

Large Air Flow and High Static Pressure Centrifugal Fan “San Ace C175” TG Type

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1. Introduction

In current markets, server and communication equipment are becoming higher performance and higher density, heating value inside the equipment is still increasing, requiring large air flow and high static pressure fan for cooling.

Also, due to the high density mounting within the equipment, securement of heat flow passage is becoming more difficult, fan is selected as a solution for best heat flow design.

This document introduces the features and performance of the large air flow and high static pressure centrifugal fan “San Ace C175” TG type fan that was developed in order to meet these needs.

2. Background of the development

We have released various axial flow fans and blowers. The image of recommended area of use for different fan structures are shown in Fig. 1.

You can see that the axial flow fans are specialized for large air flow requirement area, and the blowers are specialized in high static pressure requirement area.

However, if you try to fulfill the mid-range air flow and static pressure requirement area with the axial flow fans or blowers, one method to achieve the requirement is to increase the speed, but this will result in increase of power consumption and SPL. On the other hand, market is requiring to decrease the power consumption and SPL.

Therefore, there were applications for the fans where the axial flow fans and blowers could not meet the requirements.

Needing to meet these market needs, development of a large air flow and high static centrifugal fan was started, and the “San Ace C175” TG type for these situations was developed.

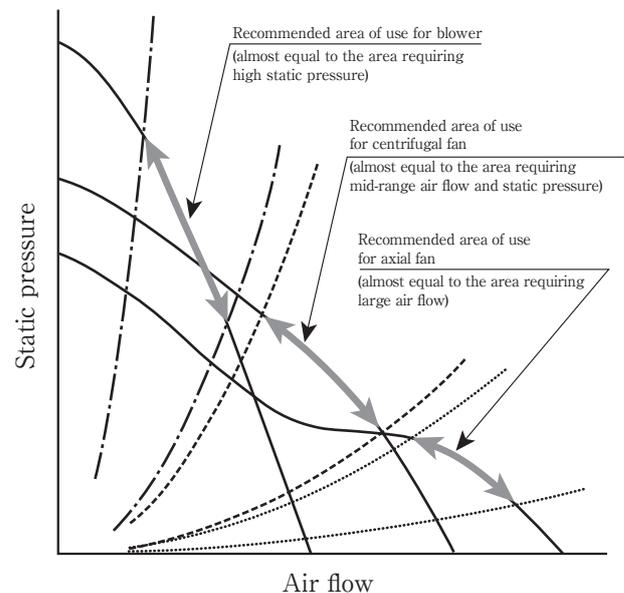


Fig. 1: The image of recommended area of use by different fan structures

3. Product features

Fig. 2 shows the appearance of the “San Ace C175” TG type.



Fig. 2: “San Ace C175” TG type

The features of this new model are as follows:

- (1) Air flow direction
- (2) Large air flow and high static pressure
- (3) Low power consumption, low SPL
- (4) PWM speed control function

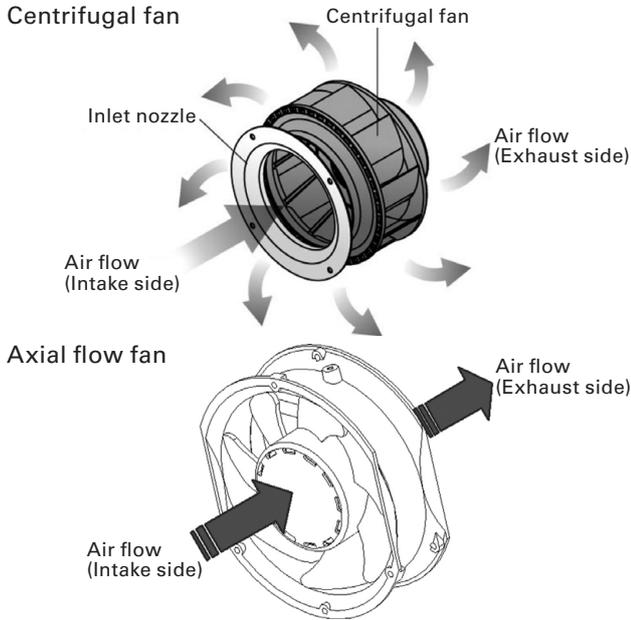


Fig. 3: Air flow of the new model and axial flow fan

Fig. 3 shows the image of the air flow, which is the major characteristics of this new model, compared with the one for an axial flow fan.

