

# Low Noise: Light Weight “San Ace 140L”

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## 1. Introduction

In recent years, space saving designs and high-density mounting of information communication equipment, which generate more heat, have generated a strong demand for a cooling fan motor which provides long life, high reliability, large air volume, and quiet operation.

In order to meet these demands, the 140mm sq.×51mm thickness long life fan “San Ace 140L” was developed. It maintains a long life performance equivalent to the conventional product and further realizes large air volume, high static pressure, and low noise. Moreover, as for mass, a large reduction in weight was achieved.

This document introduces the feature and outline of the product.

## 2. Background of the Development

In our company, three kinds of BLDC fans, a 51mm thickness, a 38mm thickness long life type, and a 38mm thickness standard type as a 140mm sq. fan, have been produced commercially until now. However, the market demand for a larger air volume and lower noise in a cooling fan is increasing, as is the demand for lighter weight fans.

In response to this situation, our company developed the low noise and lightweight “San Ace 140L” series in a 140mm sq.×51mm thickness long life fan. This realized large air volume, low noise, and light weight, and carried out improvements in performance compared to the conventional product.

## 3. Feature of the Developed Product

Fig. 1 shows the low noise: light weight “San Ace 140L”.



Fig. 1 Low Noise: Light Weight “San Ace 140L”

The features of this product are shown below.

- (1) Large air volume – High static pressure
- (2) Low noise
- (3) Light weight
- (4) Low power consumption
- (5) Long life

This newly developed product improves cooling performance by 1.25 times for the maximum air volume and 1.38 times for the maximum static pressure compared to the conventional product. It also reduces the sound pressure level by 3dB with the same air volume. Additionally, while it maintains a long life equivalent level to the conventional product, the product mass is reduced by 150g, and it has become the product which carried out improvements in performance when compared with the conventional product.

## 4. Outline of the Product

### 4.1 Dimensional Overview

The dimensional overview of the developed product are shown in Fig. 2. The size is the same as the conventional product and compatibility is maintained.

### 4.2 Characteristics

#### 4.2.1 General Characteristics

The general characteristic of the “San Ace 140L” is shown in Table 1. The rated voltage is 12V, 24V, and 48V. Three types, with differing rpm ratings, were produced commercially: S speed (4200min<sup>-1</sup>) of large air volume, H speed (3100min<sup>-1</sup>) and M speed (2050min<sup>-1</sup>) of an equivalent to the conventional product.

#### 4.2.2 Air Volume vs. Static Pressure

An example of air volume versus static pressure is shown in the Fig. 3.

#### 4.2.3 Life

The expected life of the developed product in the circumstance temperature of 60 degrees (90% of survival rate, rated voltage continuous operation, a free air state, ordinary humidity) is 100,000 hours for H and M speed and 60,000 hours for S speed.

