

Wide Temperature Range Fan “San Ace T” Series 9GT Type

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1. Introduction

In recent years, photovoltaic power generation, electric vehicles, etc. have spread rapidly from the perspective of global environmental protection and are used in various regions around the world. For this reason, there is a growing requirement to expand the operating temperature range of fans to support both low and high temperatures.

In order to respond to this requirement, Sanyo Denki developed 6 new models able to operate within a wide temperature range. This document introduces the features of the newly developed “San Ace T” series 9GT type and the abilities for each size.

2. Background of the Development

In line with the globalization of various industrial fields, fans are now required to operate under severe temperatures, from extremely low to extremely high. Amongst this, fans must support a wide operating temperature range as the ambient temperature differs depending on the region in which inverters for photovoltaic power generation, EV quick chargers, etc. are installed.

Moreover, in low temperature environments such as refrigerating/freezing devices for businesses and showcases, fans for the purpose of air circulation are required.

As it was not possible to meet these requirements using Sanyo Denki’s existing fans with a standard operating temperature range of -20°C to $+70^{\circ}\text{C}$, we developed and commercialized 6 models of the wide temperature range fan “San Ace T” series 9GT type (hereinafter referred to as “new models”) which guarantee an operating temperature range of -40°C to $+85^{\circ}\text{C}$.

3. Product Features

The features of the developed product are as follows:

- (1) Wide operating temperature range: -40°C to $+85^{\circ}\text{C}$
- (2) Expected life of 40,000 hours at 85°C
- (3) High airflow
- (4) PWM control function

Fig. 1 shows the external views of the 6 new models.

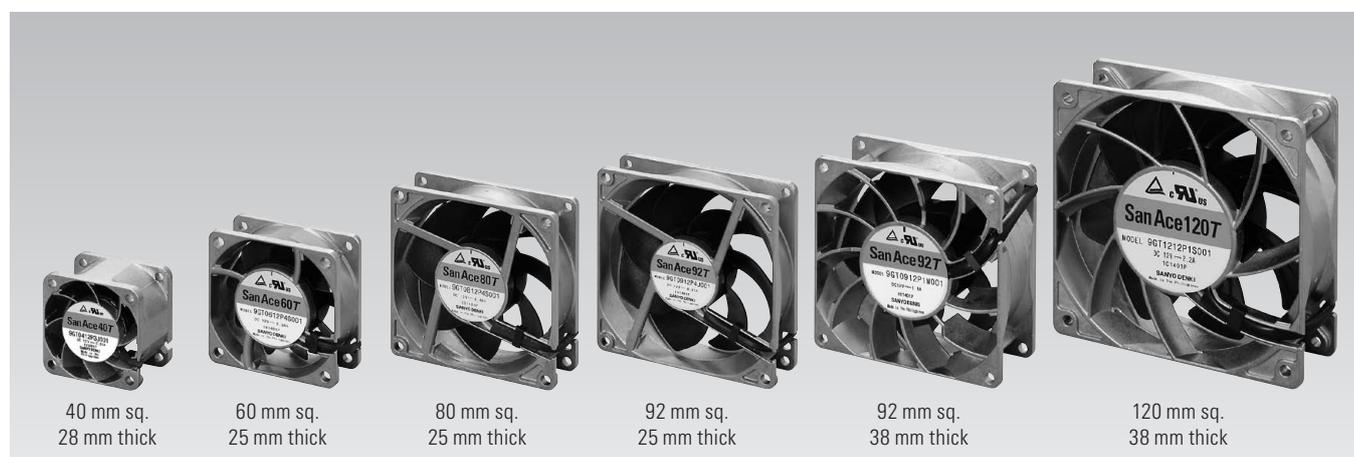


Fig. 1: External views of the 6 “San Ace T” 9GT type models

4. Outline of the New Models

4.1 Dimensions

The new models have compatibility with conventional models in regards to the external size of the fan, mounting hole dimensions and so on.

4.2 Operating temperature range

Compared to conventional models, the new models have a wide operating temperature range from -40°C to +85°C, supporting both low temperatures and high temperatures.

