High Static Pressure Long Life Counter Rotating Fan *San Ace 60L* 9CRLA Type

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1. Introduction

With the rapid shift to high-performance ICT equipment in recent years, there is a greater requirement for the high-density design of such equipment, further increasing heat generation. Amid such market trends, many customers are adopting counter rotating fans, and there is a demand for such fans to offer even higher cooling performance. Customers also require equipment with longer life expectancy, giving rise to a demand for long-life fans with high cooling performance. SANYO DENKI had already developed and launched the high static pressure counter rotating fan, *San Ace 60L* 9CRL type, however we recognized the need to improve static pressure performance in order to realize even higher cooling performance.

In response to such a requirement, we newly developed and launched the high static pressure long life counter rotating fan, *San Ace 60L* 9CRLA type (hereinafter, "new model").

This article will introduce the features and performance of the new model.

Fig. 1 60 × 60 × 76 mm *San Ace 60L* 9CRLA type

2. Product Features

Figure 1 shows an external view of the new model.
The features of the new model are:

(1) High static pressure
(2) Long life
(3) Low power consumption

3. Product Overview

3.1 Dimensions

Figure 2 shows the dimensions of the new model.

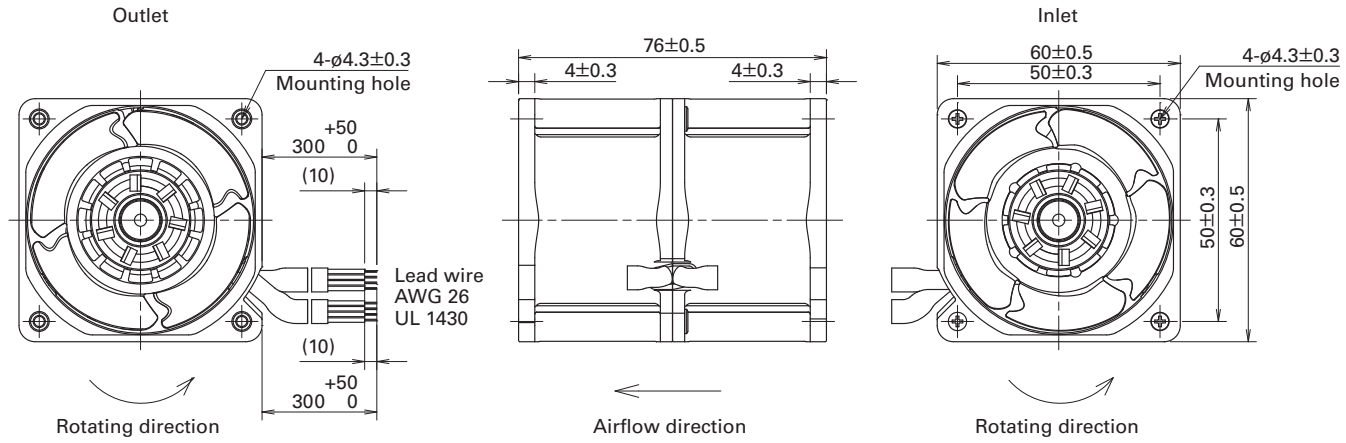

Fig. 2 Dimensions of the new model (unit: mm)

Table 1 General specifications for the new model

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]
						Inlet	Outlet	[m^3/min]	[CFM]	[Pa]	[inchH$_2$O]			
9CRLA0612P0G001	12	10.8 to 13.2	100	3.0	36.0	16,500	17,800	2.1	74.1	1,400	5.62	70	-20 to +70	100,000 / 60°C
			20	0.4	4.8	5,000	5,400	0.64	22.6	128	0.51	43		

3.2 Characteristics

3.2.1 General specifications

Table 1 shows the general specifications for the new model.

3.2.2 Airflow vs. static pressure characteristics

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

3.2.3 PWM control function

The new model has a PWM control function that enables external control of fan speed.

