ø175 mm × 69 mm Centrifugal Fan "San Ace C175" 9TGA Type

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1. Introduction

Centrifugal fans are used in various devices including ICT equipment, large inverters, refrigeration units, dust collectors, and air conditioners and the ø175 mm × 69 mm sized ones has solid track record.

In 2009, SANYO DENKI released the "San Ace C175" 9TG type ø175 mm × 69 mm centrifugal fan (hereinafter, "current model") to the market. However, in line with a constant shift towards higher performance, devices are generating more and more heat, leading to a stronger demand for centrifugal fans with better cooling performance. Also, as part of environmental initiatives, there is a demand for more eco-efficient cooling fans.

To meet such demands, SANYO DENKI developed and produced the "San Ace C175" 9TGA type centrifugal fan (hereinafter, "new model").

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

2. Product Features

Figure 1 shows an external view of the new model.

The features of the new model are:

(1) High airflow and high static pressure
(2) Low power consumption
(3) PWM speed control function
(4) Wide operating voltage range

3. Outline of the New Model

3.1 Dimensions

Figure 2 shows the dimensions of the new model. The new model is installed in the same way as the current model.

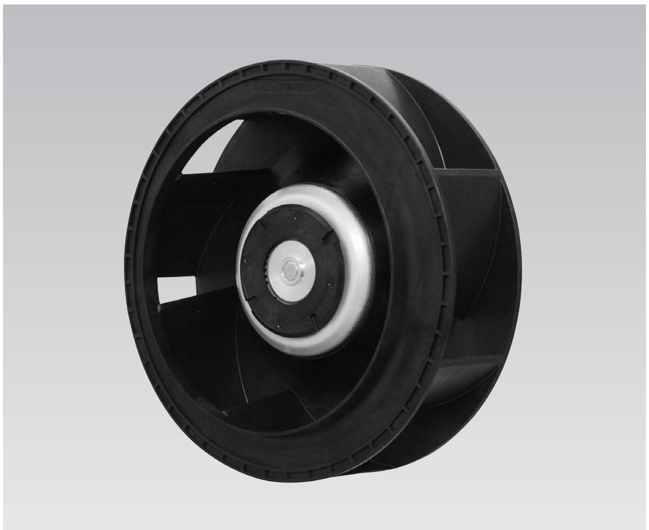


Fig. 1: ø175 mm x 69 mm centrifugal fan "San Ace C175" 9TGA type

3.2 Characteristics

3.2.1 General characteristics

Table 1 shows the general specifications for the new model.

The general specification values of a centrifugal fan are obtained with a dedicated inlet nozzle equipped (inlet nozzle installation conditions: see Figures 3 and 4).

3.2.2 Airflow vs. static pressure characteristics

Figure 5 shows the airflow vs. static pressure characteristics for the new model.

3.2.3 PWM control function

The new model has a PWM control function that enables external control of the fan speed.

