

High Air Flow and Low Power Consumption Fan “San Ace 52” GA Type

Naoki Murakami Jane Oliva Jorge Dabu Arnel Ramos Tomoaki Ikeda

1. Introduction

Global environmental protection continues to draw much attention and energy saving products have become mainstream in many different industries. Cooling fans, which are used in many fields, are no exception. There has been demand for a cooling fan that has even greater cooling performance than the conventional model, while also achieving lower power consumption and lower SPL (sound pressure level).

This document introduces the features and performance of the high air flow and low power consumption 52 mm sq., 15 mm thick fan “San Ace 52” GA type that was developed to respond to these market demands.

2. Background of the Development

Sanyo Denki has produced and sold a 52 mm sq., 15 mm thick DC fan “San Ace 52”. However, as noted in the previous section, demand increased for cooling fans with improved cooling performance (higher air flow), lower power consumption, and lower SPL.

To meet these demands, we developed the new “San Ace 52” GA type (hereafter referred to as the new model).

The new model was improved cooling performance of keeping compatibility with the conventional model in terms of size and mounting hole positions. Furthermore, it realizes low power consumption and low SPL that are the top performance in the industry (according to a Sanyo Denki investigation as of March 2012).

3. Product Features

Fig. 1 shows a photograph of the new model.

The features of the developed product are as follows:

(1) High air flow

(2) Low power consumption

(3) Low SPL

(4) PWM control function

The impeller, frame, and circuits were newly designed and the motor was optimized for the new model in order to achieve high air flow, low power consumption, and low SPL.



Fig. 1: “San Ace 52” GA type

4. Product Overview

4.1 Dimensions

Fig. 2 shows the dimensions of the new model. The new model has the same mounting dimensions as the conventional model, making it compatible.

4.2 Characteristics

4.2.1 General characteristics

There are four types in total, with rated speeds of 7,800 min^{-1} (G speed), 6,300 min^{-1} (A speed), 4,300 min^{-1} (H speed), and 3,400 min^{-1} (M speed).

Table 1 shows the general characteristics for the new model.

4.2.2 Air flow vs. static pressure characteristics

Fig. 3 shows an example of the air flow versus static pressure at rated voltage 12/24 V regarding these 4 new models.

4.2.3 PWM control function

The new model has a PWM control function that can control speed of the cooling fan from external source.

The demand for cooling fans with PWM control functions has become extremely large in recent years. By controlling speed of the cooling fan depending on the heat

generation of the equipment instead of always running the fan at full speed, the equipment as a whole can realize even lower power consumption and SPL.

As an example, Fig. 4 shows the air flow versus static pressure characteristics at individual PWM duty for the G speed (12/24 V) of the new model.

4.3 Expected life

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

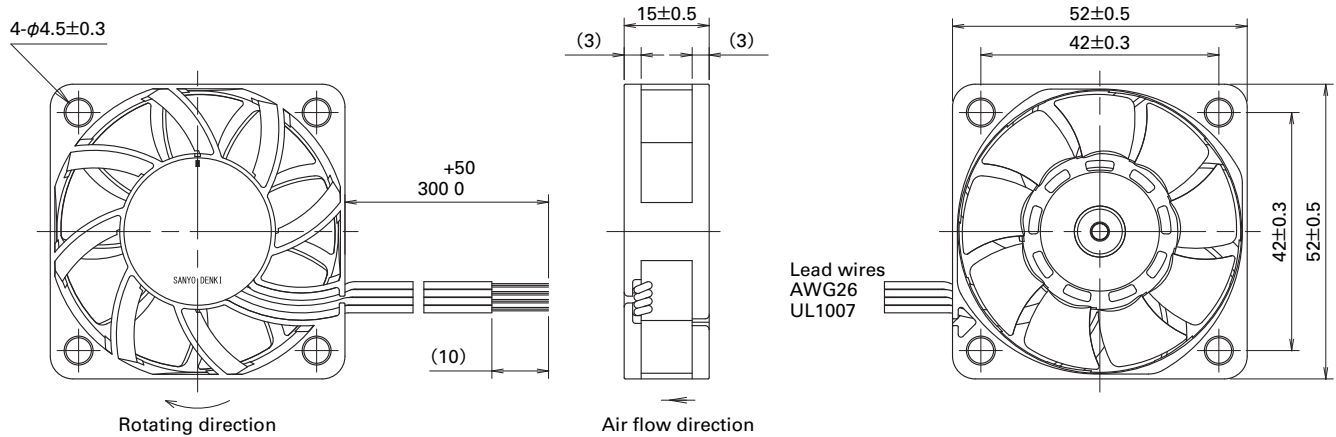


Fig. 2: "San Ace 52" GA type dimensions (unit: mm)