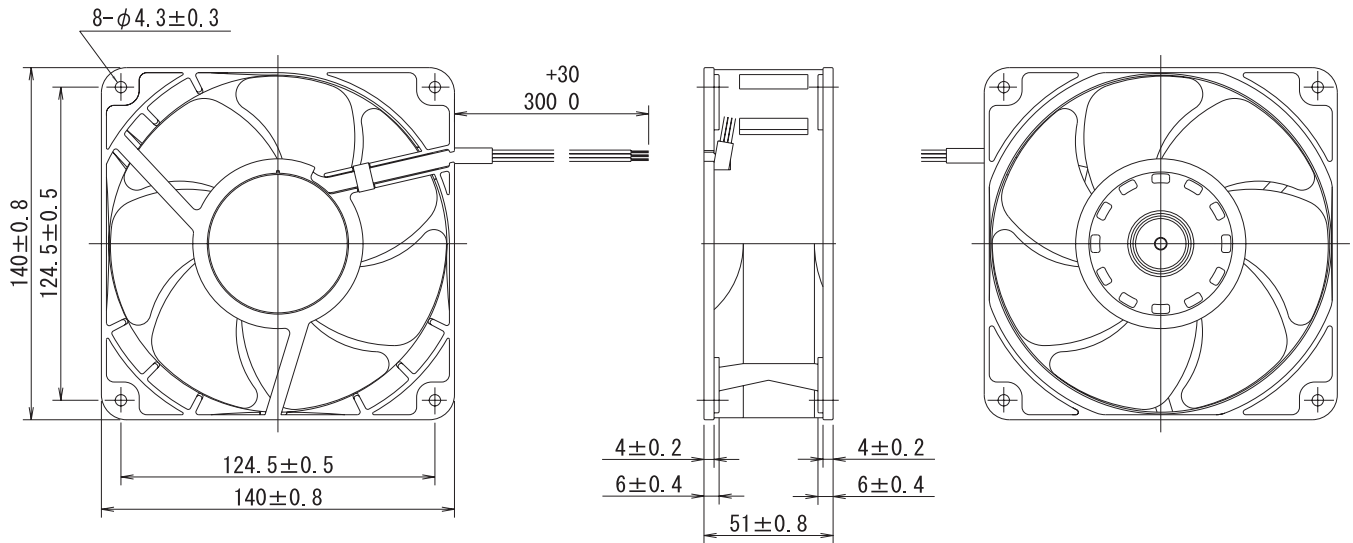


Fig. 2 Dimensional Overview of Low Noise: Light Weight "San Ace 140L" Series

Table 1 General Characteristics of Low Noise: Light Weight "San Ace 140L" Series

Model No.	Rated Voltage	Operating Voltage Range	Rated Current	Rated Input	Rated Rotating Speed	Max. Air Volume	Max. Static Pressure	Sound Pressure Level	Mass
	[V]	[V]	[A]	[W]	[min <sup>-1</sup> ]	[m <sup>3</sup> /min]	[CFM]	[dB(A)]	[g]
9LB1412S501	12	10.2~13.8	2.7	32.4	4,200	8.1	286	240	57
9LB1412H501			1.25	15.0	3,100	5.9	208	130	49
9LB1412M501			0.46	5.5	2,050	3.9	138	63	39
9LB1424S501	24	20.4~27.6	1.38	33.1	4,200	8.1	286	240	57
9LB1424H501			0.60	14.4	3,100	5.9	208	130	49
9LB1424M501			0.22	5.3	2,050	3.9	138	63	39
9LB1448S501	48	40.8~55.2	0.71	34.1	4,200	8.1	286	240	57
9LB1448H501			0.27	13.0	3,100	5.9	208	130	49
9LB1448M501			0.12	5.8	2,050	3.9	138	63	39

Air Volume vs. Static Pressure Performance  
(measured with Sanyo double chamber)

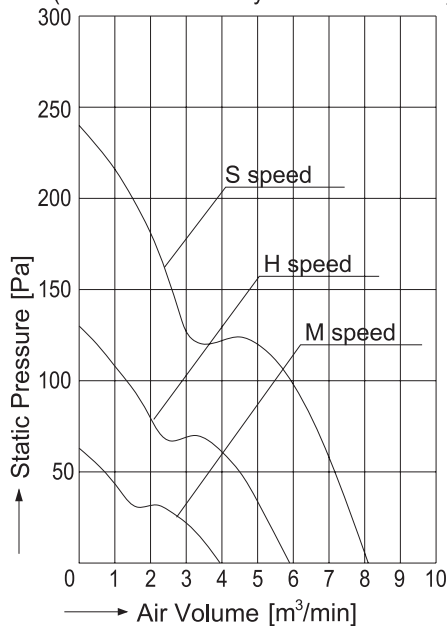


Fig. 3 Air Volume vs. Static Pressure

## 5. Comparison with the Conventional Product

In addition to increases in maximum air volume and maximum static pressure, and reduction in noise, the "San Ace 140L" also achieved a reduction in weight compared to the conventional product.

