

High Airflow Long Life Fan / High Airflow Long Life Splash Proof Fan *San Ace 140L* and *San Ace 140W*

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1. Introduction

With the growth of the ICT and renewable energy markets, there is a demand for fans to have high airflow and long life to support an increase in the internal heat generation of equipment.

Furthermore, in addition to offering high airflow and long life, there is also a demand for fans to be waterproof to meet the needs of ICT equipment and power condensers, which are installed outdoors.

Also, from the perspective of protecting the environment, there has been a sudden increase in demand for photovoltaic (PV) power generation, electric vehicles and so forth, thus creating a need for highly reliable, long life, waterproof fans to support products such as quick charging stations.

SANYO DENKI had already manufactured and released the 140 × 140 × 51 mm Long Life Fan and Splash Proof Fan. In line with higher performance and higher efficiency of ICT equipment and PV power systems in recent years, fans used in such equipment have been required to have even longer life and higher airflow.

Even Splash Proof Fans are being required to offer higher airflow and longer life in addition to sufficient waterproof performance for outdoor equipment, such as PV inverters and EV quick charging stations.

Amid such circumstances, SANYO DENKI has developed and released two models: the High Airflow Long Life Fan, *San Ace 140L* 9LG type, with an expected life of 180,000 hours, and the High Airflow Long Life Splash Proof Fan, *San Ace 140W* 9WL type, with an expected life of 100,000 hours. This article introduces the features and performances of these products.

2. Product Features

Figures 1 and 2 show the external views of the two new models.



Fig. 1 New model *San Ace 140L*



Fig. 2 New model *San Ace 140W*

The new models maintain compatibility with the current models in regard to fan size and mounting hole position, while achieving higher airflow, longer service life, and greater waterproof performance.

The features of the new models are:

- (1) Dustproof/waterproof performance: Protection rating IP68*
- (2) High airflow
- (3) Long life
- (4) PWM control function

3. Product Overview

3.1 Dimensions

The fans' external dimensions and mounting hole positions are unchanged from our current models. Figures 3 and 4 show the dimensions of the new models.

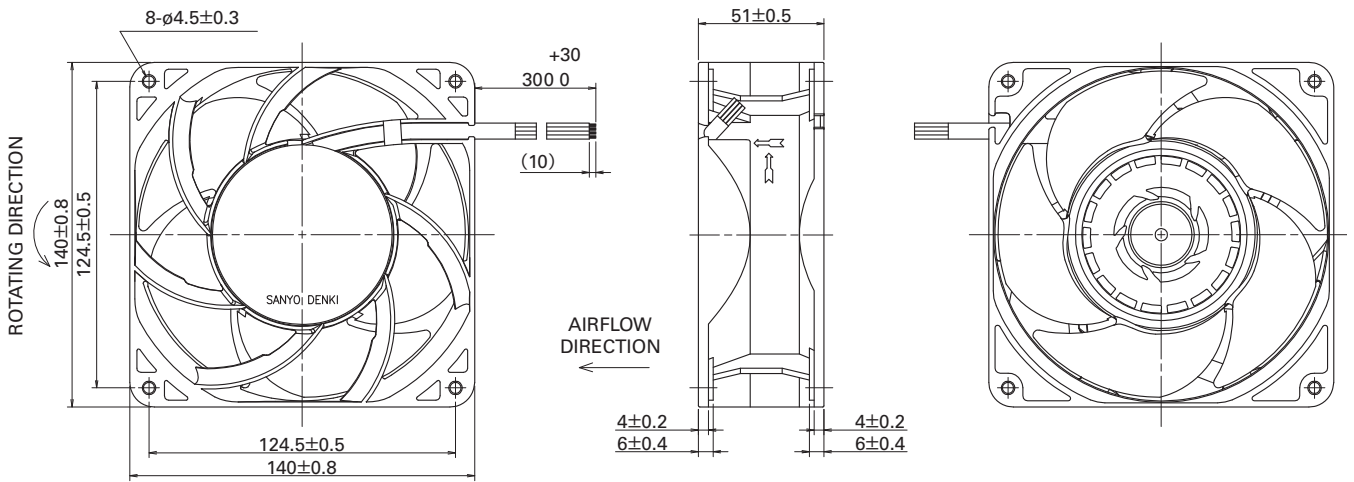


Fig. 3 Dimensions of the *San Ace 140L* (unit: mm)

