

# Low Power Consumption, Long Life AC Fan “San Ace 120AD” 9AD Type

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## 1. Introduction

In recent years, awareness of environmental protection has heightened, resulting in proactive energy conservation activities across all markets. As such, AC fans are now required to consume less power and have longer life.

Here we introduce features and performance of the “San Ace 120AD” 9AD type; a 120 mm sq. 38 mm thick AC fan with lower power consumption and longer life was developed to respond to the needs stated above.

## 2. Background of the Development

Sanyo Denki has produced and sold AC fans for many years. Sanyo Denki’s development of cooling fans began with the AC fan, which has become available in a variety of sizes and voltages since its release in 1965. However, in 1982 a DC fan was developed for the first time on which it was possible to create a circuit inside the fan. Since then, Sanyo Denki’s DC fan development has become the main focus, resulting in the increasing sophistication of performance and keeping on evolving.

Meanwhile, development of new AC fans has been fallen behind due to the increase in DC fan applications.

Given this situation, in order to enter into a new AC fan market, Sanyo Denki has developed the “San Ace 120AD” 9AD type; a 120 mm sq. 38 mm thick AC fan with lower power consumption and longer life.

## 3. Product Features

Fig. 1 shows the “San Ace 120AD” 9AD type (hereinafter “new model”) and below is a list of its features.

- (1) Low power consumption
- (2) Higher performance
- (3) Long life
- (4) Wider input voltage range
- (5) Lightweight

Conventional AC fans has induction motors which were not so efficient. As such, in order to create a low power consumption fan which satisfied the abovementioned market demands, it was necessary to devise a new method which parted from conventional technology.

In contrast, the brushless DC motor has high efficiency in comparison with induction motors. So, if AC was input and a similar drive method to the brushless DC motor could be adopted, there would be significant improvement in AC fan efficiency. Hence, this new model has an internal AC/DC converter which enables high efficiency.

The new model achieves low power consumption and long life at the same time as maintaining high airflow and high static pressure characteristics of Sanyo Denki’s conventional AC fans. Moreover, in the case of the conventional models, it was necessary to choose a fan spec to the relevant input voltage, however the new model is capable of a wide voltage range.



Fig. 1: “San Ace 120AD” 9AD type

## 4. Product Overview

### 4.1 Dimensions

Fig. 2 shows the dimensions of the new model.

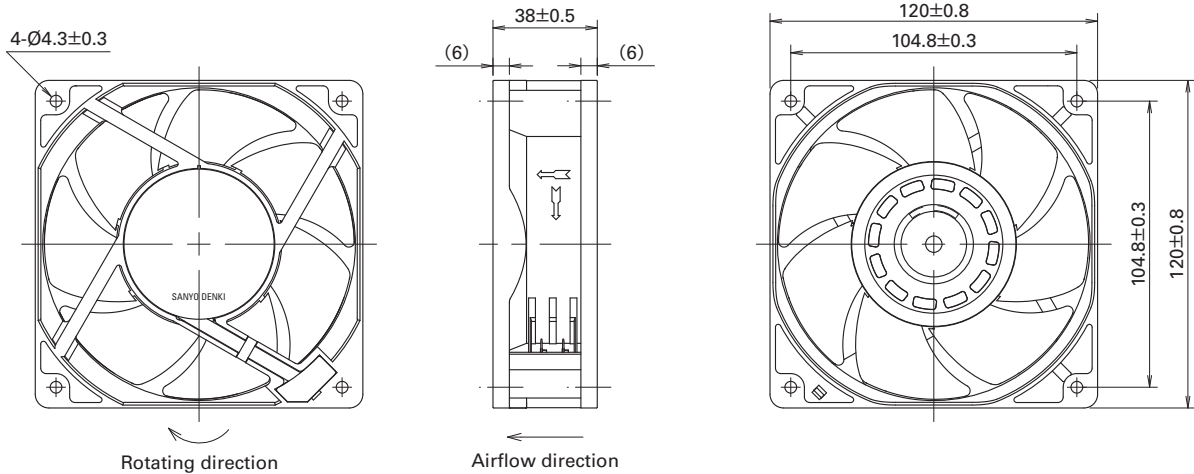


Fig. 2: Dimensions of the new model (unit: mm)

