High Air Flow and High Static Pressure Fan "San Ace 172" SG Type

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1. Introduction

Servers, storage, telecommunication equipment and other IT devices are getting smaller and more functional, increasing the density of the electronic components that are mounted on those devices. This has caused a drastic increase in the heat generated inside device chassis. However, smaller devices make proper heat flow difficult to design, meaning that fans must become even more powerful than current models.

This document introduces the features and performance of the "San Ace 172" SG type high air flow, high static pressure fan specifically designed to meet these needs.

2. Background of the development

Sanyo Denki had developed the high air flow, high static pressure "San Ace 172" GV type ϕ 172, 51 mm thick sidecut DC cooling fan. At its release, it was at the top of the industry in terms of the cooling performance for its size. However, as mentioned above, the market is now demanding a higher performance fan.

Thus, the "San Ace 172" SG type has been designed to be the best in cooling fan industry while matching its predecessor exactly in size and installation specifications to ensure perfect compatibility.

3. Product features

Fig. 1 shows a photograph of the "San Ace 172" SG type fan. The features of this product are as follows.

(1) High air flow and high static pressure
(2) 3-phase drive motor for maximum efficiency
(3) PWM speed control function
(4) Wide voltage range

The impeller, frame, motor and drive circuit have been newly designed for the "San Ace 172" SG type (referred to below as the new model) in order to achieve high air flow and high static pressure.

Fig. 1: "San Ace 172" SG type

4. Product overview

4.1 Dimensions

Fig. 2 shows the dimensions of the new model. It has the same installation dimensions as its predecessor, and thus is perfectly compatible with any device that could make use of the predecessor.

4.2 Characteristics

4.2.1 General characteristics

Table 1 shows the general characteristics for the new model. The rated voltage is DC 48 V, but the operating voltage is from 36 to 72 V, which is much wider than for previous models.

There are two types of products, G speed (8,600 min^{-1}) and H speed (6,500 min^{-1}).

4.2.2 Air flow vs. static pressure characteristics

Fig. 3 shows the air flow and static pressure characteristics of 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.

PWM control is in heavy demand because they allow fan speed to be varied to match the heat conditions instead of always running at the full speed, and thus reduce power consumption.

Fig. 4 shows the air flow and static pressure characteristics at individual PWM duty regarding the new model.

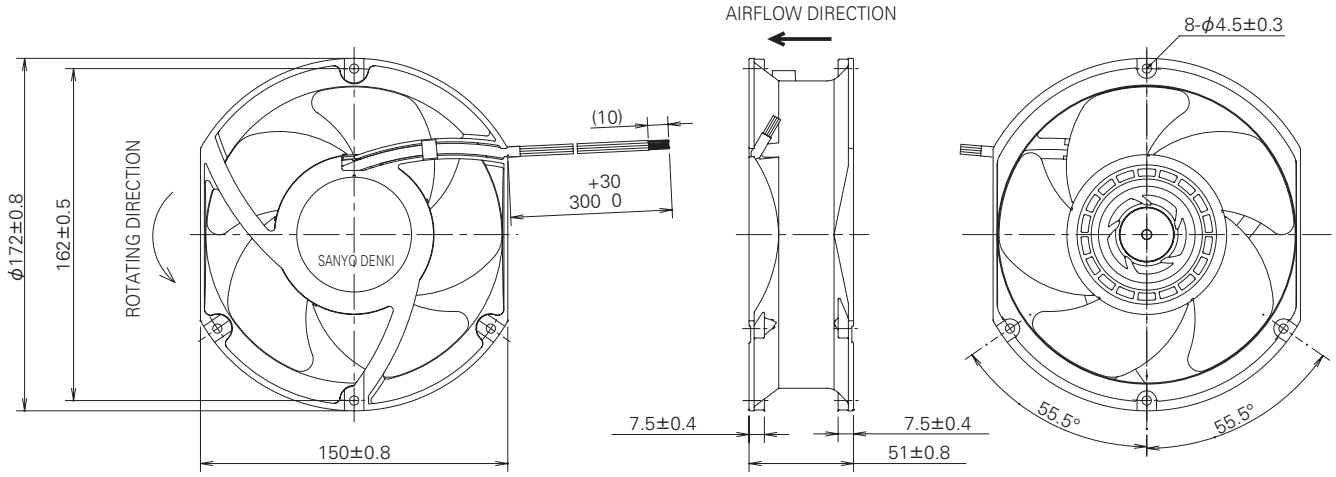

Fig. 2: “San Ace 172” SG type dimensions (unit: mm)

