SUNON®

S U N O N T E C H N O L O G Y

MagLev Motor Fan

MAGLev® Fan & Blower by SUNON

The innovative concepts of MagLev

For decades, friction and noise have been the root disadvantages for Traditional fan motors. After long term operating, rubs between the shaft and the inner surface of the bearing cause abrasions, in turn creating the noise and sway common in many fans.

Sunon has been dedicated to the development of a new motor structure to breakthrough this barrier and root out the defects o Traditional fan motors.

From this commitment and background MagLev(Magnetic Levitation System) blossomed.

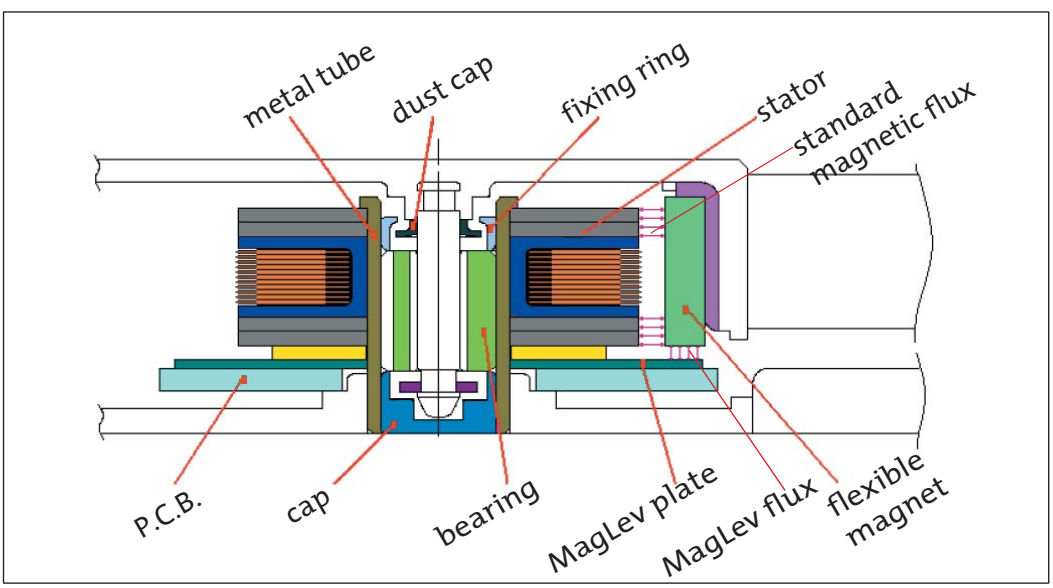
About MagLev

A fan born out of dreams-" MagLev".

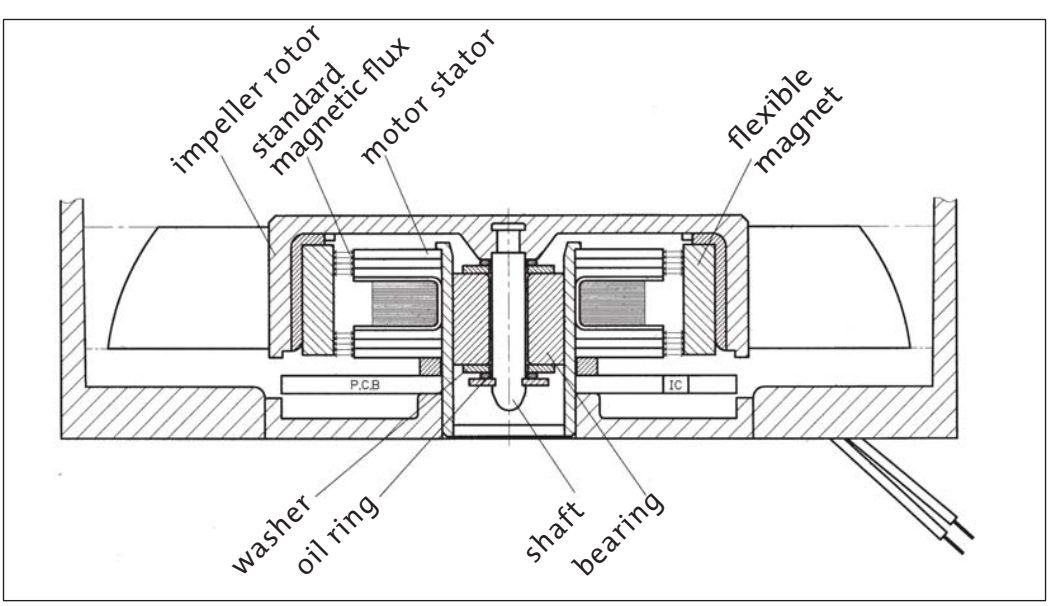
The name MagLev is derived from Magnetic Levitation System, the industry-leading fan that was first introduced by Sunon in the 4th quarter of 1999. In 2003, Sunon unveils the newly renamed MagLev to more concisely convey the meaning of the product. With MagLev, you enjoy the high level of precision that comes with this technology, but with a new simplified name.