Table 1: "San Ace 52" GA 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		SPL [dB(A)]	Operating temperature [°C]	Expected life [h]
							[m ³ /min]	[CFM]	[Pa]	[inchH ₂ O]			
9GA0512P7G001	12	10.8 to 13.2	100	0.13	1.56	7,800	0.50	17.7	91.5	0.367	38	-10 to +70	40,000
9GA0512P7A001				0.08	0.96	6,300	0.40	14.1	59	0.237	32		
9GA0512P7H001				0.05	0.60	4,300	0.275	9.7	27.5	0.110	22		
9GA0512P7M001				0.04	0.48	3,400	0.215	7.6	17	0.068	16		
9GA0524P7G001	24	20.4 to 27.6	100	0.07	1.68	7,800	0.50	17.7	91.5	0.367	38		
9GA0524P7A001				0.05	1.20	6,300	0.40	14.1	59.0	0.237	32		
9GA0524P7H001				0.03	0.72	4,300	0.275	9.7	27.5	0.110	22		
9GA0524P7M001				0.02	0.48	3,400	0.215	7.6	17.0	0.068	16		

Note: Speed is 0 min⁻¹ at 0% PWM duty cycle

*Input PWM frequency: 25 kHz

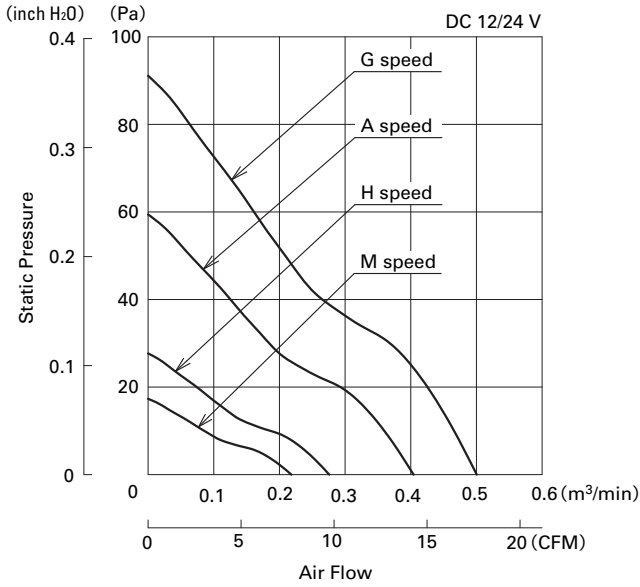


Fig. 3: Air flow - static pressure characteristics

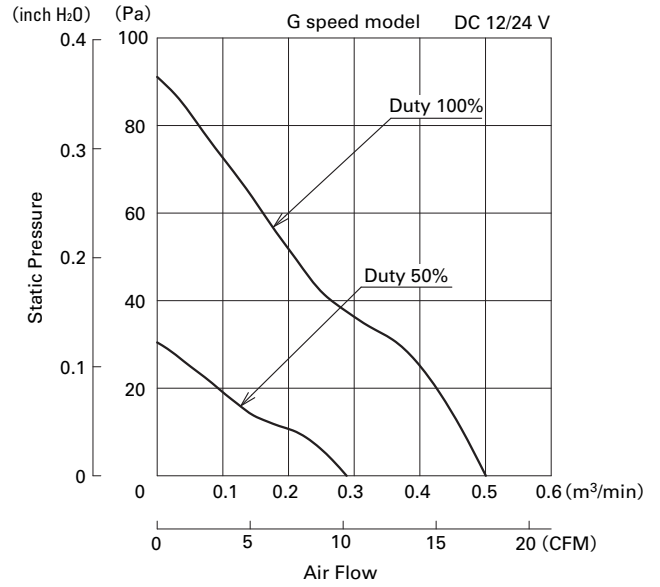


Fig. 4: Air flow - static pressure characteristics at individual PWM duty cycle

5. Comparisons with our Conventional Model

The new model uses newly designed impellers and frame, and optimized motor in order to realize massive improvements in cooling performance and reductions in the power consumption and SPL compared to our conventional model.

The following introduces the specific differences between the new model "San Ace 52" GA type and our conventional model "San Ace 52" P type.

5.1 Comparison of air flow versus static pressure

Fig. 5 shows comparison of the air flow versus static pressure characteristics between the fastest conventional model 109P0512A701 (6,800 min⁻¹) for 52 mm sq., 15 mm thick P type and the fastest new model 9GA0512P7G001 (7,800 min⁻¹). The impeller and frame were newly designed and the motor was optimized, and as a result, the cooling performance was dramatically improved with 1.3 times higher maximum air flow and 1.3 times higher maximum static pressure.