3.3 Expected life

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

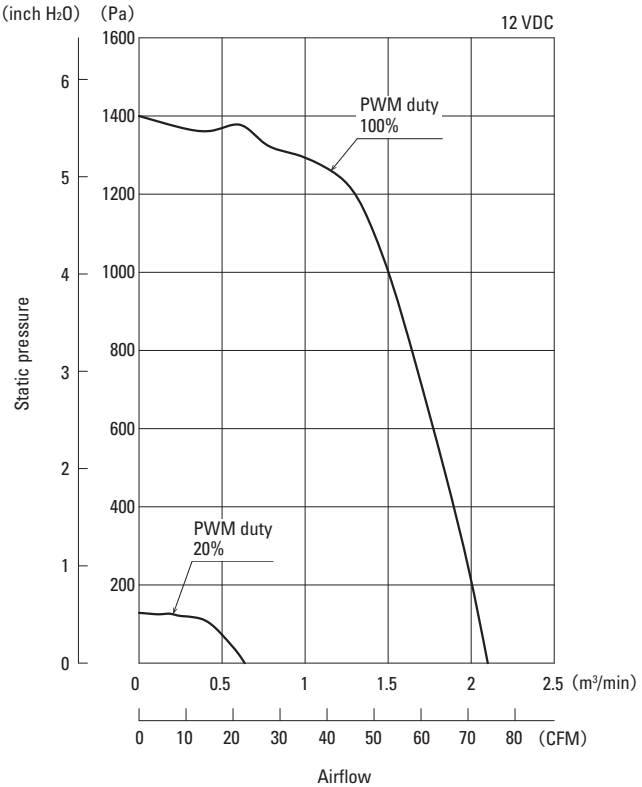

Fig. 3 Airflow vs. static pressure characteristics of the new model

4. Key Points of Development

The new model features a newly-designed impeller and frame which improves static pressure. Moreover, we increased rotational speed, which is effective in improving static pressure performance, and increased the impeller strength accordingly.

The key points of development are explained below.

4.1 Impeller and frame design

For the new model, there was a need to improve the overall static pressure performance in terms of airflow vs. static pressure characteristics. Generally speaking, increasing impeller rotation speed makes it possible to improve static pressure performance. As such, we attempted increasing rotational speed compared to the current model for this new model, however this created the issue of higher power consumption.

Figure 4 shows a dynamic blade shape comparison of the current and new models.

Figure 5 shows the flow of air of the new model.

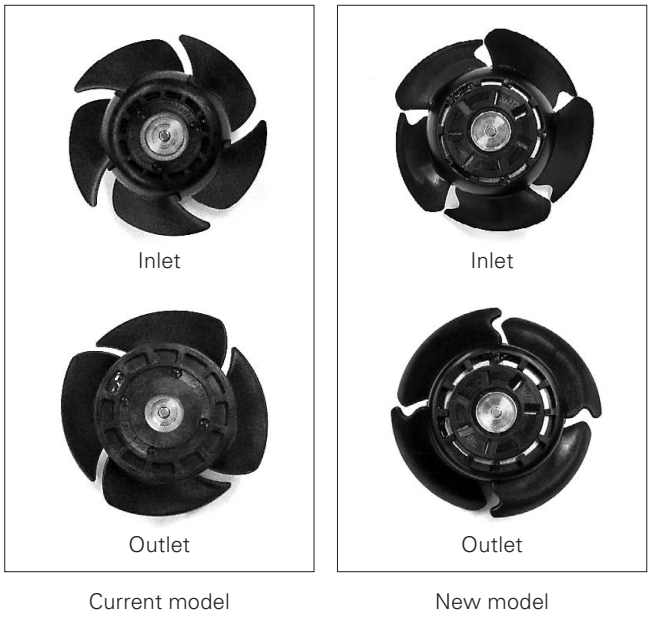

Fig. 4 Dynamic blade shape comparison of current and new models

To resolve this issue, we leveraged fluid analysis to design optimal shapes for the dynamic and static blades, and reduce power consumption. Figure 4 shows a comparison of the shapes of the current and new models. The dynamic blades straightened the wind flow. By changing the shape in this way, we increased impeller efficiency compared to the dynamic blades of the current model, and reduced the load torque of the dynamic blades, increasing the impeller's rotational speed. Figure 5 shows the airflow of the new model. Flow lines are used to indicate the airflow across the surface of the dynamic and static blades, and it is apparent that the air flows smoothly along the blade profile. Moreover, the figure expressing airflow speed distribution demonstrates the straightness of the airflow.