MagLev Motor Fan Structure

MagLev Motor Fan Structure

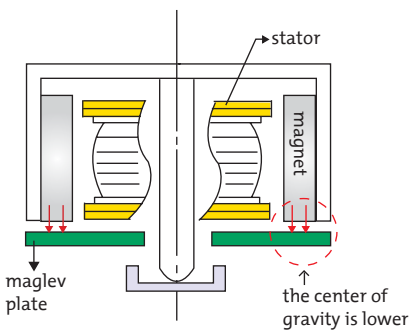
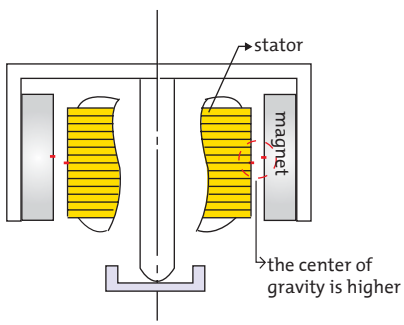


General Fan Structure



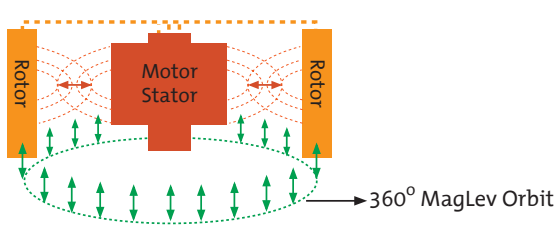
MagLev® Law

Comparison between MagLev and General Motor Fans

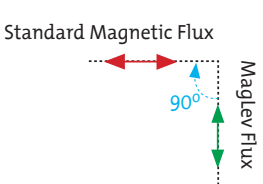
(A) Sunon MagLev Fan	(B) General Fan
	
Possesses 3 important factors: the maglev plate, the magnet and the stator	**2 factors: the magnet and the stator**
The resulting interaction between the maglev plate and the magnet pulls the rotor downward along the entire 360-degree surface. Due to the lower center of gravity, the rotor runs in a more stable consistent orbit.	The general fan utilizes a deviating magnetic center to attract the rotor downward. This technology causes the rotor to vibrate violently, due to the lack of a consistent orbit as well as a deviation of the magnetic center.

MagLev Law

1. The rotor is attracted along the entire 360 degree surface by the MagLev system,which results in stable rotation.
2. Standard magnetic flux perpendicular to MagLev flux.



MagLev System



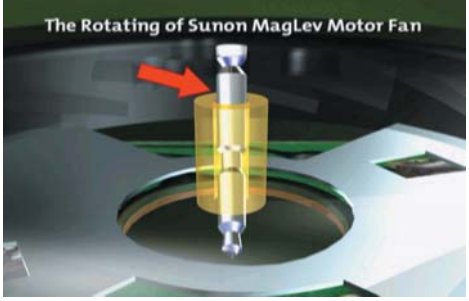
MagLev =Standard Magnetic Flux + MagLev Flux

Low Noise → High Temp. Endurance → Long Life

Advanced Features of MagLev Motor Fan

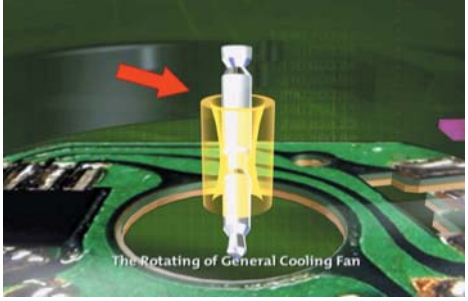
Comparison between MagLev and General Motor Fans

MagLev Motor Fan



The MagLev Motor Fan's rotation is fully exerted by Sunon's patented 360^0 MagLev Orbit, which prevents it from slanting and swaying. No friction or noise can occur, resulting in an extremely long lifespan for the fan.

