92 × 92 × 38 mm *San Ace 92* 9RA Type Low Noise Fan

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1. Introduction

The 92 × 92 × 38 mm 9G type fan we released back in 2003 still remains in high demand for use in workstations, medical devices, and rack-mounted/blade servers. However, as the SDGs (sustainable development goals) have quickly become a shared agenda of the global community, the above-mentioned equipment is increasingly pursuing better performance in quietness and energy efficiency. Cooling fans, in particular, are required to offer both low noise and low power consumption. To meet this changing market demand, we have developed and launched the *San Ace 92* 9RA type Low Noise Fan featuring the same airflow vs. static pressure characteristics as the current 92 × 92 × 38 mm 9G type fan.

This article introduces the features and performance of this new product.

2. Product Features

Figure 1 shows the new product.

The new product has lower noise and lower power consumption than the current product while maintaining the same size and cooling performance.

Fig. 1 92 × 92 × 38 mm *San Ace 92* 9RA type

3. Product Overview

3.1 Dimensions

Figure 2 shows the dimensions of the new product. The new product was designed to be compatible with the current product in size and mounting.

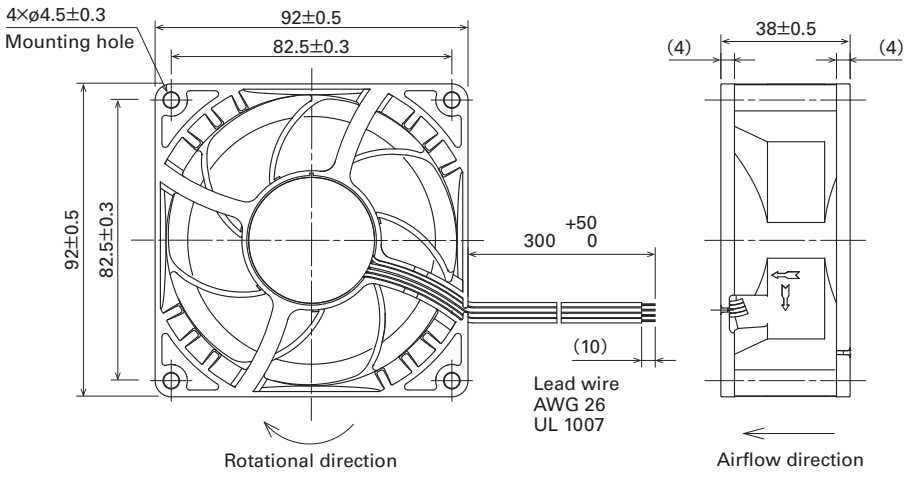


Fig. 2 Dimensions of the *San Ace 92* 9RA type (Unit: mm)

3.2 Specifications

3.2.1 General specifications

Tables 1 and 2 show the general specifications of the new product.

To support a wide range of markets and serve as a successor to the current product, we launched a lineup of models in three rated voltages of 12, 24, and 48 V and three high, medium, and low speeds.

3.2.2 Airflow vs. static pressure characteristics

Figure 3 shows the airflow vs. static pressure characteristics of the new product.

3.2.3 PWM control

The high-speed model and medium-speed model come with PWM control for controlling the fan speed.

Table 1 General specifications of the *San Ace 92* 9RA type with PWM control

Model no.	Rated voltage [V]	Operating voltage range [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$_2$O]	Sound pressure level [dB(A)]	Operating temperature range [°C]	Expected life [h]
9RA0912P1J001	12	10.8 to 13.2	100	1.24	14.9	6400	3.28	116	192	0.77	50	-20 to +70	40000 at 60°C (70000 at 40°C)
			20	0.07	0.8	1600	0.82	29	12.0	0.05	12		
9RA0912P1G001			100	0.96	11.5	5800	2.97	105	158	0.63	47		
			20	0.06	0.7	1400	0.72	25	9.2	0.04	10		
9RA0924P1J001	24	21.6 to 26.4	100	0.62	14.9	6400	3.28	116	192	0.77	50		
			20	0.07	1.7	2200	1.13	40	22.7	0.09	19		
9RA0924P1G001			100	0.48	11.5	5800	2.97	105	158	0.63	47		
			20	0.05	1.2	2000	1.02	36	18.8	0.08	17		
9RA0948P1J001	48	43.2 to 52.8	100	0.31	14.9	6400	3.28	116	192	0.77	50		
			20	0.03	1.4	2000	1.02	36	18.8	0.08	17		
9RA0948P1G001			100	0.25	12.0	5800	2.97	105	158	0.63	47		
			20	0.03	1.4	1700	0.87	31	13.6	0.05	13		

* The PWM input frequency is 25 kHz; the fan speed at 0% PWM duty cycle is 0 min^{-1}.
Note: The expected life at an ambient temperature of 40°C is for reference purposes only.