While the axial flow fan has the flow of air for the intake and exhaust in the same axis, exhaust of the centrifugal fan is perpendicular and in entire circumference direction against the intake. This is similar to the air flow of a blower, but it is different to the point that blower only exhaust in one direction.

"San Ace C175" TG type (referred to below as the new model) has achieved large air flow and high static pressure by newly designed fans and optimization of the motor drive circuit.

4. Product overview

4.1 Dimensions

Fig. 4 shows the dimensions of the new model. Furthermore, Fig. 5 shows the dimensions of the dedicated inlet nozzle for the new model (model number: 109-1073).

Inlet nozzle is a nozzle attached at the intake of the fan to align the flow of air, and it is mounted on the equipment where the fan is mounted. It is also possible to replace by forming similar shape as the inlet nozzle on the equipment.

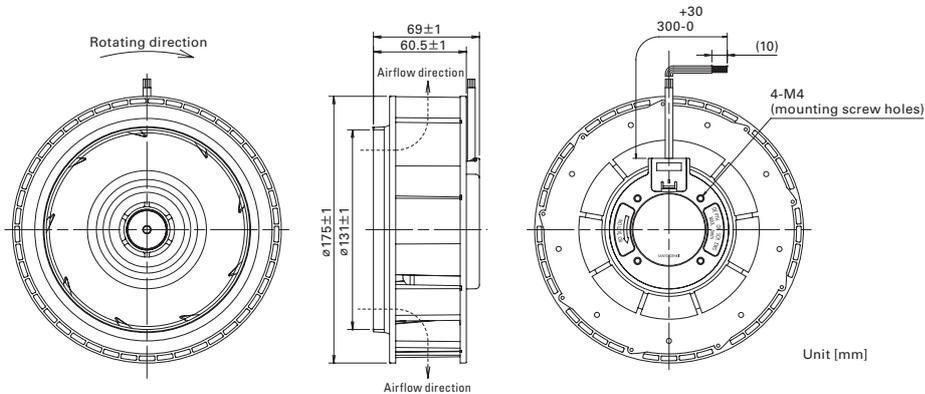


Fig. 4: "San Ace C175" TG type dimensions

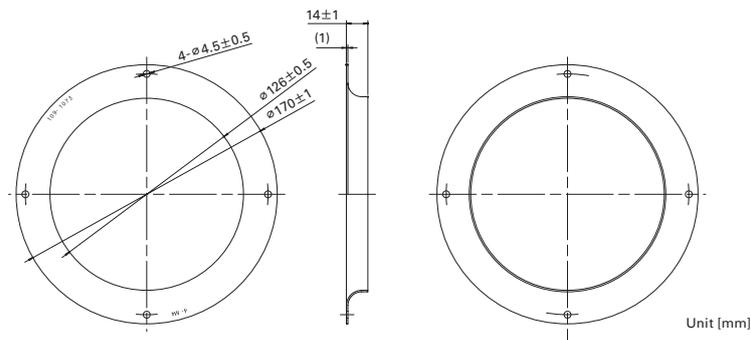


Fig. 5: Inlet nozzle for "San Ace C175" TG type dimensions

Fig. 6 shows an example of installation for the new model, while Fig. 7 shows the example of installation dimensions. The new model is mounted using four M4 screws, and the inlet nozzle is mounted using four M4 screws and four nuts.

4.2 Characteristics

4.2.1 General characteristics

Table 1 shows the general characteristics for the new model.

The values acquired with the inlet nozzle mounted are used as the standard characteristic values for the characteristics of the centrifugal fan (mounting conditions: refer to Fig. 6 and Fig. 7).

