Low Power Consumption Fan 60 mm Sq. 10 mm Thick "San Ace 60" 9GA Type

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1. Introduction

In recent years, a trend has emerged for devices in the LCD display, LED panel and other similar markets to be smaller and thinner, therefore there is a requirement for the fans equipped in such devices to be even smaller and thinner. Moreover, at the same time, the amount of heat produced by devices is increasing as they become capable of higher performance, therefore cooling fans which offer better cooling in the narrowest space of a device are required.

This document introduces the features and performance of the 60 mm sq. 10 mm thick "San Ace 60" 9GA type, which was commercialized in order to meet the requirements of the smaller, thinner device market.

2. Background of the Development

Previously, Sanyo Denki had only sold the 40 mm sq. size, 10 mm thick model as a thin product. However, due to the installation space becoming narrower and the amount of heat produced increasing, as mentioned in section 1, the cooling performance of the conventional 40 mm sq. fan was no longer sufficient. Consequently, we developed and commercialized the 60 mm sq. 10 mm thick "San Ace 60" 9GA type (hereinafter referred to as "new models") as a new 10 mm thick fan.

3. Product Features

The features of the new models are as follows:

(1) Thin
(2) Low power consumption
(3) Low SPL (sound pressure level)
(4) High reliability

Fig. 1: External view of the 60 mm sq. 10 mm thick "San Ace 60" 9GA type

The impeller, frame, motor and circuit of the new models are a new design which achieves thinness at the same time as low power consumption and low SPL.

Furthermore, by adopting a large ball bearing inside the thin structure, we have created a product which also offers high reliability.

Fig. 1 shows a photograph of the new models.

4. Outline of the New Models

4.1 Dimensions

Fig. 2 shows the dimensions of the new models.

At 10 mm in thickness, the new models are the thinnest of our 60 mm sq. size and maintain compatibility with the mounting hole dimensions and position of the conventional 60 mm sq. fan while being thinner.

4.2 Characteristics

4.2.1 General characteristics

Table 1 shows the general characteristics for the new models.

Three model types have been developed, all with a rated voltage of 12 V DC but with the varying rated speeds of 6,200 min^{-1} (G speed), 5,000 min^{-1} (H speed) and 2,300 min^{-1} (L speed).

4.2.2 Airflow vs. static pressure characteristics

Fig. 3 shows the airflow versus static pressure characteristics for the new models.

4.3 Expected life

The expected life (survival rate 90%) of the new models at an ambient temperature of 60˚C is 40,000 hours.

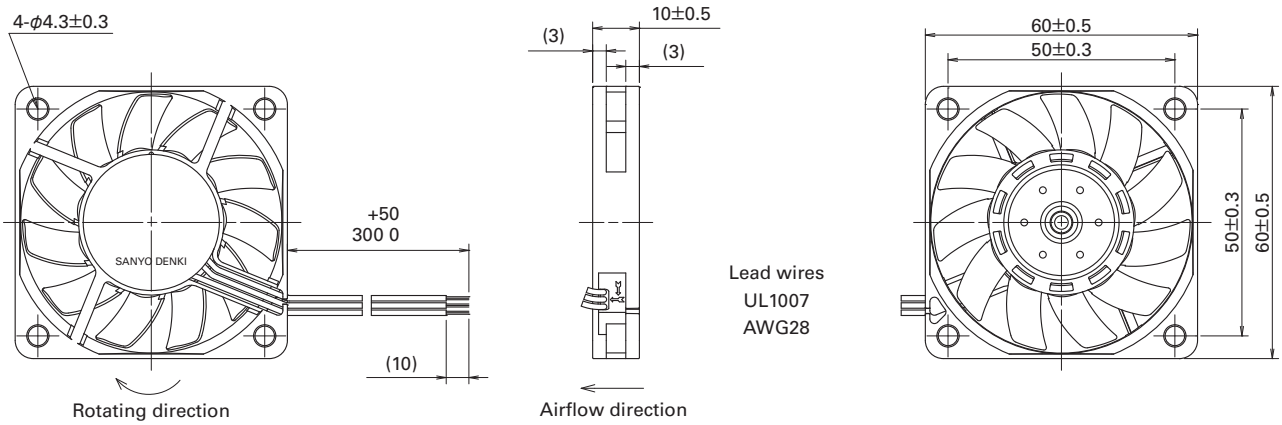

Fig. 2: Dimensions of the new models (unit: mm)

