



深圳博柯安电机有限公司
SHENZHEN BACTRIANUS MOTOR CO. , LTD.

规格书

SPECIFICATION

品名 (ITEM) : PM20B步进电机 PM20B STEPPER MOTOR

型号 (CODE NO) : BKA-PM20B-01A0

客户料号 (PART NO) :

DESCRIPTION :

RECEIVED

修改履历

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MODEL: PM20B步进电机	CODE No. : BKA-PM20B-01A0	P3/18

1. Scope 适用范围

This requirements specification is suitable for automotive air conditioning redirector stepper motor.

本要求规格书是适用于汽车空调转向器的步进电机。

2. Type型式

Normal 型

3. Measure外形(尺寸)

Outer Diameter: $\phi 20$

外径: $\phi 20$

Refer to the drawing

其它依据外形图

4.Specification

规格

NO 序号	Items 项 目	Specifications 规范
4-1	Phase 相数	Phase 2 相
4-2	Step Angle 基本步进角	18° /Step
4-3	Rated Voltage 额定电压	DC 12V
4-4	Excitation 激磁方法	2-2 Phase Unipolar 2相2路激磁驱动 360~800 pps (12V 时) 360~800 pps (at 12V)
4-5	Drive Circuit 驱动回路	Reference contour drawing 参照外形图
4-6	Insulation class 卷线绝缘等级	Class H H 级
4-7	Operating temperature and Humidity Range 使用温度、湿度范围	Operating Temperature: -40℃~+85℃ 使用温度: -40℃~+85℃ Operating Humidity: 15%~95% 使用湿度: 15%~95%
4-8	Storage temperature and humidity 贮存温度、湿度范围	Storage temperature : -40℃~+110℃ 贮存温度: -40℃~+110℃ Storage humidity : 85% or less 贮存湿度: 85%以下

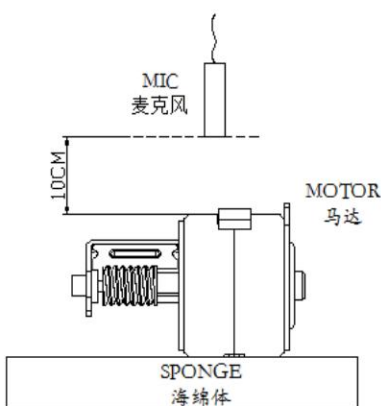
5.Characteristics

性能

Item NO 序号	Items 项 目	Specifications 规范
5-1	Resistance per phase 线圈电阻	29 Ω ±8%/相 phase(常温 Room Temp. at 25℃)
5-2	Current 电流	<360mA/相 Phase ≤600 mA /总total (上记电流值, 适用于-40℃~85℃、12V / 200pps) (The current is suitable for -40℃~85℃、 12V/200pps)
5-3	Coil inductance 电感	20mH/相 phase±10%(1KHz , 串联测试)
5-4	Insulation Resistance 绝缘电阻	1 MΩ or more(DC 100V) 1 MΩ 以上 (DC 100V)
5-5	Max pull-in pulse-Rate 最大自启动频率	400 pps or more(Rated Voltage,2 phases,No load) 400 pps 以上(额定电压, 2相激磁, 无负载时)
5-6	Max pull-out pulse-Rate 最大连续响应频率	850 pps or more(Rated Voltage,2 phases, No load) 850 pps 以上(额定电压, 2相激磁, 无负载时)
5-7	Detent Torque 静态保持转矩	4 gf.cm or less(0V Voltage , Room Temp. at 23 ± 5℃) 4 gf.cm 以下 (电压0伏, 常温 23±5℃)
5-8	Step Error 静止角度误差	18° ±10%