4.3 Characteristics

4.3.1 General characteristics

The rated voltages of the new models are 12 V DC and 24 V DC.

Table 1 shows the general characteristics of 6 new models with 12 model numbers.

4.3.2 Airflow vs. static pressure characteristics

Figures 2, 3, 4, 5, 6 and 7 respectively show the airflow vs. static pressure characteristics of the 6 new models under PWM speed control.

4.3.3 PWM control function

All 6 new models have a PWM control feature which enables speed control.

Table 1: General characteristics of the new model "San Ace T"

Model No.	Rated voltage [V]	Operating voltage [V]	PWM Duty cycle [%]	Rated current [A]	Rated input [W]	Rated speed [min ⁻¹]	Max. airflow		Max. static pressure		SPL [dB(A)]	Operating temperature range [°C]	Expected life [h]
							[m ³ /min]	[CFM]	[Pa]	[inchH ₂ O]			
9GT0412P3J001	12	10.2 to 13.8	100	0.31	3.72	11700	0.52	18.4	206	0.827	48	-40 to +85	40000/85°C
			30	0.08	0.96	4100	0.18	6.36	25.2	0.100	21		
9GT0424P3J001	24	20.4 to 27.6	100	0.15	3.60	11700	0.52	18.4	206	0.827	48		
			30	0.05	1.20	4100	0.18	6.36	25.2	0.100	21		
9GT0612P4G001	12	10.2 to 13.8	100	0.56	6.72	10000	1.26	44.5	243	0.97	52	-40 to +85	40000/85°C
			30	0.11	1.32	4100	0.52	18.3	42.8	0.17	25		
9GT0624P4G001	24	20.4 to 27.6	100	0.28	6.72	10000	1.26	44.5	243	0.97	52		
			30	0.06	1.44	4100	0.52	18.3	42.8	0.17	25		
9GT0812P4S001	12	10.2 to 13.8	100	0.46	5.52	6700	1.86	65.7	143	0.57	46	-40 to +85	40000/85°C
			30	0.09	1.08	2650	0.73	25.7	22.3	0.08	26		
9GT0824P4S001	24	20.4 to 27.6	100	0.22	5.28	6700	1.86	65.7	143	0.57	46		
			30	0.05	1.20	2650	0.73	25.7	22.3	0.08	26		
9GT0912P4J001	12	10.2 to 13.8	100	0.42	5.04	5000	2.20	77.7	105	0.42	44	-40 to +85	40000/85°C
			30	0.07	0.84	1850	0.81	28.7	14.3	0.05	18		
9GT0924P4J001	24	20.4 to 27.6	100	0.21	5.04	5000	2.20	77.7	105	0.42	44		
			30	0.05	1.20	1850	0.81	28.7	14.3	0.05	18		
9GT0912P1M001	12	10.2 to 13.8	100	1.50	18.00	8100	3.30	116.6	315	1.26	58	-40 to +85	40000/85°C
			30	0.30	3.60	3750	1.50	53.0	72.0	0.29	37		
9GT0924P1M001	24	20.4 to 27.6	100	0.75	18.00	8100	3.30	116.6	315	1.26	58		
			30	0.15	3.60	3750	1.50	53.0	72.0	0.29	37		
9GT1212P1S001	12	9.0 to 13.8	100	2.2	26.4	5600	6.00	211.8	270	1.08	58	-40 to +85	40000/85°C
			35	0.48	5.76	2900	3.00	106.0	85.6	0.34	41		
9GT1224P1S001	24	18.0 to 27.6	100	1.1	26.4	5600	6.00	211.8	270	1.08	58		
			35	0.24	5.76	2900	3.00	106.0	85.6	0.34	41		