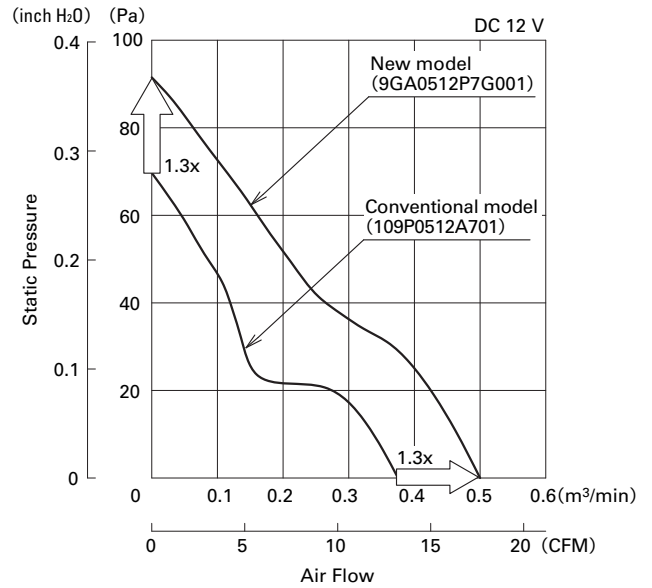


Fig. 5: Comparison of air flow - static pressure characteristics between our conventional model and the new model

5.2 Comparison of power consumption

We compared power consumption of the conventional model 109P0512A701 with the new model 9GA0512P7A001 (A speed) with similar air flow versus static pressure characteristics.

As shown in Fig. 6, the new model has dramatically lower power consumption compared to the conventional model across all ranges.

The power consumption during free air conditions is approximately 62% lower, as shown in Fig. 7.

Furthermore, within the assumed operating range (such as at air flow 0.24 m³/min), the power consumption is approximately 60% lower, as shown in Fig. 8.

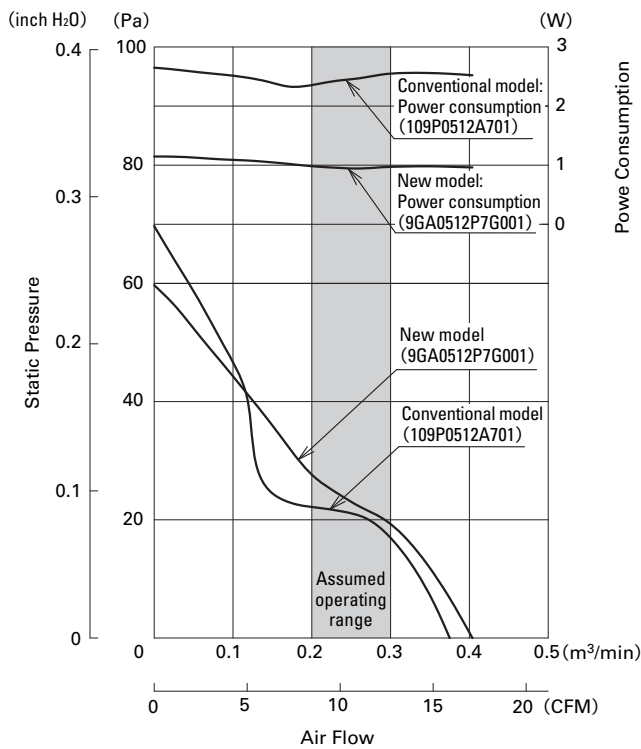


Fig. 6: Comparison of air flow - static pressure - power characteristics

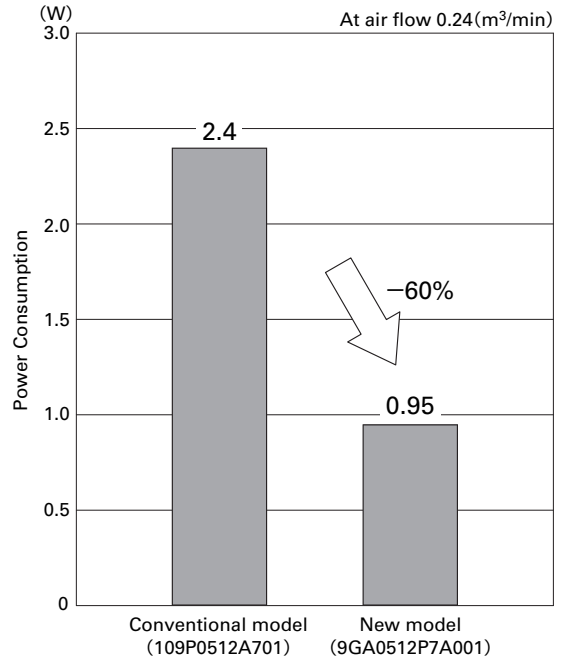


Fig. 8: Comparison of power consumption in the assumed operating range

5.3 Comparison of SPL

Fig. 9 shows a comparison of SPL using the conventional model 109P0512A701 that was used in the previous section and the new model 9GA0812P7A001 with the same cooling performance.