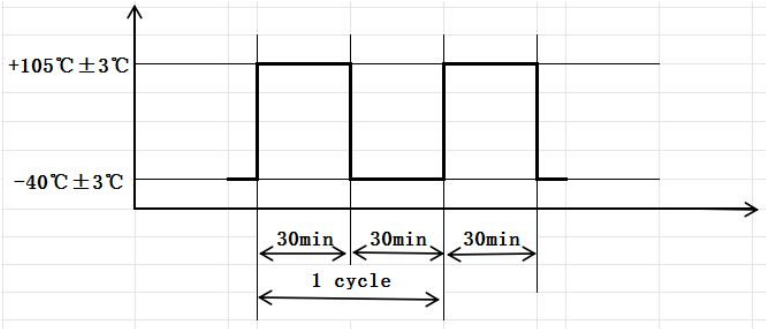
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5-9	Torque at room Temperature 常温时转矩（待定）		23℃±5℃	Torque 转矩 (gf. cm)		Frequency 频率			
				Pull-out 牵出	Pull-in 牵入				
			9V	52	48	at 200 pps			
				47	45	at 360 pps			
				14	12	at 800 pps			
			12V	65	60	at 200 pps			
				55	52	at 360 pps			
				21	17	at 800 pps			
			16V	67	63	at 200 pps			
				60	57	at 360 pps			
				25	23	at 800 pps			
			5-10	Torque at high Temperature 高温时转矩（待定）		85℃±5℃		Torque 转矩 (gf. cm)	
Pull-out 牵出	Pull-in 牵入								
9V	48	43				at 200 pps			
	45	41				at 360 pps			
	13	10				at 800 pps			
12V	56	50				at 200 pps			
	53	48				at 360 pps			
	39	35				at 800 pps			
16V	72	68				at 200 pps			
	68	64				at 360 pps			
	52	49				at 800 pps			

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5-11	Torque at low Temperature 低温时转矩（待定）		-40℃±5℃	Torque 转矩 (gf. cm)		Frequency 频率
				Pull-out 牵出	Pull-in 牵入	
			9V	67	60	at 200 pps
				53	48	at 360 pps
				16	13	at 800 pps
			12V	80	74	at 200 pps
				73	68	at 360 pps
				41	34	at 800 pps
			16V	93	85	at 200 pps
				87	81	at 360 pps
				63	56	at 800 pps
5-12	Temperature raising 温升（待定）		Motor side, normal Temp. 马达侧面，常温			
			After operating 5 minutes (Rated Voltage, 360pps, 2 phases, No load or radail load 20gf. cm) 通电5分钟后(额定电压，频率360pps, 2相激磁，无负荷或径向负载20gf. cm)			
			Frequency 频率	No load Temperature 无负荷温度	radail load 20gf. cm Temperature 负载20gf. cm温度	
			360pps	≤105℃	≤90℃	

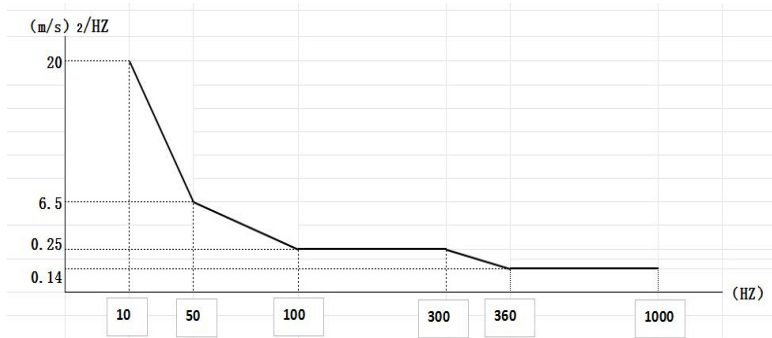
5-13	Noise 噪音（待定）	Rated Voltage, Full-Step drive, 2 phases, No load, test 10cm that was calculated from mount. Background noise 20dB max. 额定电压，整步驱动, 2相激磁，无负荷，从装置板面到10cm的位置测定。环境噪音：20 dB(A) max			
		Frequency 频率	Noise 噪音值	Abnormal Noise 异音	
		360 pps	≤34dB (A)	No, 无异音	
		800 pps	≤23dB (A)	No, 无异音	
		Among them, the specifications of 360pps in micro step mode are as follows: 其中，360pps在微步模式规格如下：			
		Microstepping 细分	1/4 Microstepping 1/4细分	1/8 Microstepping 1/8细分	1/16 Microstepping 1/16细分
		Noise 噪音值	≤29 dB (A)	≤28 dB (A)	≤26 dB (A)
					

