

BKA30L-XX Stepper Motor

Description

--The **BKA 30L-XX** stepper motor was developed as indicator driver for dashboard instrumentation and other precise indicator applications. The motor can operate directly from a numerical, i.e. digital, driving signal to move and position a pointer to visualize any parameter required. A fine analogue representation of its value and its changes is made without the need for a digital to analogue conversion.

--The **BKA 30L-XX** stepper motor consist of a motor and gear train with a reduction ratio of 1/180. The motor is provided with big dynamic torque, low running noise and current consumption, strong structure and longevity.

--Each half revolution of the rotor, defined as a full step, is converted to a one degree rotation of the pointer shaft. The full step itself again is divided to three partial steps, i.e., a 360 degree rotation of the pointer shaft consist of 1080 partial steps (see Fig.10). Full steps can be carried out up to 600Hz resulting 600°/s angular speed of pointer shaft, this allow a large rotation speed range for indicator application.

Features:

- Shaft Material: Transparent PC
- The shaft brightness is strong
- LED compatible with PLCC-2 package
- High Resolution: 1/3° resolution per partial step,
1/12° resolution per micro step (see Fig.10)
- Large Operation Temperature Range: -40~105 °C
- Low Consumption: mean operation current 15~20 mA
- Large Running Speed Range: 0~600°/s
- High Reliability: Qualified for automotive applications
- Small Dimensions: $\Phi 30 \times 7.2$ mm



Fig.1

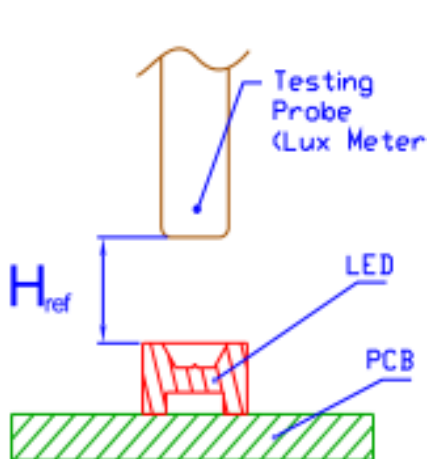
	BKA30L-XX Stepper Motor Specification	BKA30L-XX
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Lighting system:

Reference Setup: see fig.2

Parameters	LED(red)	LED(white)
The height of the testing probe distance from the LED surface	1mm	1mm
XY chromaticity coordinates	(0.7,0.27) (630~635nm)	(0.35,0.35)
Brightness strength	46000 Lux	55000 Lux
Forward voltage	2V	3.3V
Forward current	20mA	20mA
Irradiation angle	120°	120°
Package form	PLCC-2	PLCC-2

Table 1



g. 2

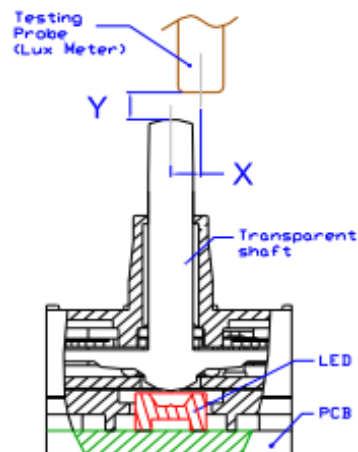


Fig. 3

Relative strength: see Fig.3

LED(red) relative strength				
Y (mm)	X (mm)			
	0. 00	0. 25	0. 50	0. 75
1. 4	118%	114%	84%	46%
1	146%	134%	94%	48%
0. 6	138%	151%	101%	53%
LED(white) relative strength				
Y (mm)	X (mm)			
	0. 00	0. 25	0. 50	0. 75
1. 4	94%	93%	78%	54%
1	100%	98%	79%	59%
0. 6	92%	93%	82%	63%

Table 2

	BKA30L-XX Stepper Motor Specification	BKA30L-XX
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Pointer Parameter:

Spec. Parameter	Min.	Typical	Max.
Length(center-end):		50mm	80mm
Mass		2.5g	10g
Inertia(JL=Jp)		2E-7 Kgm*2	20E-7 Kgm*2
Unbalance(Mu)		0.01mNm	0.04mNm