General Fan



With no magnetic control exerted over the blade trajectory, a traditional fan tends to produce irregular shuddering and vibrations. After long-term use, the shaft will cause severe abrasion on the bearings, distorting them into a horn shape. The worn-out fan will then start to produce mechanical noises and its life will be shortened.

MagLev Motor Fan Suitable for any position or angle

360^0 MagLev Orbit design

MagLev Motor Fan

The MagLev Motor Fan rotates, fully exerted by Sunon's patented 360^0 MagLev Orbit. The shaft and bearing have no direct contact during operation, and so will experience no friction, no matter how the fan is oriented.

General Fan

With no control exerted over the blade trajectory, the fan tends to produce irregular swaying and slanting. After long-term use, the shaft will cause severe abrasion on the bearings, and this different orientation will cause severe mechanical noise and shorten the fan's life.

How and Why MagLev Meets Your Needs

How and Why MagLev Meets Your Needs:

Low Noise	No friction with good balance
High Temp. Endurance	No friction and temperature increased between shaft and bearing. Consists of temperature resistance material.
Multi-Orientation	Runs along the entire 360° surface Suitable for multiple-orientation with no noise occured.
Good Balance	Lower center of gravity, Runs along the entire 360° surface.
Low Power Consumption	One coil winding results in low current
Long Life	No friction, stable operation, Prevents dust penetration, increases lubrication circulation

Since SUNON MagLev was launched in Q4 1999.

MagLev Motor fans have been shipped over

60 Million units

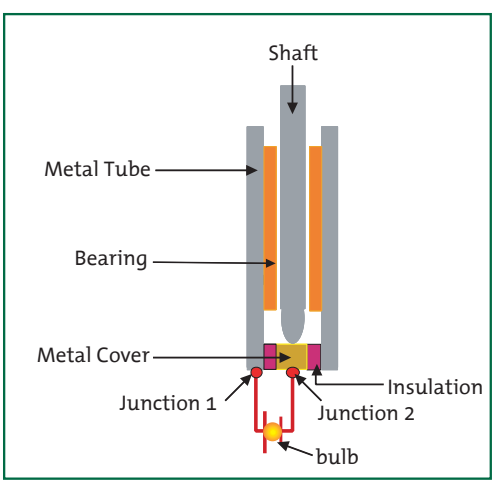
to worldwide renowned customers.

MagLev Experiments

To further demonstrate the MagLev system's quality , we have performed the following two experiments:

MagLev Experiment 1

The purpose of this experiment is to demonstrate that there is no friction between the shaft and the bearing during operation of the MagLev Motor fan.

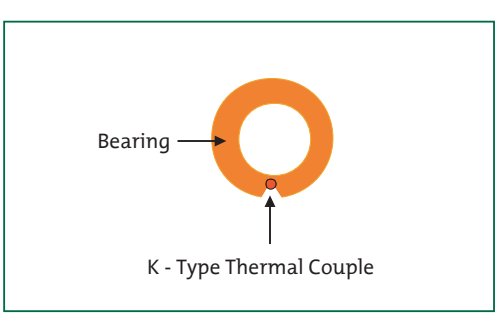


The shaft and bearing are made of metallic materials. We use an insulator to separate the shaft from the bearing at the bottom, and run wires to the metal at the two ends of the insulator. When the fan is powered on and operating, the bulbs next to the fan will light up if the bearing comes into contact with the shaft.

When we turn on the power, we see that other fans cause the bulb to stay on, due to continuous contact between the shaft and bearing, while the bulbs attached to Sunon's MagLev Motor fan are off, due to lack of contact and friction between the shaft and bearing.

MagLev Experiment 2

This proves that in the absence of friction between shaft and bearing, the temperature inside the MagLev motor will be lower during operation.



We installed a temperature sensor inside the bearing to detect the temperature variation.

After a period of time, the temperature inside the bearings of other fans rises faster than that of the MagLev Motor fan. The internal temperature of other fans is higher by more than 10 degree Celsius.

