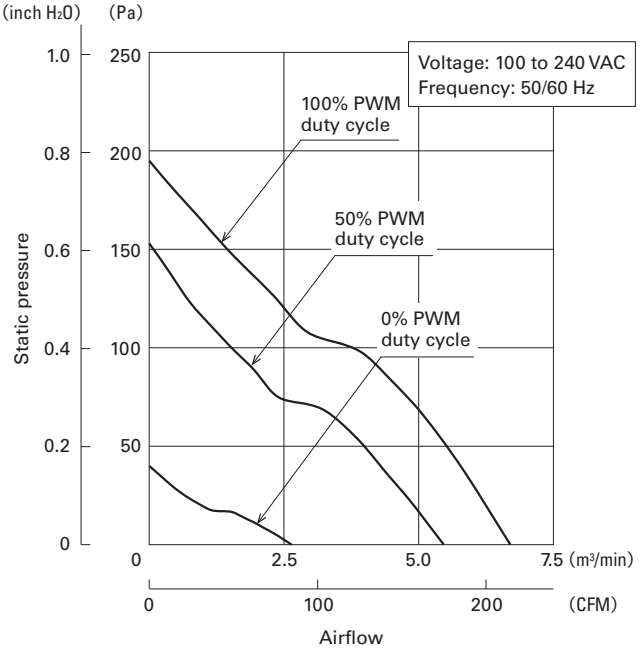

Fig. 5 Airflow vs. static pressure characteristics of new models

3.2.3 PWM control function

The new models have PWM control function and are capable of controlling fan speed.

3.3 Expected life

The new models have an expected life of 40,000 hours at 60°C (survival rate of 90%, run continuously at rated voltage in free air and at normal humidity). The expected life of the current model is 25,000 hours under the same conditions, so the expected life of the new models is 1.6 times longer than the current model.

4. Key Points of Development

Compared to the current model, the new models achieve lower power consumption, higher airflow, and higher static pressure with the size unchanged. In addition, the 9ADW type also provides dust and water protection.

The key points of development are explained as follows.

4.1 Impeller and frame design

Figure 6 compares the shapes of the impellers and frames for the current and new models.

When redesigned the impeller and frame by conducting numerous simulations for various combinations of parameters such as the number, length, and angle of blades, and the shape of the frame, and by prototype testing. In this way, we determined the design for optimized airflow performance.

4.2 Circuit design

We designed the new models to be compatible with a wider 100 to 240 VAC voltage range, improved the efficiency of the AC-DC conversion circuit to reduce power consumption, and optimized the motor-driving DC voltage. We encountered an issue with the 9ADW type where the temperature of PCB and electronic components would rise due to the PCB being sealed in an enclosure. We managed to suppress the temperature rise with a structure such that the heat from electronic components would dissipate through the frame.

4.3 Water-resistant design

Figure 7 shows the appearance of the live part of new models. We provided the 9ADW type with IP56-rated dust and water protection by coating its motor in resin and housing the circuit in the space between the frame and cover. We also reduced the amount of resin in the coating to make the product lighter.

Fig. 6 Shape comparison between the new and current models

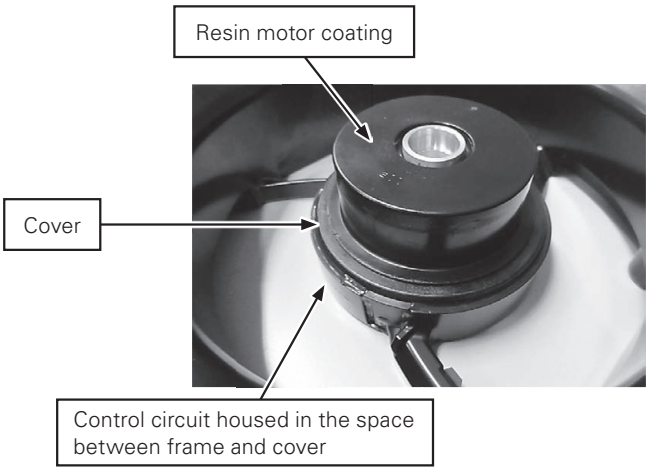

Fig. 7 Appearance of the live part

5. Comparison of New and Current Models

5.1 Comparison of airflow vs. static pressure characteristics

Figure 8 compares the airflow vs. static pressure characteristics of the new and current models. The new models have 3% higher maximum airflow than the current model while maintaining the same maximum static pressure. On the estimated system impedance (ventilation resistance) curve in the figure, the operating airflow of the new models is 27% higher than the current model.

