High Airflow, Long Life Fan 92 mm Sq., 38 mm Thick "San Ace 92L" 9LG Type

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1. Introduction

With the current expansion of the information-communication device market and recyclable energy market, products are required to have even longer life and be more considerate of the environment. At the same time, equipment is becoming higher density, improving internal cooling efficiency, therefore the fans used in such equipment are required to have even longer life, be maintenance-free and achieve higher airflow.

In order to meet these requirements, Sanyo Denki has developed and commercialized a high airflow, long life 9LG type fan.

Here we introduce the features and performance of the newly commercialized 92 mm sq., 38 mm thick "San Ace 92L" 9LG type.

2. Background of the Development

In recent years, there has been a shift to higher density in equipment such as communication devices, photovoltaic power generation devices, FA devices and power supplies, and accompanying this trend is a strengthening in demand for the fans for such equipment to have longer life and higher airflow.

In this kind of situation, Sanyo Denki has developed and commercialized 3 models of the high airflow, long life 9LG type fan which has an expected life of 180,000 hours (approx. 20 years).

(1) 60 mm sq., 25 mm thick "San Ace 60L"
(2) 80 mm sq., 25 mm thick "San Ace 80L"
(3) 92 mm sq., 25 mm thick "San Ace 92L"

In this kind of increase the airflow of the 9LG type even further, we have developed and commercialized the new size 92 mm sq., 38 mm thick "San Ace 92L" 9LG type (hereinafter "new model") which offers high airflow and long life.

3. Product Features

The features of the new model are as follows:

(1) High airflow
(2) High static pressure
(3) Long life
(4) PWM control function

The new model maintains compatibility with the fan mounting hole position of the 92 mm sq., 25 mm thick model (hereinafter "25 mm thick model") at the same time as achieving high airflow and high static pressure.

Fig. 1 shows the new model.

Fig. 1: "San Ace 92L" 9LG type

4. Product Overview

4.1 Dimensions

Fig. 2 shows the dimensions of the new model.

The new model has common square dimensions (92 mm sq.) with the 25 mm thick, thereby compatibility with the same mounting hole dimension.

4.2 Characteristics

4.2.1 General characteristics

The two types of rated voltage, 12 V DC and 24 V DC are available on the new model, and the respective rated speeds of these voltages are 9,000 min^{-1} (H speed) and 7,000 min^{-1} (F speed), 4 models in total have been commercialized.

Table 1 shows the general characteristics for the new model.

4.2.2 Airflow vs. static pressure characteristics

Fig. 3 shows the airflow vs. static pressure characteristics for the new model.

4.2.3 PWM control function

Fig. 4 shows the airflow vs. static pressure characteristics at individual PWM duty cycle of the new model.

4.3 Expected life

The new model has an expected life of 180,000 hours (approx. 20 years) at 60˚C (survival rate of 90% with continuous operation at the rated voltage under free air conditions and at normal humidity).

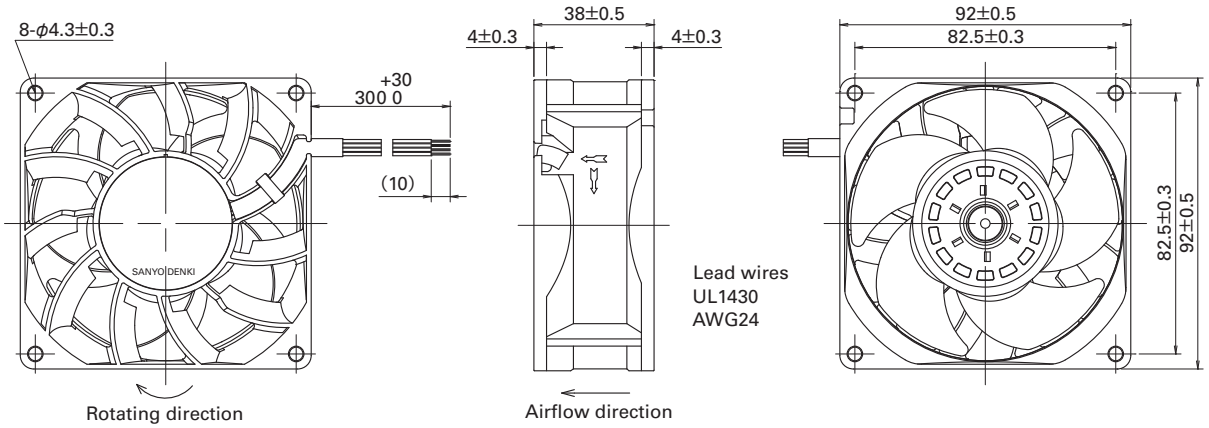

Fig. 2: Dimensions (unit: mm)