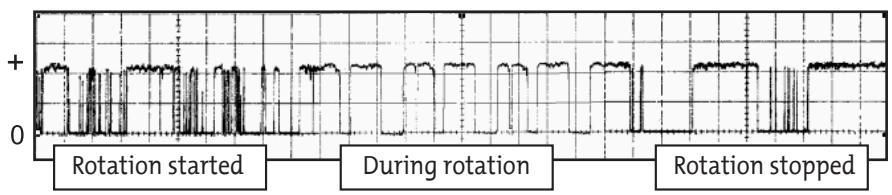
MagLev Experiment

Model: 40x40x20mm

MagLev Fan Motor-- No friction during rotating

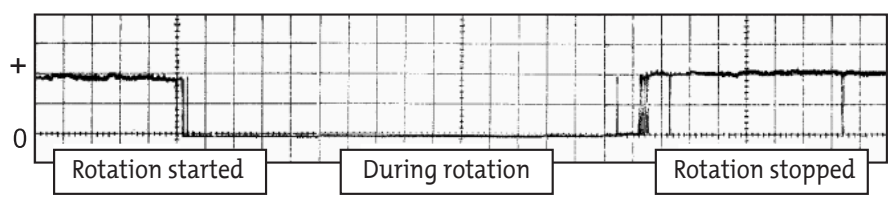
General Fan Motor

There is friction b/w shaft and bearing from time to time during rotation. Hence, the fan is very unstable.



MagLev Fan Motor

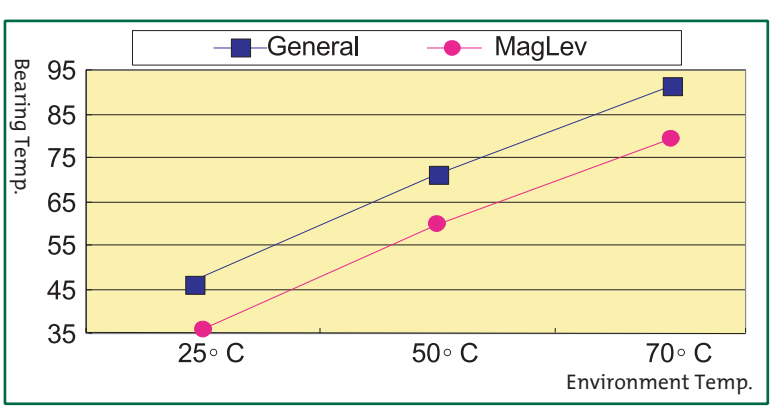
There is no friction b/w shaft and bearing during rotation for MagLev fan; therefore, it shows an open circuit.



The Comparison of Thermal Increase of Bearing During Fan Rotation

	Ambient Temp. 25 C	Ambient Temp. 50 C	Ambient Temp. 70 C	Ambient Temp. 90 C
Bearing temp. of General	48.0	71.2	91.3	
Bearing temp. of MagLev motor	35.9	59.7	79.2	99.5
△T (=T (General) - T (MagLev) (C)	12.1	11.5	12.1	

Since there is no friction b/w shaft and bearing of MagLev motor during rotation, the temperature of the MagLev motor is at least 10°C lower than that of general one.

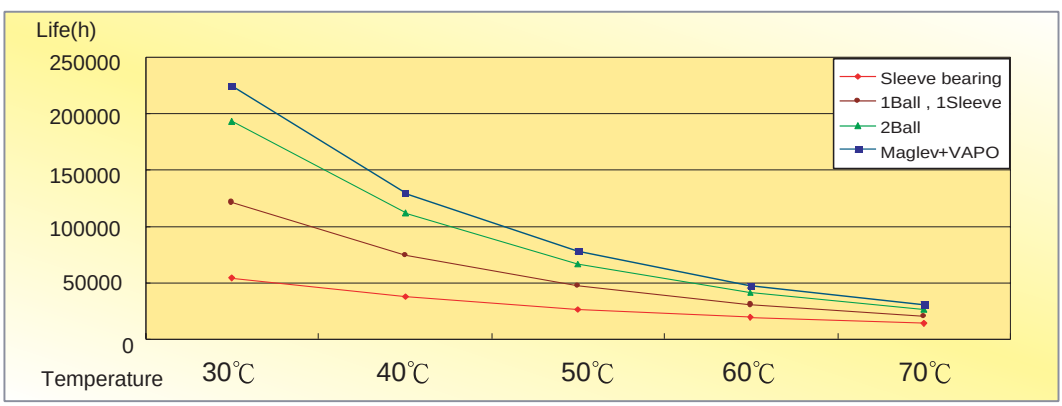


The Reliability and Performance

Life Test (L10)