Table 1: General characteristics for the new models

Model No.	Rated voltage [V]	Operating voltage [V]	Rated current [A]	Rated input [W]	Rated speed [min^{-1}]	Max. airflow [m³/min]	Max. airflow [CFM]	Max. static pressure [Pa]	Max. static pressure [inchH₂O]	SPL [dB(A)]	Operating temperature [˚C]	Expected life [h]
9GA0612G9001	12	7 to 13.2	0.27	3.24	6,200	0.62	21.9	66	0.26	43	-20 to +60	40,000/60˚C (70,000/40˚C)
9GA0612H9001		7 to 13.8	0.14	1.68	5,000	0.50	17.6	42.9	0.17	37	-20 to +70	
9GA0612L9001		7 to 13.8	0.03	0.36	2,300	0.23	8.1	9.1	0.037	17	-10 to +70	

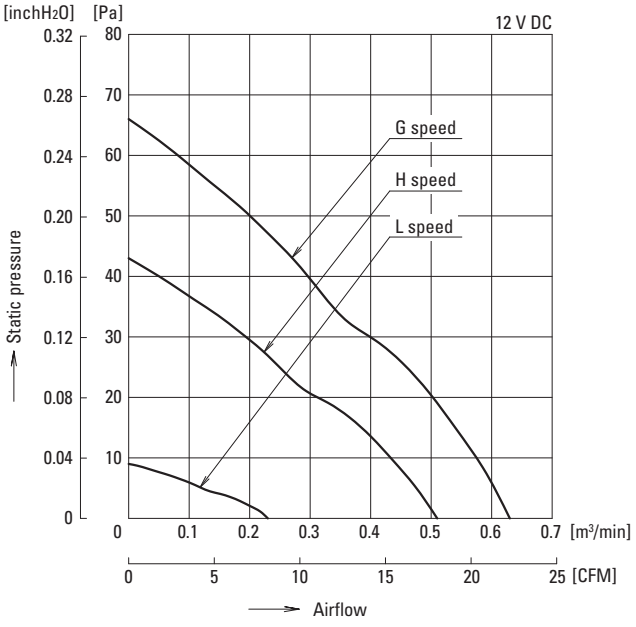

Fig. 3: New models airflow vs. static pressure

5. Development Points

The below section introduces the development points behind achieving a thin structure at the same time as low SPL and low power consumption.

5.1 Impeller design

In order to achieve low SPL and low power consumption with a thickness of just 10 mm, the shape, angle and number of impellers were optimized.

By selecting the optimal combination, low SPL and low power consumption were achieved at the same time as a high cooling performance.

5.2 Frame design

We created a design which could achieve low SPL with a thickness of only 10 mm at the same time as withstand high speed. In particular, we gave the spoke, which supports the motor area, a strength equivalent to the conventional model (60 mm sq. 15 mm thick). Hence, we were able to reduce the overall thickness of the fan while maintaining equivalent strength.

Fig. 4 shows a comparison of the frame profiles for the conventional model (60 mm sq. 15 mm thick) and the new models.

5.3 Motor design

Regarding the design of a motor to fit in the space of a thin model, the combination of stator thickness, coil height and coil space factor all greatly affect characteristics. By selecting the optimal motor for the new models, it was possible to achieve thinness and low power consumption.

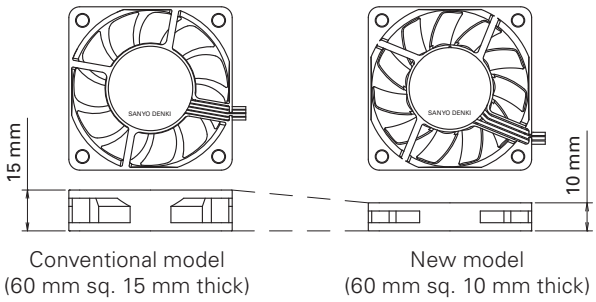

Fig. 4: Comparison of frame profiles

5.4 High reliability

In the creation of a thin model, the bearing selection is important as it significantly impacts upon reliability. In general, it is easier to achieve thinness by using a smaller bearing, however this decreases vibration resistance and shock absorbency. As such, we have placed emphasis on the reliability of the bearings adopted in the new models, and have used as large a bearing as possible, adopting a ball bearing equivalent to that used in our conventional model (60 mm sq. size). This enabled the new models to achieve both thinness and high reliability.

