ø70 × 20 mm Centrifugal Fan *San Ace C70* 9TD type

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1. Introduction

In recent years, equipment has been becoming smaller and thinner, and the cooling fans used inside it are also required to be smaller and thinner.

There is a particularly strong demand for higher cooling performance in compact, thin profile devices like graphics cards embedded in equipment that is becoming increasingly high performance.

Centrifugal fans are suitable for these applications, and there is a need for smaller and thinner centrifugal fans with higher cooling performance.

To meet this demand, we developed the ø70 × 20 mm *San Ace C70* 9TD type Centrifugal Fan (hereinafter "new model") that is compact and thin profile in a size which is a first for the market.

This article will introduce the features and performance of the new model.

2. Product Features

The features of the new model are:

(1) New size
(2) High airflow and static pressure
(3) Low power consumption and sound pressure level (SPL)

Figure 1 shows the appearance of the new model. It has an outer diameter of 70 mm and a thickness of 20 mm.

Fig. 1 ø70 × 20 mm Centrifugal Fan *San Ace C70* 9TD type

3. Product Overview

3.1 Dimensions

Figure 2 shows the dimensions of the new model. The outer diameter of the impeller is 70 mm, and the thickness from the bottom surface of the frame to the top surface of the impeller is 20 mm. It has three M3-threaded mounting holes on the bottom surface.

3.2 Specifications

3.2.1 General specifications

Table 1 shows the general specifications for the new model. It has a rated voltage of 12 V, rated speed of 9,200 min^{-1}, and a PWM control function.

Figure 3 illustrates an installation example of an inlet nozzle 109-1106 for the new model, and Figure 4 demonstrates the installation dimensions. The specifications and characteristics shown are with an inlet nozzle installed. Three M3 screws are used to secure the fan, and four sets of M4 screws and nuts are used to install the inlet nozzle.

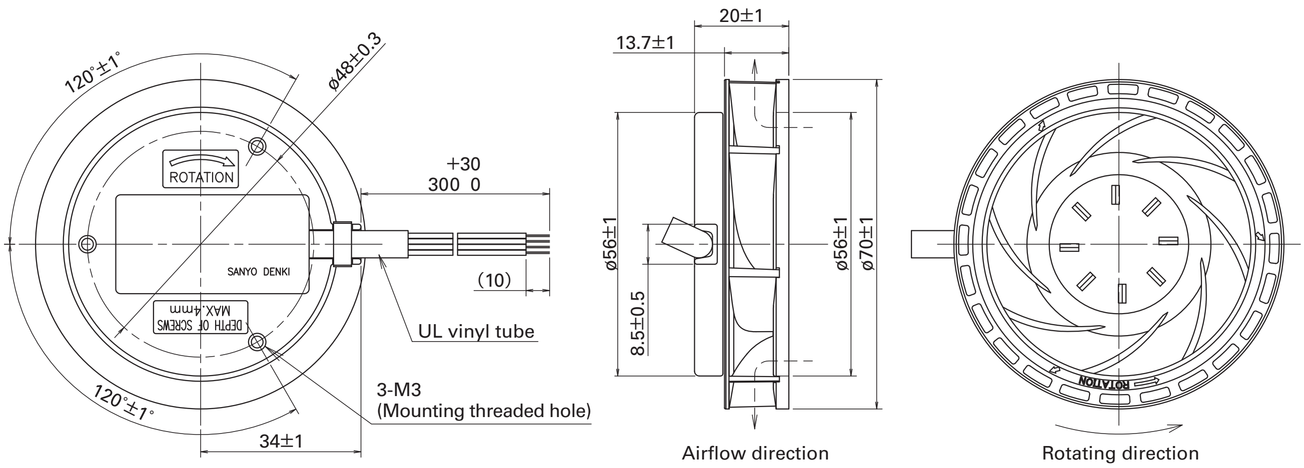

Fig. 2 Dimensions of the new model (unit: mm)

Table 1 General specifications for the new model

Model no.	Rated voltage [V]	Operating voltage range [V]	PWM duty cycle* [%]	Rated current [A]	Rated input [W]	Rated speed [min^{-1}]	Max. airflow		Max. static pressure		SPL [dB(A)]	Operating temperature range [°C]	Expected life [h]
							[m^3/min]	[CFM]	[Pa]	[inchH$_2$O]			
9TD12P6G001	12	10.8 to 13.2	100	1.0	12	9,200	1.13	39.9	560	2.24	61	-20 to +70	40,000 at 60°C (70,000 at 40°C)
			20	0.1	1.2	2,000	0.23	8.1	25	0.10	30		

* Speed is 0 min^{-1} at 0% PWM duty cycle. Input PWM frequency: 25 kHz
Note 1: When equipped with our inlet nozzle (model no.: 109-1106).
Note 2: The expected life at an ambient temperature of 40°C is for reference purpose only.

