Large Air Volume Fan "San Ace 60" G Type 60 mm sq. x 38 mm thickness

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1. Introduction

In recent years, along with the enhancement in features and speed of information communications related equipment, the heating value generated from internal devices has increased. On the other hand, as miniaturization and the high density of devices has been achieved, fans with compact size, large air volume and high static pressure are in great demand. In servers, for example, the cooling performance of the current 60 mm sq. x 25 mm thickness fan has become insufficient as the heating value of the microprocessor has increased. Therefore, the BLDC 60 mm sq. fan "San Ace 60" G type 38 mm thickness was developed. The design goals were larger air volumes, higher static pressure and lower power consumption.

The new "San Ace 60" G type 60 mm sq. fan produces 1.84 m^3/min of maximum air volume and 435 Pa of maximum static pressure. This is equivalent to the performance of a 160 mm sq. x 40 mm thick centrifugal blower with mass of five times or more. This performance leads the industry for 60 mm sq. fans.

This document introduces the features of this product.

2. Background of The Development

Prior to this effort, a 25 mm thickness fan with rotation speed of 7,600 min^{-1} was marketed as the product with the largest air volume of the 60 mm sq. fan class. Increases in rotation speed could not be achieved with this conventional fan because the motor performance was insufficient.

In this development, the thickness of the fan frame was increased by 13 mm to 38 mm thickness, which allowed room for improvements in the motor performance. The motor specifications and the drive circuit were thoroughly reviewed and the impeller and the frame shape were optimized. As a result, a great performance improvement was accomplished.

3. Feature of "San Ace 60" G Type 38 mm thickness Series

Fig.1 shows "San Ace 60" G type 60 mm sq. x 38 mm thickness.

Fig.1 "San Ace 60" G Type 38 mm thickness

The features of this product are as follows:

(1) Large air volume – high static pressure
(2) Low power consumption
(3) Low noise

3.1 Dimensions

Fig.2 shows dimensions of "San Ace 60" G type 38 mm thickness series (hereafter it is called the developed product). The mounting hole pasition is the same as the conventional 60 mm sq. x 25 mm thickness fan series to maintain compatibility.

3.2 Specifications

3.2.1 General Specifications

Table 1 shows the general specifications of the developed product. The rated voltages are 12V and 48V. The rated rpm are G speed (11,800 min^{-1}) and S speed (10,800 min^{-1}).

3.2.2 Air Volume vs. Static Pressure Performance

Fig. 3 shows the example of air volume versus static pressure of the developed product.

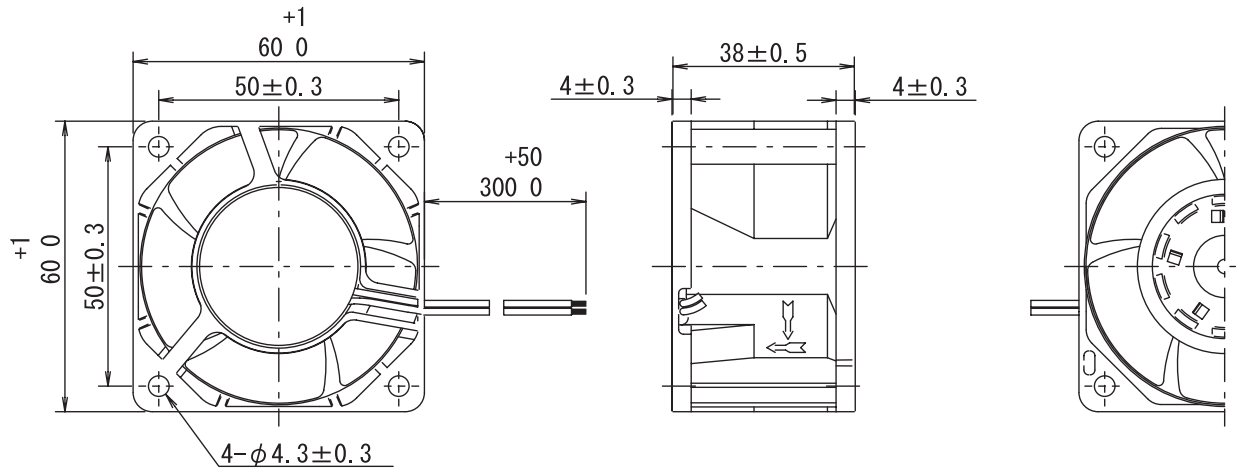

Fig.2 Dimensions of "San Ace 60" Type 38 mm thickness

Table 1 General specifications of "San Ace 60" G Type 38 mm thickness

Model No.	Rated Voltage [V]	Operating Voltage Range [V]	Rated Current [A]	Rated Input [W]	Rated RPM [min^{-1}]	Max Air Volume [m^3/min{CFM}]	Max Static Pressure [Pa]	Sound Pressure Level [dB(A)]	Mass [g]
9G0612G102	12	7.0 to 13.8	1.54	18.5	11,800	1.84 {65}	435	58	110
9G0612S102			1.10	13.2	10,800	1.70 {60}	370	56	
9G0648G102	48	28 to 55.2	0.35	16.8	11,800	1.84 {65}	435	58	
9G0648S102			0.29	13.9	10,800	1.70 {60}	370	56	