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5-14	Durability 持久性（待验证）	Condition: Voltage 12V, Whole-Step drive,, 2 phases, radial load 20gf. cm. 条件：电源电压12V, 整步驱动, 2相激磁，电机受到径向负载20gf. cm。																		
		<table><tr><td>CW (正转)</td><td></td><td></td><td></td></tr><tr><td>OFF (停止)</td><td></td><td></td><td></td></tr><tr><td>CCW (反转)</td><td></td><td></td><td></td></tr><tr><td>运行时间:</td><td>7sec.</td><td>2sec.</td><td>7sec.</td></tr></table>			CW (正转)				OFF (停止)				CCW (反转)				运行时间:	7sec.	2sec.	7sec.
		CW (正转)																		
		OFF (停止)																		
		CCW (反转)																		
		运行时间:	7sec.	2sec.	7sec.															
		1 Cycle																		
		正转7s，停止2s；反转7s，停止2s——1次循环；																		
		First, The conditions is under 85℃±2℃ and normal humidity after 60000 cycles; Second, The conditions is under 23℃±2℃ and normal humidity after 480000 cycles to testing, it could meet 5-5～5-12,no lost step, and noise is less than the value in the table below and no abnormal noise.																		
		首先，按上述条件在高温85℃±2℃常湿环境下进行60000次循环；再次，按上述条件在常温23℃±2℃常湿环境下进行480000次循环；最后，按上述条件在低温-40℃±2℃常湿环境下进行60000次循环，后测试电机性能，须满足 5-5～5-12项，过程不丢步，噪音满足下面表格数值，并无异音。																		
<table><tr><td>Frequency 频率</td><td>Noise 噪音值</td><td>Abnormal Noise 异音</td></tr><tr><td>360 pps</td><td>≤38dB(A) 待定</td><td>No, 无异音</td></tr><tr><td>800 pps</td><td>≤27dB(A)</td><td>No, 无异音</td></tr></table>			Frequency 频率	Noise 噪音值	Abnormal Noise 异音	360 pps	≤38dB(A) 待定	No, 无异音	800 pps	≤27dB(A)	No, 无异音									
Frequency 频率	Noise 噪音值	Abnormal Noise 异音																		
360 pps	≤38dB(A) 待定	No, 无异音																		
800 pps	≤27dB(A)	No, 无异音																		

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5-15	Gridlock Durability at high Temperature 高温堵转耐久（待验证）	Condition: Voltage 12V, Whole-Step drive,, 2 phases, radial load 20gf. cm. 条件：电源电压12V, 整步驱动, 2相激磁, 电机受到径向负载20gf. cm。			
		CW (正转)			
		Gridlock (堵转)			
		CCW (反转)			
		运行时间:	7sec.	2sec.	7sec. 2sec.
		1 Cycle			
		The conditions is under 85℃±2℃ and normal humidity after 200000 cycles to testing, it could meet 5-5～5-12,no lost step, and noise is less than the value in the table below and no abnormal noise. 按上述条件在85℃±2℃环境下运转200000次循环后测试电机性能，须满足须满足 5-5～5-12项，过程不丢步，噪音满足下面表格数值，并无异音。			
		Frequency 频率	Noise 噪音值	Abnormal Noise 异音	
		360 pps	≤38dB(A) 待定	No, 无异音	
		800 pps	≤27dB(A)	No, 无异音	
5-16	High Temperature and High Humidity 高温高湿（待验证）	85℃±2℃ Relative humidity 90%-95% 96(Hr) storage and test left it for 2 Hrs in the room temperature to testing, it could meet 5-5～5-13. 周围温度85℃±2℃、湿度90%-95%, 电机连续放置96Hrs后，于常温放置2Hr后测试电机性能，须满足5-5～5-13项。			
5-17	Low temperature Storage 低温存储（待验证）	-40℃±2℃ 48(Hr) storage and test left it for 2 Hrs in the room temperature to testing , it could meet 5-5～5-13. 周围温度-40℃±2℃, 电机连续放置48Hrs后，于常温放置2Hr后测试电机性能，须满足5-5～5-13项。			

