

120 × 120 × 38 mm *San Ace 120AD 9ADA* Type ACDC Fan and *San Ace 120AD 9ADAW* Type Splash Proof ACDC Fan

Masashi Murakami Noriaki Ogawa Izumi Onozawa

Toshiya Nishizawa Hidetoshi Oobayashi Masato Murata

1. Introduction

Our 120 × 120 × 38 mm ACDC Fans are primarily used in control panels of factory equipment. In recent years, control panels have become smaller and denser, requiring fans with higher airflow and higher static pressure. Environmental durability is also essential for ACDC fans for use in harsh environments such as dusty factory facilities and water-exposed plant factories.

In response to these market demands, we developed and launched new products featuring high airflow and high static pressure: a 120 × 120 × 38 mm *San Ace 120AD 9ADA* type ACDC Fan and a *San Ace 120AD 9ADAW* type Splash Proof ACDC Fan (hereinafter, “new product” for both).

This article introduces the performance and features of these new products, as well as the key points of development.

2. Product Features

Figure 1 shows the 9ADA type and Figure 2 shows the 9ADAW type.

The features of these new products are as follows:

- (1) High airflow and high static pressure
- (2) Wide AC input voltage range

In addition, the 9ADAW type is the first of our ACDC Fans to have the following feature.

- (3) IP68-rated* dust and water protection

* IP68-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)”.



Fig. 1 120 × 120 × 38 mm *San Ace 120AD 9ADA* type



Fig. 2 120 × 120 × 38 mm *San Ace 120AD 9ADAW* type

3. Product Overview

3.1 Dimensions

Figures 3 and 4 show the dimensions of the 9ADA type and 9ADAW type, respectively. Both types are identical in external dimensions and mounting dimensions, and they are also designed to be compatible with our current products.

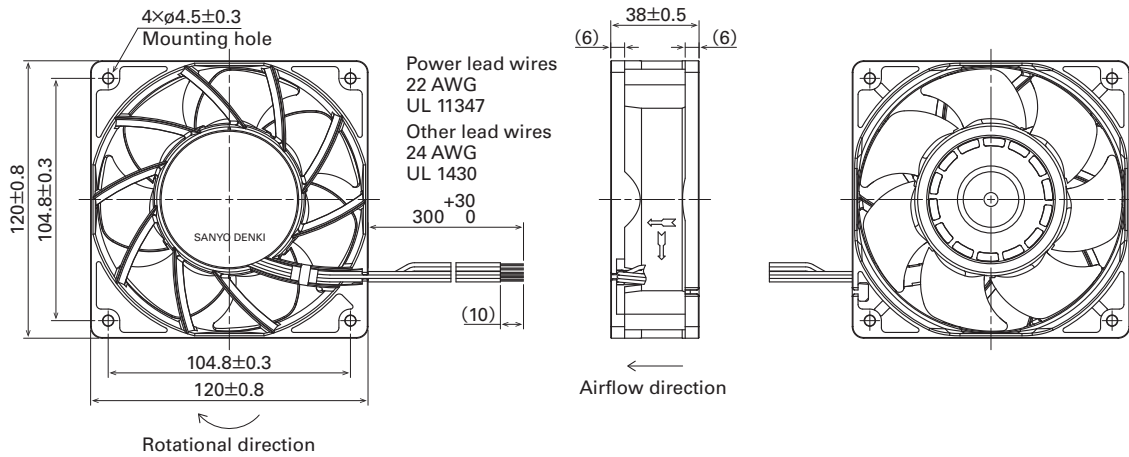


Fig. 3 Dimensions of 120 × 120 × 38 mm *San Ace 120AD 9ADA* type (Unit: mm)