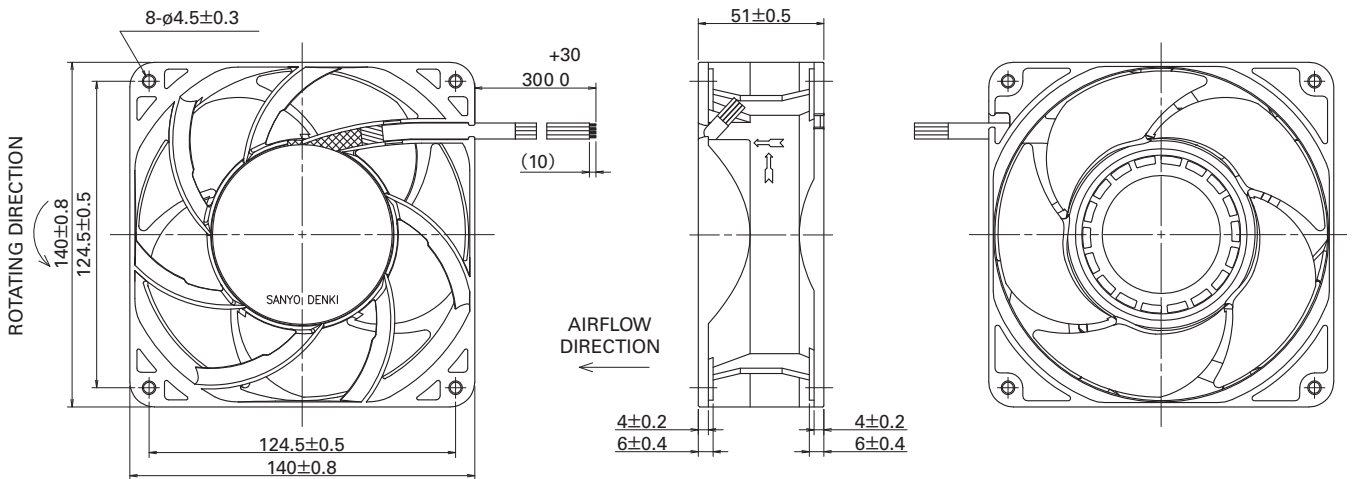


Fig. 4 Dimensions of the *San Ace 140W* (unit: mm)

3.2 Expected life

The new model has an expected life of 180,000 hours with the 9LG type and 100,000 hours with the 9WL type at 60°C (survival rate of 90%, run continuously at rated voltage in free air and at normal humidity).

3.3 Characteristics

3.3.1 General specifications

Tables 1 and 2 show the general specifications of both new models.

Table 1 General specifications for the new model *San Ace 140L*

Model no.	Rated voltage [V]	Operating voltage range [V]	PWM duty cycle [%]	Rated current [A]	Rated input [W]	Rated speed [min ⁻¹]	Max. airflow		Max. static pressure		SPL [dB (A)]	Operating temperature [°C]	Expected life [h]		
							[m ³ /min]	[CFM]	[Pa]	[inchH ₂ O]					
9LG1412P5G001	12	10.2 to 13.8	100	5.16	62	7,500	9.0	318	655	2.63	69	-20 to +70	180,000 / 60°C		
			20	0.31	3.72	2,300	2.75	97	80	0.32	38				
9LG1412P5S001			100	1.83	22	5,000	6.0	212	295	1.18	57				
			20	0.31	3.72	2,300	2.75	97	80	0.32	38				
9LG1424P5G001	24	20.4 to 27.6	100	2.58	62	7,500	9.0	318	655	2.63	69			-20 to +70	180,000 / 60°C
			20	0.16	3.84	2,300	2.75	97	80	0.32	38				
9LG1424P5S001			100	0.91	22	5,000	6.0	212	295	1.18	57				
			20	0.16	3.84	2,300	2.75	97	80	0.32	38				
9LG1448P5G001	48	40.8 to 55.2	100	1.29	62	7,500	9.0	318	655	2.63	69	-20 to +70	180,000 / 60°C		
			20	0.12	5.76	2,300	2.75	97	80	0.32	38				
9LG1448P5S001			100	0.45	22	5,000	6.0	212	295	1.18	57				
			20	0.12	5.76	2,300	2.75	97	80	0.32	38				