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5-18	High temperature Storage 高温存储（待验证）	110℃±2℃ 48(Hr) storage and test left it for 2 Hrs in the room temperature to testing , it could meet 5-5~5-13. 周围温度110℃±2℃,电机连续放置48Hrs后,于常温放置2Hr后测试电机性能,须满足5-5~5-13项。	
5-19	Thermal shock 热冲击（待验证）	Place without power and in the high an low temperature impact test chamber,perform 500 cycles according to the figure below,the two temperature environments must be switched within 5S,and test the motor performance after the test,which must meet 5-5~5-13. 不通电放置与高低温冲击试验箱中,按照下图进行500次循环,两种温度环境必须在5S内进行切换,完成试验后测试电机性能,须满足5-5~5-13项。 	
5-20	Cold Start 冷启动（待验证）	Place in the test box at -40℃ , after 4(Hr) storage without power,the motor must be able to normally and run smoothly and no lost step under the condition of voltage 8V,Whole-Step drive,360pps and radial load 20 gf.cm. 放置于-40℃的试验箱内,不通电持续4小时后,电机以电压8V、整步驱动、360pps、负载20gf.cm条件下必须可以正常启动并畅顺运转,不丢步。	

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5-22	Random Vibration 随机振动（待验证）	The driving voltage is set to 14V, the effective value of acceleration is 3g, the amplitude is 1.2mm, the cycle is 6 hours and 30 minutes, the motor is energized and unloaded, the motor is placed in the actuator, and the actuator is fixed on the mounting plate, and the parts have vibration at each position (X, Y, Z). Test motor performance after the completion of the test, must meet 5-5 ~ 5-13. 驱动电压设置为14V，加速度的有效值3g、振幅1.2mm、周期6小时30分，电机通电空载，电机放置入执行器内，而执行器被固定在安装板上，部件在每一个位置都有振动（X、Y、Z）每一振动周期时间等同于温度变化周期。完成试验后测试电机性能，须满足5-5 ~ 5-13项。																														
																																
		<table><tr><th>Breaking point</th><th>Power spectral density</th><th>Frequency (HZ)</th></tr><tr><td>1</td><td>0.001</td><td>8</td></tr><tr><td>2</td><td>0.070</td><td>10</td></tr><tr><td>3</td><td>0.070</td><td>20</td></tr><tr><td>4</td><td>0.020</td><td>40</td></tr><tr><td>5</td><td>0.020</td><td>350</td></tr><tr><td>6</td><td>0.005</td><td>550</td></tr><tr><td>7</td><td>0.001</td><td>700</td></tr><tr><td>8</td><td>0.0001</td><td>750</td></tr><tr><td>9</td><td>0.0001</td><td>2000</td></tr></table>			Breaking point	Power spectral density	Frequency (HZ)	1	0.001	8	2	0.070	10	3	0.070	20	4	0.020	40	5	0.020	350	6	0.005	550	7	0.001	700	8	0.0001	750	9
Breaking point	Power spectral density	Frequency (HZ)																														
1	0.001	8																														
2	0.070	10																														
3	0.070	20																														
4	0.020	40																														
5	0.020	350																														
6	0.005	550																														
7	0.001	700																														
8	0.0001	750																														
9	0.0001	2000																														

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6. Test Method 试验方法

6-1 Resistance of coil 线圈电阻

The resistance of coil is the value which measures at coil temperature 20°C.To make Sure the coil temperature and the temperature around motor is the same we have to Put the motor over 30 minutes. We measure the value of each phase via resistance meter the precision is +/-0.5% or via wheat stong bridge.