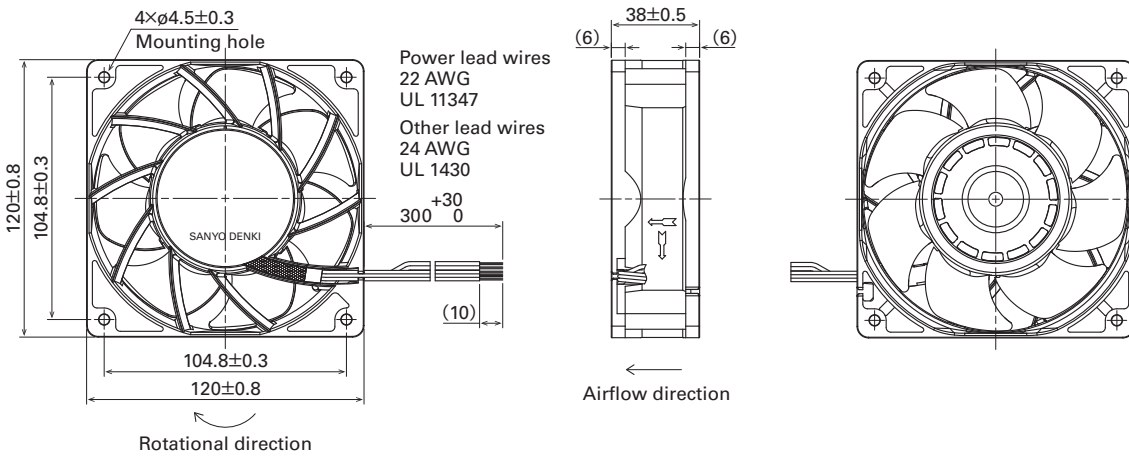


Fig. 4 Dimensions of 120 × 120 × 38 mm *San Ace 120AD 9ADAW* type (Unit: mm)

3.2 Specifications

3.2.1 General specifications

Tables 1 and 2 show the general specifications of the 9ADA type and 9ADAW type, respectively.

Their operating voltage range is 90 to 264 V, and thus they can be used both with 100 V and 200 V systems.

Table 1 General specifications of 120 × 120 × 38 mm *San Ace 120AD 9ADA* type

Model no.	Rated voltage [V]	Operating voltage range [V]	Frequency [Hz]	PWM duty cycle* [%]	Rated current [A]	Rated input [W]	Rated speed [min ⁻¹]	Max. airflow [m ³ /min] [CFM]	Max. static pressure [Pa] [inchH ₂ O]	Sound pressure level [dB(A)]	Operating temperature range [°C]	Expected life [h]	
9ADA1201P1G001	100 to 240	90 to 264	50/60	100	0.17	9.0	4400	3.9	138	170	0.683	52	40000 at 60°C (70000 at 40°C)
				20	0.04	1.4	1050	0.93	32.8	15	0.06	25	
-				0.17	9.0	4400	3.9	138	170	0.683	52		
				0.13	6.6	3800	3.36	119	128	0.514	48		
9ADA1201G1002	100 to 240	90 to 264	50/60	-	0.17	9.0	4400	3.9	138	170	0.683	52	-20 to +70
0.13					6.6	3800	3.36	119	128	0.514	48		
9ADA1201H1002				-	0.17	9.0	4400	3.9	138	170	0.683	52	
					0.13	6.6	3800	3.36	119	128	0.514	48	

* 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.

Table 2 General specifications of 120 × 120 × 38 mm *San Ace 120AD* 9ADAW type

Model no.	Rated voltage [V]	Operating voltage range [V]	Frequency [Hz]	PWM duty cycle*	Rated current [A]	Rated input [W]	Rated speed [min ⁻¹]	Max. airflow		Max. static pressure		Sound pressure level [dB(A)]	Operating temperature range [°C]	Expected life [h]
				[%]				[m ³ /min]	[CFM]	[Pa]	[inchH ₂ O]			
9ADAW1201P1H001	100 to 240	90 to 264	50/60	100	0.13	6.6	3800	3.36	119	128	0.514	48	-20 to +70	60000 at 60°C (90000 at 40°C)
				25	0.04	1.4	1050	0.93	32.8	15	0.06	25		
9ADAW1201H1002				—	0.13	6.6	3800	3.36	119	128	0.514	48		

* 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.

3.2.2 Airflow vs. static pressure characteristics

Figure 5 shows the airflow vs. static pressure characteristics of the 9ADA1201P1G001 model, Figure 6 shows the characteristics comparison between the 9ADA1201G1002 and 9ADA1201H1002 models, and Figure 7 shows the airflow vs. static pressure characteristics of the 9ADAW1201P1H001 model. The airflow vs. static pressure characteristics of all models do not change over their input voltage range from 100 to 240 V.