Table 1: “San Ace 172” SG 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 [m^3/min]	Max. air flow [CFM]	Max. static pressure [Pa]	Max. static pressure [inchH_2O]	Sound pressure level [dB(A)]
9SG5748P5G01	48	36 to 72	100	2.91	140.0	8600	15.46	546	1000	4.02	78
			0	0.21	10.1	2000	3.59	127	75.1	0.30	40
9SG5748P5H01	48	36 to 72	100	1.62	78.0	6500	11.60	410	770	3.09	71
			0	0.21	10.1	2000	3.59	127	75.1	0.30	40

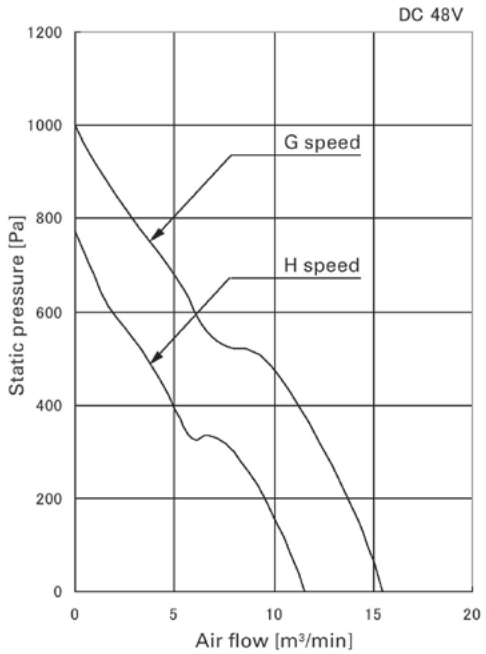

Fig. 3: Air flow vs. static pressure

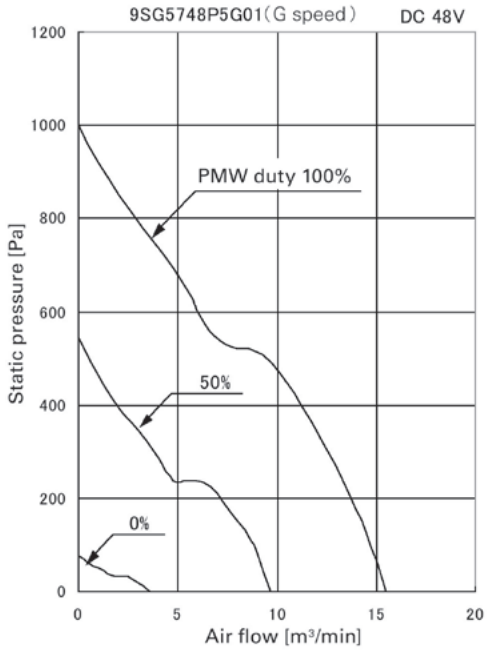

Fig. 4: Air flow and static pressure characteristics at individual PWM duty

4.3 Life expectancy

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

5. Comparisons with conventional models

The newly designed impeller and frame shape for the new model, as well as the new motor and drive circuit, have resulted in improved air flow and static pressure.

The following compares the new model "San Ace 172" SG type (9SG5748P5G01) with the conventional "San Ace 172" GV type (9GV5748H501).

5.1 Motor construction

The motor and drive circuit of the new model have been newly designed. The conventional model uses a single-phase motor while the new model uses a 3-phase motor with a load dispatch switch, which results in higher output and higher efficiency.

Note that the motor design used a magnetic field analysis (FEM) to optimize the shape of the stater core and thus increase motor output while reducing cogging torque. Fig. 5 shows the results of the magnetic field analysis.

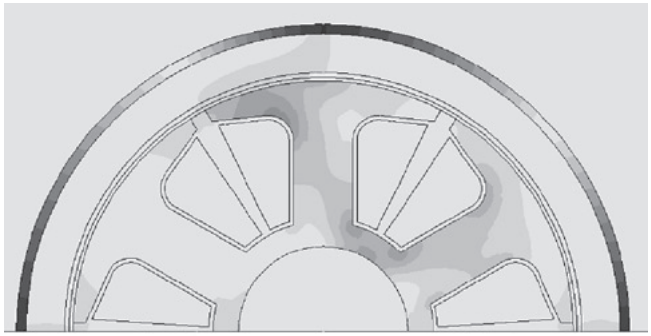

Fig. 5: Magnetic field analysis example (magnetic flux density distribution)

5.2 Air flow and static pressure characteristics

Fig. 6 shows the air flow and static pressure characteristics of the conventional and new models.