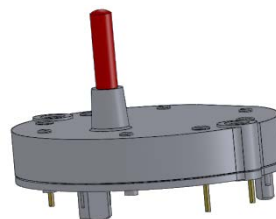
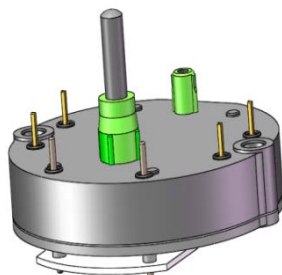
Table 3

Motor Model Description:

This manual is only applicable to the following models of motors:

---Rear mounted series: BKA30L-R x

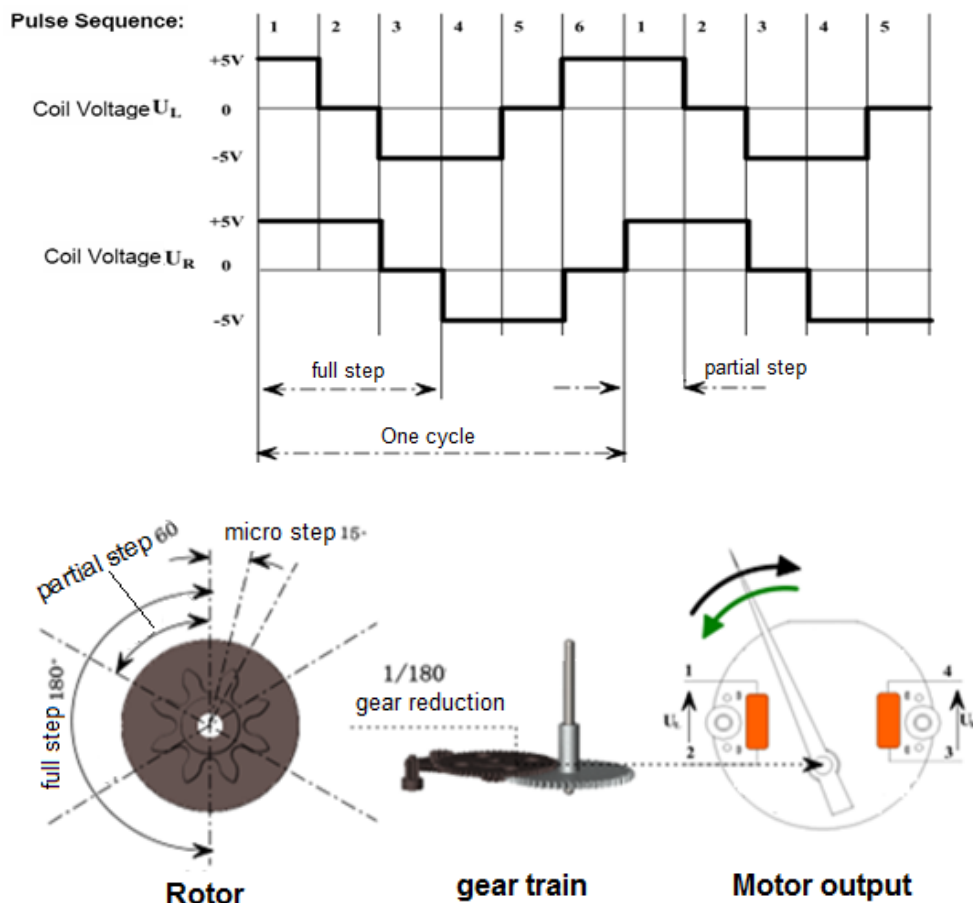
---Front mounted series: BKA30L-Fx



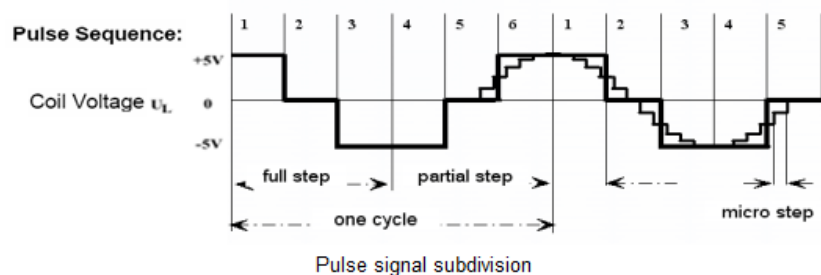
Spec Model	Contacts		with LED lights	Part Number
	Rear	Front		
BKA30L-R1	✓			BKA 30LR1 5 A0
BKA30L-R1H	✓		✓ (Red)	BKA 30LR1H 5 A0
BKA30L-R5	✓		✓ (Red)	BKA 30LR5 5 A0
BKA30L-R5W	✓		✓ (White)	BKA 30LR5W 5 A0
BKA30L-F1		✓		BKA 30LF1 5 A0
BKA30L-F3		✓		BKA 30LF3 5 A0

Functional Description

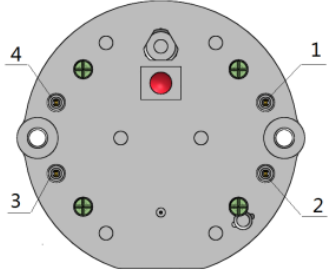
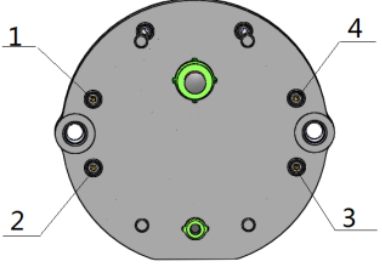
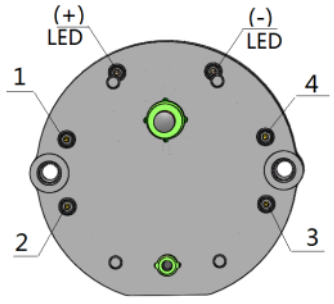
