Technology Supporting Globalization of Fans

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1. Introduction

Across the markets of the world, there are a vast number of customers who use fans. There are many applications for which these fans are used and the required specifications for fan become more and more diverse.

As a designer, manufacturer and seller of fans, Sanyo Denki must accurately understand these market requirements, in other words "What kind of fan do customers need now?" and "What kind of fans will customers need in the future?", then carry out product development to suit.

Sanyo Denki has sales locations around the world. At our sales locations, we vitalize sales activities, collect customer requests and proactively provide technical support with the aim to become "Global Sanyo Denki".

Moreover, we have fan design departments in both Japan and the Philippines and we are constantly developing new fan technology so that we can sensitively offer new products to the world market.

With a focus on the technology adopted in the "San Ace 60W/80W/92W" 9WL types (hereinafter "new model") which is a high airflow, long life, splash proof fan with better cooling performance, longer life and higher reliability, here we introduce fan technologies which support to the requirements of customers in various markets.

We would like you to see the new product introduction section regarding the details of the new model.

Fig. 1: Appearance of new model (example)
(San Ace 80W 9WL type)

2. Key things for Using Fans as Common Specification

The new model was designed with the purpose of making it possible to use as common specifications which conform to the operation environments and operating conditions of our various customers around the world.

The key things to accomplish this are as follows;

(1) High environment-resistance and long life.

(2) Possessing the cooling performance customers require.

These two things are discussed in detail below.

3. Support to Environment-Resistance and Long Life

In order to develop a fan with high environment resistance and long life, it is particularly necessary to protect the fan from effects of the external environment.

That is why we have adopted a technology to protect the parts which are affected from outside.

3.1 Coating on the frame

The aluminum frame is used for the new model.

In order to improve environmental-resistance, it is essential to protect the surface of the aluminum frame.

By applying a coat to the surface of the developed frames, we were able to improve corrosion resistance and protect the fans from corrosion caused by effects of the external environment such as the rust which occurs on the frame surface, etc.

Fig. 2: No coating on the frame

Fig. 3: Coating on the frame (New model)

3.2 Coating on the motor part (Conductor part)

The motor part (conductor part) was covered in resin material and a technology to protect the motor part itself was adopted.

Fig. 4: Coating of the conductor part

In order to adopt this technology, it was necessary to address the issue of suppressing motor heat generation.

In general, the motor is self-heating. When the input electrical energy is converted to rotational energy, not all of the energy is converted. The energy which is not converted becomes thermal energy and the heat generated from the motor.

Moreover, because the motor part is covered in resin material, it is difficult for the generated heat to dissipate.

In order to solve this problem, the new model adopted a high-efficiency motor. This motor was optimized to suit the new model based on the 9LG type motor which was developed with the aim of extending life.

This motor has been optimized with the below technologies for improving motor efficiency.

(1) Bipolar drive adopted as the drive system.
(2) Stator shape modified to have higher torque and winding space factor.

We would like you to refer to Technical Report 36 for details regarding these technologies.

By adopting this motor, it is now possible to minimize motor heat generation and suppress the increase in temperature of the ball bearing which is in correlation with the motor heat generation.

Through the above technologies, we were able to resolve the motor heat generation issue and develop a long life product with high environment-resistance.

4. Cooling Performance Customers Need (PWM Control)

We have adopted technology to control fan speed in order to achieve the necessary cooling performance when our customers' equipment requires the use of fans.

Currently, speed can be controlled on the following types of fans; 2 speed fan, thermally speed controlled fan, voltage control fan and PWM control fan.

Of these, it is possible to arbitrarily change the speed of PWM control used on the PWM control fan, making it the best control method for our customers around the world to use our fans with efficiency, hence supporting the globalization of fans.

Details of PWM control are as follows;

PWM is an abbreviation for "Pulse Width Modulation".

This is a method of controlling speed by converting the pulse width supplied as a control signal.

Fig. 5 gives an example of the actual signal input.

As the waveform input in order to enable control, there is a pulse signal which turns on and off repeatedly at a fixed interval.

By changing the on and off ratio arbitrarily, it is possible to change the speed set as a ratio.