Through this optimization of the dynamic and static blades, we succeeded in significantly increasing static pressure performance and achieved our high static pressure and low power consumption targets. Moreover, by reducing power consumption, we were able to suppress the amount of heat generated by the motor, enabling longer service life.

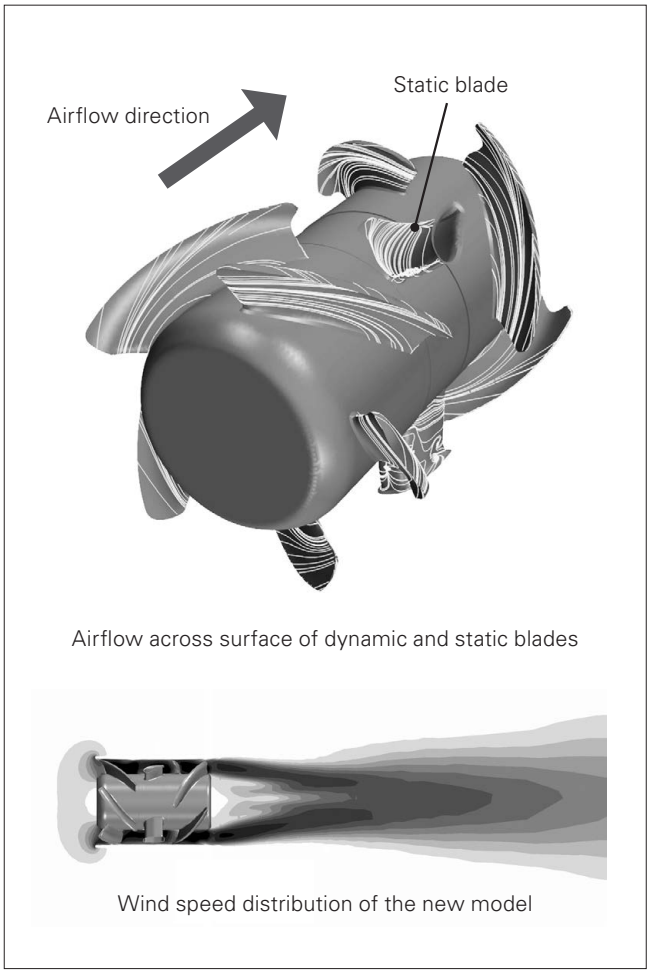

Fig. 5 Airflow of the new model

4.2 Integrated type

With increased fan rotational speed, impellers require a structure that can withstand high rotation. As such, we employed a structure that integrated the impeller and rotor cover. By increasing joint strength, the impeller can withstand high rotation.

5. Comparison with Current Model

5.1 Comparison of airflow vs. static pressure characteristics

Compared to the current model, the new model's maximum airflow has increased by 5%, and its maximum static pressure has increased by 40%.