In this development, emphasis is put on making the efficiency of each part high. In the motor part, a higher motor performance than that of the conventional product was realized. Conditions for higher efficiency while reducing motor mass by optimization of design were discovered, making this achievement possible. Moreover, in a blade and frame form, by raising fluid efficiency and motor efficiency, the the whole product is optimized.

The difference between the conventional and newly developed product is detailed below.

### 5.1 Air Volume Enlargement

A comparison example of air volume versus static pressure of the maximum performance product and the developed product is shown in the Fig. 4

In order to enlarge air volume, optimizing the expansion

of the blades' outer diameter by the device of a blade and frame form, new designs for an electronic circuit and a motor were made. Consequently, compared with the conventional highest performance product, the performance rise was realized to 1.25 times in maximum air volume, and 1.38 times in maximum static pressure.

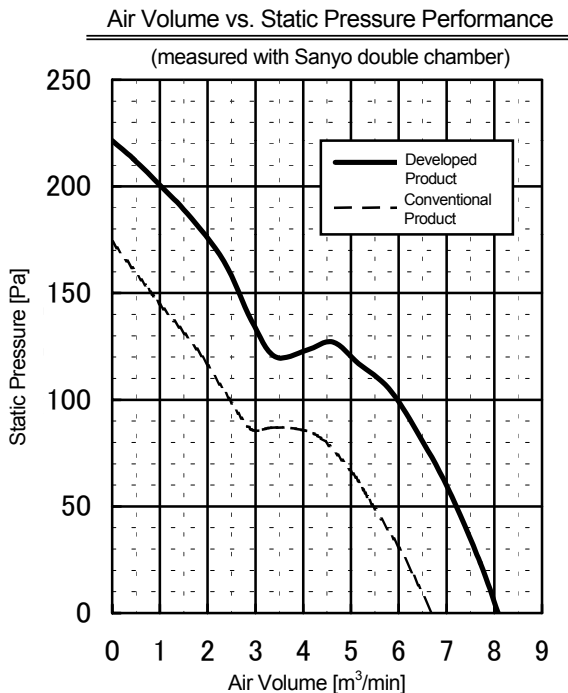


Fig. 4 Air Volume vs. Static Pressure

## 5.2 Noise Reduction

A comparison example of loaded noise characteristics of the conventional product and the developed product at the time of the operation under the same air volume is shown in Fig. 5.

The developed product reduced the sound pressure level by 3dB, while at the time achieving the same maximum air volume as the conventional product, by the device of a blade and frame form. Moreover, as Fig. 5 clearly shows, in the loaded noise characteristics at the time of the same air volume, the sound pressure level of a developed product is low over the whole region. That is, it will be low noise even though its cooling performance is equivalent to the conventional product at the time of equipment mounting.

The blades' form, which has an effect in lowering noise in 3DCAD modeling and molding trial production, was evaluated, and number of blade was changed to seven from five. Furthermore, the method of decreasing the rotation speed while maintaining the same air volume as conventional product by expansion of a blades outer diameter was adopted. About the frame, lowering noise was attained by expansion of the inside diameter of the venturi, the device of intake form, and by breathing out and preparing a rectification fin in a Fan outlet. Blade form comparison is shown in Fig. 6.