Model: 40x40x20mm

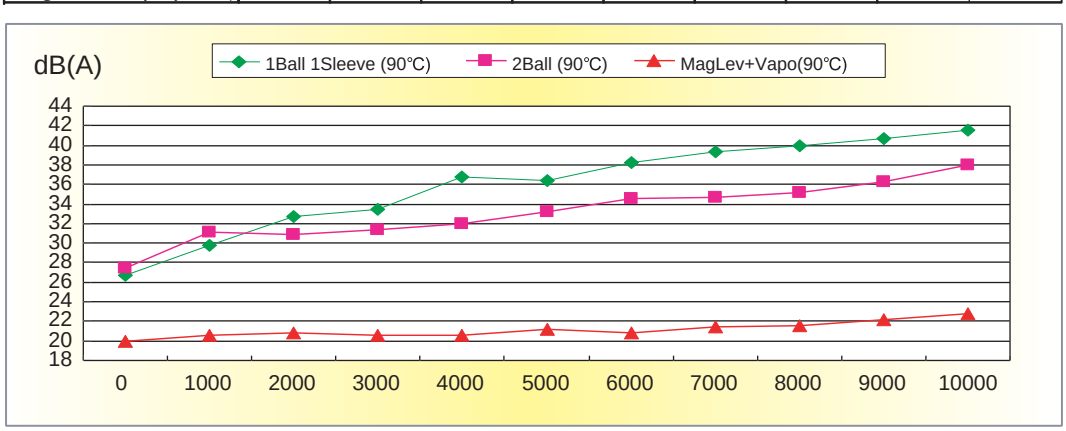
Bearing \ Temperature	30 ℃	40 ℃	50 ℃	60 ℃	70 ℃
Sleeve Bearing	54184	37539	26616	19259	14203
1 Ball,1 Sleeve	121411	74354	47057	30557	20371
2 Ball	193104	111456	66485	40928	25920
MagLev+VAPO	224752	129722	77381	47635	30168



Noise Test

Noise VS Time (MagLev+Vapo、2BALL、1Ball+1Sleeve)

Structure \ Time	0h	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h
1Ball 1Sleeve (90℃)	26.7	29.8	32.7	33.4	36.8	36.4	38.2	39.3	39.9
2Ball (90℃)	27.4	31.1	30.9	31.4	32.0	33.2	34.5	34.7	35.2
MagLev +Vapo(90℃)	20.0	20.6	20.8	20.6	20.6	21.2	20.8	21.4	21.6



The Reliability and Performance

Shock Test

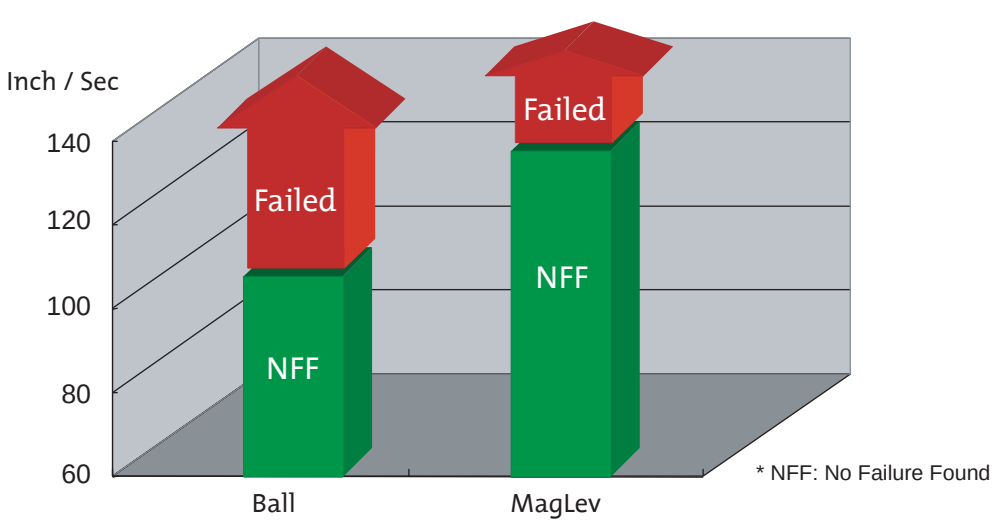
Model:40x40x20mm

Units power : Off
Wave Form : Half Sine
Pulse Form : 3ms
Velocity Change : The test start from 60 inch/sec increase impact velocity to units failure occur by 10 inch/sec.•
Shock Orientation : All six-unit face