--The **BKA30L-XX** stepper motor is a two-phase stepper motor that rotates and outputs through three-stage gear reduction. The working principle of the motor is shown in the diagram:



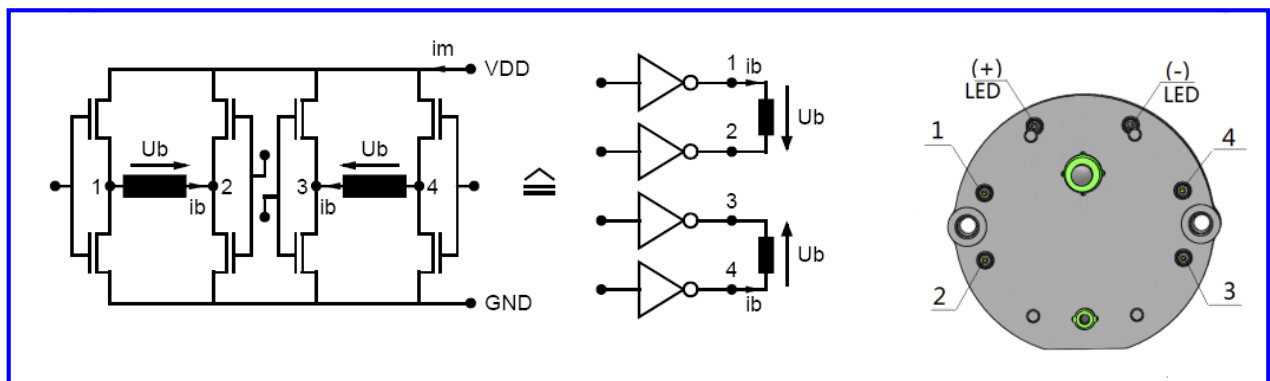
In order to ensure smoother operation of the motor and reduce working noise, subdivision technology can be used to drive the motor with a more precise pulse wave sequence that is closer to a sine wave, allowing the pointer to achieve a 1/12 micro step. As shown in the following figure:



Pin Connection

BKA30L- F1/F3	BKA30L- R1	BKA30L-R1H/R5
		

Driving Diagram:



Absolute Maximum Ratings:

Parameter	Symbol	Value
Driving Voltage	Ub	10V
ESD Tolerance	UESD	10,000V
EMI Tolerance (1KHz,AM80%,100KHz-2GHz)	E	80V/m
Solder Temperature	Ts	260°C

Table 4

Electronics and Mechanical Characteristics:

Parameter	Sym.	Test Conditions	Min.	Type	Max.	Units
Operating Temperature	Ta		-40		105	℃
Coil Resistance	Rb		260	280	300	Ω
Operating Current	Im	fz=200Hz		15	20	mA
Magnetic Saturation Voltage	Ubs				9	V
Start-Stop Frequency	fss	JL=2E-7Kg/m*2			200	Hz
Maximum Driving Frequency	fm	JL=2E-7Kg/m*2			600	Hz
Dynamic Torque	M200	fz=200Hz	0.9	1.1	See	mNm
	M400	fz=400Hz	0.75	0.9	Fig.4	mNm
Static Torque	Ms	Ub=5V	3.5	4.0		mNm
Gear clearance	σ			0.7	1.0	Degreee
Maximum Inertia of the load on shaft	Jm	See Table 5				Kgm*2
Noise Lever	SPL	See Fig.13		38	42	dB(A)
Angle of Rotation	β				320	Degree
Axial Push-on Force	FA	See Fig.7			100	N
Axial pull-off force	Fa				60	N
Radial force	Fp				5	N
Imposed Acceleration	αp			1000		Rad/s*2
Holding Torque on shaft	Th		60	80		mNm
Tamb=25℃,Ub=5V;unless otherwise specified						

Table 5

Typical Performance Characteristics:

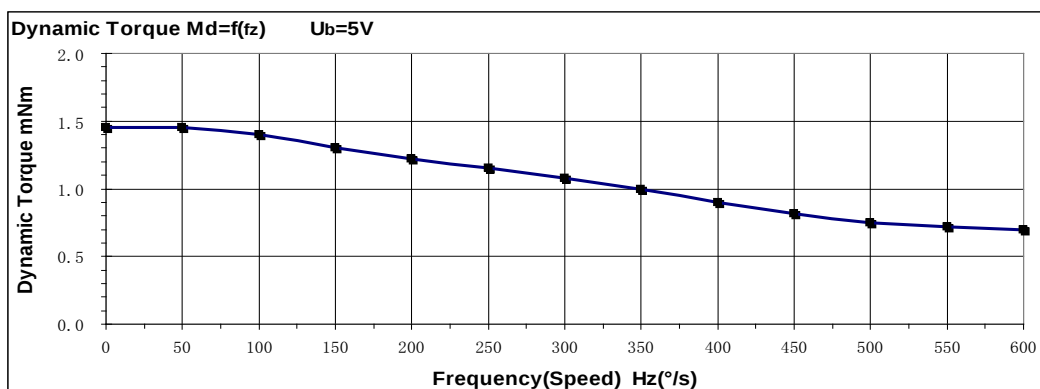


Fig.4

Mounting Load on Pointer Shaft:

The load mounting on the pointer shaft, such as a pointer, gear, etc. is usually in a pressing operation. When using this technique, care should be taken that the force do not exceed those given in the specification (see Table 5).

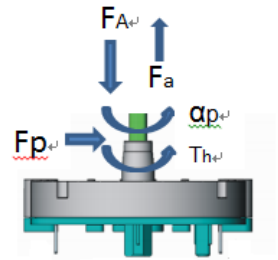


Fig.7

Motor Mounting: See Fig.8

The BKA30L-XX stepper motor can be secured in place by a variety of methods, For all automotive applications even when the motor is exposed to very strong vibrations, Suggested that the installation of two ST2.0 screws fixed

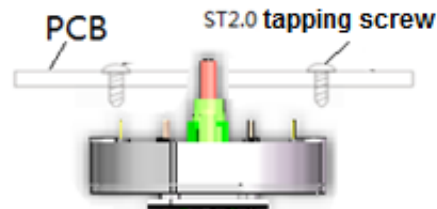
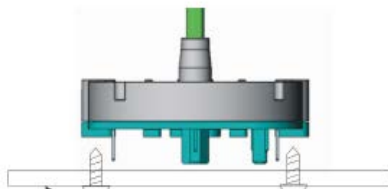


Fig.8

Noise Lever:

Test Configuration

1. reflection free room
2. microphone
3. sonometer
4. motor under test
5. reflection free cube
6. control unit in micro step mode (1/12° / step)

Test Conditions

- temperature	T_{amb}	: 25	°C
- measurement distance	L_m	: 4	cm
- measurement range		: 20 – 20k	Hz
- measurement time	t_m	: 4	s
- angular speed max	ω	: 600	°/s
- ambient noise max		: 20	dBA
- motor without load.			