Table 2 General specifications of the *San Ace 92* 9RA type constant-speed models

Model no.	Rated voltage [V]	Operating voltage range [V]	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$_2$O]	Sound pressure level [dB(A)]	Operating temperature range [°C]	Expected life [h]
9RA0912J1001	12	7 to 13.2	1.24	14.9	6400	3.28	116	192	0.77	50	-20 to +70	40000 at 60°C (70000 at 40°C)
9RA0912G1001		7 to 13.8	0.96	11.5	5800	2.97	105	158	0.63	47		
9RA0912H1001		7 to 13.8	0.52	6.2	4650	2.36	83	102	0.41	40		
9RA0924J1001	24	14 to 26.4	0.62	14.9	6400	3.28	116	192	0.77	50		
9RA0924G1001		14 to 27.6	0.48	11.5	5800	2.97	105	158	0.63	47		
9RA0924H1001		14 to 27.6	0.26	6.2	4650	2.36	83	102	0.41	40		
9RA0948J1001	48	36 to 52.8	0.31	14.9	6400	3.28	116	192	0.77	50		
9RA0948G1001		36 to 55.2	0.25	12.0	5800	2.97	105	158	0.63	47		
9RA0948H1001		36 to 55.2	0.14	6.7	4650	2.36	83	102	0.41	40		

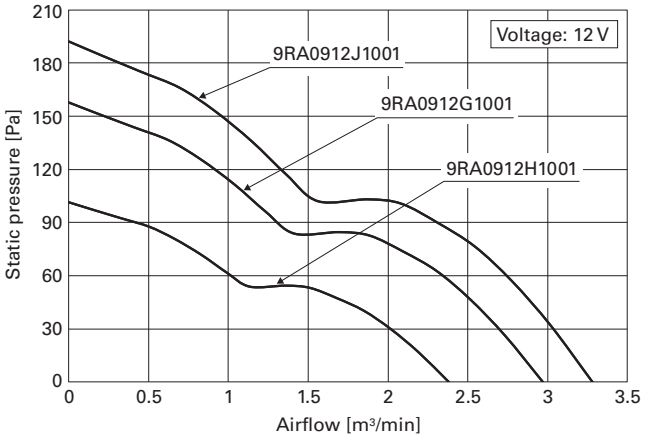


Fig. 3 Airflow vs. static pressure characteristics of the *San Ace 92* 9RA type

4. Key Points of Development

The new product achieves lower noise and lower power consumption than the current product while maintaining the same cooling performance.

The key points of development are described below.

4.1 Motor and circuit design

To reduce power consumption from the current product, the new product adopted a newly designed circuit, to which the high-efficiency bipolar drive was chosen over the unipolar drive used in the current product. Increasing the motor size is effective for reducing power consumption, but it makes noise reduction challenging. For this reason, we maintained the same motor size as the current product. We successfully reduced power consumption through the optimization of the motor output against the impeller load by increasing the motor winding fill factor.

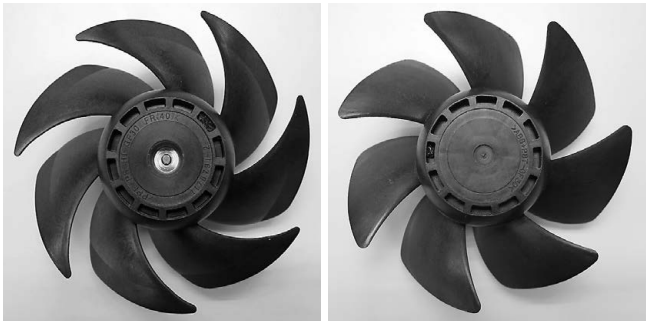
4.2 Impeller and frame design

Figure 4 compares the frame shapes, and Figure 5 compares the impeller shapes of the new and current products. Figure 6 shows an example of simulation-based sound source analysis.

While the current product has three spokes, the new product features four spokes for improved frame strength. However, adding spokes tends to increase the noise level. We have achieved lower noise and lower power consumption for the new product through simulation-based design optimization and evaluations on actual equipment by trying numerous combinations of parameters such as rotor hub diameter, impeller shape, number and mounting angle of blades, frame shape, and spoke shape and layout.

