生細胞観察に求められる機能を網羅。

- 生細胞へのダメージを低減
  波長を連続的に切り換えるモノクロメーター
  高感度冷却CCDカメラを採用し、励起光の影響を抑えた細胞観察を実現。

- 細胞内のダイナミックな動きを確実に撮影
  ピーコンフォーカス制御により、高再現性画像を高速に取得。

- 生細胞観察の最適環境
  保温チャンバー、ステージングキュベータを標準装備し、
  生体環境に近い温度（37℃）、湿度、CO2濃度を維持。

高速三次元蛍光タイムラプスイメージングシステム
ライカ AS MDW
Low-Vibration Fan “San Ace 40”

Toshiyuki Nakamura  Toshiki Ogawara  Katsumichi Ishihara  Toshiki Kobayashi

1. Introduction

With telecommunication equipments such as servers, the trend to create smaller and higher performance devices means that the amount of heat produced has increased rapidly and higher performance cooling fans are required. The rotating speed for the fans becomes faster every year, this has resulted in an increasing number of cases where the vibrations become a problem. More specifically, this causes an increase in reading errors and similar problems on the hard disk built into the device. The manufacturers must take many steps to solve these problems, such as creating stronger devices, insulating against vibrations by using vibration-proof materials, or by controlling the speed of the cooling fan.

Against this background, our company has developed a product that reduces the load for the vibration proofing used on a device while achieving the same cooling performance as the conventional model.

Two types of low-vibration fans were developed: a 40 mm sq., 28 mm thick fan and a 40 mm sq., 56 mm thick counter rotating fan are suitable for mounting on a 1U server.

This document introduces the features and performance of the “San Ace 40” low-vibration fan (both the 40 mm sq., 28 mm thick GE type and the 40 mm sq., 56 mm thick CRE type).

2. Background to Development

In conventional products, the method for reducing vibrations on the fan has involved making the amount of unbalance on the rotating blades as small as possible. However, customers have begun demanding even lower vibrations, and it became apparent that the conventional method could not meet the low-vibration abilities demanded by the customers.

In order to vastly reduce vibrations while keeping large air flow and high static pressure characteristics, this fan was developed by using a variety of low-vibration methods such as reducing the unbalance even further, improving the motor driving circuit, and increasing the stiffness of the frame.

During the development, the conventional method of reducing the unbalance was still employed, but by increasing the precision used for machining and assembling the parts, the unbalance was able to be reduced even further.

By using a soft-switching drive for the circuit used within the fan motor, the motor vibrations could be reduced.

Furthermore, a variety of materials were selected to increase the frame stiffness, and each material was tested in order to compare the ability of the materials to lower the vibrations. As a result, aluminum was selected for overall excellence, including an improvement in productivity. In the conventional product, it was difficult to produce an aluminum frame for a 40 mm sq. fan due to the small size, but during the development of this fan, changes to the shape of the frame and other such adjustments were made in order to make the frames easier to mass produce.

This newly developed product draws on these methods to reduce vibrations in order to reduce the exciting force that causes vibrations and prevent those vibrations from being transmitted externally. These successful improvements achieve a vast reduction in vibrations.

3. Features of the “San Ace 40”
Low-Vibration Fan

Fig. 1 shows a photograph of the “San Ace 40” low-vibration fan (hereinafter referred to as “the developed product”).

Fig. 1: Low-vibration fan “San Ace 40”
40 mm sq., 28 mm thick fan (left) and 40 mm sq., 56 mm thick counter rotating fan (right)
The features of the developed product are as follows:

(1) Low-vibrations
(2) Large air flow and high static pressure
(3) PWM control function

The developed products (40 mm sq., 28 mm thick fan and 40 mm sq., 56 mm thick counter rotating fan) achieve 50% less vibration compared to conventional products (9GV0412J30I, 9CRE0412JP50I) of the same size while achieving top class cooling performances. Also, the PWM control function supports speed control.