We calculate the value via following conversion when the coil temperature is out of 20°C.

$$R_{20}=255R_t/235+t \text{ (Q)}$$

Remarks: R₂₀: The resistance value (Ω)at coil temperature 20°C

R_t:Relative resistance value (Ω)at coil temperature t°C

t:The temperature around motor(°C)

线圈电阻为线圈温度20℃时的电阻值，为使测定时线圈温度和步进马达的周围温度同等，需放置30分以上，线圈各相的电阻用wheat stong bridge或精度±0.5%以上的电阻计为测定 值 。

但是测定时的周围温度非20℃时，依下列公式换算

$$R_{20}=255R_t/235+t \text{ (Q)}$$

但R₂₀:线圈温度20℃的线圈电阻值(Ω)

R_t:相对于测定时周围温度t℃时的线圈电阻值(Q)

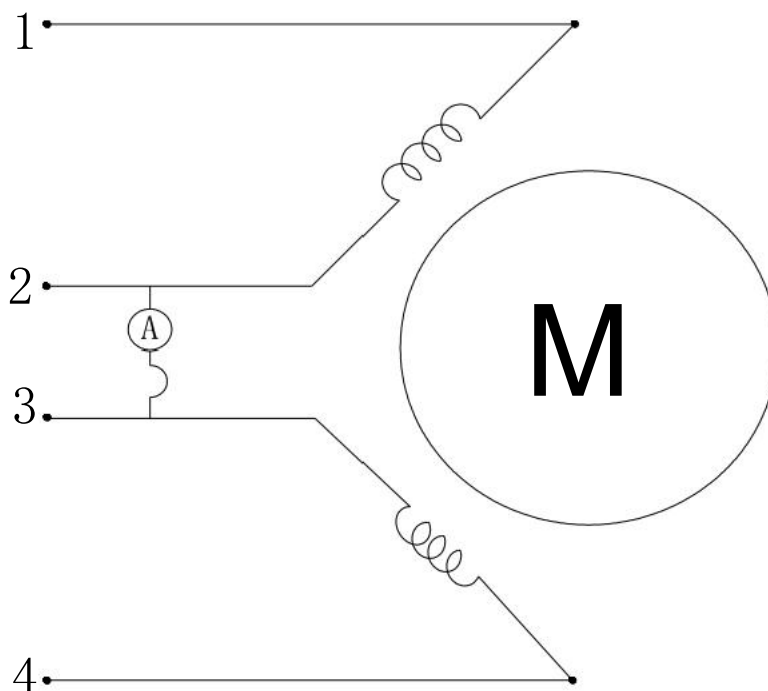
t:测定时的周围温度(℃)

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6.2 Current 电流

The current is the value of each phase, The test value (via following method) and then to multiply 1/2 is the current.