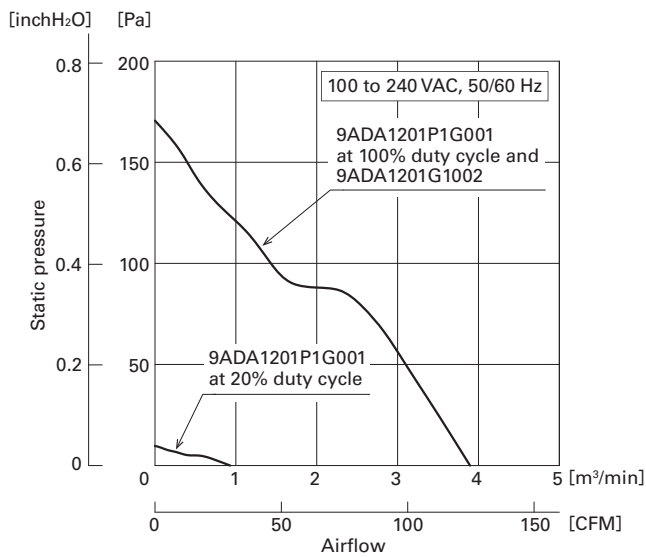


Fig. 5 Airflow vs. static pressure characteristics of 9ADA1201P1G001

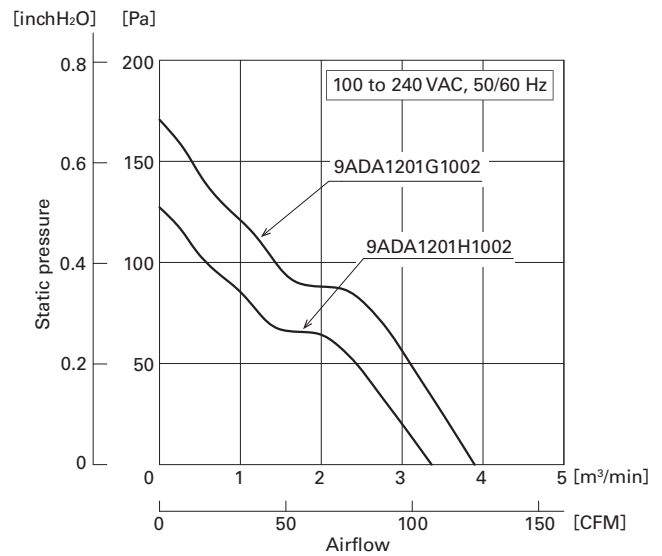


Fig. 6 Characteristics comparison between 9ADA1201G1002 and 9ADA1201H1002

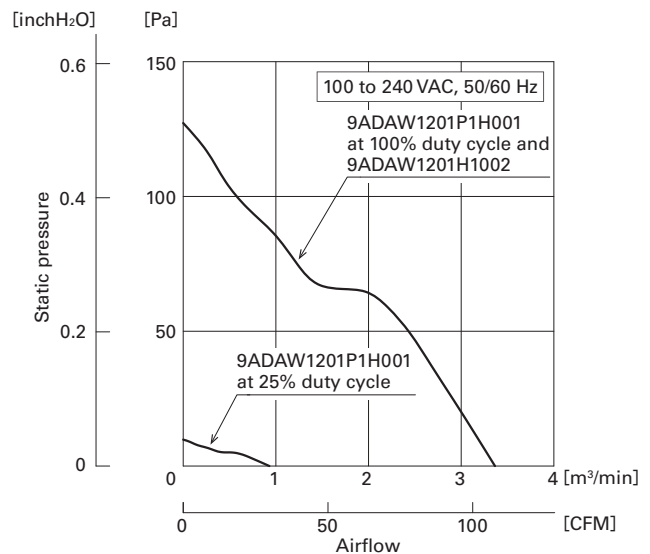


Fig. 7 Airflow vs. static pressure characteristics of 9ADAW1201P1H001

3.2.3 PWM control

The 9ADA1201P1G001 and 9ADAW1201P1H001 models come with PWM control for controlling the fan speed.

3.3 Expected life

The new products have an expected life of 40,000 hours for the 9ADA1201P1G001 model and 60,000 hours for the 9ADA1201H1002 and 9ADAW1201P1H001 models at 60°C (both have a survival rate of 90%, when run continuously at the rated voltage in free air and at normal humidity).