Note: Speed is 0 min⁻¹ at 0% PWM duty cycle

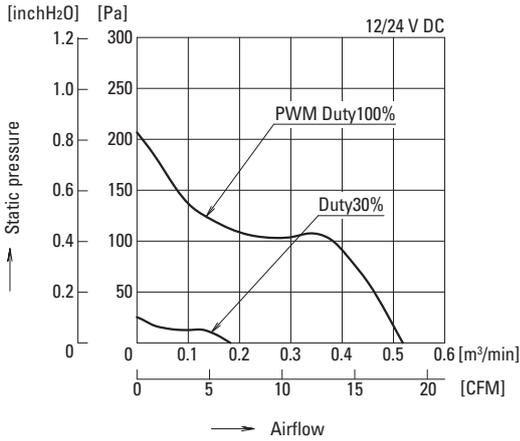


Fig. 2: 40 mm sq. 28 mm thick "San Ace 40T" airflow vs. static pressure characteristics

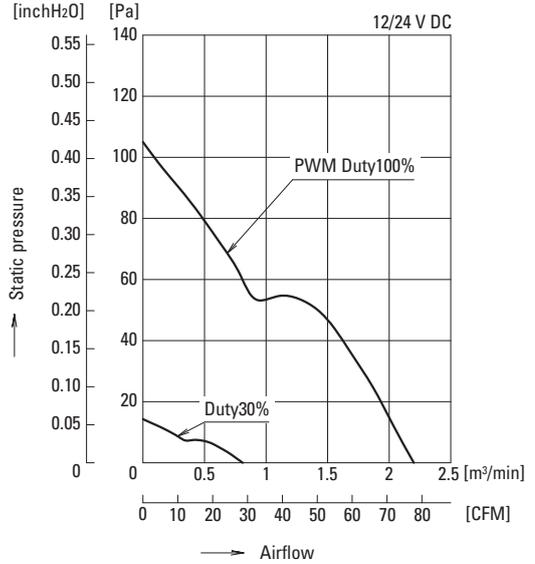


Fig. 5: 92 mm sq. 25 mm thick "San Ace 92T" airflow vs. static pressure characteristics

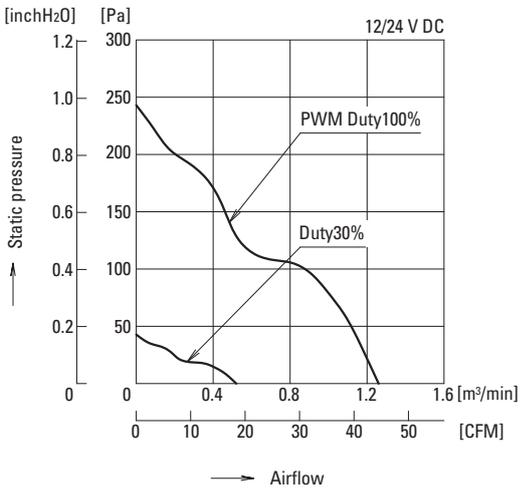


Fig. 3: 60 mm sq. 25 mm thick "San Ace 60T" airflow vs. static pressure characteristics

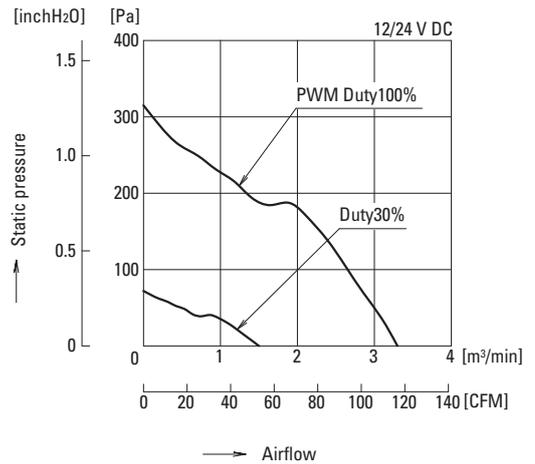


Fig. 6: 92 mm sq. 38 mm thick "San Ace 92T" airflow vs. static pressure characteristics