电流为每1相的电流值，电流依下图测试后的电流值，再乘以1/2的值。

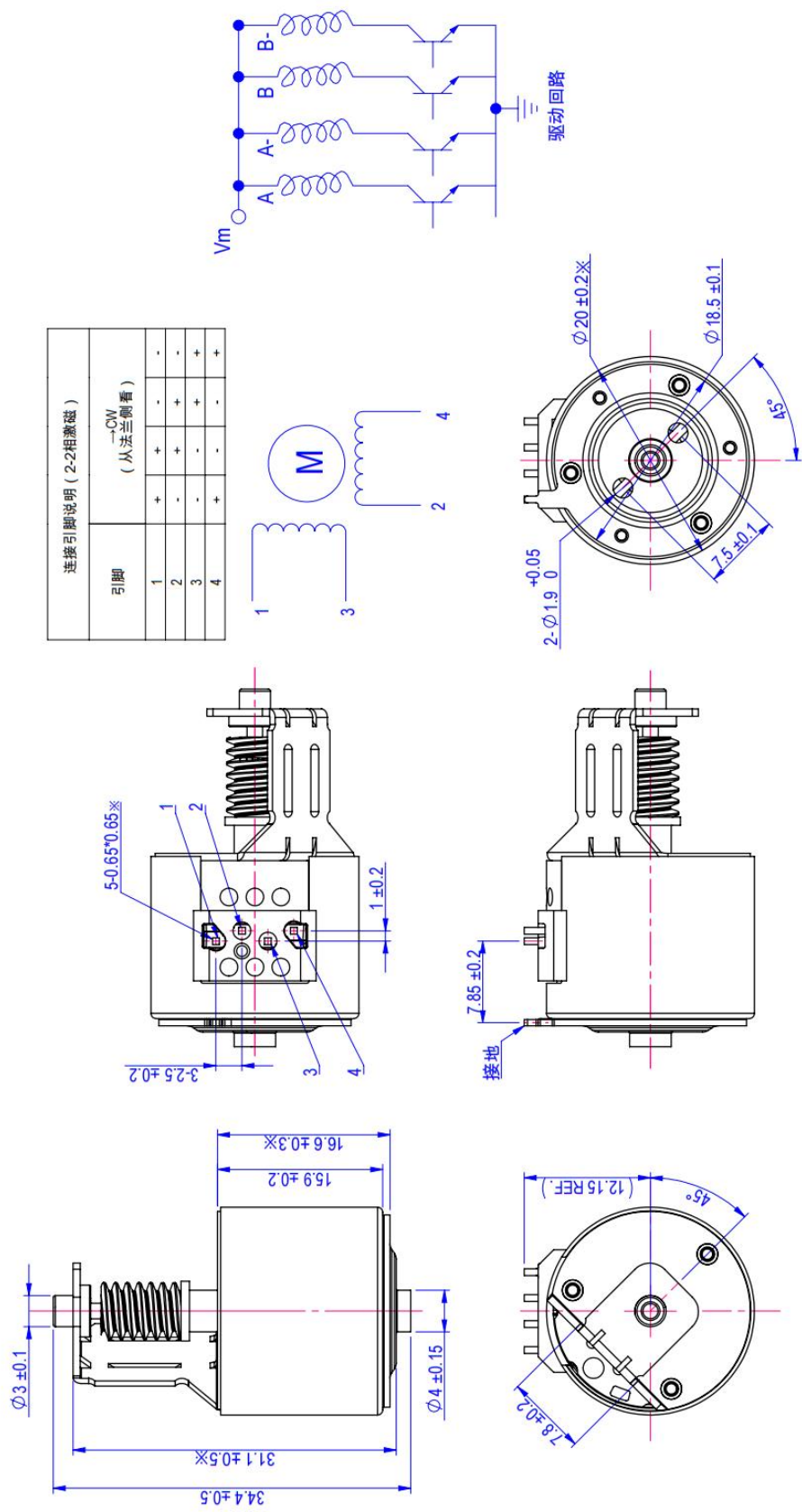


6.3 Coil inductance 电感

To test the inductor of each phase at frequency 1KHZ by Unirersal bridge or LCR. 用Unirersal bridge或LCR对频率为1KHZ的各相电感进行测试。

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7.Torque-Tachometer diagram 转矩速度图 待后续补充（To be supplemented later）		