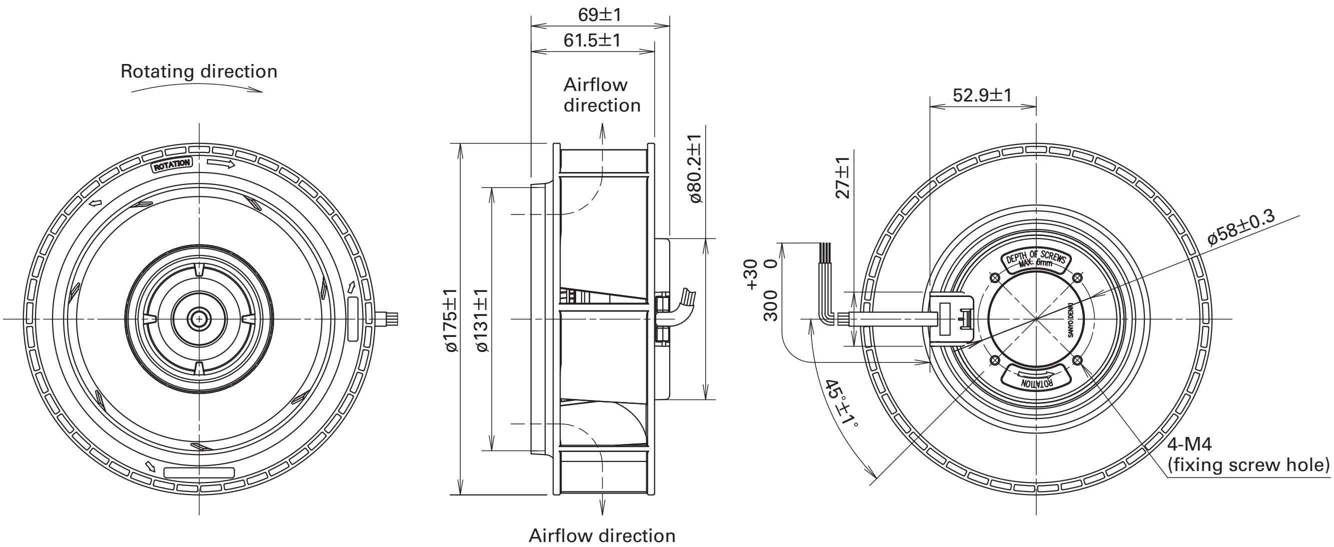


Fig. 2: Dimensions of the new model (unit: mm)

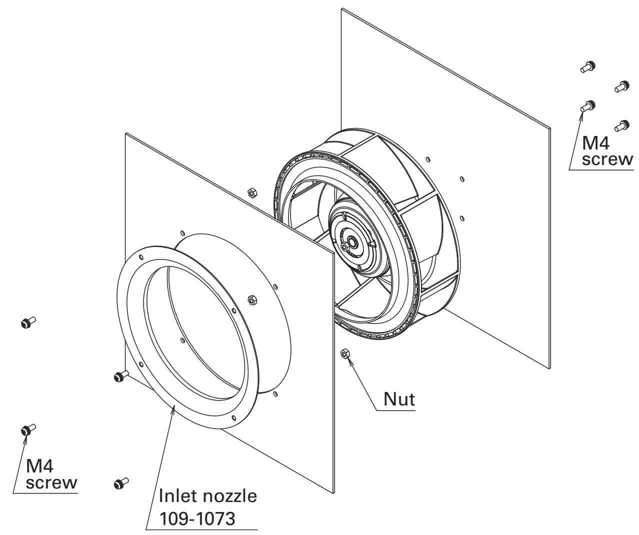


Fig. 3: Example of mounting the inlet nozzle on the new model

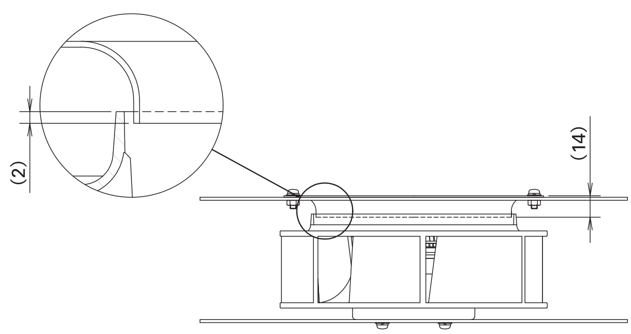


Fig. 4: Example of the new model and inlet nozzle mounting dimensions(unit:mm)

Table 1: General specifications for the new model

Model No.	Rated voltage [V]	Operating voltage range [V]	PWM duty cycle Note 1,2 [%]	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]	SPL [dB(A)]	Operating temperature [°C]	Expected life [h]
9TGA24P0H001	24	16 to 36	100	4.8	115	4,950	15.3	541	830	3.33	77	-20 to +70	40,000 / 60°C (70,000 / 40°C)
			15	0.14	3.36	800	2.5	88.3	21.8	0.088	38		
9TGA48P0G001	48	36 to 72	100	3.5	168	5,700	17.6	622	1,100	4.42	80		
			15	0.07	3.36	800	2.5	88.3	21.8	0.088	38		

Note 1: Input PWM frequency: 25 kHz
Note 2: Speed is 0 min^{-1} at 0% PWM duty cycle
Note 3: When inlet nozzle (Model No. :109-1073) is mounted.