4. Product Overview

4.1 Dimensions

Fig. 2-1. shows the dimensions of the 40 mm sq., 28 mm thick GE type, while Fig. 2-2. shows the dimensions of the 40 mm sq., 56 mm thick CRE type.

4.2 Characteristics

4.2.1 General characteristics

Both the 40 mm sq., 28 mm thick GE type and the 40 mm sq., 56 mm thick CRE type have a rated voltage of DC 12 V and a rated rotating speed of J speed, and both products also come with PWM control function.

Tables 1-1 and 1-2 show the general characteristics for the developed product. The characteristics tables show values when PWM control is using maximum speed (DUTY: 100%) and the minimum speed (DUTY: 0%).

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**Table 1-1: 40 mm sq., 28 mm thick GE type general characteristics**

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<tbody>
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<td>9GE0412P3J03</td>
<td>12</td>
<td>10.8 ~ 13.2</td>
<td>100</td>
<td>0.65</td>
<td>7.8</td>
<td>15,000</td>
<td>0.69</td>
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<td></td>
<td>0</td>
<td>0.05</td>
<td>0.6</td>
<td>2,650</td>
<td>0.12</td>
<td>4.2</td>
<td>10.7</td>
<td>0.042</td>
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</tbody>
</table>

*1 Input PWM frequency: 25 kHz

**Table 1-2: 40 mm sq., 56 mm thick CRE type general characteristics**

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<td>9CRE0412P5J03</td>
<td>12</td>
<td>10.8 ~ 13.2</td>
<td>100</td>
<td>1.4</td>
<td>16.8</td>
<td>15,800 / 12,200</td>
<td>0.9</td>
<td>31.8</td>
<td>570</td>
<td>2.29</td>
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<tr>
<td></td>
<td></td>
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<td>0</td>
<td>0.1</td>
<td>1.2</td>
<td>2,850 / 2,250</td>
<td>0.12</td>
<td>4.2</td>
<td>13.7</td>
<td>0.055</td>
</tr>
</tbody>
</table>

*1 Input PWM frequency: 25 kHz
4.2.2 Air flow vs. static pressure characteristics

Figs. 3-1 and 3-2 show the air flow versus static pressure characteristics for the developed product.

4.3 Life expectancy

The developed product has an expected life of 40,000 hours at 60°C (survival rate of 90% with continuous operation at the rated voltage under free air conditions and at normal humidity).

5. Functional Comparison with Conventional Models

The developed products achieve drastic reduction in the vibrations while retaining large air flow and high static pressure by reducing the unbalance in the blades, improving the motor driving circuit, and increasing the stiffness of the frame.

The following information introduces the differences between the conventional 40 mm sq., 28 mm thick fan (9GV0412J301) and 40 mm sq., 56 mm thick counter rotating fan (9CRA0412J501).

5.1 Low vibration

Fig. 4-1 shows examples of the rotating speed versus vibration characteristic for the 40 mm sq., 28 mm thick fan, while Fig. 4-2 shows examples of the rotating speed versus vibration characteristic for the 40 mm sq., 56 mm thick counter rotating fan (each compares the developed product to the conventional product).

Comparing the vibration acceleration for the developed product and the conventional product, when operating at the rated rotating speed, the vibration acceleration is 50% lower for the developed product compared to the conventional product. Also, the variation of the maximum and minimum values is about half compared to the conventional product.
6. Conclusion

This document introduced some of the features and abilities of the newly developed “San Ace 40” low-vibration fan.

This developed product has drastically reduced vibrations compared to the conventional products (9GV0412J301, 9CRA0412J501) while maintaining large air flow and high static pressure. By providing large air flow and high static pressure as well as the low-vibration characteristics, this product can reduce customers’ load in terms of vibration proofing for equipment such as 1U server devices with high packing density. These developments should make a large contribution to low vibration on other electronic equipments.

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