8.Drawing
图纸



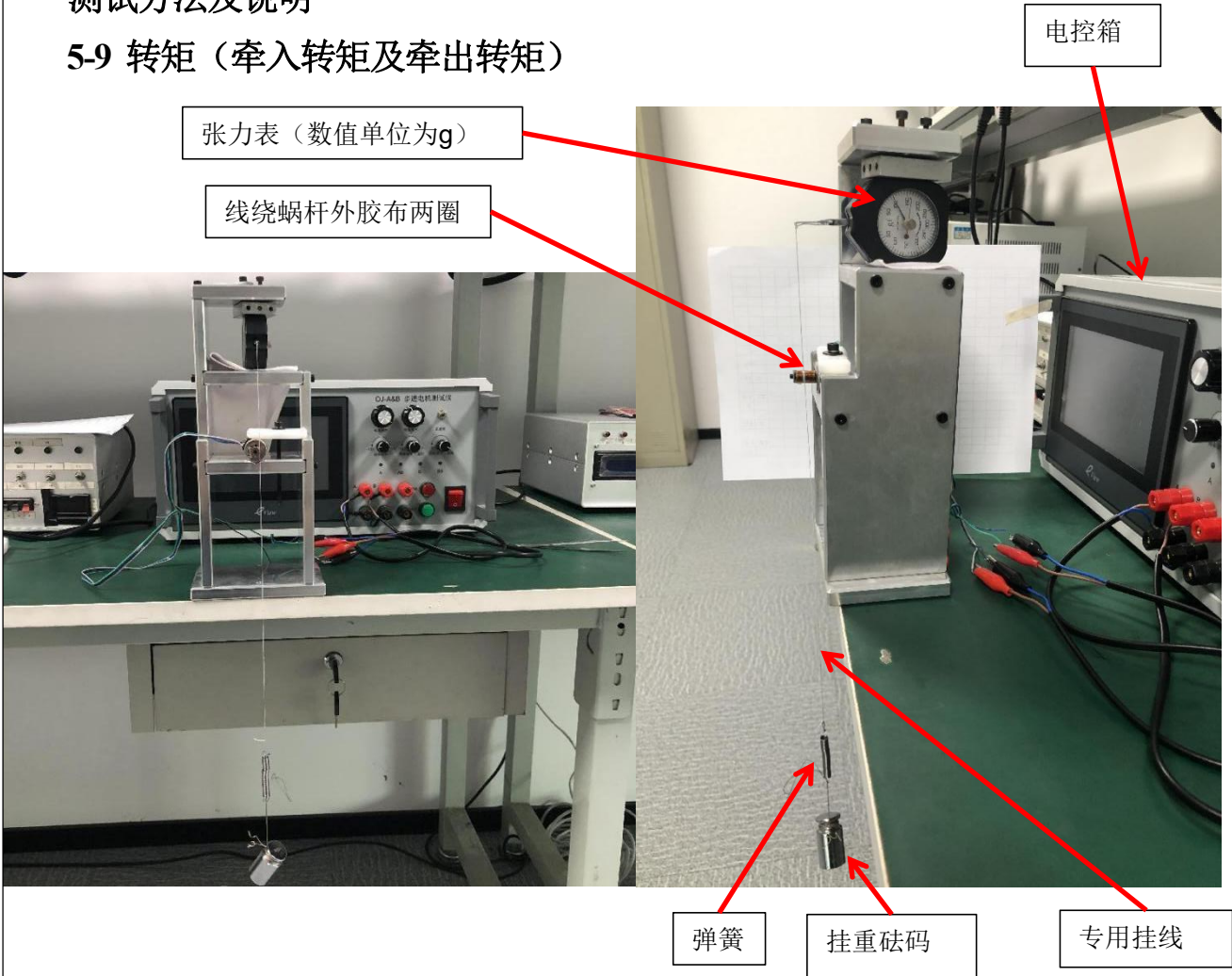
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10.PACKAGING 包装		

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11.Test method and description

测试方法及说明

5-9 转矩（牵入转矩及牵出转矩）



按测试温度，规格按5-9～5-11数据。

测试条件：整步驱动，按5-9～5-11测试条件要求：

测试仪器：张力计、电控箱及砝码

测试方法：1、牵入转矩

1.1、测量带胶布后的蜗杆外圆半径数值d，单位：mm及弹簧重量Gt，单位：g；

1.2、将测试电压及频率输入电控箱内，调整好蜗杆转动方向：使得蜗杆产生提升挂总砝码。

1.3、在弹簧下端，挂上砝码，然后启动电机，观察张力表指针晃动，当牵入转矩达到平衡时，张力表指针会稳定小幅度摆动并且会保持这种状态，此时电机正常转动。记录下指针指的数值：Gz，单位：g，统计挂重砝码的总重量数值：Gg，单位：g；

