

“San Ace 40” Counter Rotating Fan

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1. Introduction

Recently, in electronic devices such as telecommunications-related equipment, the heating value increases remarkably along with improved performance and miniaturization of built-in parts. As the result, miniaturization of devices is also rapidly advancing and an electronic device becomes highly heated as density is increased.

In order to lower the heat, it is common to move air and heat. As heat increases, more air is necessary for cooling. Moreover, when the density of an electronic device increases as parts installed increases, the space where air flows inside of the case becomes small. To move and cool the air, a fan with high static pressure is needed.

In order to realize large air volume and high static pressure, there is a method called the counter rotating method that differs from a general single axial fan as an airflow method. Performance is enhanced by mutually rotating two moving blades in the counter direction.

This document introduces the outline of the fan motor “San Ace 40” duplicate contra-rotating fan that adopts the duplicate contra-rotating method.

2. Background Of The Development

There is a high demand for the 40 mm type fan for 1U server cooling applications. Many customers are requesting larger air volumes and higher static pressures from these products.

SANYO DENKI has previously developed and marketed a product with top-class cooling capacity in the 40 mm sq. x 28 mm fan class.

Two or more fans are sometimes needed when using 40 mm sq. x 28 mm thickness fans to cool a 1U server. Recently, one server manufacturer demanded a fan that has larger air volumes and higher static pressure to match the higher performance of their servers.

However, achieving the air volume and the static pressure level that satisfies the customer’s requirements was difficult with the current class of 40 mm sq. by 28 mm thickness axial fan.

As a manufacturer of fans, SANYO DENKI decided that the development of a fan that greatly exceeds the performance of the existing fans was urgently needed, considering high heats and high density in accordance with the further enhancement of 1U servers in the future (faster microprocessors, larger power supplies and larger capacity of hard disks).

Thus the “San Ace 40” counter rotating fan of 40 mm sq. x 56 mm thickness was developed and SANYO DENKI applied the dual counter-rotating method which has been used for the ventilation of tunnels, and on aircraft, helicopters, ships, etc.

3. Features Of The Product

Fig.1 shows the “San Ace 40” counter rotating fan.



Fig.1 “San Ace 40” Counter Rotating Fan

The characteristics of this product are as follows:

- (1) Large air volume, high static pressure
- (2) Low noise
- (3) Low power consumption
- (4) Best for 1U rack (height 44-45)

The wing and the frame of the "San Ace 40" dual counter-rotating fan (hereafter, it is called the developed product) were newly designed and have achieved a large air volume, high static pressure and a low noise. Moreover, the drive circuit was redesigned, and the power consumption was optimized.

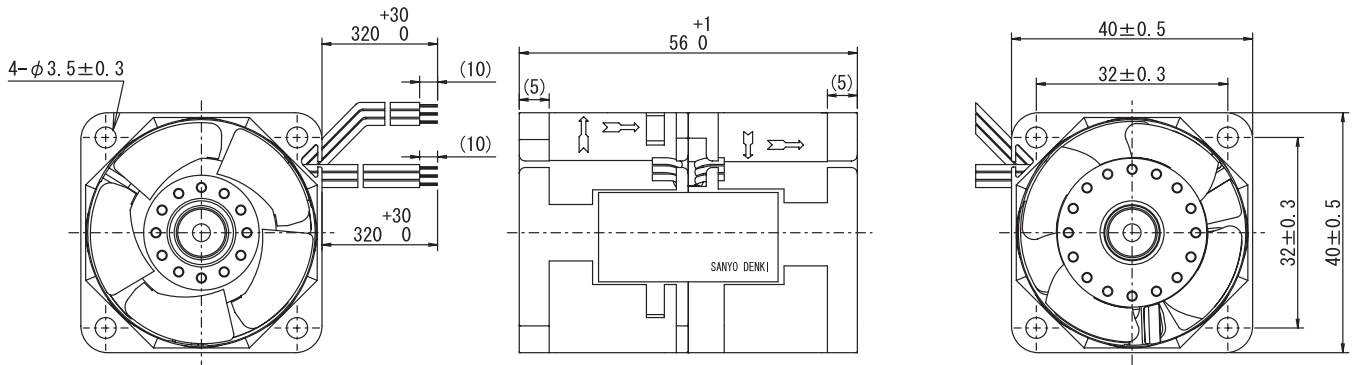


Fig.2 Size Specifications of "San Ace 40" Counter Rotating Fan

Table 1 General Characteristics of "San Ace 40" Counter Rotating Fan

Model No.	Rated Voltage	Operating Voltage Range	Rated Current	Rated Input	Rated Rotating Speed		Max. Air Volume		Max. Static Pressure		Sound Pressure Level				
	V				V	A	W	min ⁻¹		m ³ /min		CFM	Pa	inchH ₂ O	dB(A)
								INLET FAN	OUTLET FAN						
9CR0412H501	12	10.8 13.2	0.72	8.64	13300	9300	0.59	20.8	320	1.28	54				
9CR0412S501			1.1	13.2	15800	10600	0.7	24.7	450	1.8	57.5				

4. Outline Of The Product

4.1 Size Specifications

As for the appearance, this fan looks like two 40 mm sq. x 28 mm thickness fans attached together. Designed for 1U rack cabinet applications, the fan main body and lead lines are constructed so that they do not interfere with each other.