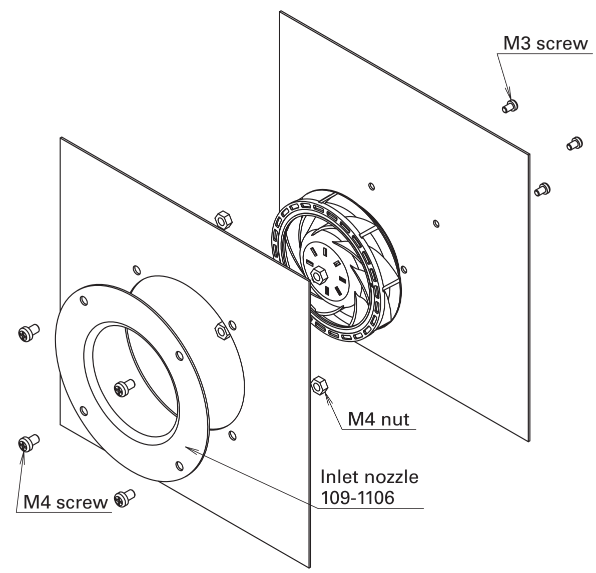

Fig. 3 Installation of inlet nozzle on new model

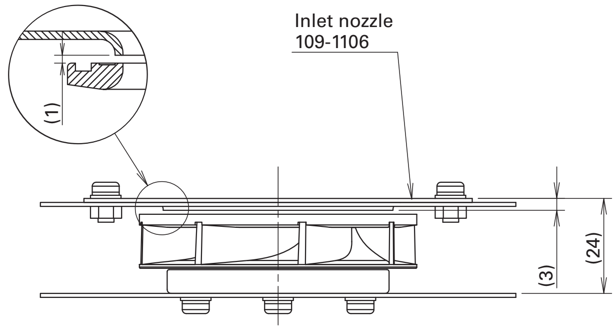

Fig. 4 Dimensions of new model with inlet nozzle installed (unit: mm)

3.2.2 Airflow vs. static pressure characteristics

Figure 5 shows the airflow vs. static pressure characteristics for the new model. The curves demonstrate the PWM duty cycle at 100%, 50%, and 20% at a rated voltage of 12 V.

3.2.3 PWM control function

The new model has a PWM control function that enables external control of fan speed. See Figure 5 for the airflow vs. static pressure characteristics at different PWM duty cycles.

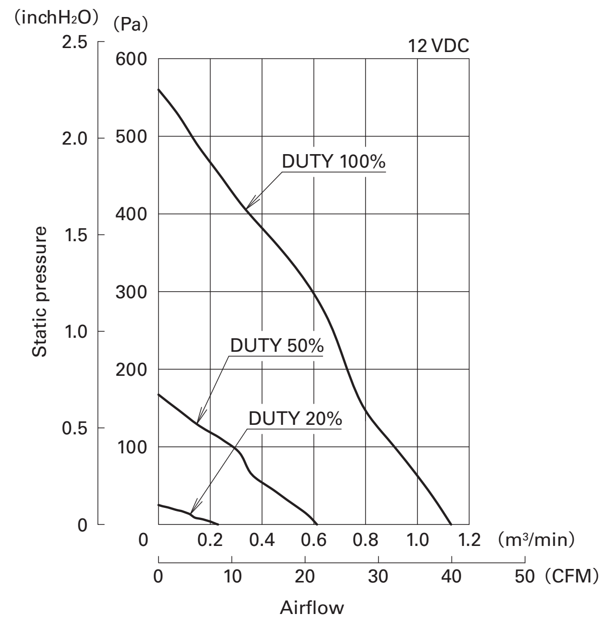

Fig. 5 Airflow vs. static pressure characteristics of new model

3.2.4 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 free air).

4. Key Points of Development

The new model achieves high airflow and high static pressure despite the compact and thin profile.

The key points of development are explained below.