4. Key Points of Development

The new products achieve higher airflow and higher static pressure while maintaining the same size as our current ACDC fan. The 9ADAW type also offers dust and water protection.

The key features of the new products are described below.

4.1 Impeller and frame design

Figure 8 compares the impeller and frame shapes of the new *San Ace 120AD* fan and our current product.

We verified various combinations of parameters such as the number, length, and angle of impellers and the frame shape through simulations and evaluations on actual equipment to determine the optimal design for excellent airflow efficiency.

4.2 Circuit design

The key was to design a circuit that operates stably while providing high airflow, high static pressure, and a wide range of input voltages despite the size limitation of the PCB due to the impeller and frame shape.

The target specifications were achieved by improving the efficiency of the ACDC conversion circuit, optimizing the DC voltage that drives the motor, and selecting the best electronic components for the specifications.

4.3 Water-resistant design

Figure 9 shows the live parts of the 9ADAW type.

The 9ADAW type is our first Splash Proof ACDC Fan to achieve IP68-rated protection.

While many of our Splash Proof DC Fans have IP68, the best protection our existing Splash Proof ACDC Fans could offer was IP56. This was because enclosing a fan's motor and circuit portions completely with resin coating works for DC fans but not for ACDC fans since it would undermine the reliability and safety of components unique to ACDC fans in the event of abnormalities.

We resolved this challenge by devising a new structure

that combined the structure of our Splash Proof DC Fan with that of our current Splash Proof ACDC Fan, ensuring the reliability and safety in the event of abnormalities and achieving IP68 protection.

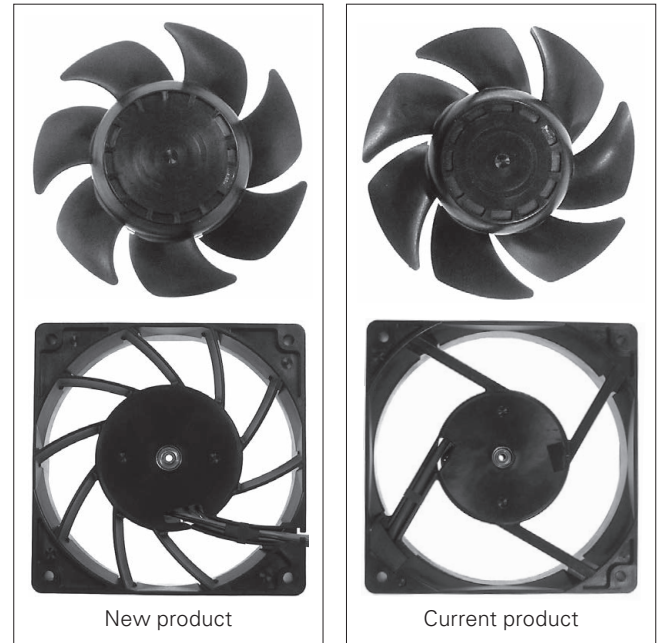


Fig. 8 Shape comparison between the new and current products

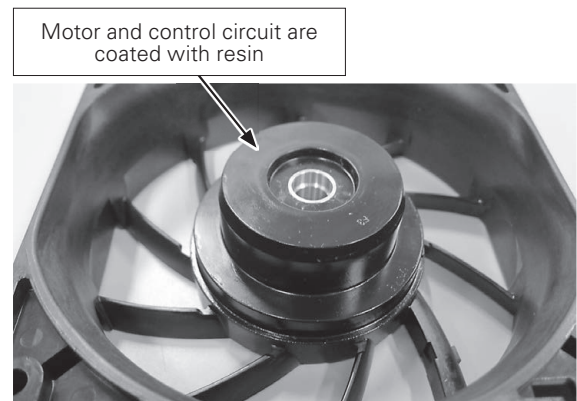


Fig. 9 Live parts of new product

5. Comparison of New and Current Products

5.1 Comparison of airflow vs. static pressure characteristics

Figure 10 compares the airflow vs. static pressure characteristics of the new 9ADA1201P1G001 and the current product. Compared to the current product, the maximum airflow and maximum static pressure have been improved by 30% and 102%, respectively.