Table 1: General characteristics for the new model

Model No.	Rated voltage [V]	Operating voltage [V]	Frequency [Hz]	Rated current [A]	Rated input [W]	Rated speed [ $\text{min}^{-1}$ ]	Max. airflow		Max. static pressure		SPL [dB(A)]	Operating temperature [ $^{\circ}\text{C}$ ]	Expected life [h]
							[ $\text{m}^3/\text{min}$ ]	[CFM]	[Pa]	[inchH <sub>2</sub> O]			
9AD1201H12	100 to 240	90 to 264	50/60	0.08	4.4	3,250	3.0	106	84	0.34	42	-20 to +75	60,000

Note: Common to 50/60 Hz

### 4.2.2 Airflow vs. static pressure characteristics

Fig. 3 shows the airflow versus static pressure characteristics for the new model.

### 4.3 Expected life

The new model has an expected life of 60,000 hours at  $60^{\circ}\text{C}$  (survival rate of 90% with continuous operation at the rated voltage under free air conditions and at normal humidity).

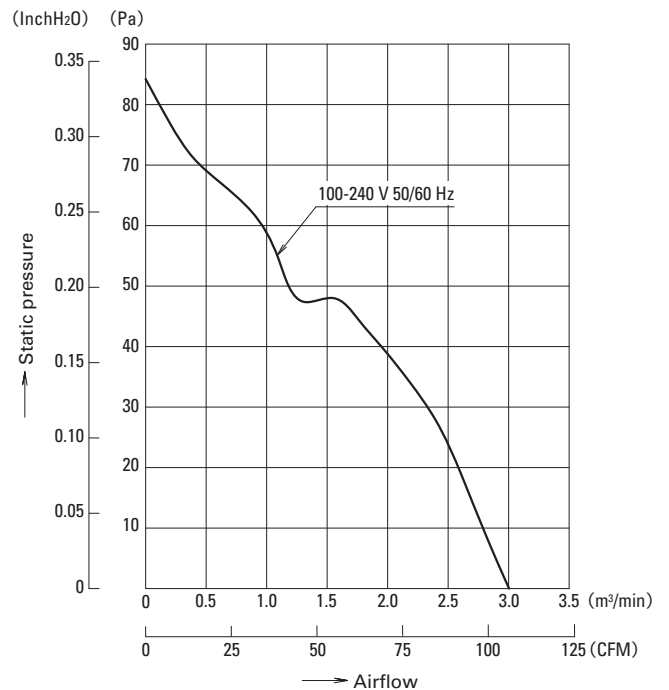


Fig. 3: New model airflow vs. static pressure

## 5. Comparisons with our Conventional Models

Comparisons of the expected life, airflow versus static pressure characteristic and power consumption between the new and conventional models are as follows;

### 5.1 Comparison of expected life

Table 2 shows comparison of the expected life and other general characteristics of the new model and conventional model.

Table 2: New model and conventional model characteristic comparison

	Expected life [h]	Max. airflow [m <sup>3</sup> /min]	Max. static pressure [Pa]	Rated input [W]
<b>New model 9AD1201H12</b>	60,000	3.0	84	4.4
<b>Conventional model 109S075UL (At 60 Hz)</b>	25,000	2.9	68.7	16

The new model has higher maximum airflow and maximum static pressure than the conventional model having low power consumption. Furthermore, the expected life (60°C ambient temperature, 90% survival rate, continuous operation at rated voltage, free air state, normal humidity) of the new model with 60,000 hours is 2.4 times longer than the conventional model with 25,000 hours.

### 5.2 Comparison of airflow vs. static pressure characteristic and power consumption

Fig. 4 shows an example of the airflow versus static pressure characteristics for the conventional models and the new model.

Compared to the conventional models, the new model has higher airflow versus static pressure characteristic in all areas. In addition, power consumption is reduced in all areas, achieving a 72% reduction in a free air state.