4.1 Compact and Thin Profile

To make the fan smaller and thinner, the motor needed to be made smaller. However, motor heat generation and motor torque issues arose. We solved these issues and achieved a thickness of 20 mm by taking the following measures.

(1) Solution for motor heat generation

We successfully suppressed the motor's temperature rise due to heat generation by using a die cast aluminum frame with excellent heat dissipation and establishing a self-cooling structure with vents on the rotor's intake face. Figure 6 shows the cooling structure of the new model.

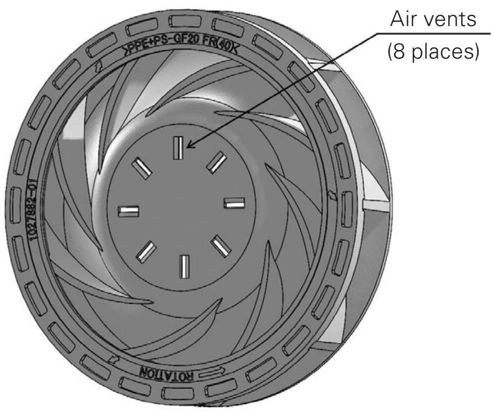

Fig. 6 Cooling structure of the new model

(2) Solution for motor torque

Motor torque can be improved by increasing the motor's diameter. However, as the ratio of the motor diameter to impeller size becomes larger, the air flow path narrows and the airflow vs. static pressure characteristics decreases. As such, we set the motor diameter to minimize the airflow vs. static pressure characteristic reduction and raised motor efficiency by designing a new circuit, achieving the necessary motor torque.

4.2 Impeller and inlet nozzle design

We optimized the impeller design by using fluid simulation with the motor size for the necessary torque and maximum flow path. Figure 7 shows a fluid simulation.

Moreover, we prepared a dedicated inlet nozzle, which is shown in Figure 3, for the new model. With the shape and mounting position optimized, as shown in Figure 4, the new model achieves high airflow and static pressure as well as lower SPL and power consumption.

Fig. 7 Fluid simulation example

5. Comparison with the Current Model

Figure 8 shows a comparison of the airflow vs. static pressure characteristics for the new model and a 76 × 20 mm Blower (hereinafter "current model") of similar size with the same impeller structure as a Centrifugal Fan.

Compared with the current model, the new model's maximum airflow has increased 3.9 times and maximum static pressure has increased 1.9 times.

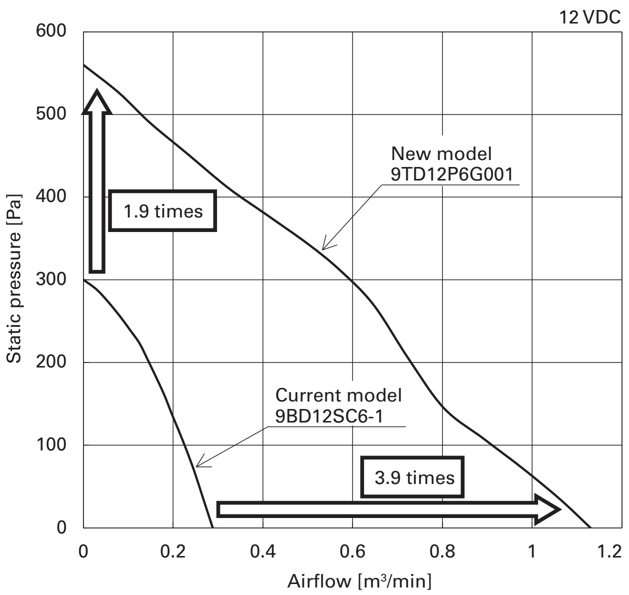

Fig. 8 Airflow vs. static pressure characteristics for the new model and the current model

6. Conclusion

This article introduced some of the features and performance of the ø70 × 20 mm Centrifugal Fan *San Ace C70* 9TD type.

With a higher-efficiency motor and optimized structure, the new model realized high cooling performance despite the compact and thin profile.

In the future, it is expected that equipment in the market will become smaller and thinner. Accordingly, there will be limited component installation space inside equipment, and the resulting higher density will make it more difficult to secure an airflow path.

The new model is the most compact of our Centrifugal Fans, and with its high airflow and static pressure, we believe it will greatly contribute to solving our customers' issues.

We will continue to stay ahead of the diversifying market and develop products that create value for our customers.

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