- Does not rotate when PWM duty cycle is 0%.
- PWM frequency: 25 kHz

Table 2 General specifications for the new model *San Ace 140W*

Model no.	Rated voltage [V]	Operating voltage range [V]	PWM duty cycle [%]	Rated current [A]	Rated input [W]	Rated speed [min ⁻¹]	Max. airflow		Max. static pressure		SPL [dB (A)]	Operating temperature [°C]	Expected life [h]		
							[m ³ /min]	[CFM]	[Pa]	[inchH ₂ O]					
9WL1412P5G001	12	10.2 to 13.8	100	5.16	62	7,500	9.0	318	655	2.63	69	-20 to +70	100,000 / 60°C		
			20	0.31	3.72	2,300	2.75	97	80	0.32	38				
9WL1412P5S001			100	1.83	22	5,000	6.0	212	295	1.18	57				
			20	0.31	3.72	2,300	2.75	97	80	0.32	38				
9WL1424P5G001	24	20.4 to 27.6	100	2.58	62	7,500	9.0	318	655	2.63	69			-20 to +70	100,000 / 60°C
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			20	0.12	5.76	2,300	2.75	97	80	0.32	38				

- Does not rotate when PWM duty cycle is 0%.
- PWM frequency: 25 kHz

3.3.2 Airflow vs. static pressure characteristics

Figure 5 shows the airflow vs. static pressure characteristics of the new models.

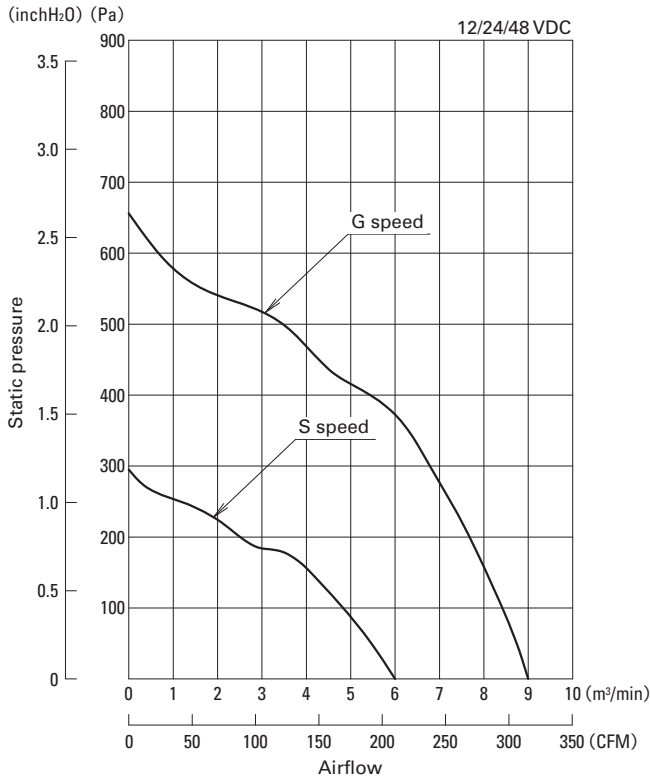


Fig. 5 Airflow vs. static pressure characteristics of the new models *San Ace 140L* and *San Ace 140W*

3.3.3 PWM control function

Both of the new models have a PWM control function and are capable of high-speed control.

4. Comparison with our Current Models

The following is a comparison of the characteristics of the new and current models.

4.1 Comparison of airflow vs. static pressure characteristics

Figure 6 provides an example of the airflow vs. static pressure characteristics of the new and current models.

Compared to the current models, the new models have a 1.1 times greater maximum airflow and 2.7 times greater maximum static pressure, thus offer an improvement in airflow vs. static pressure characteristics.