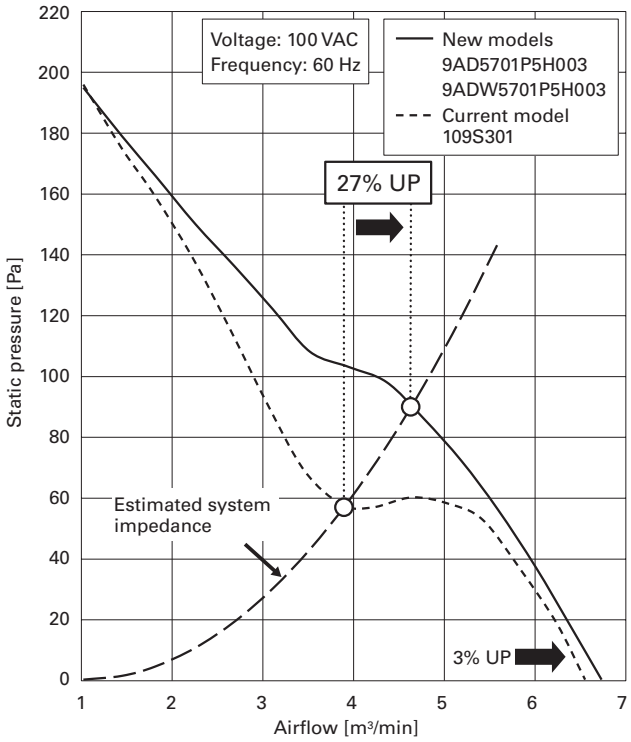

Fig. 8 Airflow vs. static pressure characteristics of the new and current models

5.2 Comparison of power consumption at an equivalent performance level as the current model

Figures 9 and 10 compare power consumption of the current and new models at equivalent cooling performance. The figures show that power consumption drops 48% at 60 Hz and 58% at 50 Hz compared to the current model when the speeds of the new models are reduced with PWM control to match the cooling performance of the current model.

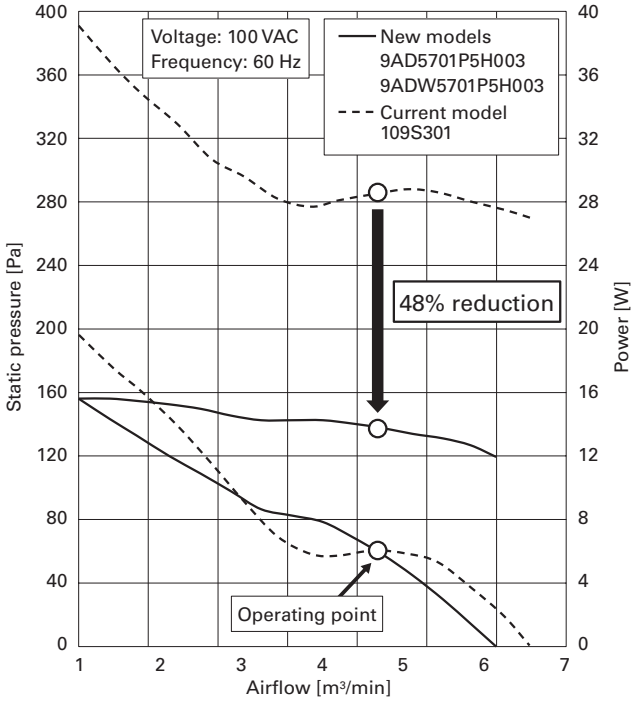

Fig. 9 Power consumption comparison between new and current models (100 V, 60 Hz)

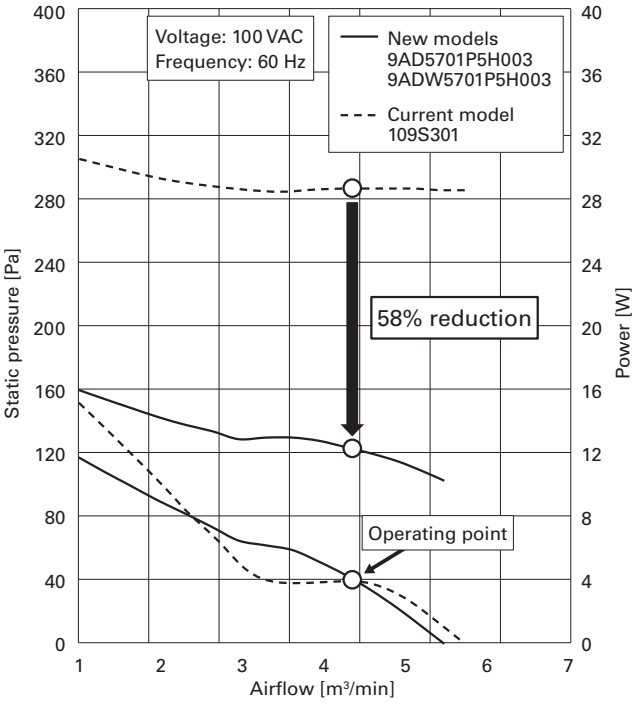

Fig. 10 Power consumption comparison between new and current models (100 V, 50 Hz)

6. Conclusion

This article introduced some of the features and performance of the *San Ace 172AD* 9AD type ACDC Fan and the *San Ace 172AD* 9ADW type Splash Proof ACDC Fan.

The new models achieved lower power consumption, higher airflow, and higher static pressure without changing the size of the current model. They can be used in a wider range of applications with a wider input voltage range and the 9ADW type's dust and water protection.

We will continue providing products that can meet market needs to help our customers create new value.

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