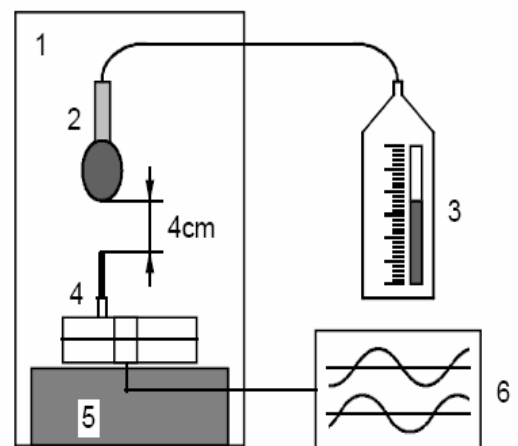


Fig. 12

Typical Noise performance:

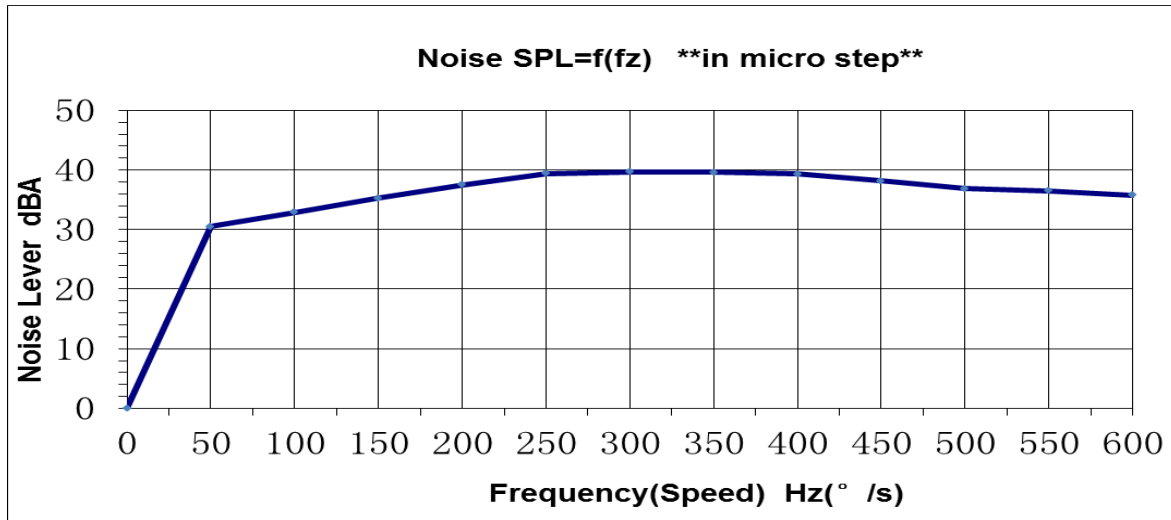


Fig.13

Start-Stop frequency:

The Fig.14 show the relation of Start-Stop Frequency (f_{ss}) & the inertia of the pointer load (J_p)