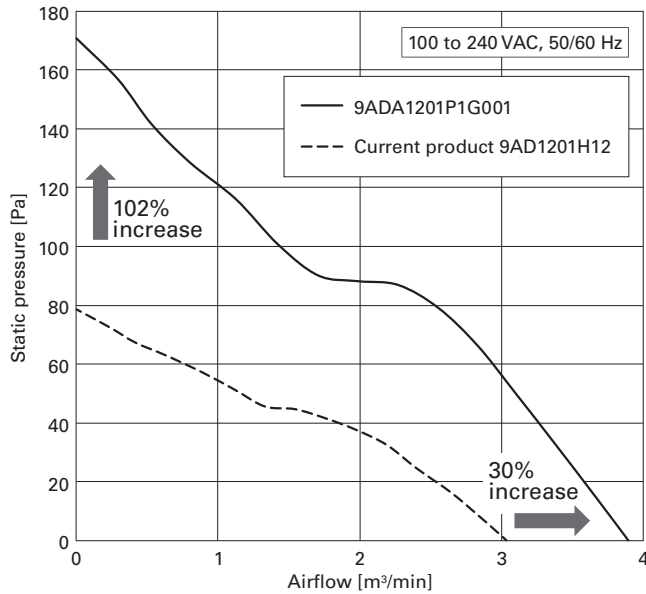


Fig. 10 Airflow vs. static pressure characteristics comparison between the current product and new 9ADA1201P1G001 (at 100 V, 60 Hz)

Figure 11 compares the airflow vs. static pressure characteristics of the new 9ADAW1201P1H001 and the current product. Compared to the current product, the maximum airflow and maximum static pressure have been improved by 12% and 52%, respectively.

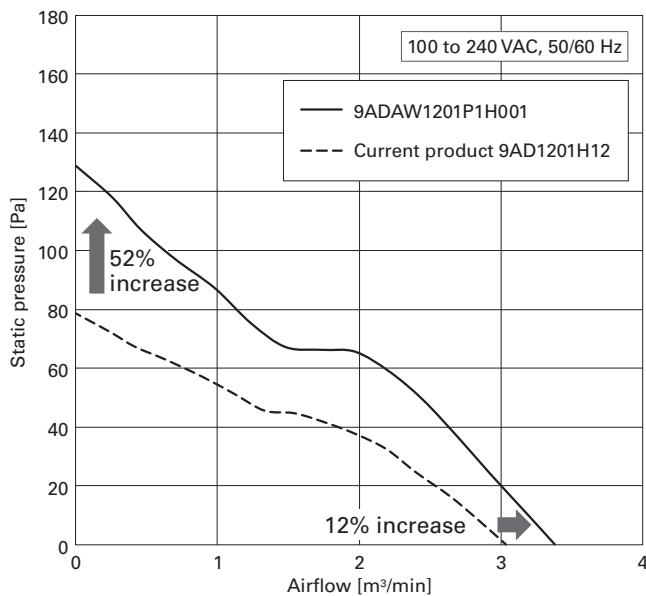


Fig. 11 Airflow vs. static pressure characteristics comparison between the current product and new 9ADAW1201P1H001 (at 100 V, 60 Hz)

6. Conclusion

This article presented some of the features and performance of the *San Ace 120AD 9ADA* type ACDC Fans and *San Ace 120AD 9ADAW* type Splash Proof ACDC Fans. Each of the new products achieves higher airflow and static pressure than the current products and can cool smaller and denser control panels. The 9ADAW type meets the requirement for use in harsh environments thanks to its dust and water protection.

We will continue to help our customers create new value by providing products that address market demand.

Author

Masashi Murakami

Design Dept., Cooling Systems Div.
Works on the development and design of cooling fans.

Noriaki Ogawa

Design Dept., Cooling Systems Div.
Works on the development and design of cooling fans.

Izumi Onozawa

Design Dept., Cooling Systems Div.
Works on the development and design of cooling fans.

Toshiya Nishizawa

Design Dept., Cooling Systems Div.
Works on the development and design of cooling fans.

Hidetoshi Oobayashi

Design Dept., Cooling Systems Div.
Works on the development and design of cooling fans.

Masato Murata

Design Dept., Cooling Systems Div.
Works on the development and design of cooling fans.