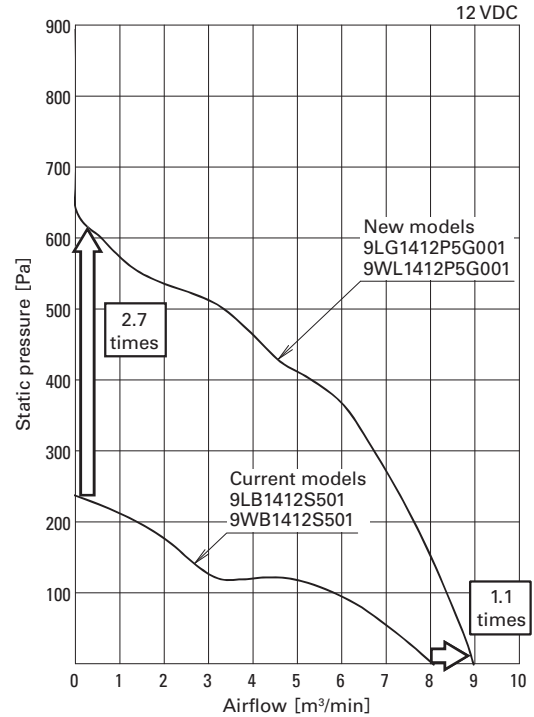


Fig. 6 Airflow vs. static pressure characteristics of the new models *San Ace 140L* and *San Ace 140W* in comparison with current models

4.2 Comparison of expected life

Tables 3 and 4 give comparisons for the expected life and general specifications of the new models and current models. The values shown are for the high performance types of each model.

Table 3 Comparison of the new model *San Ace 140L* with the current model

Model no.	Expected life [h]	Max. airflow [m³/min]	Max. static pressure [Pa]
New model 9LG1412P5G001	180,000	9.0	655
Current model 9LB1412S501	60,000	8.1	240

Table 4 Comparison of the new model *San Ace 140W* with the current model

Model no.	Expected life [h]	Max. airflow [m³/min]	Max. static pressure [Pa]
New model 9WL1412P5G001	100,000	9.0	655
Current model 9WB1412S501	60,000	8.1	240

Both the 9LG and 9WL type models offer improved airflow vs. static pressure characteristics, yet the 9LG type has an expected life (with 60°C ambient temperature, 90% survival rate, run continuously at rated voltage in free air and at normal humidity) of 180,000 hours, which is 3 times greater than the 60,000 hour lifespan of current models. The 9WL type has an expected life of 100,000 hours, which is 1.7 times greater than the 60,000 hour lifespan of current models.

5. High Airflow/Long Life and Waterproof Performance Technologies

The new models were designed to be waterproof while offering both an airflow and lifespan surpassing that of the current models.

For the new models, the impeller shape and frame were optimized to achieve higher airflow, and an aluminum die-cast frame was adopted for longer life. The following sections briefly introduce the design points contributing to higher airflow and longer life on the new models compared to the current models.

5.1 Impeller shape

We newly developed the impeller and adopted a structure with an intake route in order to suppress bearing/motor temperature. (Fig. 7) Moreover, we improved the number and angle of blades and achieved higher airflow by improving airflow efficiency, thus minimizing power consumption. Figure 8 shows an impeller shape comparison of the current and new models.