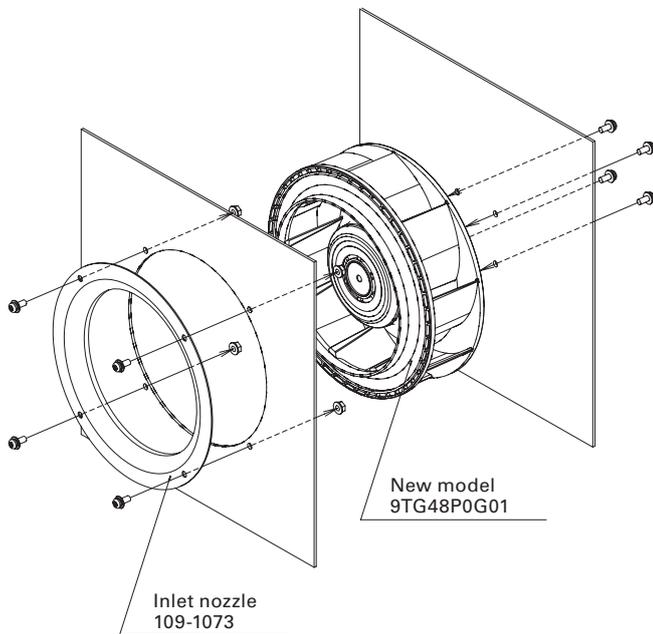


Fig. 6: Example of installation for "San Ace C175" TG type

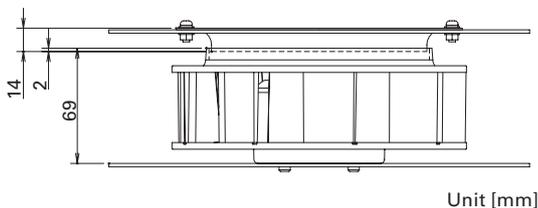


Fig. 7: Example of "San Ace C175" TG type installation dimensions

4.2.2 Air flow vs. static pressure characteristics

Fig. 8 shows the air flow versus static pressure characteristics at individual PWM duty regarding the new model.

4.2.3 PWM control function

The new model is equipped with the PWM control function, which allows an external control of the fan speed. This function reduces the power consumption and SPL for the entire device by controlling the speed of the fan by the heat from the customer equipment, not always running at full speed if unnecessary. Fig. 9 shows example of PWM duty vs. speed characteristics for the new model.

4.3 Life expectancy

The new model has a life expectancy of 40,000 hours at 60°C (survival rate of 90% with continuous operation at the rated voltage under free air conditions and at normal humidity).