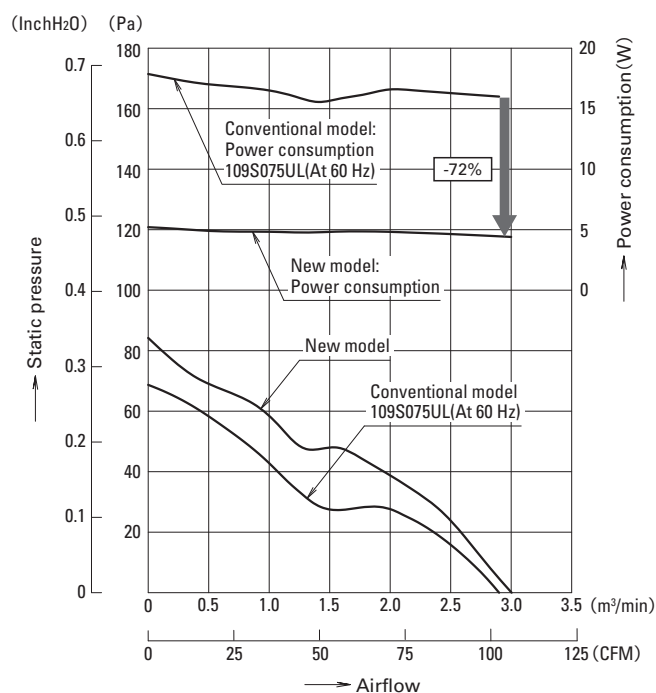


Fig. 4: Airflow vs. static pressure (New/conventional model comparison)

## 6. New Development Elements

The new model is driven converting AC to DC inside the fan. This means that an AC/DC converter is necessary and more space is required than the circuit for regular brushless DC fan motors (motor drive circuit). Due to this, motor construction was reviewed and sufficient space was secured to install the AC/DC converter.

Below lists are key things for the development to achieve the various characteristics of the new model.

#### (1) Low power consumption

- Adoption of a brushless DC motor
- Optimization of electronic components

In addition to a significant reduction in power consumption by changing the drive method to brushless DC motor, the number of electronic components was reduced to the minimal necessary in order to reduce circuit loss. Moreover, higher efficiency was achieved by selecting the optimal item for each electronic components.

#### (2) Higher performance

- Optimization of the impeller and frame shape

Fig. 5 gives a comparison between the impeller and the frame of the new and conventional models. The design of the impeller was sophisticated through repeated studies to achieve both low power consumption and high performance.

Moreover, in order to increase fan efficiency, the shape of the frame has been optimized to suit the impeller shape.

(3) Long life

- Reduced power consumption
- Optimization of electronic components in the AC/DC converter

By reducing power consumption through changing to a brushless DC motor and optimizing electronic components, the heat generation within the fan has been reduced, along with deterioration of components with life spans.

(4) Wider input voltage range

- AC/DC converter study

A study was made into the circuit for an AC/DC converter so that suitable electronic components could be chosen to support a wider input voltage range. Through this, it was possible to develop an AC fan with input voltage and frequency characteristics which does not fluctuate and send a set amount of DC voltage to the motor drive circuit even if AC input voltage fluctuates.

(5) Lightweight

- Motor size reduction
- Frame material change from aluminum die cast to resin

Conventional model frames were made from aluminum die cast however in order to reduce heat generation inside the fan the motor was made smaller and lighter, therefore we could adopt a resin frame (See Fig. 5).



Fig. 5: Comparison of the impeller and frame between new model (left) and conventional model (right)

The power is supplied to the AC fan through the plug cord. The configuration of the plug cord mounting area was modified on the new model. Fig. 6 shows the power terminal. The portion which mounts to the power terminal frame which joins with the plug cord has been made more reliable.

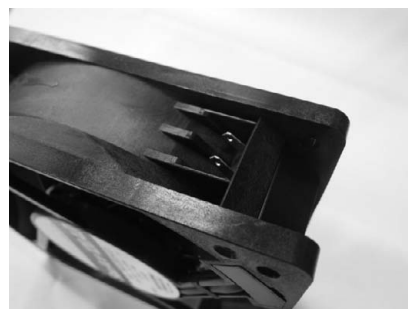


Fig. 6: Power terminal

## 7. Conclusion

This document introduced some of the features and performances of the newly developed low power consumption, long life AC fan “San Ace 120AD” 9AD type.

By performing AC/DC conversion inside the fan, the new model has incorporated the brushless DC motor drive system despite being an AC fan. As a result, it achieves lower power consumption and longer life having a higher airflow versus static pressure characteristic compared to Sanyo Denki’s conventional AC fans. Moreover, this product is extremely easy to use thanks to having characteristics not affected by input voltage and frequency.

Regarding new AC fan with features of a brushless DC fan and difference from the conventional AC fan, we anticipate to play a major role in new market expansion.



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