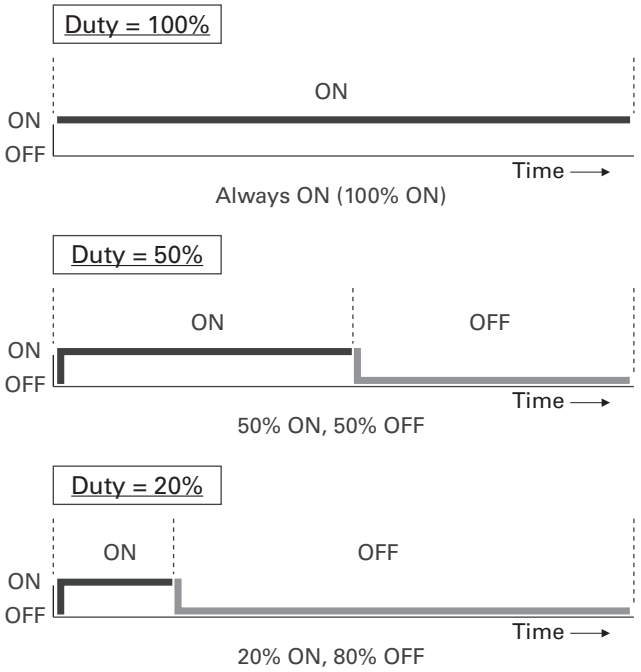

Fig. 5: Example of a PWM control input wave form

The PWM control method offers the following advantages.

(1) Speed can be linearly controlled in relation to the input PWM signal.
(2) If the PWM signal varies, fan speed is changed in a short period of time.
(3) Higher motor efficiency compared to other speed control methods, therefore power consumption is low.
(4) PWM signal can be set so that 0% duty operation is to stop the fan or rotate at low speed, etc.
(5) The speed in relation to the input PWM signal can be customized to suit the customers requirements.

Fig. 6 shows an "example of PWM duty cycle vs. speed curve in the case of stopping", while Fig. 7 shows an "example of PWM duty cycle vs. speed curve in the case of low-speed". (Reference example: 92 mm sq., 25 mm thick 9GA type)

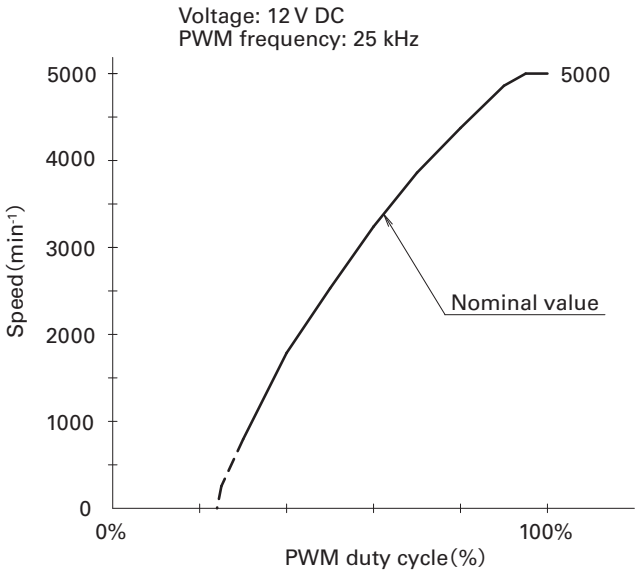

Fig. 6: PWM duty cycle vs. Speed curve
Specification for stopping at 0% duty input

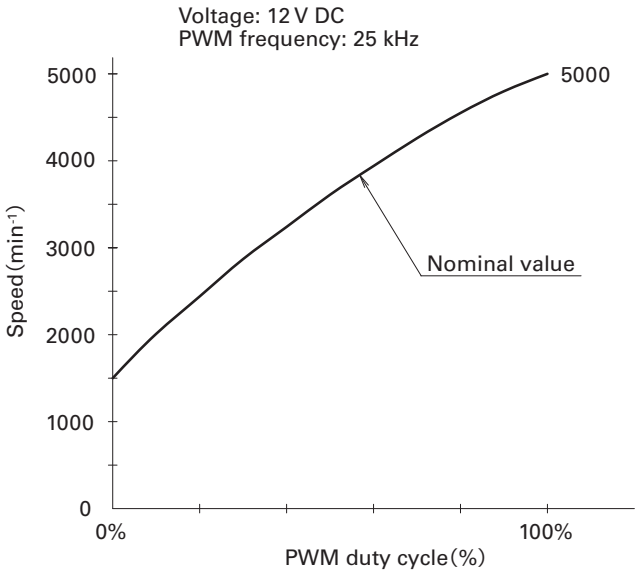

Fig. 7: PWM duty cycle vs. Speed curve
Specification for low-speed
at 0% duty input

PWM control fans only convert the input PWM signal and customers are able to set the speed themselves and drive the fan with the necessary airflow when needed. Furthermore, because there is an option to stop the fan when it is not required, the customer is able to choose the optimal performance with only one fan.

As a technology supporting globalization, PWM control contributes significantly to the reduction of power consumption and low sound pressure level.

5. Conclusion

Using the example of the ”San Ace 60W/80W/92W” 9WL type developed and commercialized by Sanyo Denki as high airflow, long life, splash proof fan, we introduced technologies which support globalization and targets customers in various markets.

We will continue to pursue fan technology required by customers through accurately understanding the requirements of the ever-changing world market and we are aware we must continue to possess the technological capability recognized by our customers.

We will utilize this technology to develop and expand new products which are recognized around the world.

Reference

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