6. Comparison of New Models and Conventional Models

6.1 Comparison of the characteristics of the new models and conventional model (40 mm sq. 10 mm thick)

Fig. 5 compares the airflow vs. static pressure characteristic of the new models with a conventional model (40 mm sq. 10 mm thick) of identical thickness.

Comparing the highest performance of the new models and the conventional model (40 mm sq. 10 mm thick), the new models have a maximum airflow 4 times greater and a maximum static pressure 1.6 times greater, making them 10 mm thick models with significantly enhanced cooling performance over the 40 mm sq. size.

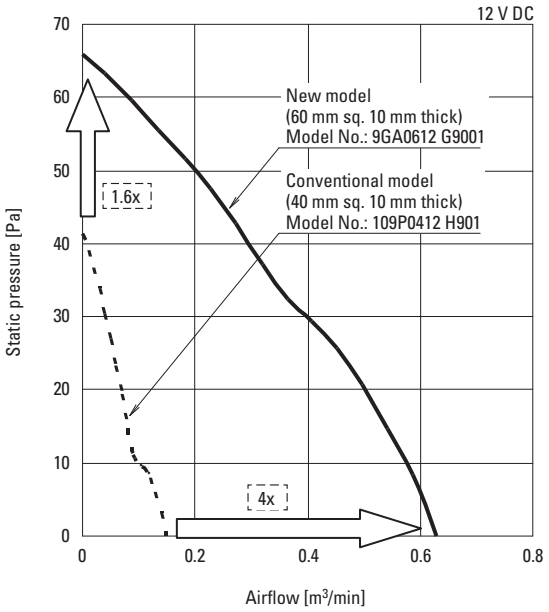

Fig. 5: Airflow vs. static pressure
Comparison of new model and conventional model (40 mm sq. 10 mm thick) characteristics

6.2 Comparison of characteristics of the new models and conventional model (60 mm sq. 15 mm thick)

Fig. 6 compares the airflow vs. static pressure characteristic of the new models with a 60 mm sq. 15 mm thick model, which was the thinnest of the conventional models.

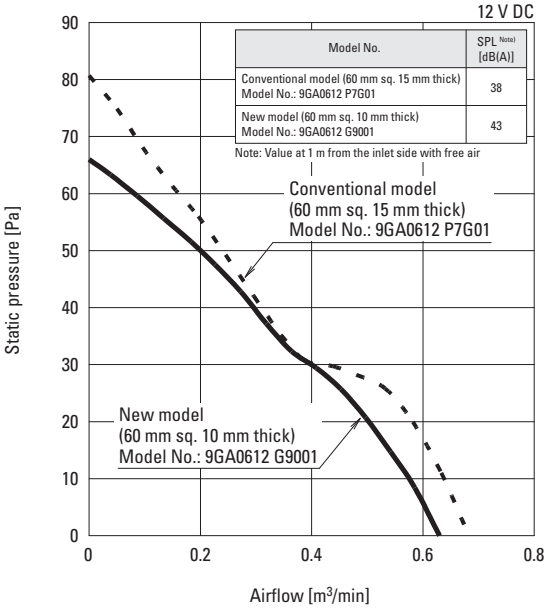

Fig. 6: Airflow vs. static pressure
Comparison of new model and conventional model (60 mm sq. 15 mm thick) characteristics

Comparing the highest performance of the new models and the conventional model (60 mm sq. 15 mm thick), the new models achieved an airflow vs. static pressure characteristic similar to the 15 mm thick model with a thickness of just 10 mm.

6.3 Comparison of characteristics when installed in narrow spaces

Faced with devices becoming increasingly thinner, we show a comparison of the impact on characteristics when the space in which fans are installed is extremely narrow. Fig. 7 is an example of installation assuming an installation space of 25 mm and the presence of a wall on the fan inlet side.