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

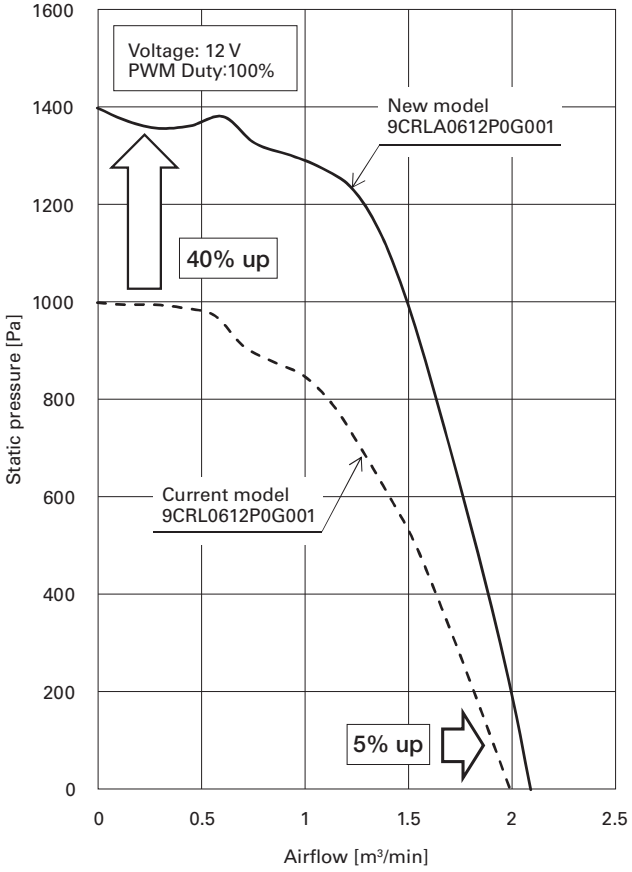

Fig. 6 Airflow vs. static pressure characteristics of current and new models

5.2 Power consumption comparison

Figure 7 gives a comparison of the power consumptions for the airflow vs. static pressure characteristics of the current and new models when both have equivalent maximum static pressure.

This graph compares the airflow vs. static pressure

characteristics when the rotational speed of the new model is reduced, and the maximum static pressures are equivalent for both the new and current models. It is evident that, overall, the new model has lower power consumption than the current model, and we have succeeded in reducing power consumption by 20% in the vicinity of maximum static pressure.

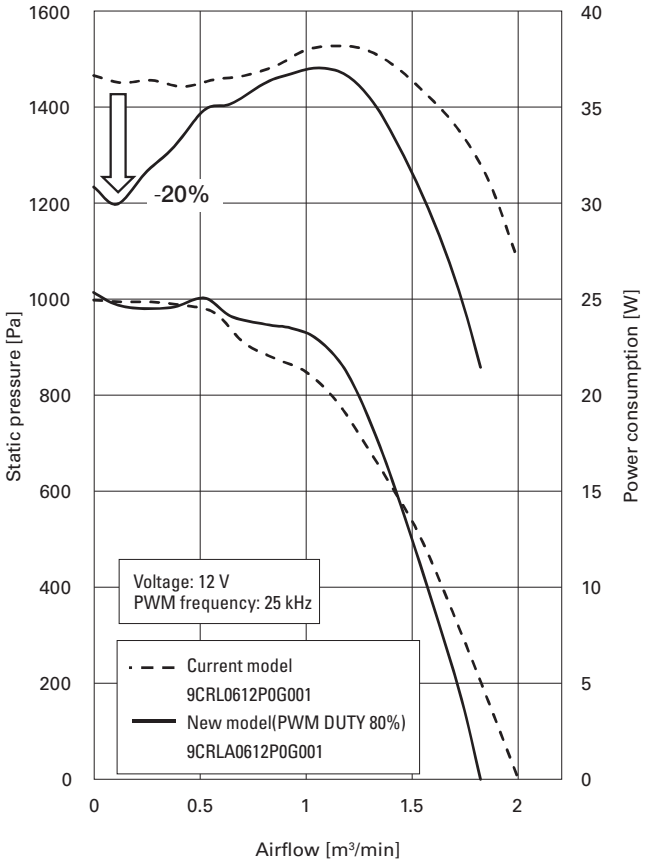

Fig. 7 Example of the airflow vs. static pressure characteristics (comparison with current model)

6. Conclusion

This article has introduced some of the features and performance of the 60 × 76 mm high static pressure long life counter rotating fan *San Ace 60L* 9CRLA type, developed by SANYO DENKI.

The new model offers longer service life at the same time as significantly higher static pressure.

As such, we believe it will significantly contribute to the cooling of high heat-generating, high-density equipment, for which demand will continue to increase.

SANYO DENKI wishes to continue developing products responding to market needs and offering products which contribute to creating new values for our customers.

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