By improving shapes of the impeller and frame, SPL during free air conditions was lowered 4 dB(A) compared to the conventional model.

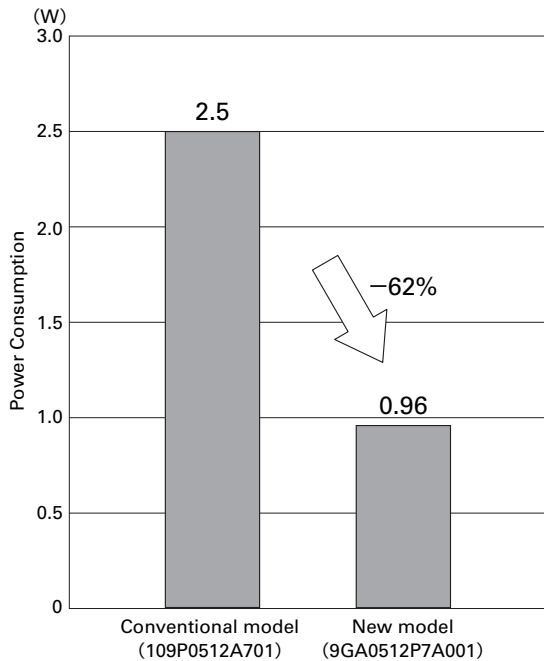


Fig. 7: Comparison of power consumption during free air conditions

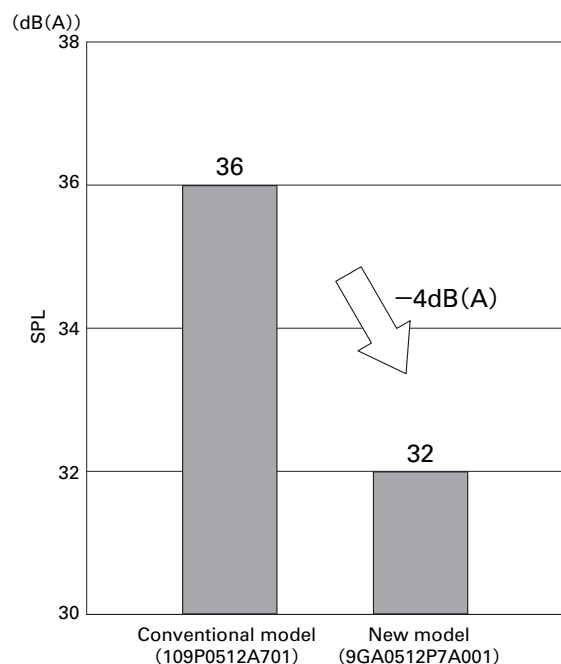


Fig. 9: SPL during free air conditions

5.4 PWM control function

The new model has PWM control function. The conventional model did not have this function as standard product, so when controlling the fan’s speed, the input voltage to the fan also had to be changed. However, this method could only control narrow range of speeds, so there were cases when necessary speed could not be achieved.

By embedding PWM control function on the new model, fan speed can be controlled in wide range, which enables lower power consumption and less SPL when mounted on equipment.

6. Conclusion

This document introduced some of the features and capabilities of the newly developed high air flow, low power consumption “San Ace 52” GA type fan.

The new model has realized dramatically higher air flow, lower power consumption, and less SPL compared to the conventional model and giving it performance that is among the top in the industry for 52 mm sq., 15 mm thick fans.

By employing the superior basic performance and PWM speed control function in the new model, we believe that we can greatly contribute to even lower power consumption and lower SPL for equipment in the future.



Naoki Murakami

Joined Sanyo Denki in 2001.
SANYO DENKI PHILIPPINES, INC., Design Dept.
Worked on the development and design of cooling fans.



Jane Oliva

Joined Sanyo Denki in 2004.
SANYO DENKI PHILIPPINES, INC., Design Dept.
Worked on the development and design of cooling fans.



Jorge Dabu

Joined Sanyo Denki in 2006.
SANYO DENKI PHILIPPINES, INC., Design Dept.
Worked on the development and design of cooling fans.



Arnel Ramos

Joined Sanyo Denki in 2006.
SANYO DENKI PHILIPPINES, INC., Design Dept.
Worked on the development and design of cooling fans.



Tomoaki Ikeda

Joined Sanyo Denki in 1990.
SANYO DENKI PHILIPPINES, INC., Design Dept.
Worked on the development and design of cooling fans.