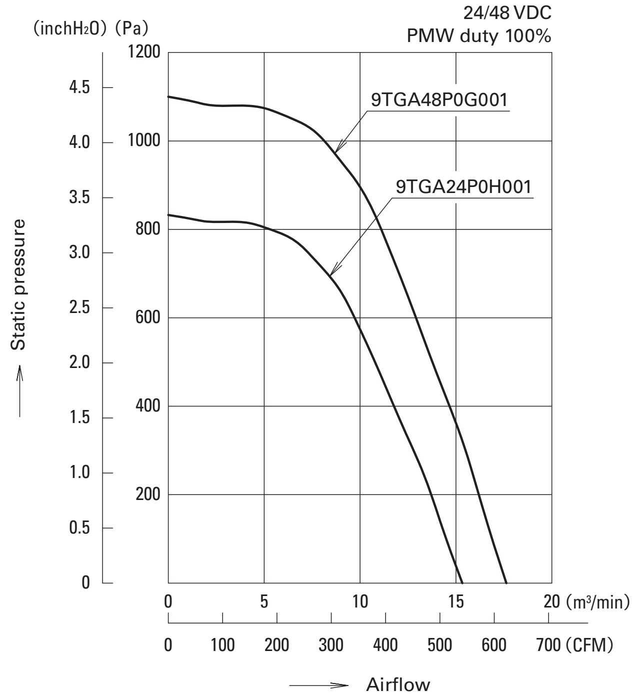


Fig. 5: Airflow vs. static pressure characteristics of new model

3.2.4 Wide operating voltage range

The new models have wide operating voltage ranges: 36 to 72 V for the 48 VDC input model, and 16 to 36 V for the 24 VDC input model.

3.3 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 in a free air state and at normal humidity).

4. Key Points of Development

The new model features a newly-designed motor, circuit, and impeller, achieving high airflow and low power consumption.

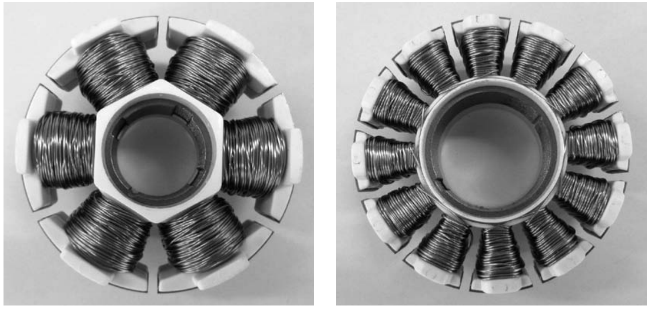
The key points of development are explained below.

4.1 Motor design

Motor efficiency has been enhanced in order to realize low power consumption.

Regarding stator shape, the new model features 12 slots, as opposed to the 6 slots on the current model, and the space factor has been increased by selecting the optimal winding diameter and number of turns to suit the new stator shape.

Figure 6 shows the stator portion of the current model and new model.



Current model (6 slots) New model (12 slots)

Fig. 6: Stator portion of the current model and new model

At the same time, material was selected for the magnet with high performance and the optimal characteristics to meet the new model's specifications, with the number of magnetic poles increased from 4 on the current model to 8.

With these motor design changes, the new model now boasts a higher-efficiency motor and 10% lower power consumption (48 VDC model) compared to the current model.

4.2 Circuit design

In order to achieve higher airflow, the drive circuit is required to be able to withstand a high load.

When designing the drive circuit, we selected a power semiconductor element with low-loss and adopted a circuit structure with minimal power loss during switching. As a result, we successfully reduced the power loss in electronic components and designed a drive circuit able to withstand higher fan rotational speed.

4.3 Impeller design

When designing the impeller, the shape, number of blades, and mounting angle were determined based on fluid analysis, stress analysis, and 3D printer modeling.

The number of blades was reduced from 9 of the current model to 7. Moreover, by adopting an integrated mold, the strength of the overall impeller has been increased and blade thickness has been kept minimal. These efforts resulted in higher efficiency and lower power consumption.

Figure 7 shows an impeller shape comparison of current model and new model.

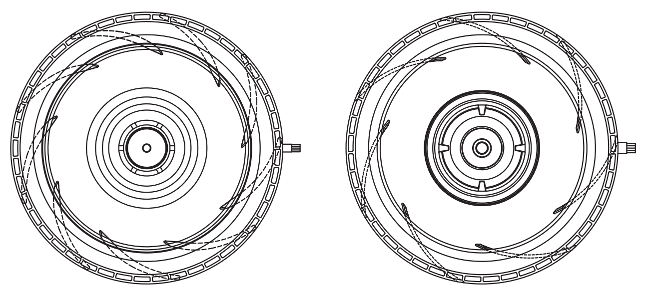


Fig. 7: Impeller shape comparison of current model and new model

5. Comparison with Current Models

5.1 Comparison of airflow vs. static pressure characteristics

The new model (48 VDC) is superior to the current model in terms of both airflow and static pressure, with maximum airflow increased by 1.25 times and maximum static pressure increased by 1.24 times. Within the operating range, airflow has been increased by up to 1.5 times, while static pressure has been increased by up to 1.7 times.

Figure 8 provides an example of the airflow vs. static pressure characteristics of the new model and the current model.