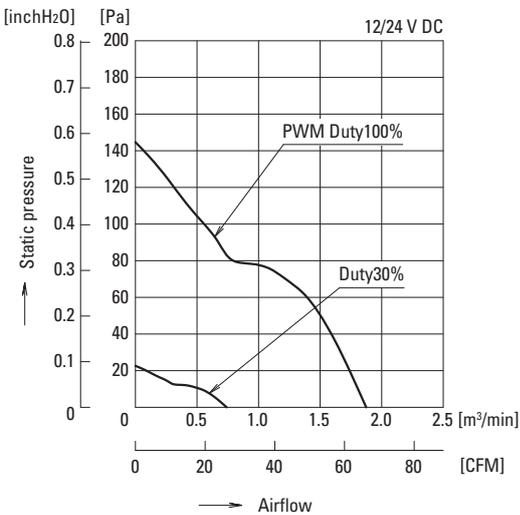


Fig. 4: 80 mm sq. 25 mm thick "San Ace 80T" airflow vs. static pressure characteristics

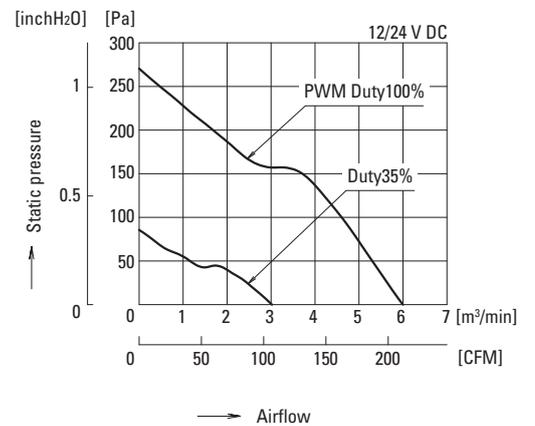


Fig. 7: 120 mm sq. 38 mm thick "San Ace 120T" airflow vs. static pressure characteristics

5. Points of the New Models

5.1 Difference in operating temperature range of conventional models

Table 2 shows the operating temperature ranges of the conventional models and new models.

Table 2: Operating temperature range of conventional models and new models

	Operating temperature	
	Lower limit [°C]	Upper limit [°C]
New model	-40	+85
Conventional model	-20	+70

Compared to conventional models, the new models have an expanded operating temperature range -20°C on the low temperature side and +15°C on the high temperature side.

5.2 Ideas of the development

In order to achieve an operating temperature range of -40°C to +85°C, which is wider than that of conventional models (-20°C to +70°C) the new models were designed with emphasis placed on the following two points.

- (1) Structure
- (2) Part selection

5.2.1 Structure

In the development process, aluminum frames were adopted for all of the models, so that sufficient reliability could be obtained to enable a wide temperature range with an upper limit of +85°C and a lower limit of -40°C. Moreover, in order to guarantee a reliability equivalent to conventional models while expanding the operating temperature range, we conducted stringent reliability assessment tests and studied which structures had durability across wide temperature variation.

5.2.2 Part selection

We revised the operating temperature of each fan part (impeller, magnet, bearing, electronic components, lead wires, etc.) and selected parts/components able to sufficiently satisfy the range of -40°C to +85°C.

There is a difference between characteristics of bearings for low temperature and high temperature, therefore we conducted repeated experiments at the actual temperatures and adopted a bearing with minimal variation in characteristics within the operating temperature range.

Regarding the control circuit, not only did the electronic

components have to satisfy the operating temperature range of -40°C to +85°C, but ample leeway also had to be secured as operations became harder than the conventional models at the upper limit. For this reason, we revised the drive IC and semiconductor and used a design in which problem-free drive was possible even at high temperatures.

6. Conclusion

This document has introduced some of the features and abilities of the newly developed wide temperature range fan "San Ace T" series 9GT type.

All 6 of the new models maintain compatibility with conventional models of the same size in regards to mounting hole dimensions, etc., and at the same time have expanded the operating temperature range on both the low and high temperature sides.

Through this, it is possible to satisfy the requirements of operating in various temperature environments unable to be supported by conventional models and, we believe, make a significant contribution by supporting new fields and markets other than those which require fans for cooling.



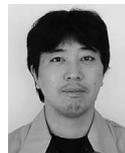
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