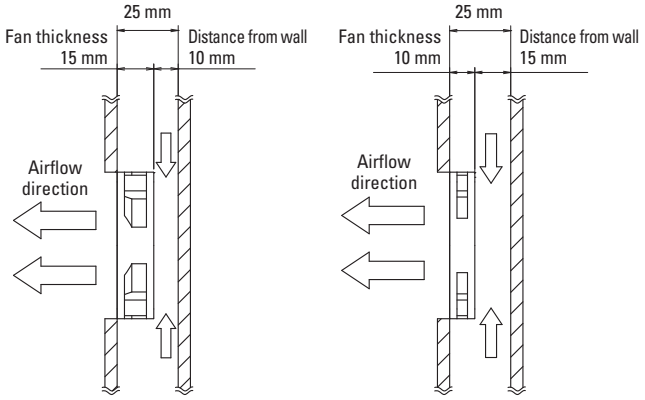

Fig. 7: Example of fan installation in a 25 mm space

If an installation space of 25 mm is assumed, then when the conventional model (60 mm sq. 15 mm thick) is installed, there will only be a gap of 10 mm to the wall on the inlet side. In contrast to this, the new models have a fan thickness of 10 mm, therefore a 15 mm gap between the fan and wall can be secured. Fig. 8 shows a comparison of the airflow vs. static pressure characteristic, while Table 2 shows a comparison of the SPL, when the conventional model and new models are installed in this type of narrow space.

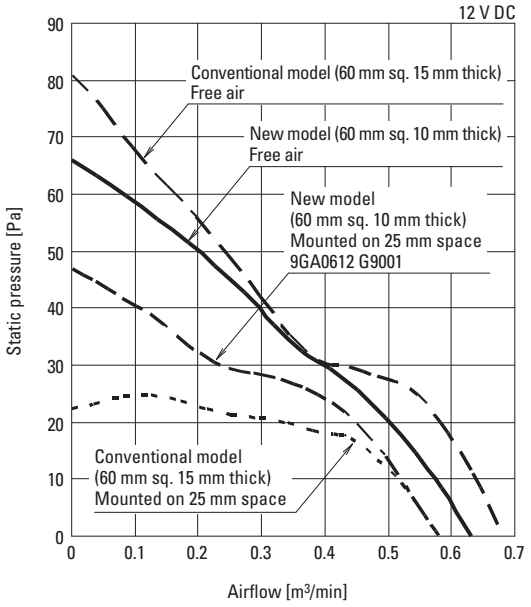

Fig. 8: Change in characteristics in 25 mm wide installation space

Table 2: Comparison of SPL characteristic in a 25 mm installation space

	Conventional model (60 mm sq. 15 mm thick) Model No.: 9GA0612P7G01		New models (60 mm sq. 10 mm thick) Model No.: 9GA0612G9001	
Fan thickness [mm]	15		10	
Condition	Free air	25 mm space	Free air	25 mm space
Max. airflow [m³/min]	0.68	0.58	0.62	0.58
Max. static pressure [Pa]	80	22	66	47
SPL* [dB(A)]	38	41	43	39

* Value at 1 m from inlet side

In open air, the conventional model (60 mm sq. 15 mm thick) showed better performance in regards to both airflow and static pressure, but when actually installed in a 25 mm space, the maximum airflows for both the new models and conventional model (60 mm sq. 15 mm thick) were identical at 0.58 m³/min. Furthermore, if the load is increased, the new models are capable of better cooling performance due to their higher static pressure characteristic.

Moreover, as shown in Table 2, the SPL of the new models when installed in a 25 mm space is 2 dB (A) lower.

In this way, the new models offer excellent cooling performance and SPL when installed in narrow spaces.

7. Conclusion

This document has introduced some of the features and performances of the new 60 mm sq. 10 mm thick, low power consumption fan “San Ace 60” 9GA type.

The new models, while maintaining high reliability equivalent to our conventional models, have also achieved low power consumption and low SPL in a thin design.

By newly adding a 60 mm sq. 10 mm thick fan to our lineup, we can now offer high cooling performance in narrow installation space not previously possible with the 40 mm sq. 10 mm thick and 60 mm sq. 15 mm thick models.

This means our customers now have a wider range of fans to choose from to suit their device’s particular dimensions, and better cooling performance is possible in narrow installation space, therefore it’s enabling customers to have thinner devices and greatly contributing to improvement of energy conservation and reliability, on which increased importance will be placed in the future.

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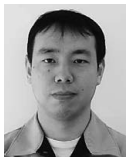

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