New product Current product

Fig. 4 Frame shape comparison of the new and current products



New product Current product

Fig. 5 Comparison of the impeller shape of the new and current products

Fig. 6 Simulation-based sound source analysis example

5. Comparison of New and Current Products

5.1 Comparison of the airflow vs. static pressure characteristics and noise levels between new and current models

Figure 7 compares the airflow vs. static pressure vs. power consumption characteristics and airflow vs. noise characteristics of the current product and the fastest model of the new product. The new product has achieved a 13% reduction in power consumption at the assumed operating point while maintaining the same airflow vs. static pressure

characteristics as the current product. The noise level has been reduced by 3 dB(A). This means that, if the noise level of the current product can be tolerated, the new product offers much higher cooling performance equivalent to two units of the current product.

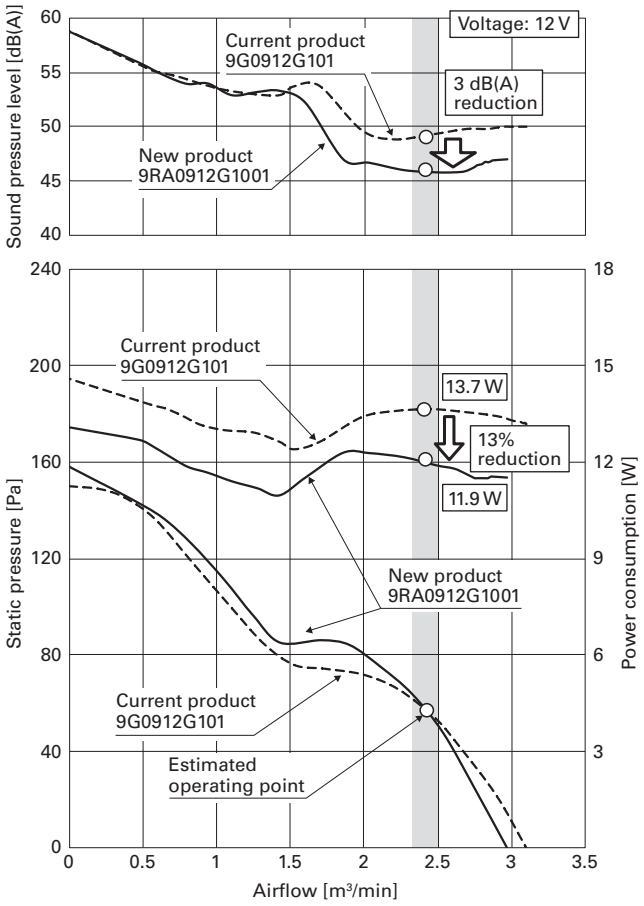


Fig. 7 Comparison of the *San Ace 92* new and current products

Figure 8 compares the CO_2 emissions of the new and current products over their life cycles.

The new product produces 13% less CO_2 emissions over its product life cycle compared to the current product, thanks to its reduced power consumption.

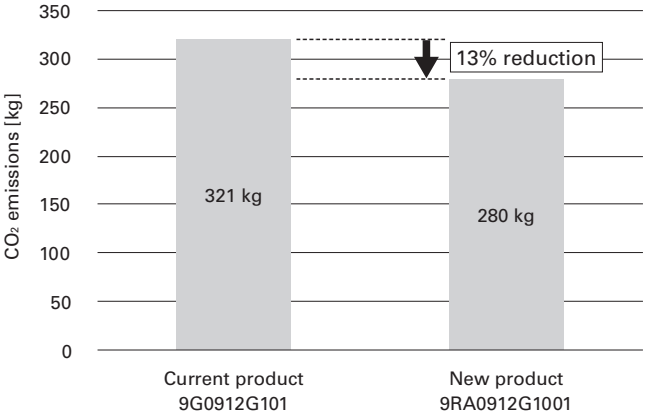


Fig. 8 CO_2 emissions comparison using our LCA calculation software (40,000 hours, when operated with the same operating airflow)

6. Conclusion

This article introduced the features and performance of the *San Ace 92* 9RA type.

The new product achieved lower noise and lower power consumption than the current product while maintaining the same cooling performance. This contributes to noise reduction and energy savings for equipment that is used near people, such as workstations, medical devices, and rack-mounted/blade servers.

We will continue developing products that promptly meet market demands to contribute to creating new value for our customers.

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