Imapct Level	60in/Sec						70in/Sec						80in/Sec						90in/Sec				
Orientation	Bottom	Top	Front	Rear	Left	Right	Bottom	Top	Front	Rear	Left	Right	Bottom	Top	Front	Rear	Left	Right	Bottom	Top	Front	Rear	Left
No.1(VAPO)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
No.2(VAPO)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
No.3(VAPO)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
No.1(BALL)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	Note 1	PASS	PASS	PASS	PASS	Note 1				
No.2(BALL)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	Note	Note 1	PASS	PASS	PASS	PASS	Note 1				
No.2(BALL)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS

Imapct Level	100 in/Sec						110 in/Sec						120 in/Sec						130 in/Sec				
Orientation	Bottom	Top	Front	Rear	Left	Right	Bottom	Top	Front	Rear	Left	Right	Bottom	Top	Front	Rear	Left	Right	Bottom	Top	Front	Rear	Left
No.1(VAPO)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	Note 1				
No.2(VAPO)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1				
No.3(VAPO)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	Note 1				
No.1(BALL)	Note 1						Note 1	Note 1	Note 2	T/S	T/S	T/S	T/S						T/S				
No.2(BALL)	Note 1						Note 1						Note 1						T/S				
No.2(BALL)	Note 1						Note 1						Note 1						T/S				

- Note 1 : Noise level increace and fan keep running as no mechanical structure damaged.
- Note 2 : Fan no function.
- T / S : Test stop .



* NFF: No Failure Found

The Reliability and Performance

Drop Test (fan stand alone stress test)

Model : 40x40x20mm

MagLev+Vapo Bearing

Model	KD1204PKV2(MagLev+Vapo)													
Item	Current			Speed			Noise			Vibration				
Unit	AMP			RPM			1MdB(A)			mm/sec			Noisy	
Spec	0.070 ±15%			6200 ±1000			21.0 Max 24			1.80			by ear	
Drop height	Before	After	Var.	Before	After	Var.	Before	After	Var.	Before	After	Var.	Before	After
10cm	0.066	0.064	3.1%	5771	5890	2.0%	20.0	20.9	0.9	1.17	0.78	0.39	OK	OK
20cm	0.065	0.065	0.0%	5917	5884	0.6%	21.6	20.8	0.8	1.17	0.78	0.39	OK	OK
30cm	0.064	0.063	1.6%	5982	6064	1.4%	21.3	21.6	0.3	1.17	1.17	0.00	OK	OK
40cm	0.071	0.069	2.9%	5500	5698	3.5%	19.4	20.1	0.7	1.17	0.78	0.39	OK	OK
50cm	0.069	0.069	0.0%	5630	5661	0.5%	19.0	20.0	1.0	1.17	0.78	0.39	OK	OK
70cm	0.067	0.067	0.0%	5848	5811	0.6%	20.0	20.2	0.2	1.17	1.17	0.00	OK	OK
100cm	0.066	0.066	0.0%	5957	5966	0.2%	20.9	20.6	0.3	0.78	0.78	0.00	OK	OK
120cm	0.069	0.07	1.4%	6034	6006	0.5%	21.4	21.3	0.1	1.56	1.17	0.39	OK	OK
150cm	0.067	0.067	0.0%	6104	6123	0.3%	21.6	21.9	0.3	0.78	1.17	0.39	OK	OK
200cm	0.065	0.065	0.0%	5843	5843	0.0%	20.1	20.5	0.4	0.78	0.78	0.00	OK	OK