Table 1: General characteristics

Model No.	Rated voltage [V]	Operating voltage [V]	PWM duty cycle [%]	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_2O]	SPL [dB(A)]	Operating temperature [˚C]	Expected life [h]
9LG0912P1H001	12	10.2 to 13.8	100	2.0	24.0	9,000	3.70	130.6	430	1.72	61	-20 to +70	180,000/60˚C
			20	0.18	2.16	2,700	1.11	39.1	38.7	0.15	30		
9LG0912P1F001			100	1.0	12.0	7,000	2.90	102.4	263	1.05	55		
			20	0.11	1.32	2,000	0.83	29.3	21.5	0.08	22		
9LG0924P1H001	24	20.4 to 27.6	100	0.90	21.6	9,000	3.70	130.6	430	1.72	61		
			30	0.08	1.92	2,700	1.11	39.1	38.7	0.15	30		
9LG0924P1F001			100	0.50	12.0	7,000	2.90	102.4	263	1.05	55		
			20	0.06	1.44	2,000	0.83	29.3	21.5	0.08	22		

Note: Speed is 0 min^{-1} at 0% PWM duty cycle

* Input PWM frequency: 25 kHz

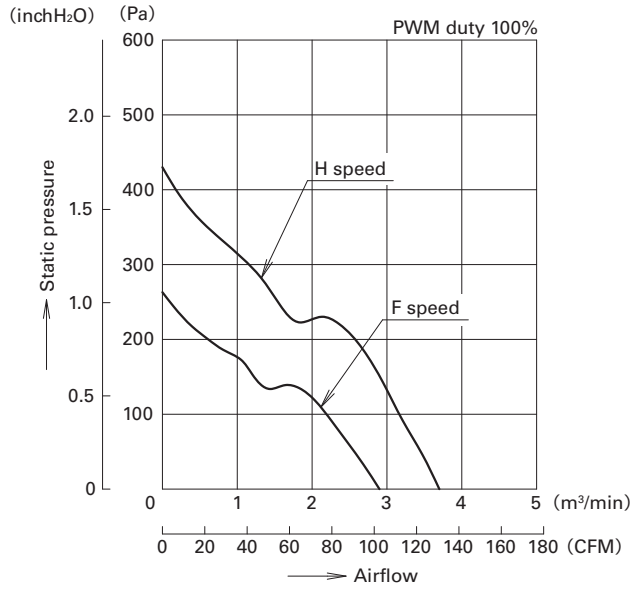

Fig. 3: Airflow vs. static pressure

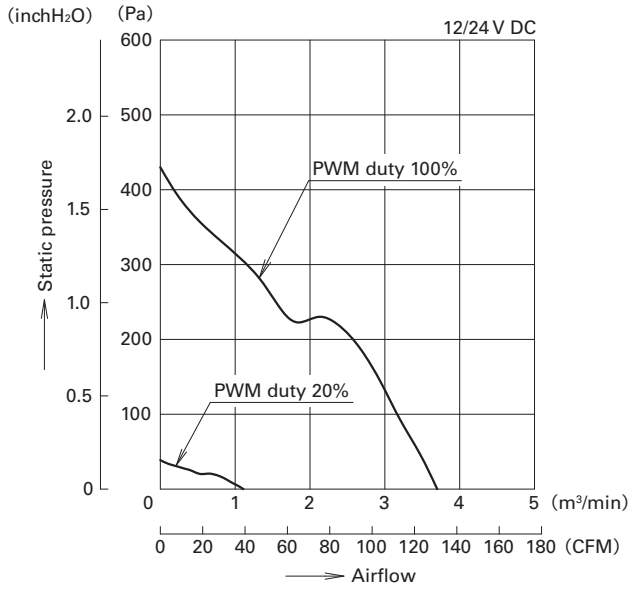

Fig. 4: Airflow vs. static pressure characteristic at individual PWM duty cycle (9,000 min^{-1}_H speed)

5. Comparison between the New Model and 25 mm Thick Model

5.1 Comparison of airflow vs. static pressure

Fig. 5 shows the airflow vs. static pressure characteristics between the 25 mm thick model and the new model.

Compared with the 25 mm thick model, the new model has 1.6 times maximum airflow and 4 times maximum static pressure achieving an expected life of 180,000 hours.

5.2 Key things for the development

Generally speaking, the "airflow vs. static pressure characteristic" of fans can be improved by increasing speed. However, if speed is simply increased to improve fan characteristics, the motor will generate much heat and the bearing temperature will rise. As a result, bearing life will decrease, the fan life will be shorter.

The life of the fan and the one of the bearing are intimately related, therefore it is necessary to improve fan characteristics in a way which does not decrease bearing life.

Below are key things to develop the new model which reduces impact on bearing life and significantly improves fan characteristics.