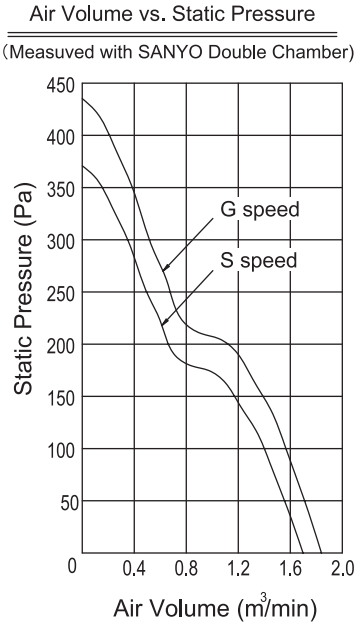

Fig.3 Air Volume vs. Static Pressure of "San Ace 60" G Type

4. Comparison With The Conventional 60 mm sq. x 25 mm thickness Fan

4.1 Comparison of Air Volume vs. Static pressure

Fig.4 shows the air volume versus static pressure of the developed product and conventional 60 mm sq. x 25 mm thick product (hereafter, it is called the conventional product). Compared with the conventional product, the maximum air volume increased by 1.7 times and the maximum static pressure increased by 2.8 times. The maximum air volume of the conventional fan was 1.05 m^3/min and maximum static pressure was 155 Pa (rated rpm 7,600 min^{-1}). On the other hand, the maximum air volume of the developed product is 1.84 m^3/min and the maximum static pressure is 435 Pa (rated rpm 11,800 min^{-1}). In addition, the power consumption is 5.26 W in the developed product and 5.64 W in the conventional product to the same air volume (1.05 m^3/min). The developed product has decreased power consumption by 7% compared with the conventional product.

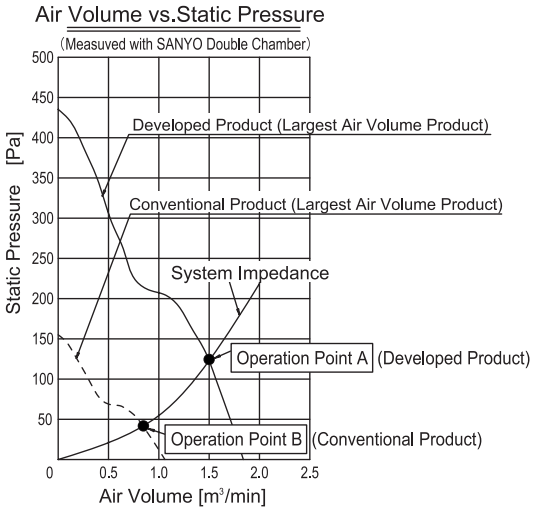

Fig.4 Comparison of Air Volume vs. Static Pressure

4.2 Comparison of Increased Temperature Values In The Equipment

Assuming that a largest air volume model (9G0612G102) of the developed product and that of the conventional product (109R0612J402) were installed in identical equipment where the internal total heating value is 300 W as shown in Fig. 5 and the temperature inside the equipment was compared. The curve in Fig. 4 is assuming the system impedance. The air volume at operation point A of the developed product becomes 1.5 m^3/min while operation point B of the conventional product becomes 0.85 m^3/min.

From the calculation below, the temperature rise value (rough estimate value) in the device is 10 K for the developed product against 17.6 K for the conventional product. The developed product can suppress the temperature rise value in the device by 7.6 K compared with the conventional product.

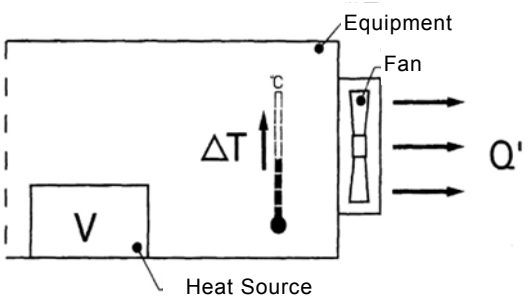

Fig.5 Temperature Rise Value inside the equipment

Heating value of the equipment V : 300 W
Air volume at A of the developed product
Q1 : 1.5 m^3/min
Air volume at B of the conventional product
Q2 : 0.85 m^3/min

Temperature rise value in the equipment with the developed product installed ΔT_1:

$$\Delta T_1 = \frac{V}{20Q_1} = \frac{300}{20 \times 1.5} = 10 \text{ K}$$

Temperature rise value in the equipment with the conventional poduct installed ΔT_2:

$$\Delta T_2 = \frac{V}{20Q_2} = \frac{300}{20 \times 0.85} = 17.6 \text{ K}$$

5. Comparison With The 160 mm sq. x 40 mm Thickness Centrifugal Blower

There is a 160 mm sq. x 40 mm thickness centrifugal blower (109BG12HA1) in the SANYO DENKI product line which has the same air volume versus static pressure characteristics as the developed product. When the developed product is operated at 10,300 min^{-1}, which is lower than the S speed of the developed product, it provides an almost equal air volume versus static pressure (refer to Fig.6) as the centrifugal blower. The footprint of the developed product is 1/4 or less (Refer to Fig.7) and the mass is 1/5 or less compared with the 160 mm sq. centrifugal blower.