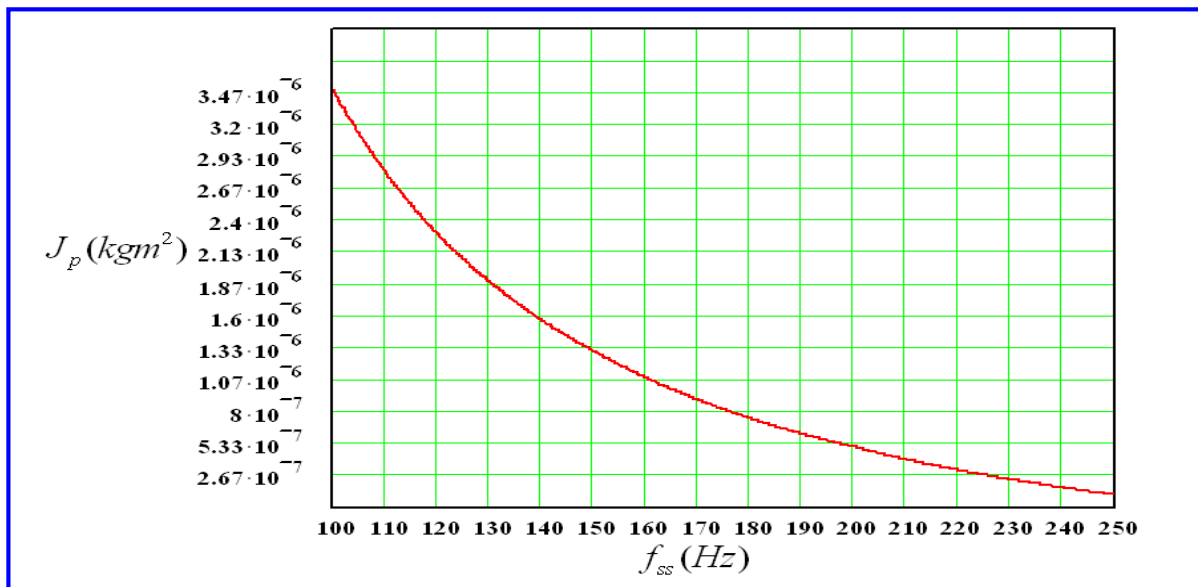


Fig.14

Frequency Acceleration:

The Fig.15 show the acceleration of the pointer shaft (α)@ different running frequency, and if the motor is running at frequency f_0 , the maximal frequency of next step can be given is f_i as specified in the Fig.16