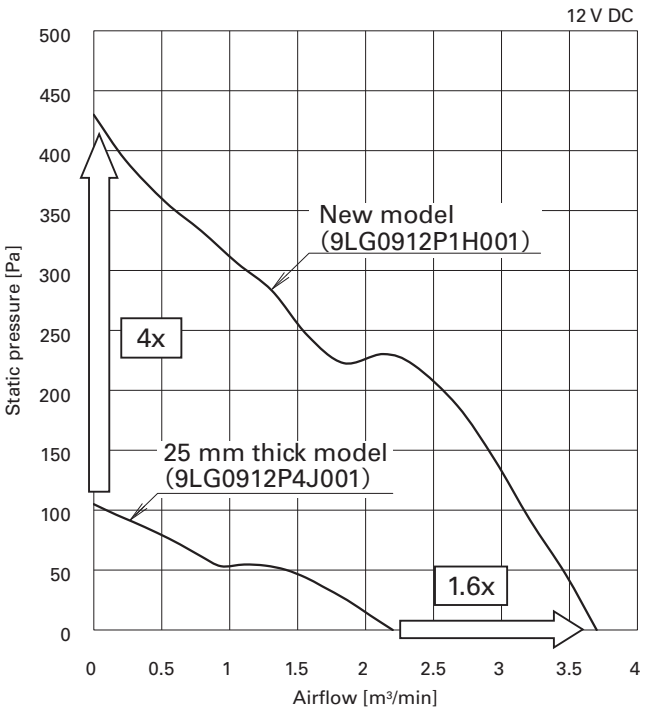

Fig. 5: Airflow vs. static pressure characteristic Comparison of the new model and 25 mm thick model

5.2.1 Motor and circuit

On the 25 mm thick model, it was not possible to suppress motor heat generation and bearing temperature rise at the same time as improving the airflow vs. static pressure characteristic by increasing speed.

On the new model, motor size was increased and motor efficiency was improved so that motor heat generation would be minimized when speed was raised. However, as a result of increasing motor size, the rotor diameter also increased, therefore a greater rotor load is applied to the bearing, which effects bearing life. As such, the new model adopts a bearing with high load resistance to avoid a drop in bearing life even if rotor load increases.

Fig. 6 is a comparison of motor size and rotor diameter between the new model and the 25 mm thick model.

Fig. 6: "San Ace 92L" Comparison of motor size and rotor diameter between the 25 mm thick model (left) and the new model (right)

5.2.2 Fan thicknesses

Generally speaking, the characteristics of axial flow fans can be improved by increasing thickness in the axial direction.

The new model has a thickness of 38 mm which is 13 mm thicker than the 25 mm thick model, thus improving fan characteristics.

Moreover, by increasing motor size and thickness, motor efficiency has been improved, as mentioned in "5.2.1 Motor and circuit".

5.2.3 Blade and frame shape

The airflow vs. static pressure characteristic can be improved by increasing speed, and the characteristics can be further enhanced by optimizing the shape of the blades and the frame.

In order to achieve a high airflow and high static pressure, the new model has been optimized with 5 moving blades and 11 static blades on the frame outlet side.

Fig. 7 is a comparison of the frame shape.

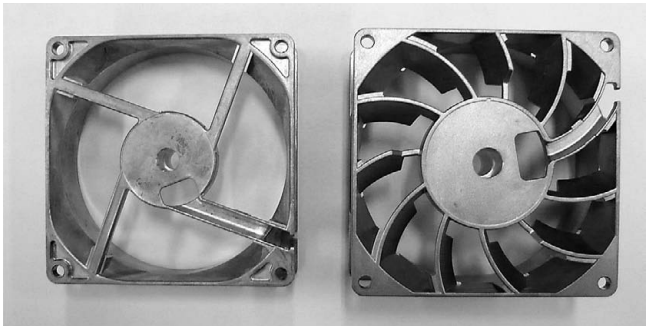

Fig. 7: Comparison of the frame shape between the 25 mm thick model (left) and the new model (right)

6. Conclusion

This document has introduced some of the features and performance of the developed 92 mm sq., 38 mm thick, high airflow, long life fan "San Ace 92L" 9LG type.

The new model has achieved the same expected life as the 25 mm thick model while maintaining mounting compatibility and achieving higher airflow and static pressure.

This makes it appropriate for application in equipment requiring high cooling performance, unachievable with the 25 mm thick model, and capable of supporting to customer requirements such as downsizing, higher density and long life, maintenance-free performance.

We sincerely believe that the high airflow, long life fan series are developed by Sanyo Denki will continue to greatly contribute to improving equipment reliability and promoting the development of industries such as communication/recyclable energy devices, environmental business devices and FA.

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