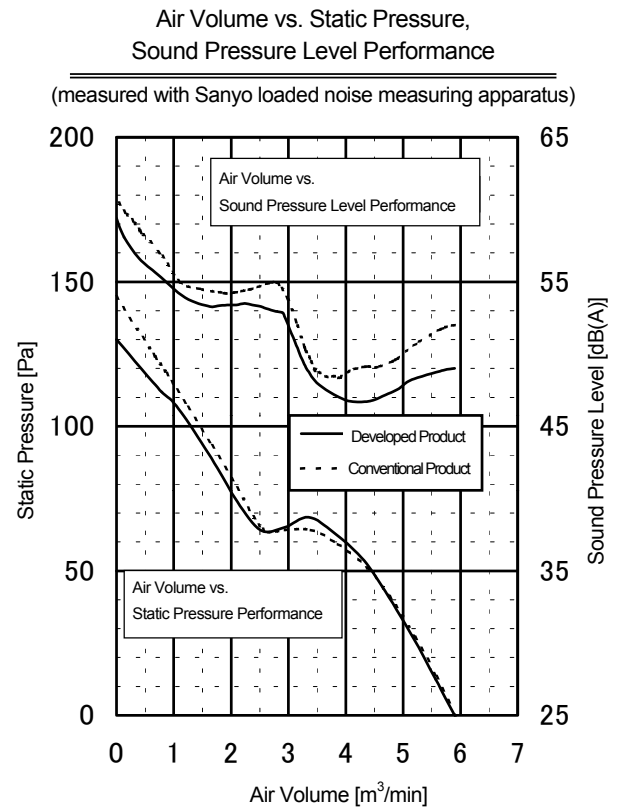


Fig. 5 Comparison Example of Load Noise Properties

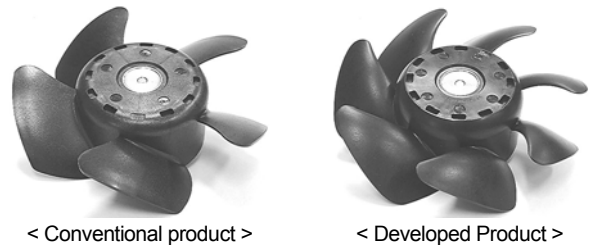


Fig. 6 Comparison of Blade Form

## 5.3 Weight Reduction

The structure comparison of the conventional product and the developed product is shown in Fig. 7.

In this development, as a result of a reduction in the size of the motor part and the thinning the frame, and by changing the magnet material, 150g of weight reduction was conventionally carried out for product mass from 760g of conventional product to 610g. Weight reduction was pursued especially on a motor part, which has a high mass ratio. It is thought that the reduction of motor size and improvement of performance have an opposite relation. However, by improving a motor design, even if it made stator armature length twenty percent thinner than conventional product, it became possible to obtain the motor performance more than that of the conventional product. Furthermore, weight reduction was attained by adopting the magnet material of small specific gravity. These realized 110g of weight reduction only in the motor part.

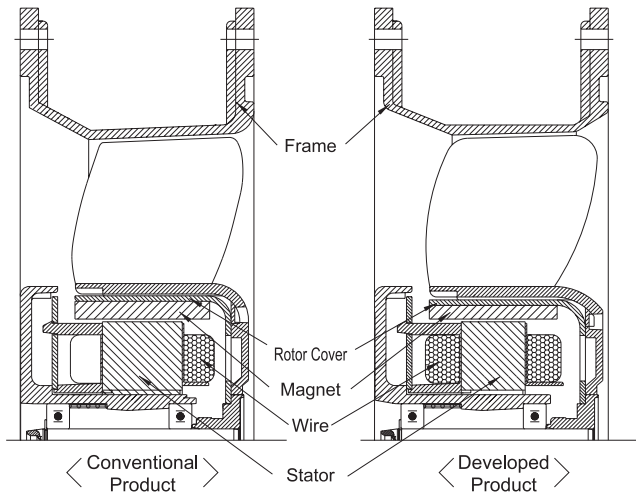


Fig. 7 Comparison of Structure

## 5.4 Power Consumption Reduction

The developed product reduced power consumption by 6.5% from 13.9W of the conventional product to 13.0W, as a result of optimizing the balance of the stator part and the rotor part in the motor design.

## 6. Conclusion

The structure and a part of performance of the low noise: light weight "San Ace 140L" were introduced above.

This developed product achieved larger air volume, higher static pressure, lower noise, lower power consumption and lighter product mass compared to the conventional product. And it improved performance.

In the information communication related market it can contribute to size reduction, performance improvement and noise reduction greatly.

In addition, this product is certified as one of Sanyo Denki's environmentally compatible products (ECO PRODUCTS) because it contributes to environmental preservation through energy savings and through reductions in size and weight (Fig. 8).



Fig. 8 ECO PRODUCTS trademark



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