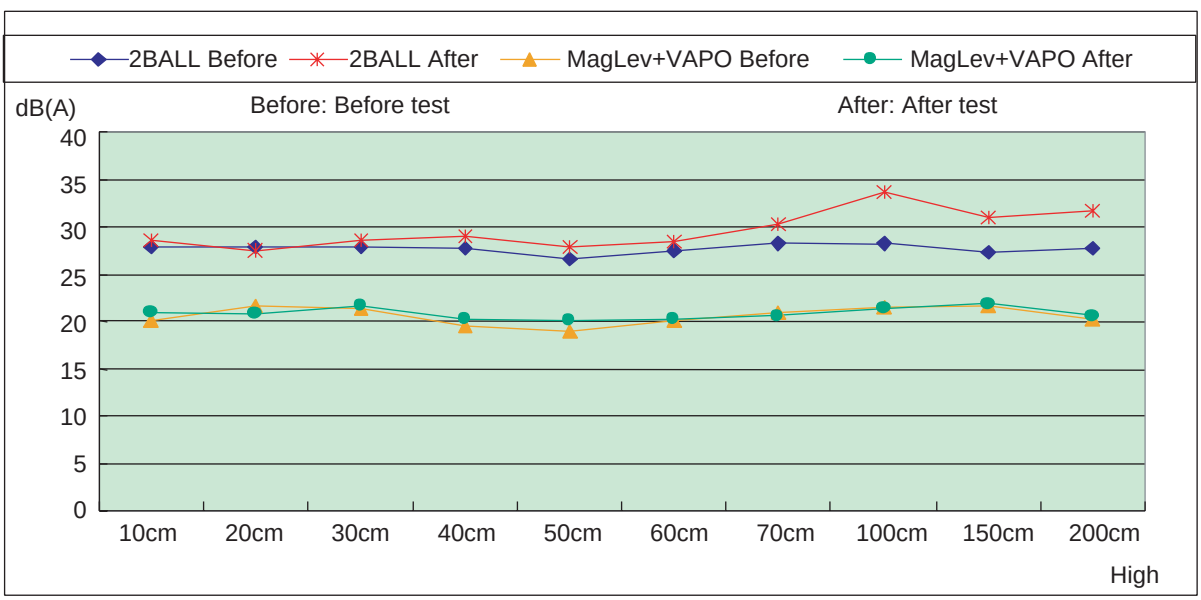
Ball Bearing

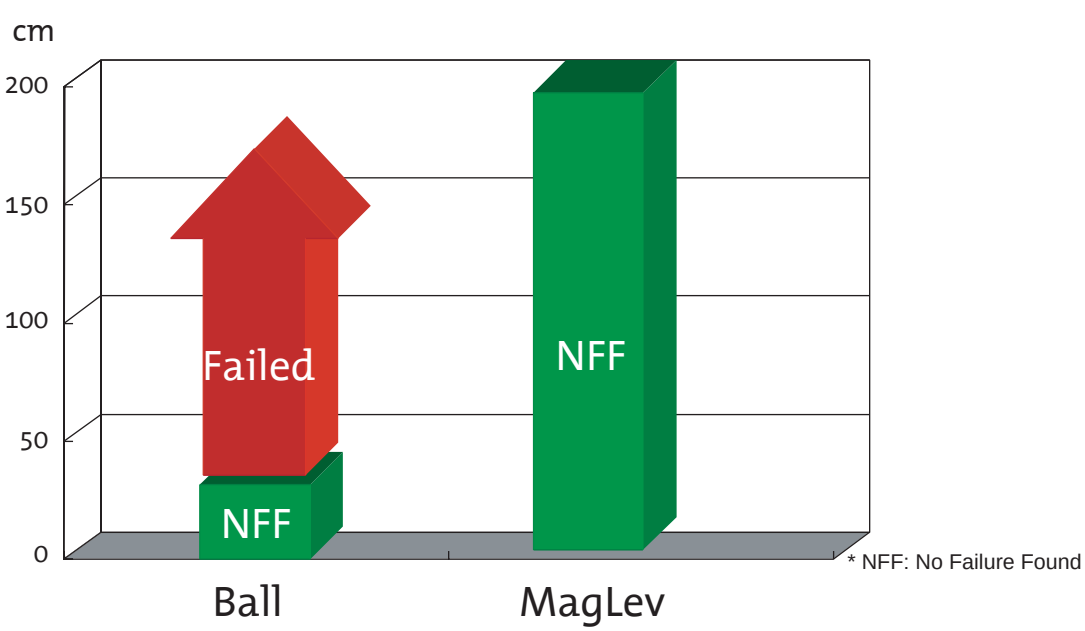
Model	KD1204PKB2(2)(2Ball-no MagLev)													
Item	Current			Speed			Noise			Vibration				
Unit	AMP			RPM			1MdB(A)			mm/sec			Noisy	
Spec	0.070 ± 15%			6500 ±1000			29.0 Max 32			1.80			by ear	
Drop height	Before	After	Var.	Before	After	Var.	Before	After	Var.	Before	After	Var.	Before	After
10cm	0.073	0.071	2.8%	6378	6437	0.9%	27.9	28.6	0.7	1.95	1.17	0.78	OK	OK
20cm	0.073	0.072	1.4%	6345	6351	0.1%	27.8	27.5	0.3	1.17	0.78	0.39	OK	OK
30cm	0.071	0.072	1.4%	6468	6345	1.9%	27.8	28.5	0.7	1.17	0.78	0.39	OK	NG
40cm	0.072	0.072	0.0%	6499	6469	0.5%	27.6	28.9	1.3	0.78	0.78	0.00	OK	NG
50cm	0.072	0.072	0.0%	6243	6202	0.7%	26.6	27.9	1.3	1.17	0.78	0.39	OK	NG
70cm	0.072	0.072	0.0%	6311	6392	1.3%	27.5	28.4	0.9	1.17	1.17	0.00	OK	NG
100cm	0.072	0.072	0.0%	6476	6458	0.3%	28.2	30.1	1.9	1.95	1.95	0.00	OK	NG
120cm	0.073	0.074	1.4%	6645	6631	0.2%	28.1	33.6	5.5	1.17	1.17	0.00	OK	NG
150cm	0.073	0.074	1.4%	6348	6353	0.1%	27.2	30.9	3.7	0.78	2.34	1.56	OK	NG
200cm	0.072	0.072	0.0%	6371	6542	2.6%	27.6	31.6	4.0	1.17	1.17	0.00	OK	NG