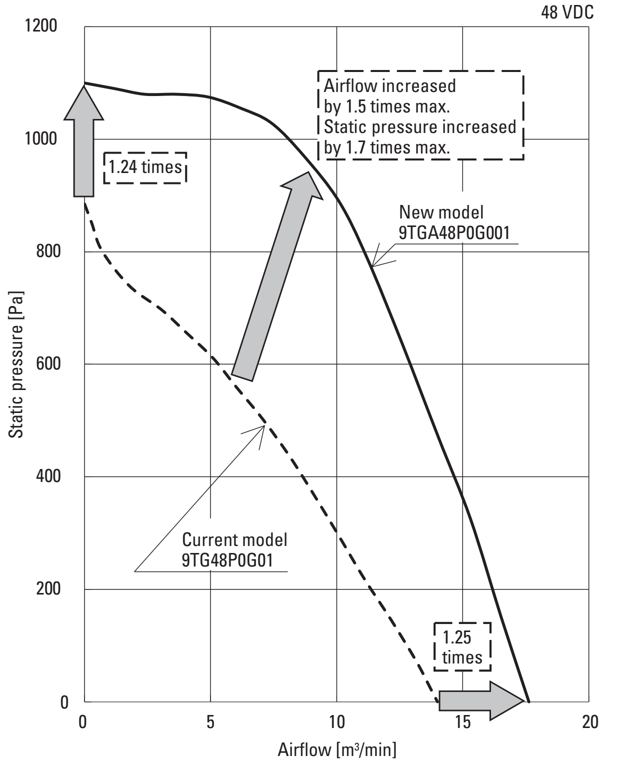


Fig. 8: Example of the airflow vs. static pressure characteristics for the new model and the current model

5.2 Power consumption comparison (when performance is equivalent to the current model)

Figure 9 provides a comparison of the power consumption of the new model (48 VDC) and the current model.

When the rotational speed of the new model is lowered and both were operated in the assumed operating range shown in the figure, the new model achieves a 10 to 18% reduction in power consumption compared with the current model.

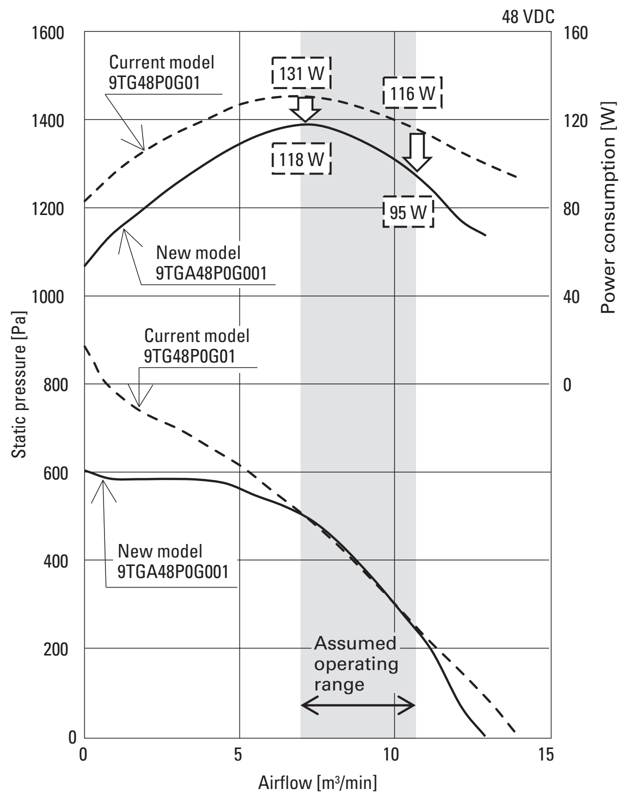


Fig. 9: Example of the airflow vs. static pressure and power consumption (when performance is equivalent with current model)

6. Conclusion

This paper has presented some of the features and performance of the “San Ace C175” 9TGA type ø175 mm × 69 mm centrifugal fan developed by SANYO DENKI.

Compared to the current model, the new model achieves higher airflow and higher static pressure, as well as lower power consumption.

We believe the new model will greatly contribute to the cooling of high-heat generating, high-density devices predicted to continue advancing in the future.

The market demands are constantly changing. SANYO DENKI wishes to continue developing products to meet those changes and contribute to the creation of our customers’ new value, and help customers achieve happiness and make their dreams come true.

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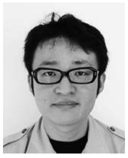

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