Fig.2 shows the size specifications of the developed product.

4.2 Characteristics

4.2.1 General Characteristics

12V operation was selected based on the requirements for 1U servers.

Table 1 shows general characteristics of the developed product.

4.2.2 Air Volume vs. Static Pressure

Unlike the general characteristic of the air volume versus static pressure of an axial flow fan, there is no depressed area of the static pressure in the central part of the characteristic curve.

Fig.3 shows the air volume versus static pressure of the developed product.

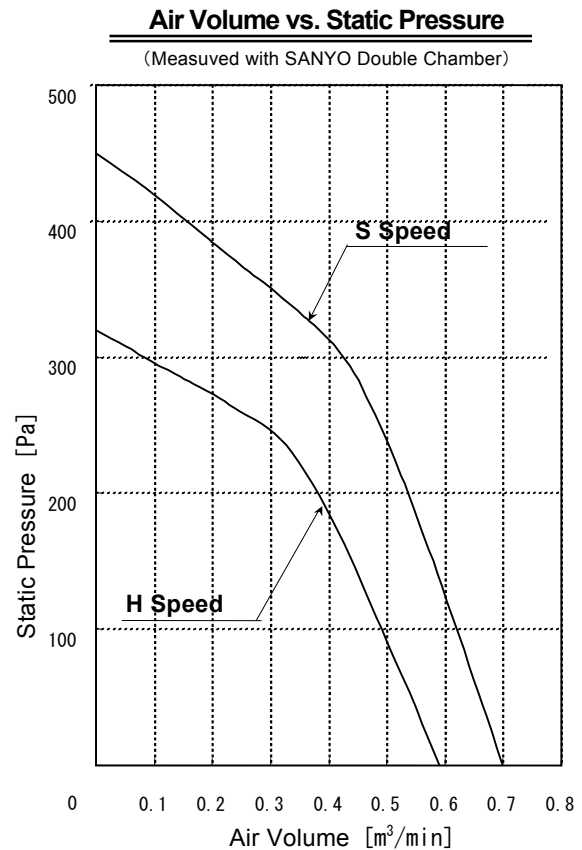


Fig.3 Air Volume vs. Static Pressure of "San Ace 40" Counter Rotating Fan

Table 2 Characteristic Comparison of the developed product and 40mm sq. x 28mm thickness largest air volume product 109P0412K3023

Model No.	Max Air Volume	Max Static Pressure	Current Value	Power Consumption	Sound Pressure Level
	(m ³ /min)	(Pa)	(A)	(W)	(dB[A])
109P0412K3023 Single	0.59	340	0.55	6.6	50
109P0412K3023 2 Series	0.64	470	0.9	10.8	60
9CR0412H502	0.59	320	0.72	8.64	54
9CR0412S502	0.7	450	1.1	13.2	57.5

*109P0412K3023 The value of the two series is measured by SANYO.

*The sound pressure level is measured 1m from the fan intake side.

5. Comparison with the Conventional Product

5.1 Comparison with General Axial Flow Fan

The characteristic of the product is different from that of a general axial flow fan.

Table 2 shows the general characteristics of the SANYO DENKI fan with the largest air volume of the 40 mm sq. x 28 mm class fans (hereafter, it is called 109P0412K3023). Fig. 4 compares the air volume and static pressure of the developed product (H speed) and the existing 109P0412K3023.

Though the maximum air volume and the maximum static pressure of 109P0412K3023 are about equal to the H speed of the developed product, as for the aerodynamic performance, the counter rotating fan excels, mainly because there is no depressed area of static pressure in the central part of the curve.

5.2 Comparison with Series of the Two Axial Flow Fans

The developed product and 109P0412K3023 are connected in series based on an actual use example provided by the server manufacturer and the performance is compared.

The values in this document of the two series of 109P0412K3023 were measured by SANYO DENKI.

5.2.1 Large Air Volume and High Static Pressure

If the air volume versus static pressure is compared when the developed product and 109P0412K3023 are connected in series, maximum air volume of the S speed of the developed product is about equal to the series and the maximum static pressure increases about 10% (refer to Table 2).

When the system impedance (load) like Fig. 5 is assumed as a condition based on actual use, the developed product increases air volume about 20% at S speed (from about 0.41 m³/min from to 0.49 m³/min increase) and increases static pressure about 40%.

Moreover, H speed of the product has an equal, aerodynamic characteristic, although it is below in the maximum air volume and the maximum static pressure in the assumed system impedance.