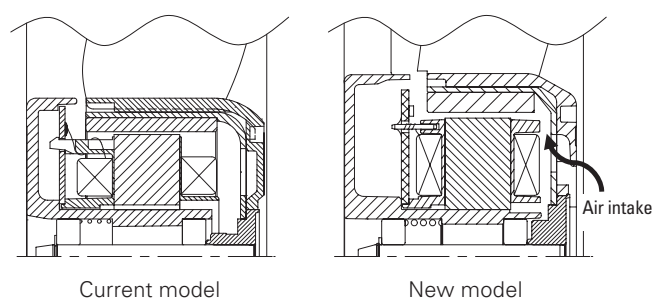


Fig. 7 Impeller cooling structure of the current and new models

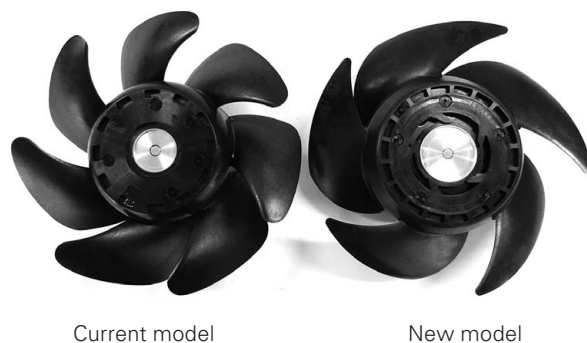


Fig. 8 Impeller shape comparison of the current and new models

5.2 Frame

For the frame, we used aluminum die-cast as the material and adopted a design whereby the frame was integrated with the bearing house. By newly developing the frame spoke shape, airflow efficiency was improved, thus achieving higher airflow and higher static pressure.

Furthermore, the aluminum die-cast frame surface has been coated to protect it from corrosion due to rust, etc. as a result of exposure to external environments. This has made it possible to use the fans for a prolonged period of time even in environments where it is splashed with water.

Figure 9 shows a frame shape comparison of the current and new models.

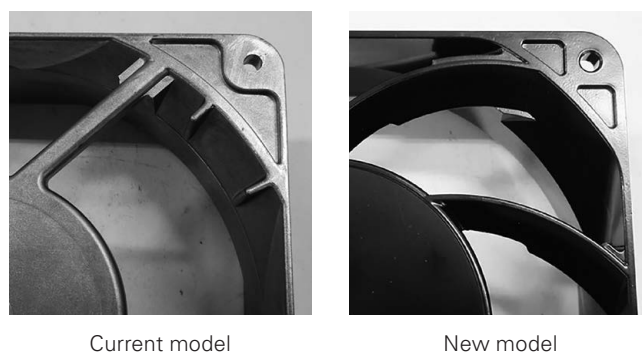


Fig. 9 Frame shape comparison of the current and new models

5.3 Drive motor

For the Splash Proof Fan, to prevent breakdowns due to water penetration, we have coated the live parts (motor, control circuit) in resin, as shown in Figure 10.

Furthermore, in order to achieve a dustproof/waterproof performance rating of IP68*, the below structure was adopted.

- (1) Live parts (motor, control circuit) protected with highly waterproof material (Fig. 10).
- (2) Magnets made from material with excellent water resistance compared to the material normally used for fans.
- (3) Rustproofing applied to the necessary areas.

The new models are faster than the current models so the drive motor was enlarged to improve motor efficiency.

This has made it possible to achieve low power consumption and, regardless of the live parts being coating in resin, reduce the heat generated by the motor coil, thus minimizing bearing temperature rise.



Fig. 10 Coating condition of live parts

6. Conclusion

This paper has introduced some features and performance of the High Airflow Long Life Fan and High Airflow Long Life Splash Proof Fan, *San Ace 140L* and *San Ace 140W*.

Both new models offer higher airflow and longer service life. As such, they contribute toward maintenance-free fans for adoption in indoor/outdoor equipment and help to reduce fan replacement frequency (no. of units).

With today's diversifying global market, we believe this development contributes significantly to optimal cooling solutions.

* Shows the protection rating for the *San Ace W* series.
The protection rating (IP code), is defined by IEC (International Electrotechnical Commission) 60529 "DEGREES OF PROTECTION PROVIDED BY ENCLOSURES (IP Code)." (IEC60529:2001)
IP68: Completely protected against dust. Protection against submersion in water.

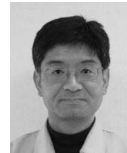
Reference

- (1) Kakuhiko Hata and others: High Airflow, High Static Pressure Splash Proof Fan *San Ace W*
SANYO DENKI Technical Report No. 32 pp. 20-24 (2011-11)
- (2) Katsumichi Ishihara and others: High Airflow Long Life Splash Proof Fan *San Ace W*
SANYO DENKI Technical Report No. 38 pp. 20-25 (2014-11)



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