In addition, the input power of the developed product is 22% lower than that of the 160 mm sq. centrifugal blower as shown in Table 4, and the sound pressure level is also 1dB(A) lower.

To summerize, the developed product is smaller, lighter, less power consumption, and operates more quietly than products with comparable air volume and static pressure capabilities.

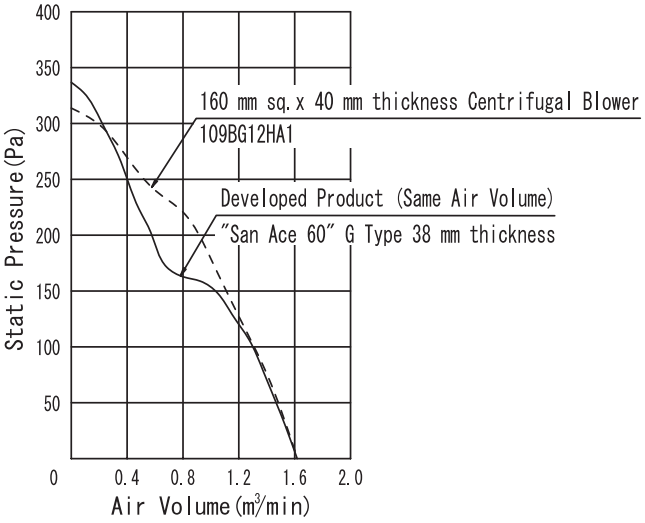

Fig.6 Comparison of Air Volume vs. Static Pressure

Table 2 Specification of the Developed Product and 160 mm sq. x 40 mm thickness Centrifugal Blower

Model No.	Rated Voltage [V]	Input Current [A]	Input Power [W]	RPM [min^{-1}]	Max Air Volume [m^3/min]	Max Static Pressure [Pa]	Sound Pressure Level [dB(A)]	Mass [g]
160 mm sq. x 40 mm thickness Centrifugal Blower 109BG12HA1	12	1.30	15.6	2,300	1.62	313	55	580
Developed Product (Same Air Volume)		1.02	12.2(-22%)	10,300		336(+7%)	54(-1dB(A))	110

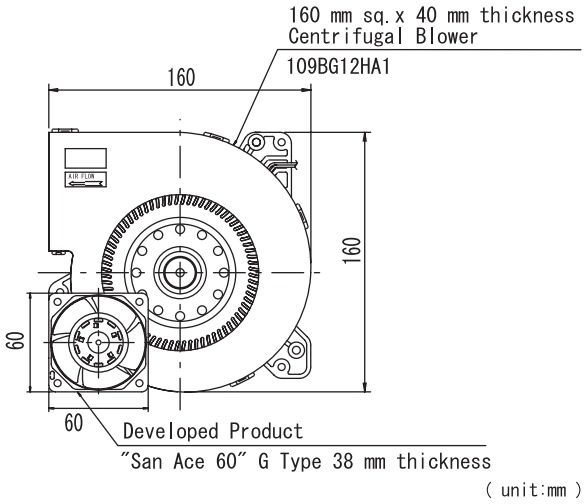

Fig.7 Size of the Developed Product vs 160 mm sq. x 40 mm thickness Centrifugal Blower

6. Conclusion

This document introduces the specification of the "San Ace 60" G type 38 mm thickness series, which was developed to satisfy customer demands, such as compact size, large air volume, low power consumption and low noise.

This developed product accomplished the following performance improvements compared with our conventional product (60 mm sq. x 25 mm thickness fan). The performance equals that of the 160 mm sq. x 40 mm thickness centrifugal blower and makes this developed product the industry-leading fan in the 60 mm sq. class.

(1) 1.7 times improvement in the maximum air volume.
(2) 2.8 times improvement in the maximum static pressure.
(3) 7% reduction in power consumption (compared at the same air volume).

This developed product can greatly contribute not only to information telecommunications related equipment but also to other devices that demand compact size, high performance, and energy-savings. In the future we want to enhance the offering of thermally speed controlled fans that can change the air volume depending on the ambient temperature, and to satisfy the demand of further energy-saving and decreasing noise.

This developed product is authorized as an environmentally compatible product (ECO PRODUCT) from the standpoint of contributing to the health of the global environment by saving energy and via performance improvements for a given volume, mass, etc.

ECO PRODUCTS

Fig.8 Symbol Mark of ECO PRODUCTS

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