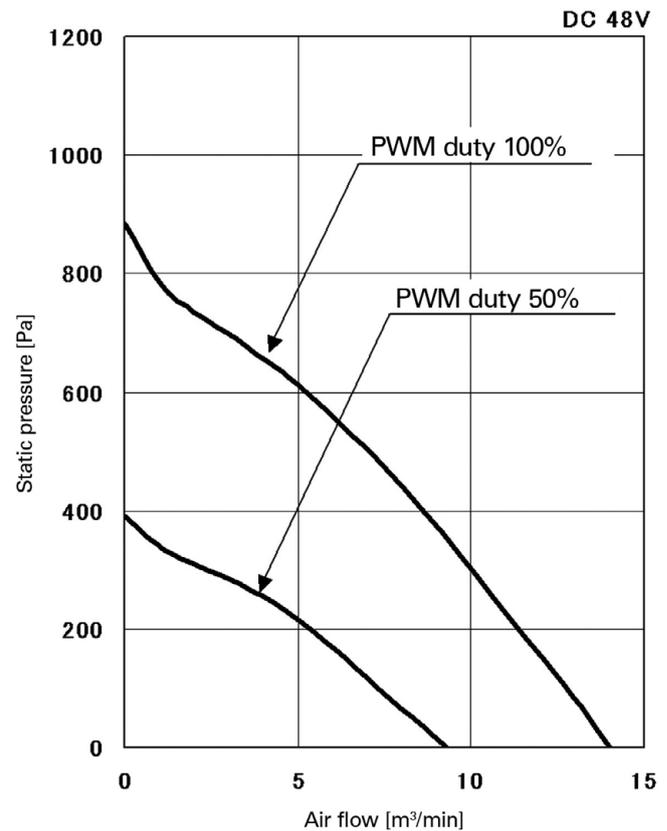


Fig. 8: Air flow vs. static pressure characteristics at individual PWM duty

Table 1: "San Ace C175" TG type general characteristics

Model No.	Rated voltage [V]	Operating voltage [V]	PWM duty cycle [%]	Rated current [A]	Rated input [W]	Rated speed [min ⁻¹]	Max. air flow		Max. static pressure		Sound pressure level [dB(A)]
							[m ³ /min]	[CFM]	[Pa]	[inchH ₂ O]	
9TG48P0G01	48	36 ~ 55.2	100	1.95	93.6	4,700	14.0	494.7	885	3.55	73

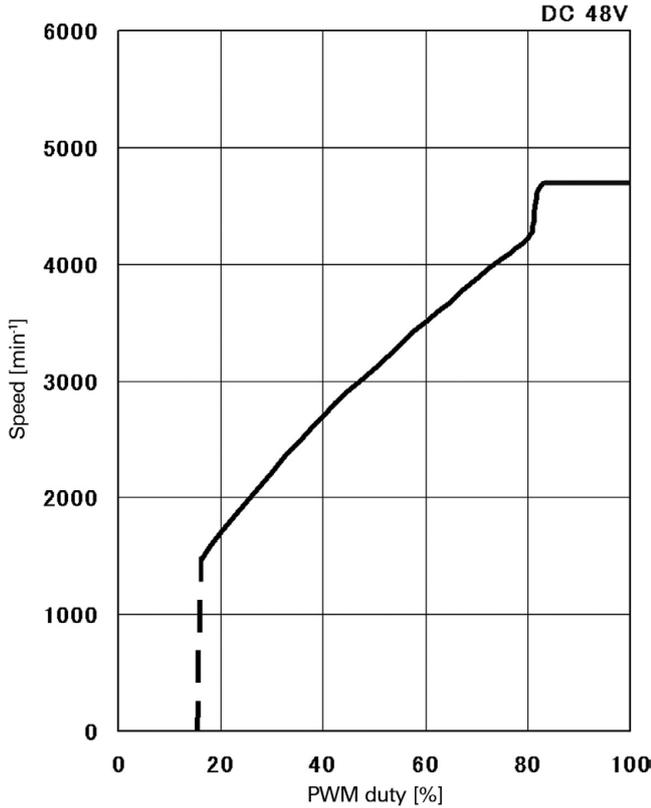


Fig. 9: PWM duty vs. speed characteristics

5. Comparison with the axial flow fan

By optimizing the blade shape and the motor drive circuit, the new model achieves large air flow, high static pressure, and low power consumption.

This section compares the new model with an axial flow fan of the same solid volume of fan size and inspects how air flow versus static pressure characteristics, power consumption, and sound pressure level has changed.

The following describes the differences between the "San Ace C175" TG type (9TG48P0G01) and the axial flow fan "San Ace 172" SG type (9SG5748P5G01).

5.1 Comparison of air flow versus static pressure

Fig. 10 shows the comparison of air flow versus static pressure characteristics when the axial flow fan is running with speed to match the cooling performance of the new model.

5.2 Comparison of power consumption and sound pressure level

Fig. 11 shows a comparison of the power consumption and sound pressure level at the operation points for both fans, assuming the system impedance shown in Fig. 10.

The power consumption for the new model is reduced 18% compared to the axial flow fan. The sound pressure level for the new model is reduced 12 dB(A) compared to the axial flow fan.