The new model uses excellent impller and frame shapes to generate superior air flow and static pressure. If the device has system impedance assumed in Fig. 6, the conventional model will operate at point A while the new model will operate at point B. At point A, the conventional model generates air flow of 7.2 m³/min while new model at point B generates air flow of 9.1 m³/min, representing 26% increase. Additionally, looking at static pressure, the conventional model generates static pressure of 296 Pa at point A, while the new model at point B generates static pressure of 510 Pa, which is 73% improvement.

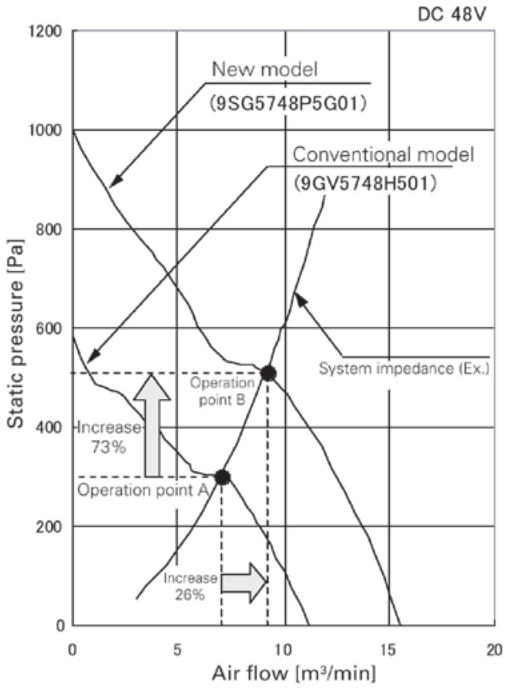

Fig. 6: Comparison of air flow and static pressure

5.3 Sound pressure level and power consumtion

With both models at point A from the last section, we compared the air flow and static pressure, as shown in Fig. 7. At point A in Fig. 7, with both models at the same cooling performance, we compared the sound pressure level and power consumption. The results are shown in Fig. 8, which indicates the new model is 1 dB (A) lower and 5% less power than the conventional model.

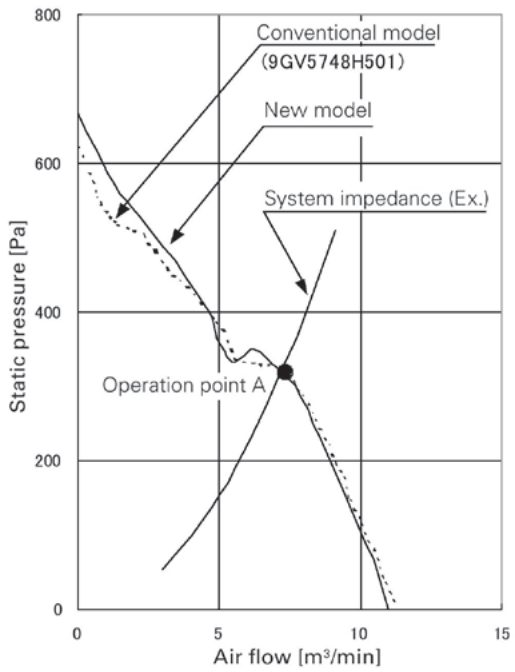

Fig. 7: Air flow and static pressure characteristics (Conventional and new model at same operation point)

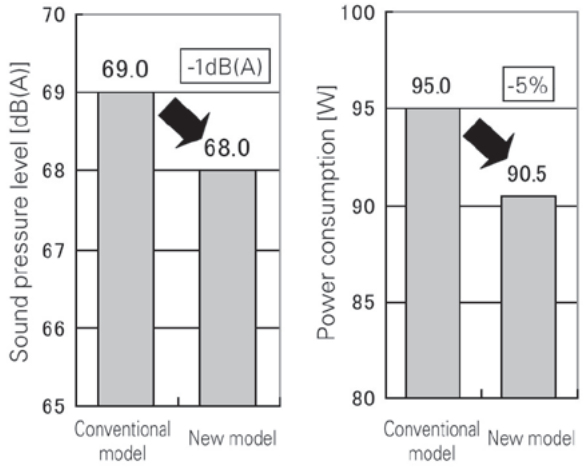

Fig. 8: Comparison of sound pressure level and power consumption

6. Conclusion

This document has introduced some of the features and advantages of the newly developed “San Ace 172” SG type DC axial cooling fan.

The newly designed impeller, frame, motor and drive circuit of the new model have generated significant improvements over the conventional model in terms of air flow and static pressure. Additionally, the new model achieved the best in the industry within the same size.

Servers, storage, telecommunication devices and other IT equipment had being packed more and more densely, with an accompanying increase in heat generation. The new model will go a long way towards solving these heat-related problems.

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