The Reliability and Performance

Drop Test v.s. Noise (fan stand alone stress test)

Model : 40x40x20mm





The Reliability and Performance

Anti-Dust Test

IEC60529 IP5X Standard.
Test duration : 8 Hours

Model:GC054009VH-8 P/N:V1.M.B237(MagLev+VAPO Bearing)with Dust Cap

NO.	Current			Speed			Noise			Vibration		Not Noisy	Remark
	before	after	Var	before	after	Var	before	after	Difference	before	after	Noisy by ear	
	AMP	AMP		Rpm	Rpm		1M dB(A)	1M dB(A)		mm/secRMS	mm/secRMS	Result	
OP	0.122	0.121	0.8%	4414	4481	1.5%	19.1	19.8	0.7	0.92	1.66	OK	
Non-OP	0.123	0.122	0.8%	4349	4395	1.0%	19.5	19.5	-	0.78	0.83	OK	

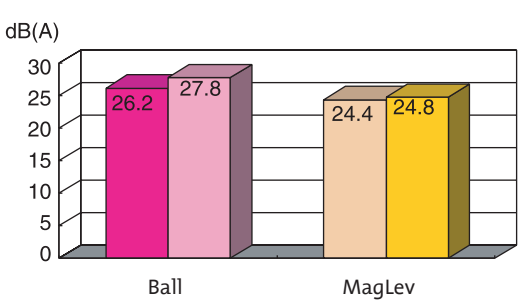
Model:GC054009BH-8 P/N:V1.M.B237(MagLev+BALL Bearing) without Dust Cap

NO.	Current			Speed			Noise			Vibration		Not Noisy	Remark
	before	after	Var	before	after	Var	before	after	Difference	before	after	Noisy by ear	
	AMP	AMP		Rpm	Rpm		1M dB(A)	1M dB(A)		mm/secRMS	mm/secRMS	Result	
OP: #1	0.123	0.121	1.6%	4341	4425	1.9%	19.0	24.8	5.8	0.66	1.66	OK	
Non-OP: #4	0.121	0.121	0.0%	4328	4377	1.1%	18.8	20.4	1.6	0.53	1.25	OK	

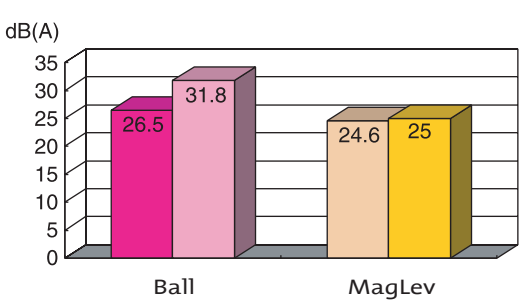
Before : Before making test.
After : Tested.
OP : Fan running during test.
Non-OP : Fan not running during test but check fan's performance before.

Anti-Dust Test v.s. Noise Test

Fan Non-Operation



Fan Operation



SUNON MagLev - the best choice for all applications

SUNON MagLev - the best partner for projector applications

- MagLev has broad applications, especially on projectors that operate in high-temperature environments over 70℃ (even up to 90℃~ 100℃) and on projectors that demand low-noise. Only Sunon MagLev motor fans can provide ultimate the thermal solutions for high temperature and low noise application. This is why well known projector makers make Sunon their first choice.

SUNON MagLev - the most silent partner for audio applications

- Cooling fans used in audio applications must be not only low noise, but also without resonance. Only Sunon MagLev motor fans can meet these criteria.

SUNON MagLev - the best choice for any application

- For portable applications such as notebooks and game consoles, Sunon MagLev motor fans are the ultimate solutions for noise and thermal problems.

S U N O N T E C H N O L O G Y

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