Large Air Volume vs. Static Pressure

(by SANYO Load Noise Measuring Trnstrment)

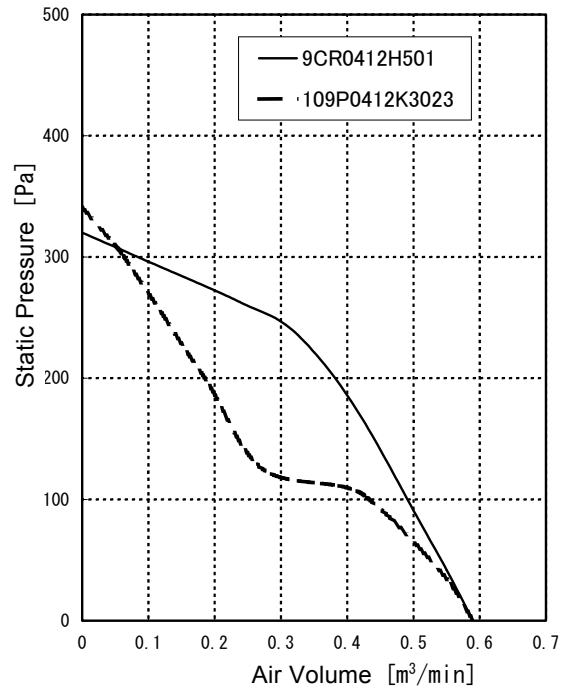


Fig.4 Air Volume vs. Static Pressure of Developed Product (H Speed) and 109P0412K3023

5.2.2 Low Noise

Compared with sound pressure level of the two series of 109P0412K3023, although the maximum air volume of the S speed of the developed product increases by about 10%, the sound pressure level decreases by 2.5dB[A] (refer to Table 2).

Moreover, the equal cooling performance of the two series of 109P0412K3023 is maintained for the H speed of the developed product when the system impedance like Fig. 5 is assumed, and the load noise at that time is decreased by about 8dB[A].

Air Volume vs. Static Pressure, Sound Pressure Level

(by SANYO Load Noise Measuring Instrument)

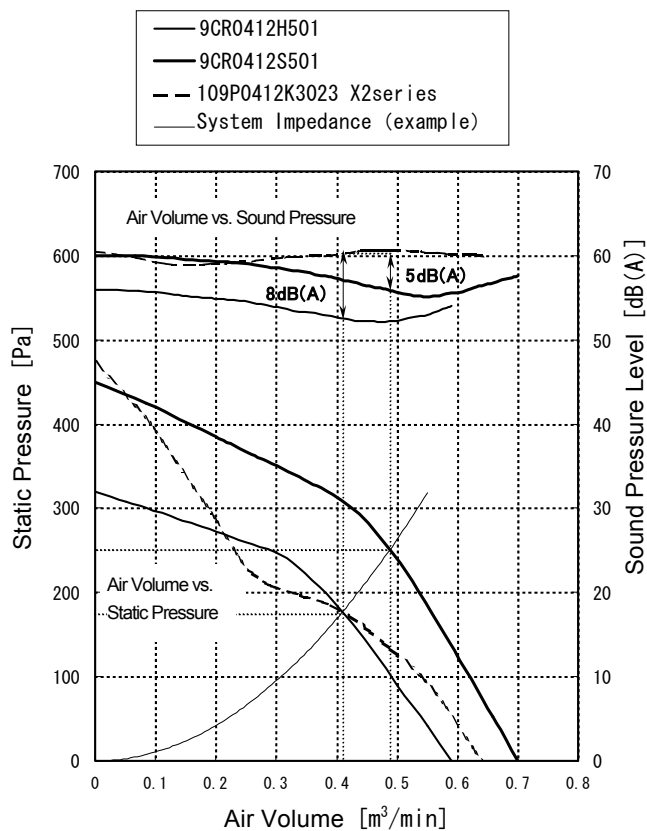


Fig.5 Air Volume vs. Static Pressure, Sound Pressure Level of Developed,
40sq. X 28 thick Largest Air Volume Product (2 Series)

At “S speed” the developed product moves a larger volume of air compared with the two series of 109P0412K3023. It can also provide the air volume of an equal level or more across the entire range. Moreover, as for noise load, the developed product has an equal level or decreases about 6dB[A] at maximum. For example, compared with two 109P0412K3023 series when system impedance like Fig.5 is assumed, the noise load decreases about 5dB[A], although the operational air volume increases by about 20% and the operation static pressure increases by about 40%.

5.2.3 Low Power Consumption

As previously mentioned, the cooling performance of two series of 109P0412K3023 and H speed of the developed product is about equal under the conditions of the assumed load. When the power consumption is compared, the developed product requires 20% less power than the two series of 109P0412K3023 (refer to Table 2).

6. Conclusion

This document introduces the features and performance of the newly developed “San Ace 40” counter rotating fan.

This developed product is a fan with aerodynamics that could not be achieved by a general axial flow fan. It is an exciting offering to the 1U server market where heating values will increase and the density will rise in the future.

Moreover, it is possible to contribute to miniaturization and high efficiency not only for the 1U server but also for other electronic devices.



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