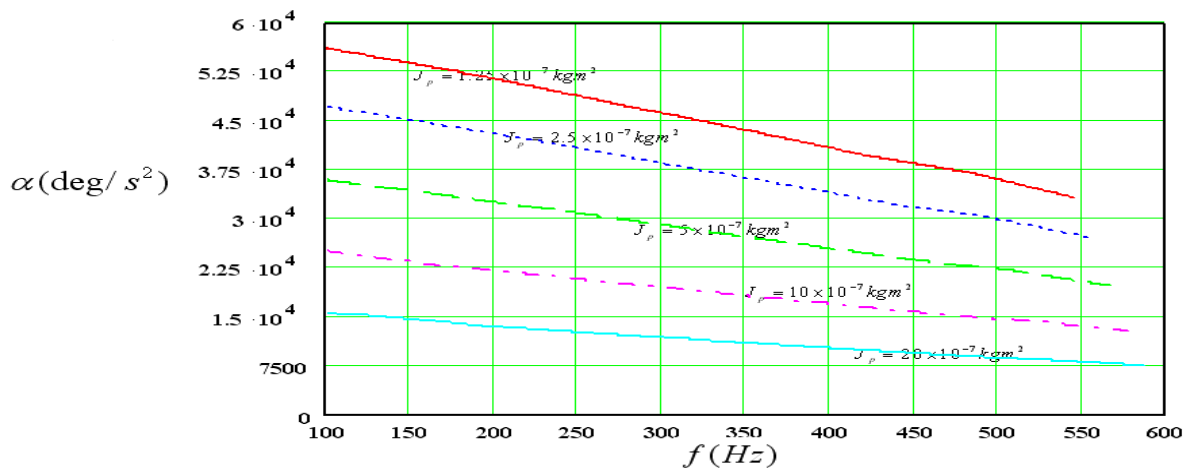


Fig. 15

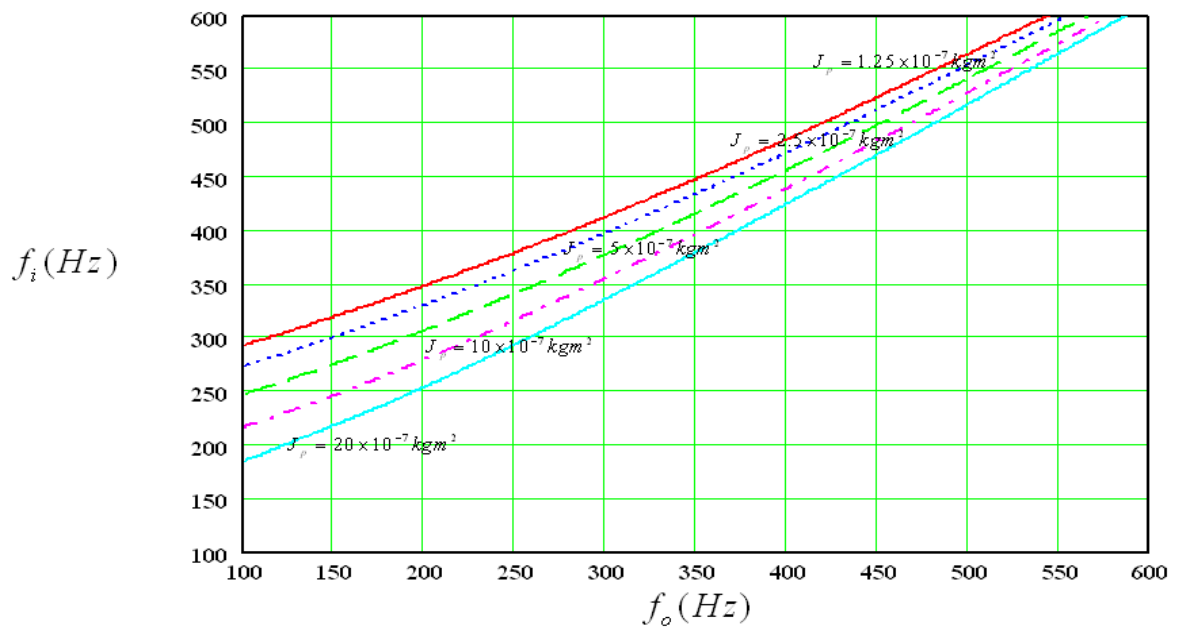


Fig. 16

Reliability Test Conditions:

Indicator Normal Load

--mass : 2.5g
 --inertia : 2E-7Kgm*2
 --unbalance : 0.01mNm

Temperature Cycle:

- Low temperature: $-40^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- High temperature: $+105^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- Dwell time: see Fig.17
- 6hrs/per cycle, running for 50cycles,
Total 300hours
- Status: running@0~600Hz sweep
- Quantity of samples: 20pcs
- Reference standard: IEC60068-2-14:1984

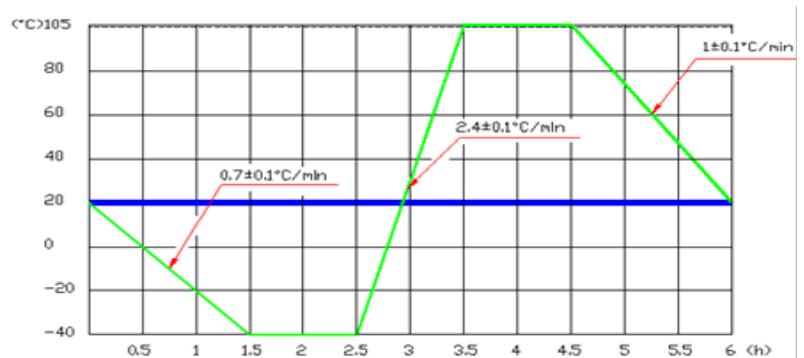


Fig.17

Thermal Shock:

- Low temperature: $-40^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- High temperature: $+105^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- Dwell time: half an hour for each
- Transfer time: Within 30s
- Cycles: 100, total 100hours
- Status: non-running
- Reference standard: IEC60068-2-14:1984

Longevity:

- Temperature: $105^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- Storage time: 1000hours
- Status: running@600Hz
- Quantity of samples: 10pcs
- Reference standard: GB/T 2689.1-1981

High Temperature Storage :

- Temperature: $105^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- Storage time: 72hours
- Status: non-running
- Quantity of samples: 10pcs
- Reference standard: IEC60068-2-2:1974

Low Temperature Storage:

- Temperature: $-40^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- Storage time: 72hours
- Status: running@ non-running
- Quantity of samples: 10pcs
- Reference standard: IEC60068-2-1:1990

Humidity Storage:

- Temperature: $80^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- Humidity: $85\pm 2\%$ RH
- Storage time: 168hours
- Status: non-running
- Quantity of samples: 20pcs
- reference standard: IEC68-2-67:1995

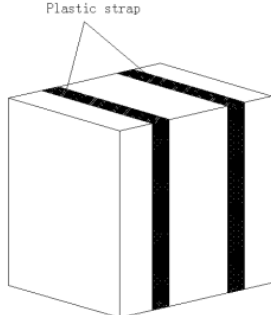
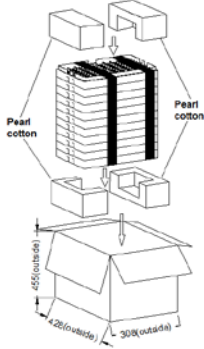
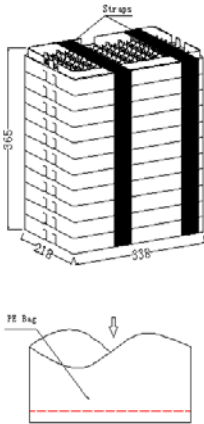
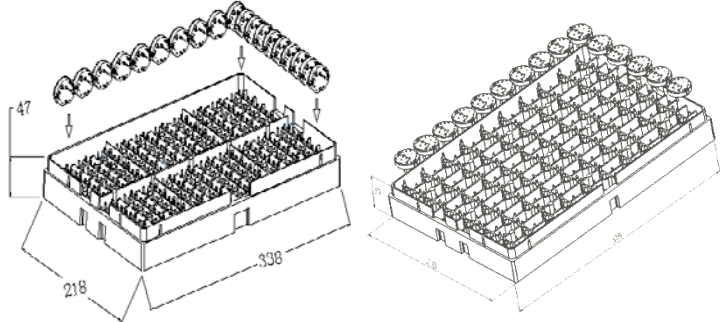
Mechanical Shock:

- Shock model: vibration
- Pulse waveform: sine
- Peak of acceleration: 50g/11ms
- Shock times: 5
- Shock direction: axial/radial
- Status: non-running
- Quantity of samples: 10pcs
- Reference standard: IEC68-2-27:1987

Mechanical Vibration:

- Pulse waveform: sine
- Frequency: 5~200Hz, logarithm sweep
- Sweep Speed: 3 Oct/Min
- Acceleration: 6g
- Amplitude: 13.2mm
- Vibration direction: axial/radial
- Vibration time: 22hours/each direction sweep
- Status: running@0~600Hz
- Quantity of samples: 20pcs
- Reference standard: IEC68-2-6:1982

Package Information:

Weight : Stacks 1 x 11885 = 11280g Plastic strap 2 x 20g = 40g (Without LED) Total = 11320g Weight : Stacks 1x8990g = 8990g Plastic strap 2x15g = 30g (With LED) Total = 9020g	
Master-carton for 1000 Motors: Material : cardboard 710g/m² Weight : Master-carton 1 x 930 = 930g (Without LED) PE bag 1 x 100 = 100g Stacks 1 x 10595 = 9990g EPE 4 x 65 = 260g Total = 11280g Master-carton for 600 Pcs Motor(With LED): Material : cardboard 710g/m² Weight : Master-carton 1x930g = 930g PE bag 1 x 105g = 105g Stacks 1x8115g = 7695g EPE 4x65g = 260g Total = 8990g	
Stack for 1000 Motors: (Without LED) Material: 11 Trays(including Cover)strapped together with plastic band Weight : Trays + Motors 10 x 960g = 9600g Cover tray 1 x 360g = 360g Plastic straps 2 x 15g = 30g Total = 9990g Stack for 600 Pcs Motor(With LED) Material : 11Trays (including Cover)strapped together with plastic band Weight : Tray+Motors 10x735g = 7350g Cover tray 1 x 315g = 315g Plastic straps 2x15g = 30g Total = 7695g	
Material : PP(Nat) Tray for 100Pcs Stepper Motor(Without LED) Weight :Tray 1x360g = 315g Motor 100x6g = 600g Total = 960g Tray for 60Pcs Stepper Motor(With LED) Weight :Tray 1x315g = 315g Motor 60x7g = 420g Total = 735g	 Without LED With LED