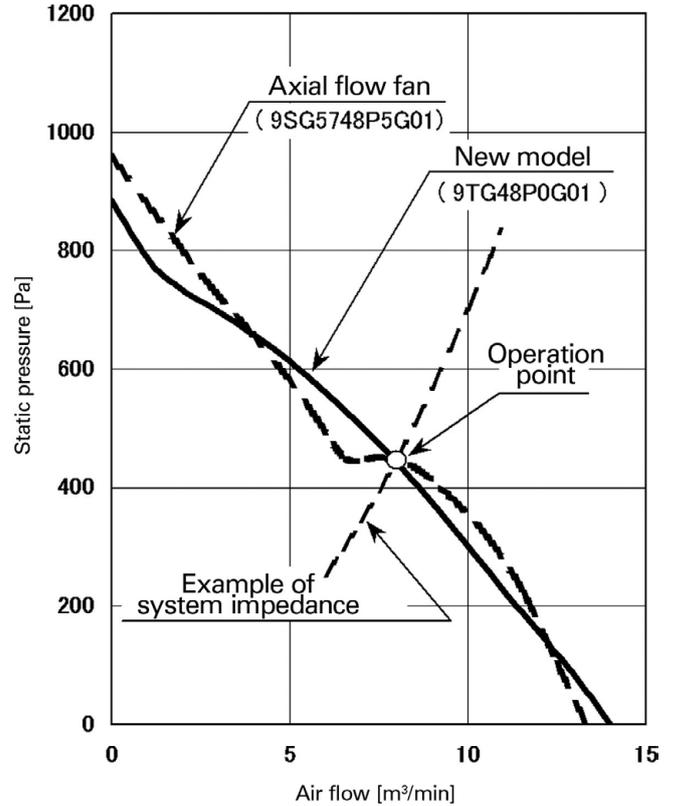


Fig. 10: Comparison of air flow vs. static pressure characteristics

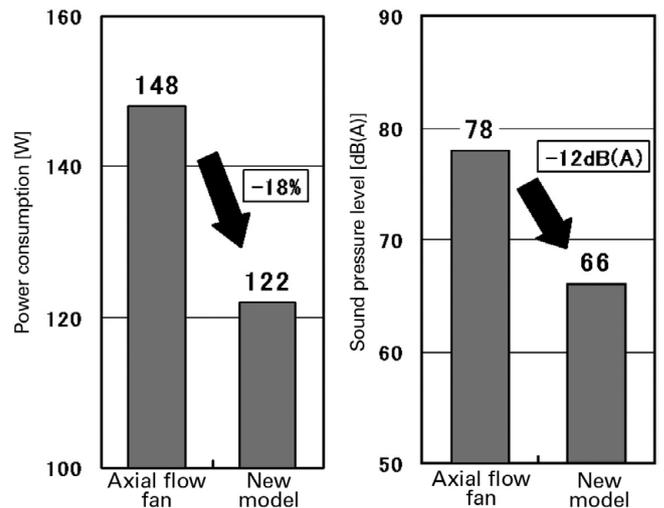


Fig. 11: Comparison of power consumption and sound pressure level

5.3 Characteristics that supports high system impedance

Power consumption and sound pressure level of the new model are considerably reduced compared with the axial flow fan at the equivalent cooling performance.

However, since the flow of air is different between centrifugal fans and axial flow fans, it is required to determine which fan to use depending on the restrictions on the flow channel of the equipment and concepts of the flow channel design.

The flow of the air may affect the cooling performance in the actual equipment, therefore this must be kept in mind during the design.

6. Conclusion

This document introduced some of the features and performance of the newly developed centrifugal fan “San Ace C175” TG type fan.

By optimizing the blade shape and the motor drive circuit, the new model has achieved large air flow, high static pressure, low power consumption, and low SPL.

Also with the different flow of air compared with the axial flow fans and blowers, it is possible to give more option depending on the flow path design of the equipment to be mounted.

Mounting density of components will keep on increasing for information systems and heat exchanger related devices, and the heat density is expected to increase even further.

Furthermore, it is predicted that more products will be produced with attention paid to environmental issues and that the demands for low power consumption and low SPL will continue to grow.

The new model has features that are effective to high cooling, low power consumption, and low SPL, allowing it to contribute greatly to solving these problems.



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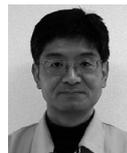
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