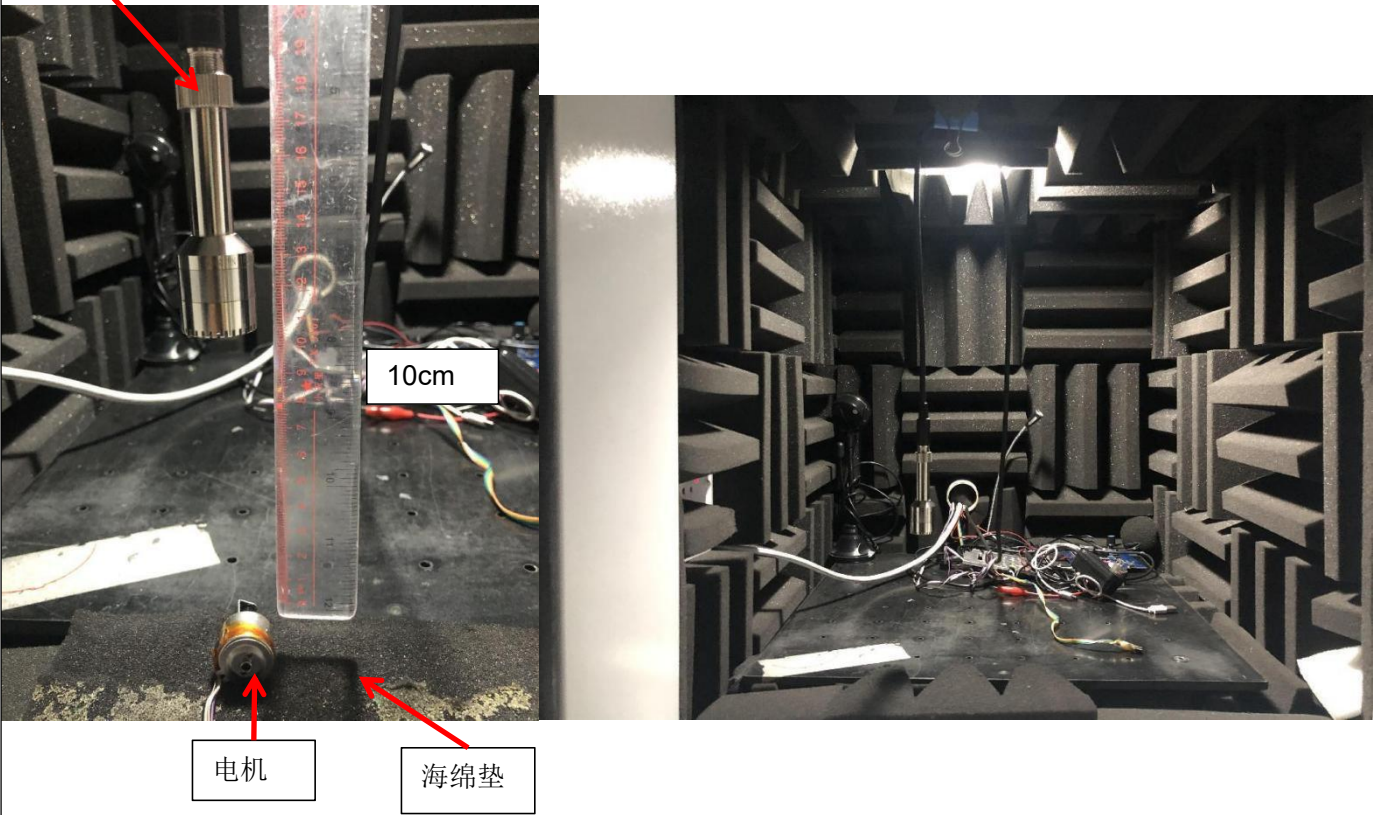
1.4、按公式：转矩（gf.cm）=（砝码重量+弹簧重量-张力计数值）*转动半径/10；也就是T =（Gg+Gt-Gz）*d/10

2、牵出转矩

整过测试过程和牵入转矩测试基本一样，区别在于：第三步时挂上砝码后，需要手托砝码，让电机启动时，电机是不受到外力矩的，电机启动后再轻轻松开手，让电机自行带上砝码运行。计算公式也和上公式一样。

5-13 噪音

麦克风



背景噪音：20dB(A)以下，电机的噪音规格如下表：

Frequency 频率	Noise 噪音值	Abnormal Noise 异音
360pps	≤34dB (A)	No, 无异音
800pps	≤23dB (A)	No, 无异音

测试条件：额定电压、整步驱动，按表格上频率；

测试仪器：噪音计

测试方法：将电机放在海绵垫上，平放，引线端子在水平左右两侧。将噪音计的麦克风放置在电机垂直上方10cm出，在电控箱输